Regional Citizens' Advisory Council

Review of Oil Spill Responses on Moderately-Sized Spills in US Waters from 1993-2000

Report for

PRINCE WILLIAM SOUND
REGIONAL CITIZENS' ADVISORY COUNCIL

by
Elise DeCola

nuka RESEARCH & PLANNING GROUP, LLC.

P.O. Box 175, Seldovia, Alaska 99663
www.nukaresearch.com

Introduction

PWSRCAC posed 4 research questions comparing the efficacy of dispersant use and mechanical response for nearshore oil spills in US waters.

1. Conduct a review of nearshore oil spill responses on moderately sized oil spills (500 to 4,000 barrels) in the United States since 1993.
2. The review shall categorize responses by type: mechanical, dispersants, in situ burning, or a combination of the responses on any one spill.
3. The review shall include the best estimate of efficiency for each of the responses used on each specific spill. For example, what percentage of the oil was removed using mechanical means only, what percentage of the oil was dispersed into the water column using chemical dispersants, etc.
4. The review shall also note the offshore responses in the United States since 1993, including a characterization of the response options, but not the detailed efficacy analysis.

This document addresses those questions, with some variations based on the limitations of the data set used for statistical and qualitative analysis.

Methodology

The following analysis was performed using the oil spill database maintained by the *Oil Spill Intelligence Report* (OSIR).[1] This data set is constrained by several factors, which should be noted in interpreting the statistics generated herein.

- The OSIR database is only complete through 2001, and spill data recorded from 2000 on is incomplete due to problems with data collection.
- The OSIR database contains uneven qualitative data – narrative explanations are provided for some but not all spills listed in the database.
- The OSIR database uses the figure "zero" as a placeholder, therefore it is not possible to distinguish whether data recorded as zero in fact reflects a value of zero (as in no oil recovered) or whether it reflects a lack of information (no data available regarding recovery amount).
- The OSIR database is most complete for U.S. spills as compared to spills occurring in other countries, however the data set is still subject to human error and omission.

Therefore, the analysis presented herein should only be considered as illustrating broad trends, and not as definitive statistical analysis.[2]

[1] DeCola, "International Oil Spill Statistics: 2000," Cutter Information Corporation, 2001.

Nearshore Response Statistics for Moderate-Sized US Spills, 1993-2000

The OSIR database was reviewed & spills that met the following criteria were isolated for analysis:

- Marine spill that occurred between 1993-2000,
- Spill amounts of between 20,000 and 200,000 gallons (476.2 and 4,761 barrels) inclusive,
- Mechanical recovery (including both manual and mechanical response methods) and/or chemical dispersants used,
- Known (recorded) recovery amounts.

This yielded a data set of 53 spills. By further limiting the criteria to include only spills in US waters, the data set was reduced to 36 spills. Of the 36 spills, at least 2 occurred in offshore, rather than nearshore waters. However, at least one of those spills is reported to have included a nearshore response component, so all of the 36 spills were included in the initial data set.

A summary of the 36-spill data set is presented in Table 1, sorted according to the percentage of oil recovered. It is important to note that this analysis considers only those spills for which recovery amounts were known (i.e. recorded as greater than zero in the OSIR database). Because the database does not distinguish whether a zero recovery value meant that recovery rates were zero or whether no recovery amounts were known, this analysis may effectively overstate recovery methods. In other words, because we are only looking at spills for which a recovery amount was recorded, we are automatically dismissing all spills where no recovery at all occurred. While this may lead to an underreporting of mechanical (and dispersant) spill responses that were totally ineffective, it does not bias the efficacy estimates for spills where a recovery rate of 1% or greater was recorded.

Data Analysis

Of the 36 spills considered for this analysis, the OSIR database provided no information regarding the type of response used for 10 of them. Those 10 spills included four spills that were reported to have had 100% recovery. To compare efficacy rates for mechanical vs. dispersant use, only the 26 spills for which response type was known were considered. Table 2 lists the 26 spills in this data set.

[2] To conduct a more definitive study, data from other sources, such as the US Coast Guard/Bureau of Transportation Statistics Marine Casualty and Pollution Database or the US oil spill database maintained by Environmental Research Consulting, could be queried.

Of the 26 spills considered, mechanical response alone was used in 24 of the responses. For the remaining 2 spills, a combination of response methods was used. Dispersants alone were not used in any of the spill responses. See Figure 1.

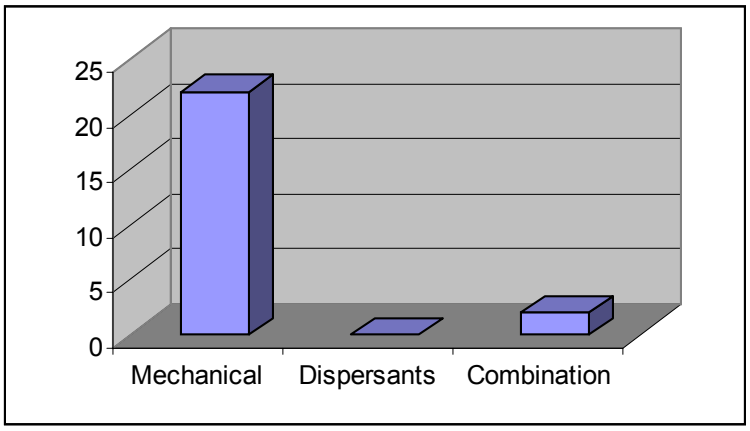

Fig. 1: Type of response used for 26 moderate-sized US oil spills, 1993-2000.

Of the 24 spills where mechanical recovery alone was used, recovery efficacy ranged from 2% to 97%. As shown in Figure 2, the majority of spills where mechanical recovery was used had an estimated recovery rate of 50 to 59%.

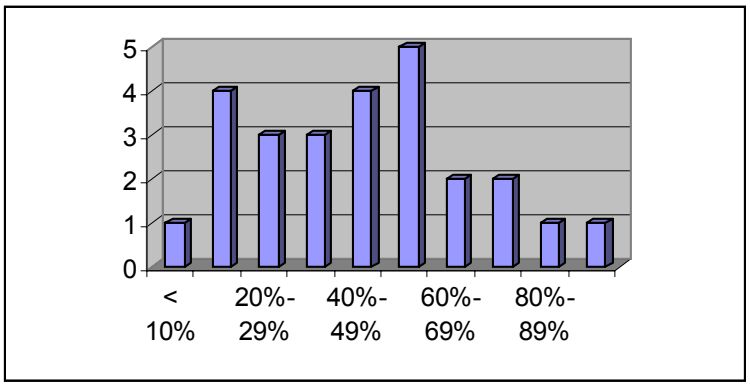

Figure 2. Estimate recovery efficacy for 24 moderately-sized US oil spills where mechanical response alone was used.

For the two spills where a combination of mechanical response and dispersants were used, recovery rates were estimated at 34% in one instance and 78% in the other. One of these spills was a 90,000-gallon spill to land and coastal waters from an underground pipeline in Texas where heavy rains made mechanical response methods ineffective. Detergent sprays were used on oiled vegetation and test burns were conducted. The second, where a 78% recovery was estimated, was the *Julie N.* spill in Portland, Maine in 1996.

The *Julie N.* spill is characterized in the OSIR database as a combination spill response, but in actuality, the recovery amount (78%) is attributed solely to mechanical recovery. The chemical agent used in the *Julie N.* was the surface-washing agent COREXIT 9580,

and therefore did not contribute to the total oil recovery amount. The *Julie N.* is often cited as an exceptional or unusual case for mechanical recovery, however based on the small sample presented here, that characterization might be false. For example, a recently published comparative analysis of advances in response technologies since the *Exxon Valdez* oil spill states that 10-30% effectiveness for mechanical recovery "can often be realized, with levels of 50% or greater being reached *on occasion* [emphasis added]."[3] However, Figure 2 shows that in fact 5 of the 24 spills examined yielded mechanical recovery effectiveness of between 50 and 59%, more than any other effectiveness range. In fact, mechanical recovery rates of 30% or greater were recorded for 19 of the 24 spills examined. The 10-29% recovery rate cited by Etkin and Tebeau accounted for only 5 of the 24 spills sampled here (20% of the total number of spills). The vast majority of mechanical response spills in the OSIR database sample (80%) had recovery rates of 30% or greater.

Conclusions

Statistical analyses play a tenuous role in any policy arena. Certainly, statistical data alone should not be considered a basis for major oil spill response policy decisions. As stated previously, this analysis is not intended as a definitive study on oil spill response efficacy rates. However, the data set sampled clearly illustrates that the actual mechanical recovery amounts recorded for spills to US waters during the mid to late 1990s tend to exceed the 10% to 30% efficacy range often cited by oil spill planning professionals.

The fact that this analysis excludes all spills with "zero" recovery amounts may be cited as reason to discount this analysis as inflated or untrue. To be clear, the mechanical recovery statistics cited herein are not presented as median or average values. The first column in the graph in Figure 2, which identifies the number of spills where mechanical recovery rates were less than 10%, is probably artificially low. However, the remaining values in that figure speak volumes in terms of the actual recovery rates that can and have been achieved using mechanical recovery in US waters.

Finally, because the data set contains no spill responses where dispersants alone were used, this analysis does not draw any conclusions regarding dispersant effectiveness values.

References Cited

DeCola, 2001. International Oil Spill Statistics: 2000. Cutter Information Corp., Arlington, MA. 59 pp.

Etkin, D.S. and P. Tebeau. 2003. Assessing progress and benefits of oil spill response technology development since *Exxon Valdez*. *Proceedings of the International Oil Spill Conference*. pp 1-8.

[3] Etkin and Tebeau, "Assessing Progress and Benefits of Oil Spill Response Technology Development since Exxon Valdez," *Proceedings of the International Oil Spill Conference,* 2003.

Table 1: Summary of 36 US Oil Spills with Known Recovery Amounts: 1993-2000

DATE	Spill Source	Location	Amount Spilled (gallons)	Amount Recovered (gallons)	Percent Recovered	Response Type	Cleanup Explanation
5/31/1994	storage tank	United States; Iliuliuk Bay, Alaska	55000	55000	100.00%	Unknown	
1/23/1995	storage tank	Houston Shipping Channel, Deer Park port, Harris County, Texas	42000	42000	100.00%	Unknown	
10/25/1995	storage tank	Kill Van Kull, Bayonne, New Jersey	23000	23000	100.00%	Unknown	
4/30/1993	vessel moored at facility	US Virgin Islands; Lime Tree Bay	21000	21000	100.00%	Unknown	
1/26/1994	storage tank	Chesapeake Bay, Edgemere, Maryland	38000	37000	97.37%	Unknown	
5/5/1994	tanker (double bottom)	Texas City Harbor port, Galveston County, Texas	36000	35000	97.22%	Mechanical	Responders used several km of containment boom.
3/14/1995	vessel	Pacific Ocean, Long Beach, Los Angeles County, California	29000	28000	96.55%	Unknown	
9/6/1996	freight vessel	Chesapeake Bay, Baltimore, Baltimore County, Maryland	39000	36000	92.31%	Unknown	
8/14/1995	tug vessel	United States; Atlantic Ocean, Jacksonville, Duval County, Florida	35000	30000	85.71%	Unknown	
5/14/1996	8-inch aboveground pipeline	Pearl Harbor, Oahu Island, Honolulu County, Hawaii	41000	35000	85.37%	Mechanical	Skimming operations.
3/11/1996	tugboat	Mobile Bay, Mobile, Alabama	24000	20000	83.33%	Unknown	
9/27/1996	tanker	Fore River, Portland, Maine	180000	141000	78.33%	Combination	Vessel and areas along river boomed with 183 m offshore boom and 1,400 m intertidal boom; skimming operations with 4 shallow-water barges w/GT 185 skimmers, Aard Vac skimmer. High-pressure, hot-water washing on shoreline; tested Corexit 9580 for oiled vegetation.
1/29/1996	pipeline	Fore River, South Portland, Cumberland County, Maine	20500	15450	75.37%	Mechanical	Sorbent boom placed at storm drain outfall; dug recovery trench to intercept underground plume of gasoline.
10/23/1994	storage tank	Houston Ship Channel, Kingwood port, Texas	116000	78000	67.24%	Mechanical	75,000 gallons crude oil, 100 gallons No. 2 fuel, 2,000 gallons jet fuel, and 500 gallons gasoline recovered.
5/15/1997	barge	Arthur Kill Waterway, near Carteret Port, Middlesex County, New Jersey	50000	32000	64.00%	Mechanical	Barge was pre-boomed prior to transfer; majority of spill contained.
2/5/1995	tanker	105 km southeast of Houston Ship Channel in the Gulf of Mexico	37000	22000	59.46%	Mechanical	Responders deployed 732 m of ocean boom around the vessel. Inclement weather prevented further cleanup until 6 February. Response vessels then began skimming operations and continued until 8 February, when overflights revealed no sheen. The USCG reported that 22,000 gallons of fuel were recovered as of 28 March 1995.
1/12/1999	barge	Gulf of Mexico, Port LaFourchon, LaFourche Parish, Louisiana	51400	29400	57.20%	Mechanical	Five Marco skimmers and three vacuum trucks used by 73 workers.

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6/27/1998	barge	Lower Mississippi River (mile 179.5), Donaldson, Ascension Parish, Louisiana	154700	80000	51.71%	Mechanical	Skimmers used to recover oil as it leaked from barge (recovered 38,000 gallons oil/water); 40 vessels, 12 skimmers, 6 km containment boom.
5/9/1996	tanker	Big Stone Anchorage, Delaware Bay, Milford, Delaware	40000	20000	50.00%	Mechanical	Response vessels removed slugs of oil from water; manual shoreline cleanup; offshore skimming.
11/6/1993	67-meter barge	Gulf Intracoastal Waterway Mile 167, near Intracoastal City, Louisiana	20000	10000	50.00%	Mechanical	Responders recovered approx. 23,000 gallons of oil/water mixture and 34 cubic meters of oiled debris from shoreline.
5/26/1996	barge	Houston Ship Channel, 4.8 km south of Bayport Shipping Channel, Galveston, Texas	42000	20000	47.62%	Mechanical	4,880 meters of boom to protect sensititive areas; nine skimming vessels for oil recovery.
4/22/1997	oil production barge	Murphy Lake, Bayou Pigion Landing, Louisiana	21000	9400	44.76%	Mechanical	9,400 gallons oil, 160 cubic yards of debris/sorbents recovred; 900 feet of boom installed.
3/18/1996	barge	Houston Ship Channel off Galveston, Texas	189000	84000	44.44%	Mechanical	Nearshore and offshore skimming; protective booming.
10/11/1995	barge	Lower Mississippi River; New Orleans port, Louisiana	193200	84000	43.48%	Mechanical	Oil sank. Difficult to locate underwater. O'Brien's Oil Pollution Service and Industrial Cleanup Inc. responded, lowering submersible pumps, shot chains with sorbents.
1/29/1999	barge	Alternate Intracoastal Waterway, Bayou Sorrel, Louisiana	64000	25000	39.06%	Mechanical	No attempt to collect or contain product (evaporated). Air monitoring conducted.
10/19/1999	storage tank	Caribbean Sea, Ensenada Honda Harbor, Cierba, Puerto Rico	112000	42000	37.50%	Mechanical	Mechanical containment and recovery.
10/8/1994	10-inch underground pipeline	east of Portland, San Patricio County, Texas	90000	31000	34.44%	Combination	Responders used skimmers, boom, and vacuum trucks to remove oil, although heavy rains made boom ineffective. Detergent sprays were used on oiled vegetation. Test burns were conducted at three sites on 21 and 22 October and determined to be effective in selected areas.
6/1/1997	facility heat treater	Paradis, Louisiana	126000	37000	29.37%	Mechanical	Responders used vacuum trucks to remove oil from berm, and vacuum trucks, sorbents, and boom to remove oil from marsh.
11/26/1997	frozen-figh freighter	Bering Sea, Constantine Bay, Unalaska Island, Alaska	47000	13600	28.94%	Mechanical	Bad weather during response. Oil recovered manually and with backhoes. Two coves boomed to protect salmon runs. Oil locked under ice. More oil collected after thaw.
12/22/1994	barge	Lower Mississippi River, Chalmette, Louisiana	38000	10000	26.32%	Unknown	
11/24/1999	20-inch pipeline	Gulf of Mexico, Grande Isle, Jefferson Parish, Louisiana	35700	7980	22.35%	Mechanical	skimming vessels and booms deployed; birds hazed with noisemakers to keep away from islands
12/31/1994	barge (4.3 million gallon capacity)	Puget Sound near Jack Island/Anacortes, Washington	26000	4200	16.15%	Mechanical	Crowley Marine Services recovered 4,200 gallons by skimming.
5/23/1999	tug vessel	Lower Mississippi River, St. Francisville, West Feliciana Parish, Louisiana	90000	12000	13.33%	Mechanical	2,000 m boom deployed. 30 personnel used 2 Marco skimmers and 4 drum skimmers.
2/22/1998	underground pipeline	San Juan Harbor, Catano, Puerto Rico	84000	10000	11.90%	Mechanical	Crews contained the oil around the dock with booms; used sorbent pads and vacuum trucks to recover oil.
5/19/1993	tanker	St. John's River, Jacksonville, Duval County, Florida	33600	4000	11.90%	Mechanical	Responders used containment boom, sorbent pads, shovels, rakes, and pumps.
9/28/1998	tanker	Pacific Ocean, south of San Francisco, California	51450	1292	2.51%	Mechanical	2 offshore skimming vessels from Clean Bay Cooperative, and workers picking up tarballs on beaches

Figure 2: Summary of 36 US Oil Spills with Known Recovery Amounts and Known Response Types: 1993-2000

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