

**QUARTERLY MONITORING REPORT
Springfield Street School Complex
Providence, Rhode Island**

**Project No. 081-12152-04
August 2007 Monitoring Round**

Prepared for
Providence School Department
797 Westminster Street
Providence, RI 02903

Prepared by
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September 21, 2007

081-12152-04

Mr. Jeffrey Crawford
Rhode Island Department of Environmental Management
Office of Waste Management
235 Promenade Street
Providence, RI 02908-5767

Subject: Quarterly Monitoring for Springfield Street School Complex, 50 Springfield Street,
Providence, RI – August 2007 Monitoring Round

Dear Mr. Crawford:

Quarterly monitoring for soil gas, indoor air and system monitoring was conducted between August 20 and 24, 2007. The monitoring was performed in accordance with the *Long-Term Operation and Maintenance Plan and Site Contingency Plan (O&M Plan)* contained in the *Remedial Action Work Plan* prepared by ATC dated April 2, 1999, revised May 3, 1999 and May 9, 1999. The *Remedial Action Work Plan (RAWP)* was approved by the Rhode Island Department of Environmental Management (RIDEM) in a letter dated June 4, 1999.

Results of monitoring are provided in the following sections and in the attachments.

COVER MONITORING

LFR conducted a visual survey of the site for evidence of significant soil cover erosion, or for any areas where the orange snow fencing indicator barrier was visible. LFR did not observe any areas where the orange indicator barrier was visible during this monitoring event.

As of August 23, 2007 repair work in areas affected by settling was nearly complete. Specific observations of site conditions are listed below:

- Concrete sidewalks and walkways at the middle school which had been affected by settling had been removed and replaced,
- The asphalt around the storm drain in the middle school courtyard had been removed and the area prepared for repaving,
- An asphalt walkway around the west and south of the middle school had been removed and was prepared for repaving,

- Fill had been placed in the settled area around the transformer behind the middle school and the elevation of storm drains in the area had been corrected,
- A settled area in the paved school yard west of the elementary school had been cut out, filled to grade, and patched.

Additional information regarding the completion of repairs will be provided under separate cover.

SUB-SLAB VENTILATION SYSTEM

The sub-slab ventilation system was inspected by LFR during the quarterly monitoring on August 23, 2007. All blowers were operating normally upon arrival at the Site.

Influent and effluent air from the two blowers at the elementary school and the blower in the rear and front sheds at the middle school was monitored. Samples of influent and effluent gas were collected in Tedlar bags at each location and screened for methane, carbon dioxide, carbon monoxide, and hydrogen sulfide using a Landtec GEM2000, and for volatile organic compounds (VOC) using a MiniRae 2000. Results are provided in Table 1.

Methane, hydrogen sulfide and organic vapor concentrations in the subslab ventilation system samples were all measured as zero during this monitoring event. Carbon dioxide readings at the elementary school ranged from 0.4 to 0.5 percent, and carbon dioxide readings at the middle school ranged from 0.1 to 0.3 percent. Carbon monoxide concentrations ranged were between 1 and 2 ppm at both schools.

INDOOR AIR MONITORING

Indoor air monitoring was conducted on August 23, 2007 using a Landtec Gem 2000 landfill gas monitor (methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulfide) and a Mini Rae photoionization detector (organic vapors). The elementary school was occupied at the time of the sampling, but the middle school was not occupied by students due to summer recess. Some staff were in the building. Results of monitoring are provided in the Table 2. Methane, carbon dioxide, and hydrogen sulfide were not detected during the indoor air monitoring. Carbon monoxide was measured at 1 ppm at all locations in both buildings. Organic vapors were detected at concentrations below the action level at two locations in the elementary school; both of these locations were near where cleaning staff were using a cleaning product to remove wax from baseboard. Screening with the PID indicated that the cleaning product was the source of the VOCs detected. Organic vapors were not detected at any other locations.

The control panel for the methane monitors in the front office of the middle school and the elementary school were inspected on August 23, 2007. The control panel in the janitor's office at the middle school was not accessible on August 23, 2007 because the floor in the area was freshly waxed. The panel in the janitor's office at the middle school was inspected on September 4, 2007. The

methane monitor control panels had stickers that indicated the monitors were last calibrated by Diamond Calibration personnel on August 14, 2007. The sensors appeared to be functioning.

Calibration Certificates from Diamond Calibration indicate that many of the sensors read above 0 when calibrated to the zero gas. This prevents the sensors from giving a fault alarm if the reading drops below zero due to a sudden temperature change, and still provides a conservative measure of protection because the alarm limit does not change.

GROUNDWATER MONITORING

Five groundwater monitoring wells were sampled by LFR on August 20, 2007. Prior to sampling, the depth to water was gauged, and a volume of water equivalent to approximately three well volumes was removed from each well. Temperature, specific conductance, dissolved oxygen, and pH were measured in the field prior to sampling. Depth to groundwater ranged from 12.56 to 18.44 feet below the ground surface. Groundwater samples were collected in laboratory prepared sample jars and delivered under chain-of-custody protocol to Contest Laboratory in East Longmeadow, Massachusetts for analysis for volatile organic compounds by EPA method 8260. The laboratory report is provided as Attachment A. Results of analysis of groundwater samples are summarized in Table 3.

The laboratory analysis of the five groundwater samples detected low concentrations of one target analyte in ATC-3, and two in ATC-4. The concentrations were well below applicable GB groundwater standards, and were consistent with concentrations and compounds detected during previous rounds of sampling and analysis.

SOIL GAS MONITORING

Soil gas monitoring was conducted at 29 locations on August 22 and 23, 2007. The sampling was conducted by placing an air sampling gripper cap on each well and attaching a piece of tubing. A volume of air equivalent to approximately 3 well volumes was removed from each well using an SKC Airchek Sampling pump. Soil gas was then screened using a Landtec Gem 2000 Landfill Gas Analyzer & Extraction Monitor and a MiniRae Photoionization Detector (PID).

Air samples were also collected in Tedlar bags using the SKC Airchek Pump from wells WB-2 and MPL-6. The Tedlar bags were submitted to Con-test Analytical Laboratory for analysis for VOC via EPA method TO-14.

Soil gas well MG-4 was not able to be located during this round of sampling. This soil gas well was located just north of the paved driveway that was being replaced at the time monitoring was being performed, and soil in the area was disturbed by the construction. LFR will attempt to locate and repair, if necessary, the soil gas well before the next round of sampling. If the well can not be located, it will be replaced with a new soil gas sampling well in this location prior to the next round of sampling.



Soil Gas Field Monitoring Results

Soil gas samples were screened for methane, carbon monoxide, hydrogen sulfide, carbon dioxide, oxygen, and total VOCs. Soil gas survey results are provided in Table 4.

Methane was detected in one well, WB-12, at 0.2% by volume on August 22. The well was resampled on August 23, and methane was not detected. The concentrations of carbon dioxide in the samples from this well were similar during both sampling events, at 1.7% and 1.6%. Oxygen was measured at 20.3% and 20.1%. Conditions at the well are aerobic, so significant methane generation is not expected.

Carbon monoxide was detected at 12 of 28 locations at concentrations ranging from 0 to 5 parts per million (ppm). The detected concentrations did not exceed the Action Level of 9 ppm.

Hydrogen sulfide was detected at only one of the 29 monitoring locations, at 1 ppm, which is just above the instrument detection limit. Organic vapors were not detected at any of the sampling locations.

Carbon dioxide was detected at 22 of 28 locations with detectable concentrations ranging from 0.1% to 13.2%. The carbon dioxide Remedial Action Work Plan Action Level is 0.1%, and 22 readings exceeded the action level. The presence of carbon dioxide in soil gas is an indicator of subsurface bacterial activity and does not represent a threat to users of the property. Graphs presenting carbon dioxide, oxygen, and methane concentrations over time for seven representative wells are presented in Attachment B. Concentrations detected during this round of monitoring appear to be consistent with the patterns of higher carbon dioxide concentrations in the summer and fall, and lower carbon dioxide concentrations in the winter and spring.

The highest carbon dioxide concentrations were observed in wells MPL-5, MPL-6 and MPL-7, which are located on the northern end of the Site in the parking lot or a landscaped area between the middle school parking lot and Hartford Avenue. The soil in this area is expected to be warmer than in other areas of the Site due to the large area of pavement. The warmth is expected to be conducive to bacterial activity. In addition, the large area of pavement blocks transport of oxygenated atmospheric air into the subsurface.

An article reprinted from Golf Course Magazine is provided in Attachment C to illustrate that carbon dioxide concentrations in soil gas as high as those found at the Site occur naturally at golf courses where no known contaminants are present.

Soil Gas Laboratory Results

Soil gas samples were collected from soil gas wells MPL-6 and WB-2 in Tedlar bags and submitted to Con-Test Analytical Laboratories for analysis by method TO-14. Results of the analysis are summarized in Table 5, and the laboratory report is provided in Attachment A. The results of analysis

were typical of the concentrations and compounds which have been detected in previous monitoring events.

The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) are provided in Table 5 for comparison purposes even though they are not applicable to soil gas, because it does not represent exposure point concentrations. The PELs are the average concentrations that OSHA allows to be present in a workplace without any respiratory protection or exposure controls. The concentrations detected in soil gas were well below the OSHA PELs.

CONCLUSIONS

Methane, carbon monoxide, hydrogen sulfide and organic vapor concentrations did not exceed RAWP action levels in any soil gas samples, indoor air or subslab ventilation system samples. Carbon dioxide concentrations exceeded the action level at some locations. The detection of carbon dioxide in soil gas is typical of what has been detected during previous monitoring events and appears to be a result of naturally occurring bacterial activity in the subsurface.

Inspection of the cap did not reveal any evidence of exposure of the orange barrier or of breaches of the cap that would allow users of the Site to be exposed to the underlying capped soils. Repairs to the grounds were completed prior to the start of school, and are described in a separate letter.

This report is subject to the limitations contained in Attachment D.

If you have any questions or require any additional information, please contact the undersigned at 401-738-3887.

Sincerely,



Donna Holden Pallister, P.E., L.S.P.
Senior Engineer

cc: A. Sepe, City of Providence
S. Tremblay, Providence School Department
Providence Public Building Authority

TABLES

Table 1
System Monitoring Notes
Springfield Street School Complex
Providence, Rhode Island
August 23, 2007

Monitoring Location	Methane % by volume Landtec	Carbon Dioxide % by volume	Oxygen % by volume	Carbon Monoxide PPM	Hydrogen Sulfide PPM	Organic Vapors PPM
Elementary School inlet 1	0.0	0.5	21.1	1	0	0.0
Elementary School inlet 2	0.0	0.4	21.3	1	0	0.0
Elementary School Outlet	0.0	0.5	21.2	2	0	0.0
Middle School front shed inlet	0.0	0.1	21.4	2	0	0.0
Middle School front shed after 2 nd carbon	0.0	0.1	21.4	2	0	0.0
Middle School back shed inlet	0.0	0.3	21.1	1	0	0.0
Middle School back shed after 2 nd carbon	0.0	0.3	21.1	2	0	0.0
Remedial Action Work Plan Action Levels	0.5	1,000 ppm (0.1%)	NA	9 ppm	10 ppm	5 ppm

Measurements made with: Landtec Gem 2000, MiniRae 2000

Sampling date: August 23, 2007

Measured by: D.H. Pallister

Table 2
Indoor Air Monitoring Results
Springfield Street School Complex
Providence, Rhode Island
August 23, 2007

Monitoring Location	Methane % by volume Landtec	Carbon Dioxide % by volume	Oxygen % by volume	Carbon Monoxide PPM	Hydrogen Sulfide PPM	Organic Vapors PPM
E.S. Front office	0.0	0.0	21.7	1	0	0.0
E.S. Elevator	0.0	0.0	21.7	1	0	0.0
E.S. Elevator Room	0.0	0.0	21.7	1	0	1.2
E.S. Gym Storage Room	0.0	0.0	21.7	1	0	0.0
E.S. Room 218	0.0	0.0	21.8	1	0	0.0
E.S. Library	0.0	0.0	21.8	1	0	1.1
E.S. Elect. Rm. in Mech. Rm.	0.0	0.0	21.9	1	0	0.0
E.S. Stairway Stair B	0.0	0.0	21.8	1	0	0.0
E.S. Room 111	0.0	0.0	21.9	1	0	0.0
E.S. Cafeteria	0.0	0.0	21.9	1	0	0.0

Table 2
Indoor Air Monitoring Notes
Springfield Street School Complex
August 23, 2007

Monitoring Location	Methane % by volume Landtec	Carbon Dioxide % by volume	Oxygen % by volume	Carbon Monoxide PPM	Hydrogen Sulfide PPM	Organic Vapors PPM
M.S. Front Office	0.0	0.0	21.3	1	0	0.0
M.S. Elevator	0.0	0.0	21.4	1	0	0.0
M.S. Music Room	0.0	0.0	21.4	1	0	0.0
M.S. Stairway near Elem. School	0.0	0.0	21.5	1	0	0.0
M.S. Comm. Rm.	0.0	0.0	21.5	1	0	0.0
M.S. Near Sensor in cafeteria	0.0	0.0	21.5	1	0	0.0
M.S. Classroom 113	0.0	0.0	21.5	1	0	0.0

Table 2
Indoor Air Monitoring Notes
Springfield Street School Complex
August 23, 2007

Monitoring Location	Methane % by volume Landtec	Carbon Dioxide % by volume	Oxygen % by volume	Carbon Monoxide PPM	Hydrogen Sulfide PPM	Organic Vapors PPM
M.S. Faculty Workroom 2 nd Floor	0.0	0.0	21.5	1	0	0.0
Remedial Action Work Plan Action Levels	0.5	1,000 ppm (0.1%)	NA	9 ppm	10 ppm	5 ppm

Notes:

E.S. indicates Elementary School

M.S. indicates Middle School

Measurements made with: GEM 2000 Gas Analyzer & Extraction Monitor, MiniRae PID Meter

Table 3
 Summary of Ground Water Sampling Results
 Springfield Street School Complex
 Springfield Street
 Providence, Rhode Island

Monitoring Wells	Detected Compounds	Sampling Dates and Results in µg/L																				RIDEM GB Groundwater Objective		
		2/28/2001	7/20/2001	*9- 12/2001	8/1/2002	8/28/2002	12/19/2002	3/18/2003	7/17/2003	11/5/2003	1/22/2004	5/21/2004	8/17/2004	12/2/2004	4/6/2005	7/27/2005	10/27&28/2005	2/2/2006	4/27/2006	8/31/2006	11/15/2006		3/27/2007	5/21/2007
ATC-1	Benzene	6.1	ND	18.9	0.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	140
	n-butylbenzene	1.7	ND	2.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	NA
	sec-Butylbenzene	1.1	ND	4.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
	tert-Butylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND	ND	NA
	Ethylbenzene	4.5	ND	12.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1600
	Isopropylbenzene	ND	ND	1.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
	n-Propylbenzene	ND	ND	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
	MTBE	12.4	7.0	28.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5000
	Trichloroethylene	ND	ND	ND	ND	ND	ND	ND	1.27	ND	ND	ND	ND	1.10	ND	ND	1.3	ND	ND	ND	ND	ND	ND	540
	Toluene	2.5	ND	8.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1700
	1,2,4-Trimethylbenzene	2.2	ND	8.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
	1,3,5-Trimethylbenzene	3.4	ND	5.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
	Xylenes	14.6	ND	37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
	1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	NA
ATC-2	Chloroform	0.9	ND	ND	1.0	ND	ND	ND	ND	ND	NS	1.1	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
ATC-3	Toluene	ND	ND	ND	ND	NS	ND	ND	ND	ND	3.03	ND	ND	ND	ND	ND	3.0	ND	4.5	13.1	ND	2.3	1.3	1700
ATC-4	Benzene	ND	ND	2.5	0.6	ND	ND	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	140
	Chlorobenzene	2.6	ND	57.3	2.7	5.18	ND	ND	ND	ND	ND	ND	0.60	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.80	70
	1,4-dichlorobenzene	4.2	ND	9.2	3.4	3.36	ND	ND	ND	ND	0.80	1.6	2.1	ND	ND	ND	ND	ND	1.2	1.1	ND	1.2	2.1	NA
	MTBE	ND	ND	ND	ND	ND	ND	ND	1.19	9.55	1.06	2.90	0.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5000
	1,2,4-Trimethylbenzene	ND	ND	1.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
ATC-5	MTBE	ND	ND	2.2	NS	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5000
	Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	0.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Sampled By:		ATC	ATC	ATC	ATC	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	LFR	

*ATC Monitoring Report for September through December 2001 did not list date samples were collected.

ND is not detected above method detection limit

NS is not sampled

NA= No applicable standard published

MTBE is Methyl tert-Butyl Ether

µg/L = micrograms per liter

Table 4
Soil Gas Survey Field Notes
Springfield Street School Complex
Providence, RI
August 22, 2007

Monitoring Well	Methane % by volume	Carbon Dioxide % by volume	Oxygen % by volume	Carbon Monoxide PPM	Hydrogen Sulfide PPM	Organic Vapors PPM
WB-1	0.0	5.6	14.7	0	0	0.0
WB-2	0.0	0.4	21.7	0	0	0.0
WB-3	0.0	0.0	22.3	0	0	0.0
WB-4	0.0	0.0	22.2	0	0	0.0
WB-5	0.0	0.0	22.1	2	0	0.0
WB-6	0.0	0.0	22.0	1	0	0.0
WB-7	0.0	0.0	22.0	1	1	0.0
WB-8	0.0	0.0	21.6	0	0	0.0
WB-12	0.2	1.7	20.3	0	0	0.0
WB-12* Recheck 8/23	0.0	1.6	20.1	2	0	0.0
WB-13	0.0	4.8	15.8	0	0	0.0
WB-14	0.0	2.4	19.2	0	0	0.0
WB-15	0.0	2.9	18.8	0	0	0.0
EPL-1	0.0	0.9	20.3	0	0	0.0
EPL-2	0.0	4.0	16.7	1	0	0.0
EPL-3	0.0	5.8	15.0	0	0	0.0
EPL-4	0.0	3.9	16.6	1	0	0.0
EPL-5	0.0	7.5	11.9	1	0	0.0
ENE-1	0.0	0.8	20.1	0	0	0.0
MG1	0.0	1.0	19.2	0	0	0.0
MG2	0.0	2.5	17.5	0	0	0.0
MG-3	0.0	1.0	20.6	0	0	0.0
MG-4						
MG-5	0.0	2.1	17.3	1	0	0.0
MPL2	0.0	0.2	20.3	5	0	0.0

Table 4
Soil Gas Survey Field Notes
Springfield Street School Complex
Providence, RI
August 22, 2007

Monitoring Well	Methane % by volume	Carbon Dioxide % by volume	Oxygen % by volume	Carbon Monoxide PPM	Hydrogen Sulfide PPM	Organic Vapors PPM
MPL3	0.0	0.1	20.9	0	0	0.0
MPL5	0.0	12.6	5.2	4	0	0.0
MPL6	0.0	13.2	8.4	3	0	0.0
MPL7	0.0	12.9	6.4	3	0	0.0
MPL8	0.0	7.5	11.7	0	0	0.0
Remedial Action Work Plan Action Levels	0.5%	1,000 PPM	NA	9 PPM	10 PPM	5 PPM

Sampled by: Chris Jamison

Weather Conditions: Partly cloudy, mid 70's

Sampling Equipment: Landtec Gem 2000 Gas Analyzer, Industrial Scientific Multigas monitor MG140, and MiniRAE 2000, SKC pump.

Table 5
Soil Gas Laboratory Analysis Results
Springfield Street School Complex
August 22, 2007

Parameter	OSHA PELs (PPBv)	Results of Analysis in parts per billion by volume (PPBv)	
		MPL-6	WB-2
Benzene	1,000	0.74	ND
Chloroethane	1,000,000	ND	1.8
Chloroform	50,000	0.48	ND
Chloromethane	100,000	0.36	ND
Dichlorodifluoromethane	1,000,000	0.28	0.57
1,4-Dichlorobenzene	75,000	0.54	0.37
1,1-Dichloroethane	100,000	0.28	29
1,1-Dichloroethylene	None	ND	2.5
Cis-1,2-Dichloroethylene	200,000	ND	3.5
Ethylbenzene	100,000	0.70	0.46
Methylene Chloride	100,000	0.84	0.5
Styrene	100,000	1.5	1.1
Tetrachloroethylene	100,000	0.27	0.81
Toluene	200,000	7.2	5.3
1,1,1-Trichloroethane	350,000	0.36	38
Trichloroethylene	100,000	0.25	4.6
Trichlorofluoromethane (Freon 11)	1,000,000	0.7	0.43
1,1,2-Trichloro-1,2,2,-Trifluoroethane	1,000,000	0.27	ND
1,3,5-Trimethylbenzene	None	ND	ND
1,2,4-Trimethylbenzene	None	0.44	0.26
M/p-Xylene	100,000	2.4	1.8
o-Xylene	100,000	0.68	0.48

Table lists only detected compounds. See laboratory report for full list of analytes.

Occupational Safety and Health Administration (OSHA) PELs = Permissible Exposure Limits from NIOSH Pocket Guide to Chemical Hazards

FIGURE

NOTES:

THE FOLLOWING MAP IS REFERENCED: ELEMENTARY & MIDDLE SCHOOLS, PROVIDENCE RHODE ISLAND, ISSUED FOR, CITY OF PROVIDENCE, GRADING AND SAMPLING LOCATION PLAN, PREPARED BY NORTHEAST ENGINEERS & CONSULTANTS, INC., DATED MAY 19, 1999, SCALE: 1"=50'.

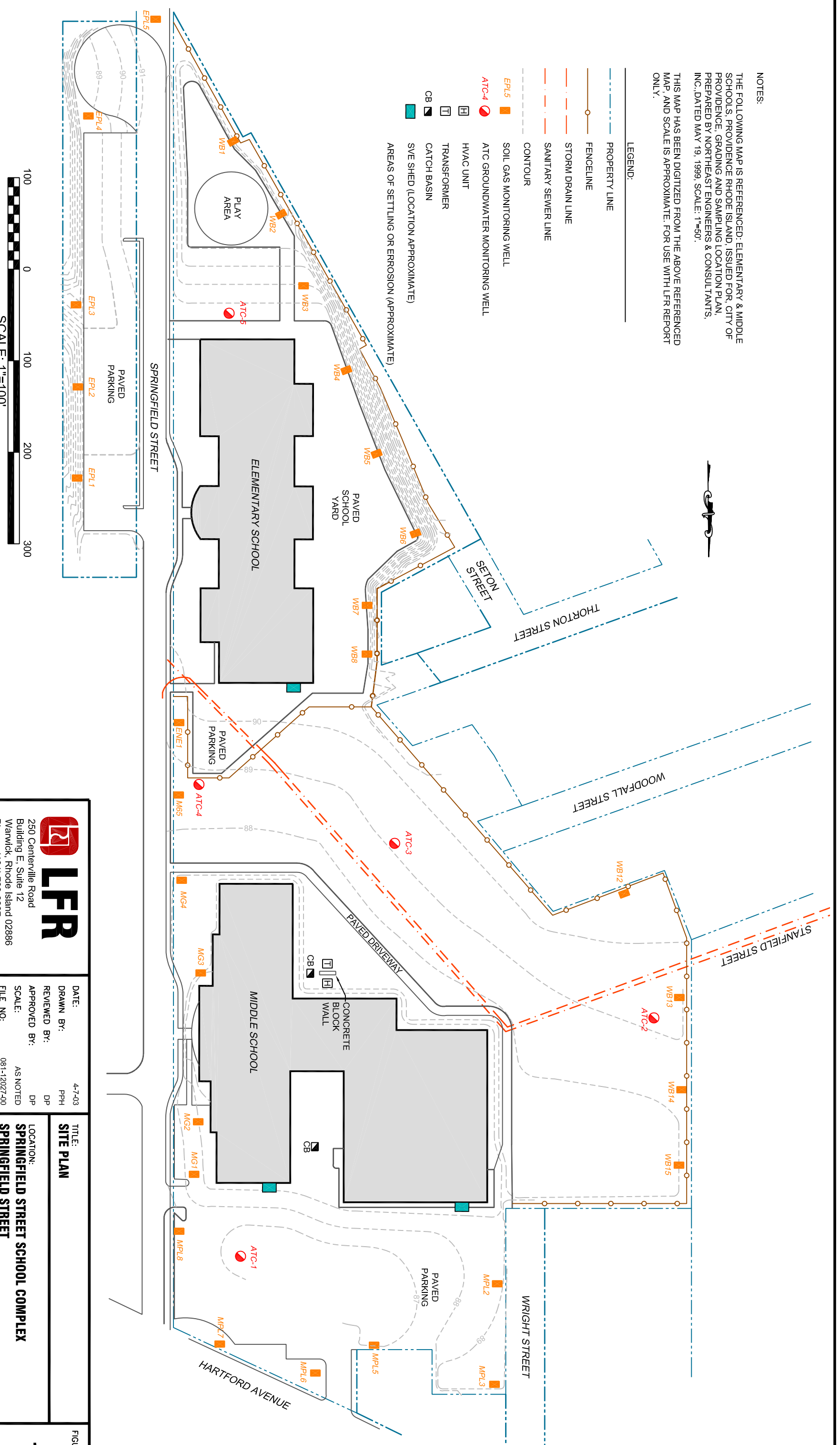
THIS MAP HAS BEEN DIGITIZED FROM THE ABOVE REFERENCED MAP, AND SCALE IS APPROXIMATE. FOR USE WITH LFR REPORT ONLY.



LEGEND:

- PROPERTY LINE
- FENCELINE
- STORM DRAIN LINE
- SANITARY SEWER LINE
- CONTOUR
- SOIL GAS MONITORING WELL
- ATC-4
- ATC-5
- ATC-3
- ATC-2
- ATC-1
- WB1
- WB2
- WB3
- WB4
- WB5
- WB6
- WB7
- WB8
- WB9
- WB10
- WB11
- WB12
- WB13
- WB14
- WB15
- MG1
- MG2
- MG3
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AREAS OF SETTLING OR EROSION (APPROXIMATE)



LFR
 250 Centerville Road
 Building E, Suite 12
 Warwick, Rhode Island 02886
 Phone: (401) 738-3887
 Fax: (401) 732-1686

DATE:	4-7-03
DRAWN BY:	PPH
REVIEWED BY:	DP
APPROVED BY:	DP
SCALE:	AS NOTED
FILE NO.:	081-12027-00
JOB NO.:	081-12027-00

TITLE:
SITE PLAN

LOCATION:
**SPRINGFIELD STREET SCHOOL COMPLEX
 SPRINGFIELD STREET
 PROVIDENCE, RHODE ISLAND**

FIGURE:
1

Attachment A

Laboratory Report for Soil Gas and Groundwater



39 Spruce Street ° East Longmeadow, MA 01028 ° FAX 413/525-6405 ° TEL. 413/525-2332

REPORT DATE 8/28/2007

LFR, INC. - RI
300 METRO CENTER BLVD., SUITE 250
WARWICK, RI 02886
ATTN: DONNA PALLISTER

CONTRACT NUMBER:
PURCHASE ORDER NUMBER: 5131

PROJECT NUMBER:

ANALYTICAL SUMMARY

LIMS BAT #: LIMT-08928
JOB NUMBER: 081-12152-04

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

PROJECT LOCATION: SPRINGFIELD STREET SCHOOL

FIELD SAMPLE #	LAB ID	MATRIX	SAMPLE DESCRIPTION	TEST
ATC-1	07B31729	GRND WATER	NOT SPECIFIED	8260 water
ATC-2	07B31732	GRND WATER	NOT SPECIFIED	8260 water
ATC-3	07B31731	GRND WATER	NOT SPECIFIED	8260 water
ATC-4	07B31730	GRND WATER	NOT SPECIFIED	8260 water
ATC-5	07B31733	GRND WATER	NOT SPECIFIED	8260 water
TRIP BLANK	07B31734	WATER OTHE	NOT SPECIFIED	8260 water

Comments :

LIMS BATCH NO. : LIMT-08928

IN METHOD 8260, ANY REPORTED RESULTS FOR TERT BUTYL ALCOHOL, 1,4-DIOXANE, TERT AMYL METHYL ETHER, 1,2,4-TRICHLOROBENZENE, NAPHTHALENE, 1,2,3-TRICHLOROBENZENE, 1,2-DIBROMO-3-CHLOROPROPANE, MTBE, AND TERT BUTYL ETHYL ETHER ARE ESTIMATED. EITHER INITIAL OR CONTINUING CALIBRATION DID NOT MEET REQUIRED CRITERIA.

The CON-TEST Environmental Laboratory operates under the following certifications and accreditations :

AIHA 100033	AIHA ELLAP (LEAD) 100033	
MASSACHUSETTS MA0100	NEW HAMPSHIRE NELAP 2516	NEW JERSEY NELAP NJ MA007 (AIR)
CONNECTICUT PH-0567	VERMONT DOH (LEAD) No. LL015036	
NEW YORK ELAP/NELAP 10899	RHODE ISLAND (LIC. No. 112)	

I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Edward Denson 8/28/07
SIGNATURE DATE

Tod Kopyscinski Director of Operations
Sondra L. Slesinski Quality Assurance Officer

Edward Denson
Technical Director

* See end of data tabulation for notes and comments pertaining to this sample

DONNA PALLISTER
 LFR, INC. - RI
 300 METRO CENTER BLVD., SUITE 250
 WARWICK, RI 02886

8/28/2007
 Page 2 of 19

Purchase Order No.: 5131

Project Location: SPRINGFIELD STREET SCHOOL
 Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928
 Job Number: 081-12152-04

Field Sample #: ATC-1

Sample ID: 07B31729 Sampled: 8/20/2007
 NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
trans-1,2-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichloropropane	ug/l	ND	1.0		08/23/07	LBD
1,3-Dichloropropane	ug/l	ND	0.5		08/23/07	LBD
2,2-Dichloropropane	ug/l	ND	1.0		08/23/07	LBD
1,1-Dichloropropene	ug/l	ND	2.0		08/23/07	LBD
cis-1,3-Dichloropropene	ug/l	ND	0.5		08/23/07	LBD
trans-1,3-Dichloropropene	ug/l	ND	0.5		08/23/07	LBD
Diethyl Ether	ug/l	ND	2.0		08/23/07	LBD
Diisopropyl Ether	ug/l	ND	0.5		08/23/07	LBD
1,4-Dioxane	ug/l	ND	50.0		08/23/07	LBD
Ethyl Benzene	ug/l	ND	1.0		08/23/07	LBD
Hexachlorobutadiene	ug/l	ND	1.0		08/23/07	LBD
2-Hexanone	ug/l	ND	10.0		08/23/07	LBD
Isopropylbenzene	ug/l	ND	1.0		08/23/07	LBD
p-Isopropyltoluene	ug/l	ND	1.0		08/23/07	LBD
MTBE	ug/l	ND	1.0		08/23/07	LBD
Methylene Chloride	ug/l	ND	5.0		08/23/07	LBD
MIBK	ug/l	ND	10.0		08/23/07	LBD
Naphthalene	ug/l	ND	2.0		08/23/07	LBD
n-Propylbenzene	ug/l	ND	1.0		08/23/07	LBD
Styrene	ug/l	ND	1.0		08/23/07	LBD
1,1,1,2-Tetrachloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1,2,2-Tetrachloroethane	ug/l	ND	0.5		08/23/07	LBD
Tetrachloroethylene	ug/l	ND	1.0		08/23/07	LBD
Tetrahydrofuran	ug/l	ND	10.0		08/23/07	LBD
Toluene	ug/l	ND	1.0		08/23/07	LBD
1,2,3-Trichlorobenzene	ug/l	ND	5.0		08/23/07	LBD
1,2,4-Trichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,1,1-Trichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1,2-Trichloroethane	ug/l	ND	1.0		08/23/07	LBD
Trichloroethylene	ug/l	ND	1.0		08/23/07	LBD
Trichlorofluoromethane	ug/l	ND	2.0		08/23/07	LBD
1,2,3-Trichloropropane	ug/l	ND	2.0		08/23/07	LBD
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/l	ND	5.0		08/23/07	LBD
1,2,4-Trimethylbenzene	ug/l	ND	1.0		08/23/07	LBD
1,3,5-Trimethylbenzene	ug/l	ND	1.0		08/23/07	LBD

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

DONNA PALLISTER

LFR, INC. - RI

300 METRO CENTER BLVD., SUITE 250

WARWICK, RI 02886

Purchase Order No.: 5131

8/28/2007

Page 3 of 19

Project Location: SPRINGFIELD STREET SCHOOL

LIMS-BAT #: LIMIT-08928

Date Received: 8/21/2007

Job Number: 081-12152-04

Field Sample #: ATC-1

Sample ID : 07B31729

Sampled : 8/20/2007

NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Vinyl Chloride	ug/l	ND	2.0		08/23/07	LBD
m + p Xylene	ug/l	ND	2.0		08/23/07	LBD
o-Xylene	ug/l	ND	1.0		08/23/07	LBD

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

DONNA PALLISTER
 LFR, INC. - RI
 300 METRO CENTER BLVD., SUITE 250
 WARWICK, RI 02886

Purchase Order No.: 5131

8/28/2007
 Page 4 of 19

Project Location: SPRINGFIELD STREET SCHOOL
 Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928
 Job Number: 081-12152-04

Field Sample #: ATC-2

Sample ID: 07B31732 Sampled: 8/20/2007
 NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Acetone	ug/l	ND	50.0		08/23/07	LBD
Acrylonitrile	ug/l	ND	5.0		08/23/07	LBD
tert-Amylmethyl Ether	ug/l	ND	0.5		08/23/07	LBD
Benzene	ug/l	ND	1.0		08/23/07	LBD
Bromobenzene	ug/l	ND	1.0		08/23/07	LBD
Bromochloromethane	ug/l	ND	1.0		08/23/07	LBD
Bromodichloromethane	ug/l	ND	1.0		08/23/07	LBD
Bromoform	ug/l	ND	1.0		08/23/07	LBD
Bromomethane	ug/l	ND	2.0		08/23/07	LBD
2-Butanone (MEK)	ug/l	ND	20.0		08/23/07	LBD
tert-Butyl Alcohol	ug/l	ND	25.0		08/23/07	LBD
n-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
sec-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
tert-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
tert-Butylethyl Ether	ug/l	ND	0.5		08/23/07	LBD
Carbon Disulfide	ug/l	ND	3.0		08/23/07	LBD
Carbon Tetrachloride	ug/l	ND	1.0		08/23/07	LBD
Chlorobenzene	ug/l	ND	1.0		08/23/07	LBD
Chlorodibromomethane	ug/l	ND	0.5		08/23/07	LBD
Chloroethane	ug/l	ND	2.0		08/23/07	LBD
Chloroform	ug/l	ND	2.0		08/23/07	LBD
Chloromethane	ug/l	ND	2.0		08/23/07	LBD
2-Chlorotoluene	ug/l	ND	1.0		08/23/07	LBD
4-Chlorotoluene	ug/l	ND	1.0		08/23/07	LBD
1,2-Dibromo-3-Chloropropane	ug/l	ND	5.0		08/23/07	LBD
1,2-Dibromoethane	ug/l	ND	0.50		08/23/07	LBD
Dibromomethane	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,3-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,4-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
trans-1,4-Dichloro-2-Butene	ug/l	ND	2.0		08/23/07	LBD
Dichlorodifluoromethane	ug/l	ND	2.0		08/23/07	LBD
1,1-Dichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD
cis-1,2-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD

RL = Reporting Limit

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* = See end of report for comments and notes applying to this sample

DONNA PALLISTER
LFR, INC. - RI
300 METRO CENTER BLVD., SUITE 250
WARWICK, RI 02886

8/28/2007
Page 6 of 19

Purchase Order No.: 5131

Project Location: SPRINGFIELD STREET SCHOOL
Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928
Job Number: 081-12152-04

Field Sample #: ATC-2

Sample ID : 07B31732 Sampled : 8/20/2007
NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Vinyl Chloride	ug/l	ND	2.0		08/23/07	LBD
m + p Xylene	ug/l	ND	2.0		08/23/07	LBD
o-Xylene	ug/l	ND	1.0		08/23/07	LBD

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

DONNA PALLISTER

LFR, INC. - RI

300 METRO CENTER BLVD., SUITE 250

WARWICK, RI 02886

Purchase Order No.: 5131

8/28/2007

Page 9 of 19

Project Location: SPRINGFIELD STREET SCHOOL

Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928

Job Number: 081-12152-04

Field Sample #: ATC-3

Sample ID : 07B31731

Sampled : 8/20/2007

NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Vinyl Chloride	ug/l	ND	2.0		08/23/07	LBD
m + p Xylene	ug/l	ND	2.0		08/23/07	LBD
o-Xylene	ug/l	ND	1.0		08/23/07	LBD

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample

DONNA PALLISTER
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 WARWICK, RI 02886

Purchase Order No.: 5131

8/28/2007
 Page 10 of 19

Project Location: SPRINGFIELD STREET SCHOOL
 Date Received: 8/21/2007

LIMS-BAT #: LIMT-08928
 Job Number: 081-12152-04

Field Sample #: ATC-4

Sample ID: 07B31730
 Sampled: 8/20/2007
 NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Acetone	ug/l	ND	50.0		08/23/07	LBD
Acrylonitrile	ug/l	ND	5.0		08/23/07	LBD
tert-Amylmethyl Ether	ug/l	ND	0.5		08/23/07	LBD
Benzene	ug/l	ND	1.0		08/23/07	LBD
Bromobenzene	ug/l	ND	1.0		08/23/07	LBD
Bromochloromethane	ug/l	ND	1.0		08/23/07	LBD
Bromodichloromethane	ug/l	ND	1.0		08/23/07	LBD
Bromoform	ug/l	ND	1.0		08/23/07	LBD
Bromomethane	ug/l	ND	2.0		08/23/07	LBD
2-Butanone (MEK)	ug/l	ND	20.0		08/23/07	LBD
tert-Butyl Alcohol	ug/l	ND	25.0		08/23/07	LBD
n-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
sec-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
tert-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
tert-Butylethyl Ether	ug/l	ND	0.5		08/23/07	LBD
Carbon Disulfide	ug/l	ND	3.0		08/23/07	LBD
Carbon Tetrachloride	ug/l	ND	1.0		08/23/07	LBD
Chlorobenzene	ug/l	1.8	1.0		08/23/07	LBD
Chlorodibromomethane	ug/l	ND	0.5		08/23/07	LBD
Chloroethane	ug/l	ND	2.0		08/23/07	LBD
Chloroform	ug/l	ND	2.0		08/23/07	LBD
Chloromethane	ug/l	ND	2.0		08/23/07	LBD
2-Chlorotoluene	ug/l	ND	1.0		08/23/07	LBD
4-Chlorotoluene	ug/l	ND	1.0		08/23/07	LBD
1,2-Dibromo-3-Chloropropane	ug/l	ND	5.0		08/23/07	LBD
1,2-Dibromoethane	ug/l	ND	0.50		08/23/07	LBD
Dibromomethane	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,3-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,4-Dichlorobenzene	ug/l	2.1	1.0		08/23/07	LBD
trans-1,4-Dichloro-2-Butene	ug/l	ND	2.0		08/23/07	LBD
Dichlorodifluoromethane	ug/l	ND	2.0		08/23/07	LBD
1,1-Dichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD
cis-1,2-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

* = See end of report for comments and notes applying to this sample



39 Spruce Street ° East Longmeadow, MA 01028 ° FAX 413/525-6405 ° TEL. 413/525-2332

DONNA PALLISTER
LFR, INC. - RI
300 METRO CENTER BLVD., SUITE 250
WARWICK, RI 02886

8/28/2007
Page 11 of 19

Purchase Order No.: 5131

Project Location: SPRINGFIELD STREET SCHOOL
Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928
Job Number: 081-12152-04

Field Sample #: ATC-4

Sample ID: 07B31730 Sampled: 8/20/2007
NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
trans-1,2-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichloropropane	ug/l	ND	1.0		08/23/07	LBD
1,3-Dichloropropane	ug/l	ND	0.5		08/23/07	LBD
2,2-Dichloropropane	ug/l	ND	1.0		08/23/07	LBD
1,1-Dichloropropene	ug/l	ND	2.0		08/23/07	LBD
cis-1,3-Dichloropropene	ug/l	ND	0.5		08/23/07	LBD
trans-1,3-Dichloropropene	ug/l	ND	0.5		08/23/07	LBD
Diethyl Ether	ug/l	ND	2.0		08/23/07	LBD
Diisopropyl Ether	ug/l	ND	0.5		08/23/07	LBD
1,4-Dioxane	ug/l	ND	50.0		08/23/07	LBD
Ethyl Benzene	ug/l	ND	1.0		08/23/07	LBD
Hexachlorobutadiene	ug/l	ND	1.0		08/23/07	LBD
2-Hexanone	ug/l	ND	10.0		08/23/07	LBD
Isopropylbenzene	ug/l	ND	1.0		08/23/07	LBD
p-Isopropyltoluene	ug/l	ND	1.0		08/23/07	LBD
MTBE	ug/l	ND	1.0		08/23/07	LBD
Methylene Chloride	ug/l	ND	5.0		08/23/07	LBD
MIBK	ug/l	ND	10.0		08/23/07	LBD
Naphthalene	ug/l	ND	2.0		08/23/07	LBD
n-Propylbenzene	ug/l	ND	1.0		08/23/07	LBD
Styrene	ug/l	ND	1.0		08/23/07	LBD
1,1,1,2-Tetrachloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1,2,2-Tetrachloroethane	ug/l	ND	0.5		08/23/07	LBD
Tetrachloroethylene	ug/l	ND	1.0		08/23/07	LBD
Tetrahydrofuran	ug/l	ND	10.0		08/23/07	LBD
Toluene	ug/l	ND	1.0		08/23/07	LBD
1,2,3-Trichlorobenzene	ug/l	ND	5.0		08/23/07	LBD
1,2,4-Trichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,1,1-Trichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1,2-Trichloroethane	ug/l	ND	1.0		08/23/07	LBD
Trichloroethylene	ug/l	ND	1.0		08/23/07	LBD
Trichlorofluoromethane	ug/l	ND	2.0		08/23/07	LBD
1,2,3-Trichloropropane	ug/l	ND	2.0		08/23/07	LBD
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/l	ND	5.0		08/23/07	LBD
1,2,4-Trimethylbenzene	ug/l	ND	1.0		08/23/07	LBD
1,3,5-Trimethylbenzene	ug/l	ND	1.0		08/23/07	LBD

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NM = Not Measured

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DONNA PALLISTER
LFR, INC. - RI
300 METRO CENTER BLVD., SUITE 250
WARWICK, RI 02886

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Purchase Order No.: 5131

Project Location: SPRINGFIELD STREET SCHOOL
Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928
Job Number: 081-12152-04

Field Sample #: ATC-4

Sample ID : 07B31730 Sampled : 8/20/2007
NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Vinyl Chloride	ug/l	ND	2.0		08/23/07	LBD
m + p Xylene	ug/l	ND	2.0		08/23/07	LBD
o-Xylene	ug/l	ND	1.0		08/23/07	LBD

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NM = Not Measured

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DONNA PALLISTER
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 WARWICK, RI 02886

Purchase Order No.: 5131

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Project Location: SPRINGFIELD STREET SCHOOL
 Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928
 Job Number: 081-12152-04

Field Sample #: ATC-5

Sample ID: 07B31733 Sampled: 8/20/2007
 NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Acetone	ug/l	ND	50.0		08/23/07	LBD
Acrylonitrile	ug/l	ND	5.0		08/23/07	LBD
tert-Amylmethyl Ether	ug/l	ND	0.5		08/23/07	LBD
Benzene	ug/l	ND	1.0		08/23/07	LBD
Bromobenzene	ug/l	ND	1.0		08/23/07	LBD
Bromochloromethane	ug/l	ND	1.0		08/23/07	LBD
Bromodichloromethane	ug/l	ND	1.0		08/23/07	LBD
Bromoform	ug/l	ND	1.0		08/23/07	LBD
Bromomethane	ug/l	ND	2.0		08/23/07	LBD
2-Butanone (MEK)	ug/l	ND	20.0		08/23/07	LBD
tert-Butyl Alcohol	ug/l	ND	25.0		08/23/07	LBD
n-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
sec-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
tert-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
tert-Butylethyl Ether	ug/l	ND	0.5		08/23/07	LBD
Carbon Disulfide	ug/l	ND	3.0		08/23/07	LBD
Carbon Tetrachloride	ug/l	ND	1.0		08/23/07	LBD
Chlorobenzene	ug/l	ND	1.0		08/23/07	LBD
Chlorodibromomethane	ug/l	ND	0.5		08/23/07	LBD
Chloroethane	ug/l	ND	2.0		08/23/07	LBD
Chloroform	ug/l	ND	2.0		08/23/07	LBD
Chloromethane	ug/l	ND	2.0		08/23/07	LBD
2-Chlorotoluene	ug/l	ND	1.0		08/23/07	LBD
4-Chlorotoluene	ug/l	ND	1.0		08/23/07	LBD
1,2-Dibromo-3-Chloropropane	ug/l	ND	5.0		08/23/07	LBD
1,2-Dibromoethane	ug/l	ND	0.50		08/23/07	LBD
Dibromomethane	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,3-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,4-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
trans-1,4-Dichloro-2-Butene	ug/l	ND	2.0		08/23/07	LBD
Dichlorodifluoromethane	ug/l	ND	2.0		08/23/07	LBD
1,1-Dichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD
cis-1,2-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD

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DONNA PALLISTER

LFR, INC. - RI

300 METRO CENTER BLVD., SUITE 250

WARWICK, RI 02886

Purchase Order No.: 5131

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Project Location: SPRINGFIELD STREET SCHOOL

Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928

Job Number: 081-12152-04

Field Sample #: ATC-5

Sample ID : 07B31733

Sampled : 8/20/2007

NOT SPECIFIED

Sample Matrix: GRND WATER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Vinyl Chloride	ug/l	ND	2.0		08/23/07	LBD
m + p Xylene	ug/l	ND	2.0		08/23/07	LBD
o-Xylene	ug/l	ND	1.0		08/23/07	LBD

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Purchase Order No.: 5131

Project Location: SPRINGFIELD STREET SCHOOL
 Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928
 Job Number: 081-12152-04

Field Sample #: TRIP BLANK

Sample ID: 07B31734 Sampled: 8/20/2007
 NOT SPECIFIED

Sample Matrix: WATER OTHER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Acetone	ug/l	ND	50.0		08/23/07	LBD
Acrylonitrile	ug/l	ND	5.0		08/23/07	LBD
tert-Amylmethyl Ether	ug/l	ND	0.5		08/23/07	LBD
Benzene	ug/l	ND	1.0		08/23/07	LBD
Bromobenzene	ug/l	ND	1.0		08/23/07	LBD
Bromochloromethane	ug/l	ND	1.0		08/23/07	LBD
Bromodichloromethane	ug/l	ND	1.0		08/23/07	LBD
Bromoform	ug/l	ND	1.0		08/23/07	LBD
Bromomethane	ug/l	ND	2.0		08/23/07	LBD
2-Butanone (MEK)	ug/l	ND	20.0		08/23/07	LBD
tert-Butyl Alcohol	ug/l	ND	25.0		08/23/07	LBD
n-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
sec-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
tert-Butylbenzene	ug/l	ND	1.0		08/23/07	LBD
tert-Butylethyl Ether	ug/l	ND	0.5		08/23/07	LBD
Carbon Disulfide	ug/l	ND	3.0		08/23/07	LBD
Carbon Tetrachloride	ug/l	ND	1.0		08/23/07	LBD
Chlorobenzene	ug/l	ND	1.0		08/23/07	LBD
Chlorodibromomethane	ug/l	ND	0.5		08/23/07	LBD
Chloroethane	ug/l	ND	2.0		08/23/07	LBD
Chloroform	ug/l	ND	2.0		08/23/07	LBD
Chloromethane	ug/l	ND	2.0		08/23/07	LBD
2-Chlorotoluene	ug/l	ND	1.0		08/23/07	LBD
4-Chlorotoluene	ug/l	ND	1.0		08/23/07	LBD
1,2-Dibromo-3-Chloropropane	ug/l	ND	5.0		08/23/07	LBD
1,2-Dibromoethane	ug/l	ND	0.50		08/23/07	LBD
Dibromomethane	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,3-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,4-Dichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
trans-1,4-Dichloro-2-Butene	ug/l	ND	2.0		08/23/07	LBD
Dichlorodifluoromethane	ug/l	ND	2.0		08/23/07	LBD
1,1-Dichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD
cis-1,2-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD

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DONNA PALLISTER
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 WARWICK, RI 02886

Purchase Order No.: 5131

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Project Location: SPRINGFIELD STREET SCHOOL
 Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928
 Job Number: 081-12152-04

Field Sample #: TRIP BLANK

Sample ID: 07B31734 Sampled: 8/20/2007
 NOT SPECIFIED

Sample Matrix: WATER OTHER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
trans-1,2-Dichloroethylene	ug/l	ND	1.0		08/23/07	LBD
1,2-Dichloropropane	ug/l	ND	1.0		08/23/07	LBD
1,3-Dichloropropane	ug/l	ND	0.5		08/23/07	LBD
2,2-Dichloropropane	ug/l	ND	1.0		08/23/07	LBD
1,1-Dichloropropene	ug/l	ND	2.0		08/23/07	LBD
cis-1,3-Dichloropropene	ug/l	ND	0.5		08/23/07	LBD
trans-1,3-Dichloropropene	ug/l	ND	0.5		08/23/07	LBD
Diethyl Ether	ug/l	ND	2.0		08/23/07	LBD
Diisopropyl Ether	ug/l	ND	0.5		08/23/07	LBD
1,4-Dioxane	ug/l	ND	50.0		08/23/07	LBD
Ethyl Benzene	ug/l	ND	1.0		08/23/07	LBD
Hexachlorobutadiene	ug/l	ND	1.0		08/23/07	LBD
2-Hexanone	ug/l	ND	10.0		08/23/07	LBD
Isopropylbenzene	ug/l	ND	1.0		08/23/07	LBD
p-Isopropyltoluene	ug/l	ND	1.0		08/23/07	LBD
MTBE	ug/l	ND	1.0		08/23/07	LBD
Methylene Chloride	ug/l	ND	5.0		08/23/07	LBD
MIBK	ug/l	ND	10.0		08/23/07	LBD
Naphthalene	ug/l	ND	2.0		08/23/07	LBD
n-Propylbenzene	ug/l	ND	1.0		08/23/07	LBD
Styrene	ug/l	ND	1.0		08/23/07	LBD
1,1,1,2-Tetrachloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1,2,2-Tetrachloroethane	ug/l	ND	0.5		08/23/07	LBD
Tetrachloroethylene	ug/l	ND	1.0		08/23/07	LBD
Tetrahydrofuran	ug/l	ND	10.0		08/23/07	LBD
Toluene	ug/l	ND	1.0		08/23/07	LBD
1,2,3-Trichlorobenzene	ug/l	ND	5.0		08/23/07	LBD
1,2,4-Trichlorobenzene	ug/l	ND	1.0		08/23/07	LBD
1,1,1-Trichloroethane	ug/l	ND	1.0		08/23/07	LBD
1,1,2-Trichloroethane	ug/l	ND	1.0		08/23/07	LBD
Trichloroethylene	ug/l	ND	1.0		08/23/07	LBD
Trichlorofluoromethane	ug/l	ND	2.0		08/23/07	LBD
1,2,3-Trichloropropane	ug/l	ND	2.0		08/23/07	LBD
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/l	ND	5.0		08/23/07	LBD
1,2,4-Trimethylbenzene	ug/l	ND	1.0		08/23/07	LBD
1,3,5-Trimethylbenzene	ug/l	ND	1.0		08/23/07	LBD

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DONNA PALLISTER
LFR, INC. - RI
300 METRO CENTER BLVD., SUITE 250
WARWICK, RI 02886

Purchase Order No.: 5131

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Project Location: SPRINGFIELD STREET SCHOOL
Date Received: 8/21/2007

LIMS-BAT #: LIMIT-08928
Job Number: 081-12152-04

Field Sample #: TRIP BLANK

Sample ID: 07B31734 Sampled: 8/20/2007
NOT SPECIFIED

Sample Matrix: WATER OTHER

	Units	Results	RL	Method	Date Analyzed	Analyst
8260 water				SW846 8260		
Vinyl Chloride	ug/l	ND	2.0		08/23/07	LBD
m + p Xylene	ug/l	ND	2.0		08/23/07	LBD
o-Xylene	ug/l	ND	1.0		08/23/07	LBD

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39 Spruce Street ° East Longmeadow, MA 01028 ° FAX 413/525-6405 ° TEL. 413/525-2332

DONNA PALLISTER
LFR, INC. - RI
300 METRO CENTER BLVD., SUITE 250
WARWICK, RI 02886

Purchase Order No.: 5131

Project Location: SPRINGFIELD STREET SCHOOL
Date Received: 8/21/2007

8/28/2007
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LIMS-BAT #: LIMIT-08928
Job Number: 081-12152-04

** END OF REPORT **

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

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QC SUMMARY REPORT

SAMPLE QC: Sample Results with Duplicates
Sample Matrix Spikes and Matrix Spike Duplicates

BATCH QC: Lab fortified Blanks and Duplicates
Standard Reference Materials and Duplicates
Method Blanks

Report Date: 8/28/2007 Lims Bat # : LIMIT-08928 Page 1 of 10

QC Batch Number: GCMS/VOL-17528

Sample Id	Analysis	QC Analysis	Values	Units	Limits
07B31729	1,2-Dichloroethane-d4	Surrogate Recovery	90.0	%	70-130
	Toluene-d8	Surrogate Recovery	97.3	%	70-130
	Bromofluorobenzene	Surrogate Recovery	94.2	%	70-130
07B31730	1,2-Dichloroethane-d4	Surrogate Recovery	88.3	%	70-130
	Toluene-d8	Surrogate Recovery	96.4	%	70-130
	Bromofluorobenzene	Surrogate Recovery	95.2	%	70-130
07B31731	1,2-Dichloroethane-d4	Surrogate Recovery	90.3	%	70-130
	Toluene-d8	Surrogate Recovery	95.4	%	70-130
	Bromofluorobenzene	Surrogate Recovery	94.5	%	70-130
07B31732	1,2-Dichloroethane-d4	Surrogate Recovery	91.8	%	70-130
	Toluene-d8	Surrogate Recovery	95.1	%	70-130
	Bromofluorobenzene	Surrogate Recovery	94.1	%	70-130
07B31733	1,2-Dichloroethane-d4	Surrogate Recovery	90.7	%	70-130
	Toluene-d8	Surrogate Recovery	96.0	%	70-130
	Bromofluorobenzene	Surrogate Recovery	95.6	%	70-130
07B31734	1,2-Dichloroethane-d4	Surrogate Recovery	92.4	%	70-130
	Toluene-d8	Surrogate Recovery	95.1	%	70-130
	Bromofluorobenzene	Surrogate Recovery	93.0	%	70-130
BLANK-106008	Acetone	Blank	<50.0	ug/l	
	Benzene	Blank	<1.0	ug/l	
	Carbon Tetrachloride	Blank	<1.0	ug/l	
	Chloroform	Blank	<2.0	ug/l	
	1,2-Dichloroethane	Blank	<1.0	ug/l	
	1,4-Dichlorobenzene	Blank	<1.0	ug/l	
	Ethyl Benzene	Blank	<1.0	ug/l	
	2-Butanone (MEK)	Blank	<20.0	ug/l	
	MIBK	Blank	<10.0	ug/l	
	Naphthalene	Blank	<2.0	ug/l	
	Styrene	Blank	<1.0	ug/l	
	Tetrachloroethylene	Blank	<1.0	ug/l	
	Toluene	Blank	<1.0	ug/l	
	1,1,1-Trichloroethane	Blank	<1.0	ug/l	
	Trichloroethylene	Blank	<1.0	ug/l	
	1,1,2-Trichloro-1,2,2-Trifluoroethane	Blank	<5.0	ug/l	
Trichlorofluoromethane	Blank	<2.0	ug/l		
o-Xylene	Blank	<1.0	ug/l		
m + p Xylene	Blank	<2.0	ug/l		



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QC SUMMARY REPORT

SAMPLE QC: Sample Results with Duplicates

BATCH QC: Lab fortified Blanks and Duplicates

Sample Matrix Spikes and Matrix Spike Duplicates

Standard Reference Materials and Duplicates

Method Blanks

Report Date: 8/28/2007

Lims Bat #: LIMIT-08928

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QC Batch Number: GCMS/VOL-17528

Sample Id	Analysis	QC Analysis	Values	Units	Limits
BLANK-106008					
	1,2-Dichlorobenzene	Blank	<1.0	ug/l	
	1,3-Dichlorobenzene	Blank	<1.0	ug/l	
	1,1-Dichloroethane	Blank	<1.0	ug/l	
	1,1-Dichloroethylene	Blank	<1.0	ug/l	
	1,4-Dioxane	Blank	<50.0	ug/l	
	MTBE	Blank	<1.0	ug/l	
	trans-1,2-Dichloroethylene	Blank	<1.0	ug/l	
	Vinyl Chloride	Blank	<2.0	ug/l	
	Methylene Chloride	Blank	<5.0	ug/l	
	Chlorobenzene	Blank	<1.0	ug/l	
	Chloromethane	Blank	<2.0	ug/l	
	Bromomethane	Blank	<2.0	ug/l	
	Chloroethane	Blank	<2.0	ug/l	
	cis-1,3-Dichloropropene	Blank	<0.5	ug/l	
	trans-1,3-Dichloropropene	Blank	<0.5	ug/l	
	Chlorodibromomethane	Blank	<0.5	ug/l	
	1,1,2-Trichloroethane	Blank	<1.0	ug/l	
	Bromoform	Blank	<1.0	ug/l	
	1,1,2,2-Tetrachloroethane	Blank	<0.5	ug/l	
	2-Chlorotoluene	Blank	<1.0	ug/l	
	Hexachlorobutadiene	Blank	<1.0	ug/l	
	Isopropylbenzene	Blank	<1.0	ug/l	
	p-Isopropyltoluene	Blank	<1.0	ug/l	
	n-Propylbenzene	Blank	<1.0	ug/l	
	sec-Butylbenzene	Blank	<1.0	ug/l	
	tert-Butylbenzene	Blank	<1.0	ug/l	
	1,2,3-Trichlorobenzene	Blank	<5.0	ug/l	
	1,2,4-Trichlorobenzene	Blank	<1.0	ug/l	
	1,2,4-Trimethylbenzene	Blank	<1.0	ug/l	
	1,3,5-Trimethylbenzene	Blank	<1.0	ug/l	
	Dibromomethane	Blank	<1.0	ug/l	
	cis-1,2-Dichloroethylene	Blank	<1.0	ug/l	
	4-Chlorotoluene	Blank	<1.0	ug/l	
	1,1-Dichloropropene	Blank	<2.0	ug/l	
	1,2-Dichloropropane	Blank	<1.0	ug/l	
	1,3-Dichloropropane	Blank	<0.5	ug/l	
	2,2-Dichloropropane	Blank	<1.0	ug/l	
	1,1,1,2-Tetrachloroethane	Blank	<1.0	ug/l	
	1,2,3-Trichloropropane	Blank	<2.0	ug/l	
	n-Butylbenzene	Blank	<1.0	ug/l	
	Dichlorodifluoromethane	Blank	<2.0	ug/l	
	Bromochloromethane	Blank	<1.0	ug/l	
	Bromobenzene	Blank	<1.0	ug/l	

QC SUMMARY REPORT

SAMPLE QC: Sample Results with Duplicates

BATCH QC: Lab fortified Blanks and Duplicates

Sample Matrix Spikes and Matrix Spike Duplicates

Standard Reference Materials and Duplicates

Method Blanks

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QC Batch Number: GCMS/VOL-17528

Sample Id	Analysis	QC Analysis	Values	Units	Limits
BLANK-106008					
	Acrylonitrile	Blank	<5.0	ug/l	
	Carbon Disulfide	Blank	<3.0	ug/l	
	2-Hexanone	Blank	<10.0	ug/l	
	trans-1,4-Dichloro-2-Butene	Blank	<2.0	ug/l	
	Diethyl Ether	Blank	<2.0	ug/l	
	Bromodichloromethane	Blank	<1.0	ug/l	
	1,2-Dibromo-3-Chloropropane	Blank	<5.0	ug/l	
	1,2-Dibromoethane	Blank	<0.50	ug/l	
	Tetrahydrofuran	Blank	<10.0	ug/l	
	tert-Butyl Alcohol	Blank	<25.0	ug/l	
	Diisopropyl Ether	Blank	<0.5	ug/l	
	tert-Butylethyl Ether	Blank	<0.5	ug/l	
	tert-Amylmethyl Ether	Blank	<0.5	ug/l	
LFBLANK-67340					
	Acetone	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.3	ug/l	
		Lab Fort Blk. % Rec.	103.7	%	70-160
	Benzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.4	ug/l	
		Lab Fort Blk. % Rec.	104.1	%	70-130
	Carbon Tetrachloride	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	11.1	ug/l	
		Lab Fort Blk. % Rec.	111.8	%	70-130
	Chloroform	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.4	ug/l	
		Lab Fort Blk. % Rec.	94.8	%	70-130
	1,2-Dichloroethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.4	ug/l	
		Lab Fort Blk. % Rec.	94.8	%	70-130
	1,4-Dichlorobenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.4	ug/l	
		Lab Fort Blk. % Rec.	104.5	%	70-130
	Ethyl Benzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.3	ug/l	
		Lab Fort Blk. % Rec.	103.5	%	70-130
	2-Butanone (MEK)	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	8.7	ug/l	
		Lab Fort Blk. % Rec.	87.1	%	40-160
	MIBK	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.0	ug/l	
		Lab Fort Blk. % Rec.	100.1	%	70-160
	Naphthalene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	5.5	ug/l	

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Sample Id	Analysis	QC Analysis	Values	Units	Limits
LFBLANK-67340					
	Naphthalene	Lab Fort Blk. % Rec.	55.3	%	40-130
	Styrene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.5	ug/l	
		Lab Fort Blk. % Rec.	105.1	%	70-130
	Tetrachloroethylene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	11.9	ug/l	
		Lab Fort Blk. % Rec.	119.8	%	70-160
	Toluene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.1	ug/l	
		Lab Fort Blk. % Rec.	101.4	%	70-130
	1,1,1-Trichloroethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.5	ug/l	
		Lab Fort Blk. % Rec.	95.7	%	70-130
	Trichloroethylene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.7	ug/l	
		Lab Fort Blk. % Rec.	97.8	%	70-130
	1,1,2-Trichloro-1,2,2-Trifluoroethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.8	ug/l	
		Lab Fort Blk. % Rec.	98.0	%	70-130
	Trichlorofluoromethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	8.9	ug/l	
		Lab Fort Blk. % Rec.	89.2	%	70-130
	o-Xylene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.1	ug/l	
		Lab Fort Blk. % Rec.	101.3	%	70-130
	m + p Xylene	Lab Fort Blank Amt.	20.0	ug/l	
		Lab Fort Blk. Found	21.0	ug/l	
		Lab Fort Blk. % Rec.	105.3	%	70-130
	1,2-Dichlorobenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.1	ug/l	
		Lab Fort Blk. % Rec.	101.5	%	70-130
	1,3-Dichlorobenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.5	ug/l	
		Lab Fort Blk. % Rec.	105.3	%	70-130
	1,1-Dichloroethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.1	ug/l	
		Lab Fort Blk. % Rec.	101.3	%	70-130
	1,1-Dichloroethylene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.2	ug/l	
		Lab Fort Blk. % Rec.	92.5	%	70-130
	1,4-Dioxane	Lab Fort Blank Amt.	50.0	ug/l	
		Lab Fort Blk. Found	53.7	ug/l	
		Lab Fort Blk. % Rec.	107.4	%	40-130

QC SUMMARY REPORT

SAMPLE QC: Sample Results with Duplicates

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Sample Id	Analysis	QC Analysis	Values	Units	Limits	
LFBLANK-67340	MTBE	Lab Fort Blank Amt.	20.0	ug/l		
		Lab Fort Blk. Found	17.9	ug/l		
		Lab Fort Blk. % Rec.	89.5	%	70-130	
	trans-1,2-Dichloroethylene	Lab Fort Blank Amt.	10.0	ug/l		
		Lab Fort Blk. Found	9.9	ug/l		
		Lab Fort Blk. % Rec.	99.9	%	70-130	
	Vinyl Chloride	Lab Fort Blank Amt.	10.0	ug/l		
		Lab Fort Blk. Found	7.3	ug/l		
		Lab Fort Blk. % Rec.	73.7	%	40-160	
	Methylene Chloride	Lab Fort Blank Amt.	10.0	ug/l		
		Lab Fort Blk. Found	8.8	ug/l		
		Lab Fort Blk. % Rec.	88.2	%	70-130	
	Chlorobenzene	Lab Fort Blank Amt.	10.0	ug/l		
		Lab Fort Blk. Found	10.6	ug/l		
		Lab Fort Blk. % Rec.	106.7	%	70-130	
	Chloromethane	Lab Fort Blank Amt.	10.0	ug/l		
		Lab Fort Blk. Found	6.7	ug/l		
		Lab Fort Blk. % Rec.	67.8	%	40-160	
	Bromomethane	Lab Fort Blank Amt.	10.0	ug/l		
		Lab Fort Blk. Found	8.9	ug/l		
Lab Fort Blk. % Rec.		89.1	%	40-160		
Chloroethane	Lab Fort Blank Amt.	10.0	ug/l			
	Lab Fort Blk. Found	11.1	ug/l			
	Lab Fort Blk. % Rec.	111.2	%	70-130		
cis-1,3-Dichloropropene	Lab Fort Blank Amt.	10.0	ug/l			
	Lab Fort Blk. Found	9.4	ug/l			
	Lab Fort Blk. % Rec.	94.3	%	70-130		
trans-1,3-Dichloropropene	Lab Fort Blank Amt.	10.0	ug/l			
	Lab Fort Blk. Found	9.2	ug/l			
	Lab Fort Blk. % Rec.	92.4	%	70-130		
Chlorodibromomethane	Lab Fort Blank Amt.	10.0	ug/l			
	Lab Fort Blk. Found	10.1	ug/l			
	Lab Fort Blk. % Rec.	101.4	%	70-130		
1,1,2-Trichloroethane	Lab Fort Blank Amt.	10.0	ug/l			
	Lab Fort Blk. Found	9.4	ug/l			
	Lab Fort Blk. % Rec.	94.3	%	70-130		
Bromoform	Lab Fort Blank Amt.	10.0	ug/l			
	Lab Fort Blk. Found	7.7	ug/l			
	Lab Fort Blk. % Rec.	77.8	%	70-130		
1,1,2,2-Tetrachloroethane	Lab Fort Blank Amt.	10.0	ug/l			
	Lab Fort Blk. Found	9.0	ug/l			
	Lab Fort Blk. % Rec.	90.6	%	70-130		
2-Chlorotoluene	Lab Fort Blank Amt.	10.0	ug/l			



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Sample Id	Analysis	QC Analysis	Values	Units	Limits
LFBLANK-67340	2-Chlorotoluene	Lab Fort Blk. Found	10.1	ug/l	
		Lab Fort Blk. % Rec.	101.8	%	70-130
	Hexachlorobutadiene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.1	ug/l	
		Lab Fort Blk. % Rec.	91.4	%	70-130
	Isopropylbenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.0	ug/l	
		Lab Fort Blk. % Rec.	100.7	%	70-130
	p-Isopropyltoluene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.3	ug/l	
		Lab Fort Blk. % Rec.	103.9	%	70-130
	n-Propylbenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.4	ug/l	
		Lab Fort Blk. % Rec.	104.6	%	70-130
	sec-Butylbenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.6	ug/l	
		Lab Fort Blk. % Rec.	106.7	%	70-130
	tert-Butylbenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	11.3	ug/l	
		Lab Fort Blk. % Rec.	113.8	%	70-130
	1,2,3-Trichlorobenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	6.0	ug/l	
		Lab Fort Blk. % Rec.	60.2	%	70-130
	1,2,4-Trichlorobenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	6.6	ug/l	
		Lab Fort Blk. % Rec.	66.2	%	70-130
	1,2,4-Trimethylbenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.4	ug/l	
		Lab Fort Blk. % Rec.	104.3	%	70-130
	1,3,5-Trimethylbenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.2	ug/l	
		Lab Fort Blk. % Rec.	102.9	%	70-130
	Dibromomethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.5	ug/l	
		Lab Fort Blk. % Rec.	95.1	%	70-130
	cis-1,2-Dichloroethylene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.1	ug/l	
		Lab Fort Blk. % Rec.	101.0	%	70-130
	4-Chlorotoluene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.2	ug/l	
		Lab Fort Blk. % Rec.	102.4	%	70-130
	1,1-Dichloropropene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.1	ug/l	

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Sample Id	Analysis	QC Analysis	Values	Units	Limits
LFBLANK-67340	1,1-Dichloropropene	Lab Fort Blk. % Rec.	101.0	%	70-130
	1,2-Dichloropropane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.0	ug/l	
		Lab Fort Blk. % Rec.	100.6	%	70-130
	1,3-Dichloropropane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.7	ug/l	
		Lab Fort Blk. % Rec.	97.1	%	70-130
	2,2-Dichloropropane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	8.6	ug/l	
		Lab Fort Blk. % Rec.	86.7	%	40-130
	1,1,1,2-Tetrachloroethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.2	ug/l	
		Lab Fort Blk. % Rec.	92.6	%	70-130
	1,2,3-Trichloropropane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	8.8	ug/l	
		Lab Fort Blk. % Rec.	88.1	%	70-130
	n-Butylbenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.9	ug/l	
		Lab Fort Blk. % Rec.	99.4	%	70-130
	Dichlorodifluoromethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	4.6	ug/l	
		Lab Fort Blk. % Rec.	46.3	%	40-160
	Bromochloromethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.3	ug/l	
		Lab Fort Blk. % Rec.	103.4	%	70-130
	Bromobenzene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.8	ug/l	
		Lab Fort Blk. % Rec.	98.9	%	70-130
	Acrylonitrile	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	10.8	ug/l	
		Lab Fort Blk. % Rec.	108.8	%	70-130
	Carbon Disulfide	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	8.7	ug/l	
		Lab Fort Blk. % Rec.	87.2	%	70-130
	2-Hexanone	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	8.2	ug/l	
		Lab Fort Blk. % Rec.	82.9	%	70-160
	trans-1,4-Dichloro-2-Butene	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.4	ug/l	
		Lab Fort Blk. % Rec.	94.9	%	70-130
	Diethyl Ether	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.0	ug/l	
		Lab Fort Blk. % Rec.	90.7	%	70-130



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Sample Id	Analysis	QC Analysis	Values	Units	Limits
LFBLANK-67340	Bromodichloromethane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.2	ug/l	
		Lab Fort Blk. % Rec.	92.2	%	70-130
1,2-Dibromo-3-Chloropropane	1,2-Dibromo-3-Chloropropane	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	7.1	ug/l	
		Lab Fort Blk. % Rec.	71.7	%	70-130
1,2-Dibromoethane	1,2-Dibromoethane	Lab Fort Blank Amt.	10.00	ug/l	
		Lab Fort Blk. Found	9.63	ug/l	
		Lab Fort Blk. % Rec.	96.30	%	70-130
Tetrahydrofuran	Tetrahydrofuran	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	8.0	ug/l	
		Lab Fort Blk. % Rec.	80.2	%	70-130
tert-Butyl Alcohol	tert-Butyl Alcohol	Lab Fort Blank Amt.	50.0	ug/l	
		Lab Fort Blk. Found	44.3	ug/l	
		Lab Fort Blk. % Rec.	88.7	%	40-160
Diisopropyl Ether	Diisopropyl Ether	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	9.8	ug/l	
		Lab Fort Blk. % Rec.	98.2	%	70-130
tert-Butylethyl Ether	tert-Butylethyl Ether	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	8.5	ug/l	
		Lab Fort Blk. % Rec.	85.7	%	70-160
tert-Amylmethyl Ether	tert-Amylmethyl Ether	Lab Fort Blank Amt.	10.0	ug/l	
		Lab Fort Blk. Found	7.9	ug/l	
		Lab Fort Blk. % Rec.	79.6	%	70-130

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NOTES:

QC Batch No. : GCMS/VOL-17528

Sample ID : LFBLANK-67340

Analysis : 1,2,3-Trichlorobenzene

LABORATORY FORTIFIED BLANK RECOVERY OUTSIDE OF CONTROL LIMITS. ANY REPORTED RESULT FOR THIS COMPOUND IN THIS BATCH IS LIKELY TO BE BIASED ON THE LOW SIDE.

QC Batch No. : GCMS/VOL-17528

Sample ID : LFBLANK-67340

Analysis : 1,2,4-Trichlorobenzene

LABORATORY FORTIFIED BLANK RECOVERY OUTSIDE OF CONTROL LIMITS. ANY REPORTED RESULT FOR THIS COMPOUND IN THIS BATCH IS LIKELY TO BE BIASED ON THE LOW SIDE.



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QUALITY CONTROL DEFINITIONS AND ABBREVIATIONS

QC BATCH NUMBER	This is the number assigned to all samples analyzed together that would be subject to comparison with a particular set of Quality Control Data.
LIMITS	Upper and Lower Control Limits for the QC ANALYSIS Reported. All values normally would fall within these statistically determined limits, unless there is an unusual circumstance that would be documented in a NOTE appearing on the last page of the QC SUMMARY REPORT. Not all QC results will have Limits defined.
Sample Amount	Amount of analyte found in a sample.
Blank	Method Blank that has been taken through all the steps of the analysis.
LFBLANK	Laboratory Fortified Blank (a control sample)
STDADD	Standard Added (a laboratory control sample)
Matrix Spk Amt Added	Amount of analyte spiked into a sample
MS Amt Measured	Amount of analyte found including amount that was spiked
Matrix Spike % Rec.	% Recovery of spiked amount in sample.
Duplicate Value	The result from the Duplicate analysis of the sample.
Duplicate RPD	The Relative Percent Difference between two Duplicate Analyses.
Surrogate Recovery	The % Recovery for non-environmental compounds (surrogates) spiked into samples to determine the performance of the analytical methods.
Sur. Recovery (ELCD)	Surrogate Recovery on the Electrolytic Conductivity Detector.
Sur. Recovery (PID)	Surrogate Recovery on the Photoionization Detector.
Standard Measured	Amount measured for a laboratory control sample
Standard Amt Added	Known value for a laboratory control sample
Standard % Recovery	% recovered for a laboratory control sample with a known value.
Lab Fort Blank Amt	Laboratory Fortified Blank Amount Added
Lab Fort Blk. Found	Laboratory Fortified Blank Amount Found
Lab Fort Blk % Rec	Laboratory Fortified Blank % Recovered
Dup Lab Fort Bl Amt	Duplicate Laboratory Fortified Blank Amount Added
Dup Lab Fort Bl Fnd	Duplicate Laboratory Fortified Blank Amount Found
Dup Lab Fort Bl % Rec	Duplicate Laboratory Fortified Blank % Recovery
Lab Fort Blank Range	Laboratory Fortified Blank Range (Absolute value of difference between recoveries for Lab Fortified Blank and Lab Fortified Blank Duplicate).
Lab Fort Bl. Av. Rec.	Laboratory Fortified Blank Average Recovery
Duplicate Sample Amt	Sample Value for Duplicate used with Matrix Spike Duplicate
MSD Amount Added	Matrix Spike Duplicate Amount Added (Spiked)
MSD Amt Measured	Matrix Spike Duplicate Amount Measured
MSD % Recovery	Matrix Spike Duplicate % Recovery
MSD Range	Absolute difference between Matrix Spike and Matrix Spike Duplicate Recoveries



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39 Spruce Street
East Longmeadow, MA
Phone: 1-413-525-2332
Fax: 1-413-525-6405

SAMPLE RECEIPT CHECKLIST

CLIENT NAME: LFR
RECEIVED BY: CEC DATE: 8/21/07

- 1. Was chain of custody relinquished and signed? YES NO
- 2. Does Chain agree with samples? YES NO

If not, explain: _____

- 3. All Samples in good condition? YES NO

If not, explain: _____

- 4. Were samples received in compliance with Temperature 0-6 degrees C? YES NO Degrees: 3.0c

- 5. Are there any dissolved samples for the lab to filter? YES NO

Who was notified? _____ Date: _____ Time: _____

- 6. Are there any on hold samples? YES NO STORED WHERE: _____

- 7. Are there any short holding time samples and who was notified? _____ Date: _____ Time: _____

- 8. Location where samples are stored: IC

CONTAINERS SENT IN TO CON-TEST	# of container
1 liter amber	
500 ml amber	
250 ml amber (8oz. Amber)	
1 liter plastic	
500 ml plastic	
250 ml plastic	
40 ml vial—which kind—list below	12
Colisure bottle	
Dissolved oxygen bottle	
Flashpoint bottle	

CONTAINERS SENT TO CON-TEST	# of containers
Air Cassettes	
8 oz clear jar	
4 oz clear jar	
2 oz clear jar	
Plastic bag	
Encore	
Brass Sleeves	
Tubes	
Summa cans	
Other	

Laboratory comments: _____

of HCL Vial _____ # of Methanol vials _____ # of Sodium Bisulfate vials _____
of DI water(to be frozen) vials _____ Time and Date when frozen _____

Do all the samples have the correct pH levels? YES NO If no, please explain above

LFR, INC. - RI
 300 METRO CENTER BLVD., SUITE 250
 WARWICK, RI 02886
 ATTN: DONNA PALLISTER

CONTRACT NUMBER:
 PURCHASE ORDER NUMBER:

PROJECT NUMBER: 081-12027-00

ANALYTICAL SUMMARY

LIMS BAT #: LIMIT-09020
 JOB NUMBER: 081-12027-00

The results of analyses performed on the following samples submitted to the CON-TEST Analytical Laboratory are found in this report.

PROJECT LOCATION: SPRINGFIELD STREET

FIELD SAMPLE #	LAB ID	MATRIX	SAMPLE DESCRIPTION	TEST
MPL-6	07B32322	AIR	NOT SPECIFIED	to-14 ppbv
MPL-6	07B32322	AIR	NOT SPECIFIED	to-14 ug/m3
WB-2	07B32323	AIR	NOT SPECIFIED	to-14 ppbv
WB-2	07B32323	AIR	NOT SPECIFIED	to-14 ug/m3

Comments :

LIMS BATCH NO. : LIMIT-09020

IN METHOD TO-14, FOR SAMPLE 07B32322, ANY REPORTED RESULT FOR DICHLORODIFLUOROMETHANE, CHLOROMETHANE, 1,2-DICHLOROTETRAFLUOROETHANE, VINYL CHLORIDE, BROMOMETHANE, CHLOROETHANE, TRICHLOROFLUOROETHANE, 1,1-DICHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROTRIFLUOROETHANE, CIS- AND TRANS-1,2-DICHLOROETHYLENE, 1,1-DICHLOROETHANE, CHLOROFORM, 1,2-DICHLOROETHANE, 1,1,1-TRICHLOROETHANE, BENZENE, CARBON TETRACHLORIDE, 1,2-DICHLOROPROPANE, TRICHLOROETHYLENE, OR CIS- AND TRANS-1,3-DICHLOROPROPENE IS ESTIMATED. INTERNAL STANDARD AREAS ARE OUTSIDE OF METHOD SPECIFIED CRITERIA. FAILURES ARE ATTRIBUTED TO THE SAMPLE MATRIX.

The CON-TEST Environmental Laboratory operates under the following certifications and accreditations :

AIHA 100033	AIHA ELLAP (LEAD) 100033	
MASSACHUSETTS MA0100	NEW HAMPSHIRE NELAP 2516	NEW JERSEY NELAP NJ MA007 (AIR)
CONNECTICUT PH-0567	VERMONT DOH (LEAD) No. LL015036	
NEW YORK ELAP/NELAP 10899	RHODE ISLAND (LIC. No. 112)	

I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Sondra L. Slesinski 08/29/07 Tod Kopyscinski
 SIGNATURE DATE Director of Operations

Sondra L. Slesinski
 Quality Assurance Officer

Edward Denson
 Technical Director

* See end of data tabulation for notes and comments pertaining to this sample

DONNA PALLISTER
 LFR, INC. - RI
 300 METRO CENTER BLVD., SUITE 250
 WARWICK, RI 02886

8/29/2007

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Purchase Order No.:

Project Number: 081-12027-00

Project Location: SPRINGFIELD STREET

LIMS-BAT #: LIMIT-09020

Date Received: 8/23/2007

Job Number: 081-12027-00

Field Sample #: MPL-6

Sample ID : 07B32322

Sampled : 8/22/2007

NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit		P/ F
						Lo	Hi	
Benzene	PPBv	0.74	08/26/07	TPH	0.20			
Bromomethane	PPBv	ND	08/26/07	TPH	0.20			
Carbon Tetrachloride	PPBv	ND	08/26/07	TPH	0.20			
Chlorobenzene	PPBv	ND	08/26/07	TPH	0.20			
Chloroethane	PPBv	ND	08/26/07	TPH	0.20			
Chloroform	PPBv	0.48	08/26/07	TPH	0.20			
Chloromethane	PPBv	0.36	08/26/07	TPH	0.20			
1,2-Dibromoethane	PPBv	ND	08/26/07	TPH	0.20			
1,2-Dichlorobenzene	PPBv	ND	08/26/07	TPH	0.20			
1,3-Dichlorobenzene	PPBv	ND	08/26/07	TPH	0.20			
1,4-Dichlorobenzene	PPBv	0.54	08/26/07	TPH	0.20			
Dichlorodifluoromethane	PPBv	0.28	08/26/07	TPH	0.20			
1,1-Dichloroethane	PPBv	0.28	08/26/07	TPH	0.20			
1,2-Dichloroethane	PPBv	ND	08/26/07	TPH	0.20			
1,1-Dichloroethylene	PPBv	ND	08/26/07	TPH	0.20			
cis-1,2-Dichloroethylene	PPBv	ND	08/26/07	TPH	0.20			
1,2-Dichloropropane	PPBv	ND	08/26/07	TPH	0.20			
cis-1,3-Dichloropropene	PPBv	ND	08/26/07	TPH	0.20			
trans-1,3-Dichloropropene	PPBv	ND	08/26/07	TPH	0.20			
1,2-Dichlorotetrafluoroethane (114)	PPBv	ND	08/26/07	TPH	0.20			
Ethylbenzene	PPBv	0.70	08/26/07	TPH	0.20			
Hexachlorobutadiene	PPBv	ND	08/26/07	TPH	0.20			
Methylene Chloride	PPBv	0.84	08/26/07	TPH	0.20			
Styrene	PPBv	1.5	08/26/07	TPH	0.20			
1,1,2,2-Tetrachloroethane	PPBv	ND	08/26/07	TPH	0.20			
Tetrachloroethylene	PPBv	0.27	08/26/07	TPH	0.20			
Toluene	PPBv	7.2	08/26/07	TPH	0.20			
1,2,4-Trichlorobenzene	PPBv	ND	08/26/07	TPH	0.20			
1,1,1-Trichloroethane	PPBv	0.36	08/26/07	TPH	0.20			
1,1,2-Trichloroethane	PPBv	ND	08/26/07	TPH	0.20			

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

NM = Not Measured

SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

* = See end of report for comments and notes applying to this sample

DONNA PALLISTER
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8/29/2007
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Purchase Order No.:

Project Number: 081-12027-00
 LIMS-BAT #: LIMIT-09020
 Job Number: 081-12027-00

Project Location: SPRINGFIELD STREET
 Date Received: 8/23/2007
 Field Sample #: MPL-6

Sample ID : 07B32322

Sampled : 8/22/2007
 NOT SPECIFIED
 Sample Medium : SUMMA

Sample Matrix: AIR

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit		P/ F
						Lo	Hi	
Trichloroethylene	PPBv	0.25	08/26/07	TPH	0.20			
Trichlorofluoromethane (Freon 11)	PPBv	0.70	08/26/07	TPH	0.20			
1,1,2-Trichloro-1,2,2-Trifluoroethane	PPBv	0.27	08/26/07	TPH	0.20			
1,2,4-Trimethylbenzene	PPBv	0.44	08/26/07	TPH	0.20			
1,3,5-Trimethylbenzene	PPBv	ND	08/26/07	TPH	0.20			
Vinyl Chloride	PPBv	ND	08/26/07	TPH	0.20			
m/p-Xylene	PPBv	2.4	08/26/07	TPH	0.40			
o-Xylene	PPBv	0.68	08/26/07	TPH	0.20			

Analytical Method:
 EPA TO-14A

SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

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8/29/2007
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Project Location: SPRINGFIELD STREET
 Date Received: 8/23/2007
 Field Sample #: WB-2

Purchase Order No.:

Project Number: 081-12027-00
 LIMS-BAT #: LIMIT-09020
 Job Number: 081-12027-00

Sample ID : 07B32323

Sampled : 8/22/2007
 NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit		P/ F
						Lo	Hi	
Benzene	PPBv	ND	08/26/07	TPH	0.20			
Bromomethane	PPBv	ND	08/26/07	TPH	0.20			
Carbon Tetrachloride	PPBv	ND	08/26/07	TPH	0.20			
Chlorobenzene	PPBv	ND	08/26/07	TPH	0.20			
Chloroethane	PPBv	1.8	08/26/07	TPH	0.20			
Chloroform	PPBv	ND	08/26/07	TPH	0.20			
Chloromethane	PPBv	ND	08/26/07	TPH	0.20			
1,2-Dibromoethane	PPBv	ND	08/26/07	TPH	0.20			
1,2-Dichlorobenzene	PPBv	ND	08/26/07	TPH	0.20			
1,3-Dichlorobenzene	PPBv	ND	08/26/07	TPH	0.20			
1,4-Dichlorobenzene	PPBv	0.37	08/26/07	TPH	0.20			
Dichlorodifluoromethane	PPBv	0.57	08/26/07	TPH	0.20			
1,1-Dichloroethane	PPBv	29	08/26/07	TPH	0.20			
1,2-Dichloroethane	PPBv	ND	08/26/07	TPH	0.20			
1,1-Dichloroethylene	PPBv	2.5	08/26/07	TPH	0.20			
cis-1,2-Dichloroethylene	PPBv	3.5	08/26/07	TPH	0.20			
1,2-Dichloropropane	PPBv	ND	08/26/07	TPH	0.20			
cis-1,3-Dichloropropene	PPBv	ND	08/26/07	TPH	0.20			
trans-1,3-Dichloropropene	PPBv	ND	08/26/07	TPH	0.20			
1,2-Dichlorotetrafluoroethane (114)	PPBv	ND	08/26/07	TPH	0.20			
Ethylbenzene	PPBv	0.46	08/26/07	TPH	0.20			
Hexachlorobutadiene	PPBv	ND	08/26/07	TPH	0.20			
Methylene Chloride	PPBv	0.50	08/26/07	TPH	0.20			
Styrene	PPBv	1.1	08/26/07	TPH	0.20			
1,1,2,2-Tetrachloroethane	PPBv	ND	08/26/07	TPH	0.20			
Tetrachloroethylene	PPBv	0.81	08/26/07	TPH	0.20			
Toluene	PPBv	5.3	08/26/07	TPH	0.20			
1,2,4-Trichlorobenzene	PPBv	ND	08/26/07	TPH	0.20			
1,1,1-Trichloroethane	PPBv	38	08/26/07	TPH	0.20			
1,1,2-Trichloroethane	PPBv	ND	08/26/07	TPH	0.20			

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8/29/2007

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Purchase Order No.:

Project Number: 081-12027-00

Project Location: SPRINGFIELD STREET

LIMS-BAT #: LIMIT-09020

Date Received: 8/23/2007

Job Number: 081-12027-00

Field Sample #: **WB-2**

Sample ID : **07B32323**

Sampled : 8/22/2007

NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit		P/ F
						Lo	Hi	
Trichloroethylene	PPBv	4.6	08/26/07	TPH	0.20			
Trichlorofluoromethane (Freon 11)	PPBv	0.43	08/26/07	TPH	0.20			
1,1,2-Trichloro-1,2,2-Trifluoroethane	PPBv	ND	08/26/07	TPH	0.20			
1,2,4-Trimethylbenzene	PPBv	0.26	08/26/07	TPH	0.20			
1,3,5-Trimethylbenzene	PPBv	ND	08/26/07	TPH	0.20			
Vinyl Chloride	PPBv	ND	08/26/07	TPH	0.20			
m/p-Xylene	PPBv	1.8	08/26/07	TPH	0.40			
o-Xylene	PPBv	0.48	08/26/07	TPH	0.20			

Analytical Method:

EPA TO-14A

SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

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DONNA PALLISTER
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8/29/2007
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Project Location: SPRINGFIELD STREET
 Date Received: 8/23/2007
 Field Sample #: MPL-6

Purchase Order No.:

Project Number: 081-12027-00
 LIMS-BAT #: LIMIT-09020
 Job Number: 081-12027-00

Sample ID : 07B32322

Sampled : 8/22/2007
 NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit		P/ F
						Lo	Hi	
Benzene	ug/m3	2.4	08/26/07	TPH	0.64			
Bromomethane	ug/m3	ND	08/26/07	TPH	0.77			
Carbon Tetrachloride	ug/m3	ND	08/26/07	TPH	1.3			
Chlorobenzene	ug/m3	ND	08/26/07	TPH	0.92			
Chloroethane	ug/m3	ND	08/26/07	TPH	0.52			
Chloroform	ug/m3	2.3	08/26/07	TPH	0.96			
Chloromethane	ug/m3	0.74	08/26/07	TPH	0.41			
1,2-Dibromoethane	ug/m3	ND	08/26/07	TPH	1.6			
1,2-Dichlorobenzene	ug/m3	ND	08/26/07	TPH	1.2			
1,3-Dichlorobenzene	ug/m3	ND	08/26/07	TPH	1.2			
1,4-Dichlorobenzene	ug/m3	3.2	08/26/07	TPH	1.2			
Dichlorodifluoromethane	ug/m3	1.4	08/26/07	TPH	0.98			
1,1-Dichloroethane	ug/m3	1.1	08/26/07	TPH	0.80			
1,2-Dichloroethane	ug/m3	ND	08/26/07	TPH	0.80			
1,1-Dichloroethylene	ug/m3	ND	08/26/07	TPH	0.78			
cis-1,2-Dichloroethylene	ug/m3	ND	08/26/07	TPH	0.78			
1,2-Dichloropropane	ug/m3	ND	08/26/07	TPH	0.92			
cis-1,3-Dichloropropene	ug/m3	ND	08/26/07	TPH	0.90			
trans-1,3-Dichloropropene	ug/m3	ND	08/26/07	TPH	0.90			
1,2-Dichlorotetrafluoroethane (114)	ug/m3	ND	08/26/07	TPH	1.4			
Ethylbenzene	ug/m3	3.0	08/26/07	TPH	0.87			
Hexachlorobutadiene	ug/m3	ND	08/26/07	TPH	2.2			
Methylene Chloride	ug/m3	2.9	08/26/07	TPH	0.69			
Styrene	ug/m3	6.5	08/26/07	TPH	0.85			
1,1,2,2-Tetrachloroethane	ug/m3	ND	08/26/07	TPH	1.4			
Tetrachloroethylene	ug/m3	1.8	08/26/07	TPH	1.4			
Toluene	ug/m3	27	08/26/07	TPH	0.75			
1,2,4-Trichlorobenzene	ug/m3	ND	08/26/07	TPH	1.5			
1,1,1-Trichloroethane	ug/m3	2.0	08/26/07	TPH	1.1			
1,1,2-Trichloroethane	ug/m3	ND	08/26/07	TPH	1.1			

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DONNA PALLISTER
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 300 METRO CENTER BLVD., SUITE 250
 WARWICK, RI 02886

8/29/2007

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Project Location: SPRINGFIELD STREET
 Date Received: 8/23/2007
 Field Sample #: MPL-6

Purchase Order No.:

Project Number: 081-12027-00
 LIMS-BAT #: LIMIT-09020
 Job Number: 081-12027-00

Sample ID : 07B32322

Sampled : 8/22/2007

NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit		P/ F
						Lo	Hi	
Trichloroethylene	ug/m3	1.3	08/26/07	TPH	1.1			
Trichlorofluoromethane	ug/m3	3.9	08/26/07	TPH	1.2			
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/m3	2.1	08/26/07	TPH	1.6			
1,2,4-Trimethylbenzene	ug/m3	2.2	08/26/07	TPH	0.98			
1,3,5-Trimethylbenzene	ug/m3	ND	08/26/07	TPH	0.98			
Vinyl Chloride	ug/m3	ND	08/26/07	TPH	0.51			
m/p-Xylene	ug/m3	10	08/26/07	TPH	1.8			
o-Xylene	ug/m3	3.0	08/26/07	TPH	0.87			

Analytical Method:

EPA TO-14A

SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

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DONNA PALLISTER
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8/29/2007

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Purchase Order No.:

Project Number: 081-12027-00

Project Location: SPRINGFIELD STREET

LIMS-BAT #: LIMIT-09020

Date Received: 8/23/2007

Job Number: 081-12027-00

Field Sample #: **WB-2**

Sample ID: **07B32323**

Sampled: 8/22/2007

NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit		P/ F
						Lo	Hi	
Benzene	ug/m3	ND	08/26/07	TPH	0.64			
Bromomethane	ug/m3	ND	08/26/07	TPH	0.77			
Carbon Tetrachloride	ug/m3	ND	08/26/07	TPH	1.3			
Chlorobenzene	ug/m3	ND	08/26/07	TPH	0.92			
Chloroethane	ug/m3	4.8	08/26/07	TPH	0.52			
Chloroform	ug/m3	ND	08/26/07	TPH	0.96			
Chloromethane	ug/m3	ND	08/26/07	TPH	0.41			
1,2-Dibromoethane	ug/m3	ND	08/26/07	TPH	1.6			
1,2-Dichlorobenzene	ug/m3	ND	08/26/07	TPH	1.2			
1,3-Dichlorobenzene	ug/m3	ND	08/26/07	TPH	1.2			
1,4-Dichlorobenzene	ug/m3	2.2	08/26/07	TPH	1.2			
Dichlorodifluoromethane	ug/m3	2.8	08/26/07	TPH	0.98			
1,1-Dichloroethane	ug/m3	120	08/26/07	TPH	0.80			
1,2-Dichloroethane	ug/m3	ND	08/26/07	TPH	0.80			
1,1-Dichloroethylene	ug/m3	9.8	08/26/07	TPH	0.78			
cis-1,2-Dichloroethylene	ug/m3	14	08/26/07	TPH	0.78			
1,2-Dichloropropane	ug/m3	ND	08/26/07	TPH	0.92			
cis-1,3-Dichloropropene	ug/m3	ND	08/26/07	TPH	0.90			
trans-1,3-Dichloropropene	ug/m3	ND	08/26/07	TPH	0.90			
1,2-Dichlorotetrafluoroethane (114)	ug/m3	ND	08/26/07	TPH	1.4			
Ethylbenzene	ug/m3	2.0	08/26/07	TPH	0.87			
Hexachlorobutadiene	ug/m3	ND	08/26/07	TPH	2.2			
Methylene Chloride	ug/m3	1.7	08/26/07	TPH	0.69			
Styrene	ug/m3	4.8	08/26/07	TPH	0.85			
1,1,2,2-Tetrachloroethane	ug/m3	ND	08/26/07	TPH	1.4			
Tetrachloroethylene	ug/m3	5.5	08/26/07	TPH	1.4			
Toluene	ug/m3	20	08/26/07	TPH	0.75			
1,2,4-Trichlorobenzene	ug/m3	ND	08/26/07	TPH	1.5			
1,1,1-Trichloroethane	ug/m3	200	08/26/07	TPH	1.1			
1,1,2-Trichloroethane	ug/m3	ND	08/26/07	TPH	1.1			

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DONNA PALLISTER
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8/29/2007
 Page 8 of 9

Project Location: SPRINGFIELD STREET
 Date Received: 8/23/2007
 Field Sample #: **WB-2**

Purchase Order No.:

Project Number: 081-12027-00
 LIMS-BAT #: LIMIT-09020
 Job Number: 081-12027-00

Sample ID : **07B32323**

Sampled : 8/22/2007
 NOT SPECIFIED

Sample Matrix: AIR

Sample Medium : SUMMA

	Units	Results	Date Analyzed	Analyst	RL	SPEC Limit Lo Hi	P/ F
Trichloroethylene	ug/m3	25	08/26/07	TPH	1.1		
Trichlorofluoromethane	ug/m3	2.4	08/26/07	TPH	1.2		
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/m3	ND	08/26/07	TPH	1.6		
1,2,4-Trimethylbenzene	ug/m3	1.3	08/26/07	TPH	0.98		
1,3,5-Trimethylbenzene	ug/m3	ND	08/26/07	TPH	0.98		
Vinyl Chloride	ug/m3	ND	08/26/07	TPH	0.51		
m/p-Xylene	ug/m3	7.6	08/26/07	TPH	1.8		
o-Xylene	ug/m3	2.1	08/26/07	TPH	0.87		

Analytical Method:

EPA TO-14A

SAMPLES ARE TAKEN IN SUMMA CANISTERS AND ANALYZED BY GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY DETECTION. (GC/MS)

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39 Spruce Street ° East Longmeadow, MA 01028 ° FAX 413/525-6405 ° TEL. 413/525-2332

DONNA PALLISTER
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300 METRO CENTER BLVD., SUITE 250
WARWICK, RI 02886

Project Location: SPRINGFIELD STREET
Date Received: 8/23/2007

Purchase Order No.:

**** END OF REPORT ****

8/29/2007

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Project Number: 081-12027-00

LIMS-BAT #: LIMIT-09020

Job Number: 081-12027-00

RL = Reporting Limit

ND = Not Detected at or above the Reporting Limit

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SPEC LIMIT = a client specified recommended or regulatory level for comparison with data to determine PASS (P) or FAIL (F) condition of results.

QC SUMMARY REPORT

SAMPLE QC: Sample Results with Duplicates

BATCH QC: Lab fortified Blanks and Duplicates

Sample Matrix Spikes and Matrix Spike Duplicates

Standard Reference Materials and Duplicates

Method Blanks

Report Date: 8/29/2007

Lims Bat #: LIMIT-09020

Page 1 of 2

QC Batch Number: BATCH-12899

Sample Id	Analysis	QC Analysis	Values	Units	Limits
07B32322	4-Bromofluorobenzene	Surrogate Recovery	104.62	%	70-130
07B32323	4-Bromofluorobenzene	Surrogate Recovery	96.87	%	70-130
BLANK-106145	Benzene	Blank	<0.64	ug/m3	
	Carbon Tetrachloride	Blank	<1.3	ug/m3	
	Chloroform	Blank	<0.96	ug/m3	
	1,2-Dichloroethane	Blank	<0.80	ug/m3	
	1,4-Dichlorobenzene	Blank	<1.2	ug/m3	
	Ethylbenzene	Blank	<0.87	ug/m3	
	Styrene	Blank	<0.85	ug/m3	
	Tetrachloroethylene	Blank	<1.4	ug/m3	
	Toluene	Blank	<0.75	ug/m3	
	1,1,1-Trichloroethane	Blank	<1.1	ug/m3	
	Trichloroethylene	Blank	<1.1	ug/m3	
	1,1,2-Trichloro-1,2,2-Trifluoroethane	Blank	<1.6	ug/m3	
	Trichlorofluoromethane	Blank	<1.2	ug/m3	
	o-Xylene	Blank	<0.87	ug/m3	
	m/p-Xylene	Blank	<1.8	ug/m3	
	1,2-Dichlorobenzene	Blank	<1.2	ug/m3	
	1,3-Dichlorobenzene	Blank	<1.2	ug/m3	
	1,1-Dichloroethane	Blank	<0.80	ug/m3	
	1,1-Dichloroethylene	Blank	<0.78	ug/m3	
	Vinyl Chloride	Blank	<0.51	ug/m3	
	Methylene Chloride	Blank	<0.69	ug/m3	
	Chlorobenzene	Blank	<0.92	ug/m3	
	Chloromethane	Blank	<0.41	ug/m3	
	Bromomethane	Blank	<0.77	ug/m3	
	Chloroethane	Blank	<0.52	ug/m3	
	cis-1,3-Dichloropropene	Blank	<0.90	ug/m3	
	trans-1,3-Dichloropropene	Blank	<0.90	ug/m3	
	1,1,2-Trichloroethane	Blank	<1.1	ug/m3	
	1,1,2,2-Tetrachloroethane	Blank	<1.4	ug/m3	
	Hexachlorobutadiene	Blank	<2.2	ug/m3	
	1,2,4-Trichlorobenzene	Blank	<1.5	ug/m3	
	1,2,4-Trimethylbenzene	Blank	<0.98	ug/m3	
	1,3,5-Trimethylbenzene	Blank	<0.98	ug/m3	
	cis-1,2-Dichloroethylene	Blank	<0.78	ug/m3	
	1,2-Dichloropropane	Blank	<0.92	ug/m3	
	Dichlorodifluoromethane	Blank	<0.98	ug/m3	
	1,2-Dibromoethane	Blank	<1.6	ug/m3	
	1,2-Dichlorotetrafluoroethane (114)	Blank	<1.4	ug/m3	



QC SUMMARY REPORT

SAMPLE QC: Sample Results with Duplicates
Sample Matrix Spikes and Matrix Spike Duplicates

BATCH QC: Lab fortified Blanks and Duplicates
Standard Reference Materials and Duplicates
Method Blanks

Report Date: 8/29/2007 Lims Bat #: LIMIT-09020 Page 2 of 2

QUALITY CONTROL DEFINITIONS AND ABBREVIATIONS

- QC BATCH NUMBER: This is the number assigned to all samples analyzed together that would be subject to comparison with a particular set of Quality Control Data.
LIMITS: Upper and Lower Control Limits for the QC ANALYSIS Reported. All values normally would fall within these statistically determined limits, unless there is an unusual circumstance that would be documented in a NOTE appearing on the last page of the QC SUMMARY REPORT.
Sample Amount: Amount of analyte found in a sample.
Blank: Method Blank that has been taken though all the steps of the analysis.
LFBLANK: Laboratory Fortified Blank (a control sample)
STDADD: Standard Added (a laboratory control sample)
Matrix Spk Amt Added: Amount of analyte spiked into a sample
MS Amt Measured: Amount of analyte found including amount that was spiked
Matrix Spike % Rec.: % Recovery of spiked amount in sample.
Duplicate Value: The result from the Duplicate analysis of the sample.
Duplicate RPD: The Relative Percent Difference between two Duplicate Analyses.
Surrogate Recovery: The % Recovery for non-environmental compounds (surrogates) spiked into samples to determine the performance of the analytical methods.
Sur. Recovery (ELCD): Surrogate Recovery on the Electrolytic Conductivity Detector.
Sur. Recovery (PID): Surrogate Recovery on the Photoionization Detector.
Standard Measured: Amount measured for a laboratory control sample
Standard Amt Added: Known value for a laboratory control sample
Standard % Recovery: % recovered for a laboratory control sample with a known value.
Lab Fort Blank Amt: Laboratory Fortified Blank Amount Added
Lab Fort Blk. Found: Laboratory Fortified Blank Amount Found
Lab Fort Blk % Rec: Laboratory Fortified Blank % Recovered
Dup Lab Fort Bl Amt: Duplicate Laboratory Fortified Blank Amount Added
Dup Lab Fort Bl Fnd: Duplicate Laboratory Fortified Blank Amount Found
Dup Lab Fort Bl % Rec: Duplicate Laboratory Fortified Blank % Recovery
Lab Fort Blank Range: Laboratory Fortified Blank Range (Absolute value of difference between recoveries for Lab Fortified Blank and Lab Fortified Blank Duplicate).
Lab Fort Bl. Av. Rec.: Laboratory Fortified Blank Average Recovery
Duplicate Sample Amt: Sample Value for Duplicate used with Matrix Spike Duplicate
MSD Amount Added: Matrix Spike Duplicate Amount Added (Spiked)
MSD Amt Measured: Matrix Spike Duplicate Amount Measured
MSD % Recovery: Matrix Spike Duplicate % Recovery
MSD Range: Absolute difference between Matrix Spike and Matrix Spike Duplicate Recoveries



www.contestlabs.com

39 Spruce Street
East Longmeadow, MA
Phone: 1-413-525-2332
Fax: 1-413-525-6405

SAMPLE RECEIPT CHECKLIST

CLIENT NAME: LEB
RECEIVED BY: Km DATE: 08/23/07

1. Was chain of custody relinquished and signed? YES NO

2. Does Chain agree with samples? YES NO

If not, explain:

3. All Samples in good condition? YES NO

If not, explain:

4. Were samples received in compliance with Temperature 0-6 degrees C? YES NO Degrees: NA

5. Are there any dissolved samples for the lab to filter? YES NO

Who was notified? _____ Date: _____ Time: _____

6. Are there any on hold samples? YES NO STORED WHERE: _____

7. Are there any short holding time samples and who was notified? _____ Date: _____ Time: _____

8. Location where samples are stored: LEB

CONTAINERS SENT IN TO CON-TEST	# of container
1 liter amber	
500 ml amber	
250 ml amber (8oz. Amber)	
1 liter plastic	
500 ml plastic	
250 ml plastic	
40 ml vial—which kind—list below	
Colisure bottle.	
Dissolved oxygen bottle	
Flashpoint bottle	

CONTAINERS SENT TO CON-TEST	# of containers
Air Cassettes	
8 oz clear jar	
4 oz clear jar	
2 oz clear jar	
Plastic bag	2
Encore	
Brass Sleeves	
Tubes	
Summa cans	
Other	

Laboratory comments:

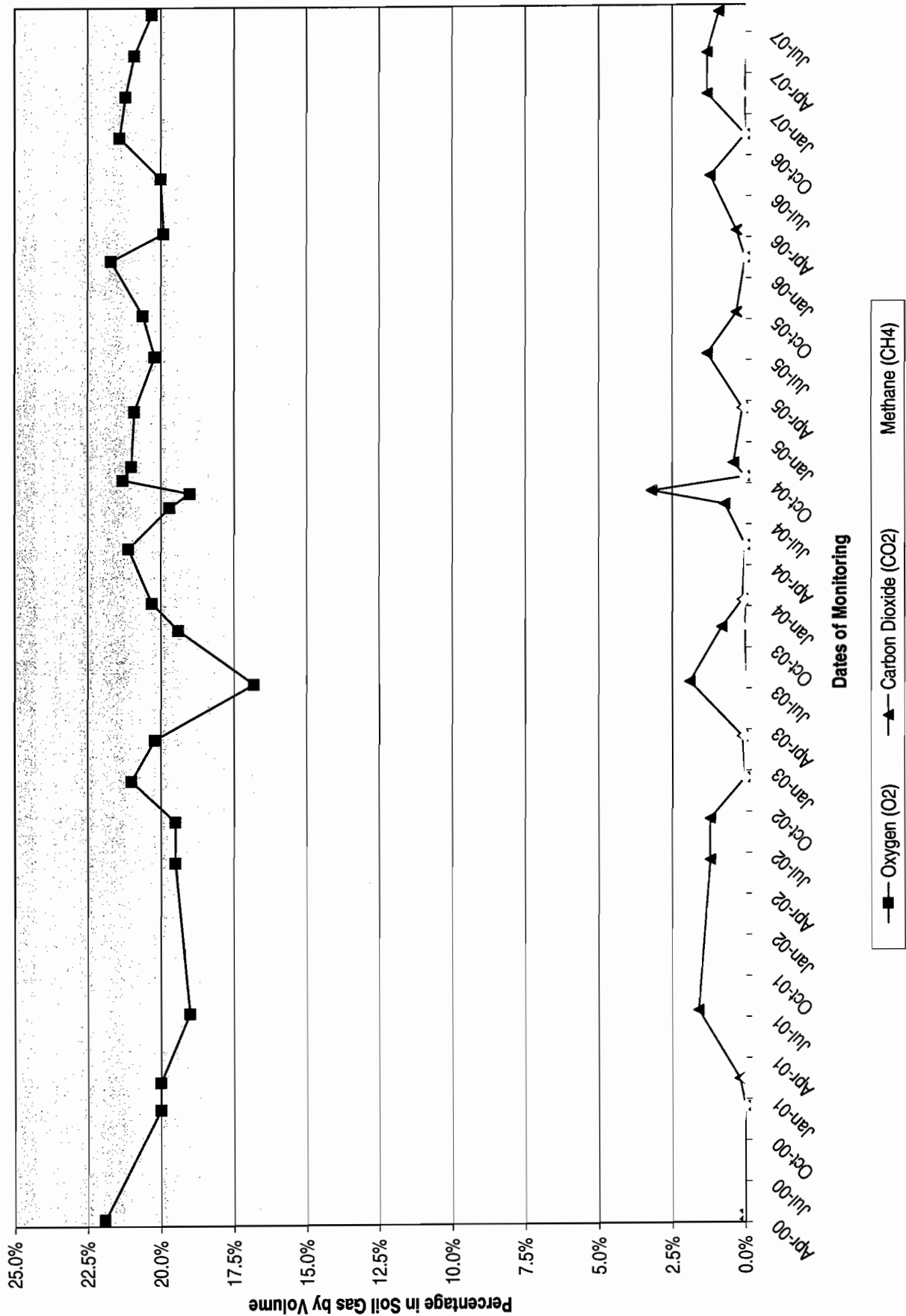
of HCL Vial _____ # of Methanol vials _____ # of Sodium Bisulfate vials _____
of DI water(to be frozen) vials _____ Time and Date when frozen _____

Do all the samples have the correct pH levels? YES NO If no, please explain above

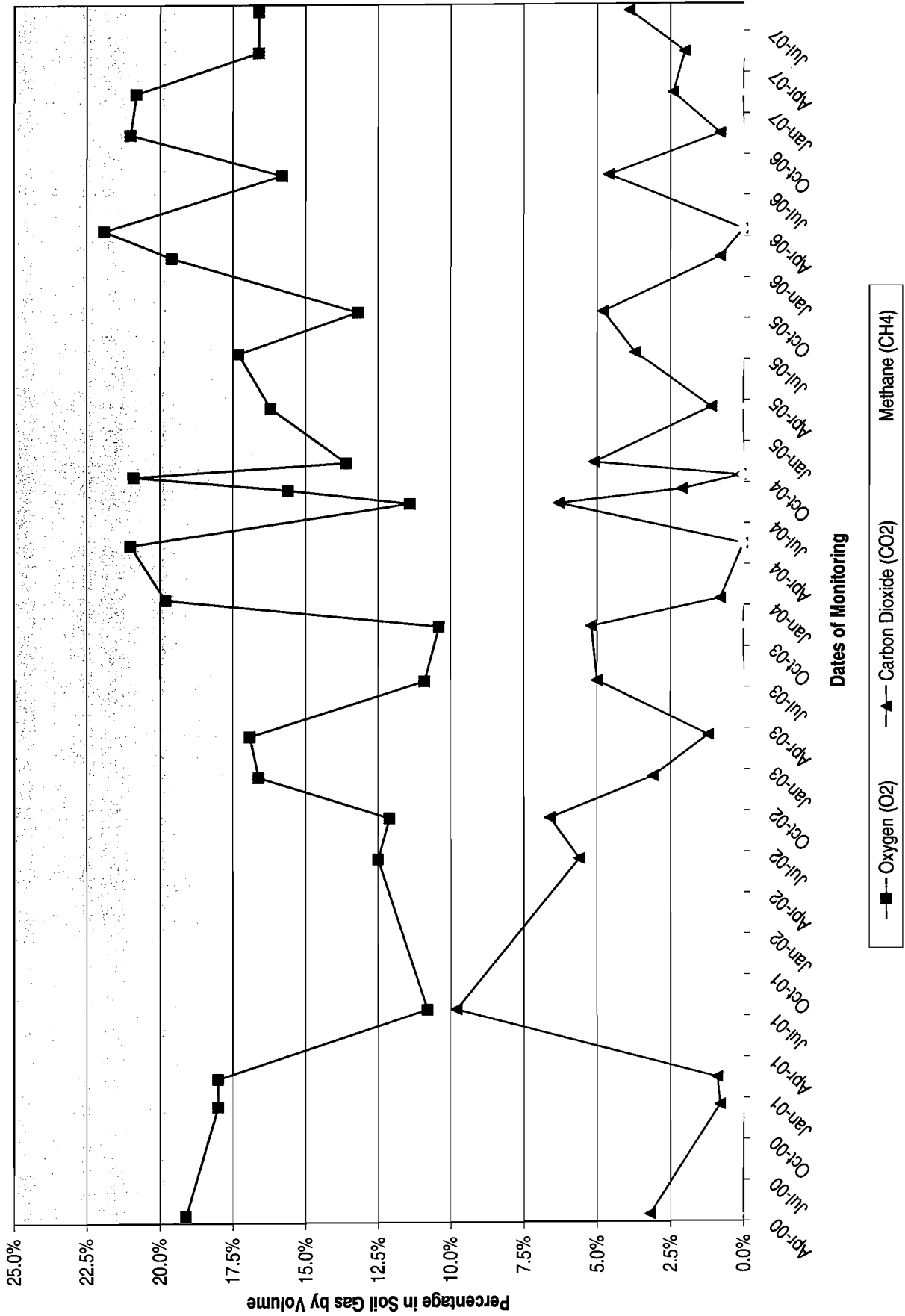
Attachment B
Soil Gas Graphs



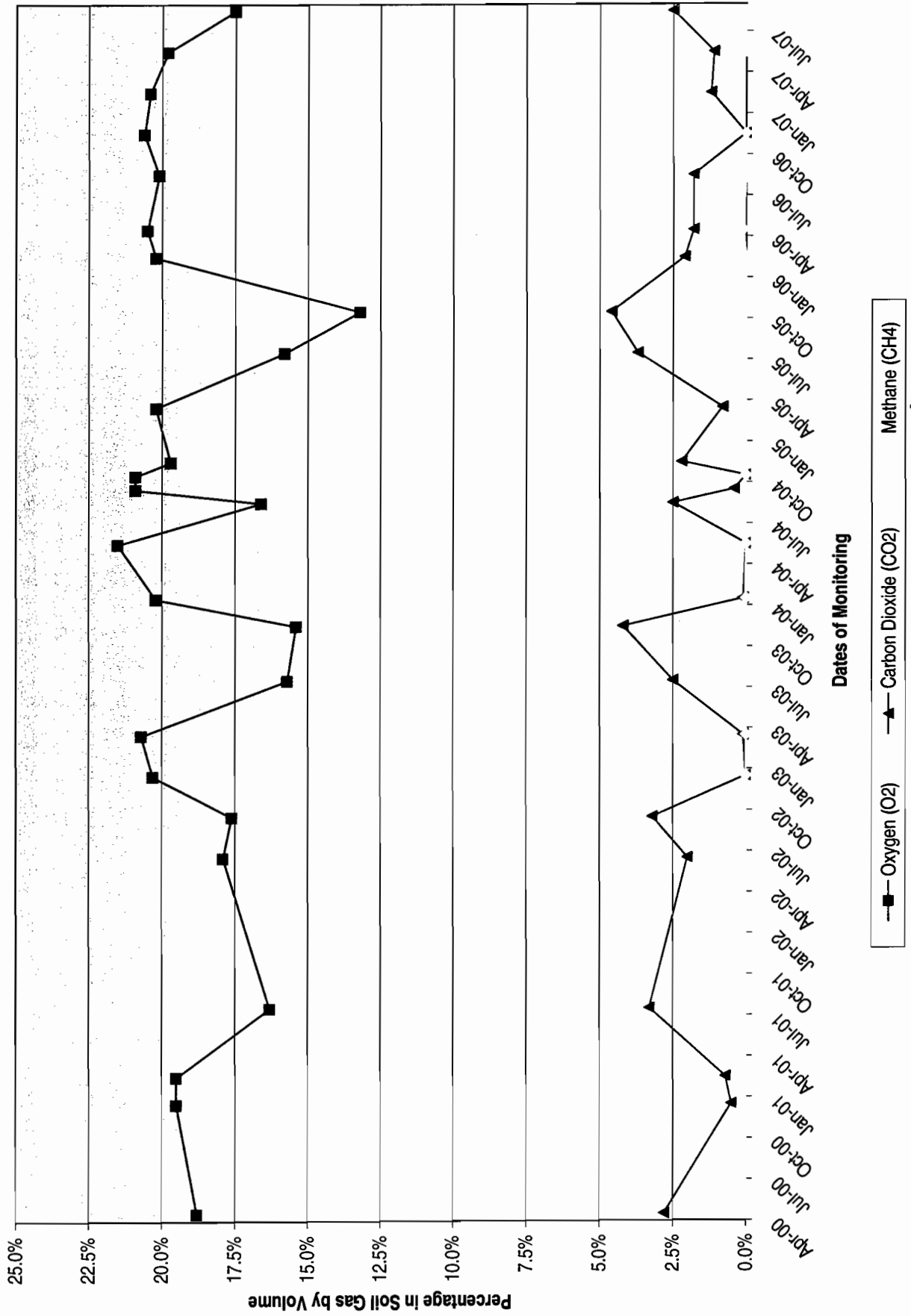
Soil Gas Well EPL1
Fluctuation in Methane, Oxygen, and Carbon Dioxide Percentages over Time
Springfield Street School Complex
Providence, Rhode Island



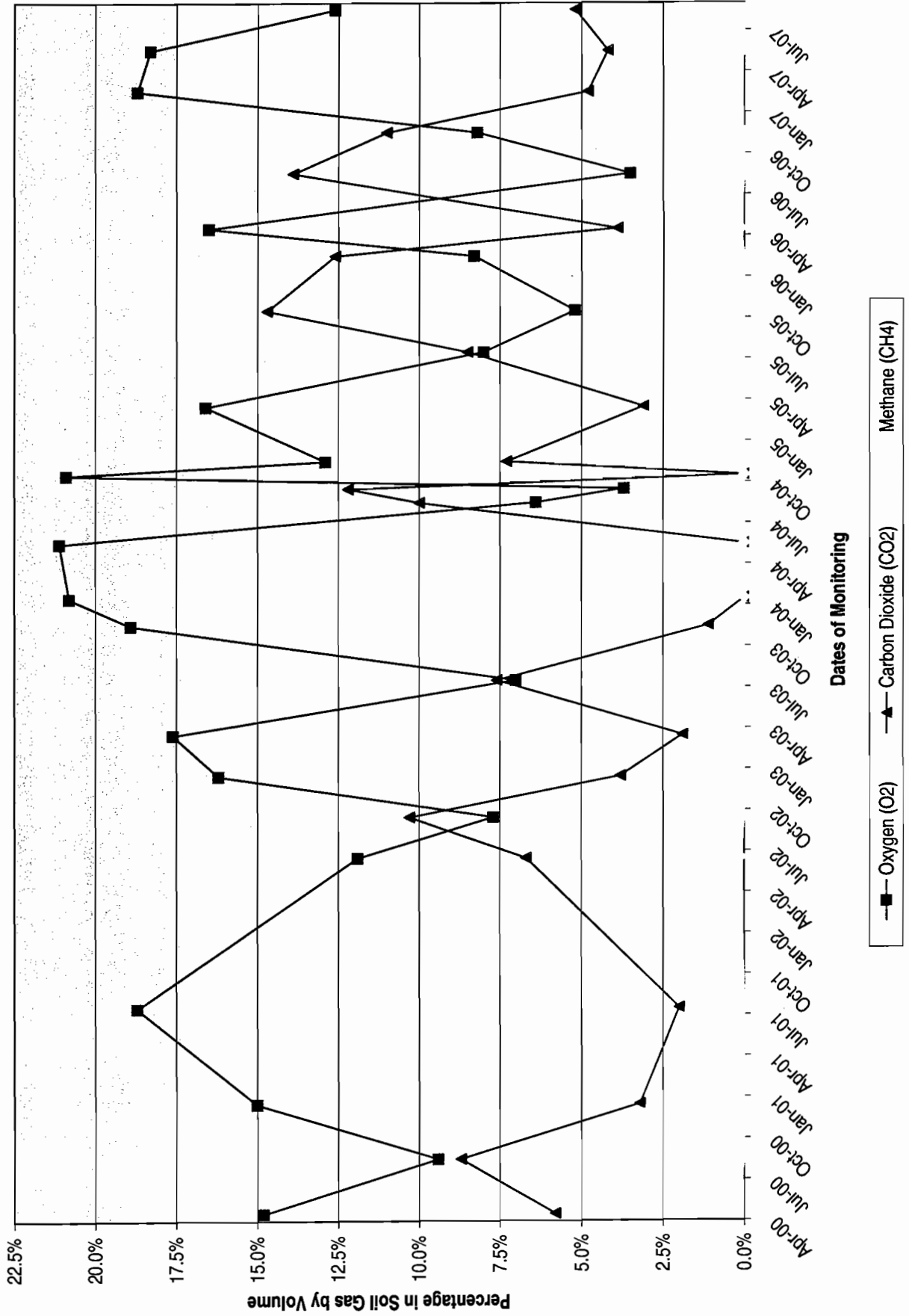
Soil Gas Well EPL4
Fluctuation in Methane, Oxygen, and Carbon Dioxide Percentages over Time
Springfield Street School Complex
Providence, Rhode Island



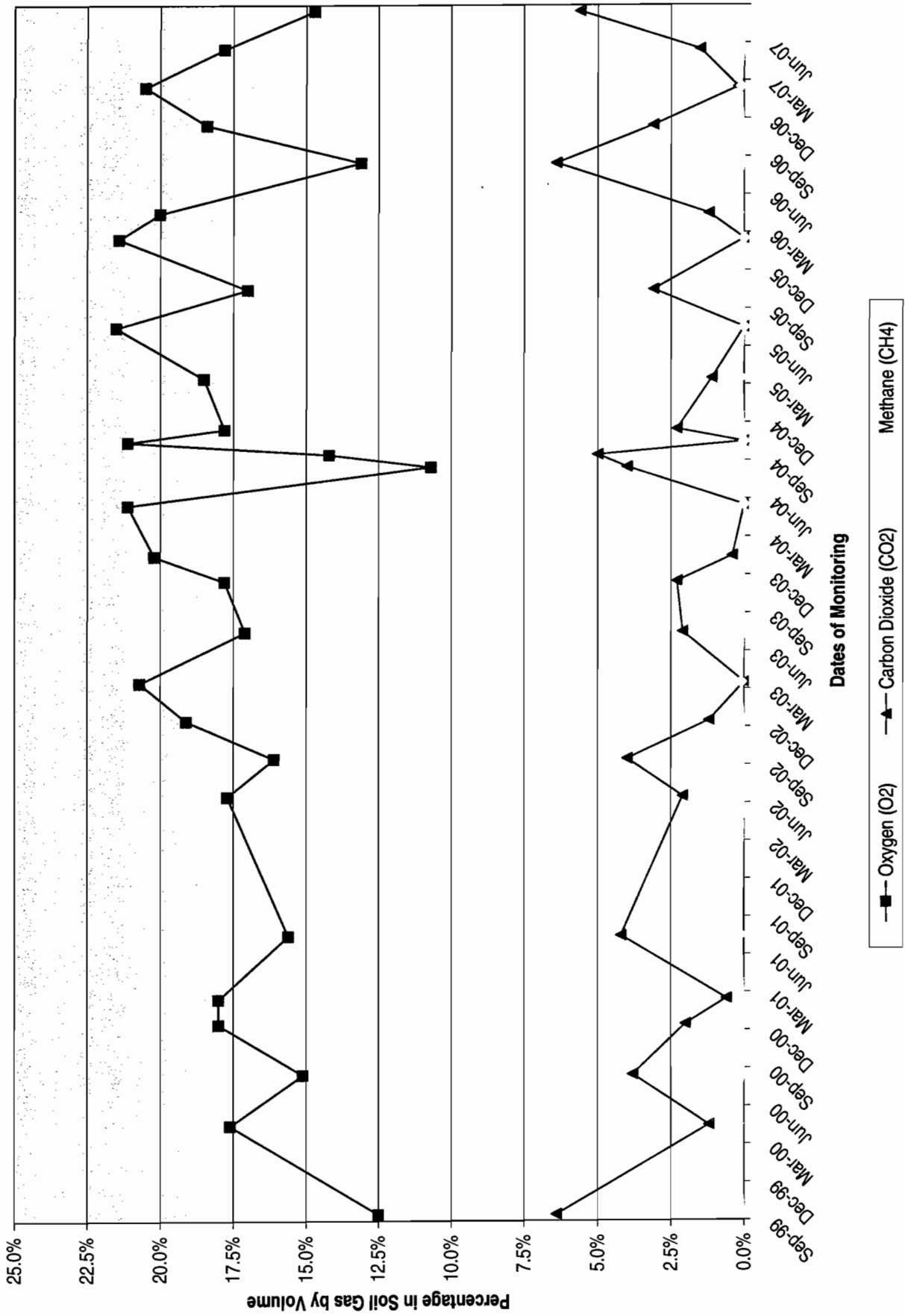
Soil Gas Well MG2
Fluctuation in Methane, Oxygen, and Carbon Dioxide Percentages over Time
Springfield Street School Complex
Providence, Rhode Island



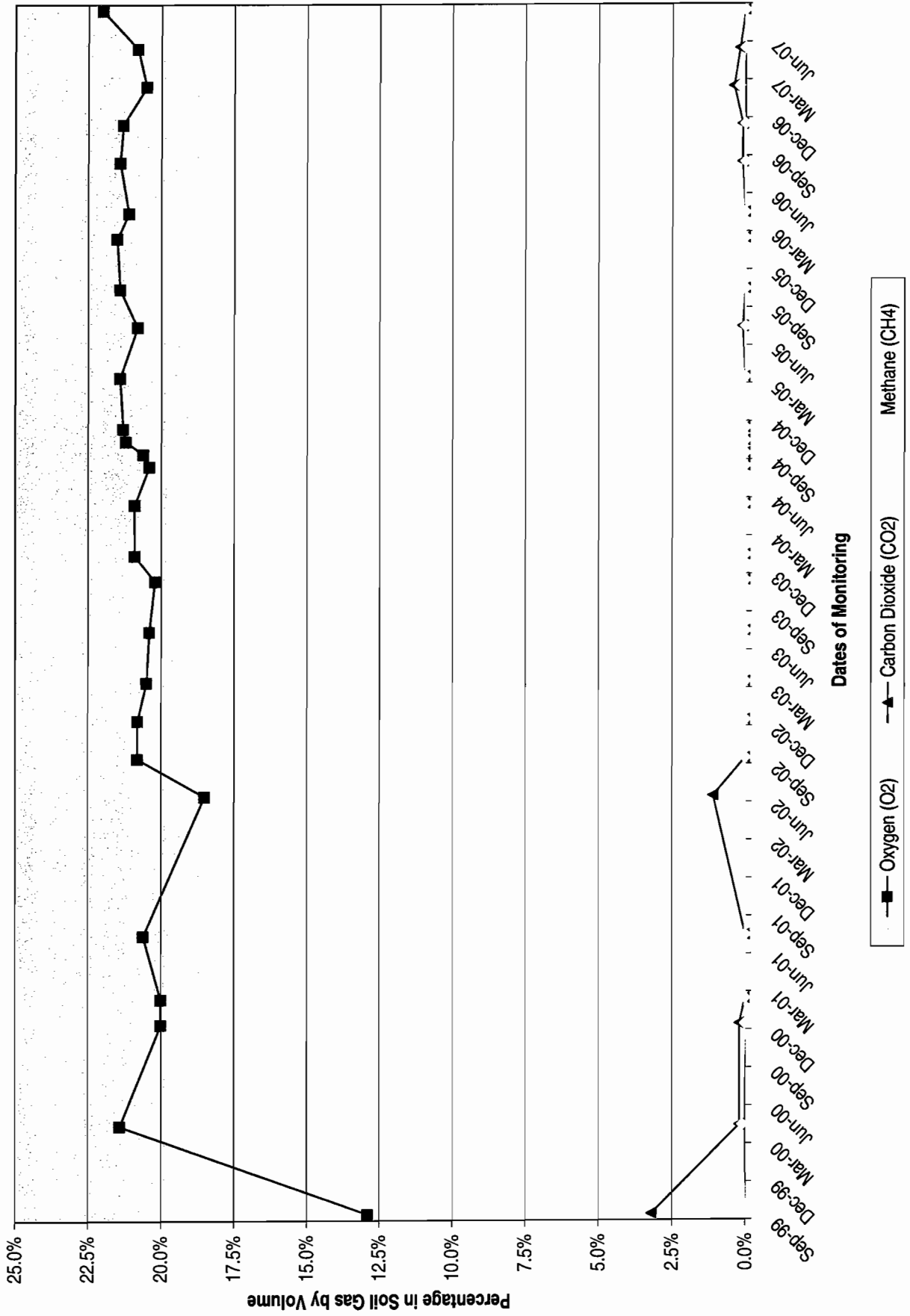
Soil Gas Well MPL5
Fluctuation in Methane, Oxygen, and Carbon Dioxide Percentages over Time
Springfield Street School Complex
Providence, Rhode Island



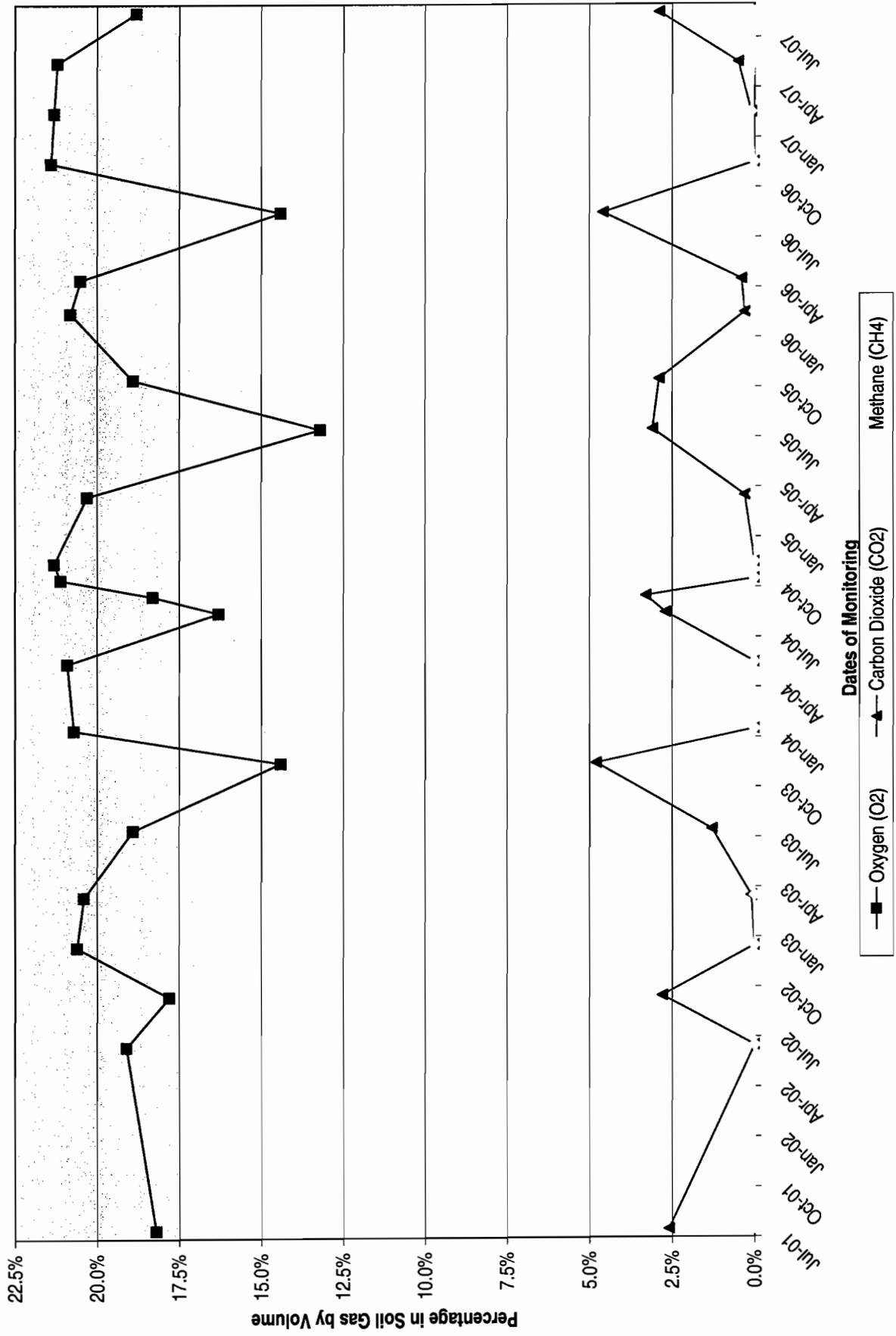
Soil Gas Well WB1
Fluctuation in Methane, Oxygen, and Carbon Dioxide Percentages over Time
Springfield Street School Complex
Providence, Rhode Island



Soil Gas Well WB7
Fluctuation in Methane, Oxygen, and Carbon Dioxide Percentages over Time
Springfield Street School Complex
Providence, Rhode Island



Soil Gas Well WB15
Fluctuation in Methane, Oxygen, and Carbon Dioxide Percentages over Time
Springfield Street School Complex
Providence, Rhode Island



Attachment C

Article from Golf Course Magazine

How do soils breathe?

Like the air in the atmosphere, soil air is vital to turfgrass health.

She-Kong Chong, Ph.D.; Richard Boniak; Chang-Ho Ok; Sam Indorante, Ph.D.; and F. Dan Dinelli, CGCS

Approximately 78 percent of the Earth's atmosphere is nitrogen and the rest is primarily oxygen (O₂), argon (Ar) and carbon dioxide (CO₂) (2-5). Together, these four gases make up more than 99.99 percent of the atmospheric air. These gases are also present in soil, but their proportions are very different. In particular, as a consequence of respiration and microbial activity, the concentration of carbon dioxide is much higher in soil air than in the atmosphere.

Managing putting greens to prevent high carbon dioxide levels in the root zone has always been a dilemma for golf course superintendents and turf researchers (4,5). Understanding air movement in the soil profile is important because soil air content in the root zone depends on air exchange between the soil and the atmosphere, the respiration rate of microorganisms and plant roots, and the solubility of gases in water.

CO₂ and O₂ in the root zone

Both carbon dioxide and oxygen play important roles in plant biological processes, especially photosynthesis and respiration. In photosynthesis, chlorophyll combines carbon dioxide and water to form sugars and release oxygen into the atmosphere. To prevent oxygen deficiencies and excessive carbon dioxide levels in most plants, oxygen levels in soil air must be maintained at levels 50 percent or greater than oxygen levels in the atmosphere (2). In respiration, plant cells consume oxygen and produce carbon dioxide. The rate of oxygen consumption can be as high as 60 to 75 percent of the carbon dioxide production rate. Carbon dioxide in the soil air is produced not only by plant root respiration but also from microbial breakdown of carbon-based organic compounds in the soil. However, carbon dioxide levels are highest when microbial and plant root activity are at

CO ₂ vs. O ₂ in soil		
Soil condition	CO ₂ content	O ₂ content
Soil texture		
Fine	high	low
Coarse	low	high
Soil structure		
Well aggregated	low	high
Poorly aggregated	high	low
Vegetated soil		
	high	low
Bare soil		
	low	high
Soil amended with organic matter		
	high	low
Fertilized soil		
	high	low
Soil water content		
Wet	high	low
Dry	low	high

a maximum. This is the main reason why carbon dioxide content in the putting green soil is low in the fall and winter, but high during the growing season (5).

KEY points

More Info: www.gcsaa.org

Oxygen in soil air needs to be maintained at appropriate levels to promote plant health.

The proper root-zone mix contributes to air permeability and the proper mix of gases in the soil.

Mechanical aeration and high-pressure water-injection can improve anaerobic root zones.

Soil air renewal and movement

Many factors can influence soil air renewal and movement in the field (6). Nitrogen levels in the soil remain stable, but carbon dioxide levels are inversely related to oxygen levels. Renewal and movement of soil air are governed by air permeability of the rooting medium, convection induced by external factors and diffusion of various gases in the profile.

Air permeability

Air permeability relates to the pore-size distribution and water-retention capacity of the root-zone mix and depends in particular on the air-filled porosity of the rooting medium. *Macroporosity* means that pore sizes are equal to or larger than 0.075 mm in diameter. Currently, the USGA Green Section (9) recommends that the root-zone

RESEARCH

mix for a putting green has 15 to 30 percent air-filled porosity (equivalent to 30 centimeters water tension). (From 1960 to 1993, the USGA recommendation was 40 centimeters water tension. The authors of this paper prefer this earlier recommendation.) Therefore, it is extremely important to pick the right sand and amendment in preparation for the root-zone mix.

The amount of amendment in the root-zone mix also plays an important role in air-filled porosity. At Southern Illinois University-Carbondale, a laboratory study was conducted to examine the influence of amendments on air permeability and hydraulic conductivity of the root-zone mix. Hydraulic conductivity indicates how well fluid will flow through a porous medium, for example, soil or gravel. Something with a high hydraulic conductivity will conduct fluid well. Results indicated that both air permeability and hydraulic conductivity varied, depending on the texture of the sand and the amendment used. This study also found that increasing peat moss content

increases resistance to the flow of both air and water. The peat moss may be coating the air-filled pores, thereby hindering air and water flow in the rooting medium.

Driving forces in gas transport

Two major mechanisms are involved in air transport in soil: mass flow and diffusive flow. Mass flow is induced mainly by temperature changes, barometric pressure fluctuations, wind velocity over the turf surface and infiltration of water (2,6,7). Diffusion is generally caused by concentration differences among gases, but it also can be influenced by differences in air pressure or temperature.

Practically, it is difficult to separate the effect of each mechanism on gas transport. Temperature differences between various parts of the soil (for example, the surface soil has a higher temperature than the subsoil) could result in density and pressure gradients that cause gas to flow, especially in the surface layer of greens. An increase in barometric pressure in the atmosphere would reduce soil air volume, which would cause movement of

the same volume of air from the atmosphere into the root zone to fill the void. In contrast, a decrease in barometric pressure in the soil profile would allow soil air to expand and enter the atmosphere.

Research on the effect of wind velocity on soil air movement in putting greens is lacking. However, barometric pressure fluctuation, soil and air temperature changes, and wind blowing over the turf surface seem to have little effect on gas renewal and composition.

Infiltration and drainage of water may flush or displace air and consequently trigger airflow in the profile. In addition, irrigation and rainfall may carry dissolved oxygen to the root zone. Similarly, when excess water is removed by drainage, air will replace the water.

Carbon dioxide at soil profile bottom

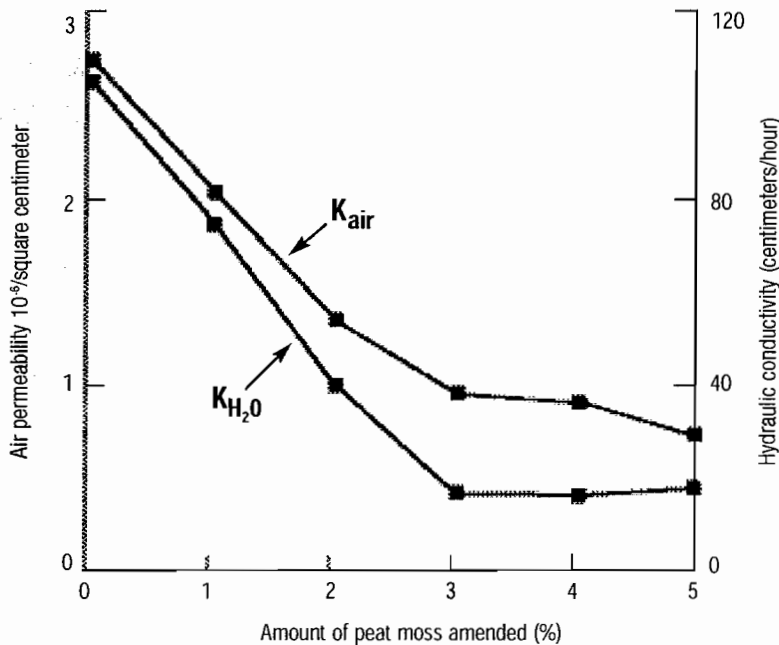
Carbon dioxide levels are often higher at the bottom of the soil profile because aeration rates are poorer at the bottom of the soil profile or root zone than in surface soil. Higher carbon dioxide concentration at greater soil depths may also be attributed to molecular weight differences among gases. Gases with higher molecular weights often stay at the bottom of the soil profile, whereas gases with lighter molecular mass are found closer to the surface.

Soil air in general has higher moisture content than air in the atmosphere. Intuitively, moist air would seem to be heavier than dry air because it contains moisture, but moist air is actually lighter. Otherwise, clouds would not hang high in the sky.

Dry air is dominated by nitrogen, carbon dioxide and oxygen. Moist air contains these three gases plus water vapor. Air changes to moist air when a water molecule replaces a carbon molecule. The molecular masses of nitrogen, carbon dioxide, oxygen and water are 28, 44, 32 and 16 grams, respectively. Therefore, when a water molecule with a molecular weight of 16 replaces a carbon molecule with a weight of 44 grams, the resulting moist air is lighter than the dry air.

In most cases, water vapor will stay in the surface soil and will eventually evaporate and enter the atmosphere. In contrast, carbon dioxide, which has the heaviest molecular weight (44 grams), will stay at the bottom of the soil profile.

Hydraulic conductivity, air permeability



Variations in hydraulic conductivity (K_{H_2O}) and air permeability (K_{Air}) in sand mixes amended with different amounts of peat moss.

Anaerobic greens

In late summer, carbon dioxide levels as high as 20 percent have been detected in putting greens (4). High carbon dioxide content is found mostly in waterlogged areas because compaction and black layer formation are some of the most common environmental settings for anaerobic conditions in greens. Although improper green installation or management can cause compaction or layer formation, traffic from golfers and maintenance crews is the major cause of compaction, and thatch accumulation and transport of fine particles in the profile can cause black layer formation.

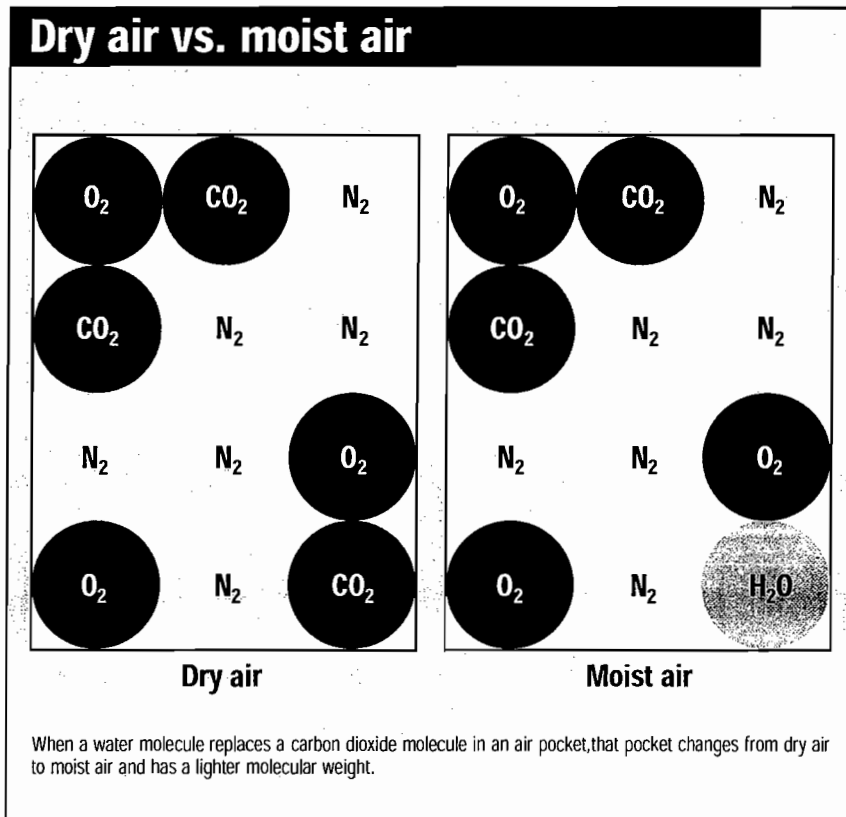
Using the wrong maintenance equipment and topdressing materials may speed up the anaerobic process. It is often suggested that the texture of topdressing sand should be the same as or coarser than what was already present in the green. As noted earlier, when peat moss, such as sphagnum or reed-sedge peat, is used as an amendment in the root-zone mix, fine particles can hinder air and water circulation. Poor aeration, high moisture content and low temperature and pH combined with the application of iron chelate (to promote a darker green turf color) create optimal conditions for black-layer in putting greens (1). Wise irrigation is critical in successful greens management.

Soil aeration

Amelioration of an anaerobic root zone is not easy, and it can also be costly. Mechanical cultivation is the most common means of improving a green that is anaerobic because of compaction and/or black layer formation. Various methods commonly used in green cultivation include coring, slicing, spiking and forking. Mechanical aeration is usually performed in the early spring and/or in the fall for cool-season grasses. Aerification by high-pressure water injection (8) can be performed even in the summer with minimal disturbance to the green. Both mechanical cultivation and water injection only temporarily alleviate compaction and layer formation problems, but a regularly scheduled, aggressive aerification program can solve these problems in many cases (5).

Summary

Preventing high carbon dioxide levels in the root zone has always been a dilemma for golf course superintendents and turf



researchers. The first step toward guaranteeing appropriate oxygen levels and a healthy root zone and putting green occurs during construction when the proper root-zone mix is selected and correct installation procedures are followed. Cultivation can enhance soil aeration and promote healthy levels of soil gases, but aerification must be continued on a regular basis or its benefits may decrease with time.

Acknowledgments

We appreciate the generous contribution of the Illinois Turf Foundation, which partially funded this research.

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Attachment D

Limitations

LIMITATIONS AND SERVICE CONSTRAINTS

General Reports/Document

The opinions and recommendations presented in this report are based upon the scope of services, information obtained through the performance of the services, and the schedule as agreed upon by LFR and the party for whom this report was originally prepared. This report is an instrument of professional service and was prepared in accordance with the generally accepted standards and level of skill and care under similar conditions and circumstances established by the environmental consulting industry. No representation, warranty, or guarantee, express or implied, is intended or given. To the extent that LFR relied upon any information prepared by other parties not under contract to LFR, LFR makes no representation as to the accuracy or completeness of such information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared for a particular purpose. Only the party for whom this report was originally prepared and/or other specifically named parties have the right to make use of and rely upon this report. Reuse of this report or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.

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