Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

In this chapter:

- ***Is a 25% increase in the mechanical recovery Caps practicable at this time as proposed in the regulations? Is another increase in mechanical recovery Caps practicable in 5 years?***
- ***Is a dispersant Cap practicable? If so, should dispersant equipment capabilities result in a decrease (offset) in the mechanical recovery Caps that a vessel or facility plan holder is required to maintain?***
- ***Is an* in situ *burn Cap practicable? If so, should* in situ *burn equipment capabilities result in a decrease (offset) in the mechanical recovery Caps that a vessel or facility plan holder is required to maintain?***
- ***Have advances in oil spill tracking technologies enhanced the effectiveness of oil spill response?***

The Caps levels originally established by 33 CFR 155 and 33 CFR 154 were designed to ensure that vessel and facility plan holders maintained a baseline capability to respond to oil spills in various generic environments around the country. The purpose of this Caps review has been to determine the impact and practicability of increasing these Caps levels to require vessel and facility plan holders to maintain an augmented response capability, using all available technologies to respond to the full range of spill scenarios. These technologies include not only mechanical recovery but also dispersants, *in situ* burning, and oil spill tracking. For all three techniques, this Caps review examines historical opportunities for use, technology development, equipment and system availability, and deployment potential.

6.1 CONCLUSIONS

Analysis of the data in this Caps review produces four fundamental conclusions:

- An increase in the current mechanical recovery Caps is practicable at this time and again in 5years.
- It is practicable to require a dispersant capability under certain conditions for plan holders operating in waters where dispersant use pre-approval or expedited approval is in place.
- It is not practicable to require an *in situ* burn capability at this time. *In situ* burning may be used to supplement existing mechanical recovery capabilities. It may be practicable to consider an offset of mechanical recovery Caps under certain conditions.

- It is practicable to require plan holders to provide an airborne visual tracking capability. Advances in oil spill tracking technology are expected to improve the effectiveness of all three spill response techniques examined in the Caps review. Those advances, however, have not been sufficient to replace human observation from aircraft as the primary means of directing response operations and evaluating effectiveness.

6.2 ALTERNATIVES AND RECOMMENDATIONS

Analyzing historical opportunities for use shows that 231 oil spills greater than 1,000 gals occurred in nearshore, offshore, and open ocean areas between January 1993 and September 1998. This equates to approximately one spill every 9 days.

To obtain a large enough data set for substantive analysis, spill size of 1,000 gals was used, which is not intended to imply that active clean up should be undertaken for every 1,000-gal spill. Rather, the spill data in Chapter 2 of this Caps review represent an approximation of the potential oil types, spill locations, and environmental conditions that might exist in a major spill event.

The purpose of the analysis in Chapter 2 was to examine the opportunities for using mechanical recovery, dispersants, and *in situ* burning either in combination or alone as primary response option. Spills in rivers and canals and the Great Lakes were not included because (1) dispersant technology is not currently recognized as a viable option by responders in those geographic areas, and (2) *in situ* burning typically is limited to incident-specific consideration rather than pre-authorization in those geographic areas.

The analysis of historical opportunities for use of mechanical recovery, dispersants, and *in situ* burning indicates the following:

- On-water mechanical recovery, as specified in the regulations, was a viable response option in 61.9% of all nearshore, offshore, and open ocean spills. Mechanical recovery was eliminated as a response option in 18.6% of the spills because of oil type (Type I or Type V) and in 21.6% of the spills because of adverse environmental conditions. Mechanical recovery was the only viable response option in 37.7% of the spills.
- Dispersant use was an option in 44.6% of all spills in the historical analysis and in 21.2% of spills that occurred more than 3 nmiles from shore. In 5.2% of the spills, dispersant use was the only viable response option.
- *In situ* burning was a viable response option in 39% of all spills in the historical analysis and in 24.2% of the spills that occurred more than 3 nmiles from shore. There were no spills in which *in situ* burning was considered the only viable response option.

The data from the historical analysis support the conclusion that no response option is adequate alone in responding to the full range of potential spill scenarios. All response options, however, are potentially useful in a significant number of spills. Additionally, dispersant use is the only viable response option in a significant number of spills; therefore, requiring a dispersant equipment capability appears warranted to optimize spill mitigation potential. The data in Chapter 2 also support further expanded planning for use of *in situ* burning in combination with mechanical recovery as a potential response option.

6.2.1 Mechanical Recovery

Is a 25% increase in the mechanical recovery Caps practicable at this time as proposed in the regulations? Is another increase in mechanical recovery Caps practicable in 5 years?

Alternatives considered:

- No mechanical recovery increase.
- A 25% increase at this time with no increase in the future.
- A 25% increase at this time and an additional 25% increase in 5 years.

Discussion. Mechanical recovery remains the mainstay countermeasure for spill response. Analysis of historical opportunities for use indicates that over 61% of all spills occurring in the United States are amenable to mechanical recovery. The current Caps, however, are inadequate to ensure an individual plan holder's capability to respond to a WCD scenario, as shown below:

- In the last 25 years, there have been 25 spills greater than 40,000 bbls (the current maximum Cap).
- In the last 25 years, there have been 22 spills greater than 50,000 bbls (the maximum Cap with a 25% increase).
- In the last 25 years, there have been 21 spills greater than 60,000 bbls (the maximum Cap with a 50% increase).

Mechanical recovery technology is steadily improving for open-water response as newer designs for containment booms, skimmers, and temporary storage devices are refined and operationally tested. Mechanical recovery technology for ice and fast currents remains static and rudimentary. Oil spill tracking technology has advanced to allow better tracking of oil slicks moving in water, but is not sufficiently refined to determine oil thickness. In addition, the procedures and instrumentation for real-time tactical use of remote-sensing data have not been developed. The market availability of mechanical recovery equipment and systems has improved as the number of models reaching the marketplace increases. National and regional inventories of equipment remain at high levels, and should be kept at these levels.

Almost all WCD scenarios reported in ACPs predict spills several times larger than current equipment Caps. Analysis of NSFCC response equipment data indicates that aggregate equipment totals in each port are sufficient for plan holders to meet increased Cap requirements without major capital expenditures.

Recommendations. Based on potential for spills in excess of both current and projected Caps and equipment availability in the marketplace and in existing spill response organizations stockpiles, an increase in current Caps levels is both warranted and practicable.

Oceans, Nearshore, and Inland. The current status of technology, availability, and recovery capacities of mechanical equipment generally support an initial Caps increase of 25% and another 25% in 5 years. Mechanical recovery technology is progressing steadily, and new models are being made available. Recovery in fast water and ice is still limited, but this is not a universal problem. The current removal capability required by the Caps is generally well below the WCD planning volumes for vessels and facilities in oceans, nearshore, and inland areas of coastal ports, particularly on the West Coast and in the Gulf of Mexico. The existing inventory of EDRC will not constrain an increase in Caps.

Great Lakes. Mechanical recovery in the Great Lakes often is similar to recovery in nearshore and offshore areas depending on weather conditions. Oil recovery under winter ice conditions remains a problem. As with the previous geographic area, the current status of technology, availability, and recovery capacities of mechanical equipment generally support an initial increase in Caps levels by 25% and another 25% in 5 years. The current Cap are generally below the required EDRCs for WCD planning volumes, but an initial 25% increase, and a 25% increase in 5 years would be sufficient to cover the required EDRC for many of the Great Lakes ports.

Rivers and Canals. The current status of technology, availability, and recovery capacities of mechanical equipment generally support an initial Caps increase of 25% and another 25% in 5 years. As has been shown in past spills, conventional techniques and equipment will be effective in lower-current portions of a waterway, and those techniques may be adapted to allow limited recovery in fast-water environments. Also, tank testing at OHMSETT indicates that commercially available fast-water booms and high-speed skimmer systems could be used to provide a recovery capability in fast water up to 3 knots. Therefore, except in areas where currents exceed 3 knots or in severe ice conditions, mechanical recovery technology and techniques can be as effective in river and canal environments as they are in other environments.

Due in part to the fact that these fast-water technologies are only now becoming commercially available, the available EDRC values for the inland river port areas are well above the current or increased Caps, but these are probably based on conventional equipment, not fast-water recovery. Therefore, the Coast Guard should establish criteria and definitions for a fast-water mechanical recovery capability. Thereafter, the Coast Guard should consider requiring plan holders operating in fast-water environments (those areas where currents routinely exceed the average capabilities of conventional booms and skimmers – e.g., 1 knot) to ensure that at least 25 % of their mechanical recovery capabilities are fast-water capable within 5 years.

6.2.2 Dispersant Use

Is a dispersant Cap practicable? If so, should dispersant equipment capabilities result in a decrease (offset) in the mechanical recovery Caps that a vessel or facility plan holder is required to maintain?

Alternatives considered:

- Do not require a dispersant equipment capability, but continue to encourage it by an allowing an offset in mechanical recovery Caps.
- Require a dispersant equipment capability with no offset in mechanical recovery Caps.

Discussion. According to the analysis of historical opportunities for use in Chapter 2, most spills that are potential dispersant use candidates occur in the Gulf of Mexico, the Northeast, and off Southern California. Dispersants have been used on several recent spills in the Gulf of Mexico with positive results.

Currently, there is one long-range dispersant aircraft contractor in the continental United States and one long-range dispersant aircraft contractor in Alaska. Suitable aircraft are available but not under contract near the West Coast; short-range aircraft are available but not under contract to plan holders in Hawaii and the Caribbean. Short-range aircraft are available by contract in Alaska, Arizona, California, and Pennsylvania, and available but not under contract in Florida, Idaho, Louisiana, Maine, Texas, and Washington.

There are dispersant stockpiles located throughout the continental United States and Alaska. There are sufficient airports around the coastal United States to accommodate dispersant operations using either long- or short-range aircraft with transit time of less than 1 hour to all spills within 50 nmiles of shore.

Dispersant application by aircraft is limited by how much dispersant each aircraft can carry on each sortie. Vessels equipped with fire monitors or dispersant spray arms can effectively apply dispersant to spilled oil. The primary advantages of vessel platforms are the vessels' dispersant-carrying capacity, and their ability to move slowly through heavier patches of oil and spray larger quantities of dispersant on those patches. The primary disadvantage of vessel platforms is the vessels' slow speed relative to dispersant aircraft both in transiting to the spill scene and between oil patches in open water. Both aircraft and vessel platforms require additional aircraft to identify patches of oil that are of suitable thickness for dispersion and to evaluate dispersant effectiveness.

Modern dispersant formulations have extended the window of opportunity for dispersant use to 72 hours and beyond. Current oil spill tracking technology allows better tracking of oil slicks moving in water, but still is not sufficiently refined to determine oil thickness. Scientific data are now available demonstrating that dispersed oil concentrations in the water column quickly return to background levels. Further, analysis of the tradeoffs between dispersant use and mechanical recovery demonstrates that, in many incidents, dispersant use, either in combination with or instead of mechanical recovery, could enhance protection of the environment significantly.

Dispersant pre-approval or expedited approval agreements exist for most U.S. coastal regions. Pre-approval agreements typically empower the FOSC or unified command to make dispersant use decisions without further consultation for spills occurring more than 3 nmiles from shore. Expedited approval agreements require consultation with other agencies, but those agencies must provide their input within 2 hours of being contacted. Many WCD scenarios in the ACPs include dispersant use consideration as part of the response strategy. Additionally, many areas are investigating the potential for dispersant pre-authorization in waters up to the shoreline.

Overall, the opportunity for use, availability of dispersants and application resources, and trend for FOSCs and RRTs to seriously consider and more readily approve their use indicate that an expanded role for dispersants is both practicable and warranted. Spill circumstances may dictate against mechanical recovery use in favor of dispersant use. For example, environmental conditions (e.g., sea state or winds) may be such that mechanical recovery equipment may be ineffective or even dangerous to operating personnel. Dispersant use is ideally suited for use in higher-sea states when containment boom is ineffective. A spill may occur relatively near to shore but in an area remote from mechanical recovery equipment. A dispersant capability may allow for a quicker, more effective response than mechanical recovery in open water, away from more environmentally sensitive areas. Also, in the case of a massive or continuous release, mechanical recovery may be hindered because of limited available temporary storage; dispersant use would then be an appropriate complement to mechanical recovery.

Recommendations. Plan holders carrying Groups II, III, and IV cargoes, operating within 50 nmiles of shore, in waters where a dispersant pre-approval or expedited approval agreement exists, should be required to maintain a dispersant equipment capability sufficient to treat a 40,000-bbl spill (24,000 bbls oil after evaporation) at a DOR of 1:20 within 60 hours of authorization. For implementation, plan holders should be required to have a dispersant delivery capability sufficient to commence application within 6 hours of incident-specific dispersant approval. Dispersant contractors should be able to complete treatment of 1,000 bbls of oil within 12 hours (Tier I); an additional 12,500 bbls of oil within 36 hours; and another 10,500 bbls of oil within 60 hours (Tier III). The regulations should allow plan holders to employ a mix of vessels and aircraft in meeting this requirement, but at least 50% of every plan holder’s dispersant delivery capability should be provided by long-range aircraft..

The required dispersant capability should not result in an offset in the mechanical recovery Caps. Even with a 50% increase in the Caps, mechanical recovery capability alone falls short of WCD scenario planning EDRC. The addition of a dispersant capability helps close the planning gap. Also, some spills are amenable only to dispersants while others are amenable only to mechanical recovery; therefore, neither capability can practicably be considered as an offset for the other.

6.2.3 *In Situ* Burning

Is an* in situ *burn Cap practicable? If so, should* in situ *burn equipment capabilities result in a decrease (offset) in the mechanical recovery Caps that a vessel or facility plan holder is required to maintain?

Alternatives considered:

- No *in situ* burn equipment capability is practicable at this time.
- Require an *in situ* burn equipment capability with no offset in mechanical recovery Caps.
- Do not require a capability, but encourage it by an allowing an offset in mechanical recovery Caps.

Discussion. According to the analysis of historical opportunities for use, most spills that are potential *in situ* burn candidates occur in the Gulf of Mexico, Northeast, and off Southern California. It should be noted that while not universally applicable in all spills, *in situ* burning can play a significant role in larger spills where mechanical recovery is limited by the sheer volume of oil. *In situ* burning has been proven viable in several test burns, but has not been used in actual open-water spill response in the United States since 1989.

In situ burn technology has progressed significantly and steadily since EXXON VALDEZ. Fire-resistant boom designs are being refined and tested to improve service life when exposed to fire and mechanical stress at sea. Advanced fire-resistant boom designs that would allow almost continuous burning are now being prototyped and tested. Concurrently, the technology and procedures for predicting the movement of the smoke plume and monitoring emissions levels have improved significantly in recent years.

In situ burn vessel platforms require aircraft to identify patches of oil that are of suitable thickness for burning and evaluate burning effectiveness. Oil spill tracking technology has advanced to allow better tracking of oil slicks moving in the water, but still is not sufficiently refined to determine oil thickness.

The availability of fire-resistant booms, pre-staged around the country, has increased dramatically in recent years. Prior to EXXON VALDEZ, virtually no fire-resistant booms were pre-staged. Now, several *in situ* burn equipment stockpiles exist in the continental United States and Alaska. In the continental United States, the largest stockpiles are owned by MSRC and CCC and are available by contract only to their members. Alaska has the largest stockpile of booms, with roughly 10,000 ft in Southern Alaska and 20,000 ft on the North Slope.

I*n situ* burning and mechanical recovery have very similar operating limitations. The primary advantage of *in situ* burning over mechanical recovery is the reduction in temporary storage and permanent disposal of recovered oil and oil residues. Also, because fewer skimmers and storage vessels are needed, manpower and equipment requirements also may be reduced, which is particularly important in responding to larger spills. The primary disadvantage of *in situ* burning compared with mechanical recovery is that its use is restricted because of human health and safety concerns related to smoke plume.

In situ burning is rapidly evolving as the immediate countermeasure of choice for certain spill scenarios. It is the only effective countermeasure for response in heavy ice. A conservative EDRC for a 500-ft section of boom is 5,000 bpd, which equals or exceeds the realistic capability of most boom and skimmer systems.

There have been significant advances in *in situ* burn use policies in the last 5 years. *In situ* burn pre-approval or expedited approval agreements exist for most U.S. coastal regions. Pre-approval agreements typically empower the FOSC or unified command to make *in situ* burn use decisions without further consultation for spills occurring more than 3 nmiles from shore. Expedited approval agreements require consultation with other agencies, but those agencies must provide their input within 2 hours of being contacted. Many WCD scenarios in the ACPs include *in situ* burn use consideration as part of the response strategy. RRTs around the country are adopting an aggressive policy on its use. It is included in several ACPs as an immediate countermeasure, and it has been integrated into training exercises in the Gulf of Mexico, Pacific Northwest, and Alaska.

Overall, the opportunity for use, growing inventory of equipment resources, and trend for FOSCs and RRTs to seriously consider and more readily approve its use indicate that an expanded role for *in situ* burning is both practicable and warranted.

Recommendations. Plan holders carrying Groups II, III, and IV cargoes, operating within 50 nmiles of shore, in waters where an *in situ* burn pre-approval or expedited approval agreement exists, should be encouraged, but not required, to establish and maintain an *in situ* burn capability. Adding and maintaining an *in situ* burn capability should be encouraged, but not required, by allowing an offset to mechanical recovery Caps of 10,000 bbls for plan holders who establish and maintain an *in situ* burn capability as follows:

- 5,000 bpd at Tier I
- 10,000 bpd at Tier II
- 10,000 bpd at Tier III (The credit is held at 10,000 bpd for Tier III because of the limited window of opportunity for use after 72 hours.)

With the current state of *in situ* burn boom technology, an individual boom package should be expected to survive for one 8- to 10-hour day. To meet the three tier requirements, a plan holder will therefore have to arrange by contract or other approved means for five burn boom packages. If stainless steel and water-cooled technologies are perfected, burn boom service life could be extended, thereby reducing the plan holder’s contracting requirements.

Tying a credit to existing pre-authorization agreements targets those areas where the technique is most likely to be used. Also, areas of most probable use are automatically targeted. It provides incentive for RRTs to finalize policies for pre-authorization and expedited approval. This also will provide an incentive to vessel and facility plan holders to further develop an *in situ* burn capability while maintaining a balanced response capability consisting of mechanical recovery, dispersants, and *in situ* burn resources as applicable.

6.2.4 Oil Spill Tracking Technologies

Have advances in oil spill tracking technologies enhanced the effectiveness of oil spill response?

Alternatives considered:

- Require plan holders to acquire advanced oil spill tracking technology
- Do not require plan holders to acquire advanced oil spill tracking technology at this time.
- Require plan holders to provide an airborne visual tracking capability.

Discussion. To mount countermeasures and cleanup, spill extent must be located and mapped quickly, and where possible, the thicker portions of a slick must be identified. Doing this allows for efficient deployment of mechanical recovery resources, as well as dispersant application systems and *in situ* burn equipment. Once on-scene, response units must be appraised of and vectored to the higher concentrations of oil to be effective. Spill reconnaissance is critical to the success of all three response techniques.

Visual observation remains the primary tool for directing spill response activities in open water. Handheld IR equipment is available that might enable tracking in poor visibility and at night. Oil spill response, however, is not undertaken in either of those conditions because of personnel safety concerns. Additionally, the technology is not sufficiently developed to enable accurate discernment between oil and other ubiquitous products in the water and therefore is susceptible to false readings. Other technologies are both prohibitively expensive and not yet advanced enough to provide added benefit in spill response operations.

In most cases, airborne visual observations provide most of the oil spill reconnaissance data, but are limited to daylight and good visibility. In addition to visual observation from aircraft, however, there are several technologies that have been used in tracking and mapping spills, particularly during periods of low visibility: oil tracking buoys, airborne oil spill remote sensing, and satellite remote sensing.

Tracking buoys are best suited for marking the location of a spill initially, and providing a global estimate of drift speed and direction. They have limited utility as a tactical spill-tracking tool.

Radar systems—SLAR and SAR—have the ability to detect surface oil slicks, but are susceptible to false targets. X-Band Radar is most effective; standard search radar systems are much less effective. These radar systems are expensive to build and operate.

IR sensors and UV scanners are more useful for tactical reconnaissance. The major technological advance over the past few years is the reduction in size and cost of IR sensors:

small, portable units can now be obtained for under $100,000 and weigh less than 50 kg. Thus, infrared is becoming the primary remote-sensing tool for spill response.

Measuring oil spill thickness is a key parameter for planning spill response operations. Oil spill thickness sensors, however, remain in the R&D stage, and an operational prototype of such a device is still several years away.

Satellite imagery continues to be used on various spills where coverage is available; however, coverage is often intermittent during response operations. This intermittent coverage limits the utility of satellite remote sensing as a tactical reconnaissance tool.

Recommendations. It is not practicable to require plan holders to establish and maintain advanced oil tracking technology at this time. Visual monitoring from aircraft has been proven both practicable and effective in directing on-water mechanical recovery systems to the thickest portions of an oil slick. Aircraft monitoring provides similar service to both dispersant and *in situ* burn operations. It also facilitates estimation of cleanup effectiveness and validation of predicted computer trajectories to aid in planning for subsequent operational periods.

Plan holders are not currently required to have airborne observation capabilities available. These services have been provided sporadically by government resources as a courtesy, time-permitting. This is not a primary mission of these government resources, and their services cannot be guaranteed.

It is therefore recommended that all plan holders be required to have available by contract or other approved means sufficient suitable aircraft, trained personnel, and support infrastructure to maintain visual observation of spill response operations within 50 nmiles from shore and in remote inland, Great Lakes, and river areas. Aircraft should be capable of sustained operations during daylight hours up to 50 nm from shore. Observer personnel should be separate from aircraft operations personnel. Observers should be able to maintain continuous communications with command and control personnel on the ground and with on-water response resources. Observer personnel should be trained using the NOAA Oil Observers guide or similar material and have experience in observing and reporting from aircraft on spilled oil on water. The purpose of such observation will be to assist mechanical recover, dispersant, and *in situ* burn operations personnel in tracking and treating the heaviest concentrations of oil in a spill.