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VACUUM-ENHANCED SKIMMING PILOT STUDY LETTER REPORT FOR FREE PRODUCT RECOVERY AT BUILDING R-12 NAVAL WEAPONS STATION - EARLE COLTS NECK, NEW JERSEY

Issued:

April 19, 2001

Prepared for:

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REMEDIAL ACTION CONTRACT N62472-94-D-0398
DELIVERY ORDER NO. 0051

1.0 INTRODUCTION

Foster Wheeler Environmental was tasked with completing a vacuum-enhanced skimming pilot study at Building R-12 of Naval Weapons Station Earle. Foster Wheeler Environmental had been operating and maintaining a oil skimming pump at several recovery wells (RW-1, RW-2, and RW-3) on the northeast corner of Building R-12.

This Letter Report is being submitted to satisfy the post-construction submittal requirements included in paragraph 1.2.1, Pre- and Post-Construction Documentation of the Statement of Services for Delivery Order No. 0051 under Remedial Action Contract No. N62472-94-D-0398.

This letter report summarizes the operation of the vacuum-enhanced skimmer pilot study and offers and evaluation of the technology as it applies to this site.

1.2 OBJECTIVES

The objective of the vacuum-enhanced skimming pilot study were to determine if this remedial technology should be considered for application at the Building R-12 Site. A passive oil skimming pump had been in operation for approximately 10 months prior to initiating the vacuum-enhanced pilot study.

2.0 PROJECT LOCATION AND DESCRIPTION

Naval Weapons Station Earle (NWS-Earle) is located in Monmouth County in east-central New Jersey. The NWS-Earle base consists of a Mainside Area and a Waterfront Area occupying a total of 11,134 acres. The Mainside of the base is located approximately 10 miles inland from the Atlantic Ocean. The Mainside and the Waterfront areas of the base are linked by a narrow tract of land that serves as a right-of-way for a government road and railroad line.

NWS-Earle is responsible for furnishing ammunition tot he Naval fleet, and coordinates all port services and logistical support for home-ported and visiting ships. The Base also conducts safety inspections, supervises ammunition loading for the United States Coast Guard, and provides marine fire fighting capability and standby tug services. The Waterfront consists of an ammunition depot, and associated piers for loading and servicing the Naval fleet.

Building R-12 is located in the Waterfront area of NWS-Earle along Road R-1. The area of concern (AOC) is behind Building R-12, at the northeast corner of the building. A former heating oil underground storage tank (UST) was abandoned in place at this location. During the UST closure, it was discovered that the bottom of the UST was encased in concrete, and located very close to the Building R-12 foundation. The UST

stored in a drum within secondary containment. This product removal method is a passive method, which does not create a significant pressure head differential to draw product towards the well.

The significant feature of the VER is that the vacuum induced on the well creates a pressure gradient around the well to enhance the product flow to the well.

3.2 PILOT STUDY OPERATION

From October 2, 2000 to October 17, 2000, A VER pilot study was conducted using a skid-mounted blower unit and a passive skimmer pump. The following equipment was used to complete the VER-pilot study:

- (1) Rotron™ regenerative blower (1.5 horsepower with a vacuum range of 0 to 85-inches of water);
- (1) Xitech passive skimmer pump;
- Air compressor unit;
- (2) vapor-phase granular activated carbon drums;
- Air-tight well seal and associated product tubing and piping;

A Xitech skimmer pump was placed in recovery well RW-3, which historically demonstrated the best recovery. An air compressor was used to supply air to the skimmer pump, and the product line was discharged to a drum inside a secondary containment area. The skid-mounted blower unit was set up near Building R-12 in order to place a vacuum on the recovery well. RW-3 was chosen for the pilot study because the previous operations of the skimmer pump demonstrated that this well had the best recovery and recharge rate of the three existing wells. The vacuum was connected to the top of the well using PVC piping and a compression cap that allowed the tubing for the pump to exit the well, but maintained an airtight seal. The exhaust of the skid-mounted blower was fitted with two granular activated carbon drums in series to treat the air being extracted from the well during the pilot study. Appendix A contains a photograph log of the VER-pilot study components, and a schematic.

The vapor stream before, between and after the granular activated carbon drums was measured with a photo-ionization meter (PID) during the pilot study. The PID readings prior to the carbon were 0 to 0.6 ppm and 0 ppm between the first and second carbon drum and after the second carbon drum. Air samples were also obtained in Summa canisters™ prior to (R10-VD01) and after the carbon (R10-VD02) and analyzed for volatile organic compounds (VOCs) via EPA Method T014
) at Apollo Anlaytics laboratory. The laboratory results, contained in Appendix B, did not reveal any detectable concentrations of VOCs.

A vacuum of 15-inches of water was applied to Recovery Well RW-3. The 15-inches of water vacuum on the recovery well caused a slight mounding of the water in the well which is not conducive to product recovery. While no product was detected in the well

during the VER skimming operation, the water level in the well rose 0.08 feet. The vacuum on the well was decreased from 15-inches of water to 5 to 7-inches of water over the two-week pilot study period to establish the most effective operating vacuum. A vacuum of 15-inches of water on the well tended to mound the water in the well, which could potentially prohibit the migration of product into the well. After incremental vacuum adjustments, it was determined that 5-inches of water vacuum allowed for the best product recovery while not mounding the water in the well.

The product recovery rates from the recovery wells exhibited a decline over the past year of operation. In the two weeks prior to the pilot study, no product was being recovered with the skimmer pump, and the recovery well in which the pump was installed only contained a sheen, with no measurable product. The product recovery rate of the skimmer system in the four months prior to conducting the pilot study (October 2000) averaged approximately 0.79 gallons per week. During the two-week pilot study, the product recovery rate was approximately 0.67 gallons per week. While the average weekly recovery rate appeared to decline, it is important to note that no product was being recovered in the two weeks prior to the pilot study.

4.0 CONCLUSIONS

As previously discussed, the product recovery rate of the skimmer pump in RW-3 was zero for the two weeks immediately prior to the pilot study. Prior to that two-week period, the average weekly recovery rate was approximately 0.79 gallons. The depth to product in RW-3 on September 8, 2000 was 9.08 feet, with a product thickness of 0.42 ft. Prior to the startup of the VER pilot study on October 2, 2000, the depth to water in RW-3 was 10.42 feet with no measurable product. According to the water level measurements taken in the weeks prior to the VER-pilot study, the water table level rose 1.34 feet before the start of the pilot study. Product is typically trapped in the saturated zone as the water table rises. When the water table rises and falls, there is usually a lag time that begins when the water level starts to change to when the product is available for recovery.

When compared to the average product recovery rates of the skimmer system in the months previous to the pilot study, the VER-skimming did not result in a significant increase of product recovery. When compared to the product recovery rate of the well in the two-week period immediately prior to the pilot study, the VER-skimming did increase product recovery. The additional costs of operating and maintaining a vacuum-enhanced skimmer system at this site would not be justified based on the amount of product recovered using this technology, and the anticipated available free-phase product available for removal.

Photo 1: Photo depicting the blower unit connected to the well and the activated carbon drums.

Photo 2: Photo of vacuum system and product line extending back to the product recovery drum.

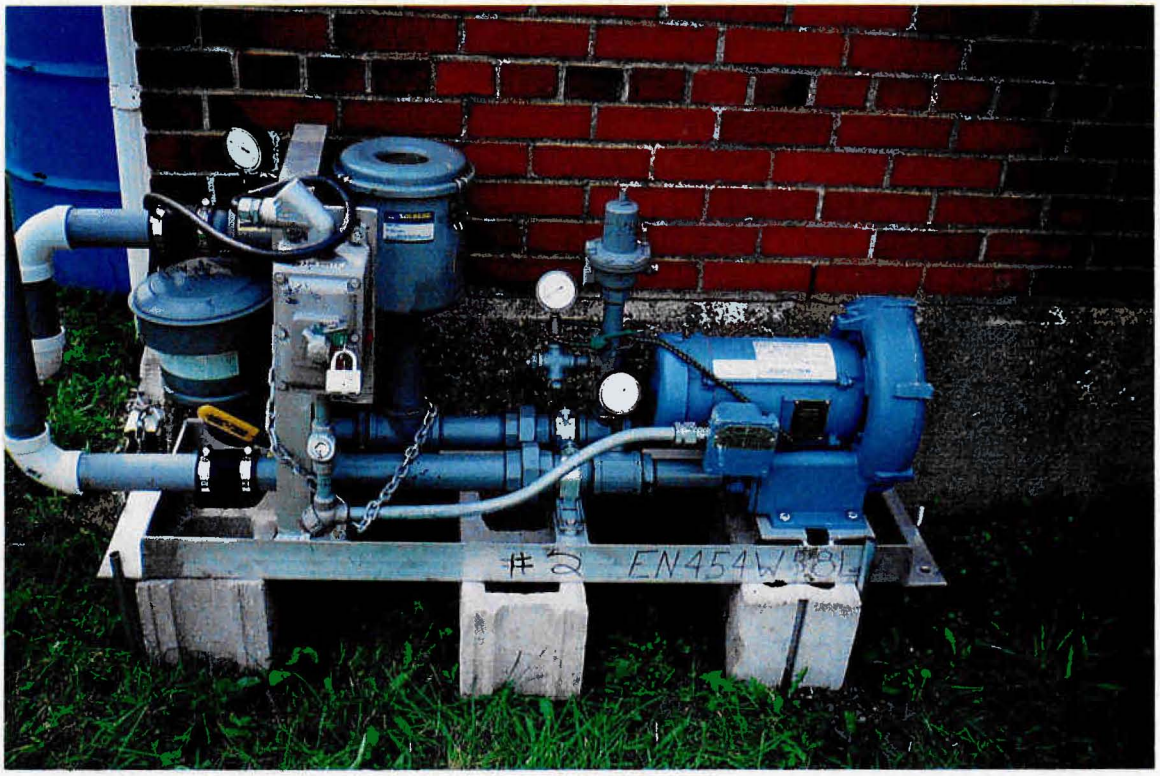
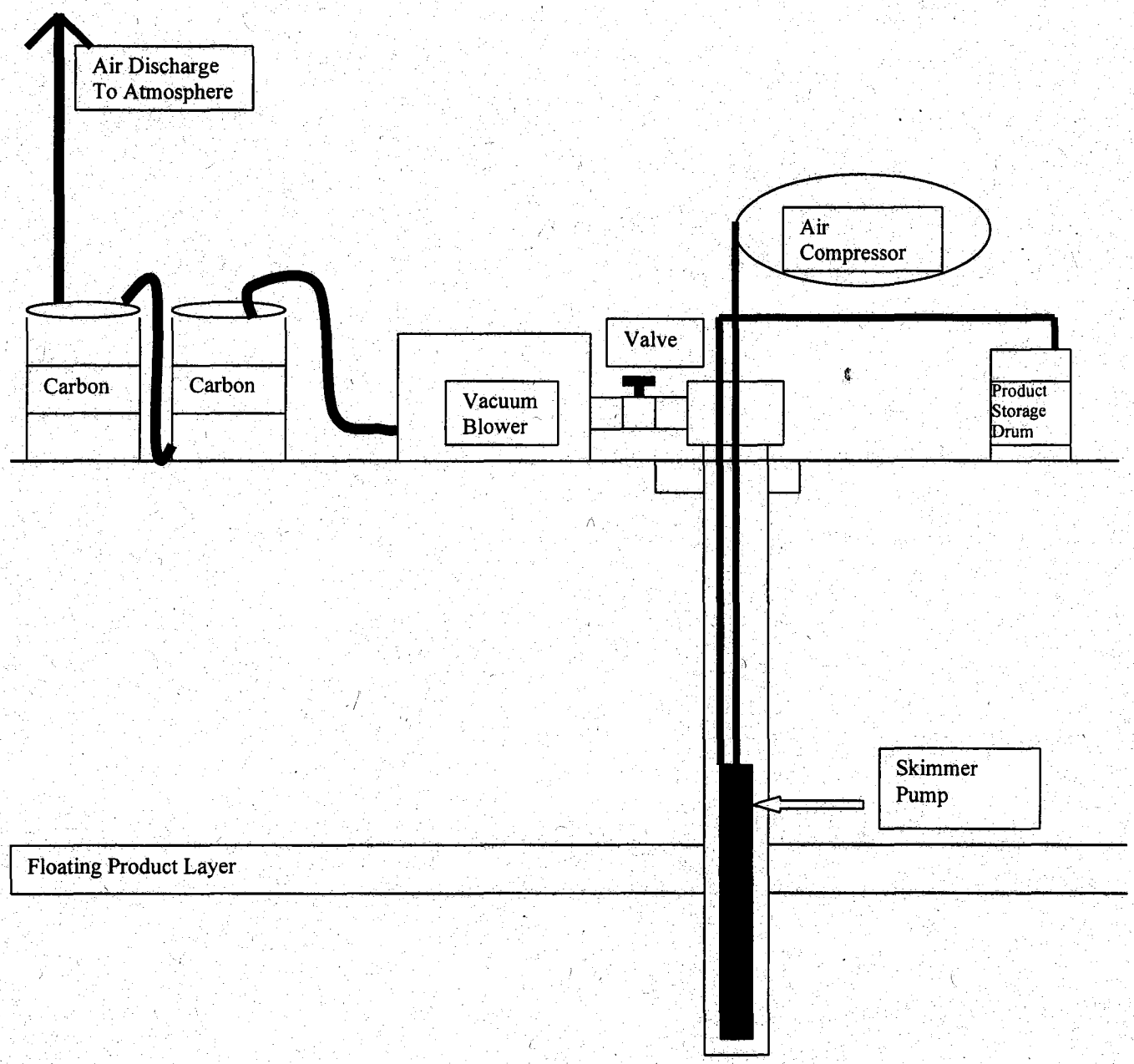


Photo 3: Close up of blower unit used for the pilot study test.

Figure 1: Vacuum-Enhanced Product Skimming Pilot Study Schematic



After Carbon

VOLATILE ORGANIC ANALYSIS

CLIENT NAME:	Foster Wheeler Company	**CLIENT SAMPLE ID:**	R10 VD002
PROJECT #:	—	**AAI RFS#**	0027702
PROJECT NAME:	Product Recovery Bid: R-10 N.W.S.E.	**AAI ID#:**	0027702-002
MATRIX:	Air/Canister		
SAMPLE VOLUME:	0.1 Liter	**DATE SAMPLED:**	10/1/2000
INITIAL PRESSURE:	14.70 psia	**DATE RECEIVED:**	10/3/2000
FINAL PRESSURE:	16.90 psia	**DATE ANALYZED:**	10/15/2000
PRES. DILUTION :	1.15		
DILUTION FACTOR:	1	**ANALYTICAL METHOD:**	EPA TO14 (GC/MS)

CAS NUMBER	COMPOUND	CONCENTRATION mg/m3	PQL	ppm(v)	PQL
74-87-3	Chloromethane	ND<	0.057	ND<	0.028
74-83-9	Bromomethane	ND<	0.057	ND<	0.015
75-01-04	Vinyl Chloride	ND<	0.057	ND<	0.022
75-00-3	Chloroethane	ND<	0.057	ND<	0.022
75-69-4	Freon 11	ND<	0.057	ND<	0.010
75-35-4	1,1-Dichloroethene	ND<	0.057	ND<	0.015
76-13-1	Freon 113	ND<	0.057	ND<	0.008
75-09-2	Methylene Chloride	ND<	0.057	ND<	0.017
75-35-3	1,1-Dichloroethane	ND<	0.057	ND<	0.014
156-60-5	trans-1,2-Dichloroethene	ND<	0.057	ND<	0.015
156-59-2	cis-1,2-Dichloroethene	ND<	0.057	ND<	0.015
67-66-3	Chloroform	ND<	0.057	ND<	0.012
71-55-6	1,1,1-Trichloroethane	ND<	0.057	ND<	0.011
56-23-5	Carbon Tetrachloride	ND<	0.057	ND<	0.009
71-43-2	Benzene	ND<	0.057	ND<	0.018
107-06-2	1,2-Dichloroethane	ND<	0.057	ND<	0.014
79-01-6	Trichloroethene	ND<	0.057	ND<	0.011
78-87-5	1,2-Dichloropropane	ND<	0.057	ND<	0.012
10061-02-6	trans-1,3-Dichloropropene	ND<	0.057	ND<	0.013
108-88-3	Toluene	ND<	0.057	ND<	0.015
10061-01-5	cis-1,3-Dichloropropene	ND<	0.057	ND<	0.013
79-00-5	1,1-2-Trichloroethane	ND<	0.057	ND<	0.011
127-18-4	Tetrachloroethene	ND<	0.057	ND<	0.008
106-93-4	Ethylene Dibromide	ND<	0.057	ND<	0.007
108-90-7	Chlorobenzene	ND<	0.057	ND<	0.012
100-41-4	Ethylbenzene	ND<	0.057	ND<	0.013
1330-20-7	m,p-Xylene	ND<	0.057	ND<	0.013
95-47-6	o-Xylene	ND<	0.057	ND<	0.013
100-42-5	Styrene	ND<	0.057	ND<	0.014
79-34-5	1,1,2,2-Tetrachlorethane	ND<	0.057	ND<	0.008
108-67-8	1,3,5-Trimethyl Benzene	ND<	0.057	ND<	0.012
95-63-6	1,2,4-Trimethyl Benzene	ND<	0.057	ND<	0.012
541-73-1	1,3-Dichlorobenzene	ND<	0.057	ND<	0.010
106-46-7	1,4-Dichlorobenzene	ND<	0.057	ND<	0.010
100-44-7	Chlorotoluene	ND<	0.057	ND<	0.011
95-50-1	1,2-Dichlorobenzene	ND<	0.057	ND<	0.010
67-64-1	Acetone	ND<	0.057	ND<	0.024
78-93-3	2-Butanone	ND<	0.057	ND<	0.020
108-10-1	4-methyl-2-pentanone	ND<	0.057	ND<	0.014
591-78-6	2-Hexanone	ND<	0.057	ND<	0.014

Surrogate Recovery	% Recovery	
1,2-Dichloroethane-D4 (SS1)	105	70-130
Toluene-d8 (SS2)	111	70-130
4- Bromofluorobenzene (SS3)	102	70-130

ND- Not detected

TR - Trace

*Value outside QC limits due to matrix interfence.

Approved by:_____ Date:_____

VOLATILE ORGANIC ANALYSIS

CLIENT NAME:	Foster Wheeler Company	**CLIENT SAMPLE ID:**	Method Blank
PROJECT #:	---	**AAI RFS#**	0027702
PROJECT NAME:	Product Recovery Bld: R-10 N.W.S.E.	**AAI ID#:**	Method Blank
MATRIX:	Air/Canister		
SAMPLE VOLUME:	0.1 Liter	**DATE SAMPLED:**	N/A
INITIAL PRESSURE:	1.00 psia	**DATE RECEIVED:**	N/A
FINAL PRESSURE:	1.00 psia	**DATE ANALYZED:**	10/15/2000
PRES. DILUTION :	1.00		
DILUTION FACTOR:	1	**ANALYTICAL METHOD:**	EPA TO14 (GC/MS)

CAS NUMBER	COMPOUND	CONCENTRATION mg/m3	PQL	ppm(v)	PQL
74-87-3	Chloromethane	ND<	0.050	ND<	0.024
74-83-9	Bromomethane	ND<	0.050	ND<	0.013
75-01-04	Vinyl Chloride	ND<	0.050	ND<	0.020
75-00-3	Chloroethane	ND<	0.050	ND<	0.019
75-69-4	Freon 11	ND<	0.050	ND<	0.009
75-35-4	1,1-Dichloroethene	ND<	0.050	ND<	0.013
76-13-1	Freon 113	ND<	0.050	ND<	0.007
75-09-2	Methylene Chloride	ND<	0.050	ND<	0.014
75-35-3	1,1-Dichloroethane	ND<	0.050	ND<	0.012
156-60-5	trans-1,2-Dichloroethene	ND<	0.050	ND<	0.013
156-59-2	cis-1,2-Dichloroethene	ND<	0.050	ND<	0.013
67-66-3	Chloroform	ND<	0.050	ND<	0.010
71-55-6	1,1,1-Trichloroethane	ND<	0.050	ND<	0.009
56-23-5	Carbon Tetrachloride	ND<	0.050	ND<	0.008
71-43-2	Benzene	ND<	0.050	ND<	0.016
107-06-2	1,2-Dichloroethane	ND<	0.050	ND<	0.012
79-01-6	Trichloroethene	ND<	0.050	ND<	0.009
78-87-5	1,2-Dichloropropane	ND<	0.050	ND<	0.011
10061-02-6	trans-1,3-Dichloropropene	ND<	0.050	ND<	0.011
108-88-3	Toluene	ND<	0.050	ND<	0.013
10061-01-5	cis-1,3-Dichloropropene	ND<	0.050	ND<	0.011
79-00-5	1,1-2-Trichloroethane	ND<	0.050	ND<	0.009
127-18-4	Tetrachloroethene	ND<	0.050	ND<	0.007
106-93-4	Ethylene Dibromide	ND<	0.050	ND<	0.007
108-90-7	Chlorobenzene	ND<	0.050	ND<	0.011
100-41-4	Ethylbenzene	ND<	0.050	ND<	0.012
1330-20-7	m,p-Xylene	ND<	0.050	ND<	0.012
95-47-6	o-Xylene	ND<	0.050	ND<	0.012
100-42-5	Styrene	ND<	0.050	ND<	0.012
79-34-5	1,1,2,2-Tetrachlorethane	ND<	0.050	ND<	0.007
108-67-8	1,3,5-Trimethyl Benzene	ND<	0.050	ND<	0.010
95-63-6	1,2,4-Trimethyl Benzene	ND<	0.050	ND<	0.010
541-73-1	1,3-Dichlorobenzene	ND<	0.050	ND<	0.008
106-46-7	1,4-Dichlorobenzene	ND<	0.050	ND<	0.008
100-44-7	Chlorotoluene	ND<	0.050	ND<	0.010
95-50-1	1,2-Dichlorobenzene	ND<	0.050	ND<	0.008
67-64-1	Acetone	ND<	0.050	ND<	0.021
78-93-3	2-Butanone	ND<	0.050	ND<	0.017
108-10-1	4-methyl-2-pentanone	ND<	0.050	ND<	0.012
591-78-6	2-Hexanone	ND<	0.050	ND<	0.012

Surrogate Recovery	% Recovery	
1,2-Dichloroethane-D4 (SS1)	130	70-130
Toluene-d8 (SS2)	98	70-130
4- Bromofluorobenzene (SS3)	108	70-130

ND- Not detected

TR - Trace

*Value outside QC limits due to matrix interfence.

Approved by:_____ Date:_____

Prior to Carbon

VOLATILE ORGANIC ANALYSIS

CLIENT NAME:	Foster Wheeler Company	**CLIENT SAMPLE ID:**	R10 VD001
PROJECT #:	---	**AAI RFS#**	0027702
PROJECT NAME:	Product Recovery Bld: R-10 N.W.S.E.	**AAI ID#:**	0027702-001
MATRIX:	Air/Canister		
SAMPLE VOLUME:	0.1 Liter	**DATE SAMPLED:**	10/1/2000
INITIAL PRESSURE:	14.90 psia	**DATE RECEIVED:**	10/3/2000
FINAL PRESSURE:	17.30 psia	**DATE ANALYZED:**	10/15/2000
PRES. DILUTION :	1.16		
DILUTION FACTOR:	1	**ANALYTICAL METHOD:**	EPA TO14 (GC/MS)

CAS NUMBER	COMPOUND	CONCENTRATION mg/m3	PQL	ppm(v)	PQL
74-87-3	Chloromethane	ND<	0.058	ND<	0.028
74-83-9	Bromomethane	ND<	0.058	ND<	0.015
75-01-04	Vinyl Chloride	ND<	0.058	ND<	0.023
75-00-3	Chloroethane	ND<	0.058	ND<	0.022
75-69-4	Freon 11	ND<	0.058	ND<	0.010
75-35-4	1,1-Dichloroethene	ND<	0.058	ND<	0.015
76-13-1	Freon 113	ND<	0.058	ND<	0.008
75-09-2	Methylene Chloride	ND<	0.058	ND<	0.017
75-35-3	1,1-Dichloroethane	ND<	0.058	ND<	0.014
156-60-5	trans-1,2-Dichloroethene	ND<	0.058	ND<	0.015
156-59-2	cis-1,2-Dichloroethene	ND<	0.058	ND<	0.015
67-66-3	Chloroform	ND<	0.058	ND<	0.012
71-55-6	1,1,1-Trichloroethane	ND<	0.058	ND<	0.011
56-23-5	Carbon Tetrachloride	ND<	0.058	ND<	0.009
71-43-2	Benzene	ND<	0.058	ND<	0.018
107-06-2	1,2-Dichloroethane	ND<	0.058	ND<	0.014
79-01-6	Trichloroethene	ND<	0.058	ND<	0.011
78-87-5	1,2-Dichloropropane	ND<	0.058	ND<	0.013
10061-02-6	trans-1,3-Dichloropropene	ND<	0.058	ND<	0.013
108-88-3	Toluene	ND<	0.058	ND<	0.015
10061-01-5	cis-1,3-Dichloropropene	ND<	0.058	ND<	0.013
79-00-5	1,1-2-Trichloroethane	ND<	0.058	ND<	0.011
127-18-4	Tetrachloroethene	ND<	0.058	ND<	0.009
106-93-4	Ethylene Dibromide	ND<	0.058	ND<	0.008
108-90-7	Chlorobenzene	ND<	0.058	ND<	0.013
100-41-4	Ethylbenzene	ND<	0.058	ND<	0.013
1330-20-7	m,p-Xylene	ND<	0.058	ND<	0.013
95-47-6	o-Xylene	ND<	0.058	ND<	0.013
100-42-5	Styrene	ND<	0.058	ND<	0.014
79-34-5	1,1,2,2-Tetrachlorethane	ND<	0.058	ND<	0.008
108-67-8	1,3,5-Trimethyl Benzene	ND<	0.058	ND<	0.012
95-63-6	1,2,4-Trimethyl Benzene	ND<	0.058	ND<	0.012
541-73-1	1,3-Dichlorobenzene	ND<	0.058	ND<	0.010
106-46-7	1,4-Dichlorobenzene	ND<	0.058	ND<	0.010
100-44-7	Chlorotoluene	ND<	0.058	ND<	0.011
95-50-1	1,2-Dichlorobenzene	ND<	0.058	ND<	0.010
67-64-1	Acetone	ND<	0.058	ND<	0.024
78-93-3	2-Butanone	ND<	0.058	ND<	0.020
108-10-1	4-methyl-2-pentanone	ND<	0.058	ND<	0.014
591-78-6	2-Hexanone	ND<	0.058	ND<	0.014

Surrogate Recovery	% Recovery	
1,2-Dichloroethane-D4 (SS1)	115	70-130
Toluene-d8 (SS2)	105	70-130
4- Bromofluorobenzene (SS3)	99	70-130

ND- Not detected

TR - Trace

*Value outside QC limits due to matrix interfence.

Approved by:_____ Date:_____