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Regulatory Assessment, For Changes To Vessel and Facility Response Plans: 2003 Mechanical Response Caps, Dispersants, Aerial Tracking and Monitoring, and *In Situ* Burning

Final Report

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Marine Safety and Environmental Protection

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Prepared by:

U.S. Department of Transportation
Research and Special Programs Administration
John A. Volpe National Transportation Systems Center
Technology Applications and Deployment Division

Cambridge, Massachusetts

June 2001

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13. ABSTRACT
The costs and benefits of five proposed regulatory alternatives developed by the U.S Coast Guard for the OPA 90 2003 vessel and facility oil spill response plan rulemaking are assessed. The analysis is based upon the Volpe Center Programmatic Regulatory Assessment Accounting Model (PRAAM), originally developed for 11 selected core rules of OPA 90, and incorporates an industry cost survey, an expert panel for quantification of estimated benefits, and spill history and projection input data pre-processed to account for geographically specific requirements in the regulatory alternatives. PRAAM output for these purposes is dollars (cost) and volume of oil recovered or treated (benefit), both in total present value (TPV), year 1996, for consistency with earlier PRAAM results. Cost and benefit results are also expressed in total present value, year 2000, as are the results of the small business and paperwork burden analyses.

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List of Tables

List of Figures

Executive Summary

The Volpe Center prepared this Regulatory Assessment (RA) for the U.S. Coast Guard Headquarters Office of Standards Evaluation and Development (G-MSR) to address proposed changes to the existing Vessel and Facility Response Plan (VRP and FRP) regulations, Title 33 of the Code of Federal Regulations (CFR) Parts 154 and 155, including five regulatory alternatives. Spill response capabilities (Caps) were originally established in a 1993 Oil Pollution Act of 1990 (OPA 90) rulemaking and were, at that time, scheduled to increase in two 25 percent increments, in 1998 and 2003. The increases were contingent on Coast Guard review of the industry and assessment of new requirements for other oil removal technologies.

The purpose of this report is to support the Coast Guard's rulemaking in the matter of the second mechanical recovery Caps increase (2003), and other changes to the oil spill response regulations for vessels carrying oil in bulk and for Marine Transportation Related oil facilities, including chemical dispersants capabilities, aerial tracking and monitoring of oil spills requirements, and an optional credit for *in situ* burning assets (dispersants and *in situ* burning are also referred to as high rate removal technologies). The assessment includes analysis of economic impact, cost-effectiveness, and small business and paperwork burden aspects of the five regulatory alternatives advanced by the Coast Guard for the proposed rulemaking.

The approach taken utilizes the Volpe Center Programmatic Regulatory Assessment Accounting Model (PRAAM) developed for the Coast Guard selected 11 core rules of OPA 90, and incorporates an industry cost survey, an expert panel for quantification of estimated benefits, and spill history and projection input data pre-processed to account for geographically specific requirements in the regulatory alternatives. PRAAM output for these purposes is dollars (cost) and volume of oil recovered or treated (benefit), both in total present value (TPV), year 1996, for consistency with earlier PRAAM results. Cost and benefit results are also expressed in total present value, year 2000, as are the results of the small business and paperwork burden analyses.

E.1 The Five Proposed Coast Guard Rulemaking Alternatives

The Coast Guard has developed five regulatory alternatives with the intent of assessing the wide range of response options and combinations among the response technologies currently available. This proposed rulemaking represents, firstly, the second (year 2003) incremental increase in mechanical oil recovery Caps, for tank vessels carrying petroleum oils as primary cargo and marine transportation related (MTR) facilities that handle, store, or transport petroleum oils (groups II, III, and IV), since the original regulations went into effect in 1993. It also recognizes the technological advances which have occurred in the oil spill response industry since 1991. The several alternatives developed by the Coast Guard for the 2003 Caps rule include combinations of:

- The second of two 25 percent mechanical recovery Caps increases relative to the 1993 requirements, resulting in a cumulative 50 percent increase over the 1993 baseline on-water mechanical recovery Effective Daily Response Capability (EDRC). This RA compares costs and benefits relative to the initial 25 percent mechanical recovery increase, effective in 2000.
- New requirements for dispersants Caps, replacing the existing credit provisions for dispersant capability, applying to planholders operating in waters where a dispersant pre-approval or expedited approval agreement exists. The Coast Guard is considering two different initial response (tier 1) Caps levels and specific Gulf Coast area waters Caps. The tier 1 (within 12 hours of spill notification) Caps levels are called option A and option B, option B being the more rigorous of the two. Planholders would be allowed to employ a mix of vessels and fixed wing aircraft to meet these dispersant delivery requirements, with at least 50 percent provided by fixed-wing aircraft. Proposed Gulf Coast area waters Caps would be higher than Caps for other waters.
- Requirement for aerial tracking and monitoring of oil spills capability, by contract or other approved means, for all vessel and MTR facility planholders, who must ensure the availability of suitable aircraft

E.2 Results

E.2.1 Cost

Table E-1 summarizes the findings of the benefit and cost analysis. All active alternatives share the aerial tracking and monitoring component, whose initial capital and yearly recurring costs are $5.40 million and $0.99 million, respectively (year 2000 $s, undiscounted). Mechanical recovery capital and yearly recurring costs are $13.39 million and $0.83 million , respectively, for implementation in all operating environments (alternatives 2 and 3), and slightly more than half those amounts for the three operating areas specified in alternative 4. The capital costs for dispersants are $16.05 million and $16.94 million for options A and B, respectively; the yearly recurring cost is $8.80 million for both options. OSROs record keeping costs, which are passed onto the planholders, range from $0.72 million to $1.1 million for the active alternatives. The planholders' own separate paperwork burden costs are $13,819,250 the first year and $7,199,250 every year thereafter. Yearly employee and training costs range from $0.41 million to $0.75 million. The government cost component is $80,052 in the first year, and minimal thereafter, and is constant for all active alternatives.

Alternative 2 is the least costly, involving mechanical recovery Caps increases only, which will probably be met by industry through additional contractual and cooperative arrangements. Alternatives 3, 4, and 5 each have required dispersants Caps components; mechanical recovery Caps costs decline for alternative 4 and disappear in alternative 5. For all four alternatives the planholders' paperwork burden costs, with a TPV of $54,260.806 in constant 1996 $s, make up the largest portion of the costs.

E.2.1 Benefits and Cost Effectiveness

Many oil spill response organizations (OSROs), and all 11 members of the April and July 2000 expert panel convened by the Volpe Center for this Caps Regulatory Assessment, strongly believe that the Coast Guard's proposed *in situ* burning credit, up to a 10,000 barrel reduction in the required mechanical recovery Cap, is not high enough to justify an investment for *in situ* burning systems. In light of the this finding, no benefits or costs are associated with the optional use of *in situ* burning response as a result of the proposed regulations. The expert panel also gave an answer of zero for the benefit of the 25 percent increase in the mechanical recovery EDACs in 2003, included in alternatives 2, 3, and 4. Aerial tracking and monitoring for the mechanical mode would slightly, and identically, enhance mechanical recovery effectiveness for those three alternatives.

New dispersant application requirements would result in significantly enhanced effectiveness relative to current practice in the currently approved pre-approved and expedited approval areas. This comes in part from aerial tracking and monitoring command and control requirements upgrading current such capabilities.

TABLE E-1: COST, BENEFIT, AND COST-EFFECTIVENESS SUMMARY

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Cost (TPV 1996 $s)	$0	$89,840,052	$169,103,542	$160,338,590	$149,082,829
Benefit (TPV barrels)	0 bbls	8,023 bbls	22,120 bbls	22,277 bbls	22,277 bbls
Cost Effectiveness ($ per bbl)	NA	$11,198	$7,645	$7,197	$6,692

1. This reference case utilizes the PRA's reference values for its parameters, as well as assigning full and eq 4th order effects of OPA 90 regulations versus benefits from 1st, 2nd, or 3rd order effects. It also assigns full weight to benefits of oil removed by the non mechanical mode (i.e., dispersants) versus benefits of oil mechanical

The highest total present value (TPV) benefits are for alternatives 4 and 5, 22,227 bbls. Alternative 3 includes option A dispersants Caps and shows slightly lower benefit. Alternative 2, which includes a 25 percent increase in the Caps for the mechanical mode and aerial tracking, would result in a benefit 8,023 bbls. Alternative 5, whose benefits derive entirely from dispersants (option B and aerial tracking enhancements), is the best at $6,692/barrel. Alternative 2, which involves mechanical recovery Caps increases only, is the least cost-effective at 11,198/barrel.

A sensitivity analysis shows the effect of lessening the benefit value of oil spillage mechanically removed from or treated (dispersed) in the water relative to the benefits from the prevention of spillage. In addition, it shows the effect of lessening the benefits of oil spillage dispersed relative to that which is mechanically removed. Reductive factors of 0.75 and 0.50 representing the potential effects of both concepts show the sensitivity of benefits and cost effectiveness for the information of the policy maker. The result (shown in the body of the report) is a set of significantly higher cost-to-benefit ratios, in which the rank order of effectiveness values for the regulatory alternatives does not change for any combination of applied factors.

The small business analysis shows that 240 of 710 vessel planholders operate as small businesses, as do approximately 1,040 of the total 2,600 affected MTR facilities. Facility total compliance costs for the four active alternatives range from $1,639 to $3,085 (TPV) per planholder. Vessel planholders incur much higher average total costs, because they alone bear the costs of the new dispersants requirements. Per planholder costs were found for both tank barge and tank ship companies, varied by fleet size (1-20 vessels, 21-100 vessels, and 101+ vessels). Costs for small business plan preparers and oil spill removal organizations (OSROs) are all assumed to be passed on to the planholders. A summary appears in Table E-2.

The proposed planning requirements include initial preparation, annual review, and revision every five years. The TPV national paperwork burden cost, TPV cost per planholder, and TPV hourly burden per planholder are as follows: $58,197,138, $17,582, both in constant 2000 $s, 163 managerial hours, and 38 clerical hours over the 23-year period.

TABLE E-2: SMALL BUSINESS COST SUMMARY PER PLANHOLDER

	Alternative 2			Alternative 3			Alternative 4			Alternative 5		
	1st year	Yrly	TPV	1st year	Yrly	TPV	1st year	Yrly	TPV	1st year	Yrly	TPV
VRP 0 - 20 vessels												
Tank Barge	$8,790	$2,609	$23,791	$22,323	$6,627	$60,420	$21,188	$6,290	$57,348	$19,701	$5,848	$53,322
Tank Ship	$7,896	$2,693	$23,820	$20,053	$6,838	$60,493	$19,034	$6,491	$57,417	$17,698	$6,035	$53,386
VRP 21-100 vessels												
Tank Barge	$79,930	$23,100	$211,935	$202,987	$58,665	$538,225	$192,666	$55,682	$510,858	$179,141	$51,773	$474,995
Tank Ship	$69,715	$21,923	$197,312	$177,047	$55,676	$501,089	$168,044	$52,845	$475,609	$156,247	$49,135	$442,222
VRP 101+ vessels												
Tank Barge	$229,229	$66,097	$606,740	$582,143	$167,859	$1,540,860	$552,543	$159,324	$1,462,511	$513,754	$148,139	$1,359,843
Tank Ship	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MTRF	$502	$197	$1,639	$937	$377	$3,085	$836	$356	$2,925	$699	$339	$2,720

logical differences and eliminated double counting of costs and benefits (more explanatory detail can be found in Chapter 3).

The findings of this RA result from a treatment of the costs and benefits using the PRAAM. Its projected spill baseline is the basis of all benefits calculated herein. The benefit due to the proposed increases in mechanical recovery Caps results from application of marginal effectiveness factors to those factors derived for the original spill response rulemaking. The costs developed herein are treated as new and separate from costs estimated for the eleven core rulemakings.

1.2 Purpose

The purpose of this report is to analyze the Coast Guard's proposed rulemaking in the matter of changes to the Caps regulations for vessels carrying oil in bulk and for marine transportation related oil facilities. The Coast Guard must assess the economic impact, cost-effectiveness, small business, and paperwork burden aspects of the proposed rule and defend their regulatory approach with quantified findings.

1.3 Elements of the Proposed Regulation

The Coast Guard's review of proposed Caps increases (found in the report "Response Plan Equipment Caps Review: Are Changes to Current Mechanical, Dispersants, and *In Situ* Burning Equipment Requirements Practicable?", May 1999) examined the practicability of increased mechanical oil recovery capability and of the use of improved oil tracking technology, as well as the implementation of "high rate removal" technologies (dispersants and *in situ* burning) and aerial tracking, on which regulations previously were silent. The review's positive findings and the proposed rulemaking reflect changes in spill technology and capabilities since 1993. In addition, it tested the assumption made in 1993 that equipment capability and availability would improve; the assumption was made at that time in acknowledgement that the 1993 Caps were far below the effective daily recovery capacity (EDRC) needed to clean worst case discharge (WCD).

At the time of the original spill response planning rulemaking in 1993, recovery of oil spilled in the water was seen as the operation of mechanical collection and removal of the oil using the boom, skimming, separation, and storage equipment available in the immediate aftermath of the *Exxon Valdez* spill. The Caps structure developed at that time has carried through to this proposed rulemaking; it specifies capabilities differentiated by time and by water body type (e.g., "open ocean", "inland waters", Great Lakes). Response time frames are designated "tiers 1, 2, and 3", representing progressively longer periods following a spill, e.g., 12, 36, and 60 hours, respectively. The two significant developments since then have been the improvement of the rates and efficiency of mechanical oil removal and the development for market of dispersant and burning technologies.

Mechanical removal involves first controlling the movement of oil on the water's surface and concentrating it, by placement of floating barriers known as "boom" in the water. The oil thus collected is then removed mechanically by motorized skimmers, which separate the oil and water mediums, and can otherwise be soaked up by sorbent pads. The spill responder must then store the recovered oil, e.g., in tanks on response vessels or in floating bladders, and transport it to shore for disposal. Mechanical response measures under the best conditions seldom achieve better than 30 percent removal, and fare worse in unfavorable conditions.

As dispersants and *in situ* burning technology and techniques have developed, so has a broader concept of spill response, one that gives the response team a variety of tools with which to attack the oil. Chemical dispersants, applied from an airplane or a response vessel, attack the oil directly by breaking it up into small droplets which then disperse into the water column. Under the proper conditions, much higher treatment efficiencies result, relative to mechanical response. Oil thus treated is not removed from the environment, however, but is moved from the surface to the water column. The Coast Guard has been careful about advancing the use of dispersants,

Alternative 1:

Take no action, i.e., status quo.

Alternative 2:

- Mechanical recovery equipment Caps increase of 25 percent for all six operating areas of water (i.e., "nearshore" area waters, "offshore" area waters, "open ocean" area waters, "inland" area waters, "Great Lakes" area waters, and "rivers and canals" area waters). ***Refer to 2.2.1.***
- Oil spill aerial tracking and monitoring of oil spills. ***Refer to 2.2.4.***
- No dispersants requirement or *in situ* burning credit.

Alternative 3:

- Mechanical recovery equipment Caps increase of 25 percent for all six operating areas of water. ***Refer to 2.2.1.***
- Dispersants with option A EDAC for tier 1 response time. ***Refer to 2.2.2.***
- *In situ* burning credit. ***Refer to 2.2.3.***
- Aerial tracking and monitoring of oil spills. ***Refer to 2.2.4.***

Alternative 4:

- Mechanical recovery equipment Caps increase of 25 percent (for inland, rivers and canals, and Great Lakes operating areas of water only). ***Refer to 2.2.1.***
- Use option B's EDACs for each tier for dispersants. ***Refer to 2.2.2.***
- *In situ* burning credit. ***Refer to 2.2.3.***
- Aerial tracking and monitoring of oil spills. ***Refer to 2.2.4.***

Alternative 5:

- No mechanical recovery Caps increase.
- Option B's EDACs for each tier for dispersants. ***Refer to 2.2.2.***
- *In situ* burning credit. ***Refer to 2.2.3.***
- Aerial tracking and monitoring of oil spills. ***Refer to 2.2.4.***

TABLE 2-1: 1993, 2000, AND PROPOSED 2003 CAPABILITY LIMITS (CAPS) ON MECHANICAL RECOVERY EQUIPMENT FOR VESSELS AND FACILITIES

Geographic Area of Water	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
Nearshore Offshore Open Ocean	10,000	20,000	40,000	12,500	25,000	50,000	15,000 12,500 with full offset (see Note 1)	30,000 25,000 w/full offset; (see Note 1)	60,000 50,000 w/full offset; (see Note 1)
Great Lakes	5,000	10,000	20,000	6,250	12,500	25,000	7,500	15,000	30,000
Inland	10,000	20,000	40,000	12,500	25,000	50,000	15,000	30,000	60,000
Rivers and Canals	1,500	3,000	6,000	1,875	3,750	7,500	2,250	5,625	9,000

1. The Coast Guard proposes an offset to the conventional mechanical recovery requirements in the "nearshore" and "open ocean" environments. If planholders choose to develop and maintain an *in situ* burning capability, the Caps are reduced for these operating environments.

The following percentages of mechanical recovery equipment identified for the applicable operational areas must be capable of operating in waters of 6 feet or less depth: (i) open ocean—none; (ii) offshore—10 percent; (iii) near-shore, inland, Great Lakes and rivers and canals—20 percent (33 CFR 154, Appendix C to Part 154, Sec. 5.5, and 33 CFR 155, Appendix B to Part 155, Sec. 5.5).

The 1993 Caps are from Table 6 of Appendix B of 155 Code of Federal Regulations (CFR), Subpart D—Vessel Response Plans, and Table 5 of Appendix C of 154 CFR, Subpart F—Facility Response Plans (these two Tables are identical). For laden vessels, the specific magnitude of their baseline Caps vary by the operating areas of water through which they transit. For MTR facilities, the specific magnitudes of their baseline Caps vary by the operating areas of water on they are located. The tier structure applies to both vessels and facilities and specifies the times within which the recovery resources must arrive on scene. Appendices B and C of the CFR for vessels and facilities, respectively, provide specific guidance on calculating the response resources required by each tier.

Mechanical response consists of the hardware components described in Chapter 1, manned and operated by qualified personnel, and transported over varying distances to the scene, depending on spill size and location, and the tier time frame which the resource provider is supporting. Most OSROs do not own all the equipment necessary to comply with the Caps specifications, but manage their WCD EDRCs through cooperatives and contracts designed for the delivery of the required assets within the given time frames.

2.2.2 Dispersants

In 2003 and thereafter, the 1993 credit/offset in mechanical recovery capability given for chemical oil dispersants will be eliminated; a maximum credit of 25 percent had been allowed, but it was seen that no planholders took advantage. In 2003 and thereafter, planholders who handle, store, or transport Groups II, III, and IV oil within the inland, nearshore or offshore areas of water, where pre-authorization or expedited approval exists, must ensure by contract for dispersants capability. Table 2-2 below indicates the proposed Caps, expressed in gallons of dispersant available for application to a spill.

The Coast Guard included options A and B as separate regulatory elements in alternatives 3, 4, and 5. Those options specify two regimes for response in the initial stage (tier 1) of a spill response event, option B being the more rigorous of the two. In addition, the Coast Guard has placed greater emphasis on tier 1 response in the Gulf of Mexico waters than elsewhere, because of the volume of bulk oil marine traffic there and the interest in enhancing the capability of the established dispersants infrastructure in pre-approval areas. "Gulf Coast area waters" means, for the purposes of the proposed dispersants application requirements, the areas of responsibility for the following Captain of the Port Zones: (1) Corpus Christi, TX; (2) Houston, TX; (3) Port Arthur, TX; (4) Morgan City, LA; (5) New Orleans, LA; (6) Mobile, AL; (7) Tampa, FL.[1]

[1] Code of Federal Regulations, 33 CFR Part 155-Oil or Hazardous Material Pollution Prevention Regulations For Vessels, Subpart D Response Plans, Section 155.1020 Definitions (Draft), January 2000.

2.2.3 In Situ Burning

The proposed regulatory alternatives include no *in situ* burning Cap requirement. Planholders operating in a nearshore or open ocean environment, carrying Groups II, III, and IV cargoes, and operating within 50 n. miles of shore in waters where an *in situ* burning pre approval or expedited approval agreement exists will receive credit against the mechanical recovery Caps for establishing and maintaining an *in situ* burning capability. The offset would be for amounts varying from 2,500 barrels (tier 1) up to 10,000 barrels (tier 3) of mechanical recovery capacity for plan holders who establish and maintain an *in situ* burning capability as shown in Table 2-4.

TABLE 2-4 *IN SITU* BURNING CAPS

	Response Time for Completed Burning (see Note 1)	Effective Daily Burn Capacity (EDBC) (see Note 2)	Cumulative Equipment Requirements			
			Fire-resistant booms (feet) (see Note 3)	Hand-held Igniters	Heli-torch Igniter (see Note 4)	Support Vessels
Tier 1	24 hours	5,000 bbls	500	4	1	2
Tier 2	48 hours	10,000 bbls	1,500	12	1	4
Tier 3	72 hours	10,000 bbls	2,500	20	1	4

1. Tiered response times represent the maximum allowable time from the instant when *in situ* burning is authorized for use by the Federal On-scene Coordinator to the completion of the operational burning period for that tier.
2. EDBC amounts for each tier above may be applied against the corresponding tiers for on-water mechanical recovery (EDRC) as required to respond to a owner or operator's worst case discharge.
3. If a fireproof boom, rather than a fire resistant boom, is identified and ensured available, the number of additional fire resistant booms that may be required will depend upon the response time and service life extension for the fireproof boom. For example, one fireproof boom package available for tier 1 and capable of an extended service life through tier 3 would only need to be augmented by two additional fire resistant booms to obtain the full credit for each
4. If a heli-torch igniter system is identified and ensured available, one-time igniters are not required.

which illustrates the effective daily burn capability for the maximum allowable mechanical recovery credit.

The credit is held at 10,000 bpd for tier 3 because of the limited window of opportunity for use of *in situ* burning after 72 hours. Tiered response times correspond with those for mechanical recovery requirements, including the shorter response times established for high volume ports. The Coast Guard has developed a set of readiness and mobilization factors for *in situ* burning response times (Table 2-5 below), similar to those for dispersants.

The credit applies in areas covered by pre-authorization agreements and includes other areas of most probable use. As such, it provides incentive for Regional Response Teams (RRTs) to finalize policies for pre-authorization and expedited approval. The intended result is for vessel and facility planholders to further develop an in situ burning capability, while maintaining a balanced response capability consisting of mechanical recovery, dispersants, and in situ burning resources.

2.2.4 *Aerial Tracking*

Visual monitoring has been proven both practicable and effective in directing on-water mechanical recovery systems, dispersant operations, and *in situ* burning to the thickest portions of an oil slick. All alternatives of the proposed regulation would require visual oil spill tracking and monitoring capability from aircraft for all response modes. All planholders will be required to have available by contract or other approved means sufficient suitable aircraft and trained personnel to maintain visual observation of spill response operations up to 50 n. miles from shore and in remote inland, Great Lakes, and river areas.

Specified aerial oil tracking and monitoring capabilities are:

- Capability to support oil spill removal operations for three ten-hour operational periods during the initial seventy-two hours of the discharge.
- Initial surveillance and observation of a discharge within 3 hours of the time its discovery (two hours recall/preparation time and one hour flight time).
- Observer personnel separate from aircraft operations personnel.
- Observers in continuous communications with command and control personnel on ground and with on-water response resources.
- Observer personnel fully trained in the use of assessment techniques as outlined in American Society for Testing Materials ASTM standard [ASTM F 1779-97], "Standard Practice for Reporting Visual Observations of Oil on Water", and with the use of other guides such as NOAA's "Open Water Oil Identification Job Aid for Aerial Observation" and NOAA's "Characteristic Coastal Habitats" Guide.

2.3 Parties Affected by Rulemaking

2.3.1 *Planholders*

Vessels and marine transportation related facilities are subject to this rulemaking as specified in 33 CFR Subpart 155.1015, Applicability Sec.

Vessels

Applicability of the rule as is follows:

- "(a) … each vessel that is constructed or adapted to carry, or that carries, oil in bulk as cargo or cargo residue, (1) is a vessel of the U.S.; (2) operates on the navigable waters of the U.S.; or (3) transfers oil in a port or place subject to the jurisdiction of the U.S.

- "(b) … vessels which engage in oil lightering operations in the marine environment beyond the baseline from which the territorial sea is measured, when the cargo lightered is destined for a port or place subject to the jurisdiction of the U.S."

- (c) Except "(1) Public vessels... (2) Vessels that, although constructed or adapted to carry oil in bulk as cargo or cargo residue, are not storing or carrying oil in bulk as cargo or cargo residue. (3) Dedicated response vessels when conducting response operations. (4) Vessels of opportunity when conducting response operations in a response area. (5) Offshore supply vessels as defined in 46 U.S.C. 2101. (6) Fishing or fishing tender vessels as defined in 46 U.S.C. 2101 of not more than 750 gross tons when engaged only in the fishing industry. (7) Foreign flag vessels engaged in innocent passage".

(2) Operates on the navigable waters of the United States; or (3) Transfers oil in a port or place subject to the jurisdiction of the United States."

VRPs and FRPs are generally applicable within the Exclusive Economic Zone (EEZ) of the United States, and on all U.S. navigable waters. The six operating areas are treated and assessed differently by changes to the VRP regulation and three by changes to the FRP regulation. Those for vessels are the grouping of inland/nearshore/Great Lakes areas, river and canal areas, offshore areas, and open ocean areas. Those for MTR facilities are: the grouping of inland/nearshore/Great Lakes areas, river and canal areas, and offshore areas (there is no open ocean requirement for MTR facilities).

The more specifically defined areas of water are as follows (as defined for these purposes in the Federal Register of February 29, 1996, Vol. 61, No. 41, p. 7919, and in the CFR) and as depicted in Figure 2-2. The reader should note that definitions of jurisdictions and ocean environments are tied to both the "territorial baseline", as defined by the CFR and international convention, and the boundary line, as defined by the CFR. The baseline is the "delimitation of the shoreward extent of the territorial sea" (33 CFR Part 2.05), aligning roughly with the shoreline. The boundary lines are distinct from the baseline, are established for more specific U.S. regulatory purposes, and "are drawn following the general trend of the seaward highwater shorelines ..... across the entrances to small bays, inlets and rivers" (46 CFR Part 7.1 and 7.5). The CFR includes specifically defined geographic points and boundary line segments for the entire coastline of the U.S. Definitions of water areas and jurisdictions follow:

Great Lakes means Lakes Superior, Michigan, Huron, Erie, and Ontario, their connecting and tributary waters, the Saint Lawrence River as far as Saint Regis, and adjacent port areas.

Inland area means the area shoreward of the boundary lines defined in 46 CFR part 7, except in the Gulf of Mexico. In the Gulf of Mexico, it means the area shoreward of the lines of demarcation (COLREG lines) defined in Secs. 80.740 through 80.850 of this chapter. The inland area does not include the Great Lakes.

Exclusive economic zone (EEZ) means the zone contiguous to the territorial sea of the United States extending to a distance up to 200 nautical miles from the baseline from which the breadth of the territorial sea is measured.

Inland area means the area shoreward of the boundary lines defined in 46 CFR part 7, except in the Gulf of Mexico. In the Gulf of Mexico, it means the area shoreward of the lines of demarcation (COLREG lines) defined in Secs. 80.740 through 80.850 of this chapter. The inland area does not include the Great Lakes.

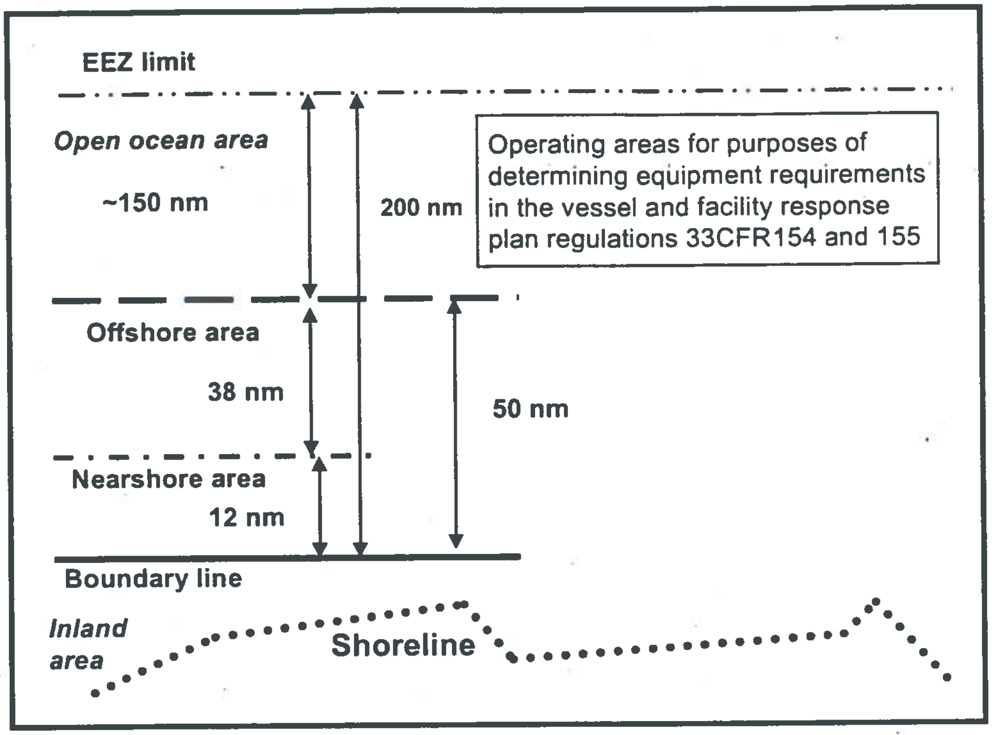
Ocean means the offshore area and nearshore area.

Open ocean means the area from 38 n. miles seaward of the outer boundary of the nearshore area, to the seaward boundary of the EEZ.

Nearshore area means the area extending seaward 12 n. miles from the boundary lines defined in 46 CFR part 7, except in the Gulf of Mexico. In the Gulf of Mexico, it means the area extending seaward 12 miles from the line of demarcation (COLREG lines) defined in Secs. 80.740- 80.850 of this chapter.

Offshore area means the area beyond 12 nautical miles measured from the boundary lines defined in 46 CFR part 7 extending seaward to 50 nautical miles, except in the Gulf of Mexico. In the Gulf of Mexico, it is the area beyond 12 nautical miles of the line of demarcation (COLREG lines) defined in Secs. 80.740-80.850 of this chapter extending seaward to 50 n. miles.

FIGURE 2-2: COAST GUARD JURISDICTIONAL LINES AND ZONES



3.2 OPA 90 Programmatic Regulatory Assessment Accounting Model

In order to avoid "double counting" of benefits between the proposed Caps rulemaking and other regulatory initiatives, the Volpe Center used a previously developed model, the Programmatic Regulatory Assessment Accounting Model (PRAAM). This section provides a brief history of the PRAAM's development, as well as a conceptual description of its application. Section 3.5 presents the details of the PRAAM's application for this rulemaking.[3]

3.2.1 Origin and Background of the Programmatic Regulatory Assessment Accounting Model

The PRAAM was developed to accurately account for the costs and benefits of the 11 most important OPA 90 rules by eliminating double counting of benefits and reconciling differences among separate U.S. Coast Guard regulatory assessments.[4] In response to broad mandates contained in the OPA 90, the U.S. Coast Guard promulgated a wide range of new regulations that are individually and collectively directed at oil spill prevention, mitigation, cleanup, and liability. To facilitate the Coast Guard rulemaking process, the OPA 90 regulatory requirements were divided into relatively small stand-alone rulemaking projects; the economic, environmental, and small entity impacts were analyzed separately in each Regulatory Assessments (RA). Having substantially completed the 11 "core" rulemaking projects, the Coast Guard decided that the relevant RAs should be integrated in one analysis to estimate more accurately the total benefits of the OPA 90 regulations.

The appropriate analytical approach was found in the PRA, which provided a consistent and comprehensive basis for evaluating the 11 core OPA 90 regulations. The estimated, combined cost-effectiveness of the core OPA 90 regulations therein accounted for any overlapping effects through the development of an innovative computational process that simultaneously addresses all those regulations without double counting benefits. The PRA includes the explicit assumptions, assessment process, complex mathematical procedure, and software, which provide an internally consistent basis for estimating the overall benefit of the 11 core regulations in their totality, or the overall benefit of any subset thereof. By means of marginal benefit and marginal cost-effectiveness analysis, the process also provided insight into the relative merit of individual regulations.

The assessment process developed for the PRA defined: a common assessment period, vessel traffic forecast, projected spillage baselines, and a consistent costing method; applied a method for obtaining expert opinions on the potential effectiveness of each individual regulation with respect to its intended target(s); applied a rigorous, mathematical procedure to remove the overlapping effects caused whenever multiple regulations address the same event; and applied a standard computational method for the Total Present Value (TPV) of the annual streams of benefits and costs.

To assist in the development of the baselines and effectiveness estimates, private sector and federal agency subject matter "experts" were assembled into two expert panels (November 1996 and February 1997) that provided substantive guidance and quantitative input via several structured workshop sessions. The first expert panel assisted in the development of future oil spillage baselines, while the second focused on estimating effectiveness of individual regulations on specified oil spill sources and causes.

[3] A more detailed description of the PRAAM appears in Appendix E, "Overview of How The Overall and Marginal Impacts of 11 Core OPA 90 Rules Are Computed In A Way That Avoids 'Double Counting' of Benefits".

[4] The Programmatic Regulatory Assessment (PRA) is intended to represent the overall cost and benefit of the complete suite of Coast Guard OPA 90 rules; however, not all of these rules had costs and benefits that were substantial and/or quantifiable. Therefore, one of the premises of the PRA was that, except for some small percentage, the total Coast Guard OPA 90 costs and benefits could be adequately represented using a group of the 11 most important rules as a proxy for the entire body of OPA 90 regulations. The 11 core rules were chosen by the Coast Guard and the Volpe Center.

- Non-mechanical benefits versus mechanical benefits factor 1.0, 0.75, and 0.50

The PRAAM and the PRA calculate benefits for the year 1996, the PRAAM, and, as presently constructed, do not allow for the initial year of benefits to be changed to a later year. Since the benefits of the proposed Caps regulation do not begin until 2003, PRAAM benefit results have been adjusted outside the model.

The original PRAAM possesses the capability of assigning fourth order benefits a lesser value relative to non-fourth order benefits. That is to say, the PRAAM can apply a factor less than or equal to 1.0 to all spilled oil that was removed or treated by any of the three response modes (mechanical, dispersants, or *in situ* burning) when computing benefits. Such a fourth order factor exists in the PRAAM because it may be needed to reflect the possibility that a barrel of oil spilled but later "removed" is worth less than a barrel of oil prevented from spilling.

In addition to the fourth order factor, a second separate factor may also be required. This factor can be used to assign benefits from non-mechanical modes (dispersants and *in situ* burning) a lesser value than benefits from the mechanical mode. To distinguish between these two factors, they will be referred to as the "fourth order factor" and the "non-mechanical benefits factor", respectively. A sensitivity analysis performed in Chapter 6 calculates benefits and cost-effectiveness using a range of values for each of these two factors.

3.3 Expert Panel for Caps Effectiveness Matters

Estimates of the potential effectiveness of changes to the OPA 90 regulations (specifically the VRP and FRP regulations) are problematical. Despite the choice of the word "capability", it would be simplistic and misguided to assume, for instance, that a 25 percent increase in Caps (equipment, devices, personnel, etc.) would necessarily translate directly into a 25 percent increase in the VRP/FRP regulation's response effectiveness factors. The causal chain between available resources and the ultimate effect they have on recovery of oil from the water is complex; moreover, some would argue that there exists the possibility of diminishing returns from increases in such resources.

In the absence of empirical data on cause-and-effect relationships directly related to the changes in the VRP and FRP regulations, acquisition of "expert opinion" estimates from a single qualified panel of experts was deemed the most viable course to follow. A highly structured process was designed to acquire qualified expert opinions on the quantified impact, relative to the baseline, that could be attributed to these regulations. The ultimate purpose of the expert panel was to provide the required inputs for the Volpe Center's methodological framework and analytical model used in the earlier PRA of the OPA 90 regulations for estimating incremental benefits.

The credibility of the RA among affected and otherwise interested groups depends on the perception of the competence and representation of the experts, whose judgments are the basis of many of the final benefits and cost estimates. The selection of qualified experts, their advance preparation, and the conduct of the expert panel workshops are discussed below.

3.3.1 Selection and Membership

The Volpe Center project team developed experience and knowledge requirements, which were approved by the Coast Guard. The approved panel positions included an experienced Coast Guard responder preferably former or current Strike Team Commanding Officer, a state environmental agency representative, a NOAA Scientific Support Coordinator, oil spill response organization representatives, environmental research consultants specializing in alternative technologies, and an environmental researcher from academia. A sufficient number of experts (11) were chosen to provide diversity and experience across a broad spectrum of public and private oil spill responders. After approving the experience requirements, the Coast Guard provided a list of organizations and

The experts first met at the Volpe Center for a two-day workshop on April 26-27, 2000. During the workshop, a Volpe Center facilitator reviewed the subject material, and guided the panelists through discussions and exchanges on the issues and development of each individual's expert opinion for each question and answer. The panel workshops were structured in a way that allowed the panelists (if needed) to engage in detailed discussions concerning each question and its important underlying assumptions. Each discussion was followed by an initial vote, for which the facilitator would always randomly chose a different panelist to answer first, thus minimizing any undue influence or pattern that might arise otherwise. Follow up discussion then took place, during which panelists were given an opportunity to explain in detail the reasons and arguments behind each of their votes. Finally, each panelist was given the opportunity to cast a final vote, which could differ (or not) from the initial vote. This iterative process was deliberately chosen by the Volpe Center to maximize the likelihood that valid and accurate estimates were given by the members of the expert panel. It was not, however, required that the expert panelists reach a consensus in each of their final answers to each question.

The experts, Volpe Center staff, and the Coast Guard agreed that a second expert panel workshop was needed to evaluate, discuss, and adjust, if necessary, the results of the first workshop. The expert panel met at NOAA's Western Regional Center, Seattle, WA for a one-day workshop on July 11, 2000. Using the same deliberation and voting process as for the April meeting, the expert panel finalized the required inputs for the Volpe Center's methodological framework and analytical model for estimating overall benefits.

The questionnaire used to elicit the required panel data, the panel's raw voting data, and the minutes of the two panel meetings are presented in Appendix A.

3.3.3 Formulation of Panel Questions

The large number of questions for the expert panel was driven by the five regulatory alternatives and their attendant complexities including (but not limited to) Gulf Coast area waters versus non-Gulf Coast area waters, three separate response measures (both previously required and not), and two capability options for dispersants. Even so, the questions were carefully worded and chosen to prevent the analysis from becoming intractable or unwieldy due to the enormous number of interrelated variables, parameters, and factors involved.[5] It was stressed to the panelists that the questions addressed all types of environments globally, and did not deal explicitly and specifically with each of the six individual "operational areas of water" as defined by the Coast Guard (for vessels: "inland/nearshore/Great Lakes", "rivers and canals", "offshore", and "open ocean"; and five areas of water for MTR facilities: "inland/nearshore/Great Lakes", "rivers and canals", and "offshore").

Because many of the same exact factors are needed for different alternatives, the questions for the expert panel were not broken out separately for each Coast Guard regulatory alternative, in order to avoid redundant questions. The expert panel's answers were combined as part of a subsequent Volpe Center analysis that dealt with each alternative separately.

When the expert panel answered questions having to do with the overall operational effectiveness of dispersants or *in situ* burning, they were carefully instructed *not* to include in their answers any downward adjustment factor that captured or reflected their possible belief that these two modes do not in fact remove the oil from the envi-

[5] Whether or not, and the extent to which, the 2003 Caps increase in the Caps upper limit influences the required capability to recover oil (i.e., benefits) will depend on a myriad of interrelated variables, parameters, and factors: (1) the "WCD volumes" (which will themselves depend on the total volume of oil cargo transported by the vessel plus 50 percent of the vessel's own fuel capacity); (2) the particular "groups" (I through IV) of oil transported; (3) the potential operational area(s) of operation/spill location(s), i.e., the "transit route(s): "inland/nearshore/Great Lakes; rivers & canals; offshore; or open ocean [(2) and (3) will determine which "recovered on-water oil factor" will be required]; (4) the particular "emulsification factor" (specific gravity) of the oil Group [the volume from (1) is multiplied by the product of each factor in (2), (3), and (4) to yield an "adjusted volume"]; (5) a particular "mobilization factor" for the appropriate operational area(s) of operation and response tier is multiplied by this adjusted volume to determine the total on-water "oil recovery capacity(ies)" in barrels per day that must be identified and contracted for to arrive on scene within the applicable time; (6) the particular tier and appropriate "operational area(s)" of operation determine the upper limit (i.e., Caps); the total on-water oil recovery capacity(ies) will be the minimum(s) of the resultant capacity(ies) from (5) and of its corresponding Caps from Table 6 on page 416 of 33 CFR 155.

3.4.1 Utilization of the OPA 90 PRAAM

The main points of the Caps benefits analytical approach follow a six-step process. Steps 2-5 are analogous to the analytical approach in the OPA 90 PRA. Steps 1 and 6 are pre-process and post-process steps created to enable the analysis of this proposed rule using the PRAAM. The six steps are:

1. Because the PRAAM did not originally distinguish spillage for Gulf Coast area waters versus non-Gulf Coast area waters, nor for inland waters versus non-inland waters, a "spillage distribution sub-model" for the benefits period was created for this RA. The sub-model was based on MSIS spillage data, other data obtained from a May 1999 report entitled "Response Plan Caps Review: Are Changes To Current Mechanical Recovery, Dispersants, and *In Situ* Burning Equipment Requirements Practicable?", U.S. Coast Guard (G-MOR), and personal communications with Coast Guard Headquarters (G-MOR).

2. Four overall separate effectiveness factors were estimated: one for mechanical recovery in 2000, one for mechanical recovery in 2003, and one each for dispersants and *in situ* burning in 2003, along with possible upward adjustments for the latter three effectiveness factors due to the impact(s) of the proposed aerial tracking and monitoring of oil spills requirement. The estimation of the overall effectiveness factors estimates includes degradation of theoretical or laboratory removal or treatment effectiveness to reflect potential real operating environments. It was deemed best to determine such estimates using information from the expert panel (April 2000 and July 2000) because operational effectiveness data sources were insufficient or nonexistent.

3. Using the February 1997 expert panel's mechanical recovery effectiveness factors[7] and the April 2000 expert panel output, the following were determined: (i) the actual impact of the initial 25 percent increase in 2000 Caps on the original PRAAM fourth order effectiveness factors for the PRA's spill sources, i.e., for "tank ships underway", "tank barges underway", "affected MTR facilities", and "tank ship lightering operations"; (ii) the actual cumulative impact of the initial 25 percent increase in the 2000 Caps and another 25 percent increase in 2003, on the original fourth order effectiveness factors for the PRA's spill sources.

4. For each of the proposed Coast Guard regulatory alternatives, the overall effectiveness factors were adjusted by use of a conditional probability framework (see Section 3.4.2) as well as by a mathematical procedure similar to that in the PRAAM. The latter adjustment is used to derive the "total overall effectiveness" when multiple response modes would be used together (or simultaneously), but to do so in a way that avoids double counting among the response modes. Using the separate results of steps 3(i) and 3(ii) this total overall effectiveness calculation was performed for: 4(i) just the year 2000 proposed changes, and 4(ii) the cumulative proposed changes for the years 2000 and 2003.

5. The marginal (incremental) yearly benefits of the 2003 proposed changes to the Caps regulation were calculated. This was done by performing two runs of the PRAAM for all 11 core regulations; the first PRAAM run using the results from step 4(ii), the second PRAAM run using the results from step 4(i). The PRAAM's TPV of the yearly undiscounted benefits of the second run were then subtracted from the PRAAM's TPV of the yearly undiscounted benefits of the first run to yield the TPV of the yearly undiscounted incremental impact due solely to the 2003 proposed Caps regulation. Figure 3-1 and Figure 3-2 below illustrate the process for the mechanical mode (i.e., alternative 2) and for multiple response modes, respectively.

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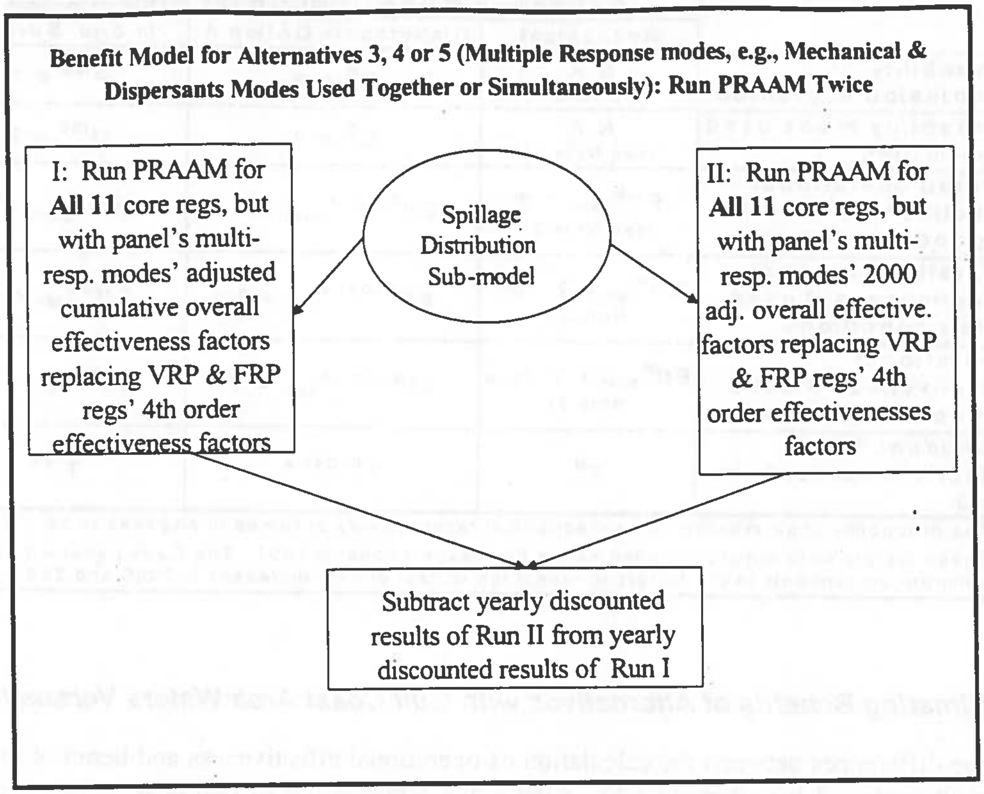
[7] The original PRA response effectiveness factors (i.e., fourth order effectiveness factors) were .06, .06, .17, and .17 for tank ship underway, tank barges underway, affected MTR facilities, and tank ship lightering operations, respectively.

FIGURE 3-2: PRAAM MODEL FOR MULTIPLE MODE BENEFITS



3.4.2 Approach Refined by Conditional Probabilities Combined with Weighted Averages

The complexity of the four active alternatives arising from three separate response modes, two geographic subsets, two dispersants options, and the use of multiple response modes, made infeasible an event tree approach addressing every specific combination of events. Rather, the expert panel worked within a conditional probability framework, where the questions and answers implicitly accounted for all scenarios. This approach enables estimation of more specific, quantifiable factors by finding number values for each of many conditions, which taken together describe the likely outcomes of a set of spill response scenarios. Later in the analysis, the separate parts (individual conditional probabilities) of the chain are recombined as needed to get the desired answers.

The expert panel, therefore, answered questions with numerical estimates for descriptions of: the likelihood of the use of the three distinct response modes; the effectiveness of response as a function of spill size; and thresholds of spill size needed before the use of each mode would occur. For each of the non-mechanical modes (dispersants and *in situ* burning), the panel supplied two conditional probabilities and operational effectiveness factors.

The panel's thinking was focused by presentation of several causal event chains, whose separate parts (represented by individual conditional probabilities) were recombined in a subsequent analysis to get the desired answers. The panel's answers provided the missing data to populate four tables (one table each for: option A and Gulf Coast area waters, option A and non-Gulf Coast area waters, option B and Gulf Coast area waters, and op-

TABLE 3-1: DATA NEEDED FROM EXPERT PANEL (OPTION A, GULF COAST WATERS)

	Response Mode, Gulf Coast Area Waters		
	Mechanical	Dispersants Option A	*In Situ* Burning
Probability permission is granted	N A (see Note 1)	$P^{D} = ?$	$P^{ISB} = ?$
Probability mode used if permitted	N A (see Note 1)	$U^{D} = ?$	$U^{ISB} = ?$
Overall operational effectiveness if used in good conditions	$Eff^{M}_{good} = ?$ (see Note 2)	$Eff^{D,Opt.A}_{good} = ?$	$Eff^{ISB}_{good} = ?$
Overall operational effectiveness if used in fair conditions	$Eff^{M}_{fair} = ?$ (see Note 2)	$Eff^{D,Opt.A}_{fair} = ?$	$Eff^{ISB}_{fair} = ?$
Operational effectiveness if used in poor conditions	$Eff^{M}_{poor} = ?$ (see Note 2)	$Eff^{D,Opt.A}_{poor} = ?$	$Eff^{ISB}_{poor} = ?$
Individual Total Effectivenesses, T, in 2003	T^{M}	$T^{D,Opt.A}$	T^{ISB}

1. The probability of permission of the mechanical recovery was assumed in all cases to be 1.0
2. These factors were initially supplied by the PRA expert panel in 1997. The Caps panel was asked to estimate adjustments to the factors to reflect the impact of 25% increases in 2000 and 2003.

3.4.3 Estimating Benefits of Alternatives with Gulf Coast Area Waters Versus Non-Gulf

There will be differences between the calculation of operational effectiveness and benefits for alternative 3 and benefits for alternative 4 (or alternative 5). Alternative 3 makes use of option A, which for tier 1 requires an Effective Daily Application Capability (EDAC) of 5,500 gallons and 2,750 gallons of dispersants for the Gulf Coast area waters spillage and non-Gulf Coast area, respectively. Alternative 4 and alternative 5 make use of option B, which for tier 1 requires an EDAC of 8,250 gallons and 4,125 gallons of dispersants for the Gulf Coast area waters and non-Gulf Coast Area waters, respectively. Thus, there are four different sub-calculations that must be carried out.

These four differences in overall operational effectiveness are easily handled by use of the separate data gathered in the four tables mentioned above. However, to calculate the benefits for the four cases involved when considering alternative 3 and alternative 4 (or alternative 5), it became necessary to separate out the portion of the yearly total spillage in all U.S. waters that was attributable solely to Gulf Coast area waters, as well as the portion attributable solely to non-Gulf Coast area waters. I.e., options A and B for the two different areas of water made it necessary to know the yearly (Total $Spillage_{U.S.Waters}$)x(Proportion of Gulf Spillage) and the yearly (Total $Spillage_{U.S.Waters}$)x(Proportion of non-Gulf Spillage).

3.4.4 Use of Spillage Statistics

Paired PRAAM runs for each of the active Coast Guard regulatory alternatives are the basis of the computation of incremental benefits, as was mentioned in 3.4.1. Since alternatives 3, 4, and 5 involve different application requirements of dispersants for Gulf Coast area waters versus the non-Gulf Coast area waters, each half of the pairs must consist of two additional PRAAM sub-runs: one for Gulf Coast area waters and one for non-Gulf Coast area waters. The PRAAM's yearly spillage baseline for these sub-runs was adjusted by means of a spillage distribution sub-model based on historical spillage data from the Coast Guard's Marine Safety Information System (MSIS). Another adjustment was performed on the PRAAM's yearly spillage baseline to capture th fact that the expert panel's estimated impact of dispersants would usually only apply to spillage whose volum for *in situ* burning against mechanical recovery equipment. and the 2003 capital investment costs for River Response capability and Great Lakes Response capability.[10] In addition, the Mercer report applied only to vessel plan holders. Finally, the Mercer Report was completed in 1993, and so its data were seven years old. Because of all of these costs limitations, the approach adopted was to obtain more recent proposed rulemaking cost data by means of an industry cost survey.

WCD OSROs Cost Calculation Approach

The Volpe Center estimated national costs as the costs for all WCD OSROs to provide the necessary services to their planholders, since they are the only OSROs impacted by the proposed Caps rulemaking. Vessel and MTR facility planholders will also have to meet the requirements of the proposed rulemaking, but their costs will be the result of the WCD OSROs' costs, which will be passed onto the planholders in the form of higher yearly fees to ensure the extra capability is available for them. A cost survey of the planholders themselves, who were capable of a WCD, would have been involved several intractable difficulties. For example, even if the national number of such planholders was known, this national number would be considerable, thereby requiring a larger number of sampled planholders compared to the sample size required of the relatively smaller national number of OSROs capable of responding to a WCD. Moreover, because of the large statistical variance in most of the important characteristics that actually determine a planholder's costs to ensure response capability (e.g., number of vessels in planholder's fleet, each vessel's maximum cargo capacities, number and types of operating areas of water in which they transit, number of different ports visited, etc.), a cost survey of the population of OSROs made more sense statistically as well. Although there exists some statistical variance (i.e. variability or standard deviation) of OSRO population, the Volpe Center was able to reduce this variance—thus reducing the required sample size—by breaking-up the WCD OSRO population into two strata. The variance within each stratum would be smaller than the variance of the entire population.

A review of the Coast Guard's OSRO Classification Program showed that the Coast Guard has reasonably accurate and current data on these OSROs.[11] An analysis of data from the Coast Guard's OSRO Classification Program for all OSROs with classifications of A, B, C, D, and E, revealed that there were 58 OSROs who were classified as E, i.e., 58 who were classified as WCD OSROs. The assumption that new Caps requirements costs would be passed on to planholders immediately through retainer or membership fees proved at least partially incorrect; discussions with many responders in the Gulf Coast and Great Lakes regions revealed that these costs are retained by the OSROs and later recovered from the planholder during the contractor's actual oil spill response activities. Nonetheless, it is assumed that the industry costs are those borne by the OSROs to upgrade their services to meet the specifications of the 2003 Caps regulation, regardless of the details of the financial compensation arrangements.

Stratified Random Sample in Cost Survey

The project team developed a cost survey (see Appendix C: "Spreadsheets of Cost Survey Results and Extrapolation to National Estimates") to determine how much OSROs would have to expend to acquire, maintain and contract on-water mechanical recovery, dispersants, *in situ* burning, and aerial monitoring assets, that provides their existing planholders with the required incremental capabilities between the 2003 Caps and the 2003 Caps. The national population of 58 WCD OSROs was divided into two strata; in stratum 1 were put the 4 largest WCD OSROs; in stratum 2 were put the 54 other OSROs.

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[10] It appears that the Mercer report did not include costs for rows 17 and 18 of their cost spreadsheet, which correspond to River Response Capability and Great Lakes Response Capability, respectively. Both would have had future Caps increases.

[11] See http://www.uscg.mil/hq/g-m/nmc/response/index.htm. Although it is true that this Classification Program is a *voluntary* program, a planholder attempting to meet current response plan requirements (and the 2003 Caps increases) by contracting to ensure availability of equipment with an OSRO, who was not in the Coast Guard OSRO Classification Program, would encounter insurmountable practical impediments. E.g., such a planholder would have to list *individually* every one of the planholder's hundreds of items and pieces of response equipment—unlike the planholders who ensured with Coast Guard classified OSROs, who would not.

The following sections present a description of the OSRO classification program, the survey design and response, and the unit cost (weighted average cost per OSRO) and national cost estimates for the response elements required by the proposed 2003 Caps regulations.

4.2.1 Coast Guard OSRO Classification Program

Section 4202 of the Oil Pollution Act of 1990 (OPA 90) amended section 311(j) of the Federal Water Pollution Control Act (FWPCA) to require the preparation and submission of response plans by the owner or operator of all vessels defined as "tank vessels" under 46 U.S.C. 2101, and by certain oil-handling facilities (hereafter referred to as plan holders). A response plan must specify in detail the capabilities of designated resource providers and was, in the initial stages of the VRP/FRP rule implementation, a burdensome process for many planholders. In 1995 the Coast Guard established a voluntary classification program to provide a systematic way to classify OSROs with the aim of facilitating the preparation and review of tank vessel and facility response plans.

The primary purpose of this program is to provide a systematic way to classify OSROs. Once the OSROs are classified, planholders can list them by name and classification as an alternative to listing extensive resources in their tank vessel and facility response plans [Title 33 Code of Federal Regulations, Part 154.1035 (e)(3)(iii) and 33 CFR Part 155.1035 (i)(8)].[15] An OSRO classification does not guarantee the performance of an OSRO, nor does the use of a Coast Guard classified OSRO in a plan relieve planholders of their ultimate statutory and regulatory responsibility to ensure the adequacy of the spill response resources identified in a response plan.

An OSRO does not have to be classified and plan holders do not have to limit their response resources to Coast Guard classified OSROs. However, by participating in the program, an OSRO agrees to meet all program requirements. In addition, similar criteria will be used by the Coast Guard to evaluate the capability of OSROs identified in response plans but not participating in the classification program. A review of the Coast Guard Classified OSROs revealed that all WCD (Class E) responders, as a practical marketing and cost-saving business strategy, participate in this voluntary program. These OSROs can be categorized as follows:

- Nationwide Organizations – These OSROs are relatively large having significant wholly owned assets and in-house personnel. These resource providers such as the Marine Spill Response Corporation (MSRC) generally have multi-million dollar equipment inventories with annual operating budgets in excess of $50 million.
- Spill Cooperatives – These OSROs are considerably smaller than the nationwide OSROs. Members are usually major oil companies and oil terminals. Cooperatives would incur new costs to meet the mechanical recovery Caps increase and high-rate removal technology requirements. It is assumed that the cost of ensuring this response capability is the appropriate incremental portion of a cooperative's budget that can be accredited to the new Caps requirement. Some cooperatives may contract to nonmembers and may supplement cooperative membership by use of retainer relationships with third party contractors to cover areas beyond the cooperative's normal operating area.
- Third Party Cleanup Contractors – These OSROs are also considerably smaller than the nationwide organizations. Vessel owners who are not members of cooperatives are assumed to enter into retainer relationships. Many contractors reported that they did not charge a fee to be listed in a plan for the 2000 Caps. This was the result of contractors already meeting the 2000 Caps, thereby obviating the need for capital expenditures for additional removal equipment. These contractors said that if they needed to purchase/lease additional equipment, they would pass along this cost as a fee to the planholder. To maintain reasonable retainer rates and to mobilize response resources more effectively, some contractors have formally banded together to form contractor networks.

[15] The Coast Guard solicited comments on proposed changes to the OSRO Classification Program. A public meeting to discuss the proposal was held on May 4, 2000 (see the *Federal Register*, Vol. 65, April 4, 2000, p. 17697).

curring costs were aggregated and weight-averaged to account for the size of the OSROs, as explained in Chapter 3. The weight averaging method for determining OSRO costs began with a consideration of the four largest resource providers, three of whom were part of the survey sample. Their estimated costs are a separate calculation, since their size and national posture so far distinguishes them from all other providers; the average of these three OSROs' estimated costs are extrapolated to capture the costs of the four largest OSROs. The other survey respondents represent a fair cross section of the remaining 54 WCD OSROs, in terms of size, capability, and geography; the average of their estimated costs are extrapolated to that portion of the OSRO population.

For each cost category and for the separate groups of 4 and 54 affected OSROs, the unit cost used is the weighted average cost *per OSRO*. The weighted averages presented herein include all of the surveyed OSROs, a device which further protects the integrity of data received in confidentiality. Multiplication of those weighted average unit costs by 58 results in the aggregate industry costs for the 58 WCD oil spill responders, yielding the expanded national estimate desired in year 2000 $s (see Appendix C: "Spreadsheet of Cost Survey Results and Extrapolation to National Cost Estimates" for details). An example of the calculations, which extrapolate national cost estimates from the survey data points, appears below.

Example of the Unit Cost Weight Averaging and Extrapolation To National

The unit (per OSRO) costs and national costs are estimated by using the cost methodology presented in Chapter 3. The example shown here is the capital expense for containment/collection boom cost category, whose unit and national costs appear in Table 4-1 and Table 4-2 below, in the cost discussion on on-water mechanical recovery. All other cost calculations in this chapter, with the exception of the fixed wing dispersant delivery platform, are estimated in the same manner. The three large OSROs, which were surveyed, reported capital cost estimates for containment/collection boom that totaled $5,000,000, and for which the average is $1,666,667. The seven smaller OSRO respondents reported capital cost estimates for containment/collection boom that totaled $230,000, and for which the average is $32,857. The unit cost (weighted average cost per OSRO) is computed by taking a weighted average of each of the two strata's sample averages: [(4x$1,666,667) + (54x$32,857)]/58 = $145,534. This unit or per OSRO cost is multiplied by the number of WCD OSROs, 58, to give a national containment/collection boom cost of: 58x$145,534 = $8,440,952.

4.2.4 Spill Response Cost

On-Water Mechanical Recovery

The calculated cost of mechanical recovery includes increases of oil recovery devices and temporary storage as well as other types of equipment specified in the OSRO classification regime, including containment boom, boats, sorbents and other additional equipment, for which the requirements will rise by 25 percent in 2001 and again in 2003.[16] While the amounts of equipment are not specified in the existing or proposed regulations, the Coast Guard and oil spill responders consider mechanical response as a total system. As a practical matter, one cannot increase the EDRC for the three response tiers by adding additional oil skimmers without a corresponding increase in other equipment requirements. Unit (i.e., weighted average cost *per OSRO*) costs for the initial acquisition and yearly maintenance costs for containment/collection boom, oil recovery devices, temporary storage, and additional equipment are presented in Table 4-1. Table 4-2 presents the national cost estimate for newly required mechanical assets, itemized by cost category.

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[16] According to the 1997 *Guidelines for Classifying Oil Spill Removal Organizations*, the Coast Guard takes a systems approach of resources to classify an OSRO. For example, skimmers without boom to contain the oil would be useless in a response. Accordingly, the Coast Guard increased resource requirements 25 percent across the board for the 2001 and 2003 Caps increases. (e-mail communication with National Strike Force Coordination Center staff, November 3, 1999). The Coast Guard is also proposing to formally incorporate these changes to the OSRO Classification Program (*Federal Register, loc. cit.*, p. 17697).

TABLE 4-3: DISPERSANTS STOCKPILE & APPLICATIONS SYSTEMS UNIT (PER OSRO) COSTS - 2000 $S

Dispersants Stockpiles and Application Systems	Capital Costs	Yearly Recurring Maintenance
Dispersants Stockpile - Option A, Gulf Coast Area Waters	$18,755	$862
Dispersants Stockpile - Option A, non Gulf Coast Waters	$56,978	$1,034
Dispersants Application Systems - Option A	$26,379	$2,198
Total Option A	**$102,113**	**$4,095**
Dispersants Stockpile - Option B, Gulf Coast Area Waters	$23,307	$862
Dispersants Stockpile - Option B, non Gulf Coast Waters	$67,624	$1,034
Dispersants Application Systems - Option B	$26,379	$2,198
Total Option B	**$117,310**	**$4,095**
Note: Rows may not add exactly to Totals due to rounding to nearest $		

Delivery Platforms

The Coast Guard May 1999 Response Plan Equipment Caps Review provided a detailed inventory of the available dispersants delivery platforms. The existing platforms are a mix of surface vessels, short-range aircraft, and long range fixed wing aircraft. The existing regulations specify neither a dispersants application capability nor any particular kind of delivery platform. The proposed 2003 Caps regulatory alternatives would require that that fixed-wing aircraft provide 50 percent of required dispersants application capability. The cost of procuring long range fixed wing aircraft such as the McDonnell-Douglas Hercules C-130 would probably be in excess of $30 million each (Chief of Information, U.S Navy reports that the cost for a new military C-130 would be $44 million), and does not include yearly maintenance, crew salary, and training costs.

Cost survey respondents and expert panel members stated, however, that it is simply not cost-effective to procure these aircraft; instead, they would lease or contract fixed wing capability and take on the associated maintenance costs. This scenario was adopted as the most realistic for the fixed wing delivery platforms cost calculation, and includes an expert panel assessment of the number of those aircraft required for the specified spill response on a national basis. Therefore, no capital costs are reported for fixed wing aircraft

There are currently only two companies offering this long-range fixed-wing capability, Airborne Support, Inc. (ASI) in the continental U.S. and Lynden Air Cargo in Alaska. Lynden keeps an aircraft in Ypsilanti, Michigan or the Houston area on a regular basis. The estimated average yearly cost to contract for one dedicated standby aircraft from the survey respondents is $1.45 million. To offset costs, these aircraft may be available to their operators for cargo service on a limited basis, depending on the individual requirements of the contract. Representatives of national service providers believe that six C-130 fixed wing aircraft would provide the specified nationwide coverage; this concept is advanced for cost estimation purposes in the absence of a more detailed picture, which might include a mix of these long-range aircraft and smaller, shorter-range planes. Since one C-130 is already on charter to provide this service at present, the yearly recurring costs of five additional C-130s is estimated to cost 5x$1.45 million = $7.25 million.[18]

It should be noted that one OSRO respondent stated that reduced fixed wing loading and deployment times, if considered, would preclude the availability of the aircraft for cargo service. For example, reducing the loaded

18 A key step in estimating incremental costs of the proposed VRP/FRP regulation is to define the baseline from which the incremental costs are measured. The baseline characterizes existing industry conditions and behavior in the absence of the proposed regulation. The baseline must include current industry practices or standards that exceed current (i.e., before the proposed regulation) regulations. All costs calculated should only be those that are incremental.. Future costs that would be incurred even if the proposed regulation were not promulgated, as well as costs that have already been incurred (sunk costs), are not part of incremental costs. Office of Management and Budget (OMB), Regulatory Program of the United States, April 1, 1990 – March 31, 1991, 1990, Appendix V, Regulatory Impact Analysis Guidance, p. 635.

TABLE 4-5: DISPERSANTS STOCKPILE & DELIVERY PLATFORM NATIONAL COSTS - 2000 $S

Asset	Capital Costs	Yearly Recurring (see Note 1)
Dispersants Stockpile & Application Systems (Gulf + Non Gulf) - Option A	$5,922,529	$237,500
Dispersants Stockpile & Application Systems (Gulf + Non Gulf) - Option B	$6,804,000	$237,500
Delivery Platform (Vessel)	$10,133,333	$1,314,000
Delivery Platform (Fixed Wing Aircraft)	$0	$7,250,000
Delivery Platform (Rotary Aircraft)	$0	$0
Primary Staging Area	$0	$0
Total: Alternative 2	$0	$0
Total: Option A, Alternative 3	$16,055,863	$8,801,500
Total: Option B, Alternatives 4 or 5	$16,937,333	$8,801,500

1 Yearly recurring costs include maintenance costs of assets owned by OSROs and annual costs with contractors or spill cooperatives

In Situ Burning

The industry survey and the expert panel agreed that five *in situ* burning sites, co-located with existing OSRO sites in high volume port areas, would provide adequate nationwide coverage. There is also the indication that no new assets will deploy to the field in the foreseeable future, because of a lack of confidence in the technology, even with rapid improvements. This stems from its high cost and the perception that the mechanical recovery Caps offset proposed by the Coast Guard is insufficient. The specific reasons are the following:

- With the current state of *in situ* burning boom technology, an individual boom package will be expected to survive for only one 8 to 10-hour day. To meet the three tier requirements, a planholder would have to arrange by contract or other approved means for five fire resistant burn boom packages.
- *In situ* burning equipment is very costly, with a single-use fire boom (1,000 - 1,500 feet in length) set at approximately $200,000. Smaller responders in particular will simply not be able to afford this technology.
- Many responders believe that the Coast Guard's proposed *in situ* burning credit, up to a 10,000 barrel reduction in the required mechanical recovery Cap, is not high enough to justify the investment. Some argued that a higher credit would provide a significant market incentive for manufacturers to conduct the research and development that would, in turn, lower the cost of *in situ* burning technology. The evolution of the technology would include, for example, water-cooled re-usable boom made of stainless steel, with extended service life and reduced replacement rates in the field.

In light of the above findings, no costs are associated with the optional use of *in situ* burning response as a result of the proposed regulations.

Aerial Tracking

Many responders believe that aerial tracking, monitoring, and command, control, and communications (C^3) capabilities are a necessary component for offshore response. It may be less important in many inland areas where the projection of the spread of spilled oil is more readily ascertained. With respect to the application of dispersants, aerial tracking and monitoring is often only way to determine and ensure its effectiveness. Most approvals to use dispersants and *in situ* burning technology in pre-approved areas have been contingent on having aerial tracking and monitoring resources available.

While the costs of providing for aerial tracking planes for monitoring in the dispersants response mode will be zero, there will be increments for its mandatory use for mechanical recovery, and for the improved integration of C^3 for all response modes specified identically in the four alternatives of the proposed rulemaking.

Costs could be lowered for OSROs located within the same geographic area through the use of shared aerial resources in a mutual aid arrangement. The reported unit (weighted average cost *per OSRO*) costs appear in Tabl

Business and Paperwork Burden Analysis.

The national record keeping costs (Table 4-9) appear in total, and then were prorated according to the requirements of each alternative. For example, alternative 2 includes only mechanical and aerial tracking elements, so its OSRO record keeping costs are prorated by a factor of (1+0+0+1)/(1+1+1+1) = 50 percent. This proration factor, 50 percent, is multiplied by the OSROs' portion but not by the planholders' paperwork burden costs. The OSROs' record keeping cost proration factors for alternatives 3, 4, and 5 are: (1+1+0+1)/4 = 75 percent, (.5433+1+0+1)/4 = 63.58 percent, and (0+1+0+1)/4 = 50 percent, respectively.[20]

Employee Training

Employee training and compensation costs were reported in five categories: mechanical recovery response, dispersants response, aerial tracking and monitoring of spills, in situ burning, and additional employee compensation for response employees. Survey respondents reported costs on a yearly recurring basis only. Because of the expert panel findings, employee training costs for *in situ* burning are zero. There were no costs for the category of additional compensation for response employees. The survey unit costs, i.e., the weighted average costs per OSRO, are shown in Table 4-10 and the national costs, prorated similar to the record keeping costs, in Table 4-11.

TABLE 4-10: EMPLOYEE TRAINING UNIT (PER OSRO) COSTS - 2000 $S

Training Activity	Capital Costs	Yearly Recurring Costs
Mechanical Recovery Response	$0	$4,407
Dispersants Response	$0	$5,920
In Situ Burning Response	$0	$0
Aerial Tracking & Monitoring of Spills	$0	$2,629
Total (All response modes plus Aerial Tracking)	**$0**	**$10,326**

TABLE 4-11: EMPLOYEE TRAINING NATIONAL COSTS - 2000 $S

Training Activities	Capital Costs	Yearly Recurring Costs
Mechanical Recovery Response	$0	$255,600
Dispersants Response	$0	$343,333
In Situ Burning Response	$0	$0
Aerial Tracking & Monitoring of Spills	$0	$152,500
Total (*All* 3 modes plus aerial)	**$0**	**$751,433**
Total Alternative 2	**$0**	**$408,100**
Total Alternative 3	**$0**	**$751,433**
Total Alternative 4 (Prorated, See Note)	**$0**	**$634,697**
Total Alternative 5	**$0**	**$495,833**
Note: Alternative 4's mechanical recovery response mode is prorated by a factor of (182/335). See also footnote #20.		

[20] Recall that only alternative 4's mechanical mode Caps increase applies only to "inland", "rivers & canals", and the "Great Lakes" operating environments of water.

4.4 State, Local, and Tribal Government Cost Component

There are no costs in this area.

4.5 Calculation of Costs of Alternatives

The Coast Guard is exploring five regulatory alternatives representing combinations of regulatory requirements. The costs of these alternatives were calculated using combinations of the six general cost categories: mechanical recovery, dispersants –option A, dispersants –option B, *in situ* burning, aerial tracking and monitoring of spills, and record keeping. The national capital costs and national yearly recurring costs from five previous tables and the zero national cost for *in situ* burning above were used to populate the six industry cost categories: mechanical recovery, dispersants, *in situ* burning, aerial tracking and monitoring, and record keeping. The applicable industry cost categories are listed as separate line items for each regulatory alternative. For each alternative, the capital costs and yearly recurring industry costs of each cost category were summed to obtain the total capital costs and total yearly recurring costs, respectively, in undiscounted 2000 $s. The undiscounted total industry capital costs and total yearly recurring industry costs for each of the four active alternatives are presented in Table 4-13.

TABLE 4-13: UNDISCOUNTED INDUSTRY REGULATORY ALTERNATIVE COSTS - 2000 $S

Cost Category	Regulatory Alternative 2: Mechanical Increase of 25%; Aerial Tracking		Regulatory Alternative 3: Mechanical Increase of 25%; Option A Dispersants; Aerial Tracking		Reg. Alternative 4: Mech. Increase of 25% for Inland, Rivers & Canals, Great Lakes only; Option B, Disp; Aerial Tracking; ISB credit		Regulatory Alternative 5: Option B Dispersants; Aerial Tracking; ISB credit	
	Capital	Yearly Recurring	Capital	Yearly Recurring	Capital	Yearly Recurring	Capital	Yearly Recurring
Mechanical Recovery	$13,388,762	$830,571	$13,388,762	$830,571	$7,273,895	$451,236	$0	$0
Dispersants Option A			$16,055,863	$8,801,500				
Dispersants Option B					$16,937,333	$8,801,500	$16,937,333	$8,801,500
In Situ Burning	$0	$0	$0	$0	$0	$0	$0	$0
Aerial Tracking	$5,400,000	$990,000	$5,400,000	$990,000	$5,400,000	$990,000	$5,400,000	$990,000
Record Keeping (see Note 1)	$0	$8,467,781	$0	$8,827,614	$0	$8,663,272	$0	$8,467,781
Employee Training	$0	$408,100	$0	$751,433	$0	$634,697	$0	$495,833
Totals (undiscounted 2000 $s)	**$18,788,762**	**$10,696,452**	**$34,844,625**	**$20,201,119**	**$29,611,228**	**$19,540,705**	**$22,337,333**	**$18,755,114**

1. Includes paperwork costs for OSROs that they will pass-on to the planholders as well as the planholders' own paperwork costs

4.5.1 Cost Discounting

To determine the present value of future costs correctly, the PRA's computational procedure for the total present value (TPV) of the annual stream of assessment period costs and up-to-date Office of Management and Budget (OMB) guidance was used. A life-length cycle of 15 years was chosen for capital assets to be consistent with the PRA. Since OMB regards interest charges on loans and amortization as "transfer payments" and not true costs to society of a regulation,[22] such transfer payments were not included in this RA. Costs were separated into capital, non-capital first year only, and yearly recurring costs; however, both industry costs and government

[22] Although interest charges due to amortizing and depreciation charges on equipment are real accounting costs for the buyer, proper cost benefit analysis excludes both because they are not legitimate opportunity costs to society. U.S. Department of Transportation, Handbook for Conducting Cost-Benefit Analysis (Draft), August 1998.

TABLE 4-14: UNDISCOUNTED INDUSTRY + GOVERNMENT REGULATORY ALTERNATIVE COSTS - 2000 $S

Life of Capital Equip.	Year	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Industry Capital Cost	Indust. & Gov't Yrly. Recurring + Gov't 1st Yr.	Industry Capital Cost	Indust. & Gov't Yrly. Recurring + Gov't 1st Yr.	Industry Capital Cost	Indust. & Gov't Yrly. Recurring + Gov't 1st Yr.	Industry Capital Cost	Indust. & Gov't Yrly. Recurring + Gov't 1st Yr.
1	2003	$18,788,762	$10,776,504	$34,844,625	$20,281,171	$29,611,228	$19,620,757	$22,337,333	$18,835,166
2	2004	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
3	2005	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
4	2006	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
5	2007	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
6	2008	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
7	2009	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
8	2010	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
9	2011	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
10	2012	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
11	2013	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
12	2014	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
13	2015	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
14	2016	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
15	2017	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
16	2018	$18,788,762	$10,699,872	$34,844,625	$20,204,539	$29,611,228	$19,544,125	$22,337,333	$18,758,534
17	2019	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
18	2020	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
19	2021	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
20	2022	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
21	2023	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
22	2024	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
23	2025	$0	$10,699,872	$0	$20,204,539	$0	$19,544,125	$0	$18,758,534
(2000 $s)		$37,577,524	$246,173,695	$69,689,249	$464,781,028	$59,222,456	$449,591,503	$44,674,667	$431,522,919

4.6 Cost Summary

The total costs for the four active proposed regulatory alternatives for the 2003 spill response Caps appear in Table 4-16, in total present value expressed in year 2000 $s and year 1996 $s. Industry and government costs were calculated over the period 2003 to 2025 and discounted at a rate of 7 percent.

The specific quantitative and qualitative findings are the following:

- The 2003 mechanical recovery Caps increase of 25 percent (from 125 percent to 150 percent of 1993 Caps values) would result in considerable incremental cost to industry, although they would meet the increased capacity requirements through new or modified contractual and cooperative arrangements.
- The *in situ* burning credit against the mechanical recovery Caps, up to a maximum of 10,000 barrels is insufficient incentive for industry to acquire more *in situ* burning packages, particularly at a time when the costs are still quite high and equipment performance challenges remain. As a result, the expansion of *in situ* burning assets is not foreseen and no attendant costs are found.
- Industry compliance with dispersants capability requirements will be met with a combination of boats and airplanes, the latter providing at least 50 percent according to Coast Guard's requirements.
- Government costs will be minimal, including a relatively large first year expense and small recurring annual expenses thereafter.
- No state, local, and tribal government costs were found.
- Actual projected costs were found to be much higher for the new dispersants capability requirements than for the augmented mechanical recovery requirements, mainly due to the associated capital expense of dispersants stockpiles and response vessel modifications for dispersants delivery. There was an un-discounted capital expense of $16.94 million in 2000 $s, and a yearly recurring undiscounted cost of $8.80 million in 2000 $s. The majority of the latter was the yearly contracting cost for a national dispersants delivery fixed wing air fleet ($7.25 million/year), which consists of five Hercules C-130 cargo airplanes to supplement those already in place.
- Aerial tracking and monitoring costs, included and identical in all four active alternatives, were significant but minor by comparison (undiscounted capital expense of $5.40 million and yearly recurring expense of $0.99 million/year in 2000 $s).

TABLE 4-16: TOTAL COST SUMMARY (TOTAL PRESENT VALUE)

	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Capital	Yrly. Recur.	Capital	Yrly. Recur.	Capital	Yrly. Recur.	Capital	Yrly. Recur.
in 2000 $s	$15,941,568	$80,415,902	$29,564,372	$151,806,730	$25,124,028	$146,846,271	$18,952,399	$140,945,594
Total in 2000 $s	**$96,357,469**		**$181,371,102**		**$171,970,300**		**$159,897,993**	
in 1996 $s	$14,863,313	$74,976,739	$27,564,700	$141,538,842	$23,424,692	$136,913,898	$17,670,498	$131,412,330
Total in 1996 $s	**$89,840,052**		**$169,103,542**		**$160,338,590**		**$149,082,829**	

In brief, the yearly spillage baseline, against which OPA 90 regulations' effectiveness factors would be multiplied to get yearly benefits, was based on spillage for "a world without OPA 90". This necessitated selecting spillage for the period 1981-1990, inclusive. The principle reason that 1981-1990 was selected as a spillage baseline against which to multiply regulations' effectiveness factors is that a more recent period's (such as 1991-1995) spillage for U.S. waters has "on the average" decreased considerably since 1990, as a direct result of the Oil Pollution Act of 1990. Thus, if one used such a recent (post 1990) period of spillage, one would seriously undercount the benefits of the OPA 90 regulations.

Both the PRA spillage baseline and spillage model assumed that future yearly spillage would be *linearly* related to increases in the tons of oil transported or handled by the four spill sources. No attempt was made to model the random occurrences of past spills to forecast the future; instead, average yearly "expected values" have been projected over the assessment period for each of the four spill sources (i.e., in the PRAAM it was assumed that the use of expected values for spillage was sufficient for the purposes of the PRA. A separate spillage baseline was constructed for each of the four spill sources.

For the years 1991-1995, Army Corps of Engineers Waterborne Commerce oil commodities data for each of the four oil spill sources was used to extend the spillage baseline through 1995 for the reference case. For the years 1996-2025, the yearly baseline spillage for the reference case was estimated by "growing" the 1995 tons transported by a factor, based on the assumption in the PRA that the baseline spillage would be proportional to the amount of oil transported. For the reference case for the years 1996-2014, PRA panel A recommended that the total overall tonnage transported by an tank ships and tank barges together be given an overall growth rate of 1.0 percent, but that tank barge tonnage would have zero percent growth. Therefore, the growth rate for tank ships underway is approximately 1.4 percent.[25] Panel A also recommended that, for the reference case, there be no growth in oil tonnage transported for either tank ships or tank barges for the years 2015-2025.

The objective was to produce an internally consistent set of baseline spillages for each spill source in each of the future years. The reference case has imbedded in it the non-double hull phase-out schedule provided by PRA panel A, and the Prince William Sound (PWS) tank ship traffic forecast based on the forecasted total oil production of the State of Alaska. Figure 5-1 below displays the PRAAM oil spillage baseline: the actual history 1981-1990 of gallons of spillage, as well as the 1991-2025 projected spillage baseline.

Finally, PRA panel A determined that spill removal efforts (within 72 hours of spill) before OPA 90 had been 10 percent effective, a determination made in the absence of any definitive data on oil spill removal experience. All subsequent fourth order benefits calculations therefore derive from a baseline of pre-VRP/FRP regulations spill response where some oil recovery took place.

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[25] This means that the growth percentage factor for tank ship lightering operations and MTR facilities must be 1.4 percent and 1.0 percent, respectively, for the years 1996-2014.

Massachusetts during April 2000, as well as thorough discussion of, and agreement on, the assumptions and conditions associated with each.

The panelists requested a second meeting for review of the questions and answers and clarification of methodological issues. The Volpe Center and Coast Guard agreed. Minutes of the first meeting were prepared by the Volpe Center and reviewed and approved by the panel prior to the Seattle meeting in July 2000. The panel heard a detailed presentation on the Programmatic Regulatory Assessment Model (PRAAM) and the method for pre-processing the panel's output data for input to the PRAAM. There was then an opportunity to revisit the questions, but the panel made no changes to the quantified answers given in April.

5.2.1 Panelists' Insights

The expert panel advised that the proposed Caps regulation and its 5 accompanying Coast Guard alternatives would be moot with respect to MTR facilities since no affected MTR facilities are located in or on pre-approved dispersants waters which consists of waters greater than 3 n. miles from the shoreline. This reason together with the panel's conclusion that the 2003 25 percent increase in the Caps for the mechanical recovery mode will have zero impact means that the benefit due to the FRP sections of the proposed regulation and alternatives is zero. The only exception to this is the proposed regulation's requirement for aerial tracking and monitoring for the mechanical mode for MTR facilities (and tank vessels) and the associated enhancement of mechanical recovery effectiveness.

The expert panel strongly believed that the magnitude of the proposed *in situ* burning credit was not large enough to cause any additional VRP/FRP planholders—beyond those who before the proposed credit already owned/contracted the eight existing sets of *in situ* burning equipment—to take advantage of it. Therefore, since the credit will not be invoked by planholders, there will be no associated incremental benefits. There will, of course, be benefits from those few planholders who use one of the pre-existing eight sets of *in situ* burning equipment; however, such benefits will be offset or cancelled out by the reduction in mechanical recovery capability/effectiveness for these same planholders. This cancellation may not be precisely zero for every use or scenario involving *in situ* burning, but in the "expected value" sense it will be close; moreover, even if it is not close to zero, relative to the other two modes' benefits, it would not be likely to show a substantial incremental benefit relative to the resolution of the PRAAM. For all of the above reasons, in this RA we need only consider the incremental benefits of mechanical recovery and dispersants modes. This means T^{ISB}, the total effectiveness factor for *in situ* burning, has a value of zero in all of the equations and attendant benefit calculations in Appendix B.[26]

5.2.2 Expert Panel Numerical Results

The eleven expert panelists' raw final votes for each question were "statistically smoothed" to reduce the variances (and standard deviations) of the expert panel's answers, and thereby arrive at better estimates. The smoothing consisted of deleting the highest and lowest panel votes for each question and taking a simple average of the remaining nine votes. The summary results of the panel's voting on the 22 questions presented appear in Table 5-1 below, and the full data set is found in Appendix A (expert panelists are identified by number only; their names are not linked to voting results).

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[26] Appendix B: "Explanations of 'Expected Value' and Conditional Probability; How Benefits of Alternatives with Multiple Response Modes Were Handled."

5.3 PRAAM Runs and Benefit Calculation for 4 Coast Guard Alternatives

The benefits calculations for the proposed regulations require a pair of PRAAM runs for each of the four active alternatives, as stated in Sections 3.6 and 5.1. Because all the alternatives except for alternative 2 involved different application requirements (i.e., different EDACs) for dispersants for the Gulf Coast area waters versus the non-Gulf Coast area waters, each of the members of each of the pairs had to be further broken-out into two additional PRAAM runs—one for Gulf Coast area waters and one for non-Gulf Coast area waters. The PRAAM's yearly spillage baseline for these "sub-runs" was adjusted by means of a spillage distribution sub-model previously discussed in Sections 3.6 and 5.1.

A second adjustment was performed on the PRAAM's yearly spillage baselines to capture the fact that the expert panel's estimated impact of dispersants would usually only apply to spills above a certain minimum threshold. This minimum threshold, when entered into the spillage distribution sub-model, reduced the available baseline spillage for dispersant application purposes by 2 percent.

Before the results of the benefits for each of the four regulatory alternatives are given, the ten steps used in the methodology to estimate benefits are shown in considerable detail using alternative 3 as an example. The benefits of the other alternatives were carried out using the same 10-step process.

5.3.1 Calculation of Benefits for Coast Guard Alternative 3

By using the expert panel's answers, weighted average calculations, and the logic of conditional probability theory in conjunction with the PRA's mathematical procedure to avoid double counting, the 4th order effectiveness factors for each of the four oil spill sources (i.e., tank ships underway, tank barges underway, tank ships lightering operations, and affected MTR facilities) for the proposed regulations are increased relative to those provided by PRA panel A. Two runs of the PRA Model are carried out for each of the four active alternatives—the first with the expert panel's enhancement, but the second "run" without the enhancement. The difference between the PRAAM runs is the resulting benefit of the 2003 changes to the VRP rule.

Recall the details of alternative 3: mechanical recovery equipment Caps increase of 25 percent for all six operating areas of water in 2003 (and 2000); dispersants option A's EDACs; *in situ* burning credit; and aerial tracking and monitoring. Figure 5-2 follows this description and illustrates the flow of the data used. Note that the text describes the process for Gulf Coast area waters only while the figure includes non-Gulf Coast area waters.

Ten Step Benefits Calculation Process

The example given below focuses on the Gulf waters recovery and treatment benefits only. Figure 5-2, an illustrative data flow diagram, includes input and output values for non-Gulf waters as well. Calculations shown in this example and in Figure 2 may not be exact due to rounding.

<u>Step 1: Panel's Raw Votes</u>: Alternative 3 required the use of the expert panelists' answers to questions 1, 2, 3, 4, 5, 6B, 8, 9, 12A, 12B, 13A, 13B, and 18.

<u>Step 2: "Statistical Smoothing" of Votes</u>: The expert panel's raw votes for the questions needed to estimate the benefits of alternative 3 were statistically smoothed. The expert panel's statistically smoothed votes for the overall operational effectiveness of dispersants option A's EDACs for Gulf Coast area waters under "good", "fair", and "poor" conditions, are .8150, .5500 and .1900, respectively. (Hereafter, in this RA all expert panels' answers are statistically smoothed, and, therefore, the qualifying phrase "statistically smoothed" will be discontinued.) The panel also gave answers of .4850, .3200 and .2250 for the percentages of time that the conditions for dispersants in Gulf Coast area waters were good, fair, and poor, respectively.

and the overall effectiveness of dispersants for all Gulf Coast area waters is using result from step 3 is:

(.2214)x(.6140) = .1359.

Step 6: Enhancement of Mechanical Recovery Effectiveness Due to Aerial Tracking and Monitoring: From the expert panel's answer to question 18 for mechanical recovery mode, aerial tracking and monitoring will be utilized 46 percent in inland area waters (i.e., less than 3 n. miles from shore) and utilized 89 percent for non-inland area waters (i.e., greater than or equal to 3 n. mi.). The corresponding enhancement in operational effectiveness will be 43 percent for inland area waters or for non-inland area waters. From the G-MOR Caps Review data and the MSIS database it was determined that 34 percent of all spillage occur greater than or equal to 3 n. miles (i.e., in non-inland area waters) and 66 percent occur in inland area waters. Then the overall enhancement to mechanical recovery mode due to aerial tracking and monitoring is:

(.3400)x(.8900)x(.4300) + (.6600)x(.4600)x(.4300) = .2607

So, the four oil spill sources' (i.e. underway tank ships, underway tank barges, tank ships lightering operations, and MTR facilities) effectiveness factors of .0600, .0600, .1700, and .1700, respectively, from the February 1997 panel when enhanced become:

(.0600)x(1.26070) = .0757, .0757, (.1700)x(1.2607) = .21434, and .2143, respectively.

Step 7: Enhancement of Dispersants' Effectiveness Due to Aerial Tracking and Monitoring: However, from the April 2000 expert panel's answer to question 19, the previous operational effectiveness of dispersants already includes an aerial tracking and monitoring enhancement since the panel declared that dispersants cannot be effectively used without aerial tracking and monitoring. Therefore, the operational effectiveness factor for dispersants of .1359 for Gulf Coast area waters does not get increased any further.

Step 8: Total Overall Operational Effectiveness by the PRA's Mathematical Procedure: The resultant total overall operational effectiveness of the dispersants mode and the mechanical recovery mode considered together, for the first two oil spill sources (i.e., tank ships underway and tank barges underway) for Gulf Coast area waters is:

$$EFF_{Disp} + (1 - EFF_{Disp})xEFF_{Mech} = .1359 + (1 - .1359)x(.0757) = .2013,$$

where the logic of the PRA's mathematical procedure has been used to eliminate double counting in each of the first two oil spill sources' effectiveness factors (i.e., the total effectiveness of the two modes together is not just the sum of effectiveness factors of each mode when acting alone). The resultant total overall operational effectiveness of the two response modes, mechanical and dispersants considered together, for the third oil spill source (i.e., tank ships lightering operations) for Gulf Coast area waters is:

$$EFF_{Disp} + (1 - EFF_{Disp})xEFF_{Mech} = .1359 + (1 -.1359)x(.2143) = .3211,$$

where again we have used the logic of the PRA's mathematical procedure to eliminate double counting in the third oil spill source's effectiveness factors.

The resultant overall operational effectiveness of the fourth oil spill source, MTR facilities will not, however be .3211. Dispersants cannot be used within 3 n. miles of the shoreline, i.e., only in offshore waters and a subset of inland waters (see section 2.4). Because the expert panel concluded that there exist no MTR facilities located more than 3 n. miles from the shoreline, the enhanced effectiveness factor for dispersants for MTR facilities is zero. This means the resultant overall operational effectiveness of the fourth oil spill source, MTR facilities is:

$$EFF_{Disp} + (1 - EFF_{Disp})xEFF_{Mech} = .0.0000 + (1 - 0.0000)x(.2143) = .2143$$

Because alternative 2 does not involve the dispersants mode but only the mechanical mode, there is no double counting and so there is no need to use the logic of the PRA mathematical procedure as was the case for alternative 3. The TPV of the benefits for alternative 2 is 8,023 bbls.

The TPV of the benefits for alternative 4 is 22,277 bbls; the TPV of the benefits for alternative 5 will also be 22,277 bbls.[27] The expert panel gave an answer of zero for the impact of the incremental change of the 25 percent increase in the EDACs in 2003 on the overall operational effectiveness of the mechanical recovery mode. This means that the incremental benefits from the mechanical EDACs increases is zero for both alternative 4 and 5. Although both alternative 4 and alternative 5 will receive a small boost in benefits from the proposed regulation's requirement for aerial tracking and monitoring for mechanical, this small boost will be identical for both alternatives. The benefits due to the proposed regulation's dispersants requirement (as well as to the aerial tracking and monitoring requirement for dispersants mode) will be identical for both alternatives.

5.4 Benefits Summary

The quantitative summary results of the benefits appear in Table 5-2. Major qualitative findings follow:

- No benefit would accrue due to the *in situ* burning optional credit, since no new assets would come into service as that credit is structured.
- MTR facilities would accrue zero benefit from mechanical recovery Caps increases, as would vessels. There would be a small mechanical recovery benefit due to the new aerial tracking and monitoring requirement, which applies to mechanical mode as for all others.
- Mechanical recovery is still the primary response option since it's used in 75 percent or more of all spills in which a response is mounted. The panel agreed that tier 1 is the critical readiness/response

TABLE 5-2: BENEFITS OF 5 COAST GUARD REGULATORY ALTERNATIVES (REFERENCE CASE)

	Regulatory Alternative 1	Regulatory Alternative 2	Regulatory Alternative 3	Regulatory Alternative 4	Regulatory Alternative 5
Total benefit (2003-2025, discounted to 1996)	0 bbls	8,023 bbls	22,120 bbls	22,277 bbls	22,277 bbls

Note 1: The expert panel felt strongly that aerial tracking & monitoring requirements of proposed Caps regulation would have no impact on dispersants mode's effectiveness, since it is not possible to disperse oil without aerial tracking & monitoring, and all dispersants operations already use/meet aerial tracking & monitoring requirements of the proposed Caps regulation. The panel felt, however, that the Caps regulation for aerial tracking & monitoring for the mechanical mode would have an impact because presently mechanical operations usually do not use/meet this requirement.
Note 2: This reference case utilizes the PRA's reference values for its parameters, as well as assigning full and equal weight to benefits from 4th order effects of OPA 90 regulations versus benefits from 1st, 2nd, or 3rd order effects. It also assigns full and equal weight to benefits of oil removed by the non-mechanical mode (i.e., dispersants) versus benefits of oil removed by the mechanical mode.

[27] Recall that alternative 4 is: mechanical recovery equipment Caps increase of 25 percent (but increase is for inland, rivers and canals, and Great Lakes areas only) in 2000 and 2003. Use option B's EDACs for each tier for dispersants, and an *in situ* burning credit is included (all with aerial tracking and monitoring). Whereas alternative 5 is: No mechanical recovery Caps increase; use option B's EDACs for each tier for dispersants, and an *in situ* burning credit is included (all with aerial tracking and monitoring).

element.

- MTR facilities would accrue zero benefit from the new dispersants Caps since none are found in the currently pre-approved areas.
- The panel felt strongly that dispersants capability should be required in 2003, although their responses indicate that personal and cultural issues might weigh against dispersant use in non-Gulf Coast area waters.
- The panel indicated that weather and temperature factors could affect dispersants performance and that dispersants become less effective for very large spills. The panel stated that dispersants would be highly effective because of the majority of occurrences of smaller spills.

Chapter 6: Cost Effectiveness

All benefit calculations utilize two important factors: a "fourth order[28] factor" and a "non-mechanical mode factor". The fourth order factor captures the possible decreased benefit given to oil that is spilled into the aquatic environment and recovered, compared to the benefit of oil spills that are prevented in the first place. The fourth order factor always has a value smaller than or equal to 1.0.

The non-mechanical mode factor is a second, downward adjustment factor that captures or reflects the belief that the dispersants mode does not, in fact, remove the oil from the environment. The non-mechanical mode factor also always has a value smaller than or equal to 1.0. For this RA, the reference case uses a value of 1.0 for both the 4th order and non-mechanical mode factors. The sensitivity analysis independently assigns to each of the two factors the values of 1.0, 0.75, and 0.5. The cost-effectiveness ratio is the total present value of costs, which results are found in Chapter 4, divided by the total present value of benefits of Chapter 5.

6.1 Reference Case Results

For the case where the fourth order factor and the non-mechanical mode factor are both equal to 1.00 (reference case), the cost-effectiveness of $6,692/bbl for alternative 5 is best, i.e., smallest dollars spent per barrel removed. Alternative 4, with a cost-effectiveness of $7,197/bbl, is the second best. Alternative 3 and alternative 2 are the least desirable with cost-effectiveness values of $7,645/bbl and $11,192/bbl, respectively. Table 6-1 shows the cost-effectiveness results of the five regulatory alternatives for the reference case.

TABLE 6-1: COST-EFFECTIVENESS 2003-2025 (REFERENCE CASE)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Cost (TPV 1996 $s)	$0	$89,840,052	$169,103,542	$160,338,590	$149,082,829
Benefit (TPV barrels)	0 bbls	8,023 bbls	22,120 bbls	22,277 bbls	22,277 bbls
Cost Effectiveness ($ per bbl)	NA	$11,198	$7,645	$7,197	$6,692

1. This reference case utilizes the PRA's reference values for its parameters, as well as assigning full and e 4th order effects of OPA 90 regulations versus benefits from 1st, 2nd, or 3rd order effects. It also assigns ful weight to benefits of oil removed by the non mechanical mode (i.e., dispersants) versus benefits of oil mechanical

[28] An OPA 90 regulation possesses a "fourth order" effectiveness if that regulation lowers (by some percentage) the expected quantity of the spilled oil that would remain (i.e., can not be removed before damage to the environment) in the water. See Chapter 3and Appendix E: "Overview of "How the Overall and Marginal Impacts of OPA 90 Rules Are Computed in a Way That Avoids 'Double Counting' of Benefits", for more details.

TABLE 6-2: COST-EFFECTIVENESS ($S PER BBL): SENSITIVITY TO FOURTH ORDER AND NON-MECHANICAL MODE FACTORS

Alternative 2		fourth order factor 1.00	0.75	0.50
Non Mechanical mode factor	1.00	*$11,198*	$14,930	$29,861
	0.75	NA	NA	NA
	0.50	NA	NA	NA
Alternative 3		**fourth order factor 1.00**	**0.75**	**0.50**
Non Mechanical mode factor	1.00	*$7,645*	$10,193	$15,290
	0.75	$9,094	$12,125	$18,188
	0.50	$11,220	$14,961	$22,441
Alternative 4		**fourth order factor 1.00**	**0.75**	**0.50**
Non Mechanical mode factor	1.00	*$7,197*	$9,597	$14,395
	0.75	$8,568	$11,424	$17,136
	0.50	$8,778	$14,111	$21,167
Alternative 5		**fourth order factor 1.00**	**0.75**	**0.50**
Non Mechanical mode factor	1.00	*$6,692*	$8,923	$13,384
	0.75	$7,967	$10,622	$15,933
	0.50	$9,840	$13,121	$19,681

Note: Reference case values are italicized.

Chapter 7: Small Business and Paperwork Burden Analysis

7.1 Initial Regulatory Flexibility Analysis

7.1.1 Need for an Initial Regulatory Flexibility Analysis

To avoid placing an undue economic burden on a substantial number of small entities in the United States that comply with the proposed federal regulations revising the VRP and FRP requirements for oil spill responders, the Coast Guard must conduct a Regulatory Flexibility Analysis under the Regulatory Flexibility Act [5 U.S.C. 601 et seq.]. The Initial Regulatory Flexibility Analysis addresses the cost and manpower burdens on small entities without making comparison to their revenues.

A small entity may be:

- A small business—any independently-owned and operated business not dominant in its field, qualifying as a small business according to the Small Business Act [15 U.S.C. 632],[29]
- A small not-for-profit organization, or
- A small government jurisdiction (a locality with < 50,000 population).

For the purposes of this Regulatory Flexibility Analysis, a small entity could be a planholder (either owner or operator) for a tank vessel carrying groups I-IV petroleum, a MTR facility meeting the other criteria of the proposed regulation, a VRP/FRP preparer company, or a WCD OSRO.

7.1.2 Reason for Agency Action

The OPA 90 (Pub. L. 101-380) directed that response plans should prepare for, to the maximum extent possible, a response to a WCD. These Caps were established taking into account 1993 technology, deployment capability, and availability of response resources. The 1993 and 1996 rules established the 1998 Caps, a 25 percent increase from the 1993 levels, as a target for increasing response capabilities. Prior to implementing the 1998 increase, the Coast Guard was required by the regulations to conduct a review to determine if the proposed increases were practicable and to propose specific Caps for 2003. The Coast Guard completed its review in May 1999 and the 25 percent increase for mechanical recovery took effect on April 5, 2000. The Coast Guard is now considering the proposed level of 2003 Caps for mechanical recovery capability and requirements for other spill response technologies.

[29] To qualify, a business must be organized for profit, with a place of business located in the United States. It must operate primarily within the United States or make a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor. Together with its affiliates, it must meet the numerical size standards for its primary industry, in total employees or annual receipts, as defined in the Small Business Administration (SBA) Size Regulations in 13 CFR 121. Effective October 1, 2000, SBA amended its size regulations by establishing a new table of small business size standards for industries as the North American Industry Classification System (NAICS) defines them. Previously, small business size standards existed for most industries under the Standard Industrial Classification (SIC). SBA determined that NAICS is a better description of industries in the U.S. economy than the SIC system for purposes of establishing small size standards (see the *Federal Register*, Vol. 65, May 15, 2000, p. 30836 and the *Federal Register*, Vol. 65, September 5, 2000, p. 53533).

TABLE 7-1: CHARACTERISTICS OF SMALL BUSINESS VESSEL RESPONSE PLANHOLDERS

Planholder Type	Fleet Size (# Vessels)	Total Number of Planholders	Number / % That Are Small Businesses	Average Number of Plans per Small Planholder	Average Number of Vessels per Small Planholder
Tank Barge Fleet Only	1-20	200	135 / 67.5%	1.1	4.3
	21-100	30	14 / 46.7%	1.0	38.9
	101+	6	3 / 50.0%	1.0	159.7
Tank Ship & Mixed (i.e., tank ship & tank barge) Fleets	1-20	453	76 / 16.8%	1.1	3.6
	21-100	21	12 / 57.1%	1.2	35.0
	101+	0	0 / 0.0%	0.0	0.0

MTR Facility Planholders

The Coast Guard Headquarters Office of Standards Evaluation and Development provided an estimate of the number of MTR Facilities that will be affected by the proposed Caps regulation, as well as the percentage that are small businesses, 40 percent (or 1,040). The Coast Guard estimate, derived from their MSMS database, is that 2,600 MTR facilities are affected by the proposed Caps regulation (under 33 CFR 154.1025, the owner or operator of a facility categorized as a significant and substantial harm facility may not handle, store, or transport oil unless the response plan has been approved).

The Census Bureau provided data that indicated the proportion of small businesses in a similar industry sector, while the Coast Guard data provide a snapshot of the affected MTR facility population. The Economic Census sorts businesses by industry classification codes, and is conducted on an establishment basis, whereby multiple facilities at multiple locations, operated by one company, are counted separately. While the original FRP RA[31] counted affected MTR facilities for the Standard Industrial Classification (SIC) codes, the industry standard is now the North American Industry Classification System (NAICS), whose categories do not track precisely with SIC. SIC and corresponding NAICS codes are reproduced in Table 7-2.

TABLE 7-2: MTR FACILITY CODES

	SIC	NAICS
Petroleum Bulk Stations and Terminals	5171	422710
Petroleum Refineries	291	32411
Government Installation	971	92811
Oil Production Facilities	131	211111
Electric Utility Plants	491	221122
Mobile Facilities	4213, 4953, & Others	484121, 484220
Total Number of MTR Affected Facilities	2,600	
Number/Percent Small Businesses	1,040/40%	

Total Small Business Estimate

The total number of small business vessel and MTR facility planholders impacted by the proposed regulation is 240 + 1,040 = 1,280.

[31] U.S. Coast Guard, "Regulatory Assessment of the U.S. Coast Guard Interim Final Regulation of Facility Response Plans," December 22, 1992 (prepared by ICF for the U.S. Coast Guard).

Alternative 3: Mechanical recovery equipment Caps increase of 25 percent for all six operating areas of water in 2003. A new VRP/FRP regulation requirement in 2003 to ensure by contract for dispersants capability for inland, nearshore or offshore areas of water, where pre-authorization or expedited approval exists. The dispersants requirement will make use of option A's Effective Daily Application Capabilities (EDACs) for each tier. An *in situ* burning credit is included. All three of these oil response modes will also be required to have aerial tracking and monitoring capability of the spill.

Alternative 4: Mechanical recovery equipment Caps increase of 25 percent (but increase is for inland, rivers and canals, and Great Lakes areas only) in 2003. A new VRP/FRP regulation requirement in 2003 to ensure by contract for dispersants capability for inland, nearshore or offshore areas of water, where pre-authorization or expedited approval exists. The dispersants requirement will make use of option B's Effective Daily Application Capabilities (EDACs) for each tier. An *in situ* burning credit is included. All three of these oil response modes will also be required to have aerial tracking and monitoring capability of the spill.

Alternative 5: No mechanical recovery Caps increase. A new VRP/FRP regulation requirement in 2003 to ensure by contract for dispersants capability for inland, nearshore or offshore areas of water, where pre-authorization or expedited approval exists. The dispersants requirement will make use of option B's Effective Daily Application Capabilities (EDACs) for each tier. An *in situ* burning credit is included. All three of these oil response modes will also be required to have aerial tracking and monitoring capability of the spill.

7.1.8 Cost for Small Business Entities

Planholders

Approach

The premise of this analysis is that OSROs must maintain profitability at current levels, and would pass the full amount of compliance costs on to the planholders in the form of additional or higher retainer fees. The estimated compliance costs found in Chapter 4 are the basis of the estimated impacts of the regulation on planholders. The costs include both the paperwork costs paid directly by planholders and equipment costs that would be passed along to planholders by the OSROs listed in their plans.

Vessel planholder and facility planholder compliance costs are, however, treated differently. While vessel planholders incur costs for all three response modes (mechanical recovery, dispersants, and *in situ* burning), no MTR facilities are located in the pre-approved areas, and MTR facility planholders therefore only incur mechanical recovery costs. *In situ* burning mode costs are zero for both tank vessels and facilities because of the Caps expert panel's conclusion that market forces, and an insufficient credit against mechanical recovery EDACs would not make *in situ* burning economically viable.

Vessel Planholders

Data collected from OSROs do not indicate the apportionment of these regulations' costs to small business vessel planholders. Those costs are found by proportionality to the small businesses' costs derived from planholders' responses to a survey for the ongoing Salvage and Marine Firefighting (hereafter referred to as S&MF) RA. The proportion depends on the ratio of the *total* cost (includes both small business and non-small business planholders' costs) of the S&MF regulation to the corresponding *total* cost of the proposed Caps regulations. Because the costs in two proposed regulations occur over different time periods (i.e., 2000-2025 for S&MF versus 2003-2025 for Caps), a more accurate estimate will be provided by using the ratio of the "annualized equivalents" of the two proposed regulations TPVs for the needed proportion. This proportion is then multiplied by the

TABLE 7-5: EXPECTED COSTS FOR THE AVERAGE SMALL BUSINESS PLANHOLDER: 101+ VESSELS (2000 $S)				
Cost Alternative	**Sm. Bus. Planholder Type**	**1st Year**	**Yearly Recurring**	**TPV**
Alternative 2				
	Tank Barge	$229,229	$66,097	$606,740
	Tank Ship	$0	$0	$0
Alternative 3				
	Tank Barge	$582,143	$167,859	$1,540,860
	Tank Ship	$0	$0	$0
Alternative 4				
	Tank Barge	$552,543	$159,324	$1,462,511
	Tank Ship	$0	$0	$0
Alternative 5				
	Tank Barge	$513,754	$148,139	$1,359,843
	Tank Ship	$0	$0	$0
Note: No tank ship operators in this category are small businesses.				

Example Calculation for Small Business Vessel Planholders

An example of this methodology will be given for alternative 2 of the proposed Caps regulation. In the S&MF RA the TPV of total cost the proposed regulation was $521,249,983 (2000-20025) in constant 2000 $s. This has an annualized equivalent of $44,728,731 in constant 2000 $s.[36] The TPV of the total cost of alternative 2 for the proposed Caps regulation was $89,840,052 (2003-2025) of which $58,038,264 was the TPV of the total cost for vessel planholders. $58,038,264 for vessel planholders has an annualized equivalent of $4,652,237 in 2000 $s. For the S&MF regulation, the small business vessel planholders with 1-20 tank barges had a first year, 2000, cost of $78,759 (undiscounted), and $23,380 (undiscounted) for the recurring years thereafter, 2001-2025. Then the small business Caps cost for alternative 2 for the vessel planholders with 1-20 tank barges for its first year, 2003, is:

($4,654,480/$44,728,731)x($78,759) = $8,790 in constant 2000 $s.

Similarly, the small business cost for alternative 2 for the vessel planholders with 1-20 tank barges for the years 2004-2025, is:

($4,654,480//$44,728,731)x($23,380) = $2,609 in constant 2000 $s.

The first year and the recurring year costs for tank ship planholders for alternative 2 for the proposed Caps regulation are calculated similarly. The resultant TPV for Caps alternative 2 is computed in a separate spreadsheet by discounting the $2,609 recurring year costs by 7 percent per annum and then adding the result to the first year cost (undiscounted) of $8,790. This yields a small business TPV of $23,791 in constant 2000 $s for alternative 2 for vessel planholders with 1-20 tank barges. The Caps small business costs for the other Caps alternatives, are derived in an analogous manner.

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36 The "annualized equivalent" of the Total Present Value, TPV, of a stream of costs over the period 2000-2025, is the yearly *undiscounted constant* cost, which when discounted over that same time period will yield a TPV equivalent to the original TPV cost. For the TPV of $521,249,983 in the Salvage and Marine Firefighting RA, this annual equivalent is:
($521,249,983) divided by $[(1 - R^{26})/(1 - R)]$, where $R = 1/(1 + r)$, and r is the discount rate used or 7 percent.

This TPV of $1,479,153 has an annualized equivalent of:

$$\$1,479,153 / [(R^8 - R^{29})/(1 - R)] = \$204,385 \text{ undiscounted in constant 2000 \$s.}$$

Therefore the MTR facilities that are small businesses will have a first year cost of $521,862 (undiscounted in constant 2000 $s), yearly recurring costs thereafter, 2004-2025, of $204,385 862 (undiscounted in constant 2000 $s), and a TPV for all years, 2003-2025, of $1,704,143 (discounted back to 1996 in constant 2000 $s).

The corresponding costs *per* MTR facility planholder are then found by dividing each of these three costs by the 40 percent of all MTR facilities that are small businesses (i.e., by dividing by 1,040). For alternative 2 this results in a first year, 2003, cost of $502 per MTR small business facility planholder, $197 per MTR small business facility planholder for the years 2004-2025, and a TPV of $1,639 per MTR small business facility planholder.

7.1.9 Federal Rules that May Duplicate, Overlap or Conflict

There are no federal rules that duplicate, overlap or conflict with the proposed rule.

7.2 Paperwork Reduction Act

7.2.1 Necessity of the Information Collection

Section 4202 (a)(6) of the OPA 90 amended section 311(j) of the Federal Water Pollution Control Act (FWPCA). It requires that MTR facilities and vessels carrying oil in bulk as cargo and operating in waters subject to U.S. jurisdiction and prepare and submit a written response plan for a WCD. Revisions to the spill response provisions of VRP/FRP regulations must therefore be complied with.

7.2.2 Needs and Uses

The paperwork requirements consist of amending the response plan, submission of revisions to the Coast Guard, and annual record keeping activities. The amended sections of VRPs and FRPs will be submitted to the Coast Guard within six months of the implementation of the Proposed Rule, and updated annually. A VRP may cover an individual vessel or multiple vessels. FRPs will generally cover an individual facility. The information in the sections will include: the names and contact information for oil spill responders for each vessel with appropriate equipment and resources located in each zone in which the vessel operates; specific lists of equipment that the resource providers will make available in case of an incident in each zone; and certification that the responders are qualified and have given their permission to be included in the plan. In addition to the respondents' burden, the Coast Guard will incur paperwork-related burdens reviewing and approving the response plans.

The information in the spill response sections of the VRP/FRP is necessary to show evidence that vessel planholders have done proper planning to prevent or mitigate oil outflow from vessel casualties, and to provide that information to the Coast Guard for their use in emergency response.

7.2.3 Use of Information Technology

VRPs and FRPs must be filed in paper form, although updates may be sent as e-mail attachments. The Coast Guard may consider electronic filing in the future, but believes this would be problematic at present because there is no standardized form for the plans, and the required information contained therein varies from planholder to planholder.

summer of 1998. They received 37 letters in response to the workshops; these letters were placed in the public docket.

Many questions from industry in the above referenced docket were specific to the 2003 Caps. In addition, there was the Expert Panel convened for the purpose of quantifying benefits for this RA, and there will a Notice of Intent announcing the preparation of an Environmental Impact Statement (EIS) and opportunities for public input into the NEPA process thereafter.

7.2.9 Paying Respondents

The Coast Guard does not pay respondents for submitting their VRPs and FRPs.

7.2.10 Assurance of Confidentiality

The information requirements for the spill response section of the VRP/FRP are mandatory. Vessels and MTR facilities not adhering to the requirements will be prohibited from operating in U.S. waters.

Vessel owners and operators are responsible for keeping apprised of and complying with new Coast Guard regulations concerning the operation of their vessels. Notices of proposed and final rulemakings are published on the Coast Guard web site, http://www.uscg.mil/, and in the *Federal Register*. Additionally, the Coast Guard will to the extent possible notify individual registered vessel owners and operators of pertinent changes in the regulations.

Much of the information contained in VRPs is public information, and is made available through the Coast Guard's web site. Since FRPs are approved by COTPs, information contained in FRPs is available to the public by contacting the individual COTP. Public information includes: the plan number, planholder, owner and operator names, planholder address, plan preparer name and address, plan expiration date, plan approval date, plan received date, number of vessels, list of vessel names, vessel identification number, vessel type, vessel flag, oil type carried, size of WCD, some vessel specifications, zones in which vessel operates, vessel status, Qualified Individuals (QI), OSROs, and operating areas. Other information is confidential and available only to Coast Guard offices and system administrators who require access to planholder, plan preparer, and QI contact information (telephone/fax numbers, email addresses). On a case-by-case basis, a planholder can request that certain items he/she feels would compromise his/her business be kept confidential. Non-confidential information is subject to release under the Freedom of Information Act.

7.2.11 Justification for Sensitive Questions

In general, no questions that would reveal financial information or put respondents at a competitive disadvantage within their industry are asked. Contact information for response providers, considered sensitive, is necessary to be collected so that the Coast Guard has immediate access to it during emergency response situations.

7.2.12 Estimate of Cost and Time Burden

The paperwork requirement consists of amending the response plan, submission of revisions to the Coast Guard, and annual record keeping activities. The amended sections of VRPs (which may cover an individual vessel or multiple vessels) and FRPs will be submitted to the Coast Guard within six months of the implementation of the proposed rule, and updated annually. The information in the plans will include: names and contact information for oil spill responders in each zone covered; specific lists of equipment that the resource providers will make available in case of an incident in each zone; and certification that the responders are qualified and have given their permission to be included in the plan.

7.2.15 Request Not to Display Expiration Date

This information collection does not employ a standardized data collection instrument, but relies on specifications set forth in the proposed rule outlining the spill response section of the VRP/FRP and the required information to be included in the plan. The expiration date for Office of Management and Budget (OMB) approval for the information collection will be published along with the Final Rule in the *Federal Register* and will appear on the Coast Guard web site. The Coast Guard previously submitted the collection of information requirements to OMB for review under section 3504(h) of the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*). The existing subpart F (FRP) and Subpart D (VRP) OMB approval number is OMB Control Number 2115-0595.

7.2.16 Exceptions to the Certification

There are several exceptions to the certification for Paperwork Reduction Act Submissions:

(c) The proposed rule does not make any exceptions for small businesses.

(i) It does not use statistical survey methodology, as the information collection applies to the entire population of affected vessels and facilities, and sampling is not used.

7.2.17 NAICS Codes Affected

The proposed rule affects the following NAICS codes for VRP and FRP planholders (listed below in total employees or annual receipts):

- 483111 Deep Sea Freight Transportation, not more than 500 employees
- 483112 Deep Sea Passenger Transportation, not more than 500 employees
- 483113 Coastal and Great Lakes Freight Transportation, not more than 500 employees
- 483114 Coastal and Great Lakes Passenger Transportation, not more than 500 employees
- 483211 Inland Freight Transportation, not more than 500 employees
- 483212 Inland Passenger Transportation, not more than 500 employees
- Subsector 483 Water Transportation – Offshore Marine Services, not more than $20.5 million
- 422710 Petroleum Bulk Stations and Terminals, not more than 100 employees

Chapter 8: Findings

8.1 Costs

A national cost estimate was developed based upon a sample survey of several of the major WCD OSROs, as well as some of smaller size. The survey data were augmented with telephone interviews and qualitative questions put to the expert panel during their sessions on effectiveness and benefits. The total costs for the four active proposed regulatory alternatives for the 2003 spill response Caps appear in Table 8-1 below, in total present value expressed in year 2000 $s and year 1996 $s. Industry and Government costs were calculated over the period 2003 to 2025 and discounted at a rate of 7 percent.

The specific quantitative and qualitative findings are the following:

- The 2003 mechanical recovery Caps increase of 25 percent (from 125 percent to 150 percent of 1993 Caps values) would result in considerable incremental cost to industry, although they would meet the increased capacity requirements through new or modified contractual and cooperative arrangements.
- The *in situ* burning credit against the mechanical recovery Caps, up to a maximum of 10,000 barrels is insufficient incentive for industry to acquire more *in situ* burning packages, particularly at a time when the costs are still quite high and equipment performance challenges remain. As a result, the expansion of in situ burning assets is not foreseen, and no attendant costs are found.
- Industry compliance with dispersants capability requirements will be met with a combination of boats and airplanes, the latter at least 50 percent according to Coast Guard's requirements.
- Government costs will be minimal, including a relatively large first year expense and small recurring annual expenses thereafter.
- No state, local, and tribal government costs were found.
- Actual projected costs were found to be much higher for the new dispersants capability requirements than for the augmented mechanical recovery requirements, mainly due to the associated capital expense of dispersants stockpiles and response vessel modifications for dispersants delivery. There would be an undiscounted capital expense of $16.94 million in constant 2000 $s, and a yearly recurring undiscounted cost of $8.80 million in constant 2000 $s. The majority of the latter was the yearly contracting cost for a national dispersants delivery fixed wing air fleet ($7.25 million/year), which consists of five Hercules C-130 cargo airplanes to supplement those already in place.
- Aerial tracking and monitoring costs, included and identical in all four active alternatives, were significant but minor by comparison (undiscounted capital expense of $5.40 million and yearly recurring expense of $0.99 million/year in 2000 $s).
- For all four alternatives the planholders' paperwork burden costs, with a TPV of $54,260,806 in constant 1996 $s, make up the largest portion of the costs.

8.3 Cost-Effectiveness

The final result of the assessment is the cost-effectiveness for the four active alternatives, arrived at by division of the total cost for each by the corresponding benefit, in present value dollars and barrels of oil, respectively. The reference case takes the benefit as 100 percent of oil removed from or treated in the water. Alternative 5 is the most cost-effective, and alternative 2 is the least cost-effective. The absolute benefits for alternatives 3, 4, and 5 are nearly identical and are nearly three times the benefit for alternative 2 (see Table 8-2).

TABLE 8-2: COST-EFFECTIVENESS SUMMARY

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Cost (TPV 1996 $s)	$0	$89,840,052	$169,103,542	$160,338,590	$149,082,829
Benefit (TPV barrels)	0 bbls	8,023 bbls	22,120 bbls	22,277 bbls	22,277 bbls
Cost Effectiveness ($ per bbl)	NA	$11,198	$7,645	$7,197	$6,692

1. This reference case utilizes the PRA's reference values for its parameters, as well as assigning full and equal 4th order effects of OPA 90 regulations versus benefits from 1st, 2nd, or 3rd order effects. It also assigns full and weight to benefits of oil removed by the non mechanical mode (i.e., dispersants) versus benefits of oil removed mechanical mode.

8.3.1 Sensitivity Analysis

The sensitivity analysis introduces notional equivalency reductions for fourth order benefits (to reflect the residual impact and reduced value that a barrel of oil in the water may have even when removed) and an additional reductive non-mechanical factor for oil that is not removed, but whose treatment by dispersants transfers it from one place in the environment to another. The factors applied here do not have any currency in government policy, but are illustrative of the point that prevention of spills may have more value to the public than spill response. The factors applied are reductions of 25 percent and 50 percent, no combinations of which affect the ranked order of the cost-effectiveness of the alternatives. As explained in Chapter 6, benefits from oil treated by dispersants are subject to both reductive factors in the analysis. Table 8-3 shows the results.

TABLE 8-4: SMALL BUSINESS COST SUMMARY

	Alternative 2			Alternative 3			Alternative 4			Alternative 5		
	1st year	Yrly	TPV	1st year	Yrly	TPV	1st year	Yrly	TPV	1st year	Yrly	TPV
VRP 0 - 20 vessels												
Tank Barge	$8,790	$2,609	$23,791	$22,323	$6,627	$60,420	$21,188	$6,290	$57,348	$19,701	$5,848	$53,322
Tank Ship	$7,896	$2,693	$23,820	$20,053	$6,838	$60,493	$19,034	$6,491	$57,417	$17,698	$6,035	$53,386
VRP 21-100 vessels												
Tank Barge	$79,930	$23,100	$211,935	$202,987	$58,665	$538,225	$192,666	$55,682	$510,858	$179,141	$51,773	$474,995
Tank Ship	$69,715	$21,923	$197,312	$177,047	$55,676	$501,089	$168,044	$52,845	$475,609	$156,247	$49,135	$442,222
VRP 101+ vessels												
Tank Barge	$229,229	$66,097	$606,740	$582,143	$167,859	$1,540,860	$552,543	$159,324	$1,462,511	$513,754	$148,139	$1,359,843
Tank Ship	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MTRF	$502	$197	$1,639	$937	$377	$3,085	$836	$356	$2,925	$699	$339	$2,720

8.5 Paperwork Burden

The paperwork requirement consists of amending the response plan, submission of revisions to the Coast Guard, and annual record keeping activities. The amended sections of VRPs (which may cover an individual vessel or multiple vessels) and FRPs will be submitted to the Coast Guard within six months of the implementation of the proposed rule, and updated annually. The information in the plans will include: names and contact information for oil spill responders in each zone covered; specific lists of equipment that the resource providers will make available in case of an incident in each zone; and certification that the responders are qualified and have given their permission to be included in the plan.

The paperwork burden costs are assumed to be the same for all four alternatives. These paperwork burden costs have not been broken-out separately for vessel planholders versus MTR facility planholders. The paperwork burden estimate is calculated on an initial revision/annual review basis for alternatives. The paperwork burden costs and hourly burden estimates of the alternatives are shown in Table 8-5 below.

The alernatives' paperwork burden cost per planholder assumes a burden of 40 hours of managerial labor per planholder and 5 hours of clerical labor for the first year. It assumes a burden of 20 hours of managerial labor per planholder and 5 hours of clerical labor for the each year thereafter. The assumed rates per hour are $100/hr. and $35/hr. (in constant 2000 $s) for managerial hours and clerical hours, respectively. The proposed planning requirements include initial preparation, annual review and revision every five years. The total annual cost, nationally, for each of the alternatives, is $58,197,138 (2000 $s TPV for the 23-year assessment period). The average total cost per planholder for alternative 3 is $17,582 (TPV 2000 $s). The proposed planning requirements

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List of Acronyms

ASTM: American Society for Testing Materials

bbls: barrels

Caps: The required limits or ceilings on capability (caps) for mechanical recovery of spilled oil.

CFR: Code of Federal Regulations

EDAC: Effective Daily Application Capability

EDRC: Effective Daily Recovery Capacity

EEZ: Exclusive Economic Zone

FRP: Facility Response Plan

FWPCA: Federal Water Pollution Control Act

ISB: *In Situ* Burning

MSIS: Marine Safety Information System

MSRC: Marine Spill Response Corporation

MTR: Marine Transportation-Related

NEPA: National Environmental Protection Act

NRC: National Response Corporation

OMB: Office of Management and Budget

OPA 90: Oil Pollution Act of 1990

OSRO: Oil Spill Response Organization

OSRV: Oil Spill Response Vessel

PRA: Programmatic Regulatory Assessment

PRAAM: Programmatic Regulatory Assessment Accounting Model

RA: Regulatory Assessment

RIA: Regulatory Impact Assessment

S&MF: Salvage and Marine Firefighting

TPV: Total Present Value

VRP: Vessel Response Plan

WCD: Worst Case Discharge

APPENDICES

Appendix A: Questionnaire Used With April 2000 Expert Panel; Expert Panel's Raw Votes to Questionnaire; and Summary Notes of Expert Panel Workshops April 26-27, and July 11, 2000

Appendix B: Explanations of 'Expected Value' and Conditional Probability: How Benefits of Alternatives with Multiple Response Modes Were Handled

Appendix C: Spreadsheet of Cost Survey Results and Extrapolation to National Estimates

Appendix D: Cost Survey Forms

Appendix E: Overview of How The Overall and Marginal Impacts of 11 Core OPA 90 Rules Are Computed In A Way That Avoids 'Double Counting' of Benefits

Appendix A: Questionnaire Used with April 2000 Expert Panel ; Expert Panel's Raw Votes to Questionnaire; and Summary Notes of Expert Panel Workshops April 26-27 and July 11, 2000

Many questions have been combined by asking a single set of questions using the phrase '**Vessels/MTR Facilities**'. If the expert panel decides that a specific question requires a different answer for spills from Vessels than for spills from MTR Facilities, then that question will be answered by the panel twice.

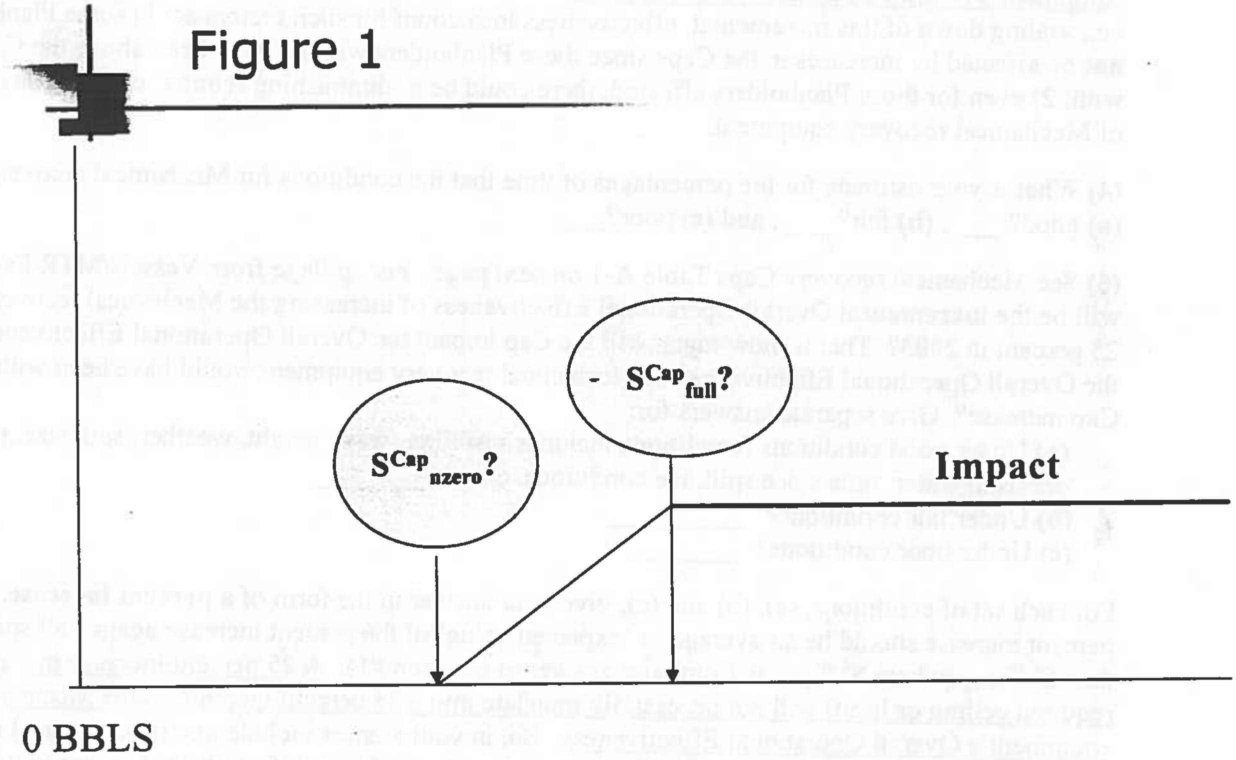
Whatever the actual magnitude of the incremental Overall Operational Effectiveness of the impact of increasing the Effective Daily Recovery Capacity by 25 percent in 2000 (and by another 25 percent in 2003) may be, not all spill sizes will be impacted to the *same degree*. That is, there wil be some **threshold** spill size, S^{Cap}_{nzero} in barrels, above which a 25 percent increase in Caps has a non-zero impact. Likewise, there will also be a second **threshold** spill size, S^{Cap}_{full}, above which the full impact of the 25 percent Caps increase occurs. These two spill sizes, S^{Cap}_{nzero} and S^{Cap}_{full}, are needed in order to adjust downward the universe of spills in U.S. waters that will be impacted by the Caps increases. The 25 percent increase is an increase only to the *limit* (i.e., to the upper bound) of the legally required capability (Cap) for oil spill response plan Mechanical equipment. For many Vessel/MTR Facility spills (i.e., the smaller spills that do not approach in magnitude a Vessel's/MTR Facility's worst case discharge volume), this 25 percent increase in the upper bound of the required capability of oil containment and recovery of oil from the water **will have zero impact**. Questions (1) through (2), together with Figure E-1 on the following page, gather this needed threshold spill size data.

(1) Below what spill size, S^{Cap}_{nzero}, from Vessels/MTR Facilities, will the extra Mechanical recovery equipment resulting from the 2000 or 2003 25 percent increase in the required Mechanical recovery capability (Cap) **have zero impact** (see Figure E-1 on next page; Caps are given in Table A-1)? _______

(2) Above what spill size, S^{Cap}_{full}, from Vessels/MTR Facilities, will the extra Mechanical recovery equipment resulting from the 2000 or 2003 25 percent increase in the required Mechanical recovery capability (Cap) **reach its full effect** (see Figure E-1 on next page; Caps are given in Table A-1, below)? _______

FIGURE A-1

Figure A-1 is needed for Questions #1 and #2



1

(3) See Mechanical recovery Caps Table A-1 on next page. For spillage from Vessels/MTR Facilities, what will be the **incremental** Overall Operational Effectiveness of increasing the Mechanical recovery Cap by 25 percent in **2000**? That is, how much will the Cap impact the Overall Operational Effectiveness of what the Overall Operational Effectiveness of Mechanical recovery equipment would have been without the 2000 Cap increase? Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? ________

(b) Under fair conditions? ________

(c) Under poor conditions? ________

For each set of conditions (a), (b) and (c), give your answer in the form of a **percent increase.** This percent increase should be an average or 'expected value' of the percent increase against all spills greater than S^{Cap}_{nzero} (where S^{Cap}_{nzero} is from your answer to question #1). A 25 percent increase in Caps (i.e., required ceiling or limit) will not necessarily translate into a 25 percent increase in the Mechanical recovery equipment's Overall Operational Effectiveness. So, in your answer include any (if necessary) adjustments, i.e., scaling down of this incremental effectiveness to account for such factors as: 1) some Planholders will **not** be affected by increases in the Caps since these Planholders will not have been above the Caps to begin with; 2) even for those Planholders affected, there could be a 'diminishing returns' effect of large amounts of Mechanical recovery equipment.

(4) What is your estimate for the percentages of time that the conditions for Mechanical recovery will be: **(a)** good? ___ ; **(b)** fair? ___ ; and **(c)** poor?___

(5) See Mechanical recovery Caps Table A-1 on next page. For spillage from Vessels/MTR Facilities, what will be the **incremental** Overall Operational Effectiveness of increasing the Mechanical recovery Cap by 25 percent in **2003**? That is, how much will the Cap impact the Overall Operational Effectiveness of what the Overall Operational Effectiveness of Mechanical recovery equipment would have been without the 2000 Cap increase? Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? ________

(b) Under fair conditions? ________

(c) Under poor conditions? ________

For each set of conditions, (a), (b) and (c), give your answer in the form of a **percent increase.** This percent increase should be an average or 'expected value' of the percent increase against all spills greater than S^{Cap}_{nzero} (where S^{Cap}_{nzero} is from your answer to question #1). A 25 percent increase in Caps (i.e., required ceiling or limit) will not necessarily translate into a 25 percent increase in the Mechanical recovery equipment's Overall Operational Effectiveness. So, in your answer include any (if necessary) adjustments, i.e., scaling down of this incremental effectiveness to account for such factors as: 1) some Planholders will **not** be affected by increases in the Caps since these Planholders will not have been above the Caps to begin with; 2) even for those Planholders affected, there could be a 'diminishing returns' effect of large amounts of Mechanical recovery equipment.

TABLE A-1: Response Capability Caps For On-Water Mechanical Recovery By Operating Areas of Water for Vessels/MTR Facilities

	Tier[†] 1 (12 hrs.)	Tier[†] 2 (36 hrs.)	Tier[†] 3 (60 hrs)
As of February 18, 1993			
All except[#] 'River & Canal' & 'Great Lakes' Areas of water	10,000 bbls/day	20,000 bbls/day	40,000 bbls/day
'Great Lakes' Areas of water *	5,000 bbls/day	10,000 bbls/day	20,000 bbls/day
'River & Canal' Areas of water	1,500 bbls/day	3,000 bbls/day	6,000 bbls/day
As of April 2000			
All except[#] 'River & Canal' and 'Great Lakes' Areas of water	12,500 bbls/day	25,000 bbls/day	50,000 bbls/day
'Great Lakes' Areas of water	6,250 bbls/day	12,500 bbls/day	25,000 bbls/day
'River & Canal' Areas of water	1,875 bbls/day	3,750 bbls/day	7,500 bbls/day
As of February 2003			
All except[#] 'River & Canal' and 'Great Lakes' Areas of water	15,000 bbls/day	30,000 bbls/day	60,000 bbls/day
'Great Lakes' Areas of water	7,500 bbls/day	15,000 bbls/day	30,000 bbls/day
'River & Canal' Areas of water	2,250 bbls/day	4,500 bbls/day	9,000 bbls/day

Table A-1 Notes: The Caps show cumulative overall Effective Daily Recovery Capacity, not incremental increases.

(6) (A) At approximately what spill size, S_{Mech}, are spills too small to have Mechanical recovery response mode of the Vessel Response Plan regulation or Facility Response Plan regulation invoked/attempted? **(B)** In pre-approved or expedited areas as they exist today, at approximately what spill size, S_{Disp}, are spills too small to have the Dispersants Response mode of the VRP or FRP invoked/attempted? **(C)** In pre-approved or expedited areas as they exist today, at approximately what spill size, S_{ISB}, are spills too small to have *In Situ* Burning response mode of the VRP or FRP invoked/attempted?

TABLE A-2A: Conditional Probability of Use and Operational Effectiveness under 3 Conditions

	Mechanical	Dispersants Opt. A	*In Situ* Burning
Probability Permission Is Granted	1.0	$P^D = ?$	$P^{ISB} = ?$
Probability Mode Used If Permitted	Not applicable*	$U^D = ?$	$U^{ISB} = ?$
Overall Operational Effectiveness If Used in good Conditions	Not applicable*	$Eff^{D, Opt.A}_{perf} = ?$	$Eff^{ISB}_{perf} = ?$
Overall Operational Effectiveness If Used In fair Conditions	Not applicable*	$Eff^{D, Opt.A}_{avg} = ?$	$Eff^{ISB}_{avg} = ?$
Overall Operational Effectiveness If Used in poor Conditions	Not applicable*	$Eff^{D, Opt.A}_{poor} = ?$	$Eff^{ISB}_{poor} = ?$
***Individual* Total Effectivenesses, T**	T^M	$T^{D, Opt.A}$	T^{ISB}

Table A-2A Notes: * This particular question is not applicable to this expert panel; the value for Overall Operational Effectiveness of Mechanical Recovery was previously supplied by a previous expert panel in February 1997. The current expert panel will be asked to estimate the necessary adjustment to reflect the impact of a 25 percent increase in the ceiling or limit of required capability (Cap) in April 2000 and 2003.

(7) What is your estimate of the Probability that Mechanical recovery is Used (i.e.. U^M) when a spill occurs from a Vessel/MTR Facility? (See Table A-2A on previous page) Assume that the size of the spill is always larger than S_{Mech} . where S_{Mech} is from your answer to question #6A. Give your estimate as an average over all US waters (i.e.. over all 6 operating areas of water. _________ *If you believe that this Probability would be significantly different for Gulf Coast Area waters than for Non Gulf Coast Area Waters, then give two separate estimates.* <u>Note</u>: 'Gulf Coast Area waters' means, for the purposes of Dispersants application requirements. the region encompassing the following Captain of the Port Zones: (1) Corpus Christi. TX; (2) Houston. TX; (3) Port Arthur, TX; (4) Morgan City, LA; (5) New Orleans, LA; (6) Mobile, AL; (7) Tampa, FL.

<u>Note</u>: Question 7 is included here even though it was decided not to ask it since the February 1997 expert panel had already included 'the Probability that Mechanical recovery is Used (i.e., U^M)' in their estimates.

(8) In pre-approved or expedited areas of water as they exist today, what is your estimate of the Probability that Permission is Granted for Dispersants for any kind of oil (i.e., P^D) when a spill occurs from a Vessel/MTR Facility? (See Table A-2A above.) Assume that the size of the spill is always larger than S_{Disp} , where S_{Disp} is from your answer to question #6B. _________ *If you believe that this Probability would be significantly different for Gulf Coast Area waters than for Non Gulf Coast Area waters, then give two separate estimates*

(9) In pre-approved or expedited areas of water as they exist today, what is your estimate of the Probability that Dispersants are Used if Permission is Granted (i.e., U^D) when a spill occurs from a Vessel/MTR Facility? See Table A-2A. (Again, assume that the size of the spill is always larger than S_{Disp} , where S_{Disp} is from your answer to question #6B. _________ *If you believe that this Probability would be significantly different for Gulf Coast Area waters than for Non Gulf Coast Area waters, then give two separate estimates.*

(10) In pre-approved or expedited areas of water as they exist today, what is your estimate of the Probability that Permission is Granted for *In Situ* Burning (P^{ISB}) when a spill occurs from a Vessel/MTR Facility? (See Table A-2A.) Assume that the size of the spill is always larger than S_{ISB} , where S_{ISB} is from your answer to question #6C. _________ *If you believe that this Probability would be significantly different for Gulf Coast Area waters than for Non Gulf Coast Area waters, then give two separate estimates.*

(11) In pre-approved or expedited areas of water as they exist today, what is your estimate of the Probability that *In Situ* Burning is Used if Permission is Granted (i.e., U^{ISB}) when a spill occurs from a Vessel/MTR Facility? See Table A-2A. (Again assume that the size of the spill is always larger than S_{ISB} , where S_{ISB} is from your answer to question #6C.) _________ *If you believe that this Probability would be significantly different for Gulf Coast Area waters than for Non Gulf Coast Area waters, then give two separate estimates.*

(12A) See Table A-3 two pages on. Recall that for the purposes of this analysis Dispersants can be delivered by either response vessels or fixed wing aircraft. In pre-approved or expedited areas of water as they exist today, <u>how effective</u> are Dispersants against spillage from Vessels/MTR Facilities **using Option A's** Effective Daily Application Capabilities (EDACs) for **Non Gulf Coast Area waters?** Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? _________

(b) Under fair conditions? _________

(c) Under poor conditions? _________

For each set of conditions (a), (b) and (c) above, give your answer in the form of a **percent** (i.e. percent effective). This percent should be an average or 'expected value' of the percent effectiveness against all spills greater than S_{Disp}, where S_{Disp} is from your answer to question #6B.

(12B) What is your estimate for the percentages of time that the conditions for Dispersants for **Non Gulf Coast Area waters** will be: **(a)** 'good'___ ; **(b)** 'fair' ___ ; and **(c)** 'poor'?___

(13A) See Table A-3 below. In pre-approved or expedited areas of water as they exist today, how effective are Dispersants against spillage from Vessels/MTR Facilities **using Option A's** Effective Daily Application Capabilities (EDACs) for **Gulf Coast Area waters?** Give separate answers for:

- **(a)** Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? _________
- **(b)** Under fair conditions? _________
- **(c)** Under poor conditions? _________

For each set of conditions (a), (b) and (c) above, give your answer in the form of a **percent** (i.e. percent effective. This percent should be an average or 'expected value' of the percent effectiveness against all spills greater than S_{Disp}, where S_{Disp} is from your answer to question #6B.

(13B) What is your estimate for the percentages of time that the conditions for Dispersants in **Gulf Coast Area waters** will be: **(a)** good?___ ; **(b)** fair? ___ ; and **(c)** poor?___

(14) See Table A-3 below. In pre-approved or expedited areas of water as they exist today, how effective are Dispersants against spillage from Vessels/MTR Facilities **using Option B's** Effective Daily Application Capabilities (EDACs) for **<u>Non</u> Gulf Coast Area waters?** Give separate answers for:

- **(a)** Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? ________
- **(b)** Under fair conditions? _________
- **(c)** Under poor conditions?_________

For each set of conditions (a), (b) and (c) above, give your answer in the form of a **percent** (i.e. percent effective). This percent should be an average or 'expected value' of the percent effectiveness against all spills greater than S_{Disp}, where S_{Disp} is from your answer to question #6B.

TABLE A-3: Tiers for Effective Daily Application of Dispersants Capability Proposed for 2003

Tiers for Effective Daily Application Capability			
	Response Time for Completed Application	**Dispersant Application Gulf Coast Area Waters**	**Dispersant Application All Other US Waters**
Tier 1 **Option A**	**12 hours**	5,500 gallons	2,750 gallons
Tier 1 **Option B**	**12 hours**	8,250 gallons	4,125 gallons
Tier 2	**36 hours**	23,375 gallons	23,375 gallons
Tier 3	**60 hours**	23,375 gallons	23,375 gallons

(15) See Table A-3. In pre-approved or expedited areas of water as they exist today, how effective are Dispersants against spillage from Vessels/MTR Facilities **using Option B's** Effective Daily Application Capabilities (EDACs) for **Gulf Coast Area waters**? Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? _________

(b) Under fair conditions? _________

(c) Under poor conditions? _________

For each set of conditions (a), (b) and (c) above, give your answer in the form of a **percent** (i.e. percent effective. This percent should be an average or 'expected value' of the percent effectiveness against all spills greater than S_{Disp}, where S_{Disp} is from your answer to question #6B.

Question (16) below requires knowledge of the following and of Table A-4 on next page.

The owner or operators of a Vessel/MTR Facility that operates in any 'Inland', 'Nearshore', or 'Offshore' Areas of water with pre-authorization or expedited approval for *In Situ* Burning may request credit which will count toward his or her on-water Mechanical recovery capability for each worst case discharge response tier up to the amounts identified in Table A-4. To receive this credit, owner or operator must identify and ensure, through contract or other approved means, the availability of the necessary resources to sustain *In Situ* Burning operations for the level of credit being requested as follows:

(1) *In Situ* Burning response resources must be capable of commencing ignition of oil at the site of a discharge within twelve hours of the initial authorization of the FOSC to conduct *In Situ* Burning to receive credit against Tier 1 requirements.
(2) *In Situ* Burning response resources for all response tiers must include:

(i) Sufficient *In Situ* Burning boom.
(ii) Vessel platforms capable of towing and tending *In Situ* Burning booms in the operating area(s) of water where credit is requested.
(iii) Sufficient ignition devices to support burning operations.
(iv) Personnel training in conducting *In Situ* Burning operations.
(v) All equipment ensured available to as required in paragraphs (i-iv) must be capable of sustained use in the operating area(s) of water for which credit is requested.

(16A) In pre-approved or expedited areas of water as they exist today, what is your estimate of the Operational Effectiveness of *In Situ* Burning if Used when a spill occurs from Vessels/MTR Facilities? Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? _________

(b) Under fair conditions? _________

(c) Under poor conditions? _________

For each set of conditions (a), (b) and (c) above, give your answer in the form of a **percent** (i.e. percent effective). This percent should be an average or 'expected value' of the percent effectiveness against all spills greater than S_{ISB}, where S_{ISB} is your answer to question #6C.

(16B) What is your estimate for the percentages of time that the conditions for *In Situ* Burning will be: **(a)** good? ___; **(b)** fair? ___; and **(c)** poor?___

TABLE A-4: Maximum Allowable Effective Daily Burn Application for Tiers Proposed for 2003

Maximum Allowable Effective Daily Burn Capability for Tiers						
	Response Time for Completed Burning*	Effective Daily Burn Capacity (EDBC) **	Cumulative Equipment Requirements			
			Fire-resistant booms (feet)***	Hand-held Igniters	Helitorch Igniter ****	Support Vessels
Tier 1	24 hours	5,000 bbls	500	4	1	2
Tier 2	48 hours	10,000 bbls	1,500	12	1	4
Tier 3	72 hours	10,000 bbls	2,500	20	1	4

Table A-4 Notes: *Tiered response times represent the maximum allowable time from the instant when *In Situ* Burning is authorized for use by the Federal On-scene coordinator to the completion of the operational burn period for that tier.

**EDBC amounts for each tier above may be applied against the corresponding tiers for on-water Mechanical recovery (EDRC) as required to respond to a owner or operator's worst case discharge.

***If a fireproof boom, rather than a fire resistant boom, is identified and ensured available, the number of additional fire resistant booms that may be required will depend upon the response time and service extension for the fireproof boom. For example, one fire proof boom package available for Tier 1 and capable of an extended service life through Tier 3 would only need to be augmented by two additional fire resistant booms to obtain the full credit for each tier.

****If a helitorch igniter system is identified and ensured available, one-time igniters are not required.

Question (17) below requires knowledge of the following. The Coast Guard is proposing an offset or credit to the Mechanical recovery requirements in the 'Nearshore', 'Offshore' and 'Open Ocean' areas of water. If plan holders choose to develop and maintain an *In Situ* Burning capability, the barrels per day (bpd) are reduced for these operating areas of water.

TABLE A-5: 2003 Proposed Offsets/Credits to Mechanical Recovery Equipment Capability for Vessels and Facilities

Operating Areas of Water	2003 PROPOSED INCREASE (barrels per day)		
	Tier 1	Tier 2	Tier 3
'Nearshore' or 'Offshore' or 'Open Ocean'	Maximum credit, i.e., allowable reduction in Mechanical Recovery Capability is 5,000 bpd	Maximum credit, i.e., allowable reduction in Mechanical Recovery Capability is 10,000 bpd	Maximum credit of 10,000 bpd

(17) How much (if any) would you lower your original answer to question 5 (question 5 is reprinted below) to reflect the above credits? "(5) For spillage from Vessels/MTR Facilities, what will be the **incremental** Overall Operational Effectiveness of increasing the Mechanical recovery Cap by 25 percent in **2003**? That is, how much will the Cap impact the Overall Operational Effectiveness of what the Overall Operational Effectiveness of Mechanical recovery equipment would have been without the 2003 Cap increase? Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? _________

(b) Under fair conditions? __________
(c) Under poor conditions? __________ "

For each set of conditions (a), (b) and (c) above, give your answer in the form of a percent increase. This percent increase should be an average or 'expected value' of the percent increase against all spills greater than S^{Cap}_{nzero} (where S^{Cap}_{nzero} is from your answer to question #1.) See Mechanical recovery Caps Table A-1."

The following is necessary background information for questions 18, 19, and 20 that deal with an oil spill Aerial Tracking Planning requirement.

Response plan requirements for manned Vessels (Tank Ships and Tank Barges) carrying oil as a primary cargo, or MTR Facilities (that could reasonably be expected to cause significant and substantial harm to the environment).

An appendix for Vessels/MTR Facilities must also separately list the companies and specific resources necessary to provide oil tracking/monitoring capabilities required in this subpart. The oil tracking resources to be listed within this appendix must include:

(a) The identification of providing resource organization
(b) Type and location of aerial surveillance aircraft that have been ensured available, through contract or other approved means
The owner or operators of a Vessels/MTR Facilities must identify in the response plan, and ensure the availability of, through contract or other approved means, response resources necessary to provide aerial oil tracking/monitoring to support oil spill assessment and cleanup activities.

(1) Aerial oil tracking resources must be capable of arriving at the site of a discharge within three hours from the time of the initial notification of the discharge for a distance up to 50 miles from shore. Aerial oil tracking/monitoring resources should plan on a minimum of two hours for a recall period and one hour of flight time to arrive on scene.

(2) Aerial oil tracking/monitoring must include the following resources that are capable of:

(i) Appropriately located aircraft and personnel capable of meeting the response time requirement for oil tracking.

(ii) Sufficient numbers of aircraft, pilots, and trained observation personnel to support oil spill operations, commencing upon initial assessment, and capable of coordinating on scene cleanup operations, including dispersant, *In Situ* Burning, and Mechanical recovery operations.

(iii) Observation personnel must be trained in the protocols of oil spill reporting and assessment, including estimation of slick size, thickness, and quantity. Observation personnel should be fully trained in the use of assessment techniques as outlined in ASTM standard [ASTM F 1779-97], Standard Practice for Reporting Visual Observations of Oil on Water, and familiar with the use of other guides such as NOAA's "Open Water Oil Identification Job Aid for Aerial Observation" and NOAA's "Characteristic Coastal Habitats" Guide.

(iv) Aerial oil tracking/monitoring resources ensured available must be capable of supporting oil spill recovery operations for three ten-hour operational periods during the initial seventy-two hours of the discharge.

(18) How much would the effectiveness of **Mechanical recovery** equipment be increased by aerial, visual/radio monitoring of spillage from Vessels/MTR Facilities? Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? ________
(b) Under fair conditions? ________
(c) Under poor conditions? ________

For each set of conditions (a), (b) and (c) above, give your answer in the form of a **percent increase**. This percent increase should be an average or 'expected value' of the percent increase against all spills greater than S^{Cap}_{nzero} (where S^{Cap}_{nzero} is from your answer to question #1).

(19) How much would the effectiveness of **Dispersants** be increased by aerial, visual/radio monitoring of spillage from Vessels/ MTR Facilities? Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? ________
(b) Under fair conditions? ________
(c) Under poor conditions? ________

For each set of conditions (a), (b) and (c) above, give your answer in the form of a **percent increase**. This percent increase should be an average or 'expected value' of the percent increase against all spills greater than S^{Cap}_{Disp} (where S^{Cap}_{Disp} was your answer to question #6B).

(20) How much would the effectiveness of ***In Situ* Burning** be increased by aerial, visual/radio monitoring of spillage from Vessels/MTR Facilities? Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? ________
(b) Under fair conditions? ________
(c) Under poor conditions? ________

For each set of conditions (a), (b) and (c) above, give your answer in the form of a **percent increase**. This percent increase should be an average or 'expected value' of the percent increase against all spills greater than S^{Cap}_{ISB} (where S^{Cap}_{ISB} was your answer to question #6C).

Questions 21-22 requires knowledge of the following:

On-Water Mechanical Recovery Caps Increase

Based on the 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 the Caps levels (beyond the initial increases scheduled for implementation in 2000) is proposed for the year 2003.

The owner or operator of a Vessel carrying groups I through IV petroleum oil as primary cargo or a MTR Facility, whose required daily recovery capacity *exceeds* the applicable contracting Caps in Table A-1, shall **identify** commercial sources of additional equipment equal to twice the Cap listed for each tier or the amount necessary to reach the calculated planning volume, whichever is lower, to the extent that this equipment is available. The equipment so identified must be capable of arriving on scene no later than the applicable tier response times contained in [CFR] Section 155.1050(g) (See Table A-7 below) or as quickly as the nearest available resource permits. A response plan must identify the specific sources, locations, and quantities of this additional equipment. No contract is required. (See Table A-1 for proposed 2003 increase.)

The Coast Guard does not want owners and operators to identify each piece of equipment above the Caps. It only wants the identification of organizations, their locations, and their capabilities (classification), not specific detailed lists of equipment. The source of this additional equipment may be the same provider as that which is providing the contracted capability. (Preamble to "Vessel Response Plans Final Rule", the *Federal Register*, Volume 61, January 12, 1996, page 1069, and Preamble to "Facility Response Plans Final Rule", the *Federal Register*, Volume 61, February 29, 1996, page 7907.)

TABLE A-7: Response Times for Identified But Not Contracted Mechanical Recovery Resources 2003 (CFR Section 155.1050(g)) for Vessels and Facilities

Operating Areas of Water	Tier 1	Tier 2	Tier 3
Higher volume port area (except tankers in Prince William Sound covered by CFR 155.1135)	12 hours	36 hours	60 hours
Great Lakes Areas	18 hours	42 hours	66 hours
All Other 'River & Canal', 'Inland', 'Nearshore', and 'Offshore' Areas of Water	24 hours	48 hours	72 hours
'Open Ocean' Area Waters (+ travel time from shore)	24 hours+	48 hours+	72 hours+

(21) Does the VRP/FRP rules' requirement to *identify but not contract for* Mechanical recovery assets up to Two times the Cap or One times the Vessel's/Facility's Planning Volume, whichever is smaller, make an **appreciable** (measurable) impact in the rules' Overall Operational Effectiveness for Mechanical recovery equipment? If your answer is 'NO', then ignore question 22, otherwise continue.

(22) If your answer to question #21 is 'YES', then: How much (if any) would you increase your original answer to question 5 (question 5 is reprinted below) to reflect such an appreciable impact? Give your answer as a **percent increase**.

"(5) For spillage from Vessels/MTR Facilities, what will be the **incremental** Overall Operational Effectiveness of increasing the Mechanical recovery Cap by 25 percent in **2003**? That is, how much will the Cap impact the Overall Operational Effectiveness of what the Overall Operational Effectiveness of Mechanical recovery equipment would have been without the 2003 Cap increase? Give separate answers for:

(a) Under good conditions (conditions includes visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.)? _________

(b) Under fair conditions? _________

(c) Under poor conditions? _________ "

For each set of conditions (a), (b) and (c) above, give your answer in the form of a **percent increase**. This percent increase should be an average or 'expected value' of the percent increase against all spills greater than S^{Cap}_{nzero} (where S^{Cap}_{nzero} is from your answer to question #1)."

Appendix A (continued): Expert Panel's Raw Votes to Questionnaire

Question 6

	Initial Vote (A) Mechanical	Initial Vote (B) Dispersants	Initial Vote (C) *In situ*	Final Vote (A) Mechanical	Final Vote (B) Dispersants	Final Vote (C) *In situ*
Average	MOOT	200	650	MOOT	82	600
Name						
Expert #1		0	500		0	500
Expert #2		100	500		50	500
Expert #3		50	1000		50	1000
Expert #4		0	500		0	500
Expert #5		500	500		100	500
Expert #6		500	500		50	500
Expert #7		0	500		0	500
Expert #8		50	500		50	500
Expert #9		0			0	
Expert #10		500	1000		100	500
Expert #11		500	1000		500	1000

Question 8

	Initial Vote				Final Vote	
Average		**81**	**40**		**53**	**24**

Name		Gulf	Non-Gulf			Gulf	Non-Gulf
Expert #1		90	60			45	30
Expert #2		95	75			50	40
Expert #3		90	40			85	35
Expert #4		35	5			35	5
Expert #5		90	50			50	30
Expert #6		90	50			60	30
Expert #7		95	50			50	25
Expert #8		75	25			40	20
Expert #9		90	40			60	20
Expert #10		90	40			60	20
Expert #11		50	3			50	10

Question 9

		Initial Vote				Final Vote	
Average		80	55			80	60
Name		Gulf	Non-Gulf			Gulf	Non-Gulf
Expert #1		90	70			90	70
Expert #2		80	70			80	80
Expert #3		80	60			80	60
Expert #4		80	60			80	60
Expert #5		80	60			80	60
Expert #6		75	75			75	75
Expert #7		80	50			80	50
Expert #8		80	60			80	60
Expert #9		75	50			75	75
Expert #10		80	25			80	45
Expert #11		80	30			80	30

Question 10

Average		69	58			76	61
		Initial Vote				Final Vote	

Name		Gulf	Non-Gulf			Gulf	Non-Gulf
Expert #1		90	90			90	90
Expert #2		75	75			75	75
Expert #3		60	40			60	40
Expert #4		80	80			80	80
Expert #5		40	20			60	40
Expert #6		90	90			90	80
Expert #7		90	90			90	90
Expert #8		60	30			60	30
Expert #9		80	80			80	80
Expert #10		10	10			70	40
Expert #11		80	30			80	30

Question 11

	Initial Vote		Final Vote	
	Gulf	Non-Gulf	Gulf	Non-Gulf
Average	**22**	**21**	**27**	**24**

Name	Initial Vote Gulf	Initial Vote Non-Gulf	Final Vote Gulf	Final Vote Non-Gulf
Expert #1	40	40	40	40
Expert #2	5	5	5	5
Expert #3	50	50	50	50
Expert #4	45	45	45	45
Expert #5	30	30	30	30
Expert #6	5	5	5	5
Expert #7	25	25	50	50
Expert #8	30	20	30	20
Expert #9	5	5	5	5
Expert #10	3	1	30	10
Expert #11	3	3	3	3

Question 12A

Average	63	41	14	79	54	18
	Initial Vote			Final Vote		
	Good	Fair	Poor	Good	Fair	Poor

Name						
Expert #1	70	40	20	95	50	20
Expert #2	90	80	20	90	80	20
Expert #3	60	30	10	80	50	20
Expert #4	60	40	20	60	40	20
Expert #5	50	30	10	90	50	20
Expert #6	80	60	20	95	80	40
Expert #7	50	25	10	90	50	10
Expert #8	60	30	10	60	30	10
Expert #9	80	50	10	80	70	10
Expert #10	50	30	10	90	50	20
Expert #11	40	40	10	40	40	10

Question 12B

	Initial Vote			Final Vote		
Average	**48**	**26**	**25**	**48**	**28**	**25**
Name	Good	Fair	Poor	Good	Fair	Poor
Expert #1	50	25	25	50	25	25
Expert #2	50	25	25	50	25	25
Expert #3	50	20	30	50	20	30
Expert #4	60	30	10	60	30	10
Expert #5	50	30	20	50	30	20
Expert #6	50	25	25	40	40	20
Expert #7	60	20	20	60	20	20
Expert #8	30	30	40	30	30	40
Expert #9	60	20	20	60	20	20
Expert #10	40	30	30	40	30	30
Expert #11	33	33	33	33	33	33

Question 13A

	Initial Vote			Final Vote		
	Good	Fair	Poor	Good	Fair	Poor
Average	**68**	**46**	**14**	**79**	**53**	**18**
Name						
Expert #1	70	40	20	90	50	20
Expert #2	90	80	20	90	80	20
Expert #3	70	40	20	80	50	20
Expert #4	60	40	20	60	40	20
Expert #5	70	30	10	80	40	20
Expert #6	80	60	15	95	80	40
Expert #7	50	40	10	90	50	10
Expert #8	60	30	10	60	30	10
Expert #9	80	70	10	80	70	10
Expert #10	80	40	10	90	50	20
Expert #11	40	40	10	50	40	10

Question 13B

	Initial Vote			Final Vote		
	Good	Fair	Poor	Good	Fair	Poor
Average	**48**	**28**	**25**	**48**	**31**	**21**
Name						
Expert #1	50	25	25	50	25	25
Expert #2	50	25	25	50	25	25
Expert #3	50	20	30	55	30	15
Expert #4	60	30	10	60	30	10
Expert #5	50	30	20	50	30	20
Expert #6	40	40	20	40	40	20
Expert #7	60	20	20	60	20	20
Expert #8	30	30	40	40	30	30
Expert #9	60	20	20	40	40	20
Expert #10	40	30	30	40	30	30
Expert #11	33	33	33	40	40	20

Question 14

	Initial Vote			Final Vote		
	Good	Fair	Poor	Good	Fair	Poor
Average	**80**	**54**	**19**	**80**	**54**	**19**
Name						
Expert #1	95	50	20	95	50	20
Expert #2	91	81	20	91	81	20
Expert #3	85	55	25	85	55	25
Expert #4	60	40	20	60	40	20
Expert #5	90	50	20	90	50	20
Expert #6	95	80	40	95	80	40
Expert #7	90	50	10	90	50	10
Expert #8	60	30	10	60	30	10
Expert #9	81	71	10	81	71	10
Expert #10	90	50	20	90	50	20
Expert #11	40	40	10	40	40	10

Question 15

	Initial Vote			Final Vote		
	Good	Fair	Poor	Good	Fair	Poor
Average	**79**	**53**	**19**	**79**	**53**	**19**
Name						
Expert #1	90	50	20	90	50	20
Expert #2	91	81	20	91	81	20
Expert #3	85	55	25	85	55	25
Expert #4	60	40	20	60	40	20
Expert #5	80	40	20	80	40	20
Expert #6	95	80	40	95	80	40
Expert #7	90	50	10	90	50	10
Expert #8	60	30	10	60	30	10
Expert #9	81	71	10	81	71	10
Expert #10	90	50	20	90	50	20
Expert #11	50	40	10	50	40	10

Question 16A

	Initial Vote			Final Vote		
	Good	Fair	Poor	Good	Fair	Poor
Average	**86**	**49**	**2**	**86**	**49**	**2**
Name						
Expert #1	98	50	0	98	50	0
Expert #2	90	50	0	90	50	0
Expert #3	80	50	10	80	50	10
Expert #4	95	45	10	95	45	10
Expert #5	90	50	1	90	50	1
Expert #6	90	45	5	90	40	0
Expert #7	98	60	0	98	60	0
Expert #8	65	40	0	65	40	0
Expert #9	95	50	0	95	50	0
Expert #10	90	50	0	90	50	0
Expert #11	60	50	0	60	50	0

Question 16B

	Initial Vote			Final Vote		
Average	11	24	65	12	25	63
Name	Good	Fair	Poor	Good	Fair	Poor
Expert #1	15	25	60	15	25	60
Expert #2	5	20	75	10	25	65
Expert #3	15	15	70	15	25	60
Expert #4	5	20	75	5	20	75
Expert #5	15	25	60	15	25	60
Expert #6	5	15	80	10	20	70
Expert #7	20	30	50	20	30	50
Expert #8	10	20	70	10	20	70
Expert #9	10	30	60	10	30	60
Expert #10	10	20	70	10	20	70
Expert #11	10	40	50	10	40	50

Question 18 **Inland**

	Initial Vote Use	Initial Vote Delta	Final Vote Use	Final Vote Delta
Average	**44**	**29**	**45**	**43**
Name				
Expert #1	40	25	40	40
Expert #2	25	25	40	40
Expert #3	50	50	50	50
Expert #4	45	26	45	40
Expert #5	60	50	50	50
Expert #6	35	20	45	40
Expert #7	40	25	40	40
Expert #8	50	30	50	40
Expert #9	40	25	40	50
Expert #10	50	20	50	40
Expert #11	50	25	50	40

Question 18 **Ocean**

Name	Initial Vote Use	Initial Vote Delta	Final Vote Use	Final Vote Delta
Average	**88**	**29**	**88**	**43**
Expert #1	80	25	80	40
Expert #2	80	25	80	40
Expert #3	90	50	90	50
Expert #4	90	26	90	40
Expert #5	95	50	95	50
Expert #6	95	20	95	40
Expert #7	90	25	90	40
Expert #8	90	30	90	40
Expert #9	80	25	80	50
Expert #10	90	20	90	40
Expert #11	90	25	90	40

Appendix A (continued): Summary Notes of Expert Panel Workshops April 26-27, and July 11, 2000

U.S. COAST GUARD REGULATORY ASSESSMENT

MINUTES

EXPERT PANEL FOR ESTIMATING EFFECTIVENESS OF OIL RECOVERY CAPABILITY (CAP) INCREASED PLANNING REQUIREMENTS FOR VESSELS AND MARINE TRANSPORTATION-RELATED FACILITIES

WORKSHOPS APRIL 26-27, 2000 AND JULY 11, 2000

THE VOLPE NATIONAL TRANSPORTATION SYSTEMS CENTER

CAMBRIDGE, MA

These minutes are organized by order of the questions presented to the panel and the discussions of the members pertaining to each. Final, averaged results are included for each question, and all the voting data are attached in Appendix A. Discussions of general matters by the panel are reported at the appropriate chronological junctures.

April 26, 2000

The meeting was called to order at 8:00 AM. Jeff Bryan started introduction of all experts. Volpe and CGHQ staff. After introductions, the following points of order were presented:

- Mike Dyer, Project Leader for the Volpe Center began with a presentation of the project background purpose.
- Jeff Bryan presented the ground rules.
- For those questions for which a range of three response conditions pertained, Leo Casey defined those conditions by using the top (best or most efficacious) third (33.33 percent) for "good", the middle third for "fair", and the bottom third for "poor".

Expert's Positions - Opening Remarks on Impact of Mechanical recovery Cap increasing by 25 percent in 2003:

- Allen: 25 percent (increase in Mechanical recovery) Caps makes no difference. Mechanical recovery is in great shape. Dispersants should be there. An ISB requirement is premature but credit is appropriate.
- Aurand: 25 percent (increase in Mechanical) Caps won't help much but won't be a burden either. Dispersants should be required. Opportunities for ISB are limited but a credit is OK.
- Benton: Mechanical Caps increase is a 'paper tiger' will not help much. Dispersants should be required but ISB is OK only in certain areas.
- Delozier: – strongly opposes Mechanical increase but supports Dispersants and ISB.
- Gaudiosi: Mechanical increase not required support and advanced technologies (Dispersants and ISB).
- Henry: Mechanical increase not required but some focus on shallow water is needed. Proactive especially for Dispersants. ISB may be available in early stages of big spills.
- Glover: Mechanical increase is unnecessary except for immediate response. He supports Dispersants…ISB option would be beneficial.
- Johnson: Mechanical increase makes no difference. Dispersants and ISB fine where pre-approved.
- Singer: Agrees with others on Mechanical increase affect. Dispersants should be required. ISB is limited.
- Toenshoff: No to Mechanical increase. Favors Dispersants requirement in pre-approved areas. MSRC has 8 ISB systems. Agrees with credit.
- Usher: No to Mechanical increase. Dispersants is a tool that should be a credit, not a requirement. Not convinced on ISB's help. It sometimes hurts, depending on the chemistry of the particular oil.

Question 1
Below what spill size, S^{Cap}_{nzero}, from Vessels/MTR Facilities, will the extra Mechanical recovery equipment resulting from the 2003 25 percent increase in the required Mechanical recovery capability (Cap) have zero impact?

Question 1 occasioned extensive discussion by members on many aspects of the existing and future spill response regimes, including the following points:

Scott Benton asked a question on the relationship between EDRC and spill response support systems, i.e., equipment such as boom, boats etc. He then asked whether OSRO classifications should be considered/factored into the panel's answers. Don Toenshoff stated that the OSRO classification was a voluntary program and should not be considered here because it would only muddy the water. OSRO program considerations should be kept out of the panel's discussions and their answers. This was agreed to by all panelists and the Volpe Center and sponsors.

- Dave Usher said there were many small business issues relative to bearing the costs. His concern was whether the small contractors would be pushed out of the market.
- Gene Johnson said equipment was available for the increase (even 200 percent) and that it was a matter of increasing contractual arrangements.
- Nick Glover said an immediate response is where a difference is made.
- Some members supported the idea that after 3 days, the "battle was lost", and that extra equipment would not avail responders. After the break, all panel members agreed that increasing the on-water Mechanical recovery Caps by 25 percent would have no benefit in terms of oil spill recovery.

Al Allen called for a statement of position on all three response modes. The panel was unanimous in claiming there was no justification for increasing Mechanical recovery mode (Caps) amounts, with the exception that Mr. Glover felt that immediate response could be improved. A majority supported the Dispersants requirement (in pre-approval zones), while some felt that a credit should be offered and others supported the idea of the technology in a more general way citing its availability as "another tool in the toolbox". The sense as regards ISB was that a credit is appropriate at this time, given the state of the technology and the limited opportunities for its use.

With respect to question 1, the panel concluded that there was no spill size at which the 2003 Mechanical Caps would make a difference and were unanimous in claiming there was no justification for increasing the Caps amounts. Since the panelists decided that no benefit would accrue by increasing the Mechanical recovery, questions 1 - 5, 6A, 7, 17, 21, and 22 became moot.

Question 6 B
At approximately what spill size, S_{Disp} , are spills too small to have Dispersants response mode of the VRP or FRP invoked/attempted?

There was initially the suggestion to split the question to address vessels and facilities separately, leading to a more general consideration of MTR facilities. Gene Johnson said there were no facilities in pre-approved areas except the LOOP. The panel felt strongly that no MTR Facilities were located in or near area(s) of water where Dispersants or *In Situ* Burning would be allowed. So all parts of questions having to do with MTR Facilities became moot (i.e. the proposed regulation had zero impact).

Charlie Henry suggested the panel consider a C-130 aircraft with 1,000 gal of Dispersants. He felt 500 bbls would be the spill size breakpoint. Don Toenshoff remarked that for planning 500 bbls is OK but in the real world, almost any size spill would be considered. He expressed a concern that the panel needs to stay within pre-approval areas (strongly concurred with by both

Volpe Center and Coast Guard and adopted for the purposes of all relevant such questions). One of the panelists said that there would be no change in Dispersants technology by 2003.

Result: 82 bbl

Question 6 C
At approximately what spill size, S_{ISB}, are spills too small to have *In Situ* Burning response mode of the VRP or FRP invoked/attempted?

Don Toenshoff said an ISB set costs $180K so there's an economic limitation to consider. Al Allen said that in 3-4 years, improved technology might lower costs per barrel (see more detailed discussion on question 17). For example, there may be re-usable boom in the future. The panel was in general agreement that the spill size should be 500 bbls, although two members answered 1,000 bbls.

Result: 500 bbl

Question 7
What is your estimate of the Probability that Mechanical recovery is Used (i.e., U^M) when a spill occurs from a Vessel/MTR Facility?

Result: Moot, as result of panel's answer to question 1.

Question 8
What is your estimate of the Probability that Permission is Granted for Dispersants (i.e., P^D) when a spill occurs from a Vessel/MTR Facility?

Assumptions:
- Spills of all types of oil, both dispersible and non-dispersible (Groups I-IV) included.
- Spills in 'Offshore waters', and 'Open Ocean waters' only, or other pre-approved or expedited approval areas.

Don Toenshoff commented forcefully later on that 'expedited' areas should not be considered for reasons of practicality and timeliness since he believes you either have pre-approval or you don't.

Previous studies on the topic were cited, including a MSRC 1977-1992 study of spills of greater than 1,000 bbls showing that 20 percent might be candidates for Dispersants and the 1999 G-MOR study stating that 47 percent of 1,000 bbl spills would be candidates. Don Toenshoff felt that personal and cultural issues might weigh against Dispersants use in Non-Gulf Coast Area waters (Scott Benton agreed) and Bob Gaudiosi stated that his answers would be low since "expedited approval" areas might slow action.

Result: Gulf Coast Area waters 53 percent; Non Gulf Coast Area waters 24 percent

Question 9
What is your estimate of the Probability that Dispersants are used if Permission is Granted (i.e., U^D) when a spill occurs from a Vessel/MTR Facility?

Assumptions: Group discussion produced the following:

- Using the spill subset from questions 6B (spill size range) and question 8 (permission granted).
- Dispersible oil spills only.
- Pre-Approval or Expedited Area.

The previous three qualifiers leave a subset that is taken as the baseline for this question.

Result: Gulf Coast Area waters: 80 percent; Non Gulf Coast Area waters 60 percent

Question 10

What is your estimate of the Probability that Permission is Granted for *In Situ* Burning (P^{ISB}) when a spill occurs from a Vessel/MTR Facility?

Al Allen opened the discussion on ISB. He stated that while Gulf Coast Area waters' weather might be better, colder water allows for better burning conditions (thicker oil, less evaporation). He then discussed the weathering effect: at up to 20 percent water emulsion, ISB can be effective, but not so when proportion is higher than 30-40 percent. Dave Usher said use was higher in Gulf Coast Area Waters because crude oil trade is higher. Panelists assumed pre-approval or expedited approval. They felt OSROs/planholders would go for both Dispersants and ISB permission at the same time for most spills.

Assumptions:

- Permission granted for ISB
- Pre-Approval or Expedited Approval Area
- Account for all II - IV oils

Result: Gulf Coast Area waters 76 percent; Non Gulf Coast Area waters 61 percent

Question 11

What is your estimate of the Probability that *In Situ* Burning is Used if Permission is Granted (i.e., U^{ISB}) when a spill occurs from a Vessel/MTR Facility?

Assumptions:

- Permission granted
- Pre-Approval or Expedited Approval Area
- Igniters available and ready to apply to the oil
- There was a dichotomy in panelists' answers because some felt that the cost of ISB systems might inhibit their use.

Result: Gulf Coast Area waters 27 percent; Non Gulf Coast Area waters 24 percent

Question 12A

How effective are Dispersants against spillage from Vessels/MTR Facilities using Option A's Effective Daily Application Capabilities (EDACs) for Non Gulf Coast Area waters?

Charlie Henry (and possible one or two other panelists) argued that since his answer to question 6B was that all spills smaller than 500 barrels should be excluded from the benefits calculations for Dispersants and, since the vast majority of all spills greater than or equal to 500 barrels are relatively small (i.e., close to 500 bbls), he would use all 20,000 gallons of his (20 to 1 ratio) Dispersants capability to continually hit these small spills (over and over) by airplane or vessel. He therefore would give exceedingly high numbers for Dispersants effectiveness. Don Aurand said Dispersants were quite effective until conditions go bad. He also said that Dispersants become less effective for very large spills. After the initial panel vote on question 12A, all gave very high final effectiveness for Dispersants because of majority of small spills.

Assumptions (Questions 12A and 12B)

- Aerial assets per regulation in place.
- Spill size greater than question 6B threshold.
- All tiers considered in one answer.
- Applied Daytime only (Coast Guard regulation has a 7 hour approval, 12 hour OPS per 24 hour period).

Result: good conditions - 79 percent; fair conditions - 54 percent; poor conditions - 18 percent

Question 12B
What is your estimate for the percentages of time that the conditions for Dispersants for Non Gulf Coast Area Waters will be: (a) good; (b) fair; and (c) poor?

Result: good conditions - 48 percent; fair conditions - 27 percent; poor conditions - 25 percent

Question 13A
How effective are Dispersants against spillage from Vessels/MTR Facilities using Option A's Effective Daily Application Capabilities (EDACs) for Gulf Coast Area waters?

The same discussion and assumptions apply as for question 12A. There was the additional comment that visibility is better in the Gulf Coast Area waters than elsewhere.

Result: good conditions - 79 percent; fair conditions - 53 percent; poor conditions - 18 percent

Question 13B
What is your estimate for the percentages of time that the conditions for Dispersants for Gulf Coast Area waters will be: (a) 'good'; (b) 'fair'; and (c) 'poor'?

Result: good conditions - 48 percent; fair conditions - 31 percent; poor conditions - 21 percent

Question 14
How effective are Dispersants against spillage from Vessels/MTR Facilities using Option B's Effective Daily Application Capabilities (EDACs) for Non Gulf Coast Area waters?

Same assumptions as question 12A. Panel felt there were very few spills where the extra capacity would make any difference so they saw a very small marginal benefit.

Result: Good conditions - 80 percent; fair conditions - 54 percent; poor conditions - 19 percent

Question 15
How effective are Dispersants against spillage from Vessels/MTR Facilities using Option B's Effective Daily Application Capabilities (EDACs) for Gulf Coast Area waters?

Charlie Henry again said he'd use Dispersants capability to overkill small spills (over and over) by airplane or vessel. The panel felt very little or no difference in incremental benefit.

Result: good conditions - 79 percent; fair conditions - 53 percent; poor conditions - 19 percent

Additional Dispersants Effectiveness Question

An additional question was asked to counter the compelling but flawed logic of high effectiveness due to Dispersants overkill on the large majority of small spills. Dyer suggested that the panel consider Dispersants effectiveness on a 40,000 bbls spill. It was agreed that we would consider Options A and B for Gulf Coast Area waters' spills, again using the set of assumptions operable for questions 12A, 13A, 14, and 15. The Volpe Center may blend the two results for an overall effectiveness value.

Result (Option A): good conditions - 63 percent; fair conditions - 35 percent; poor conditions - 14 percent.
Result (Option B): good conditions - 72 percent; fair conditions - 40 percent; poor conditions - 15 percent

Question 16A
What is your estimate of the Operational Effectiveness of *In Situ* Burning if Used when a spill occurs from Vessels/MTR Facilities?

Assumptions

- Aerial assets per regulation in place.
- Permission granted in pre-approved or expedited approval zone.
- Sufficient fire boom to capture oil.
- Spill size greater than question 6C threshold.
- 'Good' conditions were characterized as calm water, point spill source, and downwind movement of oil into the boom. Some in the group felt that under 'poor' conditions ISB would not be used at all. Glover stated that ISB is possible under the same conditions as Mechanical recovery.

Al Allen asked Bob Pond why the proposed regulation required so few hand-held igniters (i.e., why only 4 instead of, say, 50 or 100). Also, Don Toenshoff emphasized that his answers to question 16A include the assumption sufficient boom is available to corral the oil. After discussion, the panel's assumption of the presence of sufficient boom to corral oil before using Mechanical or ISB response modes, was always made for any of the questions for which such a consideration applied. (Bob Pond will revisit igniter and boom issues in the draft regulation).

Result: good conditions - 86 percent; fair conditions - 49 percent; poor conditions - 2 percent

Question 16B
What is your estimate for the percentages of time that the conditions for *In Situ* Burning will be: (a) good; (b) fair; and (c) poor?

Result: good conditions - 12 percent; fair conditions - 25 percent; poor conditions - 63 percent

The panel recessed at 4:55 PM to reconvene at 8:00 AM the following morning.

April 27, 2000

8:00 AM – meeting reconvened.

Question 17
How much (if any) would you lower your original answer to question 5 to reflect the above (ISB) credits?

Question concerns the possible effects of an ISB credit against Mechanical recovery Caps on the incremental effectiveness of the 2003 Mechanical recovery Caps, and is moot, since it referred to question 5.

The question did occasion, however, much discussion on the merits of ISB, particularly as one 'tool in the box' and by comparison to other response modes. The comments included:

- Don Toenshoff—the 10,000 bbls credit for ISB is not enough to justify an ISB investment and a 40 percent to 50 percent credit would provide a significant market incentive for manufacturers to conduct R&D.
- Bob Pond—Mechanical recovery is available for all spills. In that light, the Coast Guard probably would not reduce the 2000 Caps, certainly not below the 40,000 bbls floor.
- Dave Usher—Mechanical would always be needed after other options are applied.
- Al Allen—ISB is proven, the technology is currently sufficient, and acceptance is evolving.
- Dave Usher—'small guys' can't afford ISB.
- Gene Johnson—ISB is an "offshore" area waters option, not 'Inland' at this time.
- Nick Glover—a Dispersants credit would be "non-effective", but ISB could be mandated in pre-approved zones.
- Don Toenshoff—strongly disagreed and said the technology is still evolving and that it would be a "waste of money" to mandate. He recommended changing the credit for ISB to 25,000 bbls against Mechanical recovery mode, adding that the marketplace is not conducive at present to ISB R&D.
- Mr. Allen– added that the cost of the response mode package (especially of the fire resistant boom) would remain constant because there is no economic incentive to make better cheaper ISB technology. He stressed, however, that the cost as measured as cost per barrel of oil burned will come down for the ISB mode.
- Don Toenshoff—wanted the panel to estimate magnitude of credit needed to make ISB a viable/economic option.
- Bob Pond (USCG sponsor)—the Coast Guard would not consider a roll back to the 2000 Mechanical Caps at this time. He said this expert panel was not the forum for modifying the regulatory alternatives.

Question 18
How much would the effectiveness of Mechanical recovery equipment be increased by aerial, visual/radio monitoring of spillage from Vessels/MTR Facilities?

During the discussion, several panel members expressed a misunderstanding of the instructions "without aerial tracking/monitoring". Some members thought it meant absolutely no such capability. The intent of the question was to determine the increased effectiveness of mandatory, contracted capability of regulation's aerial monitoring and tracking <u>relative to the currently existing, non-mandatory baseline</u> aerial monitoring/tracking capability and C^3 (i.e., Command, Control, and Communications) capabilities. The panel felt unanimously that aerial monitoring was a needed response component, 'a support element'.

The panel felt that separate answers for ocean and 'Inland' Areas of water were required. For 'Inland' Areas of water, Gene Johnson said, "we know where the oil's going to go". The question was restricted to spills of 50 bbls or more. Volpe Center staff notes that the panel and project staff will have to clarify exactly what was meant by 'Inland' Areas of water and 'Open Ocean' Areas of water (July meeting).

The panel decided to answer two questions: 1) the percentage of time enhanced aerial tracking is likely to be used in the two chosen areas of water categories; and 2) the incremental effectiveness of Mechanical recovery given the enhanced aerial capability.

For Mechanical recovery enhanced by aerial assets, the panel gave the relatively high effectiveness enhancement because of the current weaknesses of the system, including C^3, and the patchwork of public and private assets responding in ad hoc manner to spill situations.

Result: 'Inland' Areas of water: Frequency of use 45 percent; delta effectiveness when used 43 percent. 'Open Ocean' Areas of water: Frequency of use 88 percent; delta effectiveness when used 43 percent.

Questions 19 and 20
How much would the effectiveness of Dispersants be increased by aerial, visual/radio monitoring of spillage from Vessels/MTR Facilities?

How much would the effectiveness of *In Situ* Burning be increased by aerial, visual/radio monitoring of spillage from Vessels/MTR Facilities?

The panel agreed with Don Aurand that the previously discussed effectiveness factors for the Dispersants and ISB response options had implicitly accounted for contracted aerial tracking capabilities, which are in fact required for pre-approval agreements. The panel decided to eliminate questions 19 and 20 since aerial assets are already an integral element of those response options. Bob Pond said that he would modify the proposed requirements to include aerial assets as part of the Dispersants and ISB response options.

Question 21
Does the VRP/FRP rules' requirement to *identify but not contract for* Mechanical recovery assets up to Two times the Cap or One times the Vessel's/Facility's Planning Volume, whichever is smaller, make an appreciable (measurable) impact in the rules' Overall Operational Effectiveness for Mechanical recovery equipment?

This question, as well as question #22 (corollary question in case of a 'Yes' answer) were rendered moot because of question 5. In any case, the sense of the panel was that 'identified' Mechanical response equipment has zero impact since the necessary assets flow into a large spill situation anyway.

Other Issues

Dave Dupont of USCG asked the panel to revisit question 3, i.e., the impact of the initial 25 percent Caps increase in 2000. The panel once more said that the answer would be zero.

There followed a more general (and final) discussion, centered on Mechanical Caps and the future posture of the response industry. Bob Pond went to white board at back of room and, using a (very) rough diagram of the eastern seaboard, argued that OSROs may very well reduce whatever surplus amount of Mechanical response capability equipment they presently have. He concluded that the 2003 Caps increase could prevent such a reduction of surplus.

Comments by the panel included:

- Don Toenshoff countered by saying that time/Tier constraints were more important than the absolute magnitude of the amount of equipment/capability in increasing efficiency against spills. He then demonstrated on the white board how you could fly equipment in from half way around world within 60 to 72 hours to meet the requirements for capability. He stressed forgetting about focusing on 25 percent Caps increases on Tiers 2 and 3, and suggested a focus on Tier 1. Panel agreed that Tier 1 is the critical readiness/response element.
- Scott Benton and Gene Johnson said that only 10 percent of all spills occur in pre-approved areas for either Dispersants or for *In Situ* Burning.
- Al Allen said that there are no storage requirements for ISB (as there are for the Mechanical recovery mode); plus ISB is 10 times quicker to begin.
- One panelist remarked that only a very small percent of spills occurs more than 3 nautical miles from the shoreline.
- Gene Johnson said that one approach would be to increase Mechanical Caps for areas where Dispersants and ISB are not allowed.
- Bob Pond (USCG) said Mechanical recovery is still the primary response option since it's used in 75 percent or more of all spills in which an attempt to use one of the 3 response options.

Conclusions

The panel decided that another meeting would necessary to confirm the results taken by the Volpe Center at this meeting and to validate the expert panel approach. All panelists agreed to commit to attend. Mike Dyer recapped that a 'quick look' report would be sent out in about 3 weeks and that we would meet again in about 2 months, near the end of June.

The meeting concluded at 11:50 AM.

Note to panelists: Our apologies for the three-week added delay in getting the minutes out to you. The proposed 11/2-day meeting date during July 11-13 gives back some breathing room.

MINUTES OF 2ND MEETING, JULY 11, 2000, SEATTLE, WASHINGTON

The panel met for its second session, following the request by members during the April meeting for an opportunity to review that meeting's minutes and numerical results. The meeting was attended by the same group, except for the following substitutions: Douglas O'Donovan for Don Toenshoff (both of MSRC); and Dr Edwin Stanton (Atlantic Strike Team) for Captain Rich Gaudiosi (Coast Guard Atlantic Strike Team, now retired)

Government representatives David DuPont (Coast Guard Headquarters) and David Crawford (Volpe Center) did not attend. A roster of all attendees is attached.

The purpose of the meeting was to reconsider, if deemed necessary, the suite of questions posed by the Volpe Center and, first, to give the panelists a more detailed picture of the analytical framework into which their deliberations will be input. Leo Casey of the Volpe Center conducted a presentation, with particular emphasis on the Programmatic Regulatory Assessment Model (PRAM), that was developed by the Volpe Center for an integrated cost and benefit calculation of all the major OPA 90 rulemakings and which is the intended basis of the benefit calculation for the 2003 Caps regulatory assessment. The main result of the meeting was that the panel did not see fit to change any of the numerical results arrived at previously. They did, however, provide considerably more insight into the technical and operational underpinnings of those answers. These are categorized as follows:

General Response Matters

- Doug O'Donovan stated that logistics, not equipment, is the main issue and that many OSROs would respond to a WCD spill and far exceed Caps Mechanical recovery requirements anyway. Spill responders will always face the same operational and physical limitations. Public expectations are always a problem.
- The panel saw no reason to revisit Gulf Coast Area waters response issues versus Non Gulf response issues, although 'cultural' matters earlier cited may indeed shift as science and experience change perspective.
- The panel felt that multiple mode response will be common in the future, and saw no reason to change the consideration of the modes adopted by the Volpe Center.

Dispersants

- Dispersants have value in two different senses: 'strategic' for small spills and 'tactical' for large spills.

In Situ Burning

The panel spent some time addressing particular ISB response conditions, including ice and marshes. The conclusion was that there is definite value for ISB in such cases, but that the application pertains mainly to exploration and production facilities under the purview of the Mines and Mineral Service or the Office of Pipeline Safety.

Question 10 was revisited because of cost implementation discussion (see below). The group concluded that the original answers reflected the status quo and the proposed 10 revision was for a delta effectiveness given that permission to use may change, but that no new equipment is likely to come on scene.

Other Issues

There was discussion of the statistical aggregation of panelists' quantified answers, whether, e.g., simple averaging, 'Olympic', or other means would be used. Leo Casey discussed the merits of these without committing to one or the other.

Don Aurand suggested that some sensitivity analysis is necessary particularly if the cost/benefit ratio, the preliminary value of which was reported by Leo to be about $10,000/barrel, is in the borderline range of what OMB is likely to find acceptable and justifiable.

OMB is likely to reduce benefits, relative to measures, which prevent oil spills, by some 'equivalency factor' less than 1.0, and will be presented with a sensitivity analysis reflecting different such factors applied to the three response modes. Mike Dyer stated that the equivalency matter is beyond the scope of this panel.

The panel raised the issue of 'ADSPAC' response time, suggesting that a 12-hour application ceiling makes sense without the 7-hour start-up time; this because of the ancillary commercial duty that some response planes put in.

Cost Considerations

The Volpe Center took the opportunity to ask the panel several questions about implementation costs. These were general topics meant to give a picture of what a future national response system would look like, particularly with new response modes in place, and will complement the specific cost data gathered through survey by the Volpe Center.

- There will likely be five Dispersants staging areas in the CONUS, plus areas in the Caribbean, Alaska, and Hawaii, each requiring large fixed wing aircraft. Presently, there are (2) C130 in Alaska carrying 'ADSPACs' with 5,000 gallons each. The Port Everglades staging area where 76,000 gallons are stored costs about $2 million/year to operate. New platforms such as surplus P3s may come into service in the future as the military decommissions them.
- There are at present eight ISB packages in the U.S., six in CONUS and one each in Hawaii and the Caribbean (all associated with RRTs with pre-approval zones). The panel concluded that the inducement offered by the Coast to acquire ISB equipment is insufficient for industry to add to this equipment. The size of the packages means that they are trucked rather than flown to spill sites. The result of this discussion was a revisitation of the ISB benefit question (question 10A; see previous ISB benefit section of these minutes).
- Additional discussion of ISB:
    - Bob Pond stated that the reason for the limited credit against Mechanical recovery mode is that the greatest ISB benefit is for non Coast Guard CG regulated Facilities.
    - Nick Glover felt that the regulations should legitimize ISB use and the group worried that the Coast Guard rulemaking process might reflect badly on ISB when other agencies reconsider spill response.
    - Some in the group felt that enhanced ISB with greater Mechanical Caps incentives would not reduce available Mechanical equipment, but Bob Pond stated that this would be the eventual result.

- It was suggested that the credit could be differentiated for Offshore response or that different credit multipliers be employed for Mechanical capacity and temporary storage.
- One of the expert panelists argued that although the proposed regulation's ISB offset credit would not have any direct benefits, the ISB credit would provide an (unquantifiable) 'endorsement' benefit. I.e., the very presence of the ISB offset/credit in the proposed regulation would enhance the reputation of ISB as a viable recovery mode, thereby. leading to greater more use of the ISB mode in the future. Such benefits that derive from ISB are not quantified in this analysis due to the difficulties involved; addressing issues such as this lie beyond the scope of this analysis.

Action items

Bob Pond will get additional geographical and operational areas of water spill data imbedded in the G-MOR report to the Volpe Center. Volpe Center will e-mail Powerpoint files to the panelists.

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Appendix B: Explanations of 'Expected Value' and Conditional Probability; How Benefits of Alternatives with Multiple Response Modes Were Handled

Expected Value

What does, using an expected value calculation for entities which are restricted to operational areas of water such as dispersants and in situ burning are restricted, mean? It means that the expert panel is asked to give us an average value that takes into account that some variables, parameters (or values based on these parameters) vary for the 6 different operating areas of water.

For example, suppose mechanical recovery equipment has an "overall operational effectiveness" factor of .20[1] for "Great Lakes" and "rivers and canals" areas of water, .20 for "inland" area waters, .10 for "nearshore' area waters, .075 for "offshore" area waters, and .02 for "open ocean" area waters. [Note: to keep this a relatively simple example, here we are only laying out the problem for laden tankers underway, and we are not applying the 2000 nor 2003 Cap increases (yet)].

Furthermore, suppose that 65 percent of all laden tanker underway spillage occurs inland area waters, Great Lakes area waters, and rivers and canals area waters, and the remaining 35 percent occur in the other area waters. Suppose in this 35 percent area 85 percent of its spillage occurs in nearshore, 10 percent in offshore' and 5 percent in open ocean areas, respectively. Then, if the Volpe Center had all of the above information (especially, had the spillage distribution by the Caps Tables' operating areas of water)—(which, of course, Volpe will not be able to get for among other reasons[2], the fields in the Coast Guard MSIS *do not coincide* with the, at times, convoluted/legalistic definitions of the 6 operating Areas of water), then the *overall m*echanical recovery effectiveness will be:

$$.65x(.20) + .35x\{.85x.06 + .10x.030 + .05x.01\} = .130 + .35x\{.051 + .003 + .0005\}$$

$$= .130 + .35x\{.0545\}$$

$$= .130 + .019075 = .149075,$$

or approximately .15. This is an expected value calculation (i.e., a weighted average that weights the different effectiveness factors by the 6 operating areas of water and by where spillage tends to occur).

In general, the Volpe Center's analytical model does not *explicitly* perform every "expected value" calculation. Instead, the expert panel uses their knowledge and expert judgment to do this *implicitly* by giving us an approximate answer for what they think the "overall operational effectiveness" of mechanical recovery equipment will be—the expert panel weighs all the considerations of the question, and hopefully arrives at an estimate that is close to the (unknowable value) of .15. One important exception to this general rule is that the expert panel is asked to give separate overall operational Effectiveness estimates for mechanical recovery (and Dispersants, and *in situ* burning) for "good", "fair", and "poor" operating conditions. This is because of the significant difference in the magnitude of these operational effectiveness estimates under good, fair or poor conditions (such as visibility, wave height, weather, spill size, presence of debris in water, time since spill, ice conditions, etc.) versus theoretical estimates of the same effectiveness performed in a laboratory test-tank.

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[1] Where .20 and each of the subsequent numbers are themselves (weighted) averages of the operational effectiveness factors under good, fair, and poor conditions.

[2] Otherwise there are $2^5 - 1 = 31$ possible different combinations of operating (water) areas and $2^5 - 1 = 31$ possible different combinations of oil types, for a grand total of $31^2 = 961$ different combinations for us to have to worry about!

An example on Dispersants or *in situ* burning: (again an overly simplistic example) suppose that Dispersants are used 30 percent for all spills, Mechanical recovery 60 percent and *In Situ* Burning 10 percent (we are, of course, in this example ignoring the possibility of two or more response modes being used on same spill). Suppose also the expert panel's final, resultant effectiveness factors are .25, .15, and .75, respectively. Then, the expected value of the Overall Effectiveness of each of the 3 technologies would be: .30x.25, .60x.15, and .10x.75, or .075, .09, and .075, respectively. If the expert panel said that *monitoring* spill operations by air would increase the effectiveness of each technology by, say, 10 percent, then each of the last 3 numbers would have to be multiplied by 1.10.

The number of expert panel questions will explode exponentially if most questions are broken out to the expert panel separately by spill size and/or by the 6 operating areas of water. Therefore, the expert panel was asked to give a *single* answer to each question, but in choosing their effectiveness factor for each question they would consider their final single answer as a (possibly weighted) average of 6 different effectivenesses for each operating area of water and a range of spill sizes. That is, rather than *explicitly* have the expert panel break-out their effectivenesses separately for different spill sizes and for each of the 6 operating areas of water, the panelists are asked to *mentally* weigh the operational effectiveness over *all* spill sizes and over all operating areas of water, giving one answer (an expected value) which *implicitly* takes into account what the potential varying operational effectiveness factors for different spill sizes, each operating areas of water (and/or oil type, etc.) would be.

How Benefits of Alternatives with Multiple Response Modes Were Handled

It is possible that more than one mode could be attempted sequentially on a single spill—or even simultaneously. The methodological approach is a five-step process that utilizes the data from the panels' answers to above four tables. To avoid getting bogged down in a morass of details the process will be demonstrated for a simple example involving a spill in Gulf Coastal area waters with option A's EDACs for the dispersants mode.

Step i: Recall that to keep the Caps RA methodology and results consistent with the previously published PRA of all 11 Core OPA 90 Regulations, the PRA's operational effectiveness for mechanical recovery from February 1997 will be used. However, this February 1997 operational effectiveness for the mechanical recovery mode had to be adjusted by the 2000 expert panel to reflect the impact of 25 percent increases in the ceiling or limit of required capability (Caps) in April 2000 and again in April 2003.

So, the Total Mechanical Effectivenesses, $T^{M,\,Gulf}$, acting *alone* equals:

(1.0) times (Difference between April 2000 panel's answers to question 5 and question 3) times (the Original, February 1997 panel's overall operational effectiveness).

Step ii: For option A in the Gulf the Total Effectiveness of dispersant, $T^{D,\,Opt.A\,Gulf}$, acting *alone* is computed by calculating:

(Probability dispersants mode granted permission in Gulf) times (Probability dispersants mode used in Gulf if permission was granted) times (Overall operational effectiveness of dispersants mode in Gulf).

$T^{D,\,Opt.A\,G}$ =

$(P^{D,\,Gulf})(U^{D,\,Gulf})[(weight1)(Eff^{D,\,GulfOpt.A}{}_{good}) + (weight2)(Eff^{D,\,Gulf\,Opt.A}{}_{fair})+(weight3)(Eff^{D,\,Gulf\,Opt.A}{}_{poor})]$

Step iii: In analogous fashion the Total Effectiveness of *in situ* burning mode acting alone is:

$T^{ISB, G} = (P^{ISB, G})(U^{ISB, G})[\,(weight1)(Eff^{ISB, G}_{good}) + (weight2)(Eff^{ISB, G}_{fair}) + (weight3)(Eff^{ISB, G}_{poor})]$

Step iv: Whenever multiple response modes are used, any possible "double counting" of benefits by the modes must be taken into consideration.[3] To avoid such double counting of benefits, the same mathematical procedure that was employed in the Programmatic Regulatory Assessment Accounting Model would then be applied to $T^{M,G}$,

$T^{D, Opt.A, G}$ and $T^{ISB, G}$ to give an estimate of effectiveness of all 3 modes in Gulf Coast area waters using option A (i.e., $EFF^{Opt.A, G}$) the total benefits of Option A for Gulf Coast area waters.

$EFF^{Opt.A, G} =$

$\{T^{M, G} + (1 - T^{M, G})x(T^{D, Opt.A, G}) + [1 - (T^{M, G} + (1 - T^{M, G})x(T^{D, Opt.B, G}))]x(T^{ISB, G})\}x(Freq_{All3})$
where $Freq_{All\,3}$ is the probability that all three response modes are used sequentially, and where the mathematical procedure of the PRAAM has been applied inside the brackets { } to avoid "double counting" of benefits from each of the response modes.

Step v: Then, $BENEFITS^{Opt.A\,, G}$ equal:

$(Proportion_{Gulf})$ times (Total Spillage) times $(EFF^{Opt.A\,, G})$,

since the Total Spillage, itself, must be reduced to account for the fact that we only the benefits in Gulf Coast area waters.

Mathematical Definition of Conditional Probability

In Chapter 3, Methodology, we defined the concept of what is called *conditional probability*. Recall that a conditional probability is when we deal with probabilities for *part rather than all* of a sample space.[4] E.g., the probability that a person randomly selected from a population possesses blue eyes differs dramatically from the probability that a person randomly selected from a sub-population containing only blondes possesses blue eyes. The actual mathematical definition of Conditional probability is the following. Let A and B be two events, and let P(A), P(B), and $P(A \cap B)$ be the probability of event A occurring, the probability of the event B occurring, and the probability of the event A and B both occur, respectively. Then the conditional probability of the event A given that event B has occurred is denoted by $P(A|B)$, and is defined as: $P(A|B)$ equals $P(A \cap B)$ divided by P(B) [i.e., $P(A|B) = P(A \cap B)/ P(B)$].

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[3] The benefits (or effectivenesses) of the response modes are not mutually exclusive nor are they necessarily independent of each other. The overall benefits (or effectiveness) of all the response modes together will not equal the sum of the effectivenesses of each individual response mode used in isolation from the other modes. If two different response modes are used, each mode will reduce the potential individual overall benefits (or effectiveness) that the other mode can achieve by itself. What follows is a simplified example of the mathematical procedure; suppose that one mode is 25 percent effective in its response, and the other (call it "second" mode) is 40 percent effective. Then the original 40 percent attributable solely to mode "Two" would have to be reduced in order to correctly adjust the simple sum of the two individual effectivenesses. This means that .40 must be multiplied by (1-.25), or (1 - .25)x(.40) = .30, to reflect the fact that only 75 percent of the original potential overall effectiveness, i.e. 75 percent of 100 percent, remains since the potential effectiveness of mode 'Two' has already been decreased by 25 percent as a result of mode "one". So, the simple sum of the two effectivenesses .25 + .40 = .65 must also be adjusted down to get the correct overall effectiveness that eliminates "double counting": .25 + (1 - .25)x(.40) = .25 + .30 = .55, instead of .the incorrect .25 + .40 = .65.

[4] A sample space is the set of the *entire* set of possible outcomes of a random experiment.

Appendix C: Spreadsheet of Cost Survey Results and Extrapolation to National Estimates

Company I Cost Factors	Initial Acquisition	Annual Maintenance	Contracted	Coop	
	2003	2003	2003	2003	
On-Water Mech Recovery					
Containment/Collection Boom					
Oil Recovery Devices					
Temporary Storage					Dispersants price per gallon
Add'l Equipment (boats, sorbents, etc.)					
Note: For dispersants' acquisition stockpile costs, Volpe used the avg. of the "big four's" (I,VIII,IX, & XI) price per gal. multiplied by the "big four's" required # of gallons.					Gallons Required
Dispersants					
Dispersant Stockpile - Option A Gulf Coast					
Dispersant Stockpile - Option A, All exc. Gulf Coast					
Dispersant Stockpile - Option B Gulf Coast					
Dispersant Stockpile - Option B, All exc. Gulf					
Dispersant Application Systems					
Delivery Platform (Vessel)			$ 1,400,000		
Delivery Platform (Fixed Wing Aircraft)					
Delivery Platform (Rotary Aircraft)					
Primary Staging Area					
Cost Factors					
In Situ Burning					
Fire-resistant Boom					
Hand-held Ignitors					
Helitorch Ignitors					
Support Vessel					
Aerial Tracking					
Spotter Aircraft					
Employee Training & Compensation					
employee training for on-water mech recovery?					
employee training for dispersant use?					
employee training for aircraft observation?					
employee training for in situ burning					
additional Compensation for response employees?					
Recordkeeping					
record creation and record keeping?					
contract preparation & negotiations with planholders?					
insurance coverage?					
Other Activities					

Company II Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop	
		2003		2003		2003		2003
On-Water Mech Recovery								
Containment/Collection Boom		$ -				$ -		$ -
Oil Recovery Devices		$ -		$ -		$ -		$ -
Temporary Storage				$ -		$ -		$ -
Add'l Equipment (boats, sorbents, etc.)		$ -		$ -		$ -		$ -
Dispersants								
Dispersant Stockpile - Option A Gulf Coast		$ -						
Dispersant Stockpile - Option A, All exc. Gulf Coast				$ -				
Dispersant Stockpile - Option B Gulf Coast								
Dispersant Stockpile - Option B, All exc. Gulf								
Dispersant Application Systems		$ -		$ -		$ -		$ -
Delivery Platform (Vessel)		$ -		$ -		$ -		$ -
Delivery Platform (Fixed Wing Aircraft)		$ -		$ -		$ -		$ -
Delivery Platform (Rotary Aircraft)		$ -		$ -		$ -		$ -
Primary Staging Area		$ -		$ -		$ -		$ -
Cost Factors								
In Situ Burning								
Fire-resistant Boom				$ -		$ -		$ -
Hand-held Ignitors				$ -		$ -		$ -
Helitorch Ignitors				$ -		$ -		$ -
Support Vessel				$ -		$ -		$ -
Aerial Tracking								
Spotter Aircraft				$ -		$ -		$ -
Employee Training & Compensation								
employee training for on-water mech recovery?				$ -				
employee training for dispersant use?				$ -				
employee training for aircraft observation?				$ -				
employee training for in situ burning				$ -				
additional Compensation for response employees?				$ -				
Recordkeeping								
record creation and record keeping?				$ -				
contract preparation & negotiations with planholders?				$ -				
insurance coverage?				$ -				
Other Activities				$ -				

Company III Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop	
		2003		2003		2003		2003
On-Water Mech Recovery								
Containment/Collection Boom		$ 60,000		$ 6,000				
Oil Recovery Devices		$ -		$ -				
Temporary Storage		$ -		$ -				
Add'l Equipment (boats, sorbents, etc.)		$ 42,000		$ 4,000				
Dispersants								
Dispersant Stockpile - Option A Gulf Coast								
Dispersant Stockpile - Option A, All exc. Gulf Coast								
Dispersant Stockpile - Option B Gulf Coast								
Dispersant Stockpile - Option B, All exc. Gulf								
Dispersant Application Systems								
Delivery Platform (Vessel)								
Delivery Platform (Fixed Wing Aircraft)								
Delivery Platform (Rotary Aircraft)								
Primary Staging Area								
Cost Factors								
In Situ Burning								
Fire-resistant Boom								
Hand-held Ignitors								
Helitorch Ignitors								
Support Vessel								
Aerial Tracking								
Spotter Aircraft								
Employee Training & Compensation								
employee training for on-water mech recovery?				$ 8,400				
employee training for dispersant use?				$ -				
employee training for aircraft observation?				$ -				
employee training for in situ burning				$ -				
additional Compensation for response employees?				$ 50,000				
Recordkeeping								
record creation and record keeping?				$ 10,000				
contract preparation & negotiations with planholders?				$ -				
insurance coverage?				$ 26,000				
Other Activities								

Company IV Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop	
		2003		2003		2003		2003
On-Water Mech Recovery								
Containment/Collection Boom		$ -		$ -		$ -		$ -
Oil Recovery Devices		$ -		$ -		$ -		$ -
Temporary Storage		$ -		$ -		$ -		$ -
Add'l Equipment (boats, sorbents, etc.)		$ -		$ -		$ -		$ -
Dispersants								
Dispersant Stockpile - Option A Gulf Coast								
Dispersant Stockpile - Option A, All exc. Gulf Coast		$ 200,000						
Dispersant Stockpile - Option B Gulf Coast								
Dispersant Stockpile - Option B, All exc. Gulf		$ 250,000						
Dispersant Application Systems		$ 100,000		$ 5,000				
Delivery Platform (Vessel)								$ 25,000
Delivery Platform (Fixed Wing Aircraft)						$ 250,000		
Delivery Platform (Rotary Aircraft)								
Primary Staging Area								
Cost Factors								
In Situ Burning								
Fire-resistant Boom		$ 1,000,000		$ 50,000				
Hand-held Ignitors								
Helitorch Ignitors								
Support Vessel								$ 10,000
Aerial Tracking								
Spotter Aircraft						$ 20,000		$ 30,000
Employee Training & Compensation								
employee training for on-water mech recovery?				$ -				
employee training for dispersant use?				$ 25,000				
employee training for aircraft observation?				$ 10,000				
employee training for in situ burning				$ 10,000				
additional Compensation for response employees?				$ -				
Recordkeeping								
record creation and record keeping?				$ -				
contract preparation & negotiations with planholders?				$ -				
insurance coverage?				$ 20,000				
Other Activities								

Company V Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop	
		2003		2003		2003		2003
On-Water Mech Recovery								
Containment/Collection Boom		$ 150,000		$ 15,000				
Oil Recovery Devices		$ 200,000		$ 20,000				
Temporary Storage		$ -		$ -				
Add'l Equipment (boats, sorbents, etc.)		$ 150,000		$ 15,000				
Dispersants								
Dispersant Stockpile - Option A Gulf Coast								
Dispersant Stockpile - Option A, All exc. Gulf Coast								
Dispersant Stockpile - Option B Gulf Coast								
Dispersant Stockpile - Option B, All exc. Gulf								
Dispersant Application Systems								
Delivery Platform (Vessel)								
Delivery Platform (Fixed Wing Aircraft)								
Delivery Platform (Rotary Aircraft)								
Primary Staging Area								
Cost Factors								
In Situ Burning								
Fire-resistant Boom								
Hand-held Ignitors								
Helitorch Ignitors								
Support Vessel								
Aerial Tracking								
Spotter Aircraft								
Employee Training & Compensation								
employee training for on-water mech recovery?								
employee training for dispersant use?								
employee training for aircraft observation?								
employee training for in situ burning								
additional Compensation for response employees?								
Recordkeeping								
record creation and record keeping?								
contract preparation & negotiations with planholders?								
insurance coverage?								
Other Activities								

Company VI Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop	
		2003		2003		2003		2003
On-Water Mech Recovery								
Containment/Collection Boom		$ -		$ -		$ -		
Oil Recovery Devices		$ -		$ -		$ -		
Temporary Storage		$ -		$ -		$ -		
Add'l Equipment (boats, sorbents, etc.)		$ -		$ -				
Dispersants								
Dispersant Stockpile - Option A Gulf Coast		$ -		$ -				
Dispersant Stockpile - Option A, All exc. Gulf Coast		$ -		$ -				
Dispersant Stockpile - Option B Gulf Coast		$ -		$ -				
Dispersant Stockpile - Option B, All exc. Gulf		$ -		$ -				
Dispersant Application Systems		$ -		$ -				
Delivery Platform (Vessel)		$ -		$ -				
Delivery Platform (Fixed Wing Aircraft)								
Delivery Platform (Rotary Aircraft)								
Primary Staging Area								
Cost Factors								
In Situ Burning								
Fire-resistant Boom		$ 300,000						
Hand-held Ignitors		$ 1,000		$ -				
Helitorch Ignitors		$ -		$ -				
Support Vessel		$ -		$ -				
Aerial Tracking								
Spotter Aircraft		$ 200,000		$ 5,000				
Employee Training & Compensation								
employee training for on-water mech recovery?				$ -				
employee training for dispersant use?				$ 5,000				
employee training for aircraft observation?				$ 2,500				
employee training for in situ burning				$ 5,000				
additional Compensation for response employees?				$ 10,000				
Recordkeeping								
record creation and record keeping?				$ 1,000				
contract preparation & negotiations with planholders?				$ 10,000				
insurance coverage?				$ -				
Other Activities								

Company VII Cost Factors	Initial Acquisition	Annual Maintenance	Contracted	Coop
	2003	2003	2003	2003
On-Water Mech Recovery				
Containment/Collection Boom	$ 20,000	$ 5,000	$ -	$ -
Oil Recovery Devices	$ 50,000	$ 5,000	$ -	$ -
Temporary Storage	$ -	$ -	$ -	$ -
Add'l Equipment (boats, sorbents, etc.)	$ 100,000	$ 10,000	$ -	$ -
Dispersants				
Dispersant Stockpile - Option A Gulf Coast				
Dispersant Stockpile - Option A, All exc. Gulf Coast				
Dispersant Stockpile - Option B Gulf Coast				
Dispersant Stockpile - Option B, All exc. Gulf				
Dispersant Application Systems				
Delivery Platform (Vessel)				
Delivery Platform (Fixed Wing Aircraft)				
Delivery Platform (Rotary Aircraft)				
Primary Staging Area				
Cost Factors				
In Situ Burning				
Fire-resistant Boom				
Hand-held Ignitors				
Helitorch Ignitors				
Support Vessel				
Aerial Tracking				
Spotter Aircraft				
Employee Training & Compensation				
employee training for on-water mech recovery?		$ 20,000		
employee training for dispersant use?		$ -		
employee training for aircraft observation?		$ -		
employee training for in situ burning		$ -		
additional Compensation for response employees?		$ -		
Recordkeeping				
record creation and record keeping?		$ 4,000		
contract preparation & negotiations with planholders?		$ 50,000		
insurance coverage?		$ 13,000		
Other Activities				

Company VIII Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop		
		2003		2003		2003		2003	
On-Water Mech Recovery									
Containment/Collection Boom		$ -							
Oil Recovery Devices		$ -							
Temporary Storage		$ -							
Add'l Equipment (boats, sorbents, etc.)		$ -							**Dispersants price per gallon**
Note: For dispersants' acquisition stockpile costs, Volpe used the avg. of the four national OSROs (I,VIII,IX, & XI) price per gal. multiplied by their required volumes in gallons.									**Gallons Required**
Dispersants									
Dispersant Stockpile - Option A Gulf Coast		$ -							0
Dispersant Stockpile - Option A, All exc. Gulf Coast		$ -							0
Dispersant Stockpile - Option B Gulf Coast		$ -							0
Dispersant Stockpile - Option B, All exc. Gulf		$ -							0
Dispersant Application Systems		$ -							
Delivery Platform (Vessel)		$ -							
Delivery Platform (Fixed Wing Aircraft)		$ -							
Delivery Platform (Rotary Aircraft)		$ -							
Primary Staging Area		$ -							
Cost Factors									
In Situ Burning									
Fire-resistant Boom		$ -							
Hand-held Ignitors		$ -							
Helitorch Ignitors		$ -							
Support Vessel		$ -							
Aerial Tracking									
Spotter Aircraft		$ -							
Employee Training & Compensation									
employee training for on-water mech recovery?				$ -					
employee training for dispersant use?				$ -					
employee training for aircraft observation?				$ -					
employee training for in situ burning				$ -					
additional Compensation for response employees?				$ -					
Recordkeeping									
record creation and record keeping?				$ -					
contract preparation & negotiations with planholders?				$ -					
insurance coverage?				$ -					
Other Activities				$ -					

Company IX Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop		
		2003		2003		2003		2003	
On-Water Mech Recovery									
Containment/Collection Boom		$ 5,000,000		$ 10,000					
Oil Recovery Devices		$ -		$ -					Dispersants
Temporary Storage		$ 100,000		$ -					price per gal.
Add'l Equipment (boats, sorbents, etc.)		$ -		$ -					
Note: For dispersants' acquisition stockpile costs, Volpe used the avg. of the four national OSROs (I,VIII,IX, & XI) price per gal. multiplied by their required volumes in gallons.									$17
									Gallons Required
Dispersants									
Dispersant Stockpile - Option A Gulf Coast		$ 490,025		$ 5,000					28,826
Dispersant Stockpile - Option A, All exc. Gulf Coast		$ 1,733,100		$ 5,000					101,947
Dispersant Stockpile - Option B Gulf Coast		$ 536,775		$ 5,000					31,575
Dispersant Stockpile - Option B, All exc. Gulf		$ 1,866,600		$ 5,000					109,800
Dispersant Application Systems									
Delivery Platform (Vessel)		$ 4,800,000		$ 32,000					
Delivery Platform (Fixed Wing Aircraft)						$ 1,500,000			
Delivery Platform (Rotary Aircraft)									
Primary Staging Area									
Cost Factors									
In Situ Burning									
Fire-resistant Boom		$ 600,000		$ 10,000					
Hand-held Ignitors				$ 4,000					
Helitorch Ignitors		$ 125,000		$ 5,000					
Support Vessel						$ 50,000			
Aerial Tracking									
Spotter Aircraft									
Employee Training & Compensation									
employee training for on-water mech recovery?				$ -					
employee training for dispersant use?				$ 30,000					
employee training for aircraft observation?				$ 5,000					
employee training for in situ burning				$ 100,000					
additional Compensation for response employees?				$ -					
Recordkeeping									
record creation and record keeping?				$ 10,000					
contract preparation & negotiations with planholders?				$ 25,000					
insurance coverage?				$ -					
Other Activities				$ -					

Company X Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop	
		2003		2003		2003		2003
On-Water Mech Recovery								
Containment/Collection Boom		$ -		$ -		$ -		$ -
Oil Recovery Devices		$ -		$ -		$ -		$ -
Temporary Storage		$ -		$ -		$ -		$ -
Add'l Equipment (boats, sorbents, etc.)		$ -		$ -		$ -		$ -
Dispersants								
Dispersant Stockpile - Option A Gulf Coast		$ -		$ -		$ -		$ -
Dispersant Stockpile - Option A, All exc. Gulf Coast		$ -		$ -		$ -		$ -
Dispersant Stockpile - Option B Gulf Coast		$ -		$ -		$ -		$ -
Dispersant Stockpile - Option B, All exc. Gulf		$ -		$ -		$ -		$ -
Dispersant Application Systems		$ -		$ -		$ -		$ -
Delivery Platform (Vessel)		$ -		$ -		$ -		$ -
Delivery Platform (Fixed Wing Aircraft)		$ -		$ -		$ -		$ -
Delivery Platform (Rotary Aircraft)		$ -		$ -		$ -		$ -
Primary Staging Area		$ -		$ -		$ -		$ -
Cost Factors								
In Situ Burning								
Fire-resistant Boom		$ -		$ -		$ -		$ -
Hand-held Ignitors		$ -		$ -		$ -		$ -
Helitorch Ignitors		$ -		$ -		$ -		$ -
Support Vessel		$ -		$ -		$ -		$ -
Aerial Tracking								
Spotter Aircraft		$ -		$ -		$ -		$ -
Employee Training & Compensation								
employee training for on-water mech recovery?				$ -		$ -		$ -
employee training for dispersant use?				$ -		$ -		$ -
employee training for aircraft observation?				$ -		$ -		$ -
employee training for in situ burning				$ -		$ -		$ -
additional Compensation for response employees?				$ -		$ -		$ -
Recordkeeping								
record creation and record keeping?				$ -		$ -		$ -
contract preparation & negotiations with planholders?				$ -		$ -		$ -
insurance coverage?				$ -		$ -		$ -
Other Activities				$ -		$ -		$ -

Company XI Cost Factors	Initial Acquisition	Annual Maintenance	Contracted	Coop	
	2003	2003	2003	2003	
On-Water Mech Recovery					
Containment/Collection Boom	$ -	$ -	$ -	$ -	
Oil Recovery Devices	$ -	$ -	$ -	$ -	**Dispersants**
Temporary Storage	$ 300,000	$ 30,000	$ -	$ -	**price per gal.**
Add'l Equipment (boats, sorbents, etc.)	$ 175,000	$ 50,000	$ -	$ -	
Note: For dispersants' acquisition stockpile costs, Volpe used the avg. of the four national OSROs (I,VIII,IX, & XI) price per gal. multiplied by their required volumes in gallons.					**$19**
Dispersants					**Gallons Required**
Dispersant Stockpile - Option A Gulf Coast	~~$ 297,000~~	$ 20,000	$ -	$ -	**16,500**
Dispersant Stockpile - Option A, All exc. Gulf Coast	~~$ 643,500~~	$ 25,000	$ -	$ -	**35,750**
Dispersant Stockpile - Option B Gulf Coast	~~$ 445,500~~	$ 20,000	$ -	$ -	**24,750**
Dispersant Stockpile - Option B, All exc. Gulf	~~$ 965,250~~	$ 25,000	$ -	$ -	**53,625**
Dispersant Application Systems	$ 90,000	$ 15,000	$ -	$ -	
Delivery Platform (Vessel)	$ 2,800,000	$ 400,000	$ -	$ -	
Delivery Platform (Fixed Wing Aircraft)	$ -	$ -	$ -	$ -	
Delivery Platform (Rotary Aircraft)	$ -	$ -	$ -	$ -	
Primary Staging Area	$ -	$ -	$ -	$ -	
Cost Factors					
In Situ Burning					
Fire-resistant Boom	$ 3,248,000	$ 75,000	$ -	$ -	
Hand-held Ignitors					
Helitorch Ignitors					
Support Vessel	$ 480,000	$ 100,000	$ -	$ -	
Aerial Tracking					
Spotter Aircraft	$ -	$ -	$ -	$ -	
Employee Training & Compensation					
employee training for on-water mech recovery?		$ -	$ -	$ -	
employee training for dispersant use?		$ 25,000	$ -	$ -	
employee training for aircraft observation?		$ 25,000	$ -	$ -	
employee training for in situ burning		$ 25,000	$ -	$ -	
additional Compensation for response employees?		$ -	$ -	$ -	
Recordkeeping					
record creation and record keeping?		$ 7,500	$ -	$ -	
contract preparation & negotiations with planholders?		$ 15,000	$ -	$ -	
insurance coverage?		$ 75,000	$ -	$ -	
Other Activities		$ 42,500	$ -	$ -	

	A	B	C	D	E	F	G	H	I	J	K
1	AVG & Total Cost Factors		Initial Acquisition		Annual Maintenance		Contracted		Coop	Total Capital Cost	Total Recurring Cost
			2003		2003		2003		2003		
2											
3	**On-Water Mech Recovery**										
4	Containment/Collection Boom		$145,534		$4,379		$0		$0	$8,440,952	$254,000
5	Oil Recovery Devices		$33,251		$3,325		$0		$0	$1,928,571	$192,857
6	Temporary Storage		$9,195		$1,034		$0		$0	$533,333	$60,000
7	Add'l Equipment (boats, sorbents, etc.)		$42,860		$5,581		$0		$0	$2,485,905	$323,714
8	**Note: For dispersants' acquisition stockpile costs, Volpe used the avg. of the four national OSROs (I,VIII,IX, & XI) price per gal. multiplied by their required volumes in gallons.**										
9	**Dispersants**										
10	Dispersant Stockpile - Option A Gulf Coast		$18,755		$862		$0			$1,087,800	$50,000
11	Dispersant Stockpile - Option A, All exc. Gulf Coast		$56,978		$1,034		$0		$0	$3,304,729	$60,000
12	Dispersant Stockpile - Option B Gulf Coast		$23,307		$862		$0		$0	$1,351,800	$50,000
13	Dispersant Stockpile - Option B, All exc. Gulf		$67,624		$1,034		$0		$0	$3,922,200	$60,000
14	Dispersant Application Systems		$26,379		$2,198		$0		$0	$1,530,000	$127,500
15	Delivery Platform (Vessel)		$174,713		$14,897		$0		$7,759	$10,133,333	$1,314,000
16	Delivery Platform (Fixed Wing Aircraft)		$0		$0		$1,450,000		$0	$0	$7,250,000
17	Delivery Platform (Rotary Aircraft)		$0		$0		$0		$0	$0	$0
18	Primary Staging Area		$0		$0		$0		$0	$0	$0
19											
20	**In Situ Burning**										
21	Fire-resistant Boom		$536,138		$18,448		$0		$0	$31,096,000	$1,070,000
22	Hand-held Ignitors		$466		$276		$0		$0	$27,000	$16,000
23	Helitorch Ignitors		$4,310		$345		$0		$0	$250,000	$20,000
24	Support Vessel		$16,552		$6,897		$1,724		$3,103	$960,000	$680,000
25											
26	**Aerial Tracking**										
27	Spotter Aircraft		$93,103		$1,552		$6,207		$9,310	$5,400,000	$990,000
29	**Employee Training & Compensation**										
30	employee training for on-water mech recovery?				$4,407		$0		$0		$255,600
31	employee training for dispersant use?				$5,920		$0		$0		$343,333
32	employee training for aircraft observation?				$2,629		$0		$0		$152,500
33	employee training for in situ burning				$5,201		$0		$0		$301,667
34	additional Compensation for response employees?				$0		$0		$0		$0
35											
36	**Recordkeeping**										
37	record creation and record keeping?				$2,730		$0		$0		$158,333
38	contract preparation & negotiations with planholders?				$10,230		$0		$0		$593,333
39	insurance coverage?				$10,879		$0		$0		$631,000
40	Other Activities				$977		$0		$0		$56,667

Appendix D: Cost Survey Forms

RESPONDENT I

Cost Factors	Initial Acquisition 2003	Annual Maintenance 2003	Contracted 2003	Coop 2003	
On-Water Mech Recovery					
Containment/Collection Boom					
Oil Recovery Devices					Dispersants price per gallon
Temporary Storage					
Add'l Equipment (boats, sorbents, etc.)					Gallons Required
Dispersants					
Dispersant Stockpile - Option A Gulf Coast					
Dispersant Stockpile - Option A, All exc. Gulf Coast					
Dispersant Stockpile - Option B Gulf Coast					
Dispersant Stockpile - Option B, All exc. Gulf					
Dispersant Application Systems					
Delivery Platform (Vessel)			$ 1,400,000		
Delivery Platform (Fixed Wing Aircraft)					
Delivery Platform (Rotary Aircraft)					
Primary Staging Area					
Cost Factors					
In Situ Burning					
Fire-resistant Boom					
Hand-held Ignitors					
Helitorch Ignitors					
Support Vessel					
Aerial Tracking					
Spotter Aircraft					
Employee Training & Compensation					
employee training for on-water mech recovery?					
employee training for dispersant use?					
employee training for aircraft observation?					
employee training for in situ burning					
additional Compensation for response employees?					
Recordkeeping					
record creation and record keeping?					
contract preparation & negotiations with planholders?					
insurance coverage?					
Other Activities					

RESPONDENT III

Company III Cost Factors	Initial Acquisition 2003	Annual Maintenance 2003	Contracted 2003	Coop 2003
On-Water Mech Recovery				
Containment/Collection Boom	$ 60,000	$ 6,000		
Oil Recovery Devices	$ -	$ -		
Temporary Storage	$ -	$ -		
Add'l Equipment (boats, sorbents, etc.)	$ 42,000	$ 4,000		
Dispersants				
Dispersant Stockpile - Option A Gulf Coast				
Dispersant Stockpile - Option A, All exc. Gulf Coast				
Dispersant Stockpile - Option B Gulf Coast				
Dispersant Stockpile - Option B, All exc. Gulf				
Dispersant Application Systems				
Delivery Platform (Vessel)				
Delivery Platform (Fixed Wing Aircraft)				
Delivery Platform (Rotary Aircraft)				
Primary Staging Area				
Cost Factors				
In Situ Burning				
Fire-resistant Boom				
Hand-held Ignitors				
Helitorch Ignitors				
Support Vessel				
Aerial Tracking				
Spotter Aircraft				
Employee Training & Compensation				
employee training for on-water mech recovery?		$ 8,400		
employee training for dispersant use?		$ -		
employee training for aircraft observation?		$ -		
employee training for in situ burning		$ -		
additional Compensation for response employees?		$ 50,000		
Recordkeeping				
record creation and record keeping?		$ 10,000		
contract preparation & negotiations with planholders?		$ -		
insurance coverage?		$ 26,000		
Other Activities				

RESPONDENT IV

Company IV Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop	
		2003		2003		2003		2003
On-Water Mech Recovery								
Containment/Collection Boom		$ -		$ -		$ -		$ -
Oil Recovery Devices		$ -		$ -		$ -		$ -
Temporary Storage		$ -		$ -		$ -		$ -
Add'l Equipment (boats, sorbents, etc.)		$ -		$ -		$ -		$ -
Dispersants								
Dispersant Stockpile - Option A Gulf Coast								
Dispersant Stockpile - Option A, All exc. Gulf Coast		$ 200,000						
Dispersant Stockpile - Option B Gulf Coast								
Dispersant Stockpile - Option B, All exc. Gulf		$ 250,000						
Dispersant Application Systems		$ 100,000		$ 5,000				
Delivery Platform (Vessel)								$ 25,000
Delivery Platform (Fixed Wing Aircraft)						$ 250,000		
Delivery Platform (Rotary Aircraft)								
Primary Staging Area								
Cost Factors								
In Situ Burning								
Fire-resistant Boom		$ 1,000,000		$ 50,000				
Hand-held Ignitors								
Helitorch Ignitors								
Support Vessel								$ 10,000
Aerial Tracking								
Spotter Aircraft						$ 20,000		$ 30,000
Employee Training & Compensation								
employee training for on-water mech recovery?				$ -				
employee training for dispersant use?				$ 25,000				
employee training for aircraft observation?				$ 10,000				
employee training for in situ burning				$ 10,000				
additional Compensation for response employees?				$ -				
Recordkeeping								
record creation and record keeping?				$ -				
contract preparation & negotiations with planholders?				$ -				
insurance coverage?				$ 20,000				
Other Activities								

RESPONDENT V

Company V Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop	
		2003		2003		2003		2003
On-Water Mech Recovery								
Containment/Collection Boom		$ 150,000		$ 15,000				
Oil Recovery Devices		$ 200,000		$ 20,000				
Temporary Storage		$ -		$ -				
Add'l Equipment (boats, sorbents, etc.)		$ 150,000		$ 15,000				
Dispersants								
Dispersant Stockpile - Option A Gulf Coast								
Dispersant Stockpile - Option A, All exc. Gulf Coast								
Dispersant Stockpile - Option B Gulf Coast								
Dispersant Stockpile - Option B, All exc. Gulf								
Dispersant Application Systems								
Delivery Platform (Vessel)								
Delivery Platform (Fixed Wing Aircraft)								
Delivery Platform (Rotary Aircraft)								
Primary Staging Area								
Cost Factors								
In Situ Burning								
Fire-resistant Boom								
Hand-held Ignitors								
Helitorch Ignitors								
Support Vessel								
Aerial Tracking								
Spotter Aircraft								
Employee Training & Compensation								
employee training for on-water mech recovery?								
employee training for dispersant use?								
employee training for aircraft observation?								
employee training for in situ burning								
additional Compensation for response employees?								
Recordkeeping								
record creation and record keeping?								
contract preparation & negotiations with planholders?								
insurance coverage?								
Other Activities								

RESPONDENT VI

Company VI Cost Factors	Initial Acquisition		Annual Maintenance		Contracted		Coop	
		2003		2003		2003		2003
On-Water Mech Recovery								
Containment/Collection Boom		$ -		$ -				
Oil Recovery Devices		$ -		$ -		$ -		
Temporary Storage		$ -		$ -		$ -		
Add'l Equipment (boats, sorbents, etc.)		$ -		$ -		$ -		
Dispersants								
Dispersant Stockpile - Option A Gulf Coast		$ -		$ -				
Dispersant Stockpile - Option A, All exc. Gulf Coast		$ -		$ -				
Dispersant Stockpile - Option B Gulf Coast		$ -		$ -				
Dispersant Stockpile - Option B, All exc. Gulf		$ -		$ -				
Dispersant Application Systems		$ -		$ -				
Delivery Platform (Vessel)		$ -		$ -				
Delivery Platform (Fixed Wing Aircraft)								
Delivery Platform (Rotary Aircraft)								
Primary Staging Area								
Cost Factors								
In Situ Burning								
Fire-resistant Boom		$ 300,000						
Hand-held Ignitors		$ 1,000		$ -				
Helitorch Ignitors		$ -		$ -				
Support Vessel		$ -		$ -				
Aerial Tracking								
Spotter Aircraft		$ 200,000		$ 5,000				
Employee Training & Compensation								
employee training for on-water mech recovery?				$ -				
employee training for dispersant use?				$ 5,000				
employee training for aircraft observation?				$ 2,500				
employee training for in situ burning				$ 5,000				
additional Compensation for response employees?				$ 10,000				
Recordkeeping								
record creation and record keeping?				$ 1,000				
contract preparation & negotiations with planholders?				$ 10,000				
insurance coverage?				$ -				
Other Activities								

RESPONDENT VII

Company VII Cost Factors	Initial Acquisition 2003	Annual Maintenance 2003	Contracted 2003	Coop 2003
On-Water Mech Recovery				
Containment/Collection Boom	$ 20,000	$ 5,000	$ -	$ -
Oil Recovery Devices	$ 50,000	$ 5,000	$ -	$ -
Temporary Storage	$ -	$ -	$ -	$ -
Add'l Equipment (boats, sorbents, etc.)	$ 100,000	$ 10,000	$ -	$ -
Dispersants				
Dispersant Stockpile - Option A Gulf Coast				
Dispersant Stockpile - Option A, All exc. Gulf Coast				
Dispersant Stockpile - Option B Gulf Coast				
Dispersant Stockpile - Option B, All exc. Gulf				
Dispersant Application Systems				
Delivery Platform (Vessel)				
Delivery Platform (Fixed Wing Aircraft)				
Delivery Platform (Rotary Aircraft)				
Primary Staging Area				
Cost Factors				
In Situ Burning				
Fire-resistant Boom				
Hand-held Ignitors				
Helitorch Ignitors				
Support Vessel				
Aerial Tracking				
Spotter Aircraft				
Employee Training & Compensation				
employee training for on-water mech recovery?		$ 20,000		
employee training for dispersant use?		$ -		
employee training for aircraft observation?		$ -		
employee training for in situ burning		$ -		
additional Compensation for response employees?		$ -		
Recordkeeping				
record creation and record keeping?		$ 4,000		
contract preparation & negotiations with planholders?		$ 50,000		
insurance coverage?		$ 13,000		
Other Activities				

RESPONDENT IX									
Company VIIII Cost Factors		Initial Acquisition 2003		Annual Maintenance 2003		Contracted 2003		Coop 2003	
On-Water Mech Recovery									
Containment/Collection Boom		$ 5,000,000		$ 10,000					
Oil Recovery Devices		$ -		$ -					
Temporary Storage		$ 100,000		$ -					**Dispersants price per gallon**
Add'l Equipment (boats, sorbents, etc.)		$ -		$ -					**$17**
									Gallons Required
Dispersants									
Dispersant Stockpile - Option A Gulf Coast		~~$ 490,025~~		$ 5,000					**28,825**
Dispersant Stockpile - Option A, All exc. Gulf Coast		~~$ 1,733,100~~		$ 5,000					**101,947**
Dispersant Stockpile - Option B Gulf Coast		~~$ 536,775~~		$ 5,000					**31,575**
Dispersant Stockpile - Option B, All exc. Gulf		~~$ 1,866,600~~		$ 5,000					**109,800**
Dispersant Application Systems									
Delivery Platform (Vessel)		$ 4,800,000		$ 32,000					
Delivery Platform (Fixed Wing Aircraft)						$ 1,500,000			
Delivery Platform (Rotary Aircraft)									
Primary Staging Area									
Cost Factors									
In Situ Burning									
Fire-resistant Boom		$ 600,000		$ 10,000					
Hand-held Ignitors				$ 4,000					
Helitorch Ignitors		$ 125,000		$ 5,000					
Support Vessel						$ 50,000			
Aerial Tracking									
Spotter Aircraft									
Employee Training & Compensation									
employee training for on-water mech recovery?				$ -					
employee training for dispersant use?				$ 30,000					
employee training for aircraft observation?				$ 5,000					
employee training for in situ burning				$ 100,000					
additional Compensation for response employees?				$ -					
Recordkeeping									
record creation and record keeping?				$ 10,000					
contract preparation & negotiations with planholders?				$ 25,000					
insurance coverage?				$ -					
Other Activities				$ -					

RESPONDENT XI

Company XI Cost Factors	Initial Acquisition 2003	Annual Maintenance 2003	Contracted 2003	Coop 2003	
On-Water Mech Recovery					
Containment/Collection Boom	$ -	$ -	$ -	$ -	
Oil Recovery Devices	$ -	$ -	$ -	$ -	
Temporary Storage	$ 300,000	$ 30,000	$ -	$ -	
Add'l Equipment (boats, sorbents, etc.)	$ 175,000	$ 50,000	$ -	$ -	**Dispersants price per gallon**
					$19
Dispersants					**Gallons Required**
Dispersant Stockpile - Option A Gulf Coast	~~$ 297,000~~	$ 20,000	$ -	$ -	**16,500**
Dispersant Stockpile - Option A, All exc. Gulf Coast	~~$ 643,500~~	$ 25,000	$ -	$ -	**35,750**
Dispersant Stockpile - Option B Gulf Coast	~~$ 445,500~~	$ 20,000	$ -	$ -	**24,750**
Dispersant Stockpile - Option B, All exc. Gulf	~~$ 965,250~~	$ 25,000	$ -	$ -	**53,625**
Dispersant Application Systems	$ 90,000	$ 15,000	$ -	$ -	
Delivery Platform (Vessel)	$ 2,800,000	$ 400,000	$ -	$ -	
Delivery Platform (Fixed Wing Aircraft)	$ -	$ -	$ -	$ -	
Delivery Platform (Rotary Aircraft)	$ -	$ -	$ -	$ -	
Primary Staging Area	$ -	$ -	$ -	$ -	
Cost Factors					
In Situ Burning					
Fire-resistant Boom	$ 3,248,000	$ 75,000	$ -	$ -	
Hand-held Ignitors					
Helitorch Ignitors					
Support Vessel	$ 480,000	$ 100,000	$ -	$ -	
Aerial Tracking					
Spotter Aircraft	$ -	$ -	$ -	$ -	
Employee Training & Compensation					
employee training for on-water mech recovery?		$ -	$ -	$ -	
employee training for dispersant use?		$ 25,000	$ -	$ -	
employee training for aircraft observation?		$ 25,000	$ -	$ -	
employee training for in situ burning		$ 25,000	$ -	$ -	
additional Compensation for response employees?		$ -	$ -	$ -	
Recordkeeping					
record creation and record keeping?		$ 7,500	$ -	$ -	
contract preparation & negotiations with planholders?		$ 15,000	$ -	$ -	
insurance coverage?		$ 75,000	$ -	$ -	
Other Activities		$ 42,500	$ -	$ -	

Appendix D: Cost Survey Forms

Oil Spill Response Organization Cost Questionnaire

Please fill in as much of the questionnaire as possible prior to your telephone/in-person interview

1 Company Name: ______________________________

2 Point of Contact & Position: ______________________________

3 Street Address: ______________________________

4 City: ______________________________

5 State: ______________________ 6. ZIP: __________

7 Telephone: ______________________________

8 Fax: ______________________________

9 E-mail: ______________________________

10a. Is your company "for profit" (Y/N)? If yes, please answer 10b — 10a. _____

10b Is your company a small business (Y/N) (<$5m in average annual proceeds for the past 3 years.) — 10b _____

11 How many years has your company been active in oil spill response? — 11 _____

12 Your company is currently listed in ________Vessel Response Plans as a **primary** oil spill responder.

13 Your company is currently listed in ________Marine Transportation-Related Facility Plans as a **primary** oil spill responder.

14 What percent of total revenue is derived from oil spill response and recovery annually averaged over the last 5 years? — 14 _____

15 How many oil spill incidents does your company respond to annually averaged over the last 5 years?

a. Vessels 15.a ______

b. MTR Facilities 15.b ______

16 Are you an OSRO classifed by the Coast Guard?(Y/N) 16 ______

17 If you are not an OSRO classified by the Coast Guard, please indicate the following:

a. Your **total** effective daily recovery rate in barrels per day based on oil recovery equipment (skimmers, vacuums, etc.) that you own or lease 17a. ______

b. Your **total** temporary storage capacity (bbls) for recovered oil (owned or leased) 17b. ______

c. Your total Containment Boom (owned or leased) 17c. ______

d. Do you have a dispersant capability? (Y/N) If so, please indicate the amount of dispersant inventory in gallons that you own? 17d. ______

e. Do you have a in situ burn capability? (Y/N) 17e. ______

18 Are you an oil spill cooperative? If no, please skip 19-27, go to item 28. 18 ______

19 If yes, how many members do you have? 19 ______

20 How many members are marine transportation-related facilities? 20 ______

21 How many members are vessel owners or operators? How many vessel trips are covered on an anuual basis (average over 5 years)? 21 ______

22 Are you a non-operating coop (mainly equipment but deployed by a third party) or an operating coop? 22 ______

23.a. What is your annual budget for operations (average over 5 years)? 23a. ______

23b. What is your annual capital budget (average over 5 years)? 23b. ______

24 What would be the incremental cost increase from the 2000 plannining requirements to meet the 2003 requirements for mechanical recovery? For dispersant capability?

24 ___________

25 What are your membership fees? Please indicate fees for full membership and associate membership. Also please list any retainer fees if not included in membership fees.

25 ___________

26 Do you respond to non-member's oil spills? If so, how many and what is your fee?

26 ___________

27 Do you contract to non-members? If so, how many and what is your fee?

27 ___________

28 If not a coop, are you a third party cleanup contractor?

28 ___________

29 How much do you charge in retainer fees to be listed as the **primary** responder in a Vessel response Plan? MTR Facility? (Attach fee schedule if available)

29 ___________

30 What is the total number of permanent employees in your company?

30 ___________

31 How many trained employees (permanent or contract) in the following categories do you have? If you have contracts to provide workers from a labor pool, please estimate the number of these persons with the indicated pollution training.

Primary Skill	# Emp.
Trained in Mechanical Recovery	
Trained in Dispersant application	
Trained A/C Observers	
Trained in In Situ Burning	

All information contained on this sheet is for regulatory assessment only, and subject to the restrictions described in the cover letter.

32 What is your cost per vessel or per facility charge (retainer) to planholders for providing oil spill response capability? 32 ______

For the 2000 and 2003 Caps rules, what additional total annual costs, if any, do you experience or anticipate for the following activities?

Expense	2000 Caps	2003 Caps
33 employee training for on-water mech recovery?		
34 employee training for dispersant use?		
35 employee training for aircraft observation?		
36 employee training for in situ burning		
37 additional Compensation for response employees?		
38 record creation and record keeping?		
39 contract preparation & negotiations with planholders?		
40 insurance coverage?		
41 Other Activities (please list)		

Oil Spill Response Organization Costs Questionnaire

In the table please provide your estimated incremental cost to meet the indicated Caps by making a capital expenditure, lease, or contract. If none, please write in zero (0). **Assume 50% of your dispersant delivery capability is by fixed wing aircraft**

For the 2000 and 2003 Caps rules, what are your equipment costs, if any, by service category for the given cost factors?

	Cost Factors			Initial Acquisition		Annual Maintenance		Contracted		Coop	
				2000	2003	2000	2003	2000	2003	2000	2003
On-Water Mech Recovery											
42	Containment/Collection Boom										
43	Oil Recovery Devices										
44	Temporary Storage										
45	Add'l Equipment (boats, sorbents, etc.)										
Dispersants											
46	Dispersant Stockpile - Option A Gulf Coast										
47	Dispersant Stockpile - Option A, All exc. Gulf Coast										
48	Dispersant Stockpile - Option B Gulf Coast										
49	Dispersant Stockpile - Option B, All exc. Gulf										
50	Dispersant Application Systems										
51	Delivery Platform (Vessel)										
52	Delivery Platform (Fixed Wing Aircraft)										

All information contained on this sheet is for regulatory assessment only, and subject to the restrictions described in the cover letter.

53	Delivery Platform (Rotary Aircraft)										
54	Primary Staging Area										
	Cost Factors			Initial Acquisition		Annual Maintenance		Contracted		Coop	
				2000	2003	2000	2003	2000	2003	2000	2003
In Situ Burning											
55	Fire-resistant Boom										
56	Hand-held Ignitors										
57	Helitorch Ignitors										
58	Support Vessel										
Visual tracking											
59	Spotter Aircraft										

For Questions #45-59, please list each piece of equipment used in your estimate of total initial acquisition cost.

Equipment Description	Service Life	Acquisition Cost

60 How do you recover or plan to recover the costs described in questions 45-59? (retainer, etc.) 60 ____________

61 How do you charge for multi-vessel and multi-zone planholders? 61 ____________

62 If you are a small business, would the proposed rule affect your ability to do business? If yes, how? 62 ____________

63 Are there any other costs, administrative or otherwise, that you expect to incur in this caps change?63 ____________

64 For the 2000 aand 2003 rules, how much additional time do you anticipate it will take to complete paperwork with regards to the activities below?

Paperwork Activities		2000 Rule (hrs)		2003 Rule (hrs)	
Developing the contract with the planholder					
Written Funding agreement					
Written consent that the provider agrees to be listed in the plan					

Appendix E: Overview of How The Overall and Marginal Impacts of 11 Core OPA 90 Rules Are Computed In A Way That Avoids 'Double Counting' of Benefits

In Appendix E the original problem structure, as represented by the spill event tree. is transformed into a structure that is much more amenable to the problem's data input requirements and its recursive nature, and embellishes the original logic so that the dilemma of "double counting" of benefits of the 11 core OPA 90 rules is solved. Appendix E discusses the principal data elements that must be decided upon beforehand and fed into the mathematical procedure—specifically, each rule's *individual* effectiveness factors *when considered alone* must be estimated and input. Although it is true that the PRA is chiefly concerned with the effects and attendant benefits when the rules are considered together, the strength of the mathematical procedure is that it requires us to focus on the individual effectiveness factors of each rule when considered in isolation. This makes the task of coming up with the needed effectiveness factors conceptually much less complicated and more tractable. The overall effect of a set of 11 core OPA 90 Coast Guard rules acting together is also illustrated. In addition, the "marginal effectiveness" and cost-effectiveness of any single rule is defined and discussed.

Much of the material in this Appendix may be of interest to the decision-makers only to assure themselves that necessary conceptual details have been addressed and to ensure that the proposed methodology is not a "black box." Therefore, only an overview is presented here; those wishing a more detailed treatment of the PRAM and the Procedure should refer to the U.S. Department of Transportation, <u>OPA 90 Programmatic Regulatory Assessment (PRA) Part 2 – Cost Effectiveness of Selected Regulations</u>[5], October 1998, especially its Appendix B – The Computational Procedure.

Interactions of OPA 90 Rules

The benefits of the OPA 90 rules are not all mutually exclusive nor are they necessarily independent of each other. That is to say, the overall beneficial effectiveness of all of the rules joined together as one distinct entity, will not be equal to the sum of the effectiveness of each individual rule when considered in isolation from all other rules. Simple summing of the *individually* estimated benefits, or effects, of each rule would result in considerable "double counting", and thereby significantly overstate the overall benefits of the full suite of the 11 core OPA 90 rules. Duplicate or interactive/overlapping effects of the *individual* rules would not be eliminated by simple summation. Figure C-1 illustrates this issue; the individual ovals represent the individual benefit or individual effectiveness of each rule when considered in complete isolation from all other rules. The area outlined in bold represents the total overall benefit, or overall effectiveness, of all rules taken together. Care must be exercised to ensure that any possible effects of a rule (previously estimated by an interim RA or by other means in isolation from other rules) is adjusted down to account for the overlapping effects of other rules.

---

[5] Prepared by John A. Volpe National Transportation Systems Center, Cambridge, Massachusetts; Prepared for U.S. Coast Guard, Marine Safety and Environmental Protection, Washington, D.C.

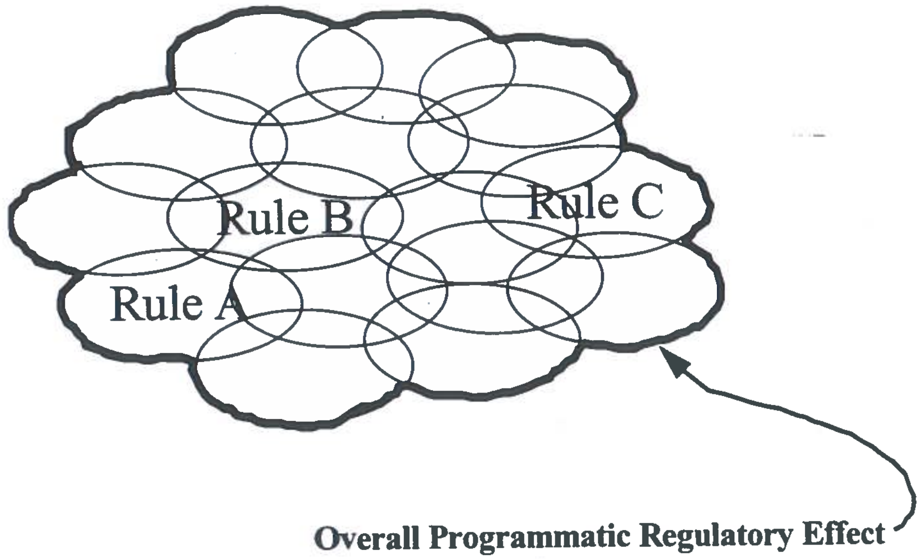

Figure E-1: Overlapping Effects and Overall Effect of OPA 90 Rules

Delineating and displaying, in the form of an event tree, the structure of the chain of causal events leading to a spill is useful.[6] Such a tree assists in trying to understand: a) the interactions and dependencies of multiple rule effects on each causal event, and b) the amount of oil that otherwise would enter and damage the marine environment. The effect that each rule has on each branch of the tree must be estimated. A single large tree displaying all of the spill sources, estimates of their respective percent shares of oil transported, or stored, as well as the attendant causal chain of events would be too complex and cluttered. Alternatively, we propose separate trees formed by taking an enlarged view of each of the sources constituting the several branches and sub-branches of the single large tree. Figure C-2 on the next page displays a typical spill event tree. After analysis of each tree and estimation of the respective benefits and costs, we can sum the results culled from the corresponding branches of each of the trees.

[6] It is important to make clear that we are not proposing a fault tree analysis. A fault tree approach would look at every conceivable event that might result in an accident and spill, and would keep the estimates of the events' probabilities separate. Our event tree is a much more macro approach in that it implicitly telescopes the micro events of the fault tree approach into 4 spill events. Any trees presented here are for heuristic purposes only.

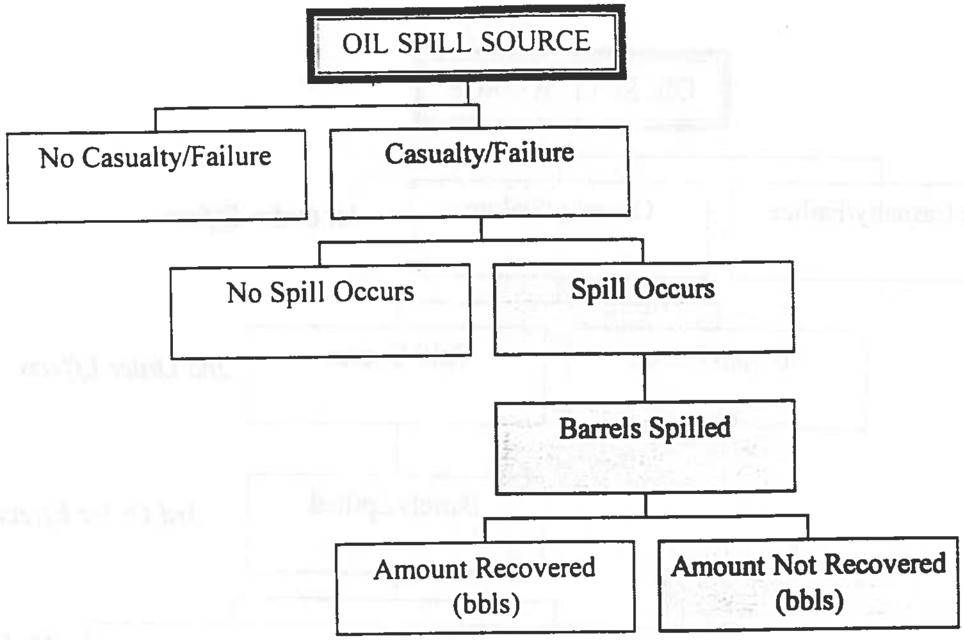

Figure E-2: Typical Spill Event Tree

Grouping scheme of 11 Core OPA 90 Rules for Estimating Benefits

There are many possible ways one might group the rules for analysis of benefits. The six categories of rules mentioned earlier in Section 3 were introduced to facilitate the discussion of the types of rules, whereas the grouping scheme that follows is used because it supports the analytical approach and computational procedure which were specifically devised by the Volpe team to avoid the double counting' of benefits.

We propose to group the rules into the following four *orders* of effectiveness:

First order: any rule that lowers (by some percentage) the likelihood of an accident or failure involving oil transportation or a storage facility. Any such rule will be said to have a *first order* effect (or *first order* effectiveness factor) and the event it affects to be a *first order* event.

Second order: any rule that lowers (by some percentage) the probability that a spill occurs if an accident or failure occurs (lowers the conditional probability of a spill given an accident or failure occurs). Any such rule will be said to have a *second order* effect.

Third order: any rule that lowers (by some percentage) the expected quantity of oil spilled, if a spill occurs. Any such rule will be said to have a *third order* effect.

Fourth order: any rule that lowers (by some percentage) the expected quantity of the spilled oil that would remain (i.e., can not be removed before damage) in the environment. Any such rule will be said to have a *fourth order* effect.

Some rules will affect more than one of these four *orders*. For instance, a rule may not only lower the probability of an accident, but may also lower the probability of a spill, or/and could even lower the expected quantities of spilled oil or/and decrease the amount of oil remaining to damage the marine environment. Figure C-3 below illustrates the above relationships.

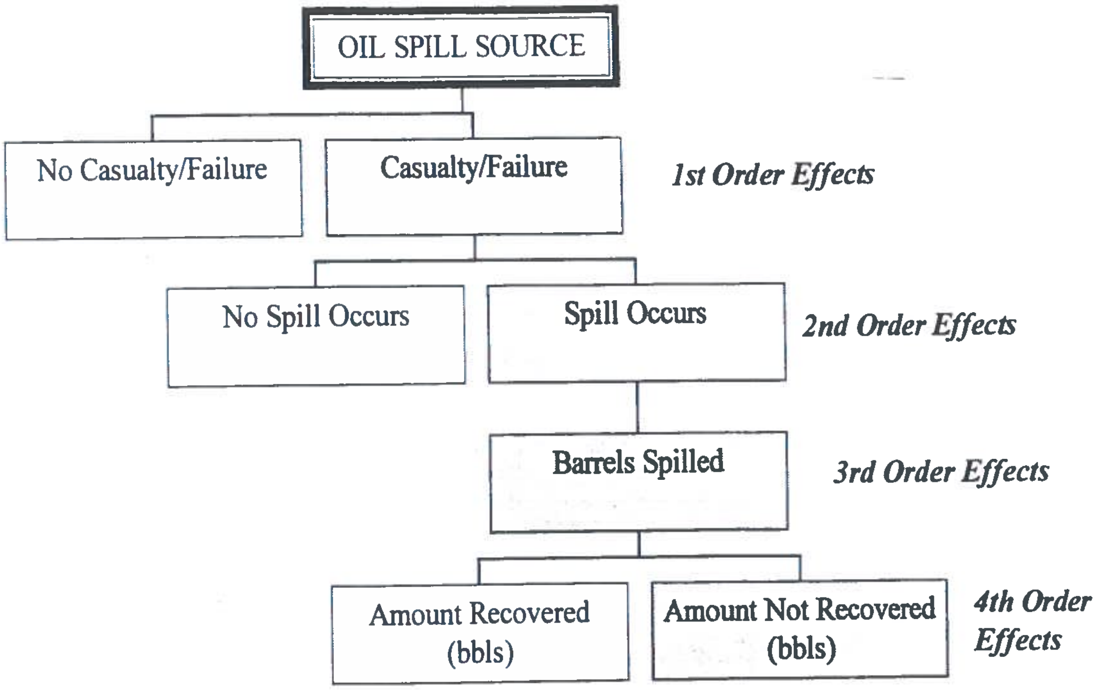

Figure E-3: Effects of OPA 90 Rules: *1st, 2nd, 3rd*, and *4th Order* Effects

Assumptions and Methodology

The Programmatic Regulatory Assessment is limited to rules applying to equipment and technology of U.S. and foreign flag vessel operations in U.S. waters. Foreign registry crews, however, are *not* excluded from coverage by the OPA 90 rules, and are assumed to make the same contribution to either the costs or the benefits. This assumes that although there is no direct, explicit U.S. authority over foreign crews, there exists by foreign governments enforcement reciprocity of these crews vis-à-vis OPA 90 rules.

For the purposes of this PRA it has been assumed that the rules' effectiveness factors, as well as the "overall effectiveness" factor and yearly "overall benefits" can be computed using "expected values". The use of expected casualties and failures, and/or expected spill sizes, and/or expected amounts removed from the environment (expected benefits), presumes that risks of different sized spills are linearly comparable. When one takes for granted that expected values can be utilized, one is assuming that the decision maker(s) are *risk neutral*. *Risk neutral* means that the importance or worth w1, of avoiding, say, a 2 million barrel spill with a likelihood of occurrence of once every 100 years, has the same worth w2 as avoiding a 40,000 barrel spill with a likelihood of occurrence of once every 2 years, or has the same worth w3 as avoiding a 1,667 barrel spill with a likelihood of occurrence of once every month. That is,

$$(2 \text{ million})\times(1/100)\times(w1) = (40{,}000)\times(1/2)\times(w2) = (1{,}667)\times(12)\times(w3) = 20{,}000 \text{ bbls/yr}$$

if $w1 = w2 = w3 = 1$.

The use of expected values also presupposes that the worth of recovering the last barrel of oil from a large spill is the same as the worth of recovering the first barrel. Assuming *risk neutrality* in the analysis, lessens the resource requirements (funding and time) of the PRA effort and simplifies its numerous calculations to an enormous degree. If the decision-maker(s) were not *risk neutral,* but are instead *risk averse,* then they would want to give greater utility, (attach greater importance), to the event with the greater adverse consequence even if two events have the exact same expected value (e.g., 10 barrels per year, as do the 10 million and 100 barrel spills above). But to account for the decision-maker(s) who is (are) *risk averse*, the analysis would now also require creating *utility function(s)* for these decision-makers. This is possible to do, but it would involve significant increases in the resource requirements of the PRA effort.[7]

Although rules' sets of effectiveness factors and the number of benefit barrels are calculated assuming risk neutrality, i.e., assuming expected values, we will make a distinction between those barrels that are prevented from being spilled versus those barrels that are spilled but are recovered in a timely fashion. The latter will first be multiplied by an exchange rate (i.e., a dimensionless weight) that is less than 1.0.[8]

The PRAAM Mathematical Procedure

The quantity of symbols and the number (and detail) of the subscripts and superscripts which appear below may at first seem excessive to the reader. One should bear in mind that we must, however, perform analyses and keep separate account of, a core group of 11 different rules, each with: one to four distinct *orders* of individual effectiveness; one to four different sources, **i**, of oil spills, each year of the life cycle period.

The procedure computes without any "double counting" as follows:

(A): 1) for each of the four sources of oil spills, **i**, the Overall_i Effectiveness Factor of *all* **N** rules joined together as one distinct, whole entity; 2) for each of the four sources of oil spills, **i**, the yearly expected Overall_i $\text{Benefits}_{\text{Yr}}$ that are a consequence of this Overall_i Effectiveness Factor (and the yearly expected Overall $\text{Benefits}_{\text{Yr}}$ by summing Overall_i $\text{Benefits}_{\text{Yr}}$ over all the **i**'s); 3) the Present Value of this stream of yearly expected Overall Benefits; and 4) the Overall Cost-Effectiveness of *all* **N** rules joined together as one distinct, whole entity. The Overall Cost-Effectiveness is measured in $/bbl and is the ratio of Total Present Value (TPV) of the stream of yearly Overall Costs to the TPV of the stream of yearly expected Overall Benefits over the same life cycle. We can also perform the above four steps on any subset of the **N** rules to get that subset's Overall_i Effectiveness Factor, Overall_i $\text{Benefits}_{\text{Yr}}$, etc.

(B): 1) the" *Marginal* Effectiveness" that any particular rule[J], J=1 to **N**, contributes to the Overall Effectiveness Factor of the other **N - 1** rules' effectiveness (which we designate by sub-overall) when these **N - 1** rules are considered as one distinct whole entity; 2) the yearly expected *Marginal* Benefits that are a consequence of this particular rule's *Marginal* Effectiveness; 3) the Present Value of the stream of yearly expected *Marginal* Benefits; and 4) the Cost-Effectiveness of these Marginal Benefits (measured in $/bbl).

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[7] By introducing an individualized utility function, $U(c_i)$, i.e., the decision-maker(s') "perceived" magnitude of the consequence assessed against every possible adverse consequence, c_i , we could, in theory, modify the PRA: from one in which the adverse consequences were not linearly comparable, into one in which the consequences are linearly comparable (i.e., *allows* the use of "expected values"'). One new price to pay would be that we would need to know precisely who the final decision makers are who may be using the results of the PRA to set policy, and the(se) decision makers would have to fully participate in the process of creating the utility function(s).

[8] Done by direction of U.S. Coast Guard and Office of Management and Budget.

Each rule's yearly costs along with its set of effectiveness factors—(i.e.. rule effectiveness for each spill event for each spill source) plus the baseline spills—are the principal data elements that must be fed into the mathematical procedure. Many of the effectiveness factors will be zero. since not all rules will affect all sources or all events. Since many of the RIA's do not provide sufficient information for deriving effectiveness factors at this level of detail. a panel of experts in February 1997 was relied upon as a consistent source for these estimates.

Illustrative Examples of Calculating the *Overall* Effectiveness Factor

Example I

Suppose, for the sake of simplicity, that there is only one rule, say A, and it affects only one source, **i**, — underway, laden tankers. *It is important to understand that even a single, isolated rule will still have a "double counting" problem if the rule has more than one order of effectiveness*; hence, in general we must retain the concept and terminology, "Overall_i Effectiveness," even in the case of a single rule. Assume that we estimate that rule A reduces the likelihood of a tanker accident for any year of the life cycle period by 40 percent (i.e., reduces the probability of a *first order* effect by 40 percent) and reduces the probability of a spill, given a tanker accident has occurred, by 10 percent (i.e., reduces the probability of a *second order* effect by 10 percent), reduces the size of a spill by 5 percent (i.e., reduces the probability of a *third order* effect by 5 percent), and increases the amount of oil recovered in a timely manner by 10 percent (i.e., increases the probability of a *fourth order* effect by 10 percent).

We can represent this information by the effectiveness vector, $\mathbf{v}_A = (.40, .10, .05, .10)$ which represents the *first, second, third,* and *fourth order* effectiveness factors of rule A when A is considered in isolation from any other rules that might be present. We want to compute rule A's Overall_i Effectiveness Factor. Computation of the Overall_i Effectiveness factor is a four-step process. Rule A is 40 percent effective in reducing tanker accidents, but since 40 percent of tanker accidents do not now occur, there will remain only 1 - .40 = .60 of the original potential accidents on which the *second order* effectiveness factor, .10, can have an impact. Therefore, this 40 percent *must be subtracted out, before we apply the next effectiveness factor*, .10. Similarly, after the *first* and *second orders* there will remain 1 - (.40 + .06) = .54 on which the *third order* factor, .05, has an effect, i.e., (.54)x.(.05) = .0270. After the *first*, *second*, and *third order* factors,

$$1 - (.4000 + .0600 + .0270) = .5130$$

remains on which the *fourth order* factor, .10, has an effect,

i.e., (.5130)x(.10) = .0513. The Overall_i Effectiveness Factor of (.40, .10, .05, .10) then is:

$$.4000 + \{ (1 - .4000) \times (.1000) \} + \{ (1 - .4600) \text{x}.0500 \} + \{ [1 - (.4600 + .0270)] \text{x}(.1000) \}$$

$$= .4000 + .0600 + .0270 + .0513$$

$$= .5383.$$ [9]

[9] Anyone using a calculator to work through the calculations in this example may find that their answers differ slightly from the Volpe Center's numbers. This is because calculations involving the PRAAM mathematical procedure (avoiding "double counting" of Overall Effectiveness factor(s) and benefits tend to be highly sensitive to rounding errors. The appropriate strategy by the Volpe Center has been to carry calculations out to many decimal places throughout, rounding off benefits (barrels) to one decimal place at the very end. Rounding off intermediate results that are used in later calculations sometimes can make a large difference in the final answer.

This means that rule A's $Overall_i$ Effectiveness Factor is .5383 not .4000 + .1000 + .0500 + .1000 = .6500. This may not seem like a significant error. i.e.. the percentage error will only be:

(error in effectiveness)/(true effectiveness) x 100 percent = (.1117)/(.5383)x 100 percent = 20.8 percent.

It can easily be shown that it is possible for the absolute error (from double counting) of the $Overall_i$ Effectiveness Factor to be as high as 25 percent and the percentage error of the $Overall_i$ Effectiveness to be as great as 33.3 percent if double counting is not eliminated.

If rule A had affected more than one source of oil spills, then the above methodology must be performed separately for each source. Next, each separate $Overall_i$ Effectiveness factor would then be multiplied by its corresponding spill volume $Baseline_i$, and then the resulting $Overall_i$ Benefits would be added together to get the $Overall_i$ Benefit. (Baseline cases will also vary by the specific *order* of effectiveness that we are applying. Part of the strength of the mathematical procedure, however, is that it automatically creates the required *order* Baselines if the mathematical procedure has previously been inputted with the necessary source and year baselines.) Each of the above three steps would be done for each year, Yr, of rule A's life cycle; the mathematical procedure would already have multiplied the yearly spill volume $Baselines_{iYr}$ by some yearly growth (or decline) factor f_s . Each of the yearly $Overall_i$ $Benefit_{Yr}$ would be discounted by 7 percent back to the year 1996 and then summed to get the Total Present Value (TPV) of the benefits over the life cycle period. A comparable series of steps would be performed on rule A's inputted costs to obtain the TPV of the costs over the same life cycle. Finally, the mathematical procedure would calculate the cost-effectiveness of rule A by computing the ratio of the TPV of rule A's costs to the TPV of its benefits.

Example II

If, in addition to rule A with its effectiveness vector, $\mathbf{v_A}$ = (.40, .10, .05, .10), there had been a second rule B with effectiveness vector, $\mathbf{v_B}$ = (.30, .05, .55, 0), then we would have proceeded analogously as above, but with a few repeated steps. We would mimic the logic of Example I to eliminate "double counting," but now we first must apply it separately on each of the pairs of effectiveness factors that possess the same *order*, i.e., on each of the pairs: (.40, .30), (.10, .05), (.05, .55), and (.10, 0). The first application would yield a Grand *First Order* Effectiveness of .58, the second application a Grand *Second Order* Effectiveness of .145, the third application a Grand *Third Order* Effectiveness factor of .55, and the fourth application a Grand *Fourth Order* Effectiveness of .10.

Finally, we would apply logic identical to that used in Example I to the effectiveness vector, $\mathbf{v_{AB}}$ = (.58, .145, .5725, .10), which represents the Grand *First*, Grand *Second*, Grand *Third*, and Grand *Fourth Order* effectiveness factors of rule A and rule B joined together and considered as a single entity. This would yield an $Overall_i$ Effectiveness Factor ≅ .8620. A series of steps analogous to those described in the last paragraph of Example I would now be carried out on .8620, the $Overall_i$ Effectiveness, to find the $Overall_i$ Cost-Effectiveness of the set consisting of the rules A and B.

The reader may have noticed the *recursive* nature of the computation performed in these two examples. The Procedure and computer software employed for the computations has been designed to exploit this *recursiveness*, rendering the entire process much more tractable.

PRAAM Oil Spill Sources

The history of oil spills in U.S. navigable waters and the Exclusive Economic Zone (EEZ) is recorded in the USCG Oil and Hazardous Substance Spill Database. An extract[10] of that database in the form of yearly total number of spills and total gallons spilled for the database period 1973 - 1995 was prepared specifically for this PRA. The yearly spill events were aggregated into the four major sources of spills. Figure C-4 displays these four spill sources. Spills that occur as a result of an event (e.g., grounding or collision) while the vessel is underway were allocated to the first two sources. Spills that originate on either type of vessel while involved in lightering were allocated to lightering operations, and spills that occur on either type of vessel while that vessel was tied to the dock or pier (or other loading/unloading MTR facility) were allocated to facilities.

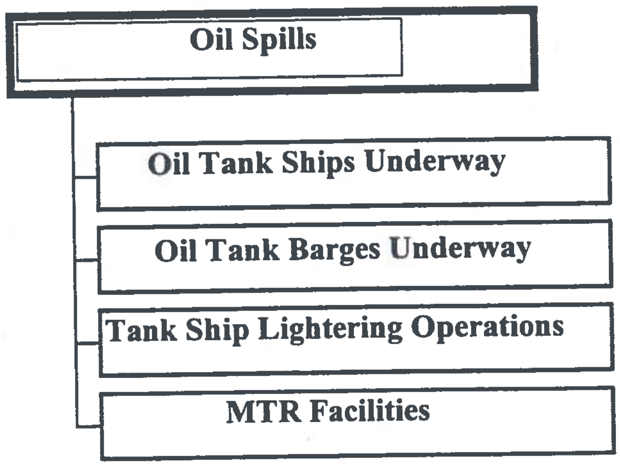

FIGURE E-4: OIL SPILL SOURCES

The Volpe Center prepared the initial set of oil spillage history and baseline forecasts and submitted them for review and validation by a panel of five experts (expert panel A which met November 1996). To forecast the oil quantities to be transported between 1996 and 2025, average annual rates of growth were applied to a 1996 value. Expert panel A gave a low average growth rate of 1 percent per year 1996 - 2015 to the total tons transported per year, but expert panel A expressed considerable uncertainty about any forecast beyond the year 2015. Therefore, it recommended that this growth be terminated at 2015 (i.e., zero growth beyond 2015). This is the PRA "Reference Case". The total yearly spillage for the 4 oil spill sources for 1996 - 2015 was also assumed to grow; the actual yearly growth rate for this spillage total, however, will not be 1.3 percent because of the different growth rates of the 4 oil spill sources.

Total tons of bulk oil transport reported in 1993, 1994, and 1995 were distributed approximately 72 percent and 28 percent respectively between Tank Ships and Tank Barges, respectively. This distribution was assumed constant for the historical period 1981-1990 for the purpose of estimating average spill rates. Expert panel A recommended that all future growth in U.S. oil transport be assigned to Tank Ships, holding constant the total annual transport quantity in Tank Barges between 1996 and 2025. The reason for this recommendation was that Tank Barge transport has been dominated by domestic movements of petroleum products, and the panel's

[10] Dr. Robert Brulle prepared a special extract of the USCG database for the Volpe Center.

opinion is that future growth in U.S. petroleum product consumption will be supplied by offshore refineries and transported in U.S. waters by tankers rather than barges.

This restriction on Tank Barge growth resulted in an average growth rate of slightly greater than 1 percent per year for Tank Ships (1.3 percent) 1996-2015. During sensitivity analysis an alternative case employing a high average growth rate of 3 percent per year 1996-2025 was also examined.[11]

[11] See the Programmatic Regulatory Assessment, Part 2 – Cost Effectiveness of Selected Regulations, pages 2-1 to 2-3, especially Figure 2-2.