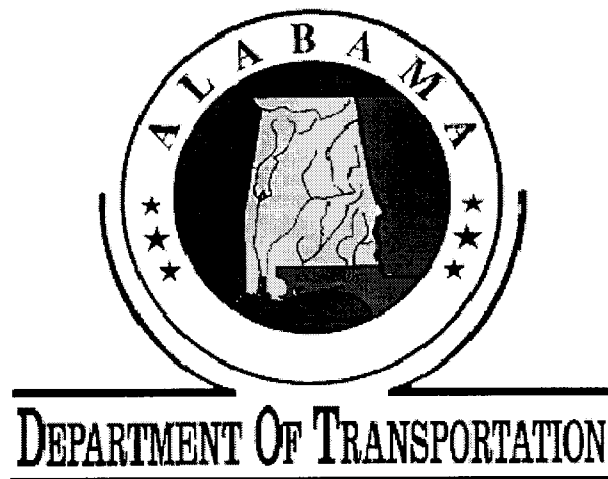


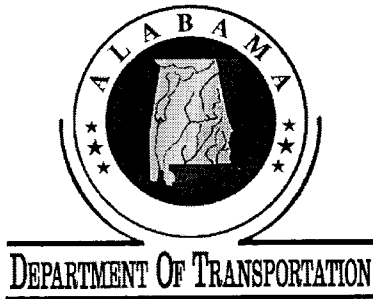
**Report of Diffusive Sampling for Volatile  
Organic Compounds in Selected Monitoring  
Wells (Addendum 12)**

**Coliseum Boulevard  
Plume Investigation**



**May 19, 2003**

**Submitted to:  
The Alabama Department of Environmental Management  
Montgomery, Alabama**



# **REPORT OF DIFFUSIVE SAMPLING FOR VOLATILE ORGANIC COMPOUNDS IN SELECTED MONITORING WELLS**

**MAY 19, 2003**

## **Introduction**

Throughout the course of the investigation of the Coliseum Boulevard Plume, the Alabama Department of Transportation (ALDOT) has pursued innovative technologies to improve the efficiency of field activities. One such innovative technology is the diffusive bag sampler for collecting ground-water samples to be analyzed for volatile organic compounds (VOCs). The use of diffusive bag samplers would greatly reduce the amount of time required for collecting ground-water samples and the volume of purge water to be treated for each sampling event.

Diffusive samplers operate on the principle that the ground water within the well is in equilibrium with the aquifer. The samplers are constructed in the shape of a tube, and are made of low-density polyethylene, which acts as a semi-permeable membrane. Prior to insertion into the well, the sampler is filled with analyte-free water. The sampler remains in the well until osmotic pressure has equilibrated. The diffusive bag samplers used were purchased from Columbia Analytical.

## **Ground-Water Sampling Procedure**

In accordance with Addendum 12 (dated January 9, 2002), TTL installed diffusive bag samplers in six monitoring wells (MW-1A, MW-105, MW-213, MW-226, MW-138A, and MW-238B) at the project site. The monitoring well locations are shown on Figure 1.

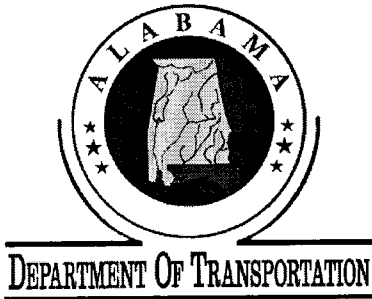
On January 17, 2003, diffusive bag samplers were placed in the monitoring wells listed above. The approximate 2-foot long samplers were filled with deionized water at each well site and suspended in each monitoring well, about one foot above the base of the well. In accordance with the manufacturer's recommendations, the samplers were to be left in the wells for a minimum of 14 days.

The diffusive bag samplers were removed from the wells between two and four weeks after installation (refer to Table 1). At the time of removal, the contents of each bag were poured into quadruplicate 40-milliliter (ml) glass vials preserved with hydrochloric acid.

Following removal of the samplers, each of the wells was purged using a bladder pump set at approximately one foot above the base of the well until the parameters of pH, conductivity, and turbidity stabilized. Ground-water samples were then collected from each of the wells and placed in containers as described above. All of the samples were placed on ice and transported to TTL's laboratory in Tuscaloosa, Alabama for VOC analyses.

## **Analytical Results**

The analytical results are summarized on Table 1. There were variations between the results from the samples collected with the diffusive samplers and those



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collected in the traditional manner. The greatest discrepancies were noted in samples collected from monitoring wells MW-138A and MW-238B. The samplers had only been in these wells for 19 days, whereas the samplers remained in the other wells for 31 or 32 days. Additionally, benzene was detected in the diffusive bag samples collected from monitoring wells MW-138A and MW-238B, and not the samples collected using standard sampling procedures.

Mr. Howard Boorse with Columbia Analytical, the manufacturer of the samplers, was contacted to discuss the analytical results. Mr. Boorse was very surprised at the variation of the analytical results. He stated that the length of time the samplers had been in the wells should have been adequate. His only explanation as to the variation in results was stratification of the contaminants in the well column. Mr. Boorse indicated that the diffusive samplers were likely providing an accurate picture of the contaminant concentrations at the location in which they were placed, and that the samples collected after purging were likely from water in a different zone of higher TCE concentration. It should be noted, however, that the well screens in four of the six wells are only about five feet long. Well screen information is provided on Table 1.

Regarding the detection of benzene in two of the samples, Mr. Boorse stated that no benzene is used in the production of the samplers. TTL's laboratory has reviewed the chromatograms, and did not observe a benzene peak in the samples collected using standard sampling procedures.

**Conclusion**

TTL concludes that the diffusive bag samplers are not a viable option for ground-water sampling at this site.

**Table 1.** Results of analyses for volatile organic compounds (VOCs)<sup>1</sup> in ground-water samples collected using diffusive bag samplers and standard sampling methods; Diffusive Sampling Report; Coliseum Boulevard Plume Investigation; Montgomery, Alabama.

Sample ID	Screened Interval (ft, BLS) <sup>2</sup>	Depth Sampler Placed/ Depth of Bottom of Pump (ft.BLS)	Purge Rate (gpm) <sup>3</sup>	Sample Date	(Concentrations are in micrograms per liter [µg/l])													
					Trichloroethylene	Vinyl Chloride	1, 1 Dichloroethene	cis-1,2-Dichloroethene	1, 1, 1-Trichloroethane	Carbon Tetrachloride	Chloromethane	Chloroform	Benzene	Toluene	Ethyl Benzene	m,p-Xylenes	O-Xylene	
MW-1A Diffusion	33-43	40-42	-- <sup>5</sup>	1/17/2003 - 2/18/2003 <sup>6</sup>	717	ND <sup>7</sup>	2.5J <sup>8</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-1A		42	--	2/18/2003	1,080	ND (<2.5)	5.9J	ND (<2.5)	ND (<2.5)	ND (<2.5)	ND (<2.5)	ND (<2.5)	ND (<2.5)	ND (<2.5)	ND (<2.5)	ND (<2.5)	ND (<2.5)	ND (<2.5)
MW-105 Diffusion	20.5-26.5	23.5-25.5	--	1/17/2003 - 2/18/2003	3.0J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-105		25.5	0.3	2/18/2003	13.9J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-213 Diffusion	31.5-35.5	32.5-34.5	--	1/17/2003 - 2/17/2003	15.0J	ND	ND	ND	ND	ND	1.8J	ND	ND	ND	ND	ND	ND	ND
MW-213		34.5	0.3	2/17/2003	81.3	ND	6.7J	ND	ND	1.7J	1.3J	ND	ND	ND	ND	ND	ND	ND
MW-226 Diffusion	11.5-20.5	17.5-19.5	--	1/17/2003 - 2/17/2003	11.2J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-226		19.5	0.7	2/17/2003	361	ND	1.6J	2.4J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-138A Diffusion	34-38.5	35.5-37.5	--	1/17/2003 - 2/5/2003	253	ND	1.4J	ND	ND	ND	ND	ND	11.0J	ND	ND	ND	ND	ND
MW-138A		37.5	0.2	2/5/2003	4,340	ND (<10.0)	67.8J	ND (<10.0)	ND (<10.0)	33.8J	ND (<10.0)	ND (<10.0)	ND (<10.0)	ND (<10.0)	ND (<10.0)	ND (<10.0)	ND (<10.0)	ND (<10.0)
MW-238B Diffusion	44-48.5	45.5-47.5	--	1/17/2003 - 2/5/2003	29.3	ND	2.8J	ND	ND	ND	ND	ND	5.5J	ND	ND	ND	ND	ND
MW-238B		47.5	0.4	2/5/2003	16,700	ND (<20.0)	1,040	ND (<20.0)	ND (<20.0)	263	ND (<20.0)	ND (<20.0)	ND (<20.0)	ND (<20.0)	ND (<20.0)	ND (<20.0)	ND (<20.0)	ND (<20.0)
Pump Rinse 1	--	--	--	2/5/2003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Rinse (Bladder Pump)	--	--	--	2/17/2003	ND	ND	ND	ND	ND	ND	1.2J	ND	ND	ND	ND	ND	ND	ND
Rinse (Bladder Pump 2)	--	--	--	2/17/2003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Blank	--	--	--	2/5/2003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Blank	--	--	--	2/17/2003 <sup>9</sup>	ND	ND	ND	ND	ND	ND	1.0J	ND	ND	ND	ND	ND	ND	ND
Blank	--	--	--	2/17/2003	ND	ND	ND	ND	ND	ND	1.3J	ND	ND	ND	ND	ND	ND	ND

**Notes:**

<sup>1</sup> Samples were analyzed by **TTL, Inc.** in accordance with Method 8260 outlined in Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA, SW-846.

<sup>2</sup> ft, BLS - Feet, below land surface

<sup>3</sup> gpm - gallons per minute

<sup>4</sup> MDL - Method Detection Limit of 1.0 microgram per liter (µg/l) for laboratory purposes.

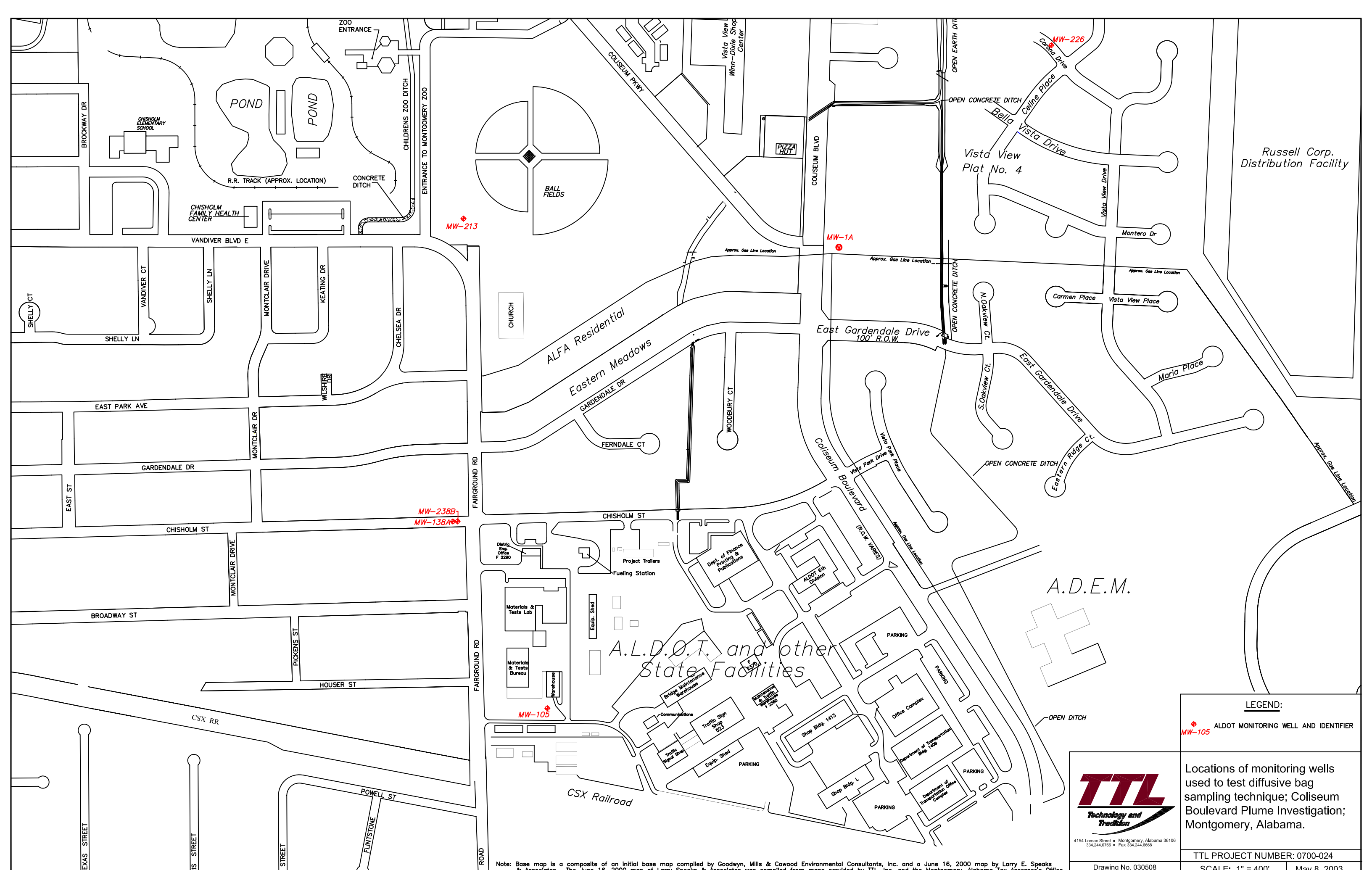
<sup>5</sup> Date range indicates date diffusion bag samplers placed in the well and the date samplers were retrieved.

<sup>6</sup> ND - Not detected

<sup>7</sup> J - Concentration below calibration curve, but above detection limit

<sup>8</sup> The total volume of water purged from well MW-226 was not recorded; therefore a purge rate could not be calculated.

<sup>9</sup> Two separate blank samples taken on this date due to two field crews at different wells.



**LEGEND:**  
 MW-105 ALDOT MONITORING WELL AND IDENTIFIER

Locations of monitoring wells used to test diffusive bag sampling technique; Coliseum Boulevard Plume Investigation; Montgomery, Alabama.



4154 Lomac Street • Montgomery, Alabama 36106  
 334.244.0766 • Fax 334.244.6668

TTL PROJECT NUMBER: 0700-024  
 Drawing No. 030508  
 SCALE: 1" = 400' May 8, 2003

Note: Base map is a composite of an initial base map compiled by Goodwyn, Mills & Cawood Environmental Consultants, Inc. and a June 16, 2000 map by Larry E. Speaks & Associates. The June 16, 2000 map of Larry Speaks & Associates was compiled from maps provided by TTL, Inc. and the Montgomery, Alabama Tax Assessor's Office.