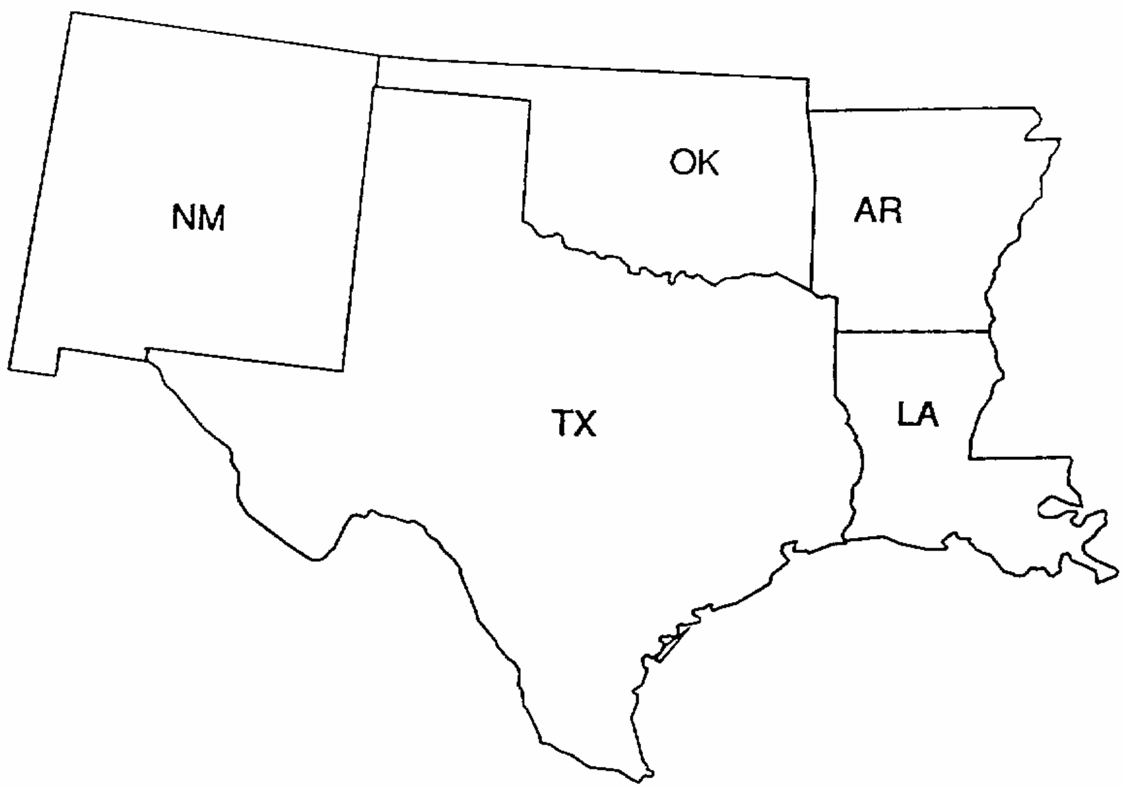
RRT VI
IN-SITU BURN PLAN
PART I
(Operations Section)



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This in-situ burn plan was developed by the Marine Spill Response Corporation (MSRC), Lake Charles, Louisiana in cooperation with the Region VI Regional Response Team (RRT). In January 1994, the plan was approved by the RRT and preapproval was granted to Coast Guard predesignated Federal On-Scene Coordinators (FOSCs) within Region VI. The preapproval allows FOSCs to permit responsible parties to employ the plan seaward of three miles of the coasts of Louisiana and Texas, with areas excluded offshore in the vicinity of certain reefs and an area off Grand Isle, Louisiana. This provision for preapproval is in accordance with the National Contingency Plan, 40 CFR Part 300.910. The plan may also be employed inshore of three miles, including bays, lakes, sounds, and rivers, but incident specific RRT approval must be granted in all such cases.

It is suggested that potential responsible parties and other commercial interests, who may be requesting use of in-situ burning in the event of a spill, review this plan and consider its incorporation into their contingency planning. While FOSCs may consider any proposal, in any form, it is strongly suggested that responsible parties use this burn plan in order to expedite approval.

Any changes to this in-situ burn plan will be announced through Coast Guard Marine Safety Offices via newsletters, industry meetings, etc. Comments on this plan are welcome and may be forwarded to the above address.

The Commander Eighth Coast Guard District views this plan as a major improvement to the pollution response posture in the Gulf of Mexico. Those in the marine industry with responsibility for response to a pollution incident are encouraged to prepare for the use of in-situ burning as one of several effective response methods.

J. W. CALHOUN
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By direction of the Commander
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FEDERAL RESPONSE TEAM REGION VI
IN-SITU BURN PLAN
OPERATION SECTION

I. INTRODUCTION

In order to minimize environmental damage caused by catastrophic oil spills responders work to keep spilled oil from impacting sensitive areas and resources. During an offshore spill, oil must be kept from reaching natural and manmade resources on or near the shoreline.

Three general categories of oil spill response options include the mechanical containment and recovery of oil, the application of chemical dispersants, and the controlled burning of oil in place (or "in-situ"). The use of each of these techniques involves a series of tradeoffs in relation to environmental impacts and disposal options.

Mechanical skimming of crude oil is initially the least harmful to the environment. However, mechanical skimming generates a large quantity of oil and water mixture that must be stored temporarily on location, transferred to onshore storage, and ultimately land filled, recycled, incinerated or disposed of in another environmentally acceptable manner.

Chemical dispersants allow the oil to break into small droplets that can be mixed into and decomposed within the water column. Efficiency rates are highly variable depending on application method and oil type as well as many environmental factors. Although mortalities of aquatic organisms exposed to dispersed oil have been documented in laboratory conditions, actual environmental impacts are generally minimal, especially when compared to the environmental consequences that could result if the untreated oil were allowed to impact sensitive areas on shore.

In-situ burning alters the composition of the spilled oil by eliminating anywhere from 90% to 99% of the original volume of oil contained in a fire resistant boom. A portion of the original oil is released into the atmosphere as soot and gaseous emissions. Solid or semisolid residues from burning represent a small percentage of the initial volume burned, are relatively easy to retrieve, and can be further reduced in volume through repeated burns and ultimately are collected and removed from the marine environment.

This document contains the background information and guidance necessary to aid the Federal On-Scene Coordinator (FOSC) while considering the use of in-situ burning as an oil spill countermeasure. Although in-situ burning should not necessarily be precluded from use on inland and nearshore spills, the intended use of this document is for oil spills 3 nautical miles or more offshore of the Louisiana and Texas shorelines.

A. Objectives

The primary objective in securing pre-authorization for in-situ burning is to allow the fast response necessary for the effective use of burning, either alone or in combination with other response options, during the early, critical stages of an oil spill.

Pre-authorization provides the Federal On Scene Coordinators (FOSCs) a rapid means of approving the use of in-situ burning for oil spills 3 nautical miles or more offshore.

A request for the use of in-situ burning should be made only when such action is safe, practical, and likely to result in the least overall impact to the environment.

This document addresses such factors as evaporation, emulsification, spreading, and other weathering processes that contribute to the relatively narrow window of opportunity involving the use of in-situ burning. These and other operational issues are considered as they might complicate or negate the effective use of controlled burning.

The document also describes other conditions and factors which could affect the use of in-situ burning or which could influence the tradeoffs associated with various response options.

Issues are presented that need to be addressed prior to a spill to allow responders to use in-situ burning in a logical and safe manner within the constraints of the limited window of opportunity for in-situ burning. Known impacts, as well as potential and perceived impacts, associated with the use of in-situ burning are described including the creation of smoke plumes, the effects of heating on aquatic organisms in the water column, the effects of fire on worker safety, etc.

A simplified version of an Operations Plan is provided in this document to illustrate how an in-situ burn operation might be initiated and carried out in the Gulf of Mexico. This planning section will address the process of manning, equipping, and training for an in-situ burn.

B. Policy

In-situ burning is adapted as a means to augment, not replace, other oil spill response techniques to avert potential impacts from offshore oil spills to the region's coastal beaches, marshes, and inland resources. It could be used as a first strike option for spills 3 nautical miles or farther offshore.

In-situ burning will be used as a response option only after appropriate consideration of potential environmental impacts, public safety, worker safety, and the possible need for disposal of burn residue. The facts concerning these and other pertinent matters will be transmitted to the FOSC using the form "Oil Spill Response Checklist: In-Situ Burning" (Appendix A).

Before, during, and after in-situ burns conducted under this authority, reasonable effort will be made to provide appropriate scientific support documentation, training, and information exchange to enhance knowledge concerning in-situ burning as an oil spill response tool.

C. Authority

Section 300.115 of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) states that the RRT is responsible for regional planning and coordinating preparedness and response actions. The NCP further states, "...The RRT provides appropriate regional mechanism for development and coordination of preparedness activities before a response action is taken and for coordination...and advice to the OSC...during such response actions ....".

Section 4201 of the Oil Pollution Act (OPA; P.L. 101-380) amended the Clean Water Act, which gives the general removal authority to "...ensure effective and immediate removal of a discharge, and mitigation ...of oil...". This same section requires the contents of the National Contingency Plan (NCP) to contain "... procedures and techniques to be employed in identifying, containing, dispersing, and removing oil...".

Section 7001 of OPA supports the concept of developing innovative technologies that are effective "...in preventing or mitigating oil discharges and which protect the environment...".

Both Louisiana and Texas have active oil spill programs created by recent legislation. On April 23, 1991, Louisiana Governor Buddy Roemer signed into law the Oil Spill Prevention and Response Act (La. R.S. 30; 2451, et seq.)

On March 28, 1991, Texas enacted a new comprehensive law entitled the Oil Spill Prevention and Response Act of 1991. (Chapter 40 of the Texas Natural Resources Code)

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II. Operational Considerations

In fighting a major oil spill, responders will have to use every tool available to insure maximum mitigation of environmental damages. The following narrative presents basic operational considerations for a response. In an actual spill, the responsible party would submit the application for the use of in-situ burning to the FOSC. In-situ burning, is a major response tool and should be used in conjunction with mechanical recovery, dispersants, and possibly other chemical additives.

A. Spill Response Scenarios

The potential spill scenarios that follow are provided as just a few representative situations where burning could take place accidentally or as a result of a decision to deliberately ignite spilled oil. It is understood that the choice to burn spilled oil must involve a careful assessment of all environmental and safety issues as presented in the "checklists" of Appendices A and B. Burning will only be considered when it is highly likely that its use will result in the least overall environmental impact.

Each of the scenarios presented on the following pages is based on the assumption that in-situ burning (when initiated as a deliberate control measure) is approved for use and that its use is safe, environmentally sound, and feasible for the spill's location, time and prevailing conditions. It is further understood that burning is not considered as a replacement for mechanical cleanup -- rather, it is seen as an additional response option that could be used along with other response measures (e.g., physical removal, chemical dispersants, and shoreline protection/cleanup).

UNCONTAINED BURNING AT OR NEAR SPILL SOURCE

If it is impractical or unsafe to contain an accidental or deliberate burn of spilled oil, it may still be possible to eliminate a major portion of the spill at or very close to the spill source. Sudden "batch" releases of oil (e.g., tanker accidents) or ongoing high-volume flow rates (e.g., oil well blowouts or pipeline ruptures) may result in the temporary accumulation of relatively thick oil layers. Particularly when winds and currents are low and/or when oil can be burned in the lee of a large object (e.g., vessel, island, etc.), it may be possible to sustain effective combustion.

BURNING OF THICK, UNCONTAINED SPILL

Large, uncontained oil spills will normally spread quickly over tens to even hundreds of square miles as they are transported from their sources by surface winds and/or currents. In some rare cases, all or a portion of such a spill may exist at thicknesses that could support a very brief period of combustion. If those portions could be ignited without risk of starting unwanted secondary fires at the source, shorelines, or other vessels, it may be possible to eliminate a significant portion of the spill.

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IMMEDIATE CONTAINMENT AND BURNING OF OIL OVER SUBSEA SOURCE

When currents at the source are low enough to permit a station-keeping operation, the boom-towing vessels may be able to hold the fire containment boom at and around the source of spillage. If the initial area or flowrate of the spill source is too great to be contained, or if the currents begin to exceed approximately 3/4 knots, it may be necessary to shift the boats and fire boom to a new location farther downstream. Two or more towed U-boom configurations could alternately reposition near the spill source while burning oil in a drift mode.

IMMEDIATE CONTAINMENT AND BURNING OF OIL ON LEEWARD SIDE OF TANKER

If the source of spillage is already burning, it may be possible to position the fire containment boom at the vessel(s), thereby enhancing the containment and elimination of oil before it has a chance to spread over large areas (and to thicknesses too thin to sustain combustion). With due consideration for personnel safety, firefighting operations, etc., it may be possible to secure the boom in place or to maintain its position with two boom-towing boats at a safe distance upstream of the vessel(s).

COLLECTION OF OIL WITH CONTROLLED BURNING AT A SAFE DISTANCE FROM THE SPILL SOURCE

Should a tanker accident involve spillage without fire at the vessel(s), fire containment boom could be used to collect oil in one or more U-configurations and then to move the oil to a safe location for ignition. If oil is already burning at the source, this mode of controlled burning should be considered if it is impractical or very unsafe to burn near the vessel(s).

B. Response Strategy Evaluation

Every spill situation is different, and throughout a spill, the conditions affecting the selection of a response mode are constantly changing. The spilled oil will be subjected to a number of natural processes that will alter the oil's physical and chemical properties. Depending on the type of oil, the magnitude of the spill, and the nature of the environment, these physical and chemical changes may significantly influence the extent to which certain response options can be used effectively. The natural spreading of an oil slick, for example, may result in such large areas that conventional containment systems would be impractical on all but a few percent of the volume spilled.

The thicknesses achieved during the spreading process will also affect the response options available. Film thicknesses may be too thick or too thin for effective use of chemical dispersants, and they may be too thin to support combustion. If, on the other hand, natural herding phenomena and/or containment barriers can be used to thicken the oil (to at least a few tenths of an inch), then combustion may be feasible.

There are many factors that must be considered during the selection of response options for a given spill situation. In addition to those processes affecting the area extent and thickness of oil spilled on water, there is also the concern over water uptake (i.e., emulsification) within the oil layer. The formation of emulsions will very quickly degrade the effectiveness of many physical containment and recovery systems, and it will seriously reduce the effectiveness of chemical dispersants and in-situ burning.

In addition to the nature and extent of the oil spilled, one must also consider a multitude of issues involving 1) the status of the spill source (e.g., if burning, if being lightered, if personnel are being evacuated, etc.), 2) the proximity of the source to shore and other sensitive resources or facilities, 3) the water depths at the source and in the response area, 4) the visibility, wind and sea state at the time of the spill, and 5) the availability of personnel and equipment needed for a given level of response.

The potential for implementing a successful burn of spilled oil depends strongly upon the knowledge and experience of those responsible for the assessment of the spill situation and the appropriateness of all available response options. Oil spill response personnel and contract support personnel should be familiar with the operational constraints involved with in-situ burning and with the safety and environmental issues involved with the controlled burning of spilled oil under a variety of conditions. Their review of the spill conditions, together with the completion of the "checklists" provided in Appendices A and B, will ensure that the safety issues, the benefits and the environmental impacts will have been examined carefully before any implementation of a controlled burn. While steps may be taken to move critical equipment into position for a possible burn, there will be no attempt to ignite spilled oil without proper authorization from both Federal and/or State On-Scene Coordinators.

There are special environmental issues that will influence the response evaluation as well as the operations phase of the in-situ burn. For example, if marine mammals or turtles are sighted, and in-situ burning is being used, towing of-the contained oil will be away from these resources. If a large concentration of pelagic birds is sighted near a spill, hazing of these birds will be accomplished before in-situ burning is initiated.

C. Interface With Other Response Activity

Throughout the planning and implementation of any in-situ burn, particular attention will be given to the ways in which burning could influence, or be influenced by, the other response activities going on. First, it is essential that any burn program be designed around any plans or activities to stabilize or control the source of spillage. In the event that the source is not already burning, it is imperative that all potential ignition sources be kept away from the source and any resulting vapor clouds. If people are involved in tanker relocation or lightering efforts, it may be totally unacceptable to conduct burning operations anywhere near the source of spillage. It is important that great care be used in selecting acceptable burn zones that are sufficiently removed from the source and which can be monitored and controlled.

These same concerns would be true if efforts were underway or being planned to evacuate personnel from the facility or stricken vessel. If there is any chance that a burning operation could interfere with the evacuation by taking away critical boats or people, or by introducing any unwanted ignition sources, the burning of spilled oil should obviously be postponed.

Similarly, response personnel will carefully review any effects that controlled burning could have upon the use of mechanical containment and recovery operations in the area. When mechanical cleanup techniques are feasible, burning might be considered as an additional response option to supplement (not replace) the physical removal of oil. In order to do this, it is important to designate specific times and locations for each response activity. If, for example, the source of spillage is already burning, it may be advisable to concentrate the burning operations on the heaviest oil near the source, while positioning physical recovery equipment well downstream where the oil is too thin and/or emulsified to burn. On the other hand, if the source is not ignited, and there are ample containment, recovery and storage systems available, it may be best to operate such equipment close to the source, and to consider the use of burning at a safe distance downstream as a backup to the mechanical response systems.

Should conditions be acceptable for the use of chemical dispersants, responders will also have to consider the optimum use of such chemicals with respect to burning and mechanical cleanup. In the event of a sudden "batch" spill that results in many square miles of oil slicks, specific zones could be identified for each mode of response. By considering the size of an area needed to conduct a particular response, and by examining the influence of vapor clouds, water depths, slick condition, etc., regions can usually be identified within which each response option (mechanical, dispersants and burning) can be conducted safely and without interference to/from the other options.

Responders will examine all of these considerations as they relate to the above activities and to the shoreline protection and cleanup activities as well. In-situ burning should be considered for use on spills located at least 3 miles offshore. However, in any spill situation where burning should be considered in close proximity to shore, the practicality of such burning would depend upon the type of shoreline and backshore area, the existence of population centers, and the nearness of docks, moorings, etc.

The feasibility of burning nearshore (or against a remote, unpopulated shoreline) would also depend upon the presence or planned activity of shoreline protection or cleanup activities nearby. In any event, the burning of oil near or adjacent to any shoreline where there is any chance of starting secondary fires, or interfering with conventional shoreline protection and cleanup activities should not be considered.

D. Equipment Deployment

The deployment of fire containment boom is basically the same as any other conventional boom. The fire boom can be deployed from dockside and towed at speeds of about 10 knots or less to the spill site, or it can be deployed on location from the decks of vessels or pre-staged platforms. Once in the water, fire containment boom would look and behave like any other containment barrier of similar configuration. The primary difference would involve the use of longer tow lines -typically about the same length of line for each towing vessel as the length of fire boom being used. A U-configuration of fire boom 500 feet in length, towed by two vessels each with tow lines 500 feet in length, would put the stem of each vessel approximately 600 to 700 feet from a fire contained within the lower one-third of the booms apex.

The use of longer tow lines is not just for protection from radiant heat from the burning oil, but for the provision of larger spacing (between vessels and fire) thereby providing greater reaction time should the vessels need to disconnect from their tow lines or respond in any other way to a sudden shift in oil slick or burn configuration, wind patterns, etc. The longer tow lines also reduce the effects of propeller-generated currents, which can increase oil entrainment beneath the boom.

During any spill incident for which the use of in-situ burning is considered, fire containment boom would normally be transported on one or more spill response vessels to the spill site. Once on location, the boom would be pulled into the water by one vessel, which together with another vessel, would then tow the boom in a U-configuration. Boom lengths of from 300 feet to 1,000 feet would be used with each U-configuration, providing oil encounter swaths of approximately 90 feet to 300 feet (assuming a swath-to-boom-length "gap ratio" of 0.3). The actual length of boom used in each configuration would depend on the total amount of boom and number of vessels available, as well as the size and shape of the oil slick to be contained. The actual deployment of fire boom would depend upon the nature and magnitude of spillage to be confined for burning in place.

Experience has shown that the tow lines need not be made of material that can withstand higher-than-normal temperatures. Standard polypropylene tow lines, for example, have been used in prior burns without damage. The lines are sufficiently protected by the water that is constantly wetting and cooling even the upper-most exposed edge of the line. Line sizes need only be selected for the usual drag forces that would be encountered for comparably sized conventional booms.

Based upon an average burn rate of 0.07 gallons/minute/square foot for most relatively fresh crude oils, personnel would determine the area (for oil containment) that could be achieved with various boom configurations, and therefore the potential average rate of oil elimination by combustion. For example, using oil holding capacities described in Section 111.13, a 500-foot-long fire boom, towed in a U-configuration, could easily capture 20,000 to 30,000 gallons of oil in its apex (assuming an average oil depth of 1 /3 the boom's draft). This volume could occupy a space within the boom with an oil surface area of approximately 6,000 to 7,000 square feet. The multiplication of this area by the above average burn rate yields an estimated oil elimination rate of about 420 to 490 gallons/minute.

The above calculations show how planners can deploy fire containment boom in a manner that maximizes elimination rates for a given set of operational constraints, source flowrates, and safety considerations. A particular deployment scheme may have to be modified as the spill progresses in order to accommodate changes in oil location, water depth (because of vessel draft), wind direction (because of potential population exposures), current shifts (because of wind or tidal influences), etc. For example, a relatively static capture-and-burn operation at or near a spill source during slack tide may have to shift into a dynamic drift mode of operation should tidal currents begin to flow that are in excess of 3/4 knot.

Other equipment deployment operations might include the coordination of aerial reconnaissance and/or ignition flights and burn residue collection vessels with the burning activities. Both operations would not involve any unique deployment schemes worthy of discussion here. Spotter aircraft are, of course, essential for the location of heavy oil concentrations and the direction of boom towing vessels to the areas where they can do the most good. However, their deployment would be essentially the same as if they were being used for aerial guidance during mechanical recovery operations. The use of aircraft for the deployment of igniters is unique, and their use is discussed in the following section, Ignition & Sustained Combustion. The deployment and use of vessels for the recovery of residue are addressed in Section 11.17, Residue Recovery and Equipment Cleanup.

E Ignition and Sustained Combustion

In the previous section the important role of spotter aircraft is discussed in light of the difficulty of seeing from vessels the true nature and extent of floating oil. Another important job for aircraft involves the potential role of helicopters in deploying aerial igniters over a slick to be burned. Hand-held igniters (e.g., off-the-shelf pyrotechnic devices, small plastic bags or cartons of gelled fuel, etc.) can be purchased or made on location; however, experience has shown that the Heli-torch (used for nearly two decades by the forestry services) is a safe and effective device for the rapid deployment of burning gelled fuel from the air. Slung beneath a helicopter (Figure I-1), the Heli-torch provides an inexpensive means of releasing small individual igniters (blobs of burning gelled fuel) or continuous streams of burning fuel for the ignition of stubborn, weathered, and/or partially emulsified oil.

Responders should assess any potential burn operation and determine the most effective as well as the safest means of igniting any spilled oil. If authorization has been obtained to burn all or a portion of any spill, responders would select and deploy the most appropriate ignition system, and arrangements would be made to have alternate backup igniters on hand as well. In the event that weather and/or equipment availability preclude the use of aerial ignition techniques, hand-held igniters can be released from one of the boom-towing vessels and allowed to drift back into the contained oil.

Offshore in-situ burn scenarios can be quite varied. In spill situations where fire containment boom is used in a U-configuration, it is essential that personnel on site keep air operations informed of the exact time and location for any pending burn. Should it be approved and practical to use the Heli-torch for ignition, a clear and concise burn plan will be established and thoroughly understood by all field personnel in vessels at or near the burn site and by all personnel planning to arrive by air.

A plan for a specific burn operation will include a careful assessment of the intended burn location(s) relative to the spill source and any potentially ignitable oil slicks nearby. Prior to ignition, specific acceptable burn areas will be identified on nautical charts or in relation to the spill source, they will be agreed to by appropriate regulatory personnel, and they will be provided to the appropriate task leaders at sea and in-the air. Depending on the nature of the spill and the existing or planned use of other spill control techniques, responders will take the necessary steps to establish specific zones where ignition and sustained combustion would (and would not) be acceptable. Any burn will be conducted so that the contained burning oil is not towed through or downwind of any major concentrations of unignited floating oil. The ignition and sustained burning operations will be conducted at least 1/4 to 1/2 mile side-wind to the spill source (unless already ignited) and any free-floating, potentially ignitable oil slicks. Care will be given continuously to the possibility of any wind shifts and to the accidental ignition of vapors associated with other oil slicks in the area.

Once all regulatory requirements are met, all notices are given, and environmental conditions are determined to be acceptable, a helicopter and its ignition system could be cleared for its approach to the controlled burn site. If ignition is to be conducted with a Heli-torch, it would normally be flown at about 30 to 50 feet above the water, with a path that is at right angles to the direction of movement for the towing vessels. A favored approach with the Heli-torch is to release the gelled fuel at least 50 feet upstream of the leading edge of the contained oil. In this way, the burning globules of gelled fuel are less likely to fall directly into the oil or any localized concentration of hydrocarbon vapors from the slick. Once on the water, the gelled fuel would float back into the oil and initiate the burn from the upwind, leading edge of the contained oil. The gelled fuel igniters could be dropped directly onto the contained oil if there is no concern over vapor-flash effects (because *of* the limited size or condition *of* the contained oil, the height and speed *of* the helicopter, general wind conditions, etc.).

Should the oil be difficult to ignite, the helicopter could hover above or upstream of the contained oil while releasing a steady stream of gelled fuel. If a continuous, large ignition area is created, enough heat may be generated to bring the weathered or emulsified oil to its fire point. A very large ignition area could create enough radiant heat adjacent to the surrounding oil that emulsions could begin to break down and weathered components could possibly be heated to their required fire points for sustained combustion. Experience has shown that gelled crude oil can provide an even hotter ignition source for the combustion of weathered/emulsified oils.

During the ignition and sustained combustion phases, the safety of all personnel associated with the burn is the primary objective. For this reason, a "Burn Watch", or individual responsible for monitoring the condition of the fire, will be assigned aboard each vessel on location. A Safety Officer will also be designated to constantly assess all activities associated with the burning operations. These individuals will be able to make direct voice or radio contact with the captains of the towing vessels and any other vessels in the area to apprise them of any sudden changes in the status of the burn.

While the boom is being operated in a U-configuration, the operators of the two boom-towing vessels will:

- Maintain a fairly constant separation of the tow vessels and therefore a reasonably constant swath opening for the U-boom configuration.

- Establish which of the two towing vessels will be considered the lead vessel so the operator of the other towing vessel can adjust speed and course to match the lead vessel. A separate radio frequency (possibly a low use citizen band) will be established for the vessel operators so that frequent communications regarding positioning can be made without tying up other important operational frequencies.

- Work closely with the vessel's Burn Watch and the Safety Officer in order to adjust the swath/speed of the towing operation in response to any changes needed in the area/thickness of the contained oil.

- Be prepared to terminate the burn quickly in response to an unacceptable shift in wind direction, or the reporting of a possible encounter with a large, potentially ignitable slick. Should it be necessary to end the burn prematurely for these or any other reasons, the fire could be put out by moving ahead at several knots, thereby forcing the oil beneath the boom. A second approach might involve the release of one tow line while the other vessel moves ahead at several knots. The oil would thus spread out quickly to thicknesses that would not sustain combustion very long.

- Be prepared to offer immediate assistance to each other should there be any kind of engine difficulty or failure during the towing operation. The operator and crew of each towing vessel should be on constant alert to cut or release its tow line, if necessary, in order to go to the aid of the other vessel.

- Routinely check and record the location of the boom towing operation to ensure that the burn is taking place within any approved or designated zones of acceptance for the burn.

- Maintain radio contact with the Incident Commander, Operations Chief or other designated supervisor responsible for the burning program. Information regarding the status of the burn will be passed on for record keeping and documentation, for the timing and correlation of photo/video coverage with conditions on the surface, for the coordination of any air or water quality measurement programs, and the alerting of any crews assigned to the collection of floating burn residue upon completion of the burn.

Throughout the oil containment and combustion phase, every effort will be made to maximize the amount of oil contained and burned within the boom. The towing vessels will attempt to operate at speeds of less than 1/2 to 3/4 knots while avoiding any sudden changes in speed. Some of the slightest surges of either vessel can result in a jerking motion of the boom and a resulting sudden loss of oil over and/or beneath it. Should any course changes or minor direction alterations occur (e.g., to avoid floating debris), such movements will be carried out slowly and smoothly to avoid excessive oil thickening and entrainment at the apex of the boom.

Depending upon the proximity of the burn to shore, population centers, other resources, etc., the towing vessels will seek the optimum orientation of the U-configuration in order to minimize undesirable wind, wave and current interactions within the boom. With due consideration for all time, space and safety considerations, it may be best to tow the U-configuration in the same direction as the wind in order to reduce the effects of reflected wind-waves within the oil containment area. Care must be given, of course, to the potential for smoke plume transport and possibly some minor fallout over or near the towing vessels. Proper protective clothing and respiratory equipment will be available to personnel on the vessels should such items be necessary during a downwind tow-and-burn operation.

During the burning process, the overall oil elimination rate can be increased by slowing down the tow boats and letting the contained oil spread forward within the fire containment boom. A twofold increase in the area of the burning oil can mean a nearly twofold increase in the oil elimination rate as well. At some point, the increase in burning area will cause some portions of the burning oil near the center of the burn area to suffer increased oxygen starvation. The efficiency and the rate of removal will likely be influenced under these conditions; however, the area increase should substantially improve the overall oil elimination rate.

As the burn progresses, the operators of the towing vessels will be alert to any signs that the contained oil is nearly depleted. During this phase, the burn area may become somewhat spotty with some areas burning more violently than others, or with portions of the burn area appearing to splatter oil droplets into the air (i.e., the boiling and release of water vapor as mini-eruptions through the overlying thin layer of oil). As this process begins, the towing vessels will maintain just enough forward motion to keep the oil trapped against the downstream apex of the boom, while allowing it to spread enough for a suitable, self-sustaining burn area.

F. Residue Recovery and Equipment Cleanup

Although burn residues usually float, there are a few examples of burn residue sinking. The establishment of exclusion zone (Appendix F) is partially a result of concerns of the possibility of residue sinking and causing damages to sensitive benthic habitats.

During the final phase of the combustion process, the oil that is left unburned within the boom will cool quickly as it is herded and thickened against the downstream end of the U-configuration. Within minutes, the unburned oil residue may reach thicknesses of several inches and be sufficiently viscous to be picked up with boat hooks, screened rakes or pitch forks, with nets, or with the use of viscous oil skimming devices. If additional burns are to be conducted, it may be possible to leave the burn residue within the booms apex as additional oil is collected. Experience has shown that a major portion of the residue can be eliminated with multiple burns. The actual technique used will depend on the nature and amount of the residue remaining following each burn. Upon completion of a burn, inspection of the burn residue remaining within the boom will help determine the most appropriate mode of recovery. A very small quantity of highly viscous residue, for example, might simply be recovered by personnel aboard one of the boom-towing vessels. In any event, preparations will need to be made aboard the towing vessels and any specially designated recovery vessels for the temporary storage of any recovered burn residue (normally less than a few percent of the volume of oil burned). The residue will normally be placed in large open top tanks or refuse containers, fish totes or drums.

If residues do sink, recovery will be achieved to the maximum extent practicable. High frequency (50k Hz) side-scan sonar may be useful to monitor the deposition of residue and to direct recovery of large concentrations with bottom trawlers. Divers might also be used to locate and/or collect bottom residues. In in-situ burns operations, the production of burn residue and its recovery will be monitored. In addition, the "cruise track" of the towing vessels will be recorded.

The toxicity and potential impact of the burn residue will normally be much lower than that of the original oil as a result of the loss of lighter ends, the ongoing degradation processes, and the likely dispersion of the residue before it enters shallow nearshore waters, or before it makes contact with any shorelines.

G. Decision Tree

The decision to burn spilled oil at sea is contingent upon many considerations, not the least of which is the "authorization" to do so. In addition to the authorization to burn there are numerous issues involving the "feasibility" of burning as well. These issues can be combined and examined within five primary categories as follows:

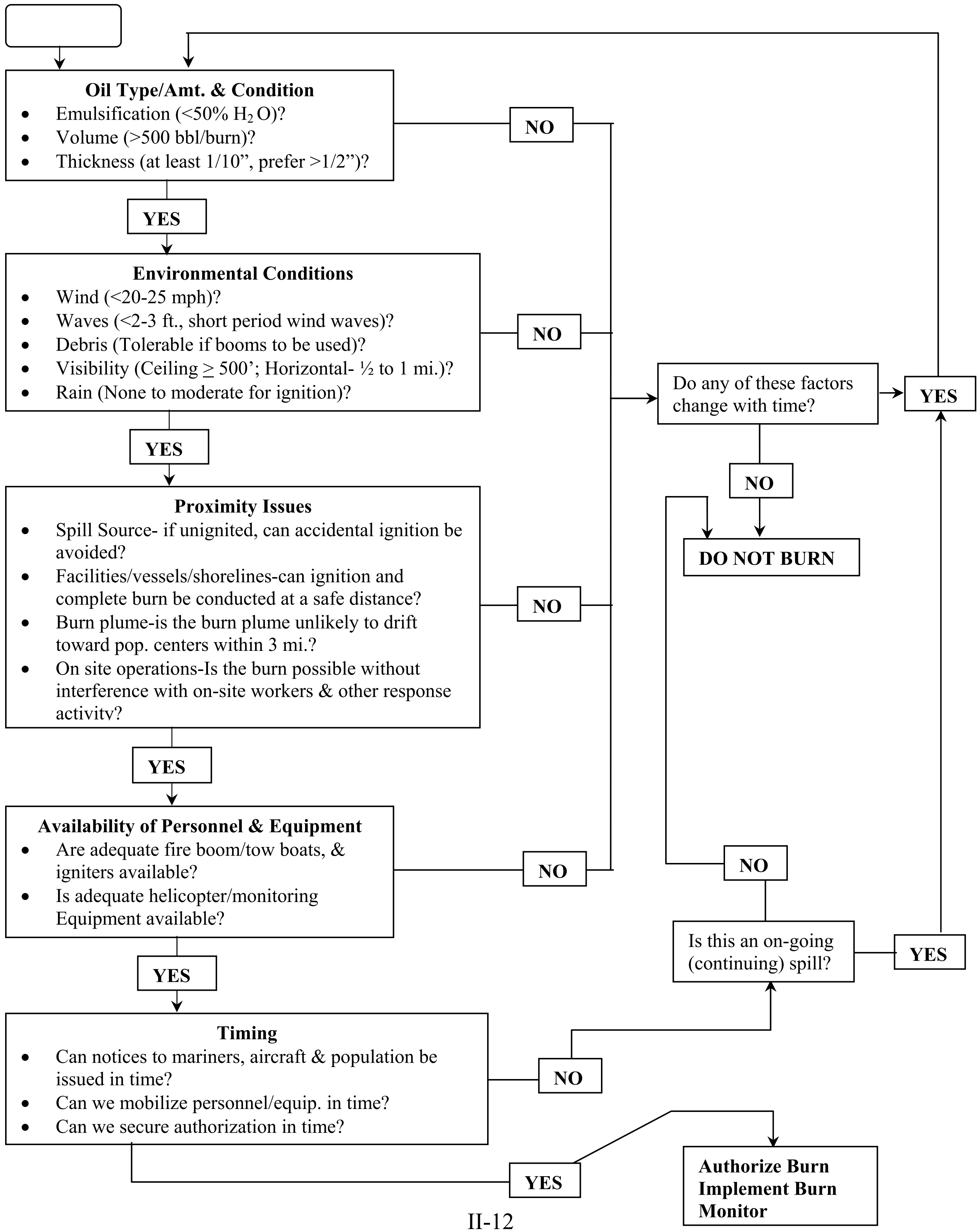
- Oil Type, Amount and Condition
- Environmental Conditions
- Proximity Issues
- Availability of Personnel and Equipment
- Timing

The operational constraints within each of the above categories have been evaluated, and key issues that would determine the feasibility of conducting a safe and effective burn have been summarized. The Decision Tree on the following page is intended as a summary of the most important issues influencing the decision to burn.

It should be recognized that a failure to meet one or more constraints (i.e., a "No" answer) in the Decision Tree, does not necessarily lead to a "No Burn" decision. With the passage of time, conditions may change which would then make in-situ burning a feasible response technique.

It is also important to emphasize the belief that controlled burning need not interfere with other response options (i.e., mechanical removal, dispersants, etc.). As indicated under Proximity Issues, the decision to burn must include a careful assessment of the interface between burning and all other response activities.

Decision Tree



III. MONITORING PLAN

In order to accommodate the short time frame available for the effective use of in-situ burning, pre-planning for an effective monitoring plan is required. Three general types of monitoring will be discussed: operational monitoring, burn performance monitoring, and worker safety monitoring. Environmental impact and damage assessment monitoring will be accomplished by the appropriate state and federal resource agencies.

A. Operational Monitoring

The components of the smoke from burning oil that are of primary concern to public safety or sensitive environments are particulates of 10 micrometers or less (PM-10s) and the polycyclic aromatic hydrocarbons (PAHs) which are absorbed to PM-10 particles. Real time measurements of PM-1 Os would allow for the gross estimation of PAHs. Since PAHs in oil burns are but a small fraction of PM-10 concentrations, if levels of concern for PM-10s were approached, PAH concentrations would be well below level of concern.

Real time monitoring of PM-10s and the resultant PAH estimate would allow monitoring teams to inform the FOSCs if levels of concern are approached so appropriate steps can be taken by the FOSC. If the level of PM-10 measured closest to, or on, the shoreline reaches 150ug/m3, the FOSC will immediately discontinue the burn to ensure that public health not be endangered by the products of combustion of the oil. Burning will not be recommended until the levels of PM-10s falls below 150ug/m3 near to, or on, the shore, or until permission is given to the FOSC to restart the burn from the appropriate state agency. In Louisiana, permission to recommence a burn when the level of PM-10s exceeds 150 ug/m^3 at the coast must come from the Department of Environmental Quality Air Quality Division, either directly to the FOSC, or through the SOSC. In Texas, permission must come from the appropriate Regional Air Program Manager of the Texas Natural Resource Conservation Commission, either directly to the FOSC or through the SOSC.

The U.S. Coast Guard is developing a monitoring capability for responses involving dispersant and in-situ burning. The program is called the Special Response Operations Monitoring Program and will be carded out by the U.S. Coast Guard Gulf Strike Team. The program will provide the specifications for instrumentation, equipment, and personnel needed to take real time measurements of PM-10s. These measurements will enable the Gulf Strike Team to advise the OSC with input that will influence decisions on when burning should be used or discontinued. If this program is approved by the RRT and developed, the Gulf Strike Team will accomplish operational monitoring. The responsible party should be responsible for operational monitoring, including real time PM-10 monitoring if the Coast Guard Program is not implemented.

A responsible party monitoring unit would consist of a dedicated boat capable of handling offshore seas with adequate personnel and equipment to monitor PM-10s.

The monitoring unit would record environmental conditions including: wind speed and direction; air and surface water temperature; cloud type, height, and coverage; visibility and ceiling height; wave height and direction; swell height and direction; current speed, direction, and method of measurement; observations on presence of marine mammals, turtles, or birds. In addition, the monitoring team will record the burn (burns) with a video camera and still photos.

The monitoring unit will record operational conditions such as boom specifications, direction of tow and relative speed of boom, type and amount of igniter used, oil volume estimate and method of estimate, estimate or measurement of volume of burn residue, collect sample of burn residue. The unit will also obtain the following samples: fresh oil (if available), pre-ignition oil, oil residue. Visual descriptions of the burn will be made 15 minutes after full ignition of the burn, every 30 minutes after ignition, then 30 minutes after the burn is extinguished. Descriptions will include height, width, and form of the smoke plume. The monitoring crew will conduct the burn performance monitoring as detailed in the following section.

B. Burn Performance Monitoring

The following information is provided so that meaningful estimates of the volume of oil consumed during an in-situ burn can be provided. The three techniques described include estimates of the volume of oil that could enter the burn collection area in the time that was available, the volume of oil that could likely be held in that area before substantial losses begin to occur, and the volume that could be burned based on the duration and estimated efficiency of burn. These estimates should be supplemented whenever possible with knowledge of the spill source volume or estimated leak rate.

1. Oil Encounter Rate

The volume of oil entering a particular system's opening (or collection area) per unit time (e.g., gallons/minute) is often referred to as the oil encounter rate (OER). If one can estimate the swath (w) of the receiving area, the velocity (v) of the system through the water (or the speed of the oil being swept into it), and the average oil thickness (t) being encountered, it is possible to estimate the approximate oil encounter rate as:

EnR (barrels/day) = (1.28 x 103) (w) (v) (t)
EnR (barrels/hour) = (53.33) (w) (v) (t)
EnR (gallons/minute) = (37.4) (w) (v)

where,

w = swath (feet)
v = velocity (feet/second)
t = average oil thickness (inches)

The average oil thickness is the most difficult parameter to estimate since a single oil slick can often consist of thickness that range over several orders of magnitude within a very small area. It is helpful if thicknesses can be determined through direct measurement and/or by sampling portions of the slick and then calculating the thicknesses based on the volumes collected from a known area. If such measurements cannot be made, it is possible to estimate average thicknesses based on typical ranges of thickness associated with different colors and characteristics of the oil. The following average thicknesses are suggested as very rough approximations that could be used for most light-to medium-weight crude oils when better estimates from direct measurements are unavailable.

- Sheen (silvery-gray in appearance): Use 10^{-6} inch as average thickness.
- Iridescent (rainbow-colored): Use 10^{-4} to 10^{-5} inch as average thickness.
- Blue-black: If aged or wind-blown but still blue to black in color, use 10^{-2} to 10^{-3} inch as average thickness
- Dark blue-black: If recently spilled, quite fresh, and near equilibrium condition (i.e., rapid gravity stage of spreading complete), use 10^{-2} inch as the average thickness if spilled onto cold (mid-winter) waters; use 10^{-2} to 10^{-3} inch as average thickness, if spilled onto warmer (mid-summer) waters.
- Brown-orange/red emulsion: If emulsified and taking on the common "chocolate mousse" appearance, use 10^{-1} inch as average "oil" thickness. While the emulsion may actually be two to three times thicker, it may have as much as 50% to 70% water (or more) entrained within it. Sample calculations for encounter rates for towed and anchored booms are provided in Figure III-1. Similar calculations can be made for actual or potential burn situations and compared with the volumes that could be held within a boom for burning and the volumes that could be eliminated through burning.

2. Oil Holding Capacity of Boom

A second method, which involves the oil holding capacity of booms, can be used to estimate the volume of oil that could be held in place before a burn. This approach is at best a very rough approximation because of the many variables that are difficult to measure and constantly changing. The assumptions are based on laboratory and field measurements for a variety of oils and sea conditions, as well as a range of different boom types and towing configurations.

Figure III-2 illustrates the relationship between boom length for various mouth openings (or swaths) and the resulting oil zone areas and volumes contained (per inch of oil depth) within such oil zones. The mouth openings (W) are shown for possible values between 0.3L and 0.6L, where L is the total boom length. The boom configuration as illustrated shows the shape that would normally result if a boom was towed with a mouth opening equal to three-tenths the length of the boom.

The cross-hatched area in the downstream end of the containment area represents a typical oil collection zone from the apex of the U-configuration to a distance one-third of the way toward the leading edges of the boom. Experience has shown that this region within a containment boom towed steadily at speeds of no more than 0.5 to 0.75 knot is representative of the oil holding zone within which oil can be held with minimal entrainment beneath the boom. The optimum area for a particular boom's nominal holding capacity will, of course, depend on several factors including the boom's design, the wind and sea conditions, the nature of the oil contained within the boom, and the skill of personnel towing the boom. In order to provide a quantitative relationship between holding capacity and boom configuration, Figure III-2 has been created for nominal oil containment areas between the apex and one-third to one-half of the way toward the leading ends of the boom.

It should be recognized that the oil within these holding zones would not be uniform in thickness while under tow, but in fact would normally become increasingly thicker toward the downstream apex of the U-configuration. The "volume contained per inch of oil depth (in barrels)" is based upon a uniform oil depth of 1 inch for a given "area of oil zone". Therefore, one must estimate the average oil depth within that zone in order to estimate the overall oil holding capacity for a given boom length (L) and mouth opening (W). One rule of thumb that has been used for the average oil depth within a boom's oiled area at capacity loading is one-third the draft of the boom.

Using Figure III-2 and the above assumption for average depth, one can estimate the potential holding capacity of a 1,000-foot-long boom with an estimated draft of nearly 28 inches towed in a U-configuration with a mouth opening of 300 feet (i.e., W=0.3L). From Figure III-2 the estimated holding capacity would be about 400 barrels per inch of oil depth for oil filling the apex one third of the way toward the leading ends of the boom. If one assumes that the average depth of the oil contained within the boom is about one third of the boom's draft (i.e., about 9 inches), then the total estimated volume of oil could approach approximately 4000 barrels. In an actual spill, volume capacity estimates such as this could be compared with oil encounter rate estimates (and the time required to collect the oil) to corroborate the potential volume of oil available within a boom for burning.

It is useful to note (from Figure III-2) that the estimated area of the oil zone in the above example is approximately 26,000 square feet. Since one can estimate the elimination rate and efficiency for burning oil on water (about 0.07 gallons/minute/square foot), this area could be used to determine the volume of oil that could be burned within the boom and the time required to complete the burn.

3. Duration and Efficiency of Burn

Typical burn efficiencies of from 90% to 98% or more are achieved when burning oil contained within a fire resistant boom. When oil is continuously fed into the fire (as with a U-configuration downstream of a spill source), burn efficiencies may exceed 98%. Such efficiencies, together with the typical elimination rate of 0.07 gallons/minute/square foot (shown in Figure III-3), suggest that many hundreds of gallons of oil per minute can be eliminated with only a few hundred feet of fire containment boom. It should be recognized, however, that somewhat slower burn rates are likely to be experienced with aged and emulsified oils.

From Figure III-2 in the previous subsection, it is evident that boom lengths of 500 feet to 1,000 feet (with mouth openings of W-0.3L or 150 feet to 300 feet) can be used to create burn areas of typically 6,000 square feet to 26,000 square feet. Figure III-3 reveals that such burn areas could result in the elimination of contained oil at hundreds of gallons/minute to approximately 1,800 gallons/minute. The higher estimate is off the chart in Figure III-3; however, it can be obtained by multiplying the burn area of 26,000 square feet by the estimated burn rate of 0.07 gallons/minute/square foot.

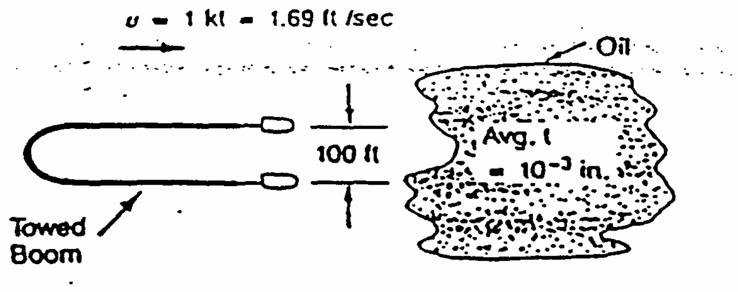
In Figure III-4 these same parameters involving boom length and burn area are plotted against the oil encounter rate that could be eliminated by burning within the downstream third [(1/3)(d)] of the contained boom area. It is evident that a 500-footlong fire boom (with backup replacement sections as needed) could be used in a U configuration to intercept oil and eliminate it at approximately 400 to 500 gallons/minute or about 15,000 barrels/day. In this example 500-foot lengths of fire boom could conceivably keep up with an oil encounter rate that is about three times greater than the Santa Barbara blowout in 1969.

In the example presented in the previous subsection, a 1,000-foot-long boom was shown to be capable of holding approximately 4000 barrels (or approximately 168,000 gallons) of oil in an area of about 26,000 square feet. If the oil could be maintained at approximately that same area coverage and burned at about 0.07 gallons/minute/square foot, the majority of the oil (say 95%, or about 150,000 gallons) could be burned in approximately an hour and a half. Some additional time would need to be added for the initial fire to spread out over the entire slick contained within the boom, and to account for the reduced rate of elimination toward the end of the burn as the oil area is gradually reduced.

The burn calculations described above would be used in the event of an actual burn using the estimated average area of the burn for a given period of time. The resulting volume of oil eliminated could then be compared with the oil encounter rate and holding capacity estimates described in the previous subsections.

FIGURE III-1
SAMPLE CALCULATIONS FOR ENCOUNTER RATE

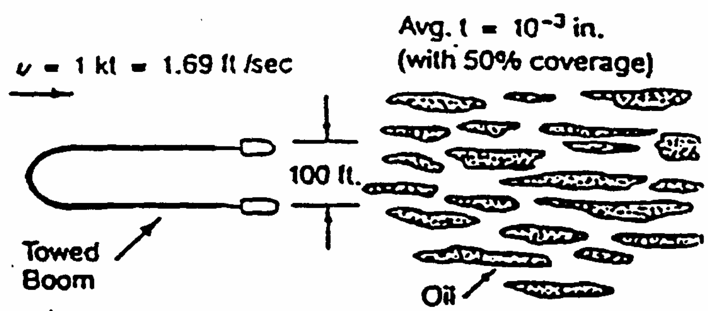
Towed Fire Boom Encountering a Continuous Layer of Relatively Fresh Oil in Temperate Waters.



EnR = 37 (100) (1.69) (10^{-3}) = 6 gpm

Towed Fire Boom Encountering an Aged Oil Slick That Has Begun to Break up into Patches of Blue-Black Oil (~50% Coverage).

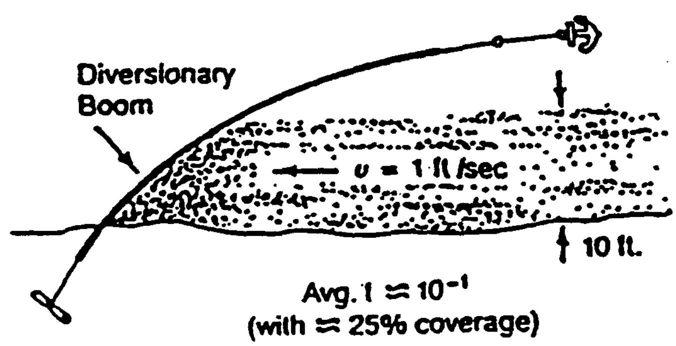
The area surrounding the patches could be rainbow colored: however, the volumes encountered for such oil would be negligible



EnR = 37 (100) (1.69) (10^{-3}) (.5) = 3 gpm

Fire Boom Anchored in a Deflection Mode to Divert Oil into a Potential Shore-side Burn Area.

Fresh dark crude oil, covering about 25% of the average swath width, is moving along the shore.



EnR = 37 (10) (1) (10^{-1}) (0.25) = 9 gpm

FIGURE III-2
BOOM HOLDING CAPACITY

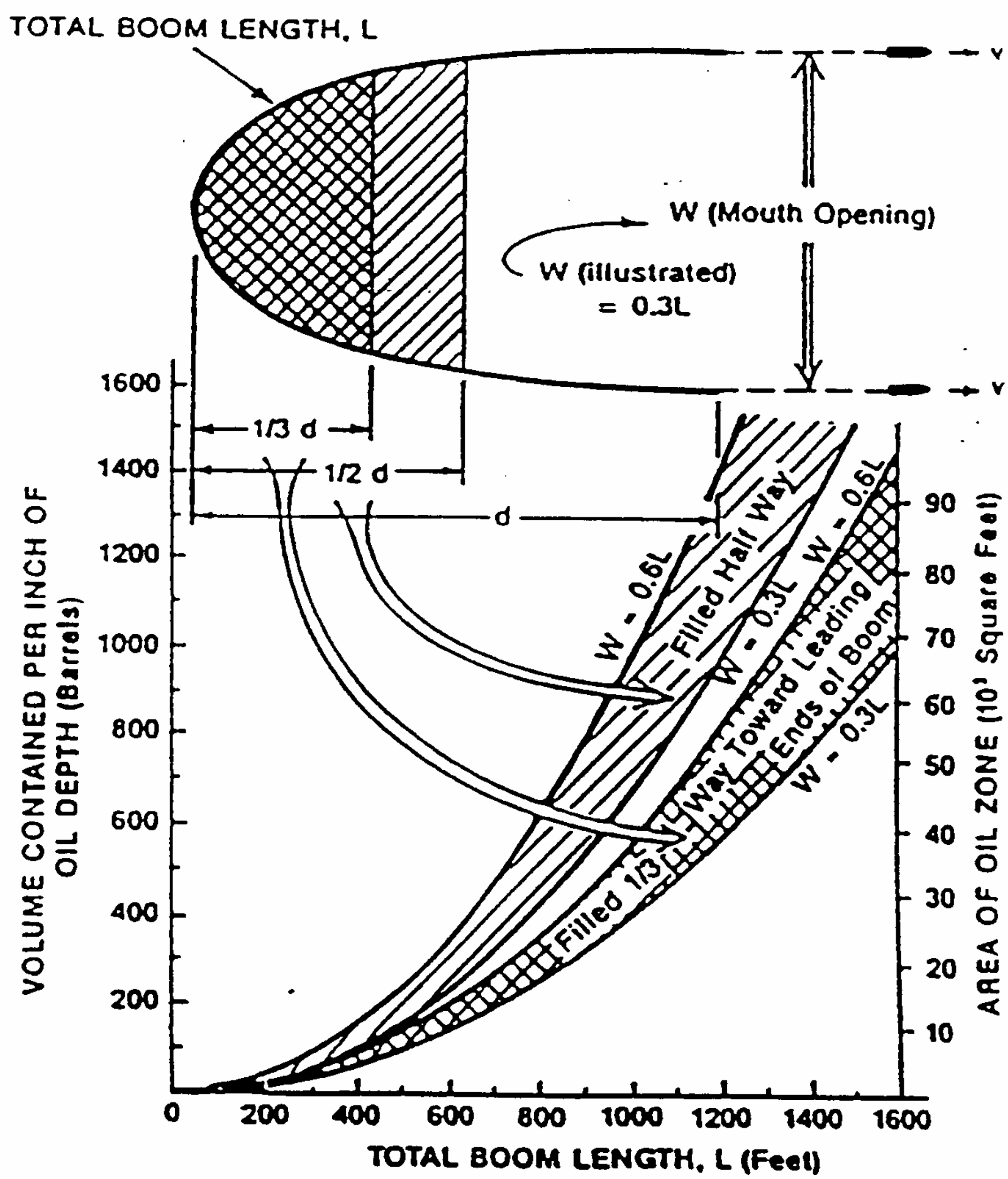


FIGURE III-3
IN-SITU BURN RATE

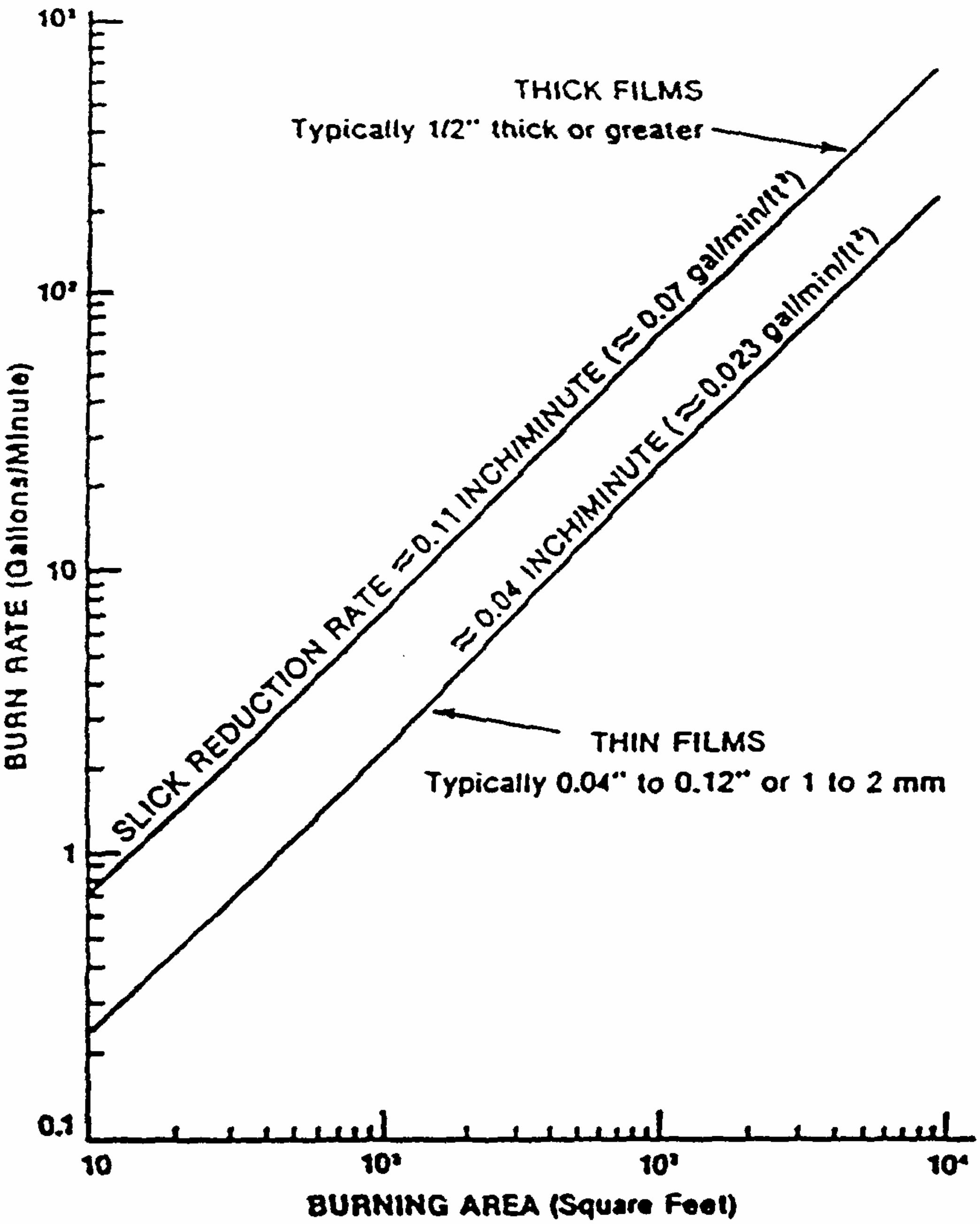
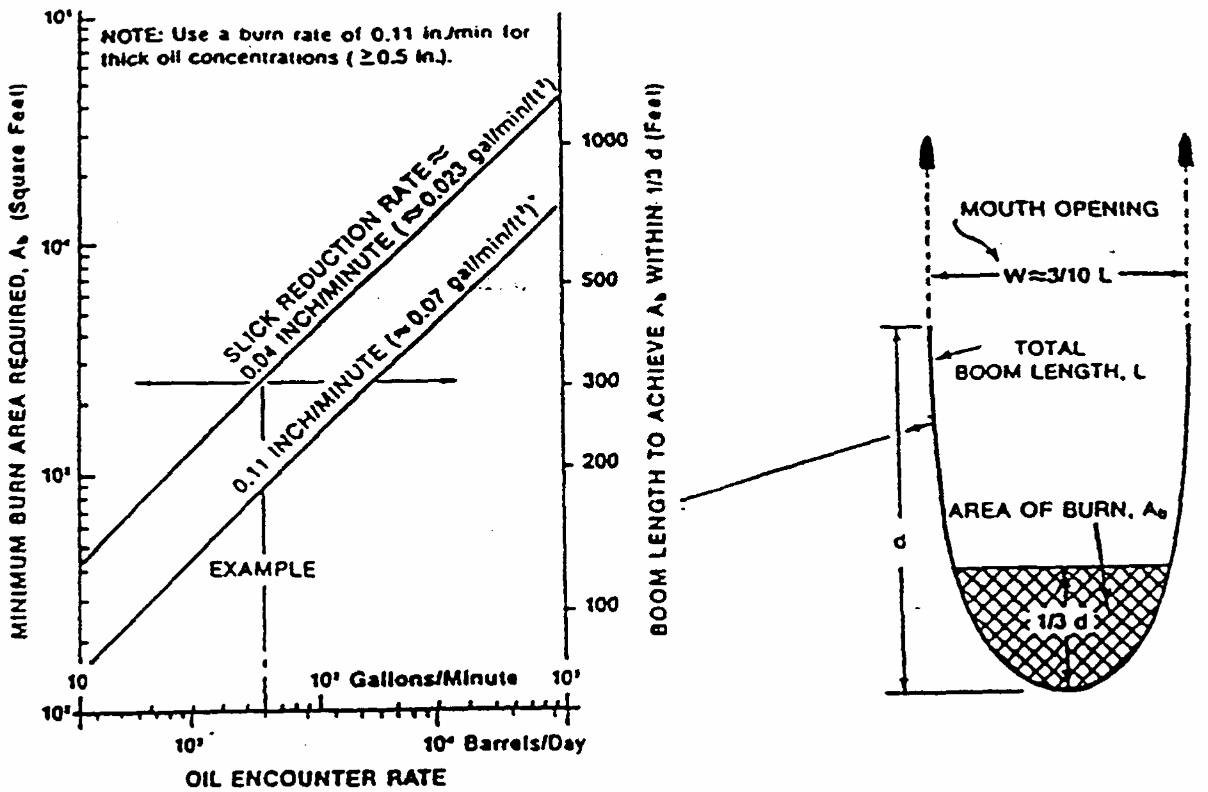


FIGURE III-4
BURN AREA/BOOM LENGTH vs. ENCOUNTER RATE



EXAMPLE

A U-boom configuration pisitioned downstream of a 15,000 bbl/day spill source would require a boom length of about 500 feet in order to provide the 6,000 to 7,000 sq. ft. needed for in-situ bruning within the downstream third [(1/3)(d)] of the boom area. The suggested mouth opening (w) in this example would be 150 ft. Of Course, w could be increased, depending on the approaching oil, the sea state, winds, and the desired burn concentration.

C. Worker Safety Monitoring

Each individual involved with the controlled burning of oil at sea will complete classroom and hands-on training. That training will be appropriate for the type and level of responsibility assigned to the individual.

Training will be conducted frequently, with an emphasis on the potential effects of burning on all personnel and equipment (e.g., thermal effects, transport of soot and other combustion products, etc), as well as all natural resources communities and facilities where thermal and/or smoke-related impacts could be experienced. As with any other type of spill response, training will also include safe operating practices for vessels, aircraft, fueling operations, the loading and transfer of heavy equipment, etc. All training and actual response activities will be conducted in a controlled, safe manner that complies with appropriate federal and state regulations. In addition, OSHA regulations require that personnel involved in oil spill response also receive Hazardous Waste Operations and Emergency Response (HAZWOPER) training.

Standard safety considerations will also be used during the towing of any boom under open-ocean conditions. From a safety standpoint, however, the following factors will be emphasized for the planning and implementation of any at-sea burn

- Adequate line will be used to provide a safe distance and reaction time for the full range of potential burn situations that could develop.

- Aerial support involving fixed -wing aircraft and/or helicopters will be available so that communications can be maintained regarding the location of the boom towing vessels relative to the oil to be collected and burned, other oil slicks in the same general area, other vessels in the area, and the anticipated region of influence from combustion products once the oil is ignited.

- The vessels towing fire containment boom will be positioned during all phases of an at-sea burn so that there is an absolute minimal chance of being surrounded by, or contacting, concentrations of oil that could pose a threat due to deliberate or accidental ignition.

- Prior to ignition, all personnel on site will be positioned upwind or crosswind from the target slick so that they are well outside the anticipated path of the smoke plume. Personnel on vessels near the burn site will be prepared to move indoors and/or don protective face masks should their vessel unexpectedly be caught in a portion of the smoke plume. Such exposures should be minimal or nonexistent with proper attention to wind conditions and vessel location.

- Should a particular spill situation involve the potential use of fire containment boom in an anchored or attached mode very close to the spill source, personnel and equipment will be kept at a safe operating distance from any unexpected explosion or premature ignition of oil at or within the source.

- The responsible party or FOSC will ensure that any contained oil is ignited only after all "predetermined" burn requirements are met and confirmed via radio link with all key participants. As with any marine spill response operation, the safety of personnel on location depends on both a clear and concise plan of operations and on reliable communications.

Care will be taken throughout any in-situ burn operation to ensure that all personnel and equipment are protected from any harmful exposure to heat and/or combustion products. Anyone that could be exposed will be provided with adequate personal protective equipment (e.g., respirators, masks, goggles, protective clothing, etc.). Federal OSHA standards for the assessment of hazards and MSRC's standard will be used for the selection of proper personal protective equipment.

During in-situ burning operations at sea, it is normally quite easy for vessels and aircraft to remain well outside any zone of potentially dangerous exposure to heat or combustion products. However, because of the brief exposures that could result due to wind shifts, vessel power failures, oil and emission sampling procedures, etc., personnel will be trained in how to avoid such exposures and what to do or wear should exposure be unavoidable.

With respect to heat exposure, safe operating distances for the separation of operating personnel and a contained fire will be specified by project supervisors. An example is provided where 500 feet (152 meters) of fire containment boom could be worked safely with 500 feet of tow line behind each towing vessel. This configuration would normally place personnel on the vessels approximately 600 to 700 feet from a contained fire within the boom. During the offshore burn conducted on the second day of the Exxon Valdez oil spill, 500-foot tow lines were used along with a 450 foot-long 3M Fire Boom. Personnel on the towing vessels could feel the heat of the fire; however, even at the peak of intense burning (flames >200 feet high), the radiated heat was quite comfortable. The distances described here are consistent with the often-used rule of thumb that personnel should be at least five fire-diameters away from an open burn.

The safety of response and non-response personnel will strongly depend on strict adherence to the aforementioned "Site Specific Safety-Plan(s)" and the avail-ability and proper use of reliable communications equipment prior to and throughout any in-situ burn program. Such communications will be needed to warn all participants, observers, government representatives, and the general public about the intent to burn oil. Proper notification will help prevent the unexpected movement of aircraft and vessels into predesignated restriction zones. In addition, routine status reports to airplanes, boats, radio and television stations, etc. will help reduce the kinds of overreaction and misinterpretation that often occur during such highly visible and controversial activity.

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APPENDIX A
OIL SPILL RESPONSE CHECKLIST: IN-SITU BURNING

The following checklist is provided as a summary of important information to be considered by the Federal On-Scene Coordinator (FOSC) in reviewing any request to conduct in-situ burning in response to an offshore oil spill in the Gulf of Mexico.

1. SPILL DATA (To be completed by Responding Party and submitted to FOSC)

A. Name of incident:

B. Date and time of incident: Month/Day/Year____________ Time_______

C. Incident: Grounding ______ Transfer Operations ______ Collision ______
Blowout ______Pipeline Rupture ______Explosion ______ Other______

D. Did spill source ignite? Yes ____ No____
Is source still burning? Yes ____ No____

E Spill Location: Latitude ________________Longitude_________________________

F Distance (in miles) and direction to nearest and _______________________________

G Product(s) released:

H. Product(s) easily emulsified? Yes _____ No____ Uncertain____

I. Product(s) already emulsified upon release? Yes _____ No _____
Light emulsion (0-20%) _________Moderate emulsion (21-50%) ___________
Heavy emulsion (>51 %) _________Unknown___________

J. Estimated volume(s) of product released: ________________gals / bbls
________________gals / bbls

K. Estimated volume(s) of product that could still be released:
___________________________gals __________ bbls ___________
___________________________gals __________ bbls ___________

L. Release status: Continuous ____ Estimated Rate ____________________
Intermittent ____ Estimated Rate ___________________
One time only ("batch" spill); flow now stopped _______

M Estimated area of spill:
Approx. Date/Time _______Surface Area ________Sq. Miles (Stat ___Naut.____)
Approx. Date/Time _______Surface Area ________Sq. Miles (Stat ___Naut.____)
Approx. Date/Time _______Surface Area ________Sq. Miles (Stat ___Naut.____)

2. WEATHER AND WATER CONDITIONS AT TIME & LOCATION OF SPILL
(To be completed by responding party and submitted to FOSC)

A. Temperature: Air _________ (deg. F) Water __________ (deg. F)

B. Weather: Clear ______Partly Cloudy ______Heavy Overcast ________
Rain _________ (heavy _____moderate _____light _____)
Fog _____ (type & amount at spill source _______________________________)
(type & amount at burn site _________________________________)

C Tidal Condition: Slack Tide ____Flood ____Ebb ____

D Dominant Surface Current (net drift):
Speed _______ (knots)
Direction (to) _________ (True compass heading)

E Wind Speed: knots _______Wind Direction (from) ____________

F Expected transition time between on-shore & off-shore breeze
____

G Sea State: Flat Calm _______Light Wind-Chop____________
Wind-Waves: <1 ft ________1-3 ft ________>3 ft ___________
Swell (est. height in ft) _________________

H. Water Depth (in feet): ____

I. Other Considerations:
General Visibility ____
Rip Tides/Eddies ____
Floating Debris ____
Submerged Hazards ____

Notes: See Section II PART I for weather and water conditions forecast (to be completed by NOAA Scientific Support Coordinator)

See Section III Part II for predicted oil behavior (to be completed by NOAA SSC).

Responding party has option of also submitting information on predicted oil behavior to FOSC.

3. PROPOSED BURNING PLAN (To be completed by party responding to spill)

A. Location of proposed burn with respect to spill source:

____

B. Location of proposed burn with respect to nearest ignitable oil slick(s):

____

C Location of proposed burn with respect to nearest land

____

D. Location of proposed burn with respect to commercial fishing activity, vessel traffic lanes, drilling rigs and/or other marine activities/facilities:

____

____

____

E. Risk of accidental (secondary) fires:

F. Risk of reducing visibility at nearby airstrip(s) or airport(s)

G. Distance to, location and type of nearest population center(s) (e.g., recreational site, town, city, etc.):

H. Methods that will be used (prior to ignition) to notify residents in areas where smoke could conceivably drift into or over such areas:

I. Type of igniter proposed for use:

J. Helicopter(s) needed to deploy igniters? No ______ Yes _______
Name of company and type of helicopter to be used:

FAA approval already granted to company for use of igniter:
Yes ______ No ________

Awaiting FAA approval or verification of prior approval

K. Burning promoters or wicking agents proposed for use? Yes ______ No ______
If yes, give type and amount: ____

L. Describe proposed method of deployment for Igniter(s):

Burning Promoter(s):

Wicking Agent(s):

M. Describe method for oil containment, if any:

N. Proposed location of oil containment relative to spill source:

O. Proposed burning strategy:

_____ Immediate ignition at or near source
_____ Ignition away from source after containment and movement to safe location
_____ Ignition of uncontained slick(s) at a safe distance
_____ Controlled burning in boom or natural collection site at/near shore
_____ Possible need for multiple ignition attempts

P. Estimated amount of oil to be burned:

Q. Estimated duration of each burn: ______
Total possible burn period: ___________

R Estimated smoke plume trajectory:
____

S. Method for collecting burned oil residue
____

T. Proposed storage & disposal of burned oil residue:
____
____

4. WEATHER AND WATER CONDITION FORECAST FROM TIME OF SPILL
(To be completed by NOAA SSC)

A. Wind Speed (knots):
24-hour projection: ________________
48-hour projection: ________________

B. Wind Direction (from):
24-hour projection: ________________
48-hour projection: ________________

C. Sea Conditions:

24-hour projection:
Flat Calm ______ Light Wind-Chop ______
Wind-Waves: <1 ft _____ 1-3 ft _______ >3 ft ______
Swell (est. height in ft) _______

48-hour projection:
Flat Calm ______ Light Wind-Chop ______
Wind-Waves: <1 ft _______ 1-3 ft _________>3 ft ________
Swell (est. height in ft) ______

D. Tidal Information:

Date _______	High	(time/height)	_____/_____
	Low	(time/height)	_____/_____
Date _______	High	(time/height)	_____/_____
	Low	(time/height)	_____/_____
Date _______	High	(time/height)	_____/_____
	Low	(time/height)	_____/_____
Date _______	High	(time/height)	_____/_____
	Low	(time/height)	_____/_____

E Predicted Dominant Current (net drift):
Speed (knots) __________ Direction (to):_______________

5. PREDICTED OIL BEHAVIOR (To be completed by NOAA SSC)

A. Unburned Oil Forecast:
Estimated trajectory (attach sketch if necessary):
____

B. Expected area(s) and time(s) of land fall:
Location ____________________ Date/Time ____________________
Location ____________________ Date/Time ____________________
Location ____________________ Date/Time ____________________
Location ____________________ Date/Time ____________________

C. Estimated percent naturally dispersed and evaporated:
Within first 12 hours: __________________
Within first 24 hours: _________________
Within first 48 hours: __________________

6. RESOURCES AT RISK (To be completed by resource agencies)

A. Habitats
Sheltered Tidal Flats ____________________
Coastal Marshes ____________________
Etc. ____________________

B. Biological Resources-
Are marine mammals, turtles, or concentrations of birds noted in the burn area?
Yes ________ No _________
Endangered/Threatened Species
Non-Endangered/Threatened Species

C Historic and Archaeological Resources

D. Commercial Harvest Areas

7. FEDERAL ON-SCENE COORDINATOR'S EVALUATION OF RESPONSE OPTIONS (To be completed by FOSC)

A. Is in-situ burning likely to result in the elimination of significant volumes of spilled oil?
Yes _____ No _______

B. Will the use of in-situ burning interfere with (or in any way reduce the effectiveness of) mechanical recovery and/or dispersant application? Yes ______ No ________

If yes, do the potential benefits of burning outweigh the potential reductions in effectiveness of mechanical/dispersant use? Yes _______ No ________

C. Can in-situ burning be used safely, and with an anticipated overall reduction in environmental impact (compared with the decision not to burn)?

8. FEDERAL ON-SCENE COORDINATOR'S DECISION REGARDING IN-SITU BURNING (To be completed by FOSC)

A. _______ Do not conduct in-situ burn
B. _______ In-situ burn may be conducted in limited or selected areas
C. _______ In-Situ burn may be conducted as requested

Note: If the FOSC approves of in-situ burning, local media and residents in areas within the potential smoke plume trajectory must be notified prior to initiating the burn.

Signature of FOSC: ______________________________________

Printed Name of FOSC: ___________________________________

Time and Date of Decision: ________________________________

APPENDIX B
OPERATIONAL CHECKLIST: IN-SITU BURNING

The following list is provided as a condensed "checklist" of critical conditions, concepts or pieces of equipment that will be considered by the responsible party, prior to the initiation of an in-situ burn in the Gulf of Mexico.

Approval and Notification Considerations:

_________ Approval "checklist" completed and submitted to federal and state RRT and FOSC.

_________ Any other burn plan or permit/approval requests completed and submitted to appropriate agencies.

_________ All approvals received from federal, state, and local organizations

_________ U.S. Coast Guard notified regarding Notice To Mariners for proposed burn time and locations in which no unauthorized vessels would be allowed.

_________ FAA notified regarding Notice To Aviators for proposed burn time and locations in which no unauthorized aircraft would be allowed.

_________ Local public radio and television announcements of intent to burn, along with information on estimated times, duration of burn(s), potentially affected areas, possible health effects, and unauthorized zones for public use.

_________ State or local emergency services groups on standby for any possible assistance in notifying or evacuating certain populations.

Oil and Environmental Conditions:

_________ Oil Type & Condition – sufficiently combustible under existing weather conditions.

_________ Visibility – suitable for vessels and aircraft in carrying out burn. Consideration given to number of daylight hours left to initiate burn.

________ Sufficient time available to mobilize response personnel transport and deploy equipment ignite and complete burn(s).

________ Timing and conditions appropriate for consideration of night-time burn(s). Possibility of night-time oil collection with burns initiated at daybreak.

________ Burning operations safe and practical in light of spill status (ignited versus non-ignited. proximity to shore mobile or fixed structures, etc.).

________ Burning safe and practical in light of vessel traffic lanes.

________ Burning safe and practical in light of spill source stabilization efforts.

________ Burning safe and practical in light of any personnel evacuation efforts.

________ Burning compatible with mechanical cleanup operations.

________ Burning compatible with dispersant application techniques.

________ Burning compatible with shoreline protection & cleanup activities.

Personnel Requirements:

________ All personnel trained and qualified for burning operations.

________ All personnel briefed and familiar with burn plan.

________ Full response team(s) and supervisor(s) for vessels on location or enroute.

________ Qualified Pilot and support personnel for aerial support functions on location or enroute (e.g. reconnaissance, Heli-torch operations, etc.).

________ Backup Fire Control Team on location or enroute.

________ Everyone has protective clothing, respirators, flotation devices, etc.

Vessel Requirements:

________ Two fire boom towing vessels available for each U-configuration.

________ One fire control vessel available for each burn region. More than one vessel possibly needed should individual burns be widely separated.

________ Backup support vessel(s) as needed for personnel transport; refueling operations; recovery and storage of burn residue; transport, deployment and recovery of fire boom, boom towing vessels; etc.

Aircraft Requirements:

_______ Helicopter(s) as appropriate for number of burns anticipated, modes of ignition to be employed, and distances to be covered from staging area(s) to assigned region(s) of coverage.

_______ Fixed-wing aircraft as appropriate to supplement helicopter operations involving oil reconnaissance missions, direction of vessels to collection sites, monitoring of smoke plume trajectories, etc.

Fire Boom and Igniter Requirements:

_______ Inspected and ready-to-deploy fire containment boom (typically 500 ft to 1.000 ft per U configuration), along with long tow lines (typically 500 ft to 800 ft per tow vessel), towing bridles, and anchoring systems as appropriate.

_______ Backup fire containment boom (500 ft to 1.000 ft per U configuration) along with additional lengths of boom for any modes of deployment (e.g., containment at spill source, deflection booming into designated near shore burn sites, exclusion booming, etc.).

_______ Inspected and ready-to-deploy Heli-torch(es) as needed for any aerial ignition activities (backup drums available for rapid turn-around).

_______ Batch mixers for gelling large quantities of fuel mix for Heli-torch(es) if necessary (backup fuel supplies such as Jet-A, gasoline, or crude oil, and gelling mix).

_______ Supply of hand-held igniters (at least 10 per vessel and helicopter) for potential use (backup supply of at least 200 igniters or a means of acquiring/constructing additional units on short notice).

Communications Requirements:

_______ Dedicated radio links (and equipment) with specific frequencies for air-to-air and air-to-surface communications.

_______ Dedicated radio links (and equipment) with specific frequencies for vessel-to-vessel and vessel-to-command communications.

_______ Repeater stations as appropriate for distant or blocked communication paths.

Fire Safety Considerations:

_______ Possible use of dedicated personnel/vessels with vapor emission monitoring equipment (explosimeter).

_______ Backup fire fighting vessels (if necessary) for unique situations involving a burning spill source and/or unusual potential exposures of personnel/vessels to burning oil.

_______ Small fire fighting packages (extinguishers, monitors, foam, etc.) aboard the boom towing boats for backup use in the event of an emergency on or near one of the response vessels.

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APPENDIX C
EXISTING FIRE BOOM INVENTORIES

Cook Inlet Spill Prevention and Response Inc.:
Nikiski, Alaska (907) 776-5129

4,000 Feet 12"x 18" 3M Fire Boom
1,000 Feet 12"x 18" 3M Fire Boom
500 Feet 12"x 18" 3M Fire Boom
1,000 Feet 18"x 24" Fire Boom (Shell)

6,500 Feet total Fire Boom on Hand

Alyeska:
Valdez, Alaska (907) 835-6923

2,600 Feet 12"x 18" 3M Fire Boom

Alaska clean Seas:
Anchorage, Alaska (907) 345-3142

2,508 Feet 8"x 12" 3M Fire Boom
6,000 Feet 8"x 12" 3M Fire Boom
4,600 Feet 12"x 18" 3M Fire Boom
4,400 Feet 18"x 24" 3M Fire Boom

Texas General land Office
Oil Spill Prevention and Response
Austin, Texas (512)463-5195

1000 Feet 12"x 30" Kepner Sea Curtain Firegard Boom

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APPENDIX D
FISHING VESSELS OF OPPORTUNITY UTILIZATION GUIDELINES

LOGISTICAL

INLAND
VHF-FM Redo
15 knot cruising speed
20 sq. ft open deck space
50 hp
5 person capacity
Current registration/documentation
Required safety gear
12 hour endurance

OFFSHORE
VHF-FM Radio
15 knot cruising speed
30 sq. ft open deck space
150 hp
8 person capacity
Current registration/documentation
Required safety gear
Shelter from elements
35 gal. fuel capacity
12 hour endurance

BOOM

INLAND
VHF-FM Radio
50 sq. ft open deck space
100 hp
Stern tow points
6 ft mar draft
Current registration/documentation
Required safety gear
24 hour endurance

OFFSHORE
VHF-FM Radio
250 sq. ft open deck space
300 hp
Stem tow points
Current registration/documentation
Required safety gear
72 hour endurance

SKIMMING

INLAND
VHF-FM Radio
350 sq. ft open deck space
300 hp
Stern tow points
6 ft mar draft
Current registration/documentation
Required safety gear
24 hour endurance

OFFSHORE
VHF-FM Radio
350 sq. ft deck space
300 hp
Stern tow points
Current registration/documentation
Required safety gear
72 hour endurance

*All requirements are minimums

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APPENDIX E
EXCLUSION ZONES

1. Grand Isle, Louisiana: Because of the proximity of the human population to the shoreline, a buffer zone of 7 miles from the center of the town of Grand Isle will be observed as an exclusion zone if a south or generally on-shore wind condition exists. If there is a north or offshore wind, the 3 mile pre-approval zone will be recognized.

2. Banks, Hard Bottom Areas.

NAME:	LATITUDE - N	LONGITUDE - W
32 Fathom Bank	28° 04'	94° 30'
Stetson Bank	28° 10'	94° 17.5'
Claypile Bank	28° 20'	94° 09'
Coffee Lump Bank	28° 03'	93° 54.5'
MacNeil Bank	28° 00'	93° 33'
29 Fathom Bank	28° 08.5’	93° 29.5'

Banks within boxed areas connecting 4 points as follows:

Heald Bank	29° 08'	94° 12'
	29° 10'	94° 09'
	29° 08'	94° 08'
	29° 06'	94° 12'
Sabine Bank – West	29° 23'	94° 05'
	29° 33'	93° 35'
	29° 26'	93° 31'
	29° 16	94° 02'
Sabine Bank – East	29° 32'	93° 30'
	29° 27’	93° 17'
	29° 21'	93° 16'
	29° 26'	93° 31'
Tiger Shoal	____________	___________
Ship Shoal	____________	___________

Table X.X Region 6 In-situ Burn Pre-Approval Exclusion Areas, natural banks and other hard bottom habitats.

Name	OCS Lease Block	Latitude (N)	Longitude (W)	Radius (feet)
Sackett Bank	W Delta S Add. 148	28 38 01.99	89 33 22.45	10,500
Diaphus Bank	S Timbalier S Add 316 & 317 -	28 53 20.04	90 42 08.53	11,200
Ewing Bank (E)	Ship Shoal S Add 335	28 06 08.55	90 55 29.02	11,550
Ewing Bank (W)	Ship Shoal S Add 336, 337, 336 & 337	28 53 2859	91 00 48.59	17,500
Jakkula	Eugene I S Add 390	27 58 00	91 35 30	11,200
Sweet	Green Canyon 90 & 134	27 51 36	91 49 00	10,500
Fishnet	Eugene I S Add 356	28 08 53.48	91 48 38.74	11,550
Alderdice	S Marsh I S Add 171,178 & 179	28 05 04.79	91 59 43.52	15,750
Parker	S Marsh I S Add 195, 202 & 203	27 57 23.44	92 01 10.81	21,000
Sonnier	Vermilion S Add 305	28 20 27.10	92 27 35.56	10,500
Rezak	Vermilion S Add 404 & 405	27 58 18.29	92 22 56.45	14;000
Sidner	Vermilion S Add 411 & 412	27 55 41.98	92 22 48.71	13,300
Bouma	Vermilion S Add 370 371 384 385 & 393	28 03 16.76	92 27 42.31	17,500
McGrail	Vermilion S Add 409 & 410	27 58 06.87	92 35 53.24	14,000
Elvers	Garden Banks 153	27 43 46.49	92 53 30	11,200
Geyer	Garden Banks 106 150 & 194	27 51 36	93 04 00	2,100
Bright	W Cameron S Add 650 656 & 657	27 53 28.59	93 17 40.43	17,500
Rankin (N)	W Cameron S Add 653 & 654, High I E Add S Ext A-371 A-391 & A-392	27 55 06.5	93 26 10.72	15,750
Rankin (S)	High I E Add S Ext A-391 & A-392	27 53 35.10	93 26 51.94	10,500
MacNeil Bank	High I E Add S Ext A-351 & A-368	28 01 09.62	93 30 57.79	14,000

29 Fathom Bank	W Cameron S Add 591; HI E Add S Ext A-329 & A-330	28 08 24.91	93 29 31.11	10,500
Coffee Lump Bank	High I E Add S Ext A-340 A-358 A-359 A-360 & A-361	28 0130	93 54 30	21,000
E Flower Garden	High I E Add S Ext A-366 A-367 A-374 A-375 A-388 A-389	27 54 30	93 36 00	Protected Area 50 CFR 638.22
W Flower Garden	High I E Add S Ext A-383 A-384 A-385 A-397 A-398 A-399 & A-401; Garden Banks 134 & 135	27 52 30	93 49 00	Protected Area 50 CFR 638.22
Claypile Bank	High I S Add A-464 & A-447	28 19 30	94 09 00	14;000
Stetson Bank	High I S Add A-503 & A-513	28 10 00	94 17 30	12,250
Applebaum Bank	High I S Add A-590; EB 122 & 123	27 52 00	94 15 00	12,250
32 Fathom Bank	High I S Add A-534 & A-535	28 03 48	94 31 18	14,000
Small Dunn Bar (aka Small Adam)	Mustang I E Add A-54	26 56 42	96 49 48	7,000
Big Dunn Bar (aka Big Adam)	Mustang I E Add A-54 & A-55	26 57 12	96 49 00	7,000
Baker	Mustang I E Add A-62 & A-86	27 45 00	96 14 00	12,250
South Baker	Mustang I E Add A-95	27 40 30	96 16 24	7,000
Aransas	Mustang I E Add A-117 & A-118	27 35 30	96 27 00	7,000
N. Hospital	Mustang I E Add A-117 & A-136	27 34 30	96 28 30	7,000
Hospital Rock	Mustang I E Add A-136	27 32 30	96 28 30	10,500
Southern	Mustang I A-9 & A-16	27 26 30	96 31 30	12,250
Dream	North Padre I E Add A-40 & A-41	27 02 30	96 42 30	12,250
Blackfish Ridge	North Padre I E Add A-72	26 52 36	96 46 36	10,500
Mysterious	North Padre I E Add A-83 & A-84	26 46 00	96 42 00	17,500

Table X.X Region 6 In-situ Burn Pre-Approval Exclusion Areas, artificial reefs of the Louisiana Artificial Reef Initiative.

Name	OCS Lease Block	Latitude (N)	Longitude (W)	Radius (ft)
Angel	W Cameron 616 & 617	28 03 01	93 19 00	5,000
Angel	W Cameron 616 & 617	28 02 50	93 19 00	5,000
Angel	W Cameron 616 & 617	28 02 59	93 18 23	5,000
Angel	W Cameron 616 & 617	28 03 27	93 18 42	5,000
Angel	W Cameron 616 & 617	28 03 28	93 19 04	5,000
Angel	W Cameron 616 & 617	28 03 13	93 18 20	5,000
Angel	W Cameron 616 & 617	28 02 55	93 18 52	5,000
Barnacle	W Delta 89	28 55 38	89 36 59	5,000
Buccaneer	Eugene I 366	28 07 27	91 25 08	5,000
Buccaneer	Eugene I 366	28 07 14	91 24 50	5;000
Coconut	E Cameron 273	28 25 55	92 39 31	5,000
Coconut	E Cameron 273	28 25 54	92 39 30	5,000
Coconut	E Cameron 273	28 25 53	92 39 56	5,000
Desparation	Ship Shoal 230	28 28 26	91 02 13	5,000
Desparation	Ship Shoal 230	28 28 30	91 02 10	5,000
Duval	Shi Shoal 215	28 30 24	90 54 09	5,000
Harbor	S Timbalier 86	28 46 44	90 14 02	5,000
Hurricane	W Delta 134	28 44 20	89 44 10	5,000
Hurricane	W Delta 134	28 43 54	89 44 18	5,000
Hurricane	W Delta 134	28 44 04	89 44 05	5,000
Hurricane	W Delta 134	28 44 13	89 44 20	5,000
McPherson	Ship Shoal 214	28 30 12	90 51 48	5,000
McPherson	Ship Shoal 214	28 30 26	90 51 31	5,000
McPherson	Ship Shoal 214	28 30 12	90 51 45	5,000
Nautical	W Cameron 608	28 06 30	93 18 31	5,000
Nautical	W Cameron 608	28 06 22	93 18 29	5,000
Pelican	W Cameron 595	28 09 04	93 17 32	5,000
Pelican	W Cameron 595	28 09 01	93 17 31	5,000
Pelican	W Cameron 595	28 08 54	93 17 30	5,000
Shelter	S Marsh I 146	28 13 07	91 58 36	5;000
Shelter	S Marsh I 146	28 13 08	91 58 46	5,000
Snapper	S Timbalier 128	28 40 14	90 15 49	5,000
Snapper	S Timbalier 128	28 40 14	90 15 48	5,000
Telegraph	E Cameron 272	28 50 03	92 37 57	5,000
Volcano	Ship Shoal 320	28 08 37	91 19 32	5,000
Volcano	Ship Shoal 320	28 08 13	91 19 14	5,000

Table X.X Region 6 In-situ Burn Pre-Approval Exclusion Areas, artificial reefs of the Texas Parks and Wildlife Department, Artificial Reef Program.

Name	OCS Lease Block	Latitude (N)	Longitude (W)	Radius (ft)
High Island	HI A-492	28 13 26.941	94 03 20.688	5,000
High Island	HI A-298	28 18 11.486	93 46 00.114	5,000
High Island	HI.A-298	28 18 13.257	93 45 58.786	5,000
High Island	HI A-298	28 18 11.274	93 46 00.518	5,000
High Island	HI A-520	28 07 27.363	93 57 23.624	5,000
High Island	HI A-281	28 21 50.057	93 47 06.586	5,000
High Island	HI A-281	28 21 53.410	93 47 03.247	5,000
High Island	HI A-315	28 12 49.926	93 41 55.804	5,000
High Island	HI A-487	28 14 54.996	94 16 18.933	5,000
High Island	HI A-542	28 02 51.308	94 09 07.853	5,000
High Island	HI A-567	27 58 30.8232	94 13 02.8803	5,000
Galveston Island	GI A-22	28 35 35	94 48 43	5,000
Galveston Island	GI A-22	28 35 36	94 48 46	5,000
Galveston Island	GI A-22	28 35 34.54	94 48 44.52	5,000
Galveston Island	GI 189	29 08 23.5	94 42 23.5	5,000
Brazos	Brazos A-28	28 08 58.866	95 29 41.523	5,000
Brazos	Brazos A-28	28 08 58.924	95 29 41.615	5,000
Brazos	Brazos A-132	27 49 20.994	95 59 24.717	5,000
Brazos	Brazos A -336-L	28 47 39	95 20 52	5,000
Matagorda Island	MI 616	28 06 35	96 05 00	5,000
Matagorda Island	MI 712	27 49 57.24	96 30 22.332	5,000
Mustang Island	Mustang I 802	27 34 10	96 51 30	5,000
Mustang Island	Mustang I 770-L	27 41 30	96 58 30	5,000
Mustang Island	Mustang I 746-L	27 46 25	96 58 15	5,000
S Padre I	SPI 1070	26 25 30.415	97 01 16.338	5,000
S Padre I	SPI 1070	26 25 29.577	97 01 21.671	5,000
S Padre I	SPI 1070	26 25 29.849	97 01 20.758	5,000

Additional Shoals:

Tiger Shoal	91 53.68	29 26.10
	91 56.26	29 30.41
	92 12.05	29 24.04
	92 09.95	29 21.99
Trinity Shoal	91 59.53	29 12.95
	92 01.87	29 20.55
	92 22.75	29 15.41
	92 20.17	29 07.50
Ship Shoal	90 33.16	28 55.48
	90 32.93	28 53.63
	91 07.49	28 50.55
	91 07.84	28 55.68

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