Report on visit to OHMSETT to observe
Exxon/MMS Cold-Water Dispersant Tests

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By Stan Jones
Public Information Manager
Prince William Sound Regional Citizens' Advisory Council

OHMSETT stands for Oil and Hazardous Materials Simulated Environmental Test Tank. It is on the grounds of Naval Weapons Station Earle, in Leonardo, New Jersey. It is a Minerals Management Service 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 Exxon tests, a boomed enclosure measuring 35 feet by 100 feet was floated in the tank.

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 who conduct the tests. They record data in notebooks, take pictures, and monitor a video camera set up to record each test from beginning to end.

Aerial view of Ohmsett test tank

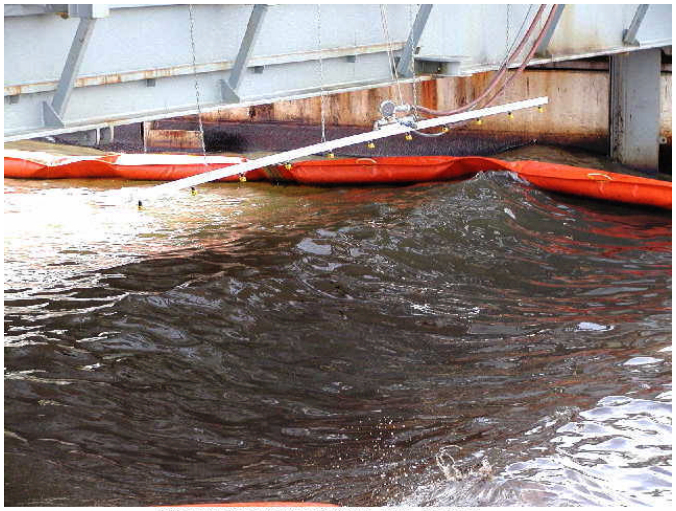
The bridge is also the platform where equipment is installed to conduct the tests. In the case of the Exxon tests, the main equipment installed on the bridge was as follows:

- 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.
- Containers of crude oil and dispersant.
- Two large fire-hose type nozzles used to spray water for herding oil into the corner of the boom enclosure for recovery by dipping with a ladle

Bridge with videocam & water nozzles

Oil sprayer in action

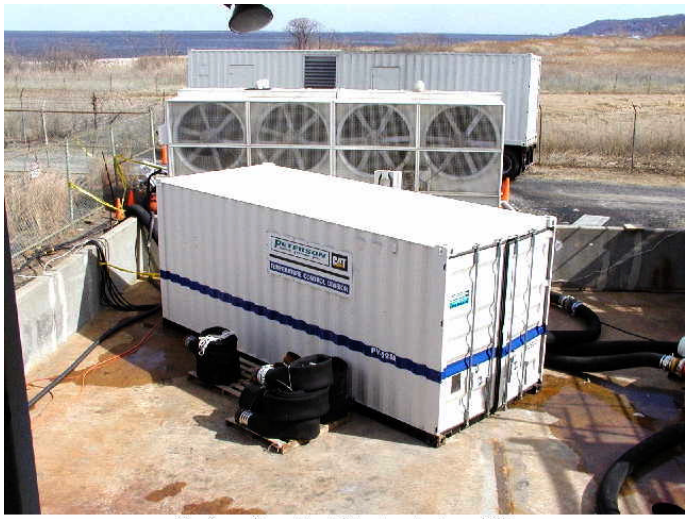


Dispersant sprayer on trailing edge of bridge

Wave generator in action

The tank water has a salinity of 3.5 parts per thousand, according to OHMSETT personnel. Ordinarily it is chlorinated to keep down algae and other organisms in the tank, but chlorination was suspended for this test.

For these cold-water tests, the system also included a chiller to keep the water temperature between 31-33F.



Cooling unit used to chill tank water to ca. 32F

On March 5, the morning low was 18 degrees and the salt-water tank had ice on it at the start of the day. Temperatures during the day were in the 20s, by my estimate, with winds from 15-30mph. On March 6, temperatures were in the 40s and low 50s, but the wind was stronger, probably gusting over 30mph.

Each test I saw was conducted the same way:

The bridge was positioned at the beginning of the boomed enclosure. The bridge began to move, and simultaneously oil and dispersant began to be sprayed into the boomed enclosure. Because the dispersant sprayer trailed the oil sprayer, oil was sprayed with dispersant within a few seconds of hitting the water.

Oil/dispersant slick before waves begin

Randy Belore and others involved in the tests said that typically 22-25 gallons of oil was laid down, giving a 1mm slick. For most of the tests, approximately one-half gallon of dispersant was laid down, giving a nominal ratio of 40:1 to 50:1. For other tests, however, the amount of dispersant was reduced to achieve a ratio of approximately 70:1, as one goal of the tests was to see what was the lowest dispersant ratio that would be effective.

(Note: Above, and throughout this report, the quantities I report are approximate and were conveyed to me orally. I did not examine or copy data sheets, as Exxon and MMS agreed to provide us with test results, along with the test plan and the official videos recorded at the time of the test.)

When the bridge reached the end of the boomed enclosure, it halted and spraying was stopped. The wave generator was started and within a minute or two the boomed enclosure was receiving the kind of waves described above.

Boom enclosure with oil at down-wave end

Wave-making continued for one hour, during which time the dispersant worked on the oil and some oil usually escaped the boomed enclosure. Then the wave generator was turned off and any oil remaining in the enclosure was herded to a corner of the boom and ladled into a bucket for analysis.

After 1 hour of waves, oil is herded to corner of boom to be ladled out

Recovered oil is ladled into plastic pail

For these tests, dispersant effectiveness was calculated by measuring the oil recovered at the end and comparing it with the amount of oil laid down by spraying. I confirmed with Randy Belore that natural dispersion was assumed to be zero, and that evaporation was ignored, though he said it could run 5-10 percent. (See below for comments on these and other assumptions that appeared to compromise the results of these tests.)

Belore said fluorimetry was not performed because the size of the tank would have made it prohibitively difficult to get meaningful results.

During the two days I was at OHMSETT, I observed four tests. Each will be summarized separately below, but the general features of each were the same:

Soon after wave action began, the amount of visible oil on the surface of the water decreased rather quickly.

In the early tests, when the water was fairly clear, it was possible to observe a "brown cloud" (as the people at the facility called it) spreading down into the water and expanding horizontally. The people at the facility said this brown cloud was dispersed oil.

In the later tests, the water in the tank was so clouded from the earlier tests that it was not possible to observe anything but surface phenomena, which consisted primarily of a reduction in the amount of visible floating oil, and of oil escaping containment due to wave action or leakage out of boom corner joints.

At the end of one hour of wave action, the remaining oil was herded to a corner of the boom enclosure and ladled into a five-gallon plastic pail for analysis. In all cases, the amount of recovered oil appeared to be quite small – less than a gallon probably, though that should be confirmed when test results are furnished to us.

Morning, March 5: This was a test of Corexit 9527 on fresh ANS crude. Randy Belore estimated the oil:dispersant ratio for this test would be 40:1 or 50:1. (The actual ratio was computed after the test based on drawdown of oil and dispersant from their containers and should be available in the test results.)

Afternoon, March 5: This was a test of Corexit 9527 on weathered ANS crude. The ratio was to be 40:1 or 50:1.

Morning, March 6: This was a test of Corexit 9500 on fresh ANS crude, but with less dispersant than the previous day. Belore estimated the oil:dispersant ratio was about 70:1 for this test.

Afternoon, March 6: This was a test of Corexit 9500 on 20 percent weathered ANS crude. Dispersant ratio was 30:1 or 40:1.

Methodological issues:

Based on my observation of the tests, there were several issues that could cloud the reliability of the calculated effectiveness of the dispersants. The test results should be examined carefully to see if any of these issues were addressed or corrected, but, as of my visit, here they are::

1. Control test. Randy Belore said the control test involved putting ANS crude on the water, turning on the wave machine, and watching it long enough to determine that no dispersion was taking place, as indicated by the absence of a "brown cloud" in the water. The wave machine was not kept on for a full hour, and there was no attempt to measure the amount of oil remaining on the water at the end of the control test. Therefore, there is no measure of the effectiveness of natural dispersion that would permit some estimate of how much additional dispersion was produced by the dispersants.

2. Use of boom enclosure. After the waves started, any undispersed oil would pile up at the down-wave end of the boom and be pounded against the boom for the remainder of the hour. How this would affect dispersion is unknown to me, but it is a phenomenon that would not occur in open-ocean use of dispersants in a real spill.

Undispersed oil trapped against boom

3. In every test I saw, some oil escaped containment. As far as I could determine, no effort was made to capture this escaped oil, or to compensate for it in the mass balance calculations used to compute effectiveness, though this should be verified in the test results. In addition, testing began the week preceding my visit, and the tank, the tank water, and the boom were not cleaned at any point. By the time I arrived, substantial amounts of floating oil had collected at the down-wave end of the tank. In addition, the boom and tank walls were heavily stained. This would further complicate any effort to determine how much oil was escaping containment during any given test, or to determine if any "old" oil came off the boom or entered the enclosure from outside it during the test.

Oil escaping boom

Downwave tank corner showing accumulated stray oil

Boom corner. Note staining of boom & tank wall (in background)

4. Because the water was not cleaned, dispersed oil was allowed to accumulate in it. As a result, by the second day of my visit, the water was quite cloudy and had taken on a greenish brown color, with patchy sheen visible on the surface. Belore said no attempt would be made to calculate the affect of dispersed oil already in the water on subsequent tests, but he asserted that the total volume of dispersant used in this series of tests would not be enough to create an appreciable concentration in a tank with a volume of more than 2 million gallons.

5. As mentioned above, winds were quite strong on both days of the test, but particularly on the second day, when I would estimate they reached 35-40mph during the gusts.

   It seems likely that winds this strong would increase evaporation of the oil, as well as increasing wave action, which would increase dispersion, whether chemical or natural. If there were large variations in wind speed over the two weeks of testing, that would seem to make it hard to compare results of the various tests.

   In particular, it appeared the wind may have affected the third test I saw, which involved a reduced amount of dispersant (approx. 70:1) in an effort to ascertain the lowest effective ratio. To reduce the amount of dispersant being applied to the oil, the nozzles on the sprayer were adjusted to give a very fine mist. It appeared to me the wind may have carried some dispersant outside the boomed enclosure (which would mean the true oil:dispersant ratio was even lower than 70:1).

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Randy Belore and Exxon's Jim Clark said the purpose of these tests was to measure the effectiveness of dispersants in cold water for comparison with the shaking-flask cold-water tests. (Our name wasn't mentioned, but presumably they mean our tests at Auke Bay.)

Joe Mullins said preliminary results of these tests would be presented at AMOP in Calgary. Belore said detailed results of earlier Exxon tests in a small tank would be presented. Mullins said EPA was interested in the OHMSETT tests with an eye to calibrating the wave energy and somehow relating it to the flask test used to measure dispersant effectiveness.

The still photographs in this report were taken during the fourth test I witnessed. I shot digital video of the first three tests. That video, along with all my photographs, will be passed on to Lisa Ka'aihue.

The End