

Report on the Non-Mechanical Response for the T/V Exxon Valdez Oil Spill

Submitted for the Oil Spill Prevention and Response Committee (OSPR)
of the Prince William Sound Regional Citizens' Advisory Council

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Executive Summary

The objective of this paper is to outline the non-mechanical response to the T/V Exxon Valdez grounding and subsequent oil spill. The author consulted state and federal documents, as well as conducted personal interviews to compile the facts surrounding non-mechanical response to the T/V Exxon Valdez. Three weeks before the grounding of the T/V Exxon Valdez, the Alaska Regional Response Team (ARRT) had approved the use of dispersants as part of its Prince William Sound-specific oil dispersant guidelines in their Regional Contingency Plan. Within hours of the spill, the United States Coast Guard (USCG) discussed their possible use with Alyeska. A trial run performed on the first day of the spill was determined to be ineffective. The effectiveness of two subsequent drops was inconclusive because of poor light and mechanical problems. The fourth drop had increased wave action that theoretically could have helped mix the dispersant. Increased winds hampered the fifth and sixth drops, and it was determined that the window for effectiveness had closed. The remaining four experimental applications in Blying Sound on April 2 and April 13 off Seward were ineffective due to the emulsification of the oil. One in situ burn was conducted on the second day of the spill and an estimated fifteen thousand gallons of crude oil were ignited and burned with high efficiency. Efforts to ignite another slick on March 25 proved futile because of the emulsion of the oil, and the strategy was abandoned.

Purpose

The objective of this paper is to outline the non-mechanical response to the T/V Exxon Valdez grounding and subsequent oil spill. The paper includes a description of the contingency plan structure, a description of the Oil Dispersants Guidelines for Alaska, the decision-making processes between the federal and state agencies, and a detailed description of all the dispersant applications performed during the spill.

National Contingency Plan Overview

The National Oil and Hazardous Substances Pollution Contingency Plan, or more commonly called the National Contingency Plan (NCP), is the federal government's blueprint for responding to both oil spills and hazardous substance releases. The NCP was originally developed and published in 1968 in response to a massive oil spill from the oil tanker Torrey Canyon off the coast of England the year before. To avoid the problems faced by responders to that incident, U.S. officials developed a coordinated approach to cope with potential spills in U.S. waters that resulted in a national response capability and promoted overall coordination among responders and contingency plans. The 1968 plan provided the first comprehensive system of accident reporting, spill containment and cleanup, and established regional response teams (EPA; <http://www.epa.gov/oilspill/ncpover.htm>).

Regional Contingency Plan

Since the NCP required federal regional plans for each standard federal region, the Alaska Regional Response Team (ARRT), mandated by the NCP, developed the Alaska Region Oil and Hazardous Substances Pollution Contingency Plan, or more commonly known as the Regional Contingency Plan (RCP). The purpose of the regional plan was to provide for a coordinated and integrated federal and state agency response in Alaska at the ARRT level. At the same time, this provided the pre-designated On-Scene Coordinator (OSC) with guidance and assistance for preparing local contingency plans and responding effectively to pollution incidents. The Environmental Protection Agency (EPA) provided OSCs for oil discharges and hazardous substances released into the inland zone, while the United States Coast Guard (USCG) provided OSCs for oil discharges or hazardous substances into the coastal zone (Regional Contingency Plan, pg 300-1.)

Oil Dispersant Guidelines for Alaska

Dispersant use had been addressed in the "Oil Dispersant Guidelines for Alaska," developed by the ARRT in 1986 and found in the RCP. As authorized by the NCP, the OSC may use dispersants in response to a spill that endangers human life, or to prevent or reduce hazard to human life. These guidelines were also designed to streamline and expedite the decision-making process and allow the timely and effective use of dispersants as an oil spill response tool to minimize environmental effects in marine waters of Alaska. The OSC, with the concurrence of the EPA representative to the ARRT and the State of Alaska, may use those dispersants on the EPA acceptance list to mitigate the effects of the spilled oil. In any case, the OSC must examine conventional response alternatives for comparison to dispersant application. Dispersant use would be considered only when an effective conventional response is not feasible (Oil Dispersant Guidelines for Alaska, 1986; pg 4).

Prince William Sound-Specific Guidelines

The ARRT had finished developing the Prince William Sound-specific dispersant guidelines in March 1989 as part of the Oil Dispersant Guidelines for Alaska found in the RCP. The ARRT first approved guidelines for Cook Inlet in 1986 with a later effort to look at Prince William Sound and the Beaufort Sea. The ARRT approved guidelines on March 1, 1989, specific for Prince William Sound, three weeks before the grounding of the T/V Exxon Valdez.

The guidelines divided the Sound into three areas for purposes of dispersant application. Within “Zone 1,” the ARRT had pre-approved dispersant use at the Federal On Scene Coordinator’s (FOSC) discretion. The guidelines state that dispersant use should be evaluated after consideration of mechanical means and if it is in areas far enough away from sensitive resources that dispersants operations would not cause disturbances. “Zone 2” was considered more biologically sensitive and needed concurrence from the EPA and Alaska Department of Environmental Conservation (ADEC) before authorizing dispersant use. In “Zone 3,” dispersant use was not recommended, but could be approved by the FOSC on a case-by-case basis after consulting with the ARRT and securing the approval of both the EPA and ADEC. Zone 3 was generally closest to mainland. (See Figure 1 and Appendix A for more detail.) (“Oil Dispersant Guidelines for Alaska, 1986 and USCG, pg. 40).

The ARRT, which includes EPA and ADEC, recognized the role of dispersants as a potential defensive measure against spill damage, but state and federal agencies encouraged caution because dispersants were potentially harmful. It was also recognized that dispersants are not 100 percent effective. Field tests of dispersants up to the time of the spill didn’t produce scientific consensus of the effectiveness of the various applications. So prudence and discretion were used in dispersant use during the T/V Exxon Valdez spill (ADEC, pg. 59) resulting in nine initial trial runs and one final test on emulsified oil.

Dispersant Applications

Friday; March 24, 1989

The T/V Exxon Valdez ran aground on Bligh Reef at 0004 on Friday morning, March 24, 1989. Bligh Reef was located in a dispersant Zone 2. As the oil slick moved southwest from the stranded vessel, it moved into a dispersant Zone 1. At 0630 on March 24 (6 hours and 26 minutes after the grounding), Commander Steve McCall, the USCG Federal OSC for Prince William Sound, contacted Alyeska to request that they initiate a request to the ARRT for dispersant use. At 0842, Alyeska Pipeline Service Company formally made a request to the ARRT to use dispersants. The FOSC convened a conference at noon to discuss dispersant use and in-situ burning with the ARRT as required by the NCP. Following the conference at 1510, the FOSC granted permission for a dispersant “test” on the leading edge of the slick – now in a Zone 1 area (USCG, pg. 40).

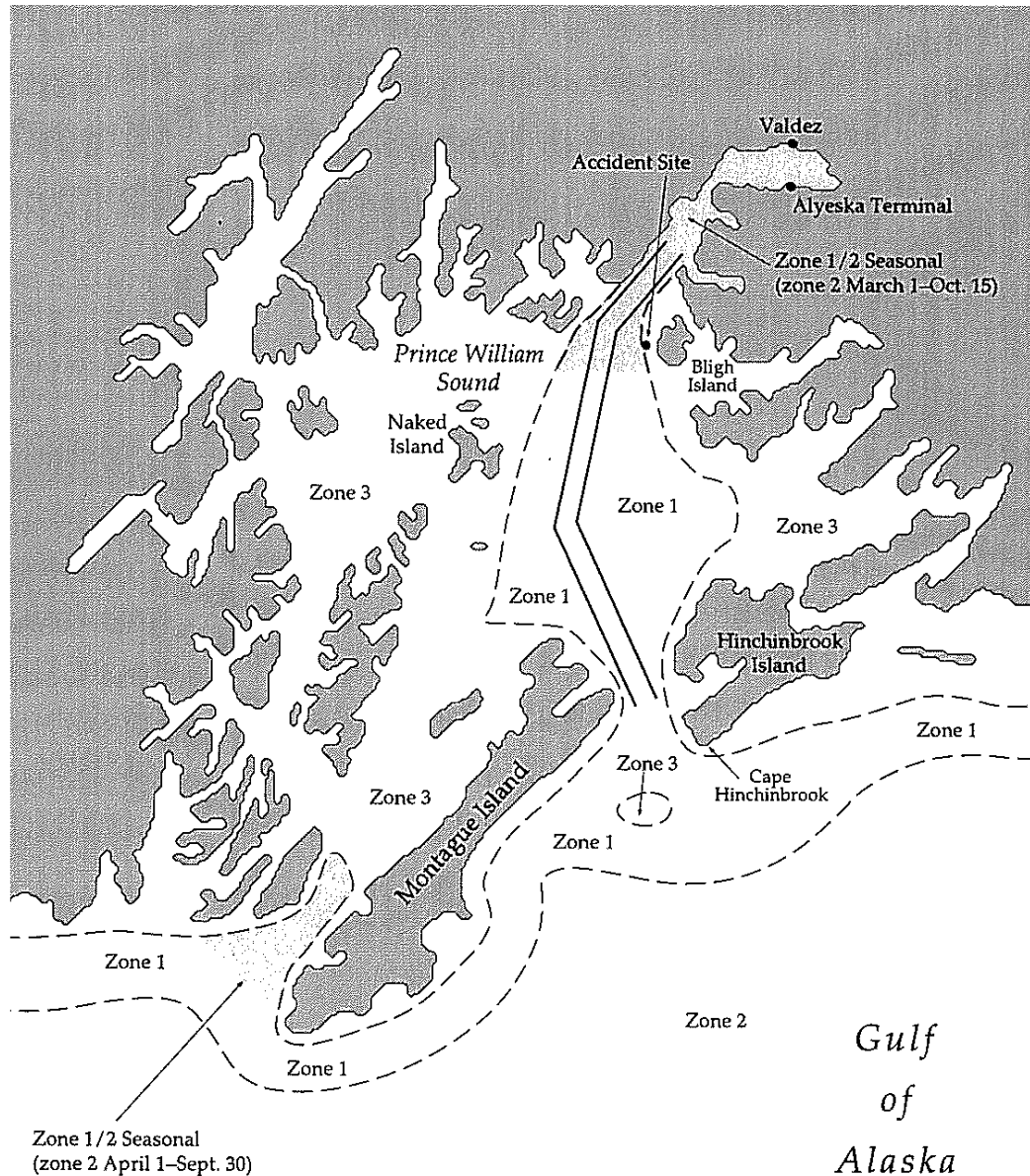


Figure 1. Dispersant Zones in Prince William Sound, and the Gulf of Alaska

Alyeska made the decision that dispersant operations be staged in Anchorage due to the frequency of weather problems at the Valdez airport. Alyeska had about 320 barrels (17,600 gallons) of Corexit 9527 dispersant available in Cook Inlet and another 10 barrels (550 gallons) on the North Slope, which made up most of the dispersants available in Alaska besides the stockpile in Valdez (Alyeska Oil Spill C-plan; VMT plan). There was some discrepancy as to the number of barrels of dispersant kept at the Valdez Marine Terminal (VMT). According to Alyeska's c-plan, they had approximately 50 barrels (2,675 gallons) at the terminal, but according to McCall's understanding, there were 69 barrels of dispersant available at the terminal. The Alaska Oil Spill Commission stated that Alyeska had "less than 4,000 gallons [approximately 72 barrels] of dispersant at the terminal." (USCG; pg 40).

Also listed in the VMT c-plan was approximately 462 barrels (about 25,000 gallons) that were five to six days away on the West Coast (Alyeska Oil Spill C-plan; VMT plan).

When the dispersant equipment was called to use, minor repairs had to be made to the dispersant spray arms delaying the time of application. By 1700, approximately 300 gallons of Corexit 9527 were loaded into a helicopter spray bucket (McCall, 2006). A second helicopter contained the FOSC and an Alyeska observer while state authorities circled nearby in a fixed-wing aircraft. The test was performed south of Bligh Island, about halfway between Bligh and Naked Islands. Several spray passes were made, and the 300-gallon-bucket appeared to function without problems. The test was conducted at 1800, a time later judged to have been less than ideal because seas were calm and little mixing of dispersants seemed to have taken place. Moreover, cloudy skies and fading light made it difficult to view the effect of dispersant chemicals upon the oil. The results were declared inconclusive (USCG, 40-41). Some observers noted that the application was ineffective and that the dispersant largely herded the oil (McCall 1989, 2003).

The FOSC later observed that the long delay (16 hours) leading up to the first test may have handicapped its chances for success. Commander McCall noted that: “Many documented tests...have occurred within approximately five hours after the initial release of oil. After that time the viscosity of the oil increases and dispersant effectiveness is reduced.” However, dispersant use was still considered an option based on the quantity and thickness of the slick, the forecasted increased winds and sea state, and the fact that mechanical skimming operations were not recovering much oil (McCall, 2006). Commander McCall also noted in his report that according to his calculations it would have taken 500,000 gallons of dispersant to treat 250,000 barrels of oil released (USCG, pgs. 41-42), far more dispersant than Alyeska and Exxon had available according to Alyeska’s C-plan.

Saturday; March 25, 1989

On Saturday, 397 drums (about 22,000 gallons) of dispersant were available, and Exxon’s Frank Iarossi declared that, “Exxon was ready to begin full-scale application of aerial dispersants.” Exxon had assumed the role of responsible party from Alyeska late on the 24th. Another 471 drums of dispersant were expected to arrive on Sunday, March 26, and Exxon reported that additional deliveries could be made on a daily basis. The total supply available at this point was still only about 10 percent of the quantity Commander McCall pointed out would have been necessary to treat the entire slick. Alyeska also dispatched a C-130 cargo aircraft to Phoenix, Arizona to obtain an Airborne Dispersant Delivery System Pack for high volume application of Corexit 9527 (USCG, pg. 42). The ARRT met at 0945 on Saturday to discuss response options. Conditions remained relatively calm which meant the natural dispersion process was not significant. At 1800, the second test application occurred with a C-130 with a 2,500 gallon payload. Exxon regarded the test “successful,” but the FOSC was not yet convinced, noting that more testing would be necessary. Poor light contributed to the uncertainties about test results. An unidentified USCG strike team member, along with an ADEC observer, suggested that the application of dispersants had perhaps missed the oil slick (USCG, pg. 42).

Sunday; March 26, 1989

On Sunday, March 26, dispersant testing continued. A late morning drop of 3,500 gallons of dispersant from a DC-6 aircraft was declared unsatisfactory according to the FOSC report. This time the dispersant spray nozzles failed to deliver an even spray pattern which is needed for dispersants to work effectively. What was needed, according to Exxon's contracted dispersants expert, was another test. Another trial run was authorized by the FOSC, and at mid-afternoon the C-130 that had been used in the previous day's tests took off for a 5,500-gallon application. This time some observers felt that results were more encouraging as oil seemed to be dispersing into the water column as light wave action was helping to mix the chemicals into the oil slick, according to Exxon. Others felt that only herding was observed (McCall, 1989). Spill managers declared that on Monday, March 27, they would continue application of dispersants. However, the winds that had been helpful earlier in the day increased, and an overnight storm in Prince William Sound caused significant changes in both plans and conditions in the response area (USCG, pgs. 42-43).

Monday; March 27, 1989

The weather conditions worsened on Monday, March 27, with gusts to 70 knots. The oil slick spread out approximately 20 miles during the night, and morning over-flight reports revealed that there had been heavy shoreline impact on Eleanor and Knight Islands. Dispersant application and skimming operations were suspended. As oil was churned by storm action, it continued to emulsify, becoming increasingly resistant to chemical-induced breakdown (USCG, pg. 43).

A C-130 mission to drop dispersants was authorized on a one-time basis into a Zone 3 area near Knight Island for Monday afternoon. After several problems and delays, the most significant of which was failure of the C-130 to arrive at the designated target location, the drop was canceled. In the meantime, two helicopter pilots working for the State of Alaska reported that they had sighted a drop of dispersants taking place at 1500 at a location four miles east of Naked Island. The Naked Island area drop, which had not been authorized by the FOSC, the ARRT, the EPA, or the ADEC, was later confirmed to have taken place through contact with Exxon's contractor (USCG, pg. 43). The amount of dispersants applied was about 5,500 gallons (ADEC, pg. 61).

Tuesday; March 28, 1989

On Tuesday, March 28, Exxon asked for permission to employ dispersants in a Zone 3 area near Eleanor Island. The ARRT declined its approval, declaring that "dispersants were not appropriate for use this Zone 3 area". Exxon then asked for permission to drop dispersants into a Zone 1 area near the T/V Exxon Valdez to disperse recently leaked oil and was given FOSC approval. Exxon later reported that the test had been highly successful, though no observers from ADEC or the FOSC had been present. Despite Exxon's optimism, the test proved not to be without flaws: (1) a portion of the dispersants had been sprayed into an unauthorized area; and (2) members of the USCG Pacific Strike Team (working on the deck of the T/V Exxon Valdez) were sprayed during the plane's discharge runs (USCG, pg. 43).

Wednesday; March 29, 1989

As stated in the FOSC report, state officials became skeptical of Exxon's dispersant application efforts. On Wednesday, March 29, the Alaska Department of Fish and Game would not support, and the ADEC would not approve, dispersant use in Zone 2 and Zone 3 until it could be definitely shown that "dispersant application...[will] be accurately targeted and effective in achieving dispersal objectives." State authorities cited the recent misapplication incidents which could have jeopardized sensitive shoreline and nearshore habitats. At the Wednesday meeting of the ARRT, it was determined that "dispersants are no longer considered feasible for use at this spill." On Thursday, March 30, Exxon declared that dispersant use was no longer considered a response option. Meanwhile, a dispersant aircraft stood by on short-notice deployment in case new releases occurred from the T/V Exxon Valdez (USCG, pg. 44).

Sunday; April 2, 1989

Additional attempts were made to use dispersants. On April 2, after the leading edge of the oil had passed Montague Strait and moved into Blying Sound, Exxon requested permission to attempt a 5,500-gallon application in an area off Point Elrington. Approval was granted by the FOSC after consulting with the ARRT (McCall, 2006). There appeared to be some success on sheens, but little effect on emulsified oil. Two more drops were authorized by the FOSC in consultation with the ARRT (McCall, 2006) during the same day with similar results. It seemed clear that most of the oil had by then formed into a water-in-oil emulsion, which resisted breakdown. The EPA declared on April 8 that further dispersant applications would "not be effective and therefore [would be] inappropriate" (USCG, pg. 45).

Monday; April 10, 1989

Exxon officials had not yet ruled out the use of dispersants. On April 10, a major new experiment was proposed. Up to 25,000 gallons of dispersants would be applied to weathered oil in Zone 1 at a rate of one part dispersant to ten parts oil (this amount was double the normal application rate). The test would involve up to five dispersant drop flights, and was intended to evaluate the ability of dispersants to break up emulsified oil in open water. For three days (April 11, 12, and 13), efforts were made to carry out these tests. During the first two days, the combination of bad weather, poor visibility, communications problems, and logistical difficulties prevented even a small drop of dispersants.

Thursday; April 13, 1989

A 5,500-gallon load of dispersant was delivered onto floating oil eight miles south of Gore Point (USCG, pg. 45). A test slick was chosen to be the target and a control slick nearby was left to act as a comparison. Six aircraft took part and consisted of a lead aircraft, a spray airplane (Hercules), a USCG helicopter for observation and three observer aircraft. The observer aircraft stayed over the site for up to four hours. The application took place in five separate dumps; one of them was applied some distance from the test slick by accident. No effect on the target slick was observed, not even a color change. This was later confirmed by samples taken from the vessel Baltic Sea; the analysis revealed no effectiveness. Interestingly, the control slick, which never had been treated, broke up by itself and was gone by the end of the observation time.

In the first nine dispersant applications, Exxon did not perform any monitoring to quantitatively measure the effectiveness of the dispersant, nor was there any requirement to monitor. Visual monitoring was required within the federal and state agencies. In the test near Gore Point, Exxon arranged for water sampling from the vessel Baltic Sea. The samples taken under the slick were later tested for hydrocarbons (Fingas and Ka'aihue, 2004), but no significant oil was found in the samples.

In-Situ Burning Application

Friday, March 24, 1989

Alyeska was notified late Friday morning, March 24, that the Cook Inlet Response Organization was sending burn equipment. At noon, Alyeska submitted a request to the FOSC that in situ burning be employed in the response effort. At 1500, the ARRT received Alyeska's request for a burn permit, which stated, "Pending this decision, Alyeska continues to mobilize the necessary resources for in situ burning, such as fireproof boom and ignition sources." The ARRT gave their approval for the test burn (Bergmann, 2006), and the ADEC gave the verbal go-ahead (ADEC, 56).

Saturday; March 25, 1989

On the morning of the second day, Saturday, March 25, equipment needed to conduct a burn arrived in Valdez. The only time the NCP allows the OSC to independently authorize the use of in situ burning or other chemicals is if the OSC feels human life is endangered. This was not the case with the T/V Exxon Valdez spill (USCG; pg 46).

Exxon got its equipment to the burn site late Saturday evening, and the "test" in-situ burn took place a couple miles west of Goose Island, in Prince William Sound. An estimated 15,000 gallons of crude oil were collected in a boom and ignited, and then burned for about 75 minutes. The test was regarded as very successful after flames reduced the mass to a small (about 100 square foot) mat consisting of a tar-like substance (USCG, pgs. 46-47), and represented a total volume of about 300 gallons (Allen, pg. 7). This amounted to 98% efficiency.

Sunday; March 26, 1989

On Sunday, March 26, representatives of the USCG, ADEC, and Exxon viewed a videotape of the previous night's test burn. Later in the day, the ARRT reviewed the results of the test, and those present felt encouraged. Plans were made to make further use of in situ burning, especially as a means of controlling the leading edge of the slick. On Sunday evening, Exxon had received the go-ahead for broader use of both dispersants and in-situ burning about the same time the weather intensified. The planned in-situ burn scheduled for 2100 was canceled (USCG, pg. 48) due to the March 26-27 wind storm that made further burning impracticable or impossible (ADEC, pg. 56).

Tuesday; March 28, 1989

Response planners did not abandon the in-situ burning strategy following the storm. On March 28, small craft advisories continued, and cleanup work was stalled. At mid-morning, Exxon requested a permit for in-situ burning to be conducted in the vicinity of Eleanor Island, an area about 15 miles southwest of Bligh Reef. A burn permit was issued with the

provision that the burn be conducted during daylight hours only. The ARRT declared that it would permit burning if sufficient oil concentrations could be located and the fireproof burn boom could be transported to the site. The oil had considerably emulsified and contained about 80 percent water. Efforts to ignite this emulsion proved futile, and Exxon abandoned the strategy with little more than one promising test burn. The FOSC and the ARRT agreed that further burning would be futile since too much water was in the oil to ignite and sustain a burn, and Exxon agreed with that conclusion.

Friday; March 31, 1989

On Friday, one week after the spill, Exxon declared that burning was no longer an option for removing oil from the water (McCall, 2006 and FOSC, pg. 48).

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Appendix A

General Alaska Dispersant Use Criteria

The dispersant use criteria developed for Alaska classify coastal waters into three dispersant use zones. In all cases, the use of dispersants will be based on the determination that the impact of dispersants or dispersed oil will be less harmful than non-dispersed oil. These zones are defined by: 1) physical parameters such as bathymetry and currents; 2) biological parameters such as sensitive habitats or fish and wildlife concentration areas; 3) nearshore human use activities; and 4) time required to respond.

Zone 1

The use of dispersants in Zone 1 is acceptable and should be evaluated after consideration of mechanical means as a response tool to mitigate oil-spill impacts. The OSC is not required to acquire approval from EPA or the State of Alaska prior to use of dispersants in this zone. However, the OSC will notify the EPA and the State of the decision as soon as practicable.

Zone 1 is defined as an area in which dispersant use should be considered as a means to prevent or reduce the amount of oil reaching the shoreline or other sensitive resources, including:

- a. endangered or threatened species protected by Federal and State governments;
- b. nesting, spawning, breeding, and nursery areas for mammals, birds, fish, and shellfish;
- c. fish and wildlife concentration areas where these animals feed, rest, or migrate;
- d. sensitive marine habitats, including:
 - seagrass beds
 - kelp beds
 - shellfish beds
 - tidal flats
 - marshes
 - shallow subtidal areas
 - low energy bays and harbors
 - rocky intertidal areas;
- e. aquaculture and commercial areas which are shallow enough to allow impacts from oil spills; and
- f. recreational and industrial areas.

Zone 1 areas are characterized by water conditions (depth, distance, and currents) that will allow dispersed oil to be rapidly diluted to low concentrations, and are far enough away from sensitive resources that dispersant operations would not cause disturbances. In this zone, there is a significant likelihood that spilled oil will impact sensitive resources, and an immediate response is required in order to mitigate environmental consequences.

Zone 2

The use of dispersants is conditional in Zone 2 in order to protect sensitive wildlife and other resources. The Federal OSC is required to consult with the RRT and obtain approval of the EPA and the State of Alaska prior to the use of dispersants in Zone 2. A spill in Zone 2 must be continuously monitored and the need for dispersant-response actions reappraised accordingly.

Zone 2 areas are characterized by water conditions (depth, distance, and currents) that will allow rapid dilution of dispersed oil to low concentrations, a sufficient distance from sensitive resources that an immediate response is not necessary and dispersant operations would not cause disturbances.

Zone 3

The use of dispersants is not recommended in Zone 3. Dispersants may be used in Zone 3 if, on a case-by-case basis, it is determined that the disturbance of the organisms and/or direct exposure to dispersants or dispersed oil would be less deleterious than the impact of spilled oil. As in Zone 2, the OSC is required to consult with the RRT and obtain approval of the EPA and the State of Alaska prior to the use of dispersants in Zone 3.

Zone 3 is defined as the area immediately in or around the resources requiring protection, including the resources themselves. Dispersant use in this area may disturb resources, may not have adequate time for effectiveness, may directly expose the resources to dispersants, or may expose other resources to unacceptably high levels of dispersed oil. Examples of these resources are provided below:

- a. endangered or threatened species protected by Federal and State governments;
- b. nesting, spawning, breeding, and nursery areas for mammals, birds, fish, and shellfish;
- c. fish and wildlife concentration areas where these animals feed, rest, or migrate;
- d. sensitive marine habitats, including:
 - seagrass beds
 - kelp beds
 - shellfish beds
 - tidal flats
 - marshes
 - shallow subtidal areas
 - low energy bays and harbors
 - rocky intertidal areas;
- e. aquaculture and commercial areas which are shallow enough to allow impacts from oil spills; and
- f. recreational and industrial areas.

Appendix B

Trial	Date	Time	Location	Application of Corexit 9527	Results per FOSC
1	Friday, March 24	1800	South of Bligh Island – halfway between Bligh and Naked Is. Zone 1	Helicopter with 300 gallons	Little mixing seas were calm, herding was observed but no effectiveness
2	Saturday, March 25	2000	Zone 1	C-130 with 3500 gallon payload	Judged inconclusive; poor light
3	Sunday, March 26	Late Morning	Zone 1	DC-6 with 3500 gallons	Spray nozzles failed to deliver even spray pattern
4	Sunday, March 26	1400	Zone 1	C-130/ ADDS PAK with 5500 gallons	Exxon observers saw it as encouraging; light wave action was helping mix dispersant into slick but other observers saw herding with no effectiveness
5	Monday, March 27	1500	4 miles east of Naked Island	C-130/ADDs PAK with 5500 gallons	Unknown results: The drop was not authorized by the FOSC, EPA, or ADEC and took place through Exxon
6	Tuesday, March 28	1230	Near the T/V Exxon Valdez Zone 1	C-130 Mounted Application System	Portion of dispersant sprayed responders on the T/V Exxon Valdez no effect on oil was observed, much of dispersant appeared to land on ships
7	Sunday April 2	1300	Zone 1: Off Elrington Point in Blying Sound	C-130 with 5500 gallons	Little effect on emulsified oil; unsuccessful
8	Sunday April 2	Sometime after the 1300 spray	Zone 1: Off Elrington Point in Blying Sound	C-130 with 5500 gallons	Little effect on emulsified oil; unsuccessful
9	Sunday April 2	Sometime after the 2nd spray	Zone 1: Off Elrington Point in Blying Sound	C-130 with 5500 gallons	Little effect on emulsified oil; unsuccessful
10	Thursday, April 13	1500	Eight miles south of Gore Point	C-130 with 5500 gallons	no effect on the emulsion