Observers' Report

MMS Cold Water Dispersant Tests
Ohmsett Testing Facility
28 February – 3 March 2006

Report to

PRINCE WILLIAM SOUND
REGIONAL CITIZENS' ADVISORY COUNCIL

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Executive Summary

This report, which was prepared for the Prince William Sound Regional Citizens' Advisory Council (PWS RCAC), contains the authors' observations from four days of cold water dispersant testing at the Ohmsett facility in February-March 2006. This report provides an overview of the testing and general observations of the PWS observer team. A companion report, entitled "Analysis of Oil Spill Dispersant Effectiveness Testing at Ohmsett," provides a technical analysis of the experimental design and testing protocols.

The purpose of the tests was to repeat cold water dispersant testing that had been conducted in 2002 and 2003, in response to criticism from the National Academies of Science (NAS), the Prince William Sound Regional Citizens' Advisory Council (PWS RCAC), and others regarding some of the test parameters for these earlier cold water dispersant trials. The PWS RCAC observer team attended the tests to monitor several issues of concern, which were outlined in a letter from PWS RCAC to the MMS (Appendix B to this report): (1) heating of oil; (2) artificial weathering of oil, (3) use of booms in testing field; (4) re-surfacing of oil; (5) tank contamination; (6) use of oils which are not typically transported; (7) herding using fire hoses; and (8) uncontrollable natural factors.

The PWS RCAC observer team concluded that the test procedures adequately addressed concerns regarding heating of oil and use of booms in the testing field. The test oil matrix included both artificially weathered oil and oil that had been weathered on the tank; presumably, the investigators' report will address the differences between the two methods.

The PWS RCAC observer team noted significant resurfacing of oil following each dispersant test. Oil that resurfaces at the end of a test was not accounted for by the investigators, and no mass balance calculations were undertaken. The testing procedures continue to use fire hoses to herd remaining surface oil for collection; this was observed to have the unintended consequence of temporarily re-dispersing oil, especially during dispersant tests. Tank contamination continued to be an issue, and sheening was visible throughout the test period from the prominent oil stain around the edges of the tank.

PWS RCAC's concerns regarding the test oils were not addressed in these trials. The Alaska crude oils tested were obtained directly from the production facilities on the North Slope, rather than in Valdez at the terminus of the Trans-Alaska pipeline. Therefore, the test oils vary in composition from oil that might actually

be spilled in Prince William Sound. Because the Ohmsett facility is open to the elements, the impact of uncontrollable natural forces continues to be a concern.

In addition to these issues, the PWS RCAC noted several additional concerns regarding the experimental design and interpretation of results from these trials. These include: the inability to derive effectiveness values in the absence of mass balance calculations; the impact of residual dispersant and surfactant in the tank during the test period; the practice of spraying dispersants immediately after the oil is applied and before any appreciable slick can form; and the fact that the dispersant-to-oil ratio used in the tests was significantly higher than the 1:20 dosage recommended for use in U.S. waters.

Purpose and Scope

This report has been prepared for the Prince William Sound Regional Citizens' Advisory Council (PWS RCAC). It contains the authors' observations from four days of cold water dispersant testing at the Ohmsett facility. The testing was part of a 3-week series begun on February 28, 2006 and conducted by S.L. Ross (investigator team) with funding from the Minerals Management Service (MMS).

This report considers the first four days of testing, for which the authors were present as PWS RCAC observers. This report documents the testing procedures observed by the authors. The authors have prepared a companion report for the PWS RCAC, entitled "Analysis of Oil Spill Dispersant Effectiveness Testing at Ohmsett," which provides a technical analysis of the experimental design and testing protocols. That report, which is pending completion due to delays in receiving requested samples and technical data from MMS and the observer team, is referenced within this document as "Technical Analysis Report."

The investigators who conducted the cold water dispersant tests (MMS and S.L. Ross) have indicated that a full report of their findings will be published at a later date.

Testing Objectives

The purpose of the tests was to repeat cold water dispersant testing that had been conducted in 2002 and 2003, in response to criticism from the National Academies of Science (NAS), the Prince William Sound Regional Citizens' Advisory Council (PWS RCAC), and others regarding some of the test parameters for these earlier cold water dispersant trials.

The test matrix included Pt. McIntyre, Alaska North Slope, Endicott, and Northstar crude oils and the dispersant Corexit 9527. The investigators reported that Corexit 9500 may be tested later in the program, although it was not used during the time period we observed. The testing included a mix of control runs, where oil was laid down without dispersants and allowed to disperse naturally, and dispersant tests where the dispersant was applied to various types of oil at various degrees of weathering.

For this test series, both fresh and weathered oils were tested. Oils were weathered in two ways: through air sparging and on the tank. Air sparging uses air bubbles to artificially "weather" oil. In response to concerns raised by the NAS regarding whether artificially weathered oil has the same physical and chemical properties as oil weathered on the sea, on-tank weathering was also used on some of the test oils. On-tank weathering was conducted at Ohmsett before the observed testing period.

On-tank weathering was conducted in one of two ways: either with high-energy (breaking) waves or with low-energy waves. The investigators' report on the testing series will compare the results of dispersant tests on air sparged oil vs. oil weathered on-tank. Weathering varied from 10% to 30% and was calculated by weight for most oils, and by volume for at least one oil (air sparged Endicott 11%). Emulsions were not tested. The investigators noted in their February 28 remarks that earlier dispersant tests on emulsions had shown very low effectiveness.

Schedule

The program began on Tuesday, February 28, 2006 with a visitor's day. Approximately 40 visitors from the U.S., Canada, the UK, and Japan spent the day at the facility and observed two tests of fresh Alaska North Slope crude oil – a control run and a dispersants test. A general schedule and set of protocols were distributed to attendees prior to the visitor's day. Copies of these are included as Appendix A to this report. A list of attendees is included as Appendix B.

The schedule for the remainder of the testing remained relatively fluid, with the general purpose of repeating as many of the 2002-2003 tests as feasible (using the same oils, dispersants, and weathering parameters.) We were informed of each day's schedule and test oils when we arrived at Ohmsett the morning of the tests. Wednesday, March 1 tests included control tests on weathered Pt. McIntyre and Alaska North Slope (ANS) crude oils, and a dispersant test on weathered ANS. Thursday, March 2 tests included control tests for weathered and fresh Endicott crude and dispersant tests on weathered ANS crude. Friday, March 3 was a half-day of testing to allow time to clean the tank before the weekend, and involved two weathered crude oils (ANS and Endicott) with dispersants.

Ohmsett Facility and Configuration for Dispersant Tests

The Oil and Hazardous Materials Simulated Environmental Test Tank (Ohmsett) is on the grounds of Naval Weapons Station Earle, in Leonardo, New Jersey. It is a Minerals Management Service (MMS) facility operated under contract by MAR, Inc. The test tank is a rectangular concrete basin 667 feet long, 65 feet wide, and 11 feet deep. Water depth is maintained at 8 feet. For the dispersant tests, a portion of the tank about 100 feet was used for the dispersant application, the oil and dispersed oil was allowed to move down the tank with the current generated by the wave-maker (Figure 1).

The tank is oriented in a north-south direction with the wave maker on the south end. For these tests, boom was placed at the north and south ends of the tank – at the north end, two booms were placed. No booms were used along the east-west walls of the tank. All walls of the tank are stained with a thick, dark ring of oil (Figure 2). The tank water has a salinity of 35 parts per thousand, according to Ohmsett personnel. For these cold-water tests, the system also included a chiller to keep the water temperature between 31°-33°F.

There are several small observation windows below deck on the west side of the tank. The windows allow observers to view the tank water at depth. Unfortunately, because the oil seemed to concentrate at the east wall of the tank, it was difficult to see much in the below deck windows.

The tank is equipped with a traveling bridge that extends across the width of the tank and is propelled along the length of the tank by steel cables on the sides of the tank. This bridge includes an enclosed, heated cab where the technicians work to conduct the tests. They record data using hand-written data logs, data exports from various types of equipment, and photographs. A video camera under the bridge records each test from beginning to end.

The bridge is also the platform where equipment is installed to conduct the tests (Figure 3). In the case of the dispersant tests, the main equipment installed on the bridge was as follows:

- A sprayer on the leading edge of the bridge to lay down the crude oils used in the tests;
- A sprayer on the trailing edge to lay down dispersant (oil sprayer and dispersant sprayer are separated by approximately 10 feet);
- Containers of crude oil and dispersant; and
- Two large fire-hose type nozzles used to spray water for herding oil into the corner of the boom enclosure for recovery.

Several instruments were suspended approximately 1.5 m below the bridge to take readings during the tests. The instrumentation monitored on the bridge during these tests (Figure 4) included:

- Live video feed from video camera (mounted directly under bridge, above water line)
- LISST Particle size monitor

- OSRL Fluorometer (second type of fluorometer monitored by OSRL employee)
- Turner fluorometer – outputted to excel spreadsheet with data points every 5 seconds
- Sontek Velocimeter – constant data feed which was recorded in "bursts" every 30 seconds when the bridge was stopped at either end of the test area.

Environmental Conditions During Test Period

During the February 28-March 3, 2006 test period, daytime temperatures ranged from the low 30s to the low 40s F. Because the Ohmsett wave tank is open to the elements, winds have an effect on the slick behavior. The winds varied from about 10 mph to 40 mph. On February 28 and March 1, winds were constant at between 15-20 mph, with occasional gusts near 40 mph.[1] The prevailing wind direction was westerly, pushing the oil slick toward the bay (east) side of the north-south oriented tank. On March 2, the winds shifted to the northeast, but the oil slicks still tended to move toward the east wall of the tank. On March 2, the winds were much lighter with a light precipitation mix of snow, sleet, and rain.

Test Procedures

Test protocols were distributed a few days prior to the visitor's day (Appendix A). Protocols were rather general, and described the basic parameters for the two ANS crude tests, which were repeated for all of the tests we observed.

Each test was conducted the same way. The bridge was positioned at the beginning of the track run. Waves were started and once up to a steady state (just prior to the onset of breaking waves), the experiment was started. After the bridge began to move (at a speed of approximately 1 knot), oil and dispersant began to be sprayed into the tank (during control tests oil only was sprayed). Oil was sprayed from a nozzle at the leading edge of the bridge and dispersant from a boom at the trailing edge. Oil (and dispersant, in some tests) was laid from north to south over an approximately 100-foot swath of the tank, near the south (wave-generating) end of the tank. The dispersant spray boom was appreciably wider than the oil spray nozzle (Figure 5).

Because the dispersant sprayer trailed the oil sprayer, oil was sprayed with dispersant within a few seconds of hitting the water. Typically 20-25 gallons of

[1] Please note that all weather data is estimated.

oil was laid down, giving a 1 to 3 mm slick. For most of the tests, approximately two gallons of dispersant was laid down, giving a nominal ratio of 10 to 1.[2] The ratios calculated by the investigators may vary significantly from our estimates, because they consider the application ratio based on a visual estimate of how much of the dispersant hits the slick. Misapplied dispersant is not counted in the investigators' oil to dispersant ratio. Table 1 expresses the dispersant to oil ratio (DOR) for each test as a function of volume of oil and volume of dispersant distributed.

When the bridge reached the end of the test track area, it was halted and spraying was stopped. Wave-making continued for one-half hour, during which time the dispersant worked on the oil (for control tests, just the wave action worked the oil). Three test runs were then conducted with the moving bridge passing through the slick to take measurements. Two fluorometers and a particle size analyzer collected data at a depth of 1.5 m, and this was recorded electronically. The locations of the fluorometer intakes were sometimes adjusted based on where the oil slick was observed to be thickest. Velocity measurements (also at 1.5 m depth) were taken at the end of each pass, while the bridge was stopped, in 30-second bursts.

The investigators took at least one sample of the fluorometer effluent during each test, as did Merv Fingas from the PWS RCAC observer team.[3] As much as possible, samples were taken during times when fluorometer levels were at their peak values. All samples taken by the observers were immediately extracted using dichloromethane (DCM), sealed with Teflon tape and stored in an on-site refrigerate until transport to the Environment Canada (EC) laboratory (Figure 6). It is unclear how or whether the investigators' samples were extracted. The investigators also collected samples of each of the oils tested. PWS RCAC has requested that the PWS RCAC observer team be provided with a sample of the ANS crude used during the Tuesday visitor's day tests for independent laboratory analysis; however, these samples had not been provided at the time of this report.

After three passes, the wave generator was turned off and any oil remaining in the enclosure was herded to the other end of the tank. Fire hoses were used to herd the oil to the northeast corner of the boom/tank area. Some oil was

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[2] Please note that all data regarding the volume of oil and dispersant used in each test is based on the information in the operator logs provided by MAR, Inc.
[3] At the time of this report, PWS RCAC was still awaiting analysis of the fluorometer effluent samples taken by Dr. Fingas.

collected manually using a small bucket that was lowered into the oil at the end of a broom handle (Figure 7). There was oil observed in the area beyond the booms at both ends of the tank, presumably left over from various tests. As the testing period progressed, the amount of oil at either end of the tank increased.

During the dispersant tests, very little oil was recovered after herding. It is likely that the force of the fire houses provided additional mixing energy for the dispersant and oil and enhanced dispersion during the herding process. For these tests, dispersant effectiveness was estimated by visually looking at the oil remaining on the surface immediately after the waves were turned off. Since herding began immediately after the waves were turned off, no time was allowed to observe the tank for signs of resurfacing oil. There was no attempt to calculate a mass balance estimate for either the control or test runs.

The PWS RCAC observer team has requested copies of all operator logs from the tests; however, we have yet to receive them. Based on our observations, the oil used in the test was approximately the same temperature as the water, give or take a few degrees. The total volume of oil and dispersant used in each test was estimated by measuring the tank levels before and after application. The tank level measurements are included in the operator logs.

Summary of Individual Tests

During our four days at Ohmsett, we observed 10 tests. Each will be summarized separately below, but the general features of each were the same. In the dispersant tests, when the water was fairly clear, it was possible to observe a dispersed oil plume spreading down into the water and expanding horizontally (Figure 8). Fluorometer readings confirmed a spike of up to 36 times over baseline within the oil plume (Tests 6 and 9). For control runs of oil with no dispersants, fluorometer readings ranged from less than 1.5 times baseline to almost 6 times baseline. The Technical Analysis Report discusses problems with correlating the fluorometer readings to actual oil concentrations.

Table 1 summarizes the tests, based on data gathered by the PWS Observer Team and information recorded on the Operator Log of the MAR, Inc. engineer who ran the tests. Note that Test 1 was a “dry run” and no data was recorded.

Additional tests were conducted during the following week but were not observed by the PWS RCAC Observer Team. Table 2 contains data from the operator log summarizing these tests.

Test 2 – Fresh ANS Control

Test 2, a fresh ANS control test, was conducted on February 28 as the first demonstration for the Ohmsett visitors. Approximately 20 gallons of the oil was applied to the tank, and was quickly driven to the downwind (east) wall by the strong prevailing winds. Observations in the windows into the water column showed a high degree of natural dispersion, more than most experienced observers had previously seen. Droplets ranging in size from 1 to 3 mm were visible floating in the water column.

Test 3 – Fresh ANS with Corexit 9527

Test 3, a fresh ANS dispersant test using Corexit 9527 was conducted on February 28 as the second demonstration for the Ohmsett visitors. The oil slick was again driven toward the east wall, however after about 10 minutes, some plumes were noted. After about 20 minutes there was more dispersion. Our visual estimates were that 20 to 40% of the oil was dispersed, although one of the operators said that about 67% was. The particle size instrument measured the droplet sizes at 35-50 microns.

About 45 minutes after the slick was laid, the oil was flushed to a collection center while the observers returned to the training room for a debriefing. Approximately 2 hours after the test, we went back up to the tank and noted that the tank was entirely covered with sheen and small patches of oil, despite the fact that it was supposed to have been cleared about ¾ of an hour earlier. It appeared that a very large portion (up to 90%) of the original volume of oil had resurfaced within this time.

The investigators estimated the dispersant dosage at 1:30. Based on volume calculations, we estimate the dosage at 1:9 (see Table 1).

Test 4 – Weathered Point McIntyre Control

Test 4 took place on March 1. Point McIntyre crude oil which had been 10% weathered by air sparging was laid down in a control test. The oil was driven by the winds (approximately 10 mph) toward the east wall. Some natural dispersion was observed in the windows in the tank and confirmed by small peaks in the fluorometric readings.

Test 5 – Weathered ANS Control

Test 5 took place March 1. ANS which had been 16% weathered by air sparging was laid down in a control test. As in Test 4, the oil was driven by the winds toward the east wall of the tank. Some natural dispersion was observed in the windows in the tank and confirmed by small peaks in the fluorometric readings.

Test 6 – Weathered ANS with Corexit 9527

Test 6 took place March 1. ANS which had been 16% weathered by air sparging was applied with Corexit 9527. The oil slick was more cohesive than others (stayed together and relatively central in the tank, at least initially) and thus the dispersant application seemed to hit the slick dead on.

The oil and dispersed oil was driven to the side wall by a wind of about 15 mph. A small localized dispersed plume formed beside the wall and the fluorometric readings through this small plume of about 20 feet long by about 10 feet wide ranged up to 180 relative fluorometric units. Our visual estimates were that about 50% was dispersed. The oil was flushed away 30 minutes after the experiment. We noted that rather than flushing oil down the tank, the spray re-dispersed oil and spread it more over the tank. We performed a walk around the tank and found significant re-surfacing within 45 minutes of "sweeping" the tank clean. We again did a walk around the tank after one and a quarter hours and found that even more oil was resurfaced. There was about a 3 foot band of re-surfaced oil all along the downwind side of the tank for about 400 feet. In the morning, we again re-surveyed the tank and found a heavy layer of oil on the downwind side of the tank. Based on the size and thickness of the slick, we estimated that the amount of oil in this slick to have been in the range of 6 to 13 gallons, or between 35% and 70% of the oil put out in the last test.

The dispersant to oil ratio could not be calculated for this test, because the operator logs do not indicate the volume of oil applied.

Test 7 – Weathered Endicott Control

Test 7 took place March 2. Endicott crude oil which had been weathered 11% (by volume) using air sparging was laid down in a control test. The oil remained largely intact and little natural dispersion was observed. As the wind was light, and from the East, the oil remained between the center and the side wall of the tank.

Test 8 – Fresh Endicott Control

Test 8 took place March 2. Fresh Endicott crude oil was laid down in a control test. The oil remained largely intact and little natural dispersion was observed. As the wind was light, and from the East, the oil remained between the centre and the side wall of the tank. Sheen appeared to spread over the whole tank.

Test 9 – Weathered ANS with Corexit 9527

Test 9 was the final test on March 2, and was initially delayed due to rain. The oil (ANS crude weathered 15% on tank with high energy) was laid to the North central part of the tank as the wind was from the North. The oil dispersed visually to about 50%. After the experiment, (30 minutes) the crew swept the tank with fire hoses and recovered about 5 gallons of oil with water, estimating that 4 of it was pure oil. We observed that the entire tank was covered with a sheen of darker gray colour. We estimated that about 10 gallons or more of the oil was in this sheen. The next morning, we found that there was about 5 gallons of oil in a heavy slick near the south end of the tank as would be expected from the wind direction. There was other oil on the tank. Because oil behind the booms was not cleaned out, it is not known from which experiment the oil in the tank or behind the booms was derived.

Based on volumetric measures in the operator logs, we estimate the dispersant to oil ratio for this test to be approximately 1:6.3.

Test 10 –Weathered ANS with Corexit 9527

Test 9 was the first of two tests on March 3. ANS which had been 15% weathered on the tank with low energy was laid to the North central part of the tank as the wind was from the North west. The oil dispersed visually to about 50%. After the experiment, (30 minutes) the crew swept the tank with fire hoses and just before the second time this was done, we observed that the East side of the tank had a column of oil all along it with some concentrations. This oil was estimated to be 10 gallons, in volume. This did not count the oil removed on the first sweep which was estimated to be 5 gallons. Another sweep was carried out later and this yielded still another 5 gallons. The origin of all this oil was not known as there was oil left behind booms from previous experiments (Figure 9).

Based on volumetric measures in the operator logs, we estimate the dispersant to oil ratio for this test to be approximately 1:6.3.

The investigators reported that the Turner fluorometer had been re-zeroed prior to this test.

Test 11 -- Weathered Endicott with Corexit 9527

Test 10 was the final test on March 3. Endicott crude which had been weathered 11% (air sparging) was laid to the north central part of the tank as the wind was from the North west at about 25 mph. The oil dispersed visually to about 40%.

After the experiment, (30 minutes) the crew swept the tank with fire hoses and just before the second time this was done, we observed that the East side of the tank had a column of oil all along it with some concentrations. Before the second sweep an additional 5 gallons was estimated on the sweep. This was a total of about 10 gallons of oil. A third sweep was done, however we did not observe the oil on this occasion.

Based on volumetric measures in the operator logs, we estimate the dispersant to oil ratio for this test to be approximately 1:6.3.

Tests 12-25

The PWS RCAC Observer Team departed Ohmsett on March 3, 2006. Cold water dispersant testing continued into the next week, and the operator logs from these tests were provided to PWS RCAC for review. Of these final 14 tests, 4 were control runs and the rest were dispersant tests. Table 2 summarizes the operator log data for these tests. The dispersant to oil ratio, based on volume, ranged from 1:11.7 to as high as 1:4.7 during these tests.

Table 1. Summary of Ohmsett Cold Water Dispersant Tests Observed by PWS RCAC Observer Team, 2/28/06 – 3/3/06 (Source: PWS Observer Notes and MAR, Inc. Operator Logs)

Test	Test type	Date	Oil type	% weather-ed	Oil temp (drum)	Water surface temp	Volume oil (gal)	Volume dispersant (gal)	DOR (by volume)	Visual Results	Oil Re-surfaced
1	control	2/28/06	Unknown	Unknown	Un-known[4]	Un-known	N/a	0	N/a		
2	Control	2/28/06	ANS	Fresh	32°F	28°F	19.4	0	n/a	good natural dispersion	
3	dispersant	2/28/06	ANS	Fresh	29°F	29°F	18.6	2.012	1:9.2	20 to 40%	most
4	control	3/1/06	Pt. McIntyre	10% air sparged	31-32°F	26°F	19.8	0	n/a	some natural dispersion	
5	control	3/1/06	ANS	16%	31°F	27°F	20.1	0	N/a	some natural dispersion	
6	dispersant	3/1/06	ANS	16%	36°F	28°F	N/a[5]	1.0	Unkwn	50%	most
7	control	3/2/06	Endicott	11% air sparged	29°F	29°F	19.4	0	n/a	little natural dispersion	
8	control	3/2/06	Endicott	Fresh	32°F	32°F	19.2	0	n/a	little natural dispersion	
9	dispersant	3/2/06	ANS	15% high energy waves	31°F	29°F	19.7	3.144	1:6.3	50%	most
10	dispersant	3/3/06	ANS	15 % low energy waves	24°F	24°F	19.4	3.081	1:6.3	50%	most
11	dispersant	3/3/06	Endicott	10 %	30/27 °F	28°F	19.4	3.14	1:6.2	40%	most

[4] Data from the first test, which was not observed by the PWS team, is not available. According to Ohmsett personnel, that test was a "dry-run" performed as a systems check.

[5] Operator log notes that volume of oil distributed is "TBD." However, no amount was calculated in the logs we received. Therefore, DOR cannot be calculated.

Table 2. Summary of Ohmsett Cold Water Dispersant Tests Not Observed by PWS RCAC Observer Team (Source: MAR, Inc. Operator Logs)

Test	Test type	Date	Oil type	weather-ed	Oil temp (drum)	Water surface temp	Volume oil (gal)	Volume dispersant (gal)	DOR (by volume)
12	Control	3/6/06	ANS	Low energy	29°F	31-32°F	20.1	0	n/a
13	Control	3/6/06	ANS	Fresh	32°F	32°F	21.2	0	n/a
14	Dispersant	3/6/06	ANS	Fresh	36°F	34°F	TBD[6]	2.075	Unknown
15	Dispersant	3/7/06	ANS	air sparged	29°F	31°F	16[7]	2.64	1:6.1
16	Dispersant	3/7/06	ANS	High energy	32°F	33°F	19.5	2.89	1:6.7
17	Dispersant	3/7/06	Endicott	Fresh	38°F	34°F	21.1	4.02	1:5.2
18	Control	3/8/06	ANS	High energy	27°F	31°F	20.4	0	n/a
19	Dispersant	3/8/06	Pt. McIntyre	High energy	33°F	32°F	20	3.835	1:5.2
20	Dispersant	3/8/06	Pt. McIntyre	Air sparged	36°F	35°F	TBD[8]	2.892	unknown
21	Dispersant	3/8/06	Pt. McIntyre	Fresh	41°F	35°F	18.5	1.76	1:10.5
22	Control	3/9/06	Pt. McIntyre	Unknown	36°F	36°F	16.5	0	n/a
23	Dispersant	3/9/06	ANS blend	High and low energy	38°F	37°F	20	1.698	1:11.7
24	Aborted[9]	3/9/06	Pt. McIntyre	Low energy	37°F	38°F	n/a	n/a	n/a
24R	Dispersant	3/9/06	Pt. McIntyre	Low energy	37°F	38°F	19.5	1.886	1:10.3
25	Dispersant	3/10/06	Endicott	Air sparged	37-38°F	38°F	20.25	4.276	1:4.7

[6] Operator log notes that volume of oil distributed is "TBD." However, no amount was calculated in the logs we received. Therefore DOR cannot be calculated.
[7] Operator log appears to indicate 16 gallons, however the number has been crossed out.
[8] Operator log notes that volume of oil distributed is "TBD." However, no amount was calculated in the logs we received. Therefore DOR cannot be calculated.
[9] Operator log notes that run was aborted due to "hose burst" on dispersant system. Test #24R is a repeat of this run.

Summary of Observations

The PWS RCAC observer team attended the 2006 cold water dispersant tests with several objectives, which were outlined in a letter from PWS RCAC to the MMS (Appendix B). PWS RCAC requested that the 2006 tests address the following concerns, which are explained further in Appendix B and in the Technical Analysis Report:

1. Heating of oil,
2. Artificial weathering of oil,
3. Use of booms in testing field,
4. Re-surfacing of oil,
5. Tank contamination,
6. Use of oils which are not typically transported,
7. Herding using fire hoses, and
8. Uncontrollable natural factors.

Heating of Oil

The test oils used during the observed tests ranged from 31° to 33° F, which was the approximate temperature of the water in the tank. This issue was adequately addressed.

Artificial Weathering of Oil

The test matrix included oils that were both artificially weathered (air sparged) and naturally weathered (on-tank with either low energy or breaking waves). Presumably, the investigators' final report will include some analysis that compares the properties and behavior of each type of weathering.

Use of Booms in Testing Field

Previous cold water dispersant tests at Ohmsett had used boom to enclose the test area within the tank. For the 2006 tests, booms were placed at the north and south end of the tank but not along the sides.

Resurfacing of Oil

One of the objectives of this observation program was to identify whether resurfaced oil was visible in the Ohmsett tank after the conclusion of dispersant tests. Resurfaced oil occurs when incomplete dispersion occurs; oil is temporarily suspended in the water column by the wave energy and/or fire house action. Once this energy is removed, the oil re-coalesces on the water surface.

Resurfaced oil was observed upon completion of each dispersant test, after the wave generator had been turned off. This effect was most obvious during the time period between the end of one day's testing and the beginning of the next. Every morning prior to initiating the days' testing, the tank was re-cleaned using the fire hose method, and the oil was herded under the boom at either end of the tank. This oil was never accounted for, as no mass balance was calculated.

Resurfaced oil first appeared as "backwards rain" at the water surface, which is the appearance of oil molecules breaking the water surface. The oil would gradually appear darker and would form lace-like patterns at the surface. Eventually, it would thicken to an appreciable slick. The presence of residual surfactant in the water was evident in the resurfaced oil, as there would be pronounced patches that were lighter in color (Figure 10).

The pending Technical Analysis Report prepared by the PWS RCAC observer team discusses the resurfacing phenomenon in detail, and recommends measures to address this by increasing the length of time between dispersant application and data collection.

Tank Contamination

Significant tank contamination was observed. Even before the tests began, a thick, dark oil stain was visible as a "bathtub ring" around the tank (Figure 2). This bathtub ring emitted a visible sheen throughout the test period. Contamination was also present in the area beyond the booms at the north and south ends of the tank. An appreciable slick of oil, at varying degrees of weathering, was present at either end of the tank. The size of these slicks increased as the test period progressed (Figure 9).

Herding using Fire Hoses

High pressure fire hoses are used to "sweep" the tank clean in between tanks. The hoses have the desired effect of herding some of the surface oil toward the boom end of the tank for recovery; however, they also have the additional, unintended effect of re-dispersing oil due to the significant energy input. A plume of re-dispersed oil was visible during herding operations (Figure 1).

Use of Oils

For these tests, the investigators reported that test oils were shipped directly from the production facilities on the Alaska North Slope. The chemical composition of these oils differs significantly from the crude oil that is shipped from the terminus of the Trans-Alaska Pipeline. The difference in oil properties between the test oils and the oil actually shipped by vessel through Alaska waters should be considered as it relates to the reported results. In the future, test oils should be obtained from the Valdez Marine Terminal.

Uncontrollable Natural Factors

During the four days of testing observed, environmental conditions included light snowfall, rain, and variable winds gusting up to 40 knots. The prevailing wind direction had a noticeable impact on the behavior of the oil slick.

Conclusions

The PWS RCAC observer team has prepared a companion report (Technical Analysis Report) that considers the experimental design and offers recommendations for improving dispersant testing at Ohmsett. For the purpose of this report, we offer the following general observations regarding the cold water dispersant tests observed in February-March 2006.

1. In the absence of mass balance calculations, it is impossible to assign effectiveness values; any conclusions regarding the effectiveness of Corexit 9527 on Alaskan oils in cold water would be based on subjective analysis and anecdotal data.

2. Resurfacing of oil was appreciable; future tests should address this fact in the experimental design.

3. Tank contamination continues to be a problem at Ohmsett and would likely complicate any attempted mass balance calculations.

4. The use of fire hoses to herd remaining surface oil has the unintended effect of temporarily re-dispersing the oil.

5. The test oils used are different than those transported by vessel through Alaska waters.

6. The presence of residual surfactant in the tank was visible in accumulated resurfaced oil (Figure 10) and should be considered in interpreting results.

7. The test design, where dispersant is sprayed within a few seconds of oil being sprayed does not allow the oil to form a slick as it would under natural conditions; therefore, the surface area available to dispersants

under these experiments is greater than it might be in the field, which may cause an overestimation of dispersant effectiveness.

8. The volume of dispersant that was applied varied throughout the testing period. Differences in the dispersant to oil ratio should be accounted for in the analysis of results.

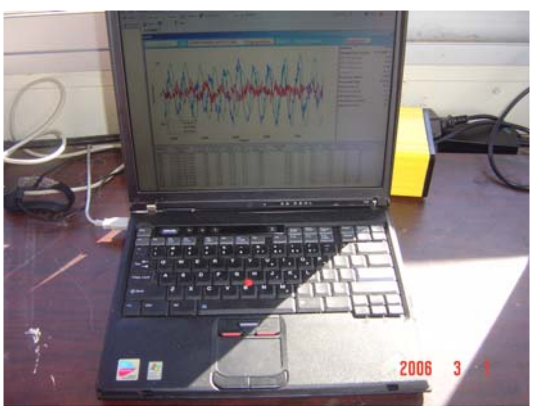
The final MMS/S.L. Ross investigators' report is not yet complete. The report may acknowledge some or all of these issues in presenting the test results. An article about the dispersant tests in the *Oil Spill Intelligence Report* indicates that the investigators will use data from the fluorometers and particle size meter to "quantify the amount of oil that was dispersed." Based on the observations discussed here and in the accompanying Technical Analysis Report, we do not believe that accurate quantification of the dispersant effectiveness is possible under the observed experimental design.

Figure 1: Ohmsett test tank

Figure 2: Oil stains on tank wall

Figure 3: Bridge

Figure 4: Instrumentation monitors on bridge



Velocimeter

Turner Fluorometer

Figure 5: Procedures for Dispersant Tests

Wave generation

Oil nozzle and dispersant boom mounted on bridge

Nozzle laying down oil

Boom spraying dispersant

Figure 6: Extraction of Fluorometer Effluent Samples by Merv Fingas

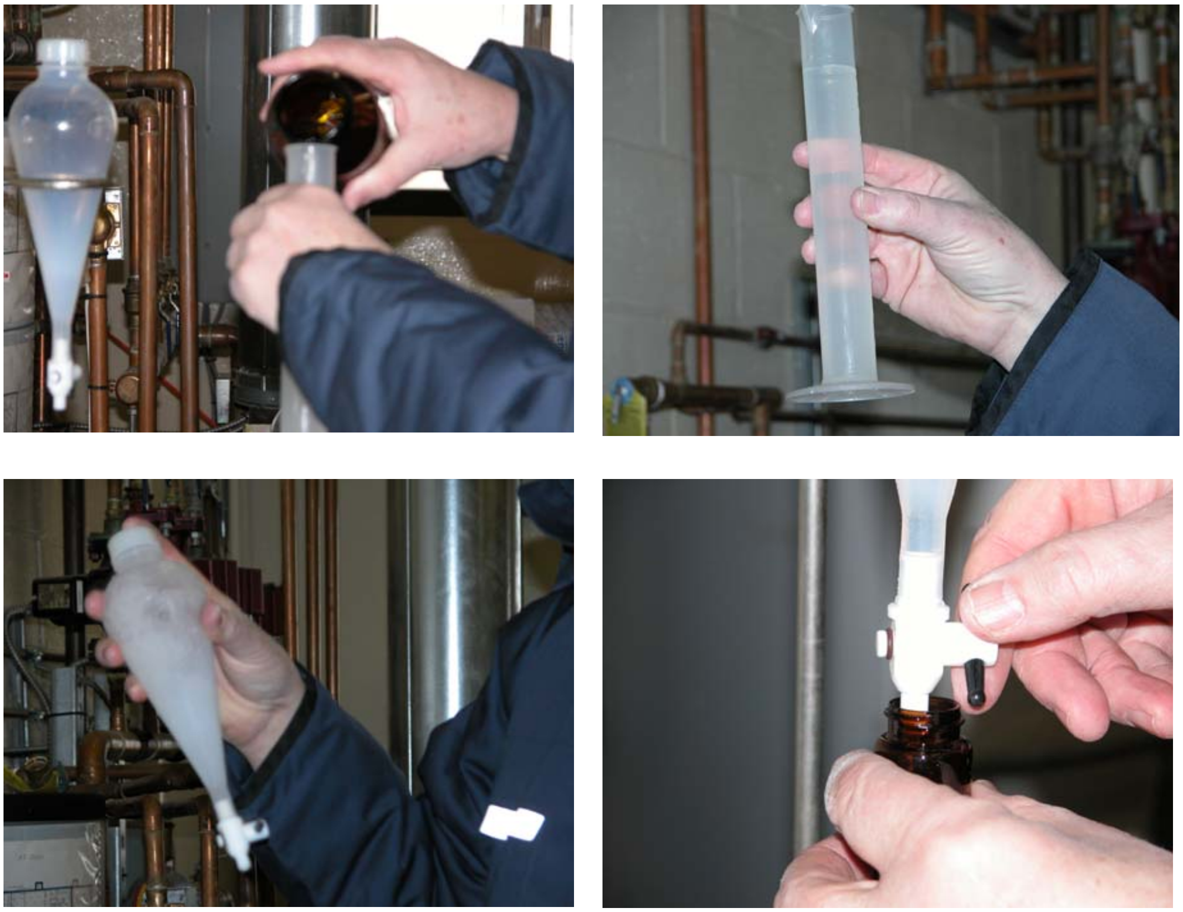
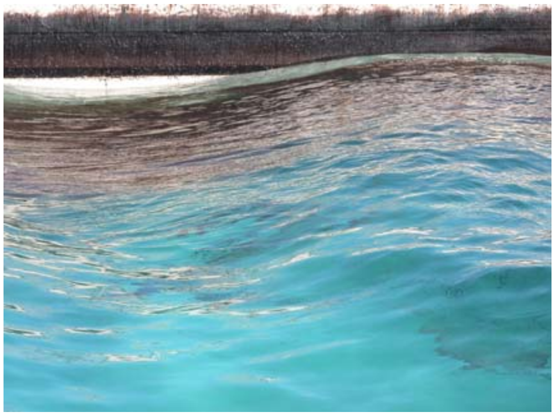


Figure 7: Herding and Collection of Oil at end of 30 minutes

Figure 8: Oil dispersion observed during Dispersant Tests



Test 3

Test 6

Test 9

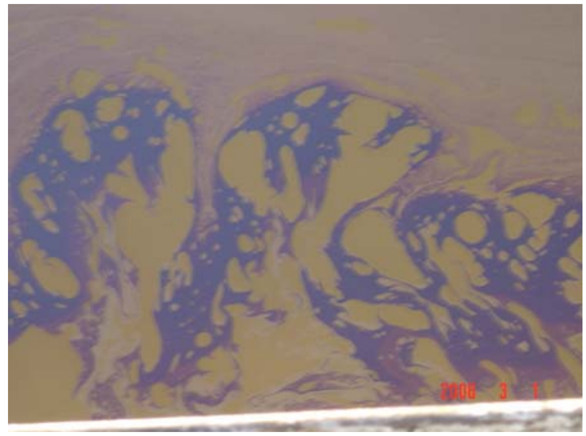
Test 10

Test 11

Figure 9: Accumulated oil in Ohmsett Test Tank from Dispersant Tests (photos taken 0730 on 3 March 2006, before Tests 10 and 11)

Figure 10: Observations of Resurfaced Oil

Resurfaced oil visible in tank 1 hour after Test 6



Resurfaced oil and surfactant (1 hour after Test 6)

Resurfaced oil the morning after Test 6

Resurfaced oil the morning after Test 6