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November 25, 2003

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

Subject: Springfield Street Schools Complex Environmental Monitoring
Response to letter dated November 21, 2003
Case #99-018

Dear Mr. Crawford:

We have prepared this letter on behalf of to address issues raised in your letter to Mr. Alan Sepe of the City of Providence, dated November 19, 2003. The issues are address in the order they appeared in your letter.

1. Future monitoring reports will be submitted in a timely manner.

2. Arrangements have been made to address the holes and depressed soil areas on the property. Photographs and documentation will be submitted upon completion of this work.

3. We conducted a more thorough evaluation of carbon monoxide in indoor air at the Site as described in a letter report we prepared dated May 5, 2003. This additional investigation was performed in response to the results of the March 2003 monitoring, and the results have been submitted to the Department. The results did not reveal any problems at the schools.

   Although we are measuring readings of hydrogen sulfide in the building, we do not observe any odors, and have not received any odor complaints. The odor threshold for hydrogen sulfide is approximately 0.5 to 1 ppb, well below the concentrations our instruments are reporting. The sensors in the portable instruments used to do the monitoring utilize an electrochemical sensor. It is possible that some other compound is causing interference.

4. As we have discussed with the Department previously, the concentrations of carbon dioxide in soil gas at the site have exceeded action levels since prior to construction of the site buildings. ATC reported concentrations of carbon dioxide in soil gas in excess of the current action limit during the initial site investigation.

   Carbon dioxide is an odorless, non-flammable gas. It is a component of our atmosphere, at a concentration of at least 350 to 400 ppm. Carbon dioxide is heavier than air and can

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build up in low confined spaces and present an asphyxiation hazard. Carbon dioxide is produced by animal respiration, and absorbed by plants during photosynthesis. Other sources of carbon dioxide include combustion of carbon based fuels, such as oil, natural gas, coal or wood, or bacterial degradation of organic materials.

Carbon dioxide is typically monitored in landfill gas as an indicator of whether bacterial activity is aerobic or anaerobic. Concentrations of carbon dioxide rise as oxygen concentrations decrease when bacterial activity in a landfill is changing from aerobic to anaerobic. Methane is produced when conditions become anaerobic, at which point carbon dioxide typically makes up 40% to 60% of the landfill gas.

Attachment 1 contains plots showing the fluctuations of oxygen and carbon dioxide with time in two wells where carbon dioxide has been detected at elevated concentrations. The plots show the inverse relationship between oxygen and carbon dioxide concentrations in the soil gas wells. They also show the seasonal variation in concentrations: carbon dioxide concentrations increase in warmer months and decrease in cooler months. This is consistent with bacterial activity, which would increase with increasing temperatures. As the soil temperature increases, bacterial activity increases, depleting available oxygen. Carbon dioxide given off by the bacteria builds up. In colder months, bacterial activity decreases due to temperature, and concentrations of carbon dioxide and oxygen move toward atmospheric conditions.

During the carbon monoxide investigation, the monitoring equipment also measured concentrations of carbon dioxide inside and outside the two schools over time. A summary of the carbon dioxide measurements is provided below:

	Elementary School Main Office	Middle School Main Office	Outside (front) Elementary School	Outside Middle School while buses were present
Minimum CO_2 Concentration (ppm)	545	548	359	368
Maximum CO_2 Concentration (ppm)	1,387	2,075	545	658
Average CO_2 Concentration (ppm)	697	706	456	416
Duration of Monitoring (hours:minutes)	6:17	5:53	6:15	0:26

The measurements showed that concentrations inside the building were higher than concentrations outside the building. This is probably due to buildup of carbon dioxide inside the building while it is occupied. Carbon dioxide from soil gas should not be entering the Site buildings because both buildings are equipped with sub-slab depressurization systems which vent air from below the building through an elevated stack to the outside.

Because the Site is located in an urban area, there are other sources of carbon dioxide in the area, such as automobile and bus exhaust, heating system exhaust, etc.

5. Carbon monoxide and hydrogen sulfide are produced by bacteria which degrade organic matter in soil. Very high (hundreds of ppm) concentrations of carbon monoxide can indicate the presence of underground landfill fires. Lower concentrations, such as the concentrations detected at the site, are typically an indication that naturally occurring bacteria is degrading organic matter at the site.

   Hydrogen sulfide has a strong rotten egg odor and a low odor threshold (0.5 to 1 ppb). There have been no reports of odor complaints at the site, and we have not observed any hydrogen sulfide odors in the soil gas wells.

   Since concentrations are not exceeding action levels, additional investigation has not been planned.

6. The recommendations listed in the March 2003 Monitoring report have been completed. The first two items were addressed by New England Gas, who performed a soil gas survey and determined that a leaking gas line was the source of the methane detected in MPL-6. Monitoring after the gas line was repaired did not detect methane. The carbon monoxide survey was performed and results were submitted to DEM.

The most recent round of quarterly monitoring was completed during the week of November 3 to 7, 2003. The report for this round of monitoring will be submitted by December 10, 2003.

Please call me at 401-738-3887 if you have any questions.

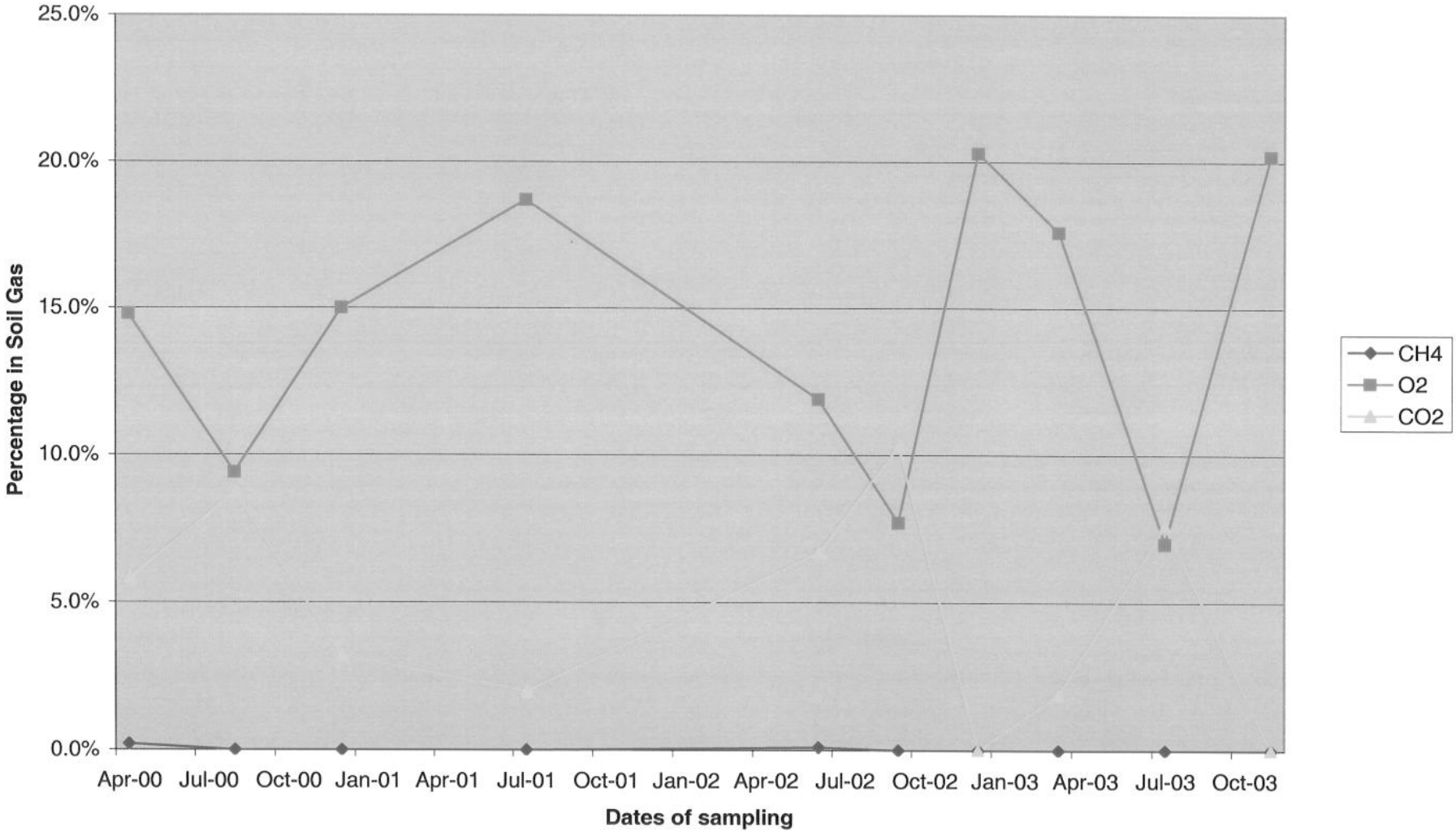
Sincerely,

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

Cc: A. Sepe, City of Providence
K. McHugh, City of Providence

Attachment 1

Fluctuation in Methane, Oxygen, and Carbon Dioxide Percentages over Time in Soil Gas Well MPL5



Fluctuation in Methane, Oxygen, and Carbon Dioxide Percentages over Time in Soil Gas Well WB1