NAME: Jones Environmental
I.D. NO.: MA 2470075731
FILE LOC: R-5
OTHER: #103326

ENVIRONMENTAL SITE ASSESSMENT

GEOCHEM FACILITY

263 HOWARD STREET

LOWELL, MASSACHUSETTS

Prepared for:
Geochem, Inc.
Lowell, Massachusetts

Prepared by:
Goldberg-Zoino & Associates, Inc.
Newton Upper Falls, Massachusetts

RDMS DocID 103326

January 1985
File No. F-4525

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January 22, 1985
File No. F-4525-C

Mr. George Haggerty
Geochem, Inc.
263 Howard Street
Lowell, Massachusetts 01852

Re: Environmental Site Assessment
Geochem Facility
263 Howard Street
Lowell, Massachusetts

Dear Mr. Haggerty:

Pursuant to our proposal dated August 10, 1984, Goldberg-Zoino & Associates, Inc. (GZA) has conducted an environmental assessment of the Geochem, Inc. site at 263 Howard Street in Lowell, Massachusetts. The purpose of this assessment was to evaluate the presence of hazardous material or oil at the site or in the environment at the site, within the meaning of Massachusetts General Laws Chapter 21E.

BACKGROUND

The subject site consists of approximately 30,000 square feet located at the junction of Tanner and Howard Streets in Lowell, Massachusetts. The site (Figure 1) is located in an area of small industry and is bounded to the north by River Meadow Brook. Adjacent businesses include a machining and welding shop, sheet metal fabricators, a plastics factory, and boiler works. The site and surrounding area are served by a municipal water supply and sewer system.

Geochem, Inc. transports, stores, and treats certain categories of hazardous waste pursuant to a license issued by the Commonwealth of Massachusetts Department of Environmental Quality Engineering (DEQE). Geochem's license allows the storage of industrial oils, nonhalogenated and halogenated solvents, acids, alkalies, volatile and nonvolatile chemicals, plating and metal

wastes and still bottoms. Geochem's license also allows the reclamation by distillation of chlorinated organic compounds.

As part of the present site assessment, certain state and local officials were contacted with regard to their knowledge of possible releases of hazardous material or oil on the site. The Lowell Health Department, Engineering Department, and Fire Department, and the Massachusetts Department of Environmental Quality Engineering (DEQE) were thus contacted. Both the Lowell Health and Engineering Departments were unaware of any private water supply wells in the area. Ron LaBrecque, of the Engineering Department, reported that the area surrounding the Geochem site is serviced by the City water system which gets its water from the Merrimack River. The Fire Department had no record of underground tanks on the site but did confirm the existence of such tanks in the area of the site.

Examination of records relating to the Geochem facility on file at the DEQE Northeast Regional office revealed a number of inspections, complaints, violation notices, and orders dating from 1978 to 1984. Activities referenced in DEQE's files included the transportation and storage of PCB and pesticide waste materials and the treatment by reduction of cyanide waste, for which Geochem was not licensed. Also cited was the storage of waste in unauthorized areas and/or in unauthorized containers, inaccurate record keeping, and various administrative deficiencies.

The DEQE files contained references to a number of site inspections at the Geochem facility by personnel of DEQE and the Division of Water Pollution Control (DWPC), during which evidence of incidental surface spillage of hazardous waste materials was observed. The files also indicated that Geochem personnel denied that any spills or releases had occurred at the facility.

SITE VISIT

On December 13, 1984, Ms. Katrina Bikis, a GZA engineer, accompanied by Mr. George Haggerty of Geochem, Inc., visited the site to view conditions relevant to this assessment. Because the facility has operated as a hazardous waste transfer station, hazardous materials were observed in storage. However, Geochem's federally permitted hazardous waste operations, transportation, storage, and treatment are presently inactive as a result of the pending sale of the property. The hazardous materials observed

in storage were prepared for final removal off-site. During GZA's site visit the facility was being "house-cleaned" for the future occupant.

The physical plant at the Geochem consists of two buildings and an unpaved yard. The yard, which is enclosed by a chain link fence, serves as a parking area for Geochem vehicles and trailers and was used for storage of empty drums prior to resale to a scrap metal dealer or disposal. Observed on site was a box trailer containing one recovery drum and a 6,000 gallon tanker whose dry bottom interior was stained purple; according to Mr. Haggerty, this color is indicative of the chemical last carried in the tanks.

The building adjacent and open to the yard is referred to as the bulk storage shed. This building is constructed of concrete block with a concrete slab floor. The floor is sloped to the rear to contain waste fluids within the building in the event of a spill. Three transport vehicles were parked inside the shed: a truck owned by Hazco International, Inc., a subcontractor of Geochem, Inc., and two tankers with 4,000 and 7,000 gallon tank capacities. Upon observation, the interior of the tanks were empty except for a small quantity of motor oil, present to protect tank valves. Several recovery drums were observed stored in the shed.

The second building abuts the bulk storage shed and consists of two offices, a boiler room, a large drum storage room, a chemical laboratory, and a room designated for distillation of chlorinated solvents, additional drum storage, and miscellaneous storage. The building is constructed of wood framing and walls. The drum storage room has a wooden floor recently covered with a concrete slab poured directly over it. The perimeters of the floor space are bermed with concrete block and cement. The distillation area also has a concrete slab covering a wood floor. The remaining floor area of the building is wood. The building is ventilated with fans and is fire protected by a dry sprinkler system.

The drum storage areas of the second building are accessed by two loading docks. The first consists of a concrete parking pad and dock at the rear of the open yard and in front of an entranceway into the distillation room. The second consists of a doorway accessed via Tanner Street and opening into the drum storage room.

Several containers of hazardous materials and oils were observed in the drum storage and distillation area. The following were noted by GZA personnel: six 55 gallon drums of freon, three 55 gallon drums of motor oil, four 30 gallon sealed drums of boiler water treatment, labeled Liquid Borate - Nitrate Corrosion Inhibitor, and one sealed drum labeled Virgin Motor Cleaner. Additionally , drummed paint adhesives were prepared and manifested for off-site shipment to SCA in Braintree, Massachusetts. Within the same storage area, two empty tanks with 500 and 200 gallon capacities for the storage of motor oil and fuel oil respectively were observed. The distillation area, used for the reclamation of chlorinated solvents, consisted of a stainless steel still and two 200 gallon stainless steel holding tanks; the tanks were observed to be empty.

A hallway connects the distillation area to the chemical laboratory, a small office, and the boiler room. Chemical standards, predominately solvents, were stocked in the laboratory. These were used for the screening procedures required to "log-in" the hazardous materials handled by Geochem, Inc. A gas chromatograph was set up on a laboratory counter. As observed in the boiler room, the building is heated by gas and oil fired steam (only the administrative office located to the front of the building is heated by electricity).

The site is in an industrial area and is adjacent to the River Meadow Brook, a channeled waterway paralleling the Lowell Connector highway, Trivak, Inc., a precision machining and welding operation, and the Old Lowell Shuttle Shop at 15 Tanner Street. The following businesses are also located along Tanner Street: Scannell Boiler Works, McGarvin Engineering, Union Sheet Metal Co., Inc., Ideas, Inc., (precision sheetmetal fabrication), and Walbert Plastics, Inc. (manufacturers of fiberglass and reinforced plastics).

The Silresim Chemical Corporation site is located 800 feet upgradient of the site. The Silresim site, a former solvent recovery facility, has been placed on the National Priority List by the EPA. Initial remedial actions, in the form of waste removal and the placement of a clay cap, have already taken place; the scope of work for additional investigations is currently being developed. Significant levels of soil and groundwater contamination have been found on the site.

SUBSURFACE EXPLORATIONS

On December 13, 1984, three test borings were executed on the Geochem site by GZA Drilling, Inc. Borings were observed and logged by a GZA engineer. Each boring was advanced using hollow stem augers without the use of drilling fluids.

Standard Penetration Tests yielding split spoon samples were taken at 5-foot intervals. These samples were classified as to soil type and screened for the presence of volatile organic compounds with an H-Nu Model PI-101 photoionizer. Logs of the test borings are included in this report as Appendix A. Results of the H-Nu screening of the soil samples are included in Table 1. Locations of the borings are indicated on Figure 1.

Each boring encountered a shallow fill layer underlain by a peat or organic silt layer which was in turn underlain by fine sands and silts. Glacial till was encountered at approximately 20 feet below ground surface. Groundwater was encountered in each boring at approximately 10 feet below ground surface.

An observation well was installed in each boring. The wells consisted of 1.5-inch I.D. schedule 80 PVC pipe with 10-foot-long slotted wellscreens (0.01-inch slots). The annular space around each wellscreen was packed with a filter of clean silica sand (Ottawa sand), and a bentonite seal was placed 1 to 2 feet below the ground surface at each well. Additionally, each well was capped with a road box for protection from vandalism and the elements. Installation details for each well are presented on the boring logs.

Surface water samples were collected from the brook above and below the site, and a groundwater sample was retrieved from each well and delivered to GZA's Newton laboratory for a GC screening analysis for volatile organic compounds (VOC's). Values of pH and specific conductivity were also determined. The wells were sampled with bailers consisting of stainless steel tubing fitted with Teflon ballcheck valves. Separate (i.e. one per well) precleaned bailers were used for each well to reduce the possibility of cross-contamination. Three times the initial volume of each well was evacuated and wasted prior to sample collection. Samples were refrigerated until analyses were performed by GZA later on the day of sample collection.

Additional soil samples were recovered by penetrating 6 to 18 inches below the surface with the drill rig at locations along the front of the bulk storage shed labeled HSA-SS-1 through 4; and from hand dug 4 to 8 inch holes at locations labeled SS-1 through 3, between the wood-frame building and the fence. All sample locations are designated on Figure 1.

RESULTS OF SCREENING ANALYSES

Soil Samples

Soil samples were returned to GZA's Newton Laboratory and screened for volatile organic compounds using an H-Nu Model PI-101 photoionization detector. The H-Nu gives total organic vapor levels, but does not identify or quantify individual compounds. The H-Nu screening results are presented on the boring logs; the values reported indicate the presence of VOCs at GZA-3, HSA-SS-2, and HSA-SS-4.

Water samples were collected from each of the four borings, and from the surface water sample stations indicated on Figure 1. Each of these samples was screened for volatile organics at GZA's Newton laboratory using a portable gas chromatograph (GC). The GC allows the detection of individual volatile organic compounds and is also more sensitive to many compounds than is the H-Nu. The GC results presented in Table 2 indicate the presence of VOCs in the groundwater at the site and, to a lesser degree, in the downstream surface water sample.

The pH and specific conductivity values are reported in Table 3. The pH values fall within the anticipated range. Although GZA-1 and GZA-3 samples exhibit slightly elevated conductivities, the observed values are not extraordinary for an urban setting.

QUANTITATIVE LABORATORY ANALYSES

Duplicates of the five water samples collected were forwarded to Resource Analysts, Inc. (RAI) to verify and quantify the GC screening results. The results of RAI's analyses are presented as Appendix B. These results indicate the presence of chlorinated organic compounds in the groundwater at the site and in surface water downstream from the site.

DISCUSSION OF RESULTS

Groundwater VOC levels observed on the site were highest at GZA-3, the upgradient well, where a total VOC concentration of 2.5 parts per million was reported. Significantly lower levels were reported for the sample from GZA-1, and the GZA-2 groundwater sample VOC level approached the analytical detection limit. The elevated H-Nu readings observed at HSA-SS-2 and particularly at HSA-SS-4 may be indicative of incidental localized spillage.

SUMMARY AND CONCLUSIONS

An environmental assessment was conducted at the Geochem, Inc. property locted at 263 Howard Street in Lowell, Massachusetts. The assessment included a site visit, a review of site history, a limited field exploration program, screening of soil and water samples, and quantitative laboratory analysis of water samples.

Based on the studies conducted and observations made as part of the present assessment, it is GZA's opinion that volatile organic compounds are present in the environment at the site. Although the high VOC readings reported for the shallow excavations may be indicative of surface spillage, the highest observed concentration of VOCs in groundwater was found to occur at GZA-3, the most upgradient sample location. Reported groundwater VOC levels decreased markedly with distance across the site. Given this situation the levels of VOCs reported may be indicative of regional groundwater quality.

LIMITATIONS

The above observations were made under the conditions stated in this letter. The conclusions presented above were based on these observations; no quantitative chemical laboratory testing was performed as part of the study. Should evidence of this nature become available in the future, these data should be reviewed by GZA, and the conclusions presented herein may be modified.

The purpose of this report was to assess the physical characteristics of the Geochem Facility site with regard to the release of hazardous material or oil, as defined in Massachusetts General Laws Chapter 21E. No attempt was made to check on the compliance of present or past owners of the Site with federal, state, or local laws and regulations.

GZA

This study and Report have been prepared on behalf of and for the exclusive use of Geochem, Inc., solely for use in an environmental evaluation of the site. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party, in whole or in part, without prior written consent of GZA. However, GZA acknowledges and agrees that the Report may be conveyed to the Buyer and Title Insurer associated with the proximate sale of the Site by our Client. The report has been prepared in accordance with generally accepted geohydrological practices and in accordance with the Statement of Terms and Conditions set forth in Appendix C. No other warranty, express or implied, is made.

We trust that the report presented herein satisfied your current requirements. Should you have any questions or comments, please do not hesitate to contact the undersigned. We have appreciated the opportunity to work with you on this project.

Very truly yours,

GOLDBERG-ZOINO & ASSOCIATES, INC.

Michael F Conway

Michael Conway
Project Manager

Lawrence Feldman
Associate-in-Charge

MC/LF:bjm
Attachments: Table
Figure
Boring Logs
RAI Laboratory Analytical Results
Statement of Terms and Conditions (Assessment)

GZA

TABLES

TABLE 1

GZA SCREENING FOR VOLATILE ORGANIC COMPOUNDS
IN HEADSPACE ABOVE SOIL

Sample Location	Sample Number	Organic Vapor Analyzer Results (parts per million)
HSA-SS-1	--	23
HSA-SS-2	--	139
HSA-SS-3	--	28
HSA-SS-4	--	2100
SS-1	--	0.1
SS-2	--	0.1
SS-3	--	2.1
GZA-1	S1	0.4
	S2	0.3
	S3	0.5
	S4	0.3
	S5	0.7
GZA-2	S1	0.9
	S2	0.1
	S3	0.9
	S4	1.1
	S5	2.2
GZA-3	S1	1.9
	S2	2.9
	S3	7.0
	S4	3.6
	S5	3.5

NOTES ON THE PORTABLE ORGANIC VAPOR ANALYZER RESULTS

1. Soil samples are screened for the presence of volatile organic compounds with a headspace technique. Soil and air contained in tightly capped glass jars (volume of 100-250 ml) are allowed to equilibriate at room temperature (approximately 21°C) for two hours. A small hole is punched

TABLE 1 (con't.)

into the metal cap and 30 ml of equilibrated gases are withdrawn for injection into the instrument.

2. Headspace gas samples are screened for volatile organics with the H-Nu Model PI-101 or AID Model 580. A 30 ml headspace sample is injected into the probe with a syringe. Detection is accomplished by photoionization of sample gases with an ultraviolet light source. H-Nu No. 2 provide an ionization energy of 10.2eV while H-Nu No. 3 provides 11.7eV; the AID provides 10.0eV. These meters detect only those gases having an ionization potential equal to or less than that of the ultraviolet light source. The major components in air (such as oxygen, nitrogen, carbon dioxide, and methane) have ionization potentials greater than 12eV and are not detected. Unfortunately, ionization potential alone does not indicate the meter's relative sensitivity to a particular gas as other physical properties contribute. And, as readings reflect the sum total of all gases present, quantitative results cannot be obtained unless only one gas is present, and identified beforehand, for empirical calibration of the meter with a standard cylinder gas of that substance. All meters are otherwise calibrated for responses relative to benzene. Results reported as concentration in ppm reflect order of magnitude only.

TABLE 2

PH AND SPECIFIC CONDUCTANCE OF
GROUNDWATER AND SURFACE WATER SAMPLES

Sample Location	pH	Specific Conductance (umhos/cm at 25°C)
GZA-1	5.98	635
GZA-2	6.56	286
GZA-3	6.07	695
Brook: Downstream	6.60	254
Brook: Upstream	6.50	253

NOTES:

pH measured with an Extech Model 651 digital pH meter.

Specific conductance measured with an Extech digital conductivity meter.

TABLE 3

GZA GC SCREENING FOR VOLATILE ORGANIC COMPOUNDS

	Peak Heights (inches)									
Sample Location	C- 1	C- 2	C- 3	C- 4	C- 5	C- 6	C- 7	C- 8	C- 9	C-10
Approximate Retention Times	.2	.3	.4	.6	.75	1.05	1.85	2.8	3.5	5.4
Brook: Upstream										.1
Brook: Downstream						0.9	0.1			
Brook: Downstream						1.0	0.1			
Brook: Downstream						1.0	<0.1			
GZA-1 (groundwater)	0.1	0.8	0.25	0.2		2.2	0.1			
GZA-2 (groundwater)	0.1	1.9	*	0.5	0.4	0.3				
GZA-3 (groundwater)	0.6	1.0		0.3	0.2	8.0	1.5			
HSA:SS-4 (soil)	6.0		2.5	430	260	100	160	50	90	

NOTES:

1. All blank spaces indicate volatiles not detected.

2. Volatile organic compounds were screened with a Century Systems Model OVA-128 organic vapor analyzer/gas chromatograph employing headspace techniques according to standard GZA method. Column employed was 12 inches long (T-12), packed with 10% 1,2,3, TRIS propane on 60/80 mesh chromosorb P,AW.

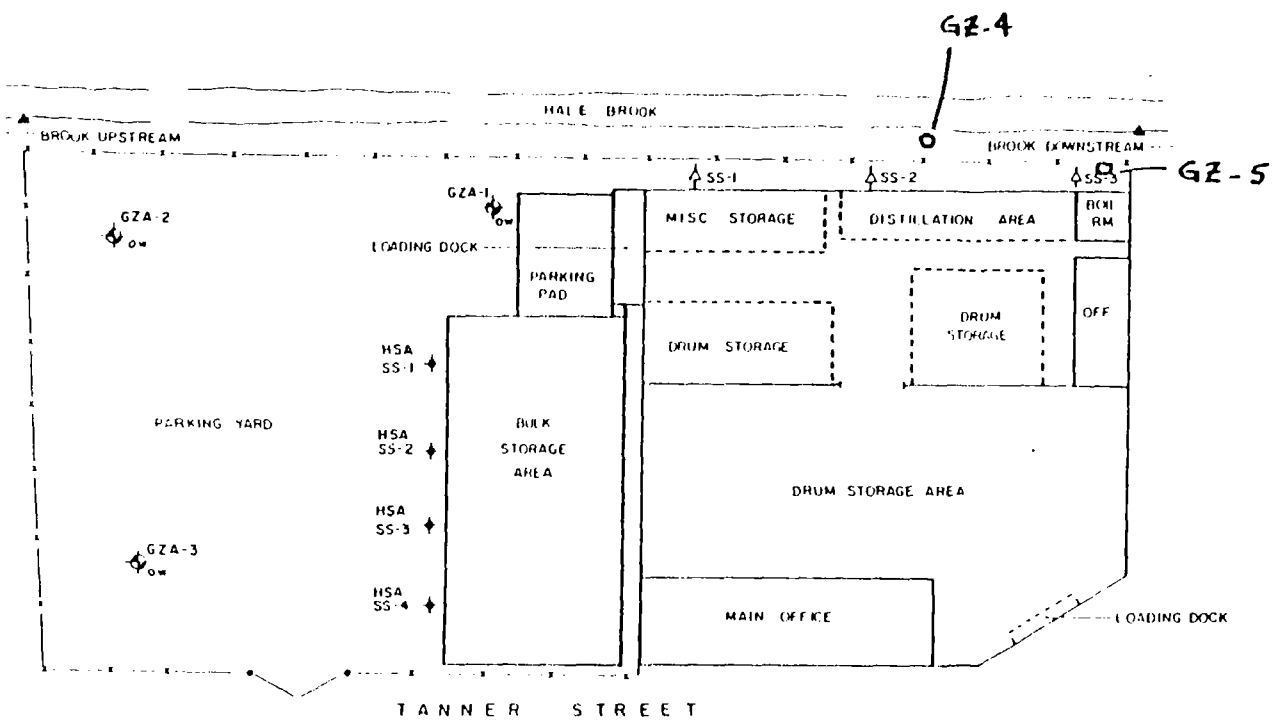
3. Peaks from volatile organics analyses numbered dequentially (C-1, C-2, etc.) based on elution times. Peak heights measured in inches and should be considered relative measures of compound concentrations only.

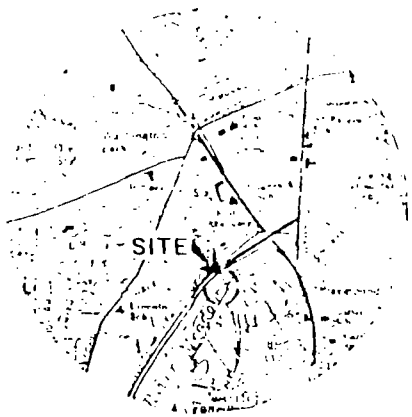
FIGURES

NOTES:

1) BASE MAP DEVELOPED FROM PLAN PROVIDED BY GEOCHEM, INC., ENTITLED "TRAINING PROGRAM GEOCHEM, INC., LOWELL, MA", UNDATED, NO SCALE GIVEN.

2) THE LOCATION OF THE BORINGS AND SAMPLING LOCATIONS WERE APPROXIMATELY DETERMINED BY TAPE MEASUREMENTS & "LINE OF SIGHT" FROM EXISTING FEATURES. THE EXPLORATIONS DEPICTED ON THE DRAWING ARE VERY APPROXIMATE





LOCUS

- NOT TO SCALE -

LEGEND

- BORINGS PERFORMED BY GZA DRILLING, INC ON 12/13/84 INDICATES OBSERVATION WELL INSTALLED
- SURFICIAL SOIL SAMPLES (RETRIEVED W/ HAND SHOVEL) BY GZA ON 12/13/84
- SURFICIAL SOIL SAMPLES (RETRIEVED W/ HOLLOW STEM AUGER) BY GZA DRILLING, INC ON 12/13/84
- SURFACE WATER SAMPLING POINT, BY GZA PERSONNEL ON 12/13/84

GZA

ENVIRONMENTAL SITE ASSESSMENT
GEOCHEM, INC.
LOWELL, MA

EXPLORATION LOCATION PLAN

JAN. 1985

FIGURE No. 1

FILE NO. F-4525

APPENDIX A

BORING LOGS

GOLDBERG-ZOINO & ASSOCIATES, INC
GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS

PROJECT: GEOMEX SITE, LOWELL, MASSACHUSETTS

REPORT OF BORING NUMBER: GZA-1
SHEET 1 OF 1
DATE 12/13/84 FILE P4525

BORING CO: GZA Drilling, Inc.
FOREMAN: Art Johnson
GZA ENGINEER: K. Bikis kkp

BORING LOCATION: See location plan
GROUND ELEV:
DATE STARTED: 12/13/84 DATE ENDED: 12/13/84

CASING
SIZE: Hollow stem auger
HAMMER: lb
FALL:

SAMPLER
TYPE: Split spoon OTHER:
HAMMER: 140 lb
FALL: 30"

GROUNDWATER READINGS

DATE	DEPTH	CASING AT	TIME/DATE OR
12/13	11.1'	OUT	IMMEDIATELY

DEPTH	CAS BL. /FT.	SAMPLE NO	PEN/REC.	DEPTH	BLOWS/6"	SAMPLE DESCRIPTION	STRTA CHG & GEN DESC	EQUIPMENT INSTALLED	FIELD TESTING[1]	RMKS
		S-1	24/14	0-2	2-7	Medium dense, brown, fine to medium SAND, little Cinders, trace scrap metal	FILL	BENTONITE SEAL 1'-2'	0.4	
					12-8					
5		S-2	24/22	5-7	2-4	Loose black PEAT, little Organic Silt, trace fine Sand changing to medium dense brown fine SAND	5' PEAT 6' FINE SAND		0.3	
					12-12					
10		S-3	24/20	10-12	5-7	Medium dense, black PEAT, little Organic Silt changing to grey, fine SAND and CLAYEY SILT	10' FINE SAND AND CLAYEY SILT	14" PVC WELL SCREEN 10'-20'	0.5	2
					5-7					
15		S-4	24/20	15-17	3-4	Loose, grey, fine SAND, some Clayey Silt	18' TILL		0.3	
20		S-5	24/12	20-22	16-22	Very dense, grey, fine to medium SAND, little Silt, little fine Gravel, (trace coarse Sand)			0.7	
						Bottom of boring at 22 feet.				

REMARKS:

1. Field testing results represent total organic vapor levels, referenced to a isobutyl standard, measured in the headspace of sealed soil sample jars using an HNU Model PI-101 photoionization analyzer. Sample injection size was 30 cc. Results in parts per million (ppm). ND indicates reading less than 1 ppm.

2. PEAT may have fallen in Auger.

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. 2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE [illegible]

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS

PROJECT: GROCHEM SITE, LOWELL, MASSACHUSETTS

REPORT OF BORING NUMBER GZA-2
SHEET 1 OF 1
DATE 12/13/84 FILE P4525

BORING CO. GZA Drilling, Inc.
FOREMAN Art Johnson
GZA ENGINEER K. Bikis

BORING LOCATION See location plan
GROUND ELEV.
DATE STARTED 12/13/84 DATE ENDED 12/13/84

CASING
SIZE Hollow stem auger
HAMMER lb.
FALL

SAMPLER
TYPE Split spoon OTHER
HAMMER 140 lb.
FALL 30"

GROUNDWATER READINGS

DATE	DEPTH	TIME AT	STABILIZATION TIME
12/13	9'	out	½ hour

DEPTH	CAS. BL. /FT.	SAMPLE NO.	PEN./REC.	DEPTH	BLOWS/6"	SAMPLE DESCRIPTION	STRATA CHG. AND GEN. DESC.	EQUIPMENT INSTALLED	FIELD TESTING	RMKS
		S-1	24/16	0-2	2-2	Loose, brown fine to coarse SAND, little (+) fine Gravel, trace Silt.	FILL	BENTONITE SEAL 1'-2'	0.9	
					3-4					
5		S-2	24/20	5-7	2-3	Medium dense, black, ORGANIC SILT, trace, fine Sand changing to grey-brown, fine Sand.	ORGANIC SILT		0.1	
					7-7					
							STRATIFIED FINE SANDS AND SILTS			
10		S-3	24/18	10-12	6-7	Medium dense, brown-grey SILT, little fine Sand.			0.9	
					7-7			15" PVC WELLSCREEN 10'-20'		
15		S-4	24/10	15-17	3-7	Medium dense, fine SAND, little (+) Clayey Silt, trace fine Gravel, (trace medium to coarse Sand).	16'		1.1	
					14-16					
							GRAVELLY SAND			
20		S-5	24/22	20-22	15-22	Very dense, grey, fine to medium SAND, little (+) fine to coarse Gravel, little (-) Silt, (trace coarse Sand).	TILL		2.2	
					33-78					
						Bottom of boring at 22 feet.				

REMARKS

1. Refer to note No. 1 on log GZA-1 for field testing procedures.

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. 2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO FACTORS NOT ACCOUNTED FOR AT THE

GOLDBERG-ZOINO & ASSOCIATES, INC
GEOTECHNICAL/GEOHYDROLOGICAL CONSULTANTS

PROJECT: GROCHEN SITE, LOWELL, MASSACHUSETTS

REPORT OF BORING NUMBER GZA-1
SHEET 1 OF 1
DATE 12/13/84 FILE 84535

BORING CO. GZA Drilling, Inc.
FOREMAN Art Johnson
GZA ENGINEER F. Bikis KKD

BORING LOCATION See location plan
GROUND ELEV
DATE STARTED 12/13/84 DATE ENDED 12/13/84

CASING
SIZE Hollow stem auger
HAMMER lb
FALL

SAMPLER
TYPE Split spoon OTHER
HAMMER 140 lb
FALL 30"

GROUNDWATER READINGS

DATE	DEPTH	CASING AT	STABILIZATION TIME
12/13	8.3'	OUT	Immediately

DEPTH	CAS. BL. /FT.	SAMPLE NO.	PEN./REC.	DEPTH	BLOWS/6"	SAMPLE DESCRIPTION	STRTA CHG	GRAPHIC DESC	EQUIPMENT INSTALLED	FIELD TESTING 1	RMKS
		S-1	24/14	0-2	22-12	Medium dense, grey, fine to coarse SAND, little Silt, changing to brown, fine to coarse Sand, little fine Gravel, trace Silt changing to black Organic Silt, little Gravel	FILL		BENTONITE SEAL 1'-2'	1.9	
					9-9						
5		S-2	24/22	5-7	1-4	Loose, black ORGANIC SILT and PEAT, trace Glass, trace fine Sand changing to medium dense, grey-brown, fine SAND, trace (+) Silt	6.5'			2.9	
					6-6						
10		S-3	24/6	10-12	5-8	Medium dense, grey, fine SAND, some coarse Gravel, some (-) Silt, (little medium to coarse Sand).	SILTY SAND AND GRAVEL		4" PVC WELLSCREEN 10'-20'	7.0	
					10-10						
15		S-4	24/15	15-17	14-20	Dense, grey, fine SAND, some fine to coarse Gravel, some (-) Silt (little medium to coarse Sand).	TILL			3.6	
					22-30						
20		S-5	18	20-21.5	19-33	Very dense, grey fine to coarse SAND, little fine to coarse Gravel, littel (-) Silt.				3.5	
					88						
						Bottom of boring at 21.5 feet.					

REMARKS

1. Refer to note No. 1 on log GZA-1 for field testing procedures.

NOTES: 1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. 2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE [illegible] FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER THAN THOSE PRESENT AT THE

APPENDIX B

RAI LABORATORY ANALYTICAL RESULTS

RAI

Resource Analysts, Incorporated
Box 4778 Hampton, NH 03842
(603) 926-7777

TO:

Mr. Michael Conway
Goldberg Zoino Associates
320 Needham Street
Newton Upper Falls, MA 02164

PO # Geochem

Date Received: 12/20/84

Lab Number: 4126

Date Reported: 12/28/84

IDENTIFICATION

Water Samples

PARAMETER	SAMPLE DESIGNATION

Please see attached.

Gloria J. Switalski
ANALYST

DIRECTOR

Lab Number: 4126-1
Sample Designation: GZA-1
Date: 12/21/84

	VOLATILE ORGANICS	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	CHLOROMETHANE	BDL	5
2V.	VINYL CHLORIDE	BDL	5
3V.	CHLOROETHANE	BDL	5
4V.	BROMOMETHANE	BDL	5
5V.	METHYLENE CHLORIDE	BDL	5
6V.	TRICHLOROFLUOROMETHANE	BDL	5
7V.	1,1-DICHLOROETHYLENE	16	5
8V.	1,1-DICHLOROETHANE	97	5
9V.	1,2-trans-DICHLOROETHYLENE	BDL	5
10V.	CHLOROFORM	BDL	5
11V.	1,2-DICHLOROETHANE	BDL	5
12V.	1,1,1-TRICHLOROETHANE	240	5
[illegible]V.	CARBON TETRACHLORIDE	BDL	5
14V.	BROMODICHLOROMETHANE	BDL	5
15V.	1,2-DICHLOROPROPANE	BDL	5
16V.	1,3-trans-DICHLOROPROPENE	BDL	5
17V.	TRICHLOROETHYLENE	26	5
18V.	1,3-cis-DICHLOROPROPENE	BDL	5
19V.	1,1,2-TRICHLOROETHANE	BDL	5
20V.	DIBROMOCHLOROMETHANE	BDL	5
21V.	BROMOFORM	BDL	5
22V.	TETRACHLOROETHYLENE	Trace	5
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	5
24V.	CHLOROBENZENE	BDL	5
25V.	2-CHLOROETHYL VINYL ETHER	BDL	5

BDL = BELOW DETECTION LIMIT
METHOD REFERENCE: EPA 600/4-79-020 METHOD 601

Lab Number: 4126-2
Sample Designation: GZA-2
Date: 12/21/84

	VOLATILE ORGANICS	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	CHLOROMETHANE	BDL	5
2V.	VINYL CHLORIDE	BDL	5
3V.	CHLOROETHANE	BDL	5
4V.	BROMOMETHANE	BDL	5
5V.	METHYLENE CHLORIDE	Trace	5
6V.	TRICHLOROFLUOROMETHANE	BDL	5
7V.	1,1-DICHLOROETHYLENE	16	5
8V.	1,1-DICHLOROETHANE	BDL	5
9V.	1,2-trans-DICHLOROETHYLENE	BDL	5
10V.	CHLOROFORM	BDL	5
11V.	1,2-DICHLOROETHANE	BDL	5
12V.	1,1,1-TRICHLOROETHANE	5	5
13V.	CARBON TETRACHLORIDE	BDL	5
14V.	BROMODICHLOROMETHANE	BDL	5
15V.	1,2-DICHLOROPROPANE	BDL	5
16V.	1,3-trans-DICHLOROPROPENE	BDL	5
17V.	TRICHLOROETHYLENE	Trace	5
18V.	1,3-cis-DICHLOROPROPENE	BDL	5
19V.	1,1,2-TRICHLOROETHANE	BDL	5
20V.	DIBROMOCHLOROMETHANE	BDL	5
21V.	BROMOFORM	BDL	5
22V.	TETRACHLOROETHYLENE	BDL	5
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	5
24V.	CHLOROBENZENE	BDL	5
25V.	2-CHLOROETHYL VINYL ETHER	BDL	5

BDL = BELOW DETECTION LIMIT
METHOD REFERENCE: EPA 600/4-79-020 METHOD 601

Lab Number: 4126-3
Sample Designation: GZA-3
Date: 12/21/84

	VOLATILE ORGANICS	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	CHLOROMETHANE	BDL	5
2V.	VINYL CHLORIDE	BDL	5
3V.	CHLOROETHANE	BDL	5
4V.	BROMOMETHANE	BDL	5
5V.	METHYLENE CHLORIDE	Trace	5
6V.	TRICHLOROFLUOROMETHANE	BDL	5
7V.	1,1-DICHLOROETHYLENE	570	5
8V.	1,1-DICHLOROETHANE	900	5
9V.	1,2-trans-DICHLOROETHYLENE	10	5
10V.	CHLOROFORM	BDL	5
11V.	1,2-DICHLOROETHANE	16	5
12V.	1,1,1-TRICHLOROETHANE	680	5
13V.	CARBON TETRACHLORIDE	BDL	5
14V.	BROMODICHLOROMETHANE	BDL	5
15V.	1,2-DICHLOROPROPANE	BDL	5
16V.	1,3-trans-DICHLOROPROPENE	BDL	5
17V.	TRICHLOROETHYLENE	290	5
18V.	1,3-cis-DICHLOROPROPENE	BDL	5
19V.	1,1,2-TRICHLOROETHANE	BDL	5
20V.	DIBROMOCHLOROMETHANE	BDL	5
21V.	BROMOFORM	BDL	5
22V.	TETRACHLOROETHYLENE	Trace	5
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	5
24V.	CHLOROBENZENE	BDL	5
25V.	2-CHLOROETHYL VINYL ETHER	BDL	5

BDL = BELOW DETECTION LIMIT
METHOD REFERENCE: EPA 600/4-79-020 METHOD 601

Lab Number: 4226-4
Sample Designation: BROOK US
Date: 12/21/84

	VOLATILE ORGANICS	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	CHLOROMETHANE	BDL	5
2V.	VINYL CHLORIDE	BDL	5
3V.	CHLOROETHANE	BDL	5
4V.	BROMOMETHANE	BDL	5
5V.	METHYLENE CHLORIDE	Trace	5
6V.	TRICHLOROFLUOROMETHANE	BDL	5
7V.	1,1-DICHLOROETHYLENE	BDL	5
8V.	1,1-DICHLOROETHANE	BDL	5
9V.	1,2-trans-DICHLOROETHYLENE	BDL	5
10V.	CHLOROFORM	BDL	5
11V.	1,2-DICHLOROETHANE	BDL	5
12V.	1,1,1-TRICHLOROETHANE	BDL	5
3V.	CARBON TETRACHLORIDE	BDL	5
4V.	BROMODICHLOROMETHANE	BDL	5
15V.	1,2-DICHLOROPROPANE	BDL	5
16V.	1,3-trans-DICHLOROPROPENE	BDL	5
17V.	TRICHLOROETHYLENE	Trace	5
18V.	1,3-cis-DICHLOROPROPENE	BDL	5
19V.	1,1,2-TRICHLOROETHANE	BDL	5
20V.	DIBROMOCHLOROMETHANE	BDL	5
21V.	BROMOFORM	BDL	5
22V.	TETRACHLOROETHYLENE	BDL	5
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	5
24V.	CHLOROBENZENE	BDL	5
25V.	2-CHLOROETHYL VINYL ETHER	BDL	5

BDL = BELOW DETECTION LIMIT
METHOD REFERENCE: EPA 600/4-79-020 METHOD 601

Lab Number: 4126-5
Sample Designation: BROOK DS
Date: 12/21/84

	VOLATILE ORGANICS	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	CHLOROMETHANE	BDL	5
2V.	VINYL CHLORIDE	BDL	5
3V.	CHLOROETHANE	BDL	5
4V.	BROMOMETHANE	BDL	5
5V.	METHYLENE CHLORIDE	26	5
6V.	TRICHLOROFLUOROMETHANE	BDL	5
7V.	1,1-DICHLOROETHYLENE	Trace	5
8V.	1,1-DICHLOROETHANE	5	5
9V.	1,2-trans-DICHLOROETHYLENE	Trace	5
10V.	CHLOROFORM	BDL	5
11V.	1,2-DICHLOROETHANE	BDL	5
12V.	1,1,1-TRICHLOROETHANE	120	5
13V.	CARBON TETRACHLORIDE	BDL	5
14V.	BROMODICHLOROMETHANE	BDL	5
15V.	1,2-DICHLOROPROPANE	BDL	5
16V.	1,3-trans-DICHLOROPROPENE	BDL	5
17V.	TRICHLOROETHYLENE	17	5
18V.	1,3-cis-DICHLOROPROPENE	BDL	5
19V.	1,1,2-TRICHLOROETHANE	BDL	5
20V.	DIBROMOCHLOROMETHANE	BDL	5
21V.	BROMOFORM	BDL	5
22V.	TETRACHLOROETHYLENE	Trace	5
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	5
24V.	CHLOROBENZENE	BDL	5
25V.	2-CHLOROETHYL VINYL ETHER	BDL	5

BDL = BELOW DETECTION LIMIT
METHOD REFERENCE: EPA 600/4-79-020 METHOD 601

APPENDIX C

STATEMENT OF TERMS AND CONDITIONS

Statement of Terms and Conditions

Reference is made to a Proposal for Services dated August 10, 1984 (the "Proposal for Services") whereunder Goldberg-Zoino & Associates, Inc. ("Company") agreed to perform certain services for Geochem, Inc. ("Client") relating to an Assessment of certain real property located at 263 Howard street, Lowell, Massachusetts (the "Site").

WHEREAS, the parties desire to further define and delineate their respective rights and obligations in connection with the Assessment;

NOW, THEREFORE, in consideration of the mutual covenants and obligations herein contained, and other good and valuable consideration, the receipt of which is hereby acknowledged, Company and Client hereby agree as follows:

Section 1. Services to be Provided. Company hereby agrees to provide Client with the services set forth in the Proposal for Services on the terms and conditions set forth herein.

Section 2. Right of Entry. Client hereby grants to Company or represents and warrants (if the Site is not owned by Client) that permission has been duly granted for a Right of Entry from time to time, by Company, its agents, staff, consultants, and contractors or subcontractors, upon the Site for the purpose of performing and with the right to perform all acts, studies, and research, including without limitation the making of test borings and other soil compilings, pursuant to the Scope of Services. Client hereby recognizes that the use of exploration equipment may unavoidably affect, alter, or damage the terrain and affect vegetation, buildings, structures, and equipment in, at, or upon the Site. Client accepts the fact that this is inherent to Company's work and will not hold Company liable or responsible for any such reasonable effect, alteration, or damage, and will defend the Company and indemnify it for damages claimed by any party on account thereof.

Section 3. Billing and Payment. Client agrees to pay Company, in the manner provided herein, and in accordance with the rates and charges set forth in the attached Proposal for Services. Invoices for Company's services shall be submitted either upon completion of such services or on a two- or four-week basis. All such invoices shall be due and payable within thirty (30) days. Client acknowledges and agrees that in the event payment is not timely made, the overdue balance shall bear interest at the maximum lawful allowable rate as set forth in Company's Invoices. It is further understood and agreed that if there be failure by Client to pay any invoice due to Company within thirty (30) days after the date of billing, Company, without waiving any other claim or right against Client, and without liability whatsoever to Client, may terminate its performance of services. In the event Company places any unpaid invoice with an agency or an attorney for collection, Client agrees to pay all costs and expenses of such collection, including without limitation all reasonable attorneys' fees and court costs.

Section 4. Public Liability. Company represents and warrants that its staff is protected by Worker's Compensation insurance with statutory limits and that Company has coverage under Public Liability and Property Damage Insurance policies. Certificates for any such policies shall be provided to Client upon written request. In no event shall Company be liable or responsible for any loss, damage, or liability, including but not limited to, fire and explosion, beyond the amounts, limits, or conditions of such insurance. In addition, Company shall in no event be liable or responsible for any loss, damage, or liability excluded from coverage of such insurance.

Company will not be liable for damages or injury arising from damage to or interference with subterranean structures (including, without limitation, pipes, tanks, telephone cables, etc.) which are not called to Company's attention and not correctly shown on the plans furnished by Client in connection with work performed under this Agreement.

Section 5. Limitations. Client agrees that Company's services are on behalf of and for the exclusive use of Client in evaluating the Site. These services will consist solely of those described in the Proposal for Services and will not be based upon scientific or technical tests or procedures beyond the scope of described services or the time and budgetary constraints imposed by Client. Client recognizes that Company's services require decisions which are not based upon pure science but rather upon judgmental considerations. Company shall perform services in accordance with generally accepted practices of geohydrologists undertaking similar site assessment services under like or identical circumstances. Client agrees that such services shall be rendered without any other warranty, express or implied, and, subject to all other limitations herein contained. Company shall be responsible only for such injury, loss, or damage as is caused by the sole negligence or willful misconduct of Company, its employees, agents, or representatives.

Section 6. Client's Duty to Notify of Hazards. Client agrees to advise Company promptly of any known hazardous substances or any known condition existing in, on, or near the Site presenting a potential danger to human health or the environment.

Section 7. Unforeseen and Unanticipated Occurrences. If, during performance of services, any unforeseen hazardous substances or other unforeseen conditions or occurrences are encountered which, in the judgment of Company, significantly affect or may affect the services or the recommended scope of services, Company will promptly notify Client thereof. Subsequent to that notification Client and Company agree to pursue one of the following options:

(a) If practicable, in the judgment of Company, the original scope of services will be completed in accordance with the procedures originally intended in the Proposal for Services;

(b) The scope of the services will be modified and the estimate of charges revised to include study of the previously unforeseen conditions or occurrences, such revision to be in writing and signed by the parties and incorporated herein;

(c) The services will be terminated, effective on the date specified by Company in writing. Client agrees to pay Company in full for all services completed and fees up to and including the date specified in the written termination and to pay all reasonable costs incurred by Company prior to and in connection with discontinuance of services.

Section 8. Hazardous Waste Disposal. In addition to the provisions of Section 11 herein, Client specifically agrees to defend, hold harmless, and indemnify Company from and against any and all claims and liabilities resulting from:

(a) Client's violation of any federal, state, or local statute, regulation, or ordinance relating to the disposal of hazardous waste, including without limitation the Resource Conservation and Recovery Act, the Comprehensive Environmental Response Compensation and Liability Act and Massachusetts General Laws Chapter 21;

(b) Client's direct or indirect undertaking of or arrangement for the treatment, storage, disposal, or transportation of hazardous materials or oil found or identified at the Site;

(c) Changed conditions or waste materials introduced at the Site by Client or third persons after the completion of services described herein.

Section 9. Limitation on Professional Liability. Client agrees to defend, hold harmless, and indemnify the Company from and against any and all liability, claims for damages, costs of defense, or expenses which may be brought, levied against, or incurred by Company on account of any claimed error, omission, or professional negligence for any amount in excess of fifty thousand dollars ($50,000) or the aggregate of Company invoices submitted and paid hereunder, whichever is greater.

Company will increase the foregoing limitation of liability upon written notice from Client received within five (5) days after execution of the Proposal for Services by Client. Any such increase in the limitation of professional liability shall result in an increased charge calculated pursuant to Section 10 below. Notice of the amount of increase, if any, may be indicated by initialing the appropriate space in Section 10.

In the event that Client makes claim against Company, at law or otherwise, for any alleged error, omission, or act arising out of the performance of Company's services, and Client fails to prove such claim upon final adjudication, then Client shall pay all costs incurred by Company in defending itself against the claim, including, without limitation, Company personnel-related costs, attorneys' fees, court costs, and other claim-related expenses, including, without limitation, costs, fees, and expenses of experts.

Section 10. Increase in Limitation of Professional Liability. Client, in consideration of the following designated increased limitation of professional liability, agrees to pay an additional charge equal to the percentage of aggregate fees for professional services or to the minimum charge, whichever is greater, that is set forth below, together with a corresponding increase of Company's estimated fee limitation set forth in the Proposal for Services.

If the Client desires this increased limitation of professional liability, Client shall so indicate by initialing and dating the appropriate space below.

Limitation of Professional Liability	Percentage of Fee	Minimum Charge In Addition to Fee	Initials/Date
$ 100,000	1	$ 100	_____
200,000	2	200	_____
300,000	3	300	_____
400,000	4	400	_____
500,000	5	500	_____
1,000,000	10	1,000	_____

Section 11. General Indemnity. Except as otherwise specifically provided herein, Client agrees to defend, hold harmless, and indemnify Company from and against any and all liability, claims for damages, costs of defense, or expenses which may be brought, levied against, or incurred by Company arising from personal injuries (including disease or death or both), property loss or damage, injuries to others (including personnel of Client and of Company, their contractors and subcontractors performing work hereunder), or from air, water, or ground pollution or environmental degradation arising out of or in any manner connected with or related to the performance of the Company's Site assessment services, unless such injury, loss, or damage shall be caused by the sole negligence or willful misconduct of Company, its employees, agents, or representatives.

Section 12. Samples. Company will preserve such soil, water, and other samples, if any, obtained from the Site for such period of time as Company in its sole discretion deems appropriate. No such samples will be discarded before completion of the Assessment without prior written notice to Client, provided, however, that samples on which soil or chemical laboratory testing has been performed may be thereafter discarded by Company without such notification. Samples shall be available at Company's office for inspection by Client and others authorized by Client, upon reasonable notice, at any time during normal business hours.

In the event that samples collected from the Site contain substances defined as hazardous by federal, state, or local statutes, regulations, or ordinances, Company will either (i) dispose of such samples by contract with a qualified waste disposal contractor; (ii) or will ship such samples to a location selected by Client for final disposal. Client agrees to pay all costs associated with the storage, transport, and disposal of samples, and to indemnify Company in the manner provided in Section 8 or 11 above for any liabilities arising therefrom. In the event any sample must be stored by Company for a period in excess of ninety (90) days, Client agrees to pay an additional fee charged in accordance with the Company's standard laboratory schedule.

Section 13. Confidentiality. Company will not intentionally divulge information regarding its services rendered to Client to any party other than Client or to parties designated by Client in writing. Information that is in the public domain or is provided to Company by third parties is excepted from the foregoing.

Company, by virtue of providing the services described in the Proposal for Services, does not assume the responsibility of the person in charge of the Site, or otherwise undertake responsibility for reporting to any federal, state, or local public agencies any conditions at the Site that may present a potential danger to public health, safety, or the environment. Client agrees to notify the appropriate federal, state, or local public agencies as required by law, or otherwise to disclose, in a timely manner, any information that may be necessary to prevent any danger to public health, safety, or the environment.

Section 14. OSHA. Company will not be held responsible in any way for any contractor's failure to observe or comply with the Occupational Health and Safety Act of 1970, any regulations or standards promulgated thereunder, or any state, county, or municipal law or regulation of similar import or intent.

Section 15. Documents. All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by Company as instruments of service shall remain the property of Company. Client agrees that all reports and other work furnished to Client or its agents shall be utilized by Client solely for the intended purposes of the Assessment. Company will retain all pertinent records relating to the services performed for a period of five (5) years following submission of the report, during which period the records will be made available to Client at Company's Office at all reasonable times. Copies will be prepared by Company for Client for reasonable cost of reproduction.

Section 16. Choice of Law. This contract will be construed in accordance with the laws of the Commonwealth of Massachusetts.

Section 17. Severability. In the event that any provisions herein shall be deemed invalid or unenforceable, the other provisions hereof shall remain in full force and effect, and binding upon the parties hereto.

Goldberg-Zoino & Associates, Inc. is an Equal Opportunity Employer.