



USEPA Bakken Oil Pilot Study – OHMSETT Facility February 2015

FATE AND RECOVERY AND AIR MONITORING

Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT)



Test Set-up and Roles: EPA and DOI

- ▶ Regions 3, 5 and 8 and ERT designed, coordinated and funded testing. Region 10 managed the Interagency Agreement thru EPA-HQ & Department of Interior.
- ▶ Bakken / Williston Basin Shale Oil ~ 1,600 gallons from the Eddystone Rail Facility in PA trucked to NJ.
- ▶ Salt Water Tank with adjustable surface area with boom
- ▶ Air Monitoring/benzene analyses: EPA – Environmental Response Team (assisted by USCG – Atlantic Strike Team)
- ▶ Oil physical property/fate and recovery testing: OHMSETT (MAR, Inc. the DOI facility contractor)

Pilot Test Objectives and Scope

- ▶ Conduct testing to obtain data to assist with response actions to shale oil spills in the environment:
- ▶ Evaluate benzene and other VOC emissions from a discharge of Bakken oil to gain more information to support Health and Safety decisions for responders and the public;
- ▶ Evaluate physical properties of Bakken oil, including as weathering progresses, in order to better predict the fate on the surface water;
- ▶ Evaluate recoverability of fresh and weathered Bakken oil using standard methods.

DOT/PHMSA testing program in 2013 (Shipping Hazard Classification Data)

Bakken Oil Sample Analysis	Results from approximately 135 samples
Flash Point	<32 to < 73 degrees F
Initial Boiling Point	85 to 104 degrees F
Butane	2.4 to 3 %
Propane	0.6 to 1.2 %
Hydrogen Sulfide	< 5 parts per million (ppm)
API Gravity	39.9 to 43.8
Reid Vapor Pressure	8.7 to 11.8 pounds per square inch absolute (psia)

Test Conditions and Weather - OHMSETT

February 11 – 12, 2015

- ▶ Approximately 660 gallons of oil were discharged into a 100 ft x 65 ft (6500 sq foot area) of the test tank.
- ▶ Weather: Average temperature of 28 °F (ranging from ~ 23 to 34°F maximum during the study). Winds averaged 8 mph.
- ▶ The oil spread rapidly and then accumulated in the downwind area of the tank. Volatilization of lighter end hydrocarbons was noted during the release.
- ▶ The oil was allowed to sit overnight ~ 22-hour period in the 6500 sqft area. No agitation or wave action was introduced mechanically.
- ▶ Air Sampling was conducted before, during and after the release.
- ▶ Oil samples were collected for physical property, benzene content and flash point testing.







02/11/2015 11:45



Testing Operations and Results: Air Monitoring and Sampling

- ▶ Monitoring parameters included:
 - ▶ volatile organic compounds (VOCs) - AreaRAEs
 - ▶ lower explosive limit (LEL) - AreaRAEs
 - ▶ hydrogen sulfide (H₂S) - AreaRAEs
 - ▶ Benzene – UltraRAEs with benzene tubes
- ▶ Air samples were collected in:
 - ▶ tedlar bags for VOCs and charcoal tubes for benzene time-weighted concentration data.
 - ▶ The Trace Atmospheric Gas Analyzer (TAGA) bus

Benzene Concentrations in Oil Samples and weathered oil flash point

Sample ID	Description	Date Collected	Time Collected	Benzene $\mu\text{g/g}$	% lost
OHM-004	at Eddystone, PA	2/4/15	08:48	1720	
OHM-001	Arrival OHMSETT	2/4/15	10:30	1720	0.0
EPA 54969	Prior to Release	2/11/15	10:09	1700	1.2
EPA 54980	~24hrs Post Release (weathered)	2/12/15	08:31	U	100
OHM-005	Extended weathering	2/18/15	08:00	U	100
	FLASH POINT RESULTS			Degrees F	
OHM / EPA	~ 24 hours weathering			132	
	~ 7 days weathering			165	

Air Monitoring Data Summary

- ▶ No LEL measured above 10 percent. A maximum of 4.7%
- ▶ Hydrogen Sulfide was detected at a maximum concentration of 0.2 ppm. One minute averages were normally below 0.04 ppm.
- ▶ Maximum VOCs of 138 ppm (located within 5 feet of tank). The highest one minute average was 67 ppm. Both were recorded within 5 minutes of the release.
- ▶ Benzene was measured between 2700 (bag) and 5500 ppbv (UltraRAE) and an 8 hour TWA was 75 ppbv. (OSHA: IDLH 500 ppm and STEL 5 ppm)
- ▶ Six hours after the initial release, VOC readings (1-minute average) were all below 5 ppm.

Oil Recovery and Weathering Data

- ▶ Oil loss by volume was 32% within 22 hours of release to the tank with a slick thickness of 4 mm (0.16 inch)
- ▶ Tank water samples show no significant hydrocarbons
- ▶ Oil density and viscosity increased during the weathering
- ▶ Oil recovery tests were performed with an oleophilic grooved drum skimmer and followed ASTM F2709 methods for stationary skimmer recovery rate tests.
- ▶ Skimmer testing was performed in a 10 ft x 10 ft area
- ▶ Fresh oil recovery: 5 gpm Weathered Oil: ~ 23 gpm

Percent Oil by Mass over Time

Time Period	Percent Lost*
1 hour	10
2 hours	15
5 hours	20
24 hours	27
7. days	40

*The majority of the oil volume lost was due to evaporation. A smaller percentage is assumed to be lost by dissolution into the water column.



02/12/2015 08:45







02/12/2015 13:54

Conclusions and Recommendations

- ▶ Concentrations of volatile organic compounds may be greater under warmer weather conditions with probable elevated LEL percentages;
- ▶ Rapid dispersion in flowing water is likely to occur under turbulent conditions;
- ▶ Skimming operations are like more efficient once lighter end are lost. (Fibrous Disc skimmers may be more effective.)
- ▶ Additional recovery testing and fate studies may be appropriate.
- ▶ Approximately 900 gallons of Bakken remain at OHMSETT.