Environmental Impacts from the Largest Gasoline Spill in U.S.A. History on the City of Dallas Water Supply-Lake Tawakoni

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Introduction

A gasoline pipeline owned by Explorer Pipeline Company ruptured leaking gasoline, and MTBE, a gasoline additive, into a creek and lake that the city of Dallas uses as a water source. Dallas Water Utilities (DWU) relies on the water from Lake Tawakoni to provide their 1.8 million users as approximately thirty-percent of their water supply. Because of the contamination, the city had to build a pipeline (2.44 m diameter, ~4.4 km in length and built in three months) to another lake, at a cost of about $9 million (~¥1,035,000,000). The volume of release was estimated at 6,640 m^3 of gasoline containing MTBE at 9% per volume. Thousands of soil, water and groundwater samples were taken to track the MTBE and benzene plumes as they moved from the spill site, through 44.6 km of creek and throughout a lake containing 0.866 x 10^9 m^3 of water (Lake Biwa Water Volume- 27.5 x10^9 m^3 [Hosada and Hosomi, 2002]). Four years after the spill, MTBE and benzene remained throughout the groundwater system in the drainage basin.

Initial Characterization: Nature and Extent

A major rain event on March 10-11, 2000 (37. mm in a drought period) occurred washing the gasoline throughout the watershed. The first water sample (sampling location 4A) in Lake Tawakoni that contained MTBE was collected at 3:30 P.M. on March 12, 2000 or 2 days, 17 hours and 10 minutes after the rupture occurred. MTBE was detected at 1,200 ug/L and benzene at a level of 46.6 ug/L in the East Caddo Inlet mid-channel of Lake Tawakoni. A second sample detected 9,000 ug/L of MTBE and 629 ug/L of benzene at the 34 bridge or 6,200 m upstream from the dividing line between East Caddo Creek and Lake Tawakoni or 3,170 m upstream/up-lake from sampling location 4A the same day. Keep in mind sampling location 4A is 48 km from the spill site.

The next day, March 13, 2000 at 1:35 P.M. at a sampling location 4.5 km into Lake Tawakoni, 5,980 ug/L of MTBE and 74.5 ug/L of benzene were detected. The city of West Tawakoni shut down their intake on March 15, 2000 after the first detections of MTBE at 101 ug/L at the surface and 74.9 ug/L at the bottom. The West Tawakoni intake is located approximately 7.4 km into Lake Tawakoni or 52 km from the spill site. The city of West Tawakoni had water delivered by tanker trucks for nine days and eventually switched to a specialized treatment system capable of treating MTBE affected water.

Leachability Testing

On March 22, 2000, stream bank soil samples were collected at four locations in the first 2,750 m downstream from the spill site in order to estimate the saturation and dissolution of MTBE via simulated leaching in the

laboratory. ASTM D4874M-Volatiles (C1-C10) entitled “Leaching Solid Material in a Column Apparatus” was strictly adhered to by PTS Laboratories, Inc. in Santa Fe Springs, California.

Table 1. Leachability Test Results of MTBE from Streambank Samples

Location	Distance in m. *	Soil-ug/kg (ppb)	One PV Water-ug/L (ppb)	Two PV Water-ug/L (ppb)	One PV Time Days	Two PV Time Days
Station 0+00	0	83,000	150,000	24,000	15	32
Station 03+00	91	34,000	45,000	15,000	10	20
Station 35+00	1,067	47,000	32,000	5,900	16	35
Station 90+00	2,750	110,000	180,000	24,000	1	1

* Measured from the intersection of Caddo Creek and the Explorer Pipeline (station 0+00).
PV-Pore Volume

The average concentration of MTBE from all four samples after one pore volume was 101,750 ug/L. The average concentration of benzene was 1,350 ug/L after one pore volume of water pass-through. The data were used to substantiate the concern of MTBE loading from the stream banks starting at the spill site to Lake Tawakoni.

Lake Tawakoni Plume Movement and Mass Calculations

The following table is the estimate of MTBE mass and average concentration in the lake at two times.

Table 2. Comparison of MTBE Mass and Volume of Lake Water Impacted

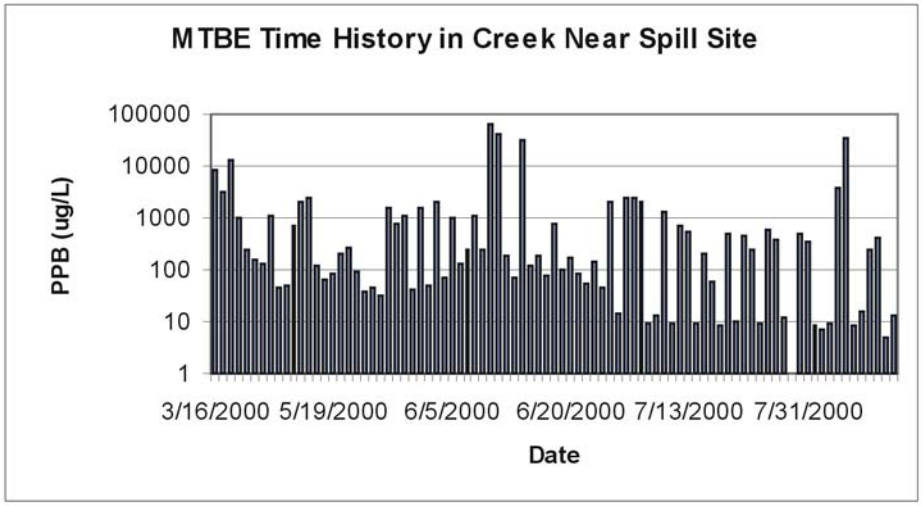
	MTBE Mass (kg)	Volume Impacted (m3)	Percent of Lake Impacted	Average MTBE (ug/L)
March 16, 2000	16,450	30 million	3.5	574.4
March 26, 2000	3,680	414 million	48.5	8.85

Based upon the sampling data collected as compared to the enormous volume of water in the lake, there is little denying that a large amount of MTBE made it to Lake Tawakoni.

Water Supply Solution

Dallas lost 722,000 m^3 per day of their water supply due to the spill disaster. A subterranean pipeline was built in approximately three months, was 4,470. m in length, 2.44 m in diameter and provided DWU with the additional capacity just in time without the benefit of Lake Tawakoni and pumpage began in June 2000.

Explorer pipeline reported on-site MTBE concentrations in water as high as 4,404,800 ug/L on May 1, 2000 which might be the largest MTBE measurement in water from a release anywhere. The following figure is a time history of MTBE in the stream near the spill site that justifies the real concern of additional slugs of gasoline contamination in the summer of 2000 that threatened Lake Tawakoni.



Conclusions

The environmental impacts from a release of over 6,640 m^3 gallons of gasoline were documented by the collection of thousands of water, soil and groundwater samples taken at the spill site, along East Caddo Creek and in Lake Tawakoni. The results of the collection of all the data lead to the conclusion that MTBE had impacted almost 44.6 km of East Caddo Creek and served as a long-term source of MTBE/Benzene in the streambanks due to spreading caused by the large rain storm that occurred the day after the release. A race to build a pipeline to a different lake then began so that the peak demand period could be satisfied. Lake Tawakoni was brought back into service on August 17, 2000, over five months after the spill, when an independently administered early warning system was put into place. Dallas recovered a large percentage of the reponse costs from the pipeline company.

References

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Biographical Sketch

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