May 17, 2006
File No. 0663-2.0

Mr. John J. Kazmarski, P.E.
Town of Enfield
Department of Public Works
40 Moody Road
Enfield, Connecticut 06082

Re: Preliminary Soil & Groundwater Sampling Results - Addendum
Enrico Fermi High School
Enfield, CT

Dear Mr. Kazmarski:

Geo**Design**, Inc (Geo**Design**) has completed additional soil and groundwater sampling and analysis at Enrico Fermi High School. This sampling report is an addendum to our March 22, 2006 report titled "Preliminary Soil & Groundwater Sampling Results, Enrico Fermi High School".

Based on the data, dieldrin and other pesticides are widely distributed within the upper one to two feet of soil. Dieldrin has also been detected in groundwater samples obtained beneath the athletic fields. The Connecticut Department of Health (CTDOH) performed a preliminary site-specific risk assessment to evaluate alternate remedial criteria in the upper six inches of soil. Based on the CTDOH's assessment, an appropriate Direct Exposure Criterion for dieldrin at the ground surface is ten to fifteen times the published residential standards. The increase in the remedial standard significantly reduces the potential cost and amount of soil removal necessary to mitigate the pesticide contamination in shallow soils at the site.

If you have any questions regarding the attached, please call. This report is subject to the appended limitations.

Very truly yours,

Geo**Design**, Inc.

Timothy Carr, LEP
Manager of Environmental Services

Robert M. Downes III, P.E.
Senior Engineer

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1.0 INTRODUCTION

Additional soil and groundwater sampling and analyses were conducted to better delineate the extent and degree of pesticide contamination identified at the Enrico Fermi High School. On March 22, 2006, Geo**Design** issued a report which identified organochlorine pesticides (primarily dieldrin) in soil samples obtained from the athletic fields above the Residential Direct Exposure Criteria of the state Remediation Standard Regulations. Dieldrin was also detected in groundwater samples obtained from temporary wells.

Based on the results of the preliminary testing, additional sampling and analyses were conducted to evaluate the presence of pesticides in soils on other areas of the school grounds, including entrance ways and other lawn areas. Permanent groundwater monitoring wells were also installed to more accurately assess concentrations of pesticides in groundwater. Our scope of services included:

- Shallow soil sampling at intervals of 0 to 3-inches and 3 to 6-inches below grade at nineteen locations, and 6 to 12-inches below grade at eighteen locations;

- Analysis of fifty-six soil samples for pesticides; and,

- Installation of permanent monitoring wells in the athletic field area and sampling of three of the monitoring wells for ethylene dibromide (EDB), vorlex (1,2 dichloropropane), and organochlorine pesticides.

The results of the additional environmental testing were compared to the Connecticut Remediation Standard Regulations, as defined in Connecticut General Statutes Section 22a-133k.

2.0 SITE DESCRIPTION

Enrico Fermi High School is located on approximately 41-acres of land. The athletic fields comprise approximately 17-acres of area. The school building, paved parking lots and lawns areas make up the balance of the property. An Area Plan in included as Figure 1 in Appendix 1. Site Plans are provided as Figures 2 through 4 in Appendix 1, respectively.

Site topography generally slopes downwards from west to east, towards a wetland area and brook. The wetlands form a headwater to Freshwater Brook located approximately 2,800-feet to the north. Based on regional topographic and drainage considerations, groundwater beneath the site is inferred to flow in an easterly to northeasterly direction. Groundwater elevation data from three monitoring wells support this inference, as summarized in Section 3.4.1 below.

2.1 ENVIRONMENTAL SETTING & APPLICABLE REMEDIAL CRITERIA

The site is used as a public school, which constitutes residential use as defined by the state of Connecticut's Remediation Standard Regulations in Regulations for Connecticut State Agencies (RCSA) 22a-133k. According to the Connecticut Department of Environmental Protection's (CTDEP's), "Water Quality Classifications of the Connecticut River and South Central Coastal Basins" map dated February 1993, site groundwater is classified as GA. GA groundwater is presumed to be suitable for direct human consumption without treatment.

Based on the current site uses (school) and groundwater quality (GA), the applicable remediation standards for site soils are the Residential Direct Exposure Criteria (R-DEC), and GA Groundwater Pollutant Mobility Criteria (GA-PMC). The applicable remediation standards for site groundwater are the Groundwater Protection Criteria (GWPC) and the Surface Water Protection Criteria (SWPC).

In accordance with RCSA 22a-133k-2(d)(2), the Commissioner of the CTDEP "may approve alternative direct exposure criterion and an alternative method for determining compliance with such criterion provided it is demonstrated to the satisfaction of the Commissioner, after consultation with the Commissioner of Public Health that an application of such alternative criterion at the subject release area will protect human heath and the environment from the risks associated with direct exposure to polluted soil…..". Proposed alternate criteria are discussed below in Section 4.0.

3.0 ADDITIONAL SAMPLING & ANALYSES

3.1 SHALLOW SOIL SAMPLING & ANALYSES

Additional soil samples were obtained on March 25, 2006 and April 7, 2006. Samples were completed at a total of nineteen additional locations designated S1 through S19. Sampling locations are shown on Figures 2 through 4 in Appendix 1.

At each location (with the exception of location S1) soil was sampled at the intervals of 0 to 3-inches, 3 to 6-inches, and 6 to 12-inches below grade. The interval of 6 to 12-inches below grade was not sampled at location S1 due to an obstruction. The sampling equipment was decontaminated between each sample location using a detergent and water solution followed by a potable water rinse. A Global Positioning System receiver was used to identify the sample locations.

Soil samples were submitted to Phoenix Environmental Laboratories of Manchester, Connecticut for analysis of organochlorine pesticides by EPA Method 8081.

3.1.1 Soil Sample Results

The analytical results are summarized on Table 1 and are compared to the published R-DECs. The results are also indicated on Figures 2 through 4 in Appendix 1. The laboratory data sheets are included in Appendix 2.

Based on the results obtained, dieldrin exceeded the published R-DEC of 38 µg/kg in forty-six of fifty-six samples analyzed. The R-DEC exceedances occurred at varying depth intervals. At some locations, dieldrin concentrations increased with depth. Chlordane and DDT isomers were also detected in the samples. However, dieldrin was the most commonly detected contaminant and has the lowest remedial standard.

The dieldrin concentration in sample S11/6-12" was 1,300 µg/kg. This concentration exceeded the Significant Environmental Hazard threshold. However, because this condition has already been reported to CTDEP, additional reporting is not required.

3.2 MONITORING WELL INSTALLATIONS & GROUNDWATER SAMPLING

On March 31, 2005, A&A Test Borings of South Windsor, Connecticut installed four permanent monitoring wells on-site which were designated OW-1 through OW-4. The boring locations were selected to provide general coverage across the athletic fields. Well locations are shown on Figure 2 in Appendix 1.

Soil samples were collected using standard penetration methods and hollow stem auger techniques from the ground surface to the maximum depth explored of twenty feet below grade. The subsurface materials encountered in each boring were logged by Geo**Design** personnel. Boring logs are included in Appendix 3.

In general, the subsurface soils encountered consisted of 6-inches to 2.5 feet of topsoil, underlain by sandy fill and/or dense glacial till. A 2-foot thick layer of peat was encountered at a depth of 17 to 19-feet below grade in boring OW-2, which was located nearest the wetland area to the east of the site. The bedrock surface is believed to have been encountered in OW-4 at 13.3 feet below grade but was not confirmed with rock coring. Saturated soils were encountered in each boring at depths greater than six to ten feet below grade.

At each location a two-inch diameter PVC well screen was installed to intersect the groundwater table. The well screen was backfilled with a sand pack, bentonite seal, and finished with an expandable cap and a flush mount curb box. Details of the well installations are shown on the boring logs.

The monitoring wells were developed by removal of water using a peristaltic pump and hand bailers. The purpose of the well development was to remove silt and fine sediments from the interior of the well and to increase the efficiency of the sand filter pack.

On April 7, 2006 samples of groundwater were obtained from monitoring wells OW-1 through OW-3. Monitoring well OW-4 did not contain sufficient groundwater for sampling. Low flow purging and sampling methods were performed using a peristaltic pump with dedicated tubing. The groundwater samples were analyzed for ethylene dibromide (EDB) by EPA Method 504, Vorlex (1,2 dichloropropane) by EPA Method 524.2, and organochlorine pesticides by EPA Method 8081. The laboratory data sheets are included in Appendix 4 and the data is summarized below.

3.2.1 Groundwater Elevation Measurements

Prior to sampling the top of PVC well pipes were surveyed relative to a nearby benchmark (rim of catch basin on Moody Road). Depths to groundwater in the wells were obtained using an electric water level meter. Groundwater elevations were calculated as follows:

Well Designation	Top of PVC Elevation	Depth to Groundwater (feet)	Groundwater Elevation
OW-1	175.7	7.9	167.8
OW-2	182.5	11.2	171.3
OW-3	182.9	7.0	175.9
OW-4	186.8	DRY	---

Insufficient groundwater was present in OW-4 to provide an accurate measurement of water elevation and the well could not be sampled. Based on the three groundwater elevation measurements obtained, groundwater flows is in an easterly direction beneath the athletic fields and towards the wetland area which comprises the eastern site border. This agrees with our inferred groundwater flow direction.

3.2.2 Field Screening Parameters

A calibrated Oakton Model 10 series meter was used to monitor purge water for stabilized pH, specific conductance, and temperature readings. The stabilized results can be summarized as follows:

Well Designation	pH (standard units)	Specific Conductance (µSiemens)	Temperature (Celsius)
OW-1	7.2	248	8.9
OW-2	6.6	210	9.5
OW-3	7.0	82	6.4
OW-4	Not Sampled	Not Sampled	Not Sampled

These data were in the range expected for groundwater in a suburban setting.

3.2.3 Pesticide Analysis of Groundwater Samples

The three groundwater samples (OW-1, OW-2 and OW-3) were analyzed for organochlorine pesticides, ethylene dibromide and vorlex. The results are summarized on Table 2 in Appendix 1 and can be summarized and compared to published Groundwater Protection Criteria (GWPC) and the Surface Water Protection Criteria (SWPC), as follows:

Parameter	Sample Designation and Result (µg/l)			Remediation Standards (µg/l)	
	OW-1	OW-2	OW-3	GWPC	SWPC
Ethylene dibromide (EDB)	0.02	ND	ND	0.05	NE
Vorlex compounds	ND	ND	ND	NE	NE
Dieldrin	**0.014**	**0.03**	**0.55**	0.002	0.1

The GWPC for dieldrin was exceeded in all three samples. The SWPC for dieldrin was exceeded in sample OW-3. EDB was detected in sample OW-1 at 0.02 µg/l which was below the GWPC of 0.05 µg/l. The laboratory data sheets are attached in Appendix 4.

4.0 SITE-SPECIFIC RISK ASSESSMENT & ALTERNATE REMEDIAL STANDARD

The Connecticut Department of Health (CTDOH) performed a preliminary site-specific risk assessment to evaluate alternate direct exposure criteria which would apply to the upper six inches of soil in the athletic field areas and to the upper 3-inches of soil elsewhere on school grounds.

On April 13, 2006, CTDOH indicated that they had conducted a preliminary risk evaluation for dieldrin and chlordane in soils. CTDOH's evaluation indicated that a four year high school athlete, playing three sports (exposure period of 8 months per year for four years) would not be subject to excess risk if exposed to dieldrin and chlordane concentrations in soil up to ten to fifteen times higher than the published R-DEC. CTDOH also concluded that the same alternative criterion (10 to 15 times the published standard) would be protective for school facility maintenance personnel. As described above in Section 2.1, this alternative criterion can be applied in accordance with RCSA 22a-133k-2(d)(2) and requires the approvals of both the Commissioner of the CTDEP and the Commissioner of the CTDOH. CTDEP and CTDOH indicated that compliance with the alternate criterion would require submittal of a turf management plan.

For dieldrin, this alternative criterion would allow contaminated soils to remain in place at surface concentrations of 380 µg/kg to 570 µg/kg. The alternate standard significantly reduces the costs and amount of soil removal that might otherwise be necessary. Seven soil samples exceed the revised standard in the athletic fields and two samples exceed the standard on the school grounds, as summarized below:

Sample Designation & Depth (Inches below grade)	Pesticide Result (ug/kg)			
	4,4-DDE	4,4-DDT	Chlordane	Dieldrin
Samples In Athletic Field Areas				
S9/0-3"	65	57	240	**450**
S9/3-6"	120	110	280	**480**
S10/0-3"	62	44	200	**520**
S10/3-6"	140	140	330	**420**
S11/3-6"	270	300	670	**920**
S14/0-3"	69	77	390	**490**
S14/3-6"	150	120	510	**600**
Samples From School Grounds				
S2/0-3"	85	40	260	**480**
S4/0-3"	65	62	130	**400**
Alternate R-DEC[1]	18000	18000	4900	380

Remedial actions taken to mitigate the surface soils which exceed the alternate remedial standard identified can be incorporated into the already planned renovations of the athletic fields. Importation of up to 6-inches of uncontaminated topsoil would control direct exposure risks to soils, if coordinated with a turf management plan which prevents unplanned excavation or other disturbance of deeper soils.

Regarding groundwater conditions, both CTDEP and CTDOH indicated that efforts must be continued to identify and assess the locations of potable water supplies that might be impacted from the site. This assessment is facilitated by the fact that water well surveys and EDB sampling and monitoring has been conducted in the site area for many years.

5.0 SUMMARY & CONCLUSIONS

In summary, the data indicated that certain organochlorine pesticides are present in shallow soil and groundwater at concentrations exceeding published remedial standards. The pesticides are widely distributed over the school property and appear to be present at depths up three feet below grade. However, a preliminary alternate remedial standard proposed by the Connecticut Department of Health increases the published standard by ten to fifteen times, is protective of the health of student athletes and school facilities personnel, and does not require large scale soil removal or capping. Incorporation of remedial measures into the planned renovation of the athletic fields is highly recommended.

Dieldrin concentrations in the groundwater samples also exceeded published remedial standards. Efforts to locate and assess potential water supply sources in the vicinity should be continued.

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1 Alternate DEC standard as preliminarily proposed by Connecticut Department of Health personnel is town to fifteen times the published standard. Other limitations to the use of this alternate standard would apply.