PHASE I REPORT

GROUND-WATER MONITORING AT THE GREENBUSH DISPOSAL FACILITY

GREENBUSH, MAINE

DRAFT

October 1992

PREPARED BY
STONE & WEBSTER ENVIRONMENTAL SERVICES INC.
FOR
UNIVERSITY OF MAINE SYSTEM, OFFICE OF FACILITIES

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EXECUTIVE SUMMARY

On November 6, 1991 drilling began for the construction of four monitoring wells, one on each side and adjacent to the Greenbush Disposal Facility boundary. Monitoring well construction was completed December 18, 1991 by All Terrain Drilling of Greenland, NH, using a mobile B-47 rotary drilling rig. Full time supervision, direction, and health and safety monitoring were provided by Stone & Webster Environmental Services, Inc. of Boston.

The monitoring wells were installed in borings advanced through soil by driving and cleaning out 6 inch and 4 inch casing. Borings were advanced through rock by spinning a standard H size core barrel. Monitoring wells were constructed of 2 inch ID PVC standpipes and 2 inch ID Type 304 Stainless Steel, continuous slot well screens. The screens were placed across the water table in each well in order to facilitate detection of light, non-aqueous, immiscible liquids ("floaters") that might reside on top of the ground water, and to assure that only stainless steel would remain permanently in contact with ground water. Approximately 40 feet of screen was placed in the first well in order to assure proper placement across the watertable. This well was monitored for several days until general depth-to-water at the site could be confidently determined. Shorter well screen sections were then placed in each of the remaining three wells.

All wells were purged and sampled on May 7 and 8, 1992 using transparent teflon bailers. Depths to water measurements were also made, and a preliminary transit survey of the well heads was conducted to determine relative locations and elevations. In addition, a vapor sample was taken from immediately beneath the hypalon and soil cap overlying the landfill. This was accomplished by inserting and sealing a plastic tube through a small incision made in the hypalon and pulling the vapor through the tube into a sorbant cylinder using a battery powered vacuum pump. Approximately 2.2 liters per minute of vapor were pumped through the cylinder for a period of approximately one hour.

All samples were shipped to C.E.P. Laboratories of Santa Fe, New Mexico for analysis of organic volatiles (EPA Method 624) and radioactivity (gross Alpha, gross Beta, and Gamma Spectral Analysis).

The results of the sampling and testing showed no elevated level of organic volatiles or radioactivity in the ground water and no detectible organic vapors beneath the hypalon liner.

Based on the data collected to date, there is no evidence of contaminant leakage from the landfill. The addition of four new monitoring wells plus a continuous sampling and testing program will complete the monitoring system and provide a reasonable level of confidence that future sampling and analysis will reflect the landfill performance.

1.0 INTRODUCTION

This report presents the results of the hydrogeologic studies including the results of ground-water sampling and testing at the University of Maine's disposal facility at Greenbush, Maine. The work reported in this document covers the activities completed during the October 1991 and September 1992 period.

Stone & Webster originally proposed (June 27,1989) a scope of work that included eight well nests with each nest consisting of one shallow well and one deep well. Water samples collected from the well were to be subjected to a comprehensive analytical testing program. Following discussions with the University, the work was divided into phases. The first phase, the results of which are reported in this document, consisted of four wells located adjacent to the disposal facility followed by one round of ground water sampling and a limited analytical testing program. As work on Phase II is completed and as additional analytical data is collected, this report will be updated.

The work reported in this document was authorized by the University of Maine System, Office of Facilities on October 1, 1991 as part of the Agreement For Consulting Services with Stone & Webster Environmental Services Inc. (Stone & Webster) dated March 20, 1989.

2.0 MONITORING WELL INSTALLATION

The Greenbush Disposal Facility is located approximately 26 miles north-northeast of Bangor, Maine in a wooded area on State Tree Nursery property, approximately 0.6 miles north of Scotts Corner, on the west side of Goulds Ridge Road. The 40' X 40' site is located on a late Wisconsinan esker at approximate elevation 250'. There is an irrigation pond 0.3 miles to the southwest of the site at elevation 170'. Olamon stream is located 1.0 mile southwest at approximate elevation 125' (U.S. Geological Survey, 1988) (Figure 1).

Four monitoring wells were installed around the site perimeter during the period November 6 to December 18, 1991 (Figure 2). The wells ranged in depth from 80.5' to 110.1'. Monitoring well B was advanced to 60.8' by driving 6" casing with a 300 lbs. hammer after cleaning out ahead of the casing with a 5 5/8" rollerbit. After refusal at 60.8' a spinning shoe was installed on the 6" casing and the hole was advanced utilizing spinning techniques until refusal at 70.0'. At 70.0' 4" casing with a spinning shoe was telescoped down through the 6" casing. The hole was then advanced spinning the 4" casing down to bedrock using a 3 5/8" rollerbit ahead of the casing.

Monitoring wells A, C, and D were all installed by advancing the hole with a 3 5/8" rollerbit and driving 4" casing until refusal. After refusal the casing was advanced utilizing spinning techniques. While advancing C and D through the till layer, water loss was 100%.

In all of the monitoring wells the holes were advanced through the bedrock using a standard 4" H rock core barrel. Drilling was smooth during each core run with rock core recoveries approaching 100%. While coring C and D drilling fluid (water) loss was 100%.

To avoid contaminating the wells during installation the use of petroleum- based lubricants was not permitted. The only lubricant used during the installation of the wells was a vegetable oil based lubricant that was used on the 6" casing in B. Water used to wash the cuttings out of the hole was continuously monitored for both volatile organic carbon and Υ radiation to avoid introducing any contaminants into the well.

All material used to install the wells including casing, rods, driving shoes, spinning shoes, and rollerbits were monitored for volatile organic carbon and Υ radiation. All equipment used to develop the wells, including a Watera pump and a teflon bailer, were new, having not been used on other sites.

While drilling a half barrel and a T-adapter were utilized to recirculate the drilling fluids. This was done to prevent drilling fluid from moving off the site. Any drilling fluid that spilled during the drilling process or circulated to the surface while spinning down the casing was absorbed by the formation in close proximity to the hole. In addition, all fluid that was used to flush the hole before installing the wells was disposed of in close proximity to the hole and also was absorbed by the formation.

Below the watertable, 2.0" ID, type 304, stainless steel, 10 slot, continuous slot, wire wound screens were used in all wells with a 2.7" stainless steel silt

trap. Above the well screen the inner casing consisted of 10.0' of 2.0" ID, type 304, stainless steel, riser pipe. From the stainless steel riser pipe to the top-of-well the inner casing was made of 2.0" ID, PVC pipe. A filter pack composed of well-graded filter sand was placed from the bottom of each well to a minimum depth of 10.0' above the well screens. Above the filter pack a 5.0' minimum thickness bentonite seal was installed in each well. Cuttings or filter sand was placed above the bentonite seals to the base of the stand-up guard pipes where an additional bentonite seal was placed. Cuttings or filter sand was then placed on top of the surface seal to permit water to drain out below the stand-up guard pipes. The 5.0' long, 6.25' ID, steel, stand-up guard pipes with locking caps were installed at least 2.3' above ground surface, and were secured in place with bentonite (Figures 6-9).

The four monitoring wells installed on the site are all seated in bedrock. Based on readings taken shortly after well construction, the depth of the water table ranges from 72.6' on the north side of the site, to 69.7' on the west. The water table is located within the till layer anywhere from 2.9' to 16.5' above the bedrock. The maximum difference in the elevation of the water table between all four wells was 2.9'. This indicates that the water table is not influenced by the more extreme dip of the bedrock (Figures 6-9).

In order to confirm the depth of the water table, monitoring well B was bailed. Approximately 5 gallons of water were removed from the well, drawing down the water level 0.5' to a depth of 76.5'. The water level in the well fully recovered in 105 seconds. To further confirm the depth of the water table a daily record was kept of the ground-water levels in the completed wells during the drilling program. Over a period of 21 days, the water level in B fluctuated 0.15'. In A, over a 7 day period, the depth to the water table fluctuated 0.10', in D over a 3 day period it fluctuated 0.25'. As Well C was completed last, flictuations could not be measured in this well over a meaningful time period.

While drilling through the till and coring the bedrock in C and D, drilling fluid loss was 100%. This, and the rapid recovery noted while bailing B, indicates good transmissivity of the aquifer medium.

During the monitoring well installation and during the sampling activities an HNu volatile organic carbon vapor monitor and a Υ radiation indicator were present on the site at all times. The HNu was calibrated daily and no unusual drift was observed. Background levels with the HNu and the Υ indicator were established each day prior to the commencement of work activities and averaged approximately 0.4 ppm on the HNu and 0.1 mR/h on the Υ indicator. Measurements were taken every 0.5 hour or every 5.0' during rapid advancement of the hole. During prolonged periods of inactivity on the site, measurements were taken less frequently as deemed appropriate. Monitoring with the HNu was performed in the breathing zone, while monitoring with the Υ indicator was performed at waist level. Monitoring with both the HNu and the Υ indicator was also performed at the well head.

Throughout the drilling program there was only one reading on the HNu exceeding the 5 ppm action level. This occurred in B at 57.5', on 11-8-91 at 0715. After advancing the casing to 59.0', the driller was washing the cuttings at 57.5' when it was noted that the drilling fluid was effervescing. A reading of

approximately 20.0 ppm was observed at the wellhead on the HNu at this time, while only background levels were noted in the breathing zone. Background levels were also observed with the ϒ indicator in both the breathing zone and at the well head. The drillers were subsequently instructed to move off the site and drilling activities were suspended.

At 0830 Dick Skryness, Larry Picking, and Larry Cohen were contacted and it was decided to return to the site and monitor the breathing zone and the well head. Upon returning, the breathing zone and the well head were at background levels on both the HNu and the ϒ indicator. At 0920 drilling activities resumed and effervescing was again noted in the drilling fluid. At this point the drillers were instructed to again move off the site and drilling activities were suspended.

At 1000 Dick Skryness and Jim Skrabak were contacted and it was decided to resume drilling and to monitor the breathing zone and the well head every 15 minutes, and avoid skin contact with the drilling fluid. Upon the resumption of drilling, background levels were observed in the breathing zone with both the HNu and the ϒ indicator. At the well head, while washing out the cuttings at 59.0', readings on the HNu were observed to be 2.0 ppm at 1050. At 1105 readings of 10.0 ppm were noted. After advancing to 60.8' a reading of 2.0 ppm was noted at 1150. Background levels were observed with the ϒ indicator at the well head throughout. At 1215, while monitoring the cuttings from 55.0'-60.0', readings of 20.0+ ppm were noted with the HNu and background levels were observed with the ϒ indicator. After casing off the hole to 60.8', no unusual readings were noted on the HNu or the ϒ indicator.

The effervescing observed in the drilling fluid plus the absence of exlevated (gamma) readings indicates the presence of a naturally occuring gas. The response was detected at 57.5' near the gradational interface between the upper sand and the lower till. Therefore, it could be the result of an organic-rich silt deposit present at this depth, too small to be identified in the drill cuttings. This response also appears to be locally isolated and was not observed in any of the other monitoring wells.

Background levels were observed with the ϒ indicator in all borings throughout the drilling program.

3.0 SITE HYDROGEOLOGY

Surficial deposits in the site area are dated by Thompson and Borns (1989) as late Wisconsinan in age and range in thickness from 73.6' along the east side of the site, to 86.2' along the west, reflecting the local dip of the bedrock. These deposits are composed of two units - an upper sand with traces of gravel and boulders, and a lower till (Figures 2-5).

The upper sand with traces of gravel and boulders is an esker deposit and ranges in thickness from 60.8' on the north side of the site, to 51.5' on the south. This unit is composed primarily of interbedded well-graded and poorly graded brown to gray sands with 0-5% nonplastic fines and occasional rounded, fine gravel (to 0.5") and boulders.

The lower unit is a till that ranges from 14.7' along the north side of the site, to 34.2' along the west. This unit is composed of interbedded well-graded and poorly graded gray sands with 0-5% nonplastic fines, and widely graded sandy gravels with 0-5% nonplastic fines. Boulders are abundant throughout the interval.

Bedrock in the area is composed of slates and sandstones of the Silurian Allsbury Formation (Osberg et al., 1989). The Allsbury Formation is part of the Maine Slate Belt, which forms the core of the Kearsarge-Central Maine synclinorium. The Allsbury Formation is dominated by intervals of slate and quartz-rich graywackes (Roy, 1981; Osberg et al., 1989). Fossils contained within the Slate Member of the formation collectively indicate an age in the Silurian between Late Llandoverian to Early Ludlovian and mineral assemblages indicate a low greenschist grade of metamorphism (Roy, 1981).

Bedrock is at a depth of 73.6' on the east side of the site, and at 86.2' on the west, indicating a general east to west dip (Figure 5). Rock cores retrieved while drilling monitoring wells at the site confirm the presence of green to gray slate in the area. The slate was generally found to be moderately fractured to sound with both steeply dipping close, tight, planar, smooth joints along foliation and steeply dipping, close, open, irregular, rough joints at an angle to foliation. Quartz veins are prominent throughout the cores, as are healed joints. Oxidized joints are also present throughout the cores.

The geologic profile described above plus the depths to ground water noted in Section 2.0 of this report, and later confirmed during sampling of the monitoring wells (Section 4.0), indicate that the esker deposits are unsaturated, and the esker upon which the site is located is not an aquifer. At the site and within the immediate region, ground water in usable quantities occurs only in the uppermost fractured zone of bedrock and in the lowermost zone of the overlying till.

4.0 SAMPLING PROTOCOL

On May 7 & 8, 1992, samples were taken for laboratory testing, static water depths were measured, and relative evevations of the well heads were measured using a transit and stadia rod.

The objective of this task was primarily to obtain samples from the monitoring wells for analysis of ground water volatile organic content and radioactivity.

Prior to sampling, the wells were monitored at the wellhead and in the breathing zone for vapors and gases using an HNu volatile organic compound detector. In addition, the wellhead and immediate area approximately 4 ft. above the ground surface (waist level) was monitored for Υ radiation with a Υ detector.

After checking for vapors and gases, the depth to water was measured using a decontaminated water level indicator. The decontamination procedure for the water level indicator was as follows: Wipe the water level indicator dry with a paper towel. After the water level indicator is dry, thoroughly rinse it with deionized water and again wipe dry.

While determining the depth to water, the probe was not lowered below the water surface any further than necessary, and the depth was determined with as little physical disturbance to the water in the well as possible.

Sampling was performed using sampling kits prepared in advance and supplied by the analytical laboratory. A dedicated one-liter, transparent teflon bailer was used to purge nad sample each well. The bailer was decontaminated at the factory and sealed in a protective cover. The bailer was equipped with polyethylene line.

An initial sample was obtained using the bailer by gently lowering the bailer down the well until contact with the well fluid was made. The bailer was lowered approximately one-half its length and retrieved. The purpose of the initial bail was to capture any immiscible, lighter-than-water fluids that may have been floating at the ground-water surface.

The next step in the sampling procedure was to evacuate the standing water inside the well casing. The depth from the top of the casing to the bottom of the well (total depth of the well) was measured, and the height and volume of the standing water was determined. A minimum of 3 to 5 well volumes, was removed, using the dedicated purging bailer.

After purging, the well was not disturbed for a period of time sufficient to allow settling of fines from the uppermost portion of the water column.

Fluid from the initial bail after purging was used to prepare samples for laboratory analysis of volatile organic compounds. The remaining sample jars were then filled for transport to the laboratory.

Field sampling techniques for radionuclides were in accordance with EPA 901.1 for Gamma Spectralanalysis and 900.0 for Gross Alpha and Gross Beta. These each.

require 1 liter of fluid sample in a plastic container. Field sampling techniques for volatile organic compounds were in accordance with SW846 Series for Method 624. This requires two 40 ml VOA Septum Vials with zero head space.

A total of 8 water samples including 4 quality control (2 duplicate samples and 2 equipment blanks) were collected for laboratory analysis. A duplicate sample is a repeat sample taken from an identified well and is used to determine laboratory/sampling precision (repeatability of results). An equipment blank is a sample prepared by using the same sampling equipment as was used to sample the wells (ie, the sampling bailer) to obtain a sample of distilled water transported to the wellhead vicinity by the sampling team from an offsite commercial source. The equipment blank is prepared, containerized, preserved, shipped to the laboratory and otherwise treated in the same manner as the ground-water samples, and analyzed at the laboratory with the ground-water samples. Any contaminant detected in both a ground-water sample and an equipment-blank sample in more-or-less similar concentrations would be suspected of having been introduced by the sampling/preparation/shipping/testing procedures, rather than occuring as an actual contaminant in the ground-water.

For shipment, sample containers were packed in insulated coolers containing ice and foam packing material. Shipment to the laboratory was by a commercial overnight delivery service.

SOIL GAS SAMPLING

The objective of this task was to sample and measure volatile organic gases that may be present in the soil underlying the landfill cover.

One soil gas sample was obtained beneath the impervious cover of the disposal facility. One sample was collected outside the disposal facility area prior to penetrating the hypalon liner and was used as a sample blank.

Prior to collecting the soil gas sample the breathing area was monitored for vapors and gasses using an HNu volatile organic compound detector. In addition, the area approximately 4 ft above the ground surface was monitored for γ radiation.

The soil gas sampling location was prepared by removing approximately 6" of sand that covers the hypalon liner. A small incision was made to insert a plastic tube below the hypalon. The tube was sealed to the liner with duct tape. A battery operated vacuum pump with built in flowmeter extracted soil gas from beneath the liner through a TENAX filled glass tube. Any organic gas present would be adsorbed onto the TENAX. The organic gasses can be desorbed and quantified by the loaboratory. The flow rate on the pump was set at 2.2 l/min and monitored periodically. The pump was operated for 1 hour. HNu readings were taken immediately after penetrating the cover and during the sample collection. Area radiation measurements were taken during the sampling period. No levels above off site background were detected. After sampling, the hypalon liner was sealed with several layers of duct tape and covered with sand. The sample location was marked with a stack of cobbles for future reference. The gas samples were labeled, packed and shipped with the ground-water samples for overnight delivery to the CEP laboratory for analysis.

5.0 ANALYTICAL RESULTS

All four monitoring wells were sampled in accordance with the sampling protocol discussed in section 4.0. Ground-water samples were collected for radioactivity and volatile organic compound analyses. A soil gas sample was collected from beneath the hypalon liner in order to determine if volatile compounds have accumulated in the soil overlying the disposal site. Laboratory analysis of all samples was performed by Controls for Environmental Pollution (CEP) located in Santa Fe, New Mexico.

The test results indicate that no man-made gamma emitting isotopes and no gross alpha or beta activity are present in the ground water collected from Wells A,B,C,and D. A very low concentration of alpha and beta activity was initially detected in Wells C and D, the two wells that were noticably turbid when sampled. Upon instructions from Stone & Webster, the laboratory filtered the remaining sample water from Well C and Well D. Filtering the sample water significantly reduces the concentration of suspended solids and the naturally occurring radioactivity that is present in soil particles that constitute the suspended solids. Gross alpha and beta analysis performed on the filter residue and the filtered water (filtrate) show that all detectible alpha and beta activity is removed by filtration. The analysis of filtered and unfiltered ground-water samples indicate that ground water at the site contains no measurable levels of alpha or beta radioactivity and the activity detected initially can be attributed to natural radioactivity from suspended soil particle in the turbid water. laboratory analysis for radioactivity are summarized on Table 1.

The results of the organic analysis are shown on TABLE 2. Trace concentrations of methylene chloride were reported in all samples including the equipment blank. Trace concentrations of chloroform were detected in Well B (DUP), WELL D and in the equipment blank. The presence of these two analytes in the equipment blank at essentially the same concentrations as reported in the wells, (refer to Section 4 for a description of the equipment blank) clearly shows the source of these analytes as being other than the ground water. All other analytes, including toluene, are reported as non-detected.

TABLE 1 LABORATORY ANALYSIS-RADIOACTIVITY

SAMPLE No.	01	02	03	04	05	06
WELL	WELL A	WELL B	WELL B (DUP)	WELL C	WELL D	WELL A (BLANK)
PHYSICAL DESCRIPTION	CLEAR	CLEAR	CLEAR	TURBID	TURBID	CLEAR
GROSS ALPHA (pCi/l)	<2	<2	<2	14±6	13±6	<2
GROSS BETA (pCi/l)	<3	<3	<3	38±6	38±6	<3
GAMMA SPEC (pCi/l)	ND	ND	ND	ND	ND	ND
SUSPENDED SOLIDS (gm/l)	(-)	(-)	(-)	1.0060	1.2880	(-)
FILTER GROSS ALPHA ACTIVITY (pCi/gm)	(-)	(-)	(-)	1.25±0.58[1]	1.71±0.69[1]	(-)
FILTER GROSS BETA ACTIVITY (pCi/gm)	(-)	(-)	(-)	2.39±0.74[1]	4.46±0.83[1]	(-)
FILTRATE GROSS ALPHA ACTIVITY (pCi/l)	(-)	(-)	(-)	<2	<2	(-)
FILTRATE GROSS BETA ACTIVITY (pCi/l)	(-)	(-)	(-)	<3	<3	(-)

[1] Activity on filter does not equate to original activity probably due to attempting to measure activities in the lower end of the quantification limit, decay, filter interference or a combination thereof.

(-) No analysis performed

ND No man-made nuclides detected

TABLE 2 LABORATORY ANALYSIS-ORGANICS

SAMPLE No.	01B	02B	03B	04B	05B	06B
WELL	WELL A	WELL B	WELL B (DUP)	WELL C	WELL D	WELL A (BLANK)
PHYSICAL DESCRIPTION	CLEAR	CLEAR	CLEAR	TURBID	TURBID	CLEAR
Chloromethane	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND
Methylene Chloride	3.6	3.2	3.0	3.0	3.8	3.6
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND
trans-1,2 -Dichloroethene	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	3.7	ND	3.5	3.5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND
Trichlorofloromethane	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND
1,1,2,2 -Tetrachloroethane	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND
trans-1,3 -Dichloropropene	ND	ND	ND	ND	ND	ND
Trichlorethene	ND	ND	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND	ND	ND
1,1,2 -Trichloroethane	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND
cis-1,3 -Dichloropropene	ND	ND	ND	ND	ND	ND

2-Chloroethyl Vinly Ether	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND
Tetrachlorethene	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND
Ethyl Benzene	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND

ND Below the quanitification limit

6.0 RESULTS AND CONCLUSIONS

The additional knowledge gained from this phase of the work at Greenbush can be summarized as follows:

1) There is no evidence of ground water or soil vapor contamination in the immediate vicinity of the landfill.

The four new monitoring wells that were drilled and sampled represent the closest and most comprehensive sampling and testing conducted at the site to-date. These plus the soil vapor sample taken beneath the liner showed no evidence of either radiation above background or of any of the volatile organic scintillation fluids known to have been disposed of in the landfill.

2) Depths to ground water are greater than originally expected.

Measured depths to ground water taken both in the late fall-early winter, 1991 and spring, 1992 indicate a watertable approximately 70 feet below ground surface. This places the watertable beneath the base of the esker deposits and close to the bedrock surface, and indicates the esker is not an aquifer. While the saturated portions of the upper bedrock-lower till are an important local and near-regional ground-water resource for domestic, livestock, and limited commercial use, the site is not located over a major esker-aquifer system such as commonly occur elsewhere in Maine. Potential regional well yields and related radii-of-influences will be low, and the possibility for existing or future ground-water exploitation to induce gradients and ground-water movement that would alter or enhance contaminant migration away from the site are minimal.

The greater than expected ground-water depths also means that at least 50 feet of unsaturated soil exists between the base of the landfill and the watertable, and any contaminant leaking from the landfill must traverse this material before it can contaminate the ground water and be transported away from the site. As this soil will have both absorbing and cation-exchange capability, this large thickness will greatly retard contaminant migration to the ground water.

These factors lead to two conclusions, namely; 1) the risk of offsite ground-water contamination due to the landfill is less than originally expected, and 2) in the event that it did occur, it could be detected by a properly designed monitoring system in time so that remedial measures could be taken before it presented a significant threat to the accessible environment (ie; wells, springs, surface water bodies).

The nearness of the watertable to the bedrock surface also permits adequate monitoring for potential floating contaminant and dissolved and heavy contaminant in a single well, as opposed to the two-well "nests" originally proposed. This cuts the required number of wells in half and will save construction as well as maintenance and sampling cost.

7.0 RECOMMENDATIONS

Based on the observations made during monitoring well installation and ground-water sampling, and analysis of the laboratory test results of the ground-water samples, the followmig recommendations are made.

- Four additional outer perimeter monitoring wells should be installed at the Greenbush facility. The well design should be similar to the inner perimeter wells.

- Following the installation of the outer perimeter wells, a long-term sampling and testing program should be initiated. Ground-water samples should be taken and analyzed annually. Sampling protocol and analytical testing should be similar to the sampling and testing performed on the inner perimeter wells. Water-levels should be measured quarterly.

- A soil vapor sample should by taken from beneath the hypalon cap and analyzed on an annual basis.

- All sampling and testing should be conducted according to procedures prepared as part of a formal Sampling and Testing Program Plan.

- An Action Plan should be prepared to describe actions to be taken if testing data indicate landfill contamintion of ground water.

These recommendations are subject to change based on additional data that will result from constructing the additional wells and future sampling and testing.

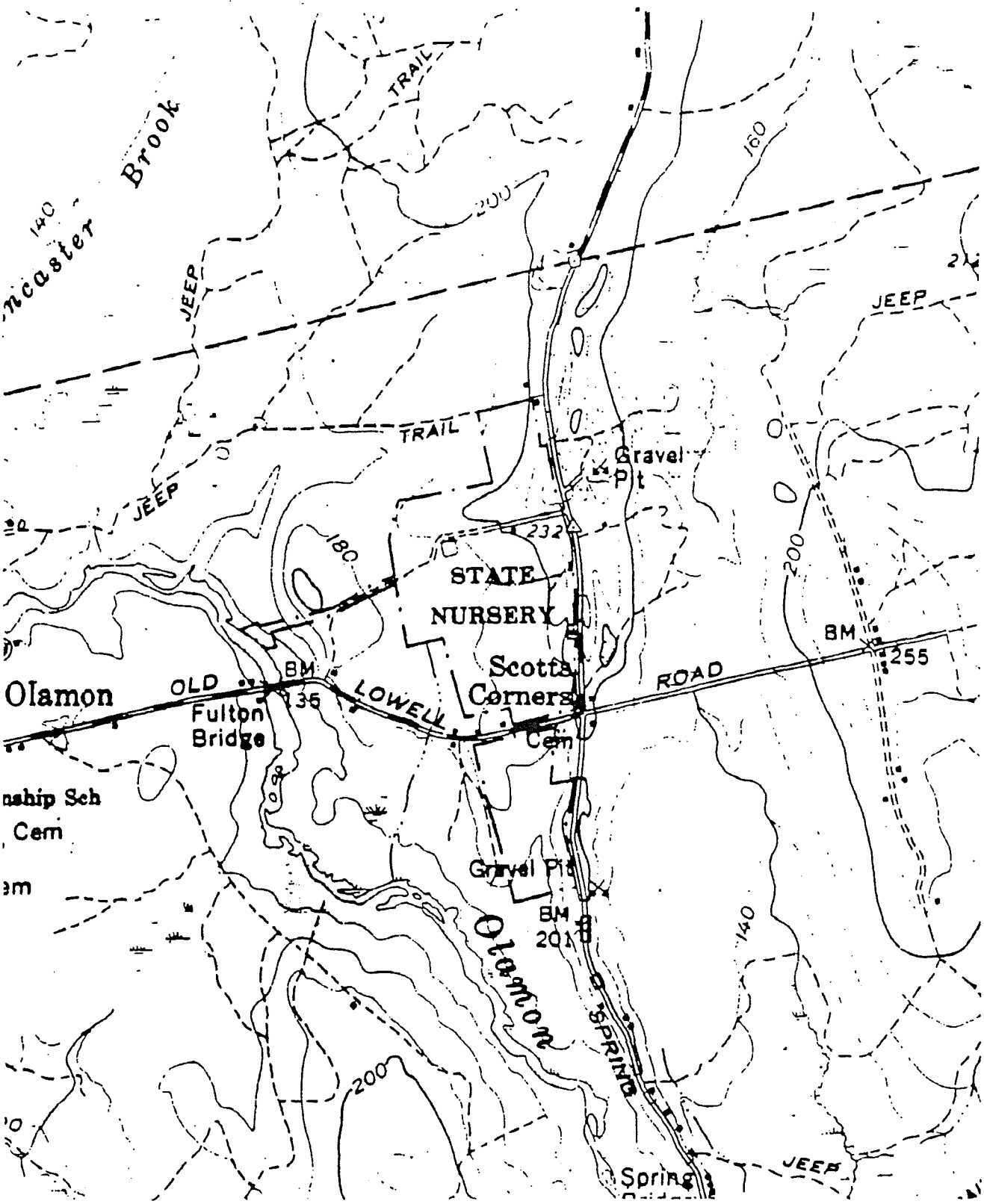

FIGURE 1
SITE LOCATION MAP

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GREENBUSH DISPOSAL FACILITY
OBSERVATION WELL LOCATIONS

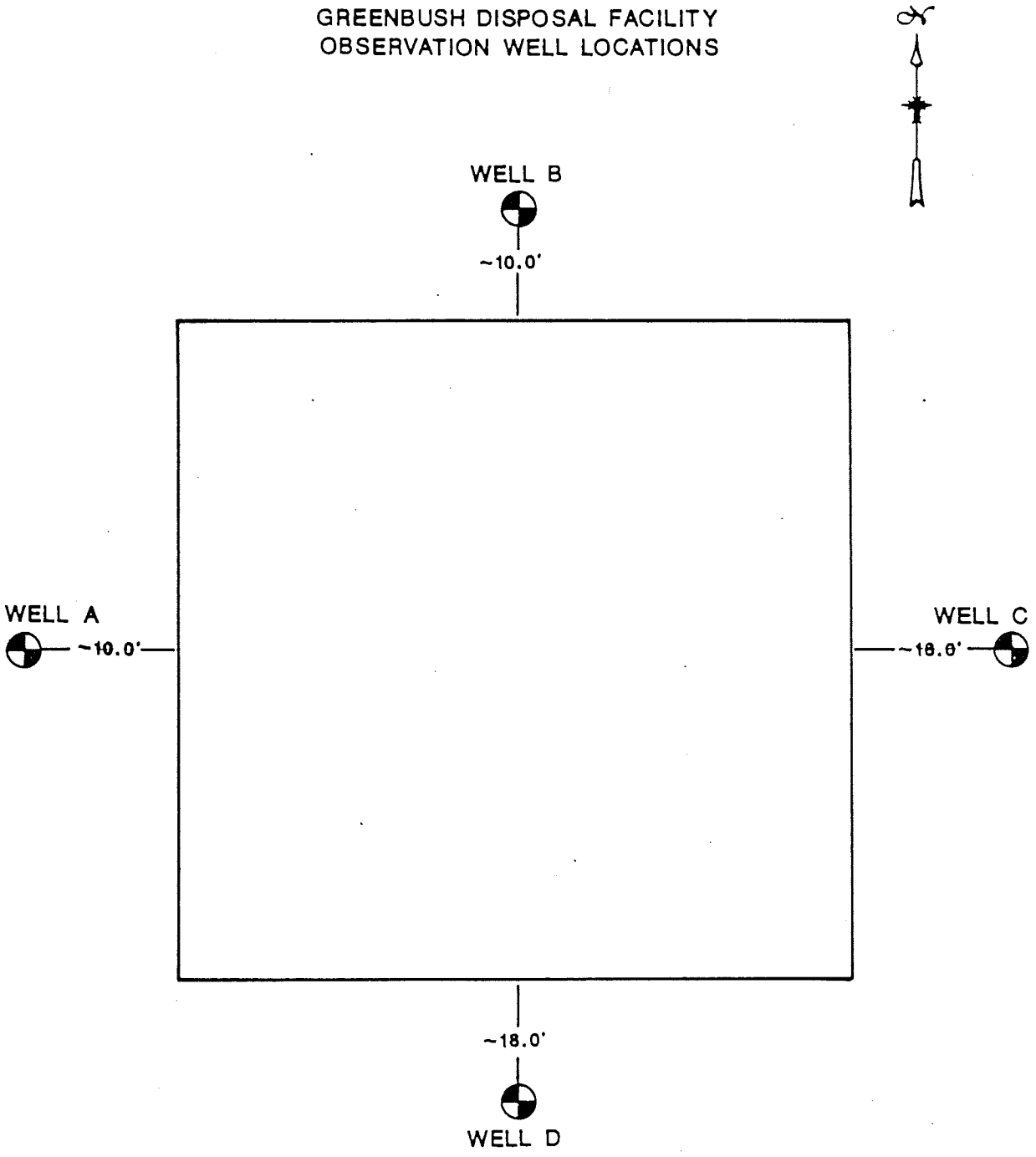


FIGURE 2
OBSERVATION WELL LOCATIONS

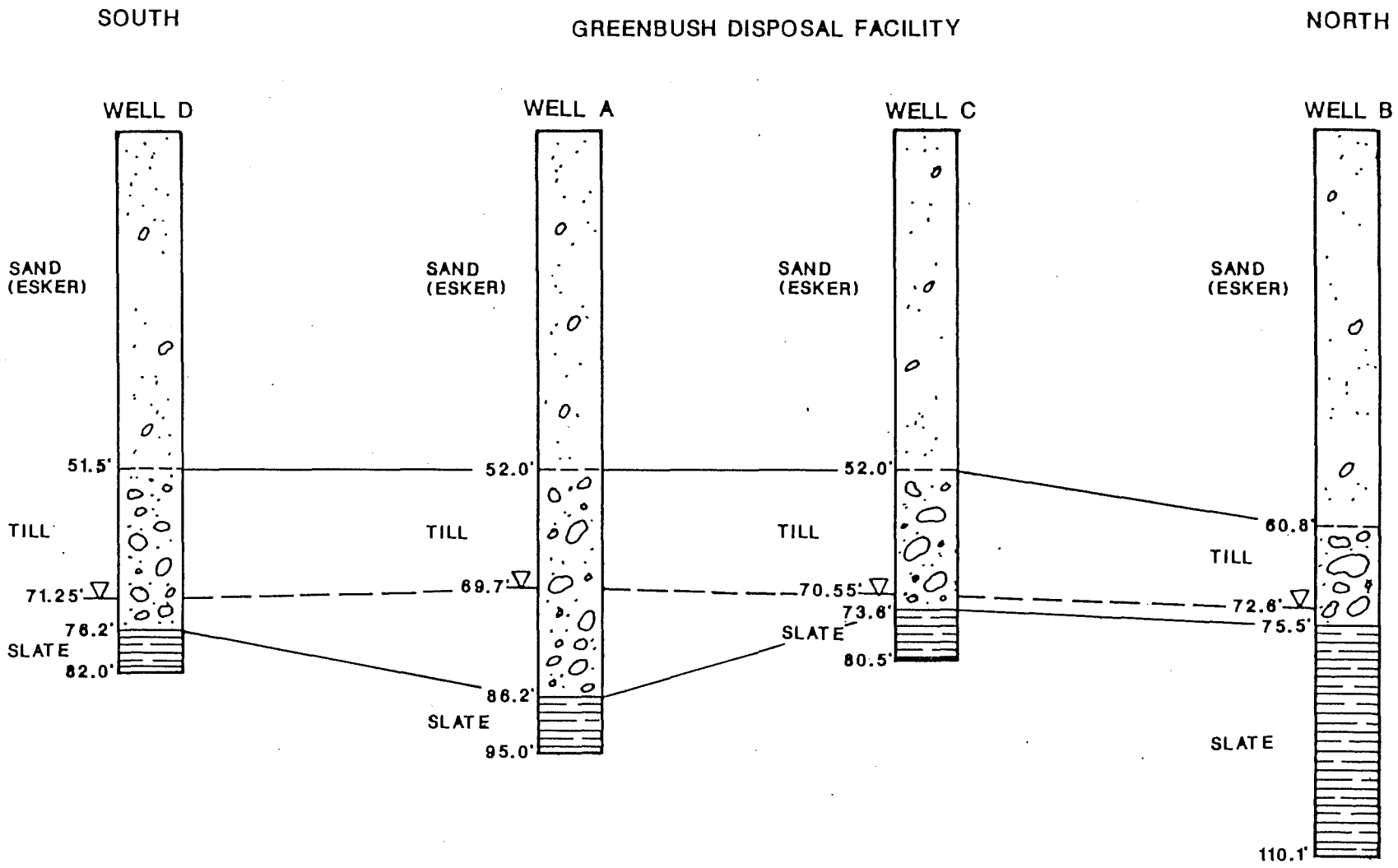


FIGURE 3

NORTH-SOUTH PROFILE

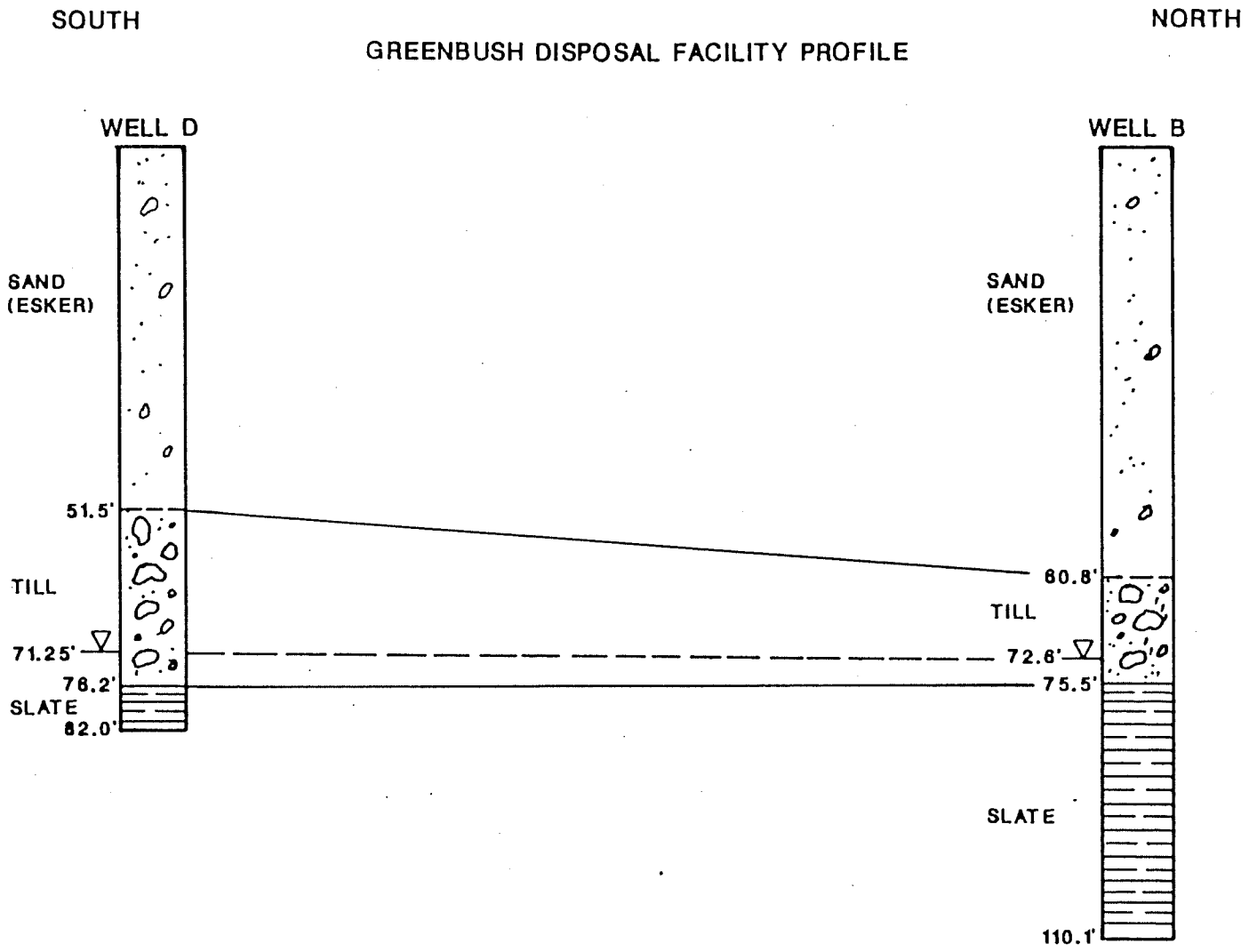


FIGURE 4

PROFILE WELL B TO WELL D

WEST

EAST

GREENBUSH DISPOSAL FACILITY PROFILE

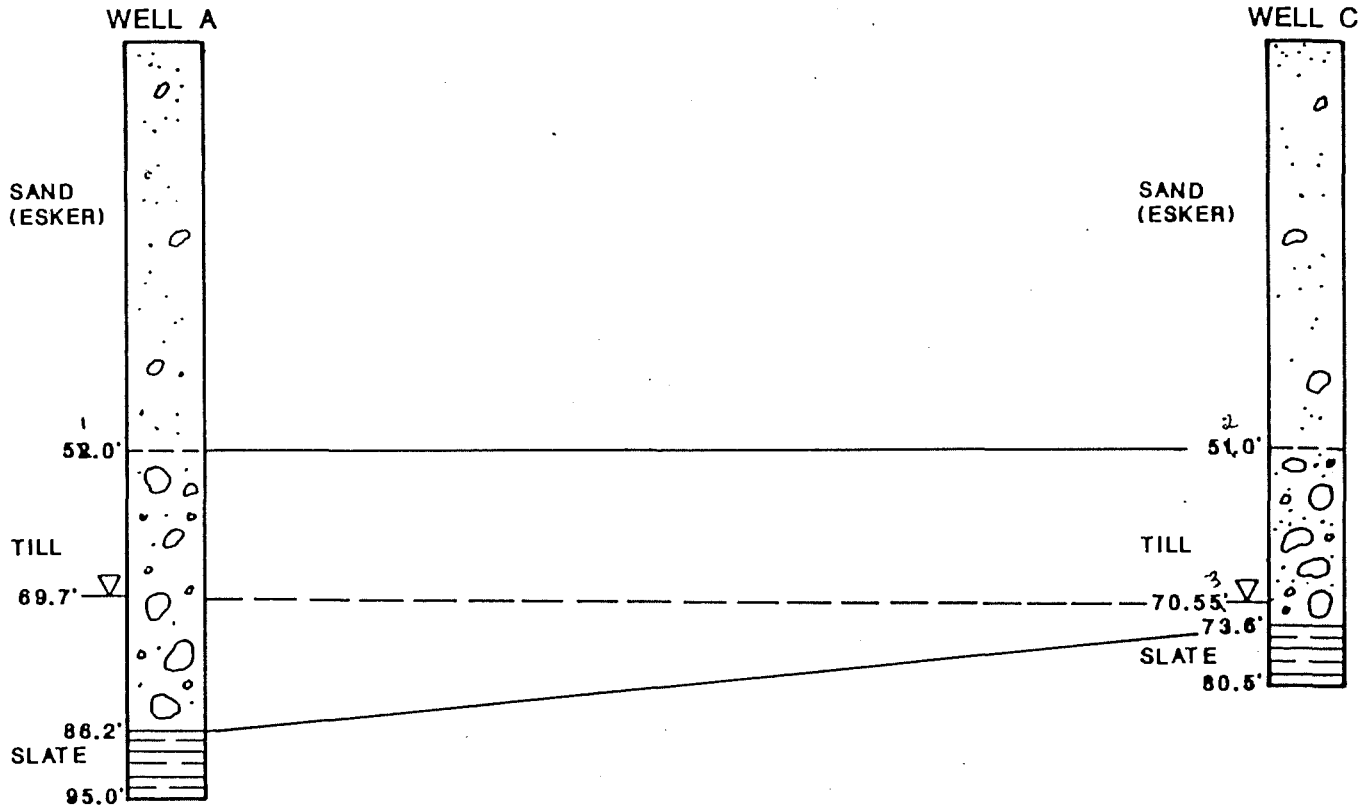


FIGURE 5

PROFILE WELL C TO WELL A

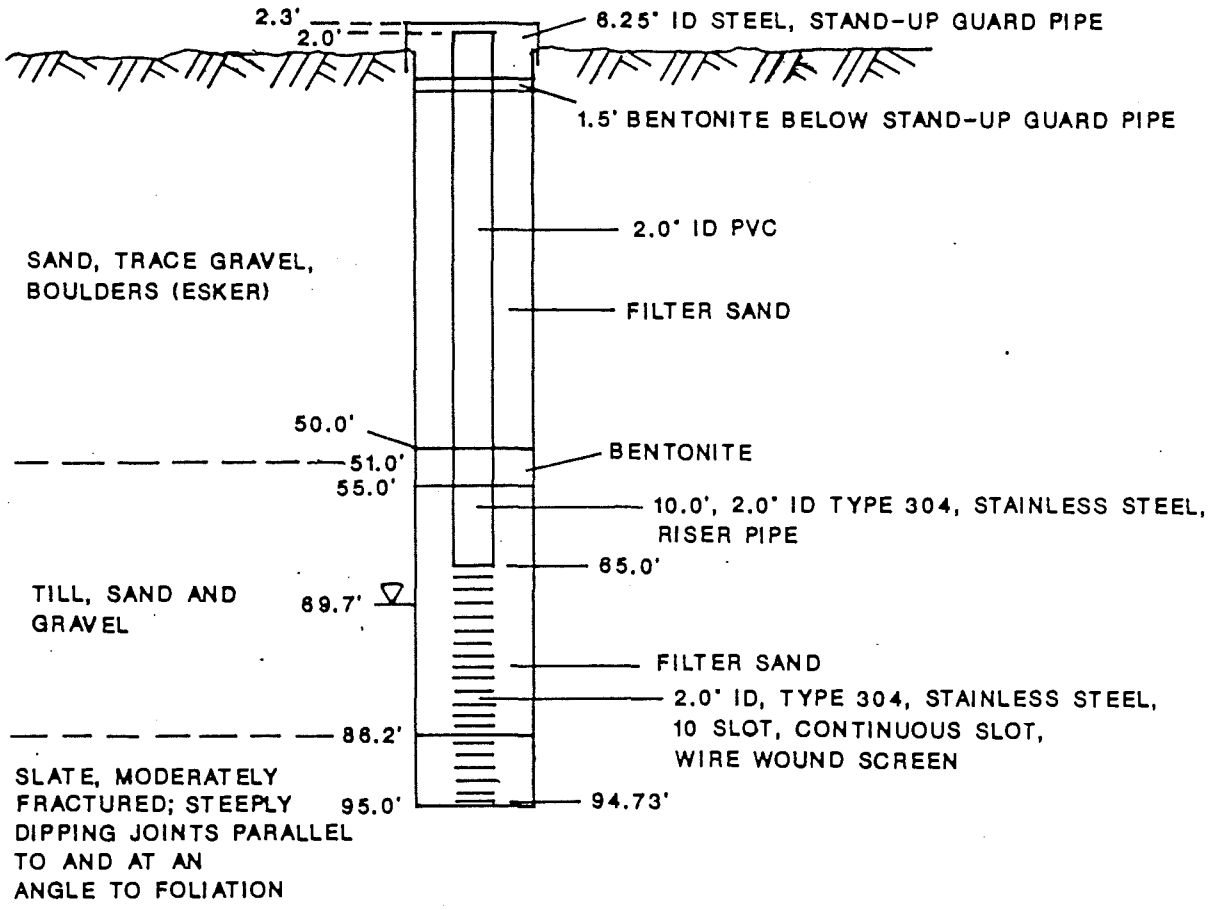
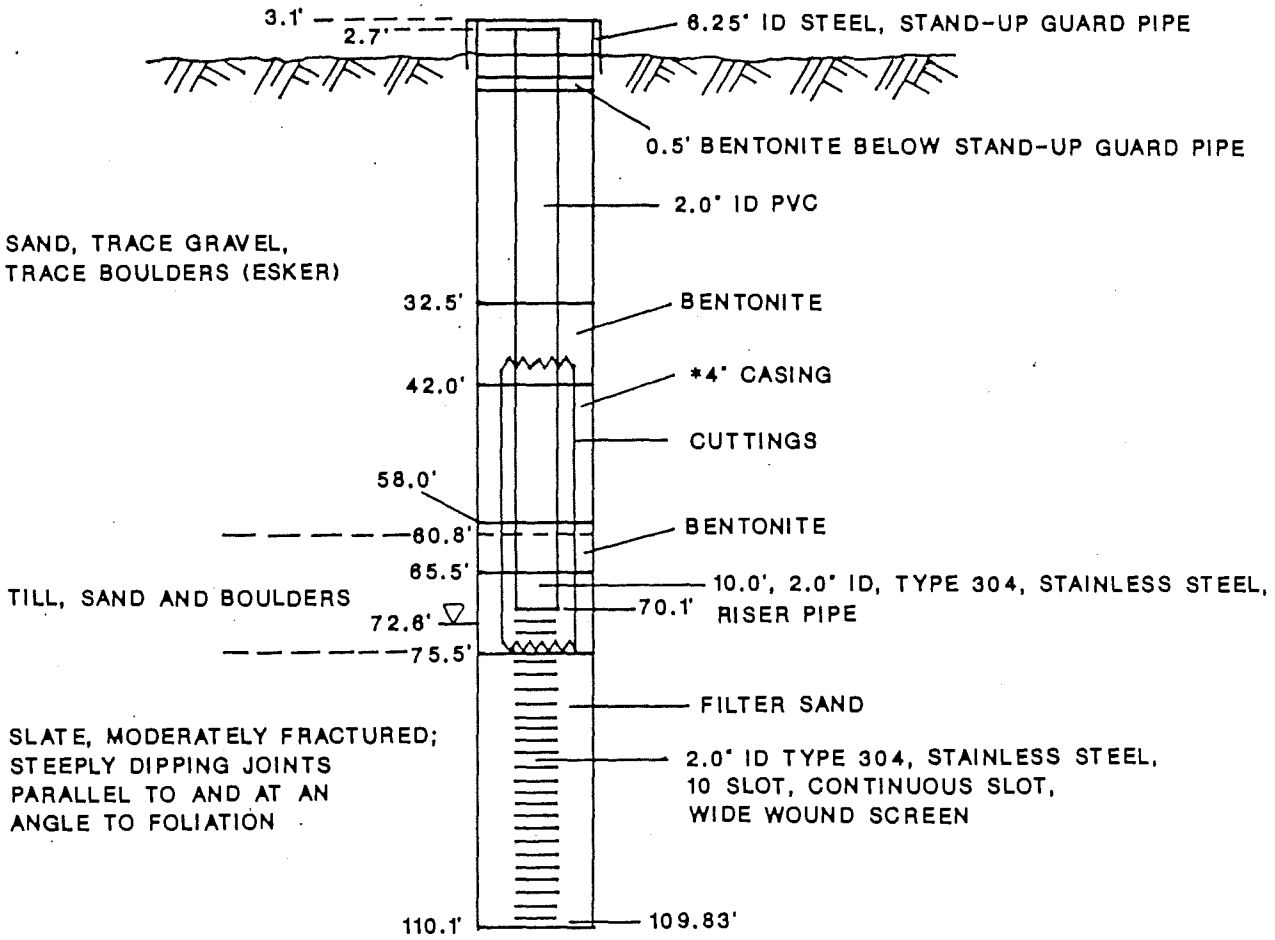
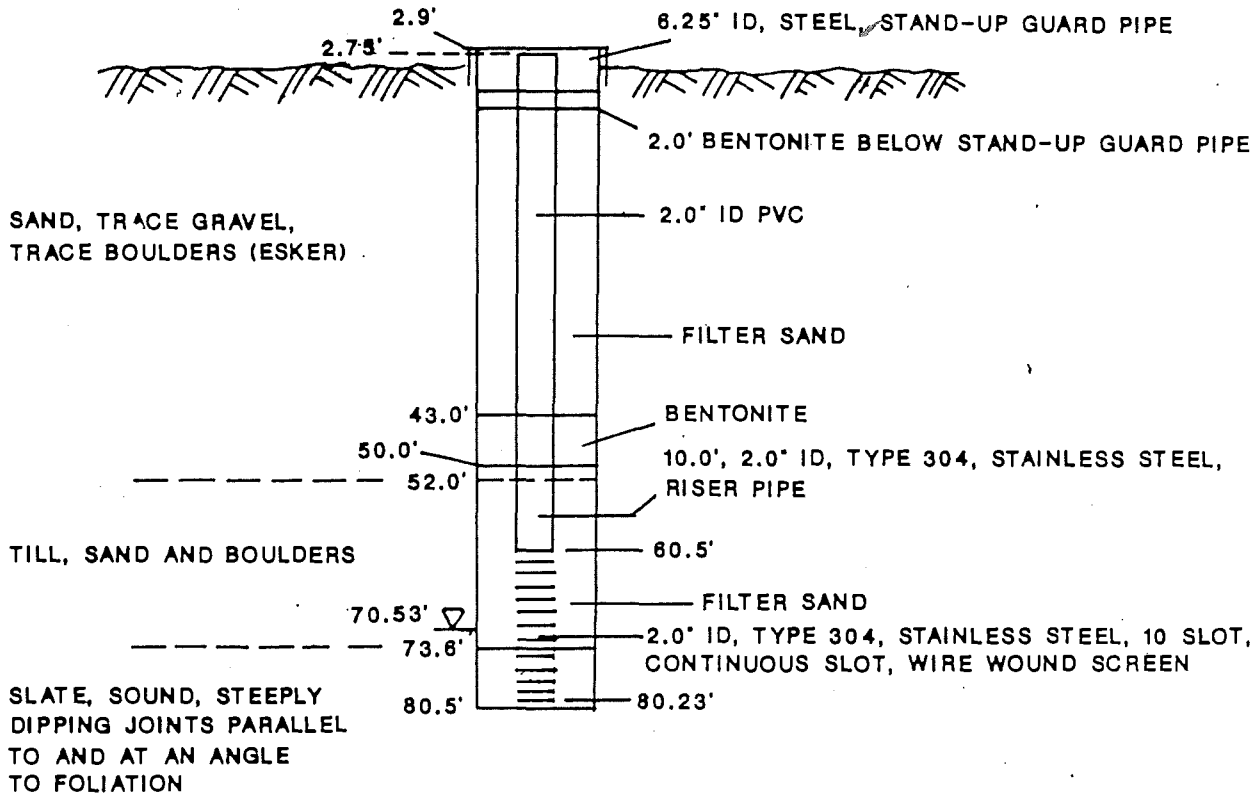


FIGURE 6
WELL A



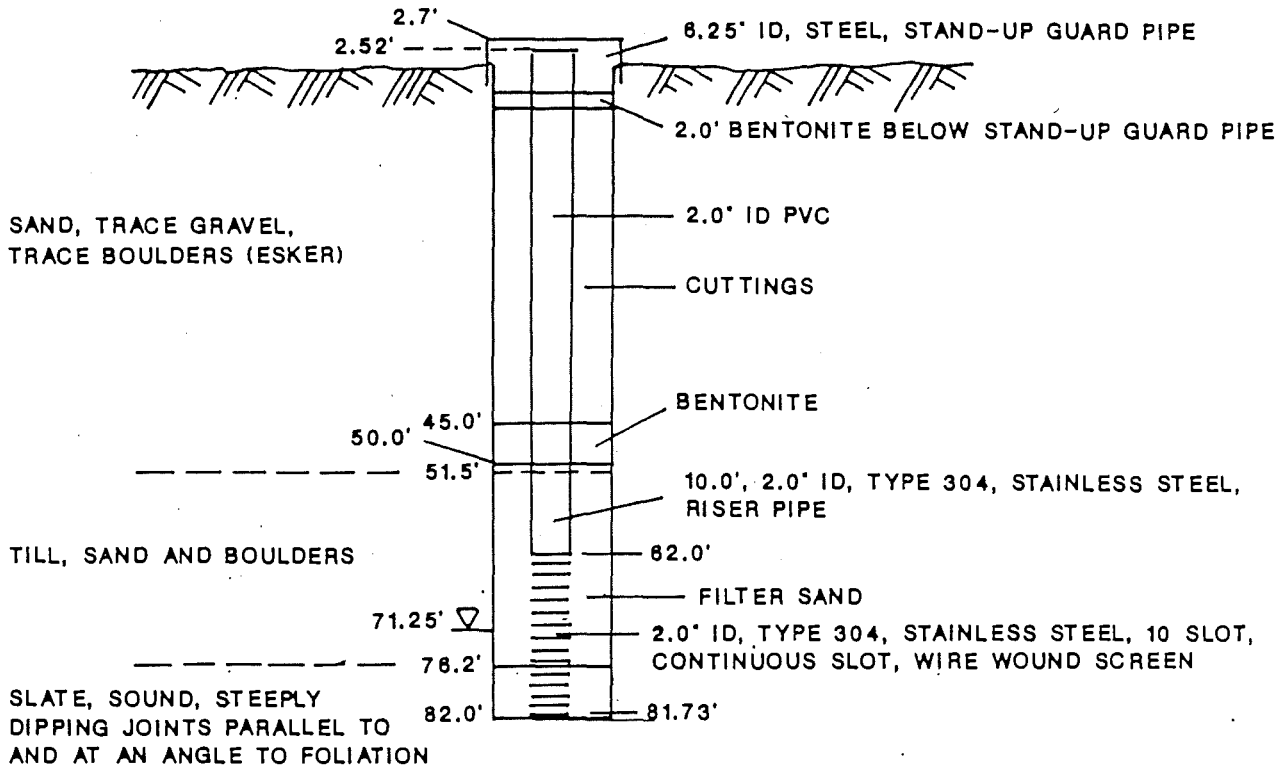
*NOTE: 4" CASING BROKE OFF IN THE HOLE FROM 40.0'-75.5'

FIGURE 7
WELL B



*NOTE: WHILE DRILLING IN TILL AND SLATE WATER LOSS WAS 100%

FIGURE 8
WELL C



*NOTE: WHILE DRILLING IN TILL AND SLATE WATER LOSS WAS 100%

FIGURE 9
WELL D

8.0 REFERENCES

Osberg, P.H., A.M. Hussey, II, G.M. Boone, editors, 1985. Bedrock Geologic Map of Maine, Dept. of Conservation, Maine Geological Survey, Augusta, ME., Scale 1:500,000.

Roy, D.C., 1981. Reconnaissance Bedrock Geology of the Sherman, Mattawamkeag, and Millinocket 15' Quadrangles, Maine, Open-File Report 81-46, Dept. of Conservation, Maine Geological Survey, Augusta, ME., 18 p.

Thompson, W.B. and H.W. Borns, Jr., editors, 1985. Surficial Geologic Map of Maine, Dept. of Conservation, Maine Geological Survey, Augusta, ME., Scale 1:500,000.

U.S. Geological Survey, 1988. Passadumkeag 15' Quadrangle, Maine-Penobscot Co., 7.5 Minute Series, Topographic Map, Dept. of the Interior, U.S. Geological Survey, Reston, VA., Scale 1:24,000.
LOCATION

ATTACHMENT 1
LABORATORY DATA SHEETS

FedEx 3958135151

CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.
CHAIN OF CUSTODY FORM

Page 1 of 1

Client Name: Stone & Webster
Address: 245 Summer St
City/State/Zip: Boston, MA 02107
Contact: R. Skryness
Telephone No.: 617-589-2076

Project Name: Greenbush Disposal Facility
Project No.: 18988.01

Company: (Signature)

Remarks:

Preserved in field yes ✓ no ___

Sampler (Signature) Larry Pilling / Richard Skryness

Sample No.	Date	Time	Comp.	Grab	Sample Location	Seals in Tact yes	Seals in Tact no	No. of Containers	Test Requested: TCLP	Test Requested: Per Contract	REMARKS
A	5/8/92	10:28			Well A	✓		4	X		Groundwater
B	5/8/92	11:14			Well B	✓		4	X		"
B-DUP	5/8/92	11:14			Well B	✓		4	X		"
C	5/8/92	11:45			Well C	✓		4	X		"
D	5/8/92	12:14			Well D	✓		4	X		"
Equip/Blnk	5/8/92	10:04			Well A	✓		4	X		"
Blank	5/8/92	9:40			Inside fence	* N/A		1	X		* Flow Rate = 2.2 LPM
Sample 1	5/8/92	10:47			Inside fence	* N/A		1	X		* " " = 2.2 LPM
						* NO SEAL					* Gas (Vapor)

Relinquished by: (Signature)	Date	Received By: (Signature)	Date	Relinquished by: (Signature)	Date	Received By: (Signature)	Date
Richard Skryness	5/8/92	Cecilia Rodriguez	5/11/92				
	1300 Time		9:20 Time		Time		Time
Relinquished by: (Signature)	Date	Received By: (Signature)	Date	Relinquished by: (Signature)	Date	Received By: (Signature)	Date
	Time		Time		Time		Time

Laboratory Remarks

Controls for Environmental Pollution, Inc.
P.O. BOX 5351 • Santa Fe, New Mexico 87502 IN STATE 505/982-9841
OUT OF STATE 800/545-2188 • FAX - 505-982-9289

Controls for Environmental
Pollution, Inc.
P. O. Box 5351
Santa Fe, NM 87502

Phone: (505) 982-9841/(800) 545-2188

Stone & Webster
245 Summer St.
Boston, MA 02107

Attn: Richard Skyrness
Invoice Number:

Order #: 92-05-211
Date: 06/15/92 10:55
Work ID: Water (NR)
Date Received: 05/11/92
Date Completed: 06/12/92
Client Code: STONE_WEB

ND - No man-made nuclides detected.

SAMPLE IDENTIFICATION

Sample Number	Sample Description
01	A Well A
02	B Well B
03	B-DUP Well B
04	C Well C
05	D Well D
06	Equip/Blank Well A

Remainder of sample(s) for routine analysis will be disposed of three weeks from final report date. Sample(s) for bacteria analysis only, will be disposed of immediately after analysis. This is not applicable if other arrangements have been made.

Approved By

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IN STATE 505-982-9811

TEST RESULTS BY SAMPLE

Sample: 01A A Well A Collected: 05/08/92 Category: WATER

Test Description	Result	D.L.	Units	Analyzed	By
Gamma Spectral Analysis	ND		pCi/liter		
Gross Alpha	<2		pCi/liter	05/20/92	CD
Gross Beta	<3		pCi/liter	05/20/92	CD

Sample: 02A B Well B Collected: 05/08/92 Category: WATER

Test Description	Result	D.L.	Units	Analyzed	By
Gamma Spectral Analysis	ND		pCi/liter		
Gross Alpha	<2		pCi/liter	05/20/92	CD
Gross Beta	<3		pCi/liter	05/20/92	CD

Sample: 03A B-DUP Well B Collected: 05/08/92 Category: WATER

Test Description	Result	D.L.	Units	Analyzed	By
Gamma Spectral Analysis	ND		pCi/liter		
Gross Alpha	<2		pCi/liter	05/20/92	CD
Gross Beta	<3		pCi/liter	05/20/92	CD

Sample: 04A C Well C Collected: 05/08/92 Category: WATER

Test Description	Result	D.L.	Units	Analyzed	By
Gamma Spectral Analysis	ND		pCi/liter		
Gross Alpha	14+/-6		pCi/liter	05/20/92	CD
Gross Beta	38+/-8		pCi/liter	05/20/92	CD

Sample: 05A D Well D Collected: 05/08/92 Category: WATER

Test Description	Result	D.L.	Units	Analyzed	By
Gamma Spectral Analysis	ND		pCi/liter		
Gross Alpha	13+/-7		pCi/liter	05/20/92	CD
Gross Beta	38+/-8		pCi/liter	05/20/92	CD

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Order # 92-05-211 Controls for Environmental
06/15/92 10:55 TEST RESULTS BY SAMPLE

Sample: 06A Equip/Blank Well A Collected: 05/08/92 Category: WATER

Test Description	Result	D.L.	Units	Analyzed	By
Gamma Spectral Analysis	ND		pCi/liter		
Gross Alpha	<2		pCi/liter	05/20/92	CD
Gross Beta	<3		pCi/liter	05/20/92	CD

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Controls for Environmental
Pollution, Inc
P O. Box 5351
Santa Fe, NM 87502

Phone: (505) 982-9841/(800) 545-2188

Stone & Webster
245 Summer St
Boston, MA 02107

Attn: Richard Sigrness
Invoice Number

Order #: 92-06-502
Date: 07/01/92 16:09
Work ID: Filter -NR-
Date Received: 06/23/92
Date Completed: 07/01/92
Client Code: STONE_WEB

* Amount of suspended solids in 1000ml of water

SAMPLE IDENTIFICATION

Sample Number	Sample Description	Sample Number	Sample Description
01	C Well C	02	D Well D

Remainder of sample(s) for routine analysis will be disposed of three weeks from final report date. Sample(s) for bacteria analysis only will be disposed of immediately after analysis. This is not applicable if other arrangements have been made

Approved By

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IN STATE 505/982-9811

Order # 92-06-502 Controls for Environmental Page 2
07/01/92 16 09 TEST RESULTS BY SAMPLE

Sample 01A C Well C Collected 05/06/92 Category FILTER

Test Description	Result	D L	Units	Analyzed	By
Suspended Solids	1.0060*		grams		

Sample 02A D Well D Collected 05/08/92 Category: FILTER

Test Description	Result	D L	Units	Analyzed	By
Suspended Solids	1.2880*		grams		

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Order # 92-06-502 Controls for Environmental Page 3
07/01/92 16:09 TEST RESULTS BY SAMPLE

Sample Description: C Well C Lab No: 01A
Test Description: Gross Alpha.Beta Method: Test Code: AB_S
Collected: 05/08/92 11 45 Category: FILTER

Type of Analysis	RESULT
Gross Alpha	1.25+/-0.58
Gross Beta	2.39+/-0.74

All results reported in

UNITS pCi/gram

Sample Description: D Well D Lab No: 02A
Test Description: Gross Alpha/Beta Method: Test Code: AB_S
Collected: 05/08/92 12 14 Category: FILTER

Type of Analysis	RESULT
Gross Alpha	1.71+/-0.69
Gross Beta	4.46+/-0.83

All results reported in

UNITS pCi/gram

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Controls for Environmental
Pollution, Inc
P. O. Box 5351
Santa Fe, NM 87502

Phone: (505) 982-9041/(800) 545-2188

Stone & Webster
245 Summer St.
Boston, MA 02107

Attn: Richard Skyrness
Invoice Number:

Order #: 92-06-501
Date: 07/01/92 10:49
Work ID: Water (NR)
Date Received: 06/23/92
Date Completed 07/01/92
Client Code: STONE_WEB

SAMPLE IDENTIFICATION

Sample Number	Sample Description	Sample Number	Sample Description
01	C Well C	02	D Well D

Remainder of sample(s) for routine analysis will be disposed of three weeks from final report date. Sample(s) for bacteria analysis only, will be disposed of immediately after analysis. This is not applicable if other arrangements have been made

Approved By

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Sample 01A C Well C Collected 05/08/92 Category WATER

Test Description	Result	D L	Units	Analyzed	By
Gross Alpha (dissolved)	<2		pCi/liter	06/25/92	LH
Gross Beta (dissolved)	<3		pCi/liter	06/25/92	LH

Sample 02A D Well D Collected 05/08/92 Category WATER

Test Description	Result	D L	Units	Analyzed	By
Gross Alpha (dissolved)	<2		pCi/liter	06/25/92	LH
Gross Beta (dissolved)	<3		pCi/liter	06/25/92	LH

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Sample Description: C Well C Lab No: 01A
Test Description: Gross Alpha/Beta Method: Test Code: AB_S
Collected: 05/08/92 11 45 Category: FILTER

Type of Analysis	RESULT
Gross Alpha	1.25+/-0.58
Gross Beta	2.39+/-0.74

All results reported in

UNITS pCi/gram

Sample Description: D Well D Lab No: 02A
Test Description: Gross Alpha/Beta Method: Test Code: AB_S
Collected: 05/08/92 12:14 Category: FILTER

Type of Analysis	RESULT
Gross Alpha	1.71+/-0.69
Gross Beta	4.46+/-0.83

All results reported in

UNITS pCi/gram

Controls for Environmental Pollution, Inc.
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IN STATE 505/982-9811

TEST RESULTS BY SAMPLE

Sample Description: A Well A
Test Description: EPA - method 624
Collected: 05/08/92 10:28

Lab No: 01B
Method:
Category: WATER

Test Code: 624_1

PARAMETER	RESULT	LIMIT
Chloromethane	<10	10
Bromomethane	<10	10
Vinyl Chloride	<10	10
Chloroethane	<10	10
Methylene Chloride	3.6	2.8
1,1-Dichloroethene	<2.8	2.8
1,1-Dichloroethane	<4.7	4.7
trans-1,2-Dichloroethene	<1.6	1.6
Chloroform	3.5	1.6
1,2-Dichloroethane	<2.8	2.8
Trichlorofluoromethane	<5.0	5.0
1,1,1-Trichloroethane	<3.8	3.8
Carbon Tetrachloride	<2.8	2.8
Bromodichloromethane	<2.2	2.2
1,1,2,2-Tetrachloroethane	<6.9	6.9
1,2-Dichloropropane	<6.0	6.0
trans-1,3-Dichloropropene	<5.0	5.0
Trichloroethene	<1.9	1.9
Dibromochloromethane	<3.1	3.1
1,1,2-Trichloroethane	<5.0	5.0
Benzene	<4.4	4.4
cis-1,3-Dichloropropene	<5.0	5.0
2-Chloroethyl Vinyl Ether	<5.0	5.0
Bromoform	<4.7	4.7
Tetrachloroethene	<4.1	4.1
Toluene	<6.0	6.0
Chlorobenzene	<6.0	6.0
Ethyl Benzene	<7.2	7.2
1,3-Dichlorobenzene	<5.0	5.0
1,2-Dichlorobenzene	<5.0	5.0

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TEST RESULTS BY SAMPLE

Sample Description: A Well A Lab No: 01B
Test Description: EPA - method 624 Method: Test Code: 624_1
Collected: 05/08/92 10:28 Category: WATER

1,4-Dichlorobenzene	<5.0	5.0

Notes and Definitions for this Report:

DATE RUN 05/22/92
ANALYST DVM
UNITS ug/liter

Controls for Environmental Pollution, Inc.
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IN STATE 505/982-9881

TEST RESULTS BY SAMPLE

Sample Description: B Well B Lab No: 02B
Test Description: EPA - method 624 Method: Test Code: 624_1
Collected: 05/08/92 11:14 Category: WATER

PARAMETER	RESULT	LIMIT
Chloromethane	<10	10
Bromomethane	<10	10
Vinyl Chloride	<10	10
Chloroethane	<10	10
Methylene Chloride	3.2	2.8
1,1-Dichloroethene	<2.8	2.8
1,1-Dichloroethane	<4.7	4.7
trans-1,2-Dichloroethene	<1.6	1.6
Chloroform	<1.6	1.6
1,2-Dichloroethane	<2.8	2.8
Trichlorofluoromethane	<5.0	5.0
1,1,1-Trichloroethane	<3.8	3.8
Carbon Tetrachloride	<2.8	2.8
Bromodichloromethane	<2.2	2.2
1,1,2,2-Tetrachloroethane	<6.9	6.9
1,2-Dichloropropane	<6.0	6.0
trans-1,3-Dichloropropene	<5.0	5.0
Trichloroethene	<1.9	1.9
Dibromochloromethane	<3.1	3.1
1,1,2-Trichloroethane	<5.0	5.0
Benzene	<4.4	4.4
cis-1,3-Dichloropropene	<5.0	5.0
2-Chloroethyl Vinyl Ether	<5.0	5.0
Bromoform	<4.7	4.7
Tetrachloroethene	<4.1	4.1
Toluene	<6.0	6.0
Chlorobenzene	<6.0	6.0
Ethyl Benzene	<7.2	7.2
1,3-Dichlorobenzene	<5.0	5.0
1,2-Dichlorobenzene	<5.0	5.0

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IN STATE 505/982-9811

Sample Description: B Well B Lab No: 02B
Test Description: EPA - method 624 Method: Test Code: 624_1
Collected: 05/08/92 11:14 Category: WATER

1,4-Dichlorobenzene	<5.0	5.0

Notes and Definitions for this Report:

DATE RUN 05/22/92
ANALYST DVM
UNITS ug/liter

Controls for Environmental Pollution, Inc.
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Order # 92-05-211 Controls for Environmental Page 8
06/15/92 10:55 TEST RESULTS BY SAMPLE

Sample Description: B-DUP Well B Lab No: 03B
Test Description: EPA - method 624 Method: Test Code: 624_1
Collected: 05/08/92 11:14 Category: WATER

PARAMETER	RESULT	LIMIT
Chloromethane	<10	10
Bromomethane	<10	10
Vinyl Chloride	<10	10
Chloroethane	<10	10
Methylene Chloride	3.0	2.8
1,1-Dichloroethene	<2.8	2.8
1,1-Dichloroethane	<4.7	4.7
trans-1,2-Dichloroethene	<1.6	1.6
Chloroform	3.7	1.6
1,2-Dichloroethane	<2.8	2.8
Trichlorofluoromethane	<5.0	5.0
1,1,1-Trichloroethane	<3.8	3.8
Carbon Tetrachloride	<2.8	2.8
Bromodichloromethane	<2.2	2.2
1,1,2,2-Tetrachloroethane	<6.9	6.9
1,2-Dichloropropane	<6.0	6.0
trans-1,3-Dichloropropene	<5.0	5.0
Trichloroethene	<1.9	1.9
Dibromochloromethane	<3.1	3.1
1,1,2-Trichloroethane	<5.0	5.0
Benzene	<4.4	4.4
cis-1,3-Dichloropropene	<5.0	5.0
2-Chloroethyl Vinyl Ether	<5.0	5.0
Bromoform	<4.7	4.7
Tetrachloroethene	<4.1	4.1
Toluene	<6.0	6.0
Chlorobenzene	<6.0	6.0
Ethyl Benzene	<7.2	7.2
1,3-Dichlorobenzene	<5.0	5.0
1,2-Dichlorobenzene	<5.0	5.0

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Sample Description: B-DUP Well B Lab No: 03B
Test Description: EPA - method 624 Method: Test Code: 624_1
Collected: 05/08/92 11:14 Category: WATER

1,4-Dichlorobenzene	<5.0	5.0

Notes and Definitions for this Report:

DATE RUN 05/22/92
ANALYST DVM
UNITS ug/liter

Controls for Environmental Pollution, Inc.
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Order # 92-05-211 Controls for Environmental
06/15/92 10:55 TEST RESULTS BY SAMPLE

Sample Description: C Well C Lab No: 04B
Test Description: EPA - method 624 Method: Test Code: 624_1
Collected: 05/08/92 11:45 Category: WATER

PARAMETER	RESULT	LIMIT
Chloromethane	<10	10
Bromomethane	<10	10
Vinyl Chloride	<10	10
Chloroethane	<10	10
Methylene Chloride	3.0	2.8
1,1-Dichloroethene	<2.8	2.8
1,1-Dichloroethane	<4.7	4.7
trans-1,2-Dichloroethene	<1.6	1.6
Chloroform	<1.6	1.6
1,2-Dichloroethane	<2.8	2.8
Trichlorofluoromethane	<5.0	5.0
1,1,1-Trichloroethane	<3.8	3.8
Carbon Tetrachloride	<2.8	2.8
Bromodichloromethane	<2.2	2.2
1,1,2,2-Tetrachloroethane	<6.9	6.9
1,2-Dichloropropane	<6.0	6.0
trans-1,3-Dichloropropene	<5.0	5.0
Trichloroethene	<1.9	1.9
Dibromochloromethane	<3.1	3.1
1,1,2-Trichloroethane	<5.0	5.0
Benzene	<4.4	4.4
cis-1,3-Dichloropropene	<5.0	5.0
2-Chloroethyl Vinyl Ether	<5.0	5.0
Bromoform	<4.7	4.7
Tetrachloroethene	<4.1	4.1
Toluene	<6.0	6.0
Chlorobenzene	<6.0	6.0
Ethyl Benzene	<7.2	7.2
1,3-Dichlorobenzene	<5.0	5.0
1,2-Dichlorobenzene	<5.0	5.0

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IN STATE 505/982-9811

TEST RESULTS BY SAMPLE

Sample Description: C Well C Lab No: 04B
Test Description: EPA - method 624 Method: Test Code: 624_1
Collected: 05/08/92 11:45 Category: WATER

1,4-Dichlorobenzene	<5.0	5.0

Notes and Definitions for this Report:

DATE RUN 05/22/92
ANALYST DVM
UNITS ug/liter

Controls for Environmental Pollution, Inc.
P.O. BOX 5351 • Santa Fe, New Mexico 87502 OUT OF STATE 800/545-2188 • FAX - 505-982-9289

Sample Description: D Well D Lab No: 05B
Test Description: EPA - method 624 Method: Test Code: 624_1
Collected: 05/08/92 12:14 Category: WATER

PARAMETER	RESULT	LIMIT
Chloromethane	<10	10
Bromomethane	<10	10
Vinyl Chloride	<10	10
Chloroethane	<10	10
Methylene Chloride	3.8	2.8
1,1-Dichloroethene	<2.8	2.8
1,1-Dichloroethane	<4.7	4.7
trans-1,2-Dichloroethene	<1.6	1.6
Chloroform	3.5	1.6
1,2-Dichloroethane	<2.8	2.8
Trichlorofluoromethane	<5.0	5.0
1,1,1-Trichloroethane	<3.8	3.8
Carbon Tetrachloride	<2.8	2.8
Bromodichloromethane	<2.2	2.2
1,1,2,2-Tetrachloroethane	<6.9	6.9
1,2-Dichloropropane	<6.0	6.0
trans-1,3-Dichloropropene	<5.0	5.0
Trichloroethene	<1.9	1.9
Dibromochloromethane	<3.1	3.1
1,1,2-Trichloroethane	<5.0	5.0
Benzene	<4.4	4.4
cis-1,3-Dichloropropene	<5.0	5.0
2 Chloroethyl Vinyl Ether	<5.0	5.0
Bromoform	<4.7	4.7
Tetrachloroethene	<4.1	4.1
Toluene	<6.0	6.0
Chlorobenzene	<6.0	6.0
Ethyl Benzene	<7.2	7.2
1,3-Dichlorobenzene	<5.0	5.0
1,2-Dichlorobenzene	<5.0	5.0

Controls for Environmental Pollution, Inc.
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OUT OF STATE 800/545-2188 • FAX - 505-982-9289

Sample Description: D Well D Lab No: 05B
Test Description: EPA - method 624 Method: Test Code: 624_1
Collected: 05/08/92 12:14 Category: WATER

1,4-Dichlorobenzene	<5.0	5.0

Notes and Definitions for this Report:

DATE RUN 05/22/92
ANALYST DVM
UNITS ug/liter

Controls for Environmental Pollution, Inc.
P.O. BOX 5351 • Santa Fe, New Mexico 87502 OUT OF STATE 800/545-2188 • FAX - 505-982-9289
IN STATE 505/982-9811

Order # 92-05-211
06/15/92 10:55

Controls for Environmental
TEST RESULTS BY SAMPLE

Sample Description: Equip/Blank Well A
Test Description: EPA - method 624
Collected: 05/08/92 10.04

Lab No: 06B
Method:
Category: WATER

Test Code: 624_1

PARAMETER	RESULT	LIMIT
Chloromethane	<10	10
Bromomethane	<10	10
Vinyl Chloride	<10	10
Chloroethane	<10	10
Methylene Chloride	3.1	2.8
1,1-Dichloroethene	<2.8	2.8
1,1-Dichloroethane	<4.7	4.7
trans-1,2-Dichloroethene	<1.6	1.6
Chloroform	<1.6	1.6
1,2-Dichloroethane	<2.8	2.8
Trichlorofluoromethane	<5.0	5.0
1,1,1-Trichloroethane	<3.8	3.8
Carbon Tetrachloride	<2.8	2.8
Bromodichloromethane	<2.2	2.2
1,1,2,2-Tetrachloroethane	<6.9	6.9
1,2-Dichloropropane	<6.0	6.0
trans-1,3-Dichloropropene	<5.0	5.0
Trichloroethene	<1.9	1.9
Dibromochloromethane	<3.1	3.1
1,1,2-Trichloroethane	<5.0	5.0
Benzene	<4.4	4.4
cis-1,3-Dichloropropene	<5.0	5.0
2-Chloroethyl Vinyl Ether	<5.0	5.0
Bromoform	<4.7	4.7
Tetrachloroethene	<4.1	4.1
Toluene	<6.0	6.0
Chlorobenzene	<6.0	6.0
Ethyl Benzene	<7.2	7.2
1,3-Dichlorobenzene	<5.0	5.0
1,2-Dichlorobenzene	<5.0	5.0

Controls for Environmental Pollution, Inc.
P.O. BOX 5351 • Santa Fe, New Mexico 87502
IN STATE 505/982-9811
OUT OF STATE 800/545-2188 • FAX - 505-982-9289

Sample Description: Equip/Blank Well A
Test Description: EPA - method 624
Collected: 05/08/92 10:04
Lab No: 06B
Method:
Category: WATER
Test Code: 624_1

1,4-Dichlorobenzene	<5.0	5.0

Notes and Definitions for this Report:

DATE RUN 05/22/92
ANALYST DVM
UNITS ug/liter

Controls for Environmental Pollution, Inc.
P.O. BOX 5351 • Santa Fe, New Mexico 87502 OUT OF STATE 800/545-2188 • FAX - 505-982-9289

Controls for Environmental
Pollution, Inc.
P. O. Box 5351
Santa Fe, NM 87502

Phone: (505) 982-9841/(800) 545-2188

Stone & Webster
245 Summer St.
Boston, MA 02107

Attn: Richard Skyrness
Invoice Number:

Order #: 92-05-212
Date: 07/15/92 11:25
Work ID: Soil Gas Vapor (NR)
Date Received: 05/11/92
Date Completed: 07/14/92
Client Code: STONE_WEB

SAMPLE IDENTIFICATION

Sample Number	Sample Description	Sample Number	Sample Description
01	BLANK Inside Fence	02	SAMPLE 1 Inside Fence

Remainder of sample(s) for routine analysis will be disposed of three weeks from final report date. Sample(s) for bacteria analysis only, will be disposed of immediately after analysis. This is not applicable if other arrangements have been made.

Approved By

Controls for Environmental Pollution, Inc.
P.O. BOX 5351 • Santa Fe, New Mexico 87502 OUT OF STATE 800/545-2188 • FAX - 505-982-9289

Sample Description: BLANK Inside Fence Lab No: 01A
Test Description: EPA - method 8240 Method: Test Code: 8240_5
Collected: 05/08/92 09:40 Category: SOIL_GAS_VAP

PARAMETER	RESULT	LIMIT
Chloromethane	<0.075	0.075
Bromomethane	<0.075	0.075
Vinyl Chloride	<0.015	0.015
Chloroethane	<0.075	0.075
Methylene Chloride	<0.021	0.021
Acetone	<0.075	0.075
Carbon Disulfide	<0.04	0.04
1,1-Dichloroethene	<0.021	0.021
1,1-Dichloroethane	<0.04	0.04
trans-1,2-Dichloroethene	<0.012	0.012
Chloroform	<0.012	0.012
1,2-Dichloroethane	<0.021	0.021
2-Butanone	<0.075	0.075
1,1,1-Trichloroethane	<0.029	0.029
Carbon Tetrachloride	<0.021	0.021
Vinyl Acetate	<0.075	0.075
Bromodichloromethane	<0.017	0.017
1,1,2,2-Tetrachloroethane	<0.051	0.051
1,2-Dichloropropane	<0.045	0.045
trans-1,3-Dichloropropene	<0.038	0.038
Trichloroethene	<0.014	0.014
Dibromochloromethane	<0.023	0.023
1,1,2-Trichloroethane	<0.038	0.038
Benzene	<0.033	0.033
cis-1,3-Dichloropropene	<0.038	0.038
2-Chloroethyl Vinyl Ether	<0.075	0.075
Bromoform	<0.035	0.035
2-Hexanone	<0.075	0.075

Controls for Environmental Pollution, Inc.
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TEST RESULTS BY SAMPLE

Sample Description: BLANK Inside Fence Lab No: 01A
Test Description: EPA - method 8240 Method: Test Code: 8240_5
Collected: 05/08/92 09:40 Category: SOIL_GAS_VAP

4-Methyl-2-Pentanone	<0.075	0.075
Tetrachloroethene	<0.031	0.031
Toluene	<0.045	0.045
Chlorobenzene	<0.045	0.045
Ethyl Benzene	<0.05	0.05
Styrene	<0.038	0.038
Total Xylenes	<0.038	0.038

Notes and Definitions for this Report:

DATE RUN 05/22/92
ANALYST DVM
UNITS mg/m3

Controls for Environmental Pollution, Inc.
P.O. BOX 5351 • Santa Fe, New Mexico 87502 OUT OF STATE 800/545-2188 • FAX - 505-982-9289

TEST RESULTS BY SAMPLE

Sample Description: SAMPLE 1 Inside Fence Lab No: 02A
Test Description: EPA - method 8240 Method: Test Code: 8240_5
Collected: 05/08/92 10:47 Category: SOIL_GAS_VAP

PARAMETER	RESULT	LIMIT
Chloromethane	<0.075	0.075
Bromomethane	<0.075	0.075
Vinyl Chloride	<0.015	0.015
Chloroethane	<0.075	0.075
Methylene Chloride	<0.021	0.021
Acetone	<0.075	0.075
Carbon Disulfide	0.04	0.04
1,1-Dichloroethene	<0.021	0.021
1,1-Dichloroethane	<0.04	0.04
trans-1,2-Dichloroethene	<0.012	0.012
Chloroform	<0.012	0.012
1,2-Dichloroethane	<0.021	0.021
2-Butanone	<0.075	0.075
1,1,1-Trichloroethane	<0.029	0.029
Carbon Tetrachloride	<0.021	0.021
Vinyl Acetate	<0.075	0.075
Bromodichloromethane	<0.017	0.017
1,1,2,2-Tetrachloroethane	<0.051	0.051
1,2-Dichloropropane	<0.045	0.045
trans-1,3-Dichloropropene	<0.038	0.038
Trichloroethene	<0.014	0.014
Dibromochloromethane	<0.023	0.023
1,1,2-Trichloroethane	<0.038	0.038
Benzene	<0.033	0.033
cis-1,3-Dichloropropene	<0.038	0.038
2-Chloroethyl Vinyl Ether	<0.075	0.075
Bromoform	<0.035	0.035
2-Hexanone	<0.075	0.075
4-Methyl-2-Pentanone	<0.075	0.075
Tetrachloroethene	<0.031	0.031

Controls for Environmental Pollution, Inc.
P.O. BOX 5689 • Santa Fe, New Mexico 87502 OUT OF STATE 800/545-2188 • FAX - 505-982-9289

TEST RESULTS BY SAMPLE

Sample Description: SAMPLE 1 Inside Fence Lab No: 02A
Test Description: EPA - method 8240 Method: Test Code: 8240_5
Collected: 05/08/92 10:47 Category: SOIL_GAS_VAP

Toluene	<0.045	0.045
Chlorobenzene	<0.045	0.045
Ethyl Benzene	<0.05	0.05
Styrene	<0.038	0.038
Total Xylenes	<0.038	10.0

Notes and Definitions for this Report:

DATE RUN 05/22/92
ANALYST DVM
UNITS mg/m3

WATER VOLATILE SURROGATE RECOVERY

Client Name: Stone

Date Analyzed: 5-22-92

Analyst: DVR

Data Reviewed By:

Procedure: 624 water 8240 Filter

Reference Page: 92195-156 8240
92065-071 624

CEP Surrogate Standard Log Number: 13216

CEP Sample Number	% Recovery 1,2-DCE-d4	% Recovery Tol-d8	% Recovery BFB	Total Out
SPCC/CCC	82	91	103	0
Blank MS	86	91	101	0
Blank MSD	89	92	104	0
Blank	77	89	105	0
9205211-01	82	93	111	0
9205211-02	77	93	113	0
9205211-03	80	95	111	0
9205211-04	82	96	114	0
9205211-05	85	92	108	0
9205211-06	83	95	112	0
9205212-01	77	89	105	0
9205212-02	92	95	113	0

Surrogate Compound Recovery: 0 out of 36 outside limits

	QC LIMITS
1,2-DCE-d4 = 1,2-Dichloroethane-d4	(76-114)
Tol-d8 = Toluene-d8	(88-110)
BFB = Bromofluorobenzene	(86-115)

Q. A. APPROVED
BY:
DATE: 6-19-92

* Value outside of required QC limit

Comments:

WATER VOLATILE SURROGATE RECOVERY

Client Name: Stone

Date Analyzed: 5-22-92

Analyst: Dun

Data Reviewed By:

Procedure: 624 with 8240 Fifth

Reference Page: 9L195-156 8240
9L065-071 624

CEP Surrogate Standard Log Number: 13216

CEP Sample Number	% Recovery 1,2-DCE-d4	% Recovery Tol-d8	% Recovery BFB	Total Out
Spcc/cca	82	91	103	0
Blank MS	86	91	101	0
Blank MSD	89	92	104	0
Blank	77	89	105	0
9L05211-01	81	90	111	0
9L05211-02	77	93	113	0
9L05211-03	80	99	111	0
9L05211-04	82	96	114	0
9L05211-05	85	92	108	0
9L05211-06	83	95	112	0
9L05212-01	77	89	105	0
9L05212-02	92	99	110	0

Surrogate Compound Recovery: 0 out of 36 outside limits

	QC LIMITS
1,2-DCE-d4 = 1,2-Dichloroethane-d4	(76-114)
Tol-d8 = Toluene-d8	(88-110)
BFB = Bromofluorobenzene	(86-115)

Q. A. APPROVED
BY:
DATE: 6-19-92

* Value outside of required QC limit

Comments:

WATER VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Client Name: Stone

Date Analyzed: 5-22-94

Analyst: Dur

Data Reviewed By:

Procedure: 8240 w/ Filter / 624 water

Reference Page: 94151-176 8240
94265-071 624

CEP Matrix Spike Standard Log Number: 13218

CEP Sample # on this report: 9405211-01 | 9405211-05 | _____
-02 | 9405212-01 | _____
-03 | -02 | _____
-04 | 7 only | _____

CEP Sample # Used For Matrix Spike: _____

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS % REC	QC LIMITS % REC
1,1-Dichloroethene	50	0	57	114	61-145
Trichloroethene	50	0	52	104	71-120
Benzene	50	0	47	78	76-127
Toluene	50	0	51	102	76-125
Chlorobenzene	50	0	50	100	75-130

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD % REC	% RPD	QC LIMITS RPD	QC LIMITS % REC
1,1-Dichloroethene	50	50	100	13	14	61-145
Trichloroethene	50	55	110	5.6	14	71-120
Benzene	50	57	102	4	11	76-127
Toluene	50	51	102	0	13	76-125
Chlorobenzene	50	54	104	3.9	13	75-130

* Values outside of QC limits

Spike % Recovery: 0 out of 10 outside limits
RPD: 0 out of 5 outside limits

Comments: _____

Q. A. APPROVED
BY:
DATE: 6-1-94

WATER VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Client Name: Stone

Date Analyzed: 5-22-92

Analyst: DVR

Data Reviewed By:

Procedure: 8240 in Filter / 624 water

Reference Page: 9215T-156 8240
92065-071 624

CEP Matrix Spike Standard Log Number: 13218

CEP Sample # on this report: 9205211-01, 9205211-05, -02, 9205212-01, -03, -04, 7only

CEP Sample # Used For Matrix Spike:

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS % REC	QC LIMITS % REC
1,1-Dichloroethene	50	0	57	114	61-145
Trichloroethene	50	0	52	104	71-120
Benzene	50	0	47	78	76-127
Toluene	50	0	51	102	76-125
Chlorobenzene	50	0	50	101	75-130

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD % REC	% RPD	QC LIMITS RPD	QC LIMITS % REC
1,1-Dichloroethene	50	50	100	13	14	61-145
Trichloroethene	50	55	110	5.6	14	71-120
Benzene	50	51	102	4	11	76-127
Toluene	50	51	102	0	13	76-125
Chlorobenzene	50	52	104	3.9	13	75-130

* Values outside of QC limits

Spike % Recovery: 0 out of 10 outside limits
RPD: 0 out of 5 outside limits

Comments:

Q. A. APPROVED
BY:
DATE: 6-11-92

RADIOCHEMISTRY ACCEPTANCE

No. Samples on This QA Report 10

Laboratory No.: 92-05-207

Client: Ford Chem

Lab No. on This Report
92-05-207 01
92-05-210 (01-03)
92-05-211 (01-06)

Matrix: H_2O

Technician's Name: C. Deiner Date: 5-20-92

Reviewer's Initials: Date: 5/28/92

QA Approval: Date: 5/28/92

Units: pCi (gr./l)

RUSH ☐ PRIORITY ☐ EMERGENCY ☐

ILS Results at 10%

Test		ILS Value	Tech Value	Tech Value / ILS Value	Resolution	Pass NRC Y/N	RPD %
α	ILS	13.5 ± 2.5	11.90 ± 0.99	0.9	5	Y	1
	ILS DUP		11.14 ± 0.96	0.8	5	Y	6.61
β	ILS	42.6 ± 5.3	44.87 ± 2.04	1.0	8	Y	1
	ILS DUP		39.55 ± 1.93	0.9	8	Y	12.6
	REC						
α	Method Blank	0.44					
β	Method Blank	2.06					

Comments:

1

ATTACHMENT 2
SITE INVESTIGATION SAFETY PLAN

STONE & WEBSTER
SITE INVESTIGATION
SAFETY PLAN

PLAN REVIEW AND APPROVAL

On-site Supervisor Dick Skryness, Larry Picking Date: 5/6/92

Corp. Health & Safety Larry Cohen, James Skrabak Date: 5/6/92

1.0 SITE DESCRIPTION JOB NO. 18988.01

1.1 Location Greenbush, Maine
(Attach Map or Diagram)

1.2 Surrounding Population Rural approximately 20 people within a 1 mile radius. Next to a tree nursery.

1.3 Topography and Accessibility Rural, wooded.

1.4 Site History A 40 X 40 ft. controlled landfill with a 65 X 65 ft. fence around the perimeter. The site contains laboratory waste including chemical compounds and low-level radioactive waste. The site operated for approximately 18 years from 1960-1978.

1.5 Planned Duration of Site Activity 1 day.

1.6 Anticipated Weather Conditions During Activity Cool to cold, mostly dry, possible showers or flurries.

1.7 Will this Job Involve "Confined Space" Work (ie. indoor drilling)?
Yes ____ No X

If Yes, explain: _____

1.8 Are Utility Notifications Needed for Subsurface Work? Yes _____ No X

If yes, specify clearance dates, clearance I.D. #, and other relevant information. _____

2.0 **ENTRY OBJECTIVES**- Describe planned activities covered by the plan and their objectives.

Groundwater sampling for water quality and passive soil gas sampling.

3.0 **ON-SITE ORGANIZATION**- Identify persons involved in the project and their job functions.

Team Leader Dick Skryness, Larry Picking

Site Safety Officer Same

Team Members Same

4.0 **HAZARD ANALYSIS**- For each task or operation describe the potential hazards.

4.1 List Source and Location of Potential Contamination: Landfill containing low-level radioactive waste and laboratory chemical constituents. Waste is buried at a depth of approximately 10 ft. in an esker deposit.

4.2 List Characteristics of Representative Contaminants:

Representative Chemicals	Medium	Exposure Limits
H-3	Unsealed	Exposure limit for all
C-14	Unsealed	the radioactive isotopes
Pb-210	Unsealed	combined is 0.5mR/h.
Co-60	Unsealed	
Cs-134	Unsealed	
H-3	Plated	PEL or TLV whichever is
Ra-Be	Sealed in bronze	lower:
Toluene	Pl. Btl./Steel Drum	100ppm-TWA 150ppm-STEL
Polyethylene glycol	Pl. Btl./Steel Drum	N/A
Dioxane	Pl. Btl./Steel Drum	25ppm-TWA
Methanol	Pl. Btl./Steel Drum	200ppm-TWA 250ppm-STEL
Naphthalene	Pl. Btl./Steel Drum	10ppm-TWA 150ppm-STEL
Xylene	Pl. Btl./Steel Drum	100ppm-TWA 150ppm-STEL
Propylene glycol	Pl. Btl./Steel Drum	N/A
Ethylene glycol	Pl. Btl./Steel Drum	50ppm-C

4.3 Identify Unique Chemical Characteristics (ie. odor, warning properties):

Toluene - aromatic odor like benzene.

Polyethylene glycol - hard, water soluble, waxlike solid.

Dioxane - colorless liquid with a mild etherlike odor.

Methanol - colorless liquid with a characteristic pungent odor.

Naphthalene - colorless to brown solid with an odor of mothballs.

Xylene - colorless liquid with aromatic odor.

Propylene glycol - colorless, almost odorless, slightly viscous liquid with a slightly acrid taste.

4.4 Additional Site-Specific Hazard Information: Previous drilling program to install monitoring wells did not detect any volatile organic compounds or radioactivity above background levels. Methane gas was present during well installation

4.5 List Potential Physical Hazards:

5.0 AIR MONITORING- Describe frequency and types of air monitoring to be done and the equipment and calibration procedures to be used.

A HNu and radiation survey meter will be present onsite. Measurements will be taken when a well is initially opened, when samples are collected from the well, and when passive soil gas collectors are being placed beneath the landfill cover. Background levels will be measured prior to the commencement of work activities each day. If any measurement exceeds action levels, work activity will stop and personnel will move off the site. HNu measurements will be taken in the breathing zone, at the wellhead, and at ground surface when placing passive soil gas collectors Radiation measurements will be made

Combustion gas indicator will be used to detect Methane in the well vapor space prior to sampling. If levels above action levels are noted, personnel

at waist level, at the wellhead, and at ground surface when placing passive soil gas collectors Action levels will be: HNu-5ppm in the breathing zone, radiation survey meter-2 X background. Background levels will be deemed as being exceeded if a sustained reading above action levels lasts for longer than two minutes. All readings will be recorded in the field notebook including background levels. At 10% of the LEL, personnel will leave the immediate area and allow the well to vent.

6.0 PERSONAL PROTECTIVE EQUIPMENT- Describe the levels of protection to be used and under what conditions they will be upgraded or work stopped.

Work will be performed at level D protection including surgical inner gloves and protective outer gloves.

7.0 SITE CONTROLS

7.1 Work Zones Will be established, if necessary, by the site safety officer (Attach Map or Diagram) onsite.

7.2 Site Communications Will be verbal.

7.3 Work Practices Standard safety precautions will be taken regarding groundwater sampling procedures (refer to section 5.0), and skin contact with the well fluid or soil will be avoided.

8.0 TRAINING- Describe the training requirements of the project and how the personnel named to the project meet those requirements.

All personnel will receive an onsite briefing. The site safety officer will be OSHA trained (40 hr Hazardous Waste) and familiar with the use and maintenance of monitoring equipment.

9.0 DECONTAMINATION- Describe what materials will need to be decontaminated, how they will be decontaminated and how other materials will be classified and disposed.

Personal clothing and footware will be brushed off every day before leaving the job site. Gloves will be disposed of on site.

10.0 EMERGENCY RESPONSE

10.1 First Aid- Identify location and individual responsible for first aid kit.

Site safety officer will be responsible for providing.

10.2 Telephone Numbers

Local Fire Department 1-800-432-7911

Police Department 1-800-432-7911

Ambulance Service (207)-827-5551

10.3 Nearest Hospital

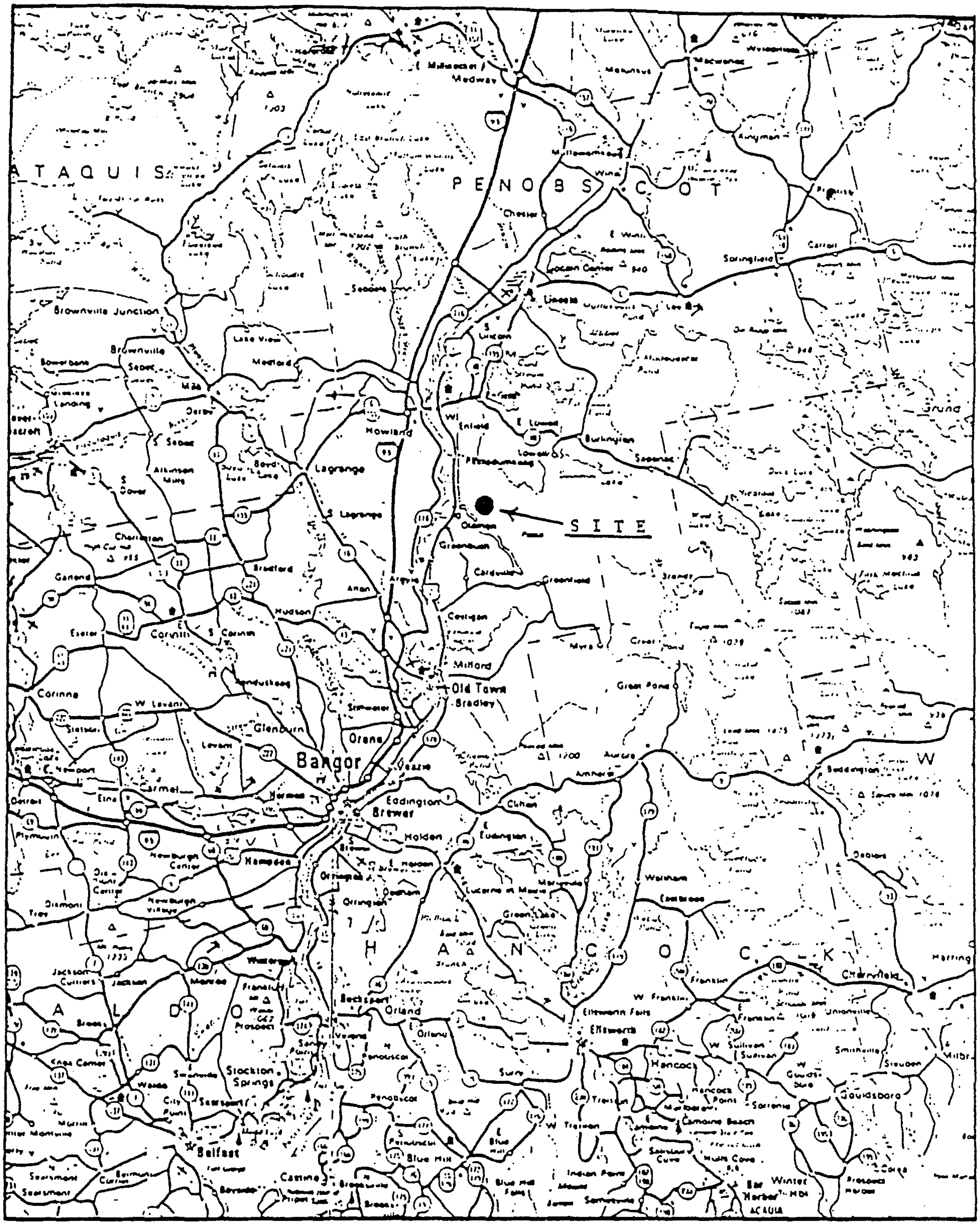
Name Eastern Medical Center

Address 489 State Street

Bangor, Maine

Directions (Attach Map)

11.0 OTHER The nearest telephone is located in the Greenbush Town Hall, or at the Olamon Supermarket in Olamon, Maine.



LOCATION OF SITE