Nevada
Environmental
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Characterization Report for
Area 23, Building 650 Leachfield,
Corrective Action Unit No. 94,
Nevada Test Site

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January 1998

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**CHARACTERIZATION REPORT FOR
AREA 23, BUILDING 650 LEACHFIELD,
CORRECTIVE ACTION UNIT NO. 94,
NEVADA TEST SITE**

DOE Nevada Operations Office
Las Vegas, Nevada

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**CHARACTERIZATION REPORT FOR
AREA 23, BUILDING 650 LEACHFIELD,
CORRECTIVE ACTION UNIT NO. 94,
NEVADA TEST SITE**

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List of Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
bgs	Below ground surface
cm	Centimeter(s)
cm water	Centimeter(s) of water
cm/s	Centimeter(s) per second
CAU	Corrective Action Unit
CFC	Chlorofluorocarbon(s)
CFR	<i>Code of Federal Regulations</i>
Co	Cobalt
COC	Constituent(s) of concern
CRDL	Contract-required detection limit(s)
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DS	Dry sieve
DQO	Data Quality Objective(s)
EM	Electromagnetic
EPA	U.S. Environmental Protection Agency
ft	Foot (feet)
g/cm ³	Gram(s) per cubic centimeter
G/H	Geotechnical/hydrologic
ICP	Inductively Coupled Plasma
in.	Inch(es)
IT	IT Corporation
Ksat	Saturated permeability
LAS	Lockheed Analytical Services Laboratories, Inc.
m	Meter(s)
mm	Millimeter(s)
MDA	Minimum detectable activity(ies)

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List of Acronyms and Abbreviations (continued)

MDL	Minimum detection limit(s)
MEK	Methyl ethyl ketone
mg/kg	Milligram(s) per kilogram
MS/MSD	Matrix spike/matrix spike duplicate
ND	Not detected
NDB	Not detected above normal background
NDEP	Nevada Division of Environmental Protection
NTS	Nevada Test Site
PCB	Polychlorinated biphenyl(s)
pCi/g	Picocurie(s) per gram
PRG	Preliminary remediation goal(s)
Pu	Plutonium
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	<i>Resource Conservation and Recovery Act</i>
RCT	Radiological control technician
REECO	Reynolds Electrical & Engineering Company, Inc.
RPD	Relative percent difference
Sr	Strontium
SSSAJ	Soil Science Society of America Journal
SVOC	Semivolatile organic compound(s)
TC	Toxicity characteristic
TPH	Total petroleum hydrocarbon(s)
TPH-G	Total petroleum hydrocarbon in the gasoline range
TPH-D	Total petroleum hydrocarbon in the diesel range
VOC	Volatile organic compound(s)

List of Acronyms and Abbreviations (continued)

%	Percent
% cm ³ /cm ³	Percent, cubic centimeter per cubic centimeter
%, g/g	Percent, gram per gram
μCi/g	Microcurie(s) per gram
μCi/mL	Microcurie(s) per milliliter
μg/kg	Microgram(s) per kilogram
μg/L	Microgram(s) per liter

1.0 Introduction

Corrective Action Unit (CAU) No. 94, Building 650 Leachfield, is an historic laboratory disposal unit located in Area 23 at the Nevada Test Site (NTS) in Nye County, Nevada (see Figures 1-1, 1-2 and 1-3). The NTS, the former nuclear weapons testing area, is operated by the U.S. Department of Energy, Nevada Operations Office (DOE/NV). Building 650 Leachfield has been characterized under the requirements of the *Resource Conservation and Recovery Act* (RCRA), Part B Permit (NDEP, 1995), for the NTS and Title 40 *Code of Federal Regulations* (CFR) Part 265 (1996b).

1.1 Project Objectives

The objectives of this project were twofold:

- Characterize subsurface conditions at the CAU with respect to the on-site disposal unit.
- Provide sufficient information to develop a closure strategy for the leachfield.

To this end, subsurface sampling was conducted in the vicinity of the piping above the distribution box, under and around the distribution box, and within the leachfield to accomplish the following goals:

- Evaluate the condition of the surrounding sediment and determine if constituents of concern (COCs) were present in the subsurface.
- Assess the potential for migration of COCs downward from the leachfield through the underlying sediment.
- Estimate the extent of contaminant migration (if present) from the leachfield.

Soil and headspace samples were collected from all of the sampling locations at specified intervals in the soil borings during characterization activities. Detailed field observations of surface and subsurface conditions, including lithologic description of drill cuttings, were also made.

Figure 1-1
Location of the Nevada Test Site

CAU 94 RCRA
650LF CR
Section: 1.0
Revision: 1
Date: 1/27/98
Page 3 of 47

**Area 23
Building 650
Leachfield**

SCALE

**Figure 1-2
Location of the Area 23, Building 650 Leachfield**

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0405a01 1/8/96

Figure 1-3
Area 23, Building 650 Leachfield Site Plan

1.2 Report Content

To make this sampling report more concise, complete field documentation and laboratory data (such as Field Activity Daily Logs, Sample Collection Logs, Analysis Request and Chain-of-Custody Forms, soil sample descriptions, laboratory certificates of analyses, and headspace screening results) are not included. However, these documents are retained in project files and will be supplied upon request. Descriptions of the site history, waste, inventories, and previous characterization activities are discussed in detail in the *RCRA Industrial Site Environmental Restoration Site Characterization Plan, Area 23, Building 650 Leachfield* (DOE, 1997a) and, therefore, will not be repeated in this report.

2.0 Prior Field Investigation and Sampling Activities

The objectives of the various sampling efforts conducted in the past at the Building 650 Leachfield site have included evaluation of the presence, concentration, and extent of any contamination present within the liquid in the leachfield distribution box, the soil below the upper pipelines leading to the distribution box, the soil immediately below the distribution box, and the soil within the center of the leachfield.

2.1 Distribution Box Liquid Evaluations

In 1988 and 1990, a total of six liquid grab samples were taken from the distribution box by Reynolds Electrical & Engineering Company, Inc. (REEC Co, 1993). The samples were analyzed for gross beta, gamma, and/or tritium, and the results of the sampling are summarized in Table 2-1.

Table 2-1
Radionuclide Concentrations for Water Samples
from the Building 650 Leachfield Distribution Box

Sample Date	Tritium ($\mu\text{Ci/mL}^a$)	Gross Beta ($\mu\text{Ci/mL}$)	Gamma Scan ($\mu\text{Ci/mL}$)
3/23/88	6.990E-07	6.840E-09	ND ^b
4/15/88	7.450E-07	1.420E-08	Cobalt-607.510E-08 Rhodium-1061.340E-07
5/11/88	1.130E-06	2.260E-05	ND
4/25/90	9.130E-08	1.764E-06	ND
8/17/90	1.566E-07	1.487E-08	ND
9/12/90	1.432E-07	2.102E-08	ND
12/5/90	ND	NA ^c	ND

^aMicrocurie(s) per milliliter

^bNondetected above laboratory detection/reporting limits

^cNot analyzed

2.2 1992 Soil Sample from Below the Distribution Box

On October 15, 1992, REECo collected a soil sample from below the distribution box by inserting an aluminum tube through the hole in the bottom of the box and downward approximately 10 to 15 centimeters (cm) (4 to 6 inches [in.]) into the underlying soil. The sample was analyzed at the Building 650 laboratory for gamma emitters. Analysis indicated the presence of cesium-137 at $3.30\text{E-}06$ $\mu\text{Ci/g}$ (microcuries per gram) (3.30 picocuries per gram [pCi/g]) and cobalt-60 at $1.44\text{E-}04$ $\mu\text{Ci/g}$ (144 pCi/g). The cesium-137 result is slightly above the 3.0 pCi/g background level for this radionuclide, and the cobalt-60 result is considered an indication of potential site contamination based on its background level.

2.3 1992 Piping Excavation Sampling

In October 1992, REECo excavated three trenches east of Building 650 (REECo, 1993): one at each drain line (referred to as the north and south trenches) and one along the main leachfield line at the sewer manhole between the drain lines (referred to as the middle trench) (see Figure 2-1). Soil samples were obtained adjacent to the drain lines at three locations in the trenches. The samples from the south and middle trenches were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), toxicity characteristic (TC) metals, pH, tritium, gamma scan, and plutonium while the sample from the north trench was only analyzed for SVOCs. The only constituents identified were methylene chloride and acetone at laboratory contamination levels, TC barium at background levels, plutonium-239 at $2.20\text{E-}09$ $\mu\text{Ci/g}$ ($2.20\text{E-}03$ pCi/g) in the middle trench sample and cesium-137 at $1.66\text{E-}07$ $\mu\text{Ci/g}$ (0.166 pCi/g) in the south trench sample. Both of the radionuclide results are considered to be below background levels.

2.4 Preliminary Subsurface Evaluation of the Leachfield

In August and September 1994, IT conducted a preliminary evaluation of the Building 650 Leachfield (IT, 1995). The evaluation involved the excavation of two trenches across and along the two western leachfield drain pipes near the distal end of the leachfield. The trenches were excavated to a depth of approximately 3.7 meters (m) (12 feet [ft]) below ground surface and samples were collected from the trench profiles (see Figure 2-2 for the approximate locations of the trenches). A total of four soil samples in addition to one background sample and one field

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Figure 2-1
1992 and 1994 Piping Excavation Sampling Trenches and Sample Locations
Area 23, Building 650 Leachfield

SCALE

Source: IT, 1995

LEGEND

- Contour interval equals 1 foot
- Drainage ditch
- Distribution pipe
- Discharge pipe
- Approximate trench location

Figure 2-2
1994 Preliminary Evaluation Trench and Sample Locations
Area 23, Building 650 Leachfield

duplicate sample were collected and analyzed for VOCs using U.S. Environmental Protection Agency (EPA) Test Method 8240, SVOCs using EPA Test Method 8270, total petroleum hydrocarbons (TPHs) using EPA Test Method 418.1, TC metals using EPA Test Methods 6010 and 7000 (EPA, 1996), and radiological parameters using Standard Method 7110 (gross alpha and gross beta) and HASL 300, 4.5.2.3 (gamma spec) (DOE, 1992).

Sample LCH00007, taken from the bottom of the west end of Trench 1, was reported to contain 155 milligrams/kilogram (mg/kg) of TPH. However, the TPH result was obtained using EPA Test Method 418.1 which is only used for gross screening for hydrocarbon compounds and cannot be used to substantiate the presence or absence of hydrocarbon contamination to the NDEP (EPA, 1996). It is likely that the results of an analysis using EPA Test Method 8015 Modified rather than Method 418.1 for TPH would have yielded lower results for the same sample (EPA, 1996). Sample LCH00008, taken from 2.4 to 3.6 m (8 to 10 ft) depth on the east end of Trench 1, was reported to contain 5 micrograms per kilogram ($\mu\text{g/kg}$) of methylene chloride. The methylene chloride is likely to be a laboratory contaminant based on: its very low concentration, the detection limit for methylene chloride (i.e., 5 $\mu\text{g/kg}$), and its lack of presence in any of the other samples. The analytical results did not indicate the presence of man-made radionuclides in the samples analyzed.

2.5 1994 Distribution Box and Laboratory 126 Discharge Line Operational Closure

In March and May 1994, closure activities were conducted by REECo on the Building 650 Leachfield distribution box and the Laboratory 126 discharge line going into the distribution box (REECo, 1994). The closure activities included plugging the discharge line into the distribution box with rapid-setting cement, hand excavation of the laboratory discharge line, sampling of soil at two locations along the line, and rerouting the line to the sanitary sewer. A total of four soil samples were collected on May 18, 1994, within two trenches excavated in the leachfield: two below a deteriorated pipe junction and two below the intersection of the laboratory discharge line and the main leachfield line (see Figure 2-1). A background soil sample was also collected in the vicinity of the helicopter pad, approximately 183 m (600 ft) southeast of the project site. The soil samples were analyzed for VOCs, SVOCs, TC metals, polychlorinated biphenyls (PCBs), pH,

gamma scan, isotopic plutonium, and tritium. The results of the soil analyses indicated no chemical or radioactive COCs in the soil below the piping.

2.6 1994 Geophysical Evaluation

In October and November 1994, a geophysical investigation was conducted at the Building 650 Leachfield (IT, 1996) with the following objectives:

- Determine if leachate migration away from the leachfield has occurred.
- Approximate the lateral boundaries and vertical extent of any plume present in the shallow subsurface.
- Locate shallow conductive zones in the vicinity of the leachfield potentially representing perched leachate.

To accomplish these objectives, electromagnetic (EM) induction surveys were conducted at various transmitter/receiver intercoil spacings and system configurations, which provided for a qualitative interpretation of changing physical conditions with depth beneath the surface. Interpretation of the results of the survey suggested that there was no obvious subsurface fluid/leachate migration away from the leachfield. The 1997 subsurface investigation and sampling confirmed these results.

2.7 1995 Preliminary Subsurface Evaluation of the Distribution Box

In February 1995, REECo used a GeoProbe sampling device to collect three samples from below the leachfield distribution box (Emer, 1995). The GeoProbe apparatus used a hydraulic ram to drive a small-diameter core barrel through the hole in the bottom of the distribution box and into the underlying soil. Samples were collected from approximately 56 cm (22 in.), 112 cm (44 in.), and 168 cm (66 in.) below the base of the distribution box. The samples were analyzed for total and TC metals, gamma scan (20- and 300-minute), tritium oxide, and gross alpha/beta. The small sample volumes did not allow for additional analyses. The 300-minute gamma scan results indicated the presence of americium-241, cobalt-60, and cesium-137 in the soil to a depth of at least 168 cm (66 in.). No other constituents of concern were identified (Emer, 1995). Table 2-2 summarizes the analytical data.

Table 2-2
1995 300-Minute Gamma Scan Analytical Results

Sample Number	Americium-241 (pCi/g*)	Cobalt-60 (pCi/g)	Cesium-137 (pCi/g)
650-DB-22	ND ^b	0.699	1.23
650-DB-22-44	20.2	1.33	0.718
650-DB-44-66	1.97	1.18	0.944

*Picocurie(s) per gram

^bNondetect

The cobalt-60 and americium-241 results are considered indicative of site contamination based on normal background levels for these radionuclides. The cesium-137 results are not considered indicative of contamination above normal background levels.

3.0 1997 Subsurface Soil Sampling

The primary objective of the 1997 drilling and sampling activities at the Building 650 Leachfield was to evaluate the presence, concentration, and extent of any contamination present below the distribution box, the piping just above the distribution box in the system, and the proximal and distal ends of the leachfield based on the conceptual model study areas presented in the Site Characterization Plan (DOE, 1997a). The secondary objective was to assess the potential for downward migration of contaminants at the site. The following sections discuss the results of the past evaluations and the process used for the 1997 subsurface evaluation of the site. With the completion of the characterization activities, the study areas are further refined and have either been eliminated or are now considered contaminant zones, as follows:

- Zone 1 is contaminated soil located directly below and immediately surrounding the distribution box and the uppermost northeastern portion of the leachfield.
- Zone 2 is uncontaminated soil located around and below Zone 1 and encompasses the entire remainder of the site. It includes the majority of the leachfield and all the piping leading from Building 650 to the distribution box.

Field activities associated with the 1997 subsurface evaluation were performed in accordance with an approved Site-Specific Health and Safety Plan (DOE, 1997b). Samples were collected and documented by following established sampling, field activity and sample collection documentation, decontamination, chain of custody, shipping, radiation screening protocols and procedures and field sampling instructions as indicated in the Site Characterization Plan (DOE, 1997a). Quality control (QC) samples (e.g., field blanks, equipment blanks, and trip blanks) were collected as required by the Industrial Sites Quality Assurance Project Plan (QAPP) (DOE, 1996a) and approved procedures (IT, 1993). All field and sample documentation is maintained in the project files. During the field activities, the following waste minimization practices were followed: segregation of the waste from each investigative boring, segregation of suspected contaminated soil from suspected uncontaminated soil, separation of personal protective equipment into bags (based upon daily use), and collection and segregation of the rinsate waters from decontamination operations.

The subsurface investigation implemented the Data Quality Objective (DQO) process (DOE, 1996b). Boring locations were selected and marked on the ground in a pattern based on the configuration of the leachfield and associated piping and the results of the various preliminary investigations (Figure 3-1). The zone below the base of the leachfield was evaluated to establish how far, if at all, COCs have migrated downward.

3.1 Soil Boring and Sampling

Hollow-stem auger borings were drilled to a depth of approximately 15 m (50 ft). Samples were obtained using a split-spoon sampler from measured intervals in each boring (i.e., two consecutive samples were taken starting at approximately 2.7 m [9 ft], and additional samples were collected at approximate 1.5-m [5-ft] intervals thereafter). Prior to removing samples from the split-spoon, the sampling equipment was screened for radiation by the radiological control technician (RCT) at the site.

While the borings were being advanced, the sample collection team set out the required containers (i.e., brass split-spoon sampling rings) for the sampling interval and noted the condition of the soil being drilled. The sample containers were annotated for their respective analyses and placed in a cooler. When the desired interval was penetrated, the time was noted by the lead sampler.

All collected samples were analyzed by off-site laboratories (Lockheed Analytical Services [LAS] Laboratories, Inc. [chemical and radiological parameters], and/or D.B. Stephens & Associates [hydrologic and geotechnical parameters]) for the parameters listed in Tables 3-1 and 3-2. The parameters were selected using EPA's DQO process (EPA, 1994a) and were based on the anticipated COCs associated with the activities known to have been conducted at the site, the results of the 1994 preliminary sampling activities at the site, the wide range of other contaminant types potentially encountered on the NTS, and the potential need for hydrologic and closure modeling. There were 103 subsurface soil samples and 29 QC samples obtained from the Building 650 Leachfield.

Borings 11 - 12

4" line disconnected
and plugged 11/1992

Building 650

LCHB-12 Distribution box

Sub-
station

Double
Boxcar

LCHB-11

LCHB-4
LCHB-1

LCHB-3

LCHB-2

LCHB-5

LCHB-8

LCHB-6

LCHB-7

Leachfield location

LCHB-9

LCHB-10

Ambulance
Port

Decon
Pad
(1994)

Decon Pad
(1997)

1/20

SCALE

0 40 80 Feet

0 10 20 Meters

LEGEND

• Borehole locations

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Figure 3-1
Soil Boring Locations
Area 23, Building 650 Leachfield

Table 3-1
1997 Subsurface Soil Sampling Chemical and Radiological Analytical Methods

Analytical Parameter ^a	Analytical Method
Total Volatile Organic Compounds	EPA ^b 8260
Total Semivolatile Organic Compounds	EPA 8270
TC ^c Metals: ICP ^d (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, Silver) TC Metals: Mercury	EPA 1311/6010 EPA 1311/7470
Total Petroleum Hydrocarbons - Gasoline, Diesel, and Motor Oil	EPA 8015 Modified
Gross Alpha/Beta	LAS-91-SOP-0060* LAS-91-SOP-0061*
Gamma Scan	LAS-91-SOP-0063* LAS-91-SOP-0064*
Isotopic Plutonium	LAS-91-SOP-0108*
Strontium-89/90	LAS-91-SOP-0196*
Tritium	LAS-91-SOP-0066* LAS-91-SOP-0067*
Free Liquids Paint Filter Test	EPA 9095

^aTotal constituent analyses were conducted on liquid samples;
toxicity characteristic analyses were not performed on liquid samples.

^bU.S. Environmental Protection Agency SW-846 (EPA, 1996)

^cToxicity characteristics

^dInductively coupled plasma

*LAS Laboratories, Inc. Standard Operating Procedures (LAS, 1991)

Table 3-2
1997 Subsurface Soil Sampling
Hydrologic and Geotechnical Analytical Methods

Analytical Parameter	Analytical Method
Initial Moisture Content	ASTM ^a D 2216-92/D 4643-93
Dry Bulk Density	ASTM D 2937-94/MOSA ^b Chapter 13
Calculated Porosity	MOSA Chapter 18
Saturated Hydraulic Conductivity	ASTM D 2434-68(94)
Unsaturated Hydraulic Conductivity	SSAJ, 1980
Particle Size Distribution	ASTM D 422-63(90)
Moisture Retention Characteristics	MOSA Chapter 26 ASTM D 2325-68(94)/MOSA Chapter 26
	MOSA Chapter 24
	SSSAJ, 1982
	ASTM D 3252
	MOSA Chapter 23
	ASTM D 4943-89
	ASTM D 854-92
Shrink/swell	
Specific gravity	

^aAmerican Society for Testing and Materials (ASTM, 1994)

^bMethods of Soil Analysis (ASA, 1986)

Collection of samples from the split-spoon sampler began with samples for VOCs and TPH in the gasoline range (TPH-G). For a full sample suite, samples were collected in the following general order:

- Total VOCs
- TC VOCs
- TPH
- TC metals, TC SVOCs
- Radionuclides
- Paint filter

As samples were collected, special care was taken to optimize the sample for its specific type of analysis. The VOC samples were collected with as little disturbance of the soil as possible to minimize granulation (volatilization). Sample containers were filled to eliminate or minimize headspace, and the rim was cleaned using the sampling tool or a gloved hand to ensure a good seal when closing the container. Teflon liners were placed under all sampling tube plastic end caps. As samples were collected, notes about weather conditions, soil description, and sample quantities were recorded on the Sample Collection Logs.

The samples were labeled and placed in individual plastic bags and sealed; collected in a single larger sealed bag marked with the sample number, date, and time; and placed into an iced cooler. A trip blank was included in coolers containing samples for VOC analysis. Samples were selected for shipment to the off-site laboratory based on predetermined sampling intervals (i.e., approximate 1.5-m [5-ft] intervals, beginning at approximately 2.7 m [9 ft] and proceeding to a depth of approximately 15 m [50 ft]), the results of the on-site screening, visual indications of contamination. There were no visual indications of contamination and no observed elevated radiation levels. The goal was to select both impacted and unimpacted samples to represent the sampling intervals of interest. However, due to a lack of field indications of contamination, segregation of impacted and unimpacted samples was not possible, so all of the samples collected were analyzed by the laboratory.

The results of laboratory chemical and radiological analysis of the samples collected are presented and discussed in the following sections.

3.2 Geologic, Hydrologic, and Geotechnical Analysis

As samples were collected, soil characteristics such as sand and gravel content, relative amounts of pebbles and cobbles, the absence or presence of clays, and any unusual variations were noted. This information was recorded in field notes and on boring logs for the project. In addition to a visual description, information about the difficulty of drilling was noted. Three samples were also collected from the bottom of two of the borings (i.e., unimpacted soil) to analyze for hydrologic and geotechnical parameters. The results of these analyses may be used to evaluate geotechnical factors that might later affect closure activities at the site, if necessary.

The results of laboratory hydrologic and geotechnical analysis of the samples collected are presented in Section 4.1.7 of this report.

3.3 Technical Changes

Two changes were made to the activities proposed in the *Resource Conservation and Recovery Act* Industrial Site Characterization Plan Area 23, Building 650 Leachfield (DOE, 1997a) for the site:

- While three samples were planned to be collected and analyzed for hydrologic and geotechnical parameters, only two samples were collected because sample recovery problems at the depth specified for the collection of these samples (i.e., approximately 15 m [50 ft] below ground surface [bgs]).
- Based on the very short half-life of strontium-89 (approximately 55 days) the subsurface soil samples were analyzed for strontium-89/90 rather than the strontium-89 and strontium-90 isotopes as originally planned.

4.0 1997 Sampling Results

The results of the analysis of samples from within and around the Building 650 Leachfield have been compiled and analyzed to evaluate the presence and/or extent of contamination in the soil surrounding the leachfield and associated piping. The analytical results are summarized in the following sections. The complete laboratory data packages are available in the IT project files. Section 5.0 of this report presents a discussion and summary of QC samples.

Table 4-1 presents a list of the characterization sample numbers and locations. Gaps in the numeric sample sequence that represent rinsate, field, and trip blank (quality control) samples not included on this table, are discussed in Section 5.0.

4.1 Subsurface Soil Sampling Results

The results of each analysis were reviewed to determine their validity with respect to minimum detection limits (MDLs) or minimum detectable activities (MDAs), measurement errors (radionuclide analyses), probable occurrence due to laboratory contamination, laboratory data qualifications, relationship to naturally occurring or typical man-made background levels, and other factors that might affect the use of the data as valid indications of environmental contamination. Resultant values for radionuclides that were above the MDA, but were determined not to exceed typical background levels for the measurement, were not considered to represent indications of contamination. Chemical analytes that were qualified by the laboratory as estimated (i.e., below the MDL) and/or were present in method blanks for the analyses were also not considered to represent contamination for the purpose of the characterization. Finally, results indicating the presence of common laboratory contaminants in low concentrations (i.e., typically less than five times the detection limit, although acetone and 2-butanone commonly appear as laboratory contamination at much higher levels) include acetone, 2-butanone, methylene chloride, toluene, various phthalates and chlorofluorocarbons (CFCs), and were considered to be nondetect, unless there were patterns of contamination that would suggest the presence of the constituents related to discharge from the site. The results of the individual analyses are presented and discussed in the following sections.

Table 4-1
Soil Samples for Chemical and Radiological Analysis
(Page 1 of 3)

Sample #	m	Depth	ft	Location
LCH00040	2.4-3.1	8-10.25		LCHB-3
LCH00041	3.1-4.3	10.25-14		
LCH00042	4.6-5.2	15-17		
LCH00043	6.1-6.7	20-22		
LCH00044	7.6-8.2	25-27		
LCH00045	9.1-9.6	30-32		
LCH00046	10.7-11.3	35-37		
LCH00047	12.2-12.8	40-42		
LCH00048	13.7-14.3	45-47		
LCH00049	2.1-3.1	7-10		LCHB-11
LCH00050	3.1-3.7	10-12		
LCH00051	4.6-5.2	15-17		
LCH00052	6.1-6.7	20-22		
LCH00053	7.6-8.2	25-27		
LCH00054	9.1-9.6	30-32		
LCH00055	10.7-11.3	35-37		
LCH00056	12.2-12.8	40-42		
LCH00057	13.7-14.3	45-47		
LCH00058	1.8-2.7	6-9		LCHB-4
LCH00059	2.7-4.0	9-13		
LCH00060	6.1-6.7	20-22		
LCH00061	7.6-8.2	25-27		
LCH00062	9.1-9.6	30-32		
LCH00063	12.2-12.8	40-42		
LCH00064	13.7-14.3	45-47		
LCH00065	1.8-2.7	6-9		LCHB-2
LCH00066	2.7-3.4	9-11		
LCH00067	4.6-5.2	15-17		
LCH00068	6.1-6.7	20-22		
LCH00069	7.6-8.2	25-27		
LCH00070	9.1-9.6	30-32		
LCH00071	10.7-11.3	35-37		
LCH00072	12.2-12.8	40-42		
LCH00073	13.7-14.3	45-47		
LCH00074	2.7-3.4	9-11		LCHB-1
LCH00075	3.4-4.0	11-13		

Table 4-1
Soil Samples for Chemical and Radiological Analysis
(Page 2 of 3)

Sample #	m	Depth	ft	Location
LCH00076	4.6-5.2	15-17		
LCH00077	6.1-6.7	20-22		
LCH00078	7.6-8.2	25-27		
LCH00079	9.1-9.6	30-32		
LCH00080	10.7-11.3	35-37		
LCH00081	12.2-12.8	40-42		
LCH00082	13.7-14.3	45-47		
LCH00083 G/H	14.3-14.9	45-47		
LCH00084	1.8-2.4	6-8		LCHB-12
LCH00085	2.4-3.1	8-10		
LCH00086	4.6-5.8	15-19		
LCH00087	7.6-8.2	25-27		
LCH00088	9.1-9.6	30-32		
LCH00089	10.7-11.3	35-37		
LCH00090	12.2-12.8	40-42		
LCH00091	13.7-14.3	45-47		
LCH00092	2.1-2.7	7-9		LCHB-10
LCH00093	2.7-3.2	9-10.5		
LCH00094	4.6-5.8	15-19		
LCH00095	7.6-8.2	25-27		
LCH00096	9.1-9.6	30-32		
LCH00097	10.7-11.3	35-37		
LCH00098 G/H	11.2-11.9	37-39		
LCH00099	12.2-12.8	40-42		
LCH00100	13.7-14.3	45-47		LCHB-9
LCH00101	2.1-2.7	7-9		
LCH00102	2.7-3.4	9-11		
LCH00103	4.6-5.2	15-17		
LCH00104	6.1-8.2	20-27		
LCH00105	9.1-9.6	30-32		
LCH00106	10.7-11.3	35-37		
LCH00107	12.2-12.8	40-42		
LCH00108	13.7-14.3	45-47		LCHB-5
LCH00109	2.1-2.7	7-9		
LCH00110	2.7-3.2	9-11		
LCH00111	4.6-5.2	15-17		

Table 4-1
Soil Samples for Chemical and Radiological Analysis
 (Page 3 of 3)

Sample #	m	Depth	ft	Location
LCH00112	6.1-6.7	20-22		
LCH00113	7.6-8.2	25-27		
LCH00114	9.1-9.6	30-32		
LCH00115	10.7-11.3	35-37		
LCH00116	12.2-12.8	40-42		
LCH00117	13.7-14.3	45-47		
LCH00118	2.1-2.6	7-8.5		LCHB-6
LCH00119	2.7-3.4	9-11		
LCH00120	4.6-5.2	15-17		
LCH00121	6.1-6.7	20-22		
LCH00122	7.6-8.8	25-29		
LCH00123	10.7-11.2	35-36.5		
LCH00124	12.2-12.8	40-42		
LCH00125	13.7-14.3	45-47		
LCH00126	2.1-2.7	7-9		LCHB-7
LCH00127	2.7-3.4	9-11		
LCH00128	4.6-5.2	15-17		
LCH00129	6.1-6.7	20-22		
LCH00130	7.6-8.1	25-26.5		
LCH00131	9.1-9.6	30-32		
LCH00132	10.7-11.2	35-36.8		
LCH00133	12.2-12.8	40-42		
LCH00134	13.7-14.1	45-46.5		
LCH00135	2.1-2.7	7-9		LCHB-8
LCH00136	2.7-3.4	9-11		
LCH00137	4.6-5.2	15-17		
LCH00138	6.1-6.7	20-22		
LCH00139	7.6-8.2	25-27		
LCH00140	9.1-10.4	30-34		
LCH00141	12.2-12.8	40-42		
LCH00142	13.7-14.3	45-47		

G/H = Geotechnical/hydrogeologic analysis sample

m = Meter(s)

ft = Feet

4.1.1 Radionuclides

All soil samples were analyzed for gross alpha and gross beta, and by gamma spectroscopy. Because gross alpha and beta analyses are used only as a screening tool to indicate the possible presence of elevated levels of alpha- and beta-emitting isotopes, the results of these analyses are not presented in this report. However, the gross-alpha/beta results did correspond with the generally low levels of radionuclide contaminants identified through gamma spectroscopy and isotopic analyses and did not suggest the presence of elevated levels of man-made radionuclides not covered by the isotopic analyses performed.

Based on the very short half-life of strontium-89 (approximately 55 days), the subsurface soil samples were analyzed for strontium-89/90 rather than the strontium-89 and strontium-90 isotopes as originally planned. Table 4-2 depicts the radionuclides of concern detected above typical background at the Building 650 Leachfield. These include low levels of plutonium, strontium, and cobalt isotopes concentrated in the area below the distribution box from a depth of approximately 2.7 m (9 ft) (the base of the distribution box) to 6.7 m (22 ft) bgs and below the uppermost, northeastern portion of the leachfield from a depth of approximately 3.4 m (11 ft) bgs or approximately 0.6 m (2 ft) below the leachfield distribution lines.

Table 4-2
Radionuclide Laboratory Analysis Results Detected
Above Normal Background for the Area 23, Building 650 Leachfield

Sample Number	Constituents of Concern in Picocuries per Gram (pCi/g)			
	Co-60	Sr-89/90	Pu-238	Pu-239/240
LCH00065	1.57	ND	ND	NDB
LCH00074	0.384	ND	4.26	77.1
LCH00076	0.199	ND	0.135	4.12
LCH00077	ND	ND	0.027	0.51
LCH00106	ND	2.75	ND	ND

ND = Nondetect

NDB = Nondetected above normal background

Sample LCH00106 yielded a result of 2.75 pCi/g of Sr-89/90. The location of this sample and the result do not appear to correspond to any of the physical features of the site, and based on QC problems encountered by the laboratory while conducting the Sr-89/90 analyses (see Section 5.0), this probably represents a false positive result.

4.1.2 Total and Toxicity Characteristic Volatile Organic Compounds

Soil samples from the Building 650 Leachfield were analyzed for total and TC VOCs. Five samples show unqualified hits of either acetone or 2-butanone. A further discussion of these results is found below. All remaining results show COCs to be either less than detection limits (CRDLs) or present in laboratory or trip blank samples at concentrations comparable with the blanks. This indicates that the detected concentrations are a result of sample contamination that has occurred either in the field or in; the laboratory. Sample contamination is further supported by the types of contaminants that were detected, which are common laboratory contaminants (e.g., acetone, 2-butanone, chloroform, methylene chloride, chlorofluorocarbons, toluene, and xylene).

Of the unqualified sample results, 2-butanone (also known as methyl ethyl ketone, or MEK) was found in the leachate of four samples, in the TC analysis. TC 2-butanone was detected in samples LCH00105 (Boring 9), LCH0096 and LCH00099 (Boring 10), and LCH00136 (Boring 11) at concentrations of 0.29, 0.27, 0.28, and 0.27 mg/L, respectively (Table 4-3). These samples were also analyzed for 2-butanone under SW-846, Method 8260, which is an analytical method that detects the total amount of the constituent in the sample. 2-butanone was not detected using the Method 8260. If 2-butanone was present in the samples, it would have been detected, since it must be in the sample to be in the leachate from the sample.

For all four TC 2-butanone detecting in samples LCH00096, LCH00099, LCH00105, and LCH00136, the total concentrations were nondetects while the TC concentrations were above detection limits (i.e., the total analysis method detection limit by multiplied 20; this resulted in a calculated detection limit of 2 mg/kg. This is a commonly used method to determine total concentration equivalents for comparison to CFR 261.24 values). Based on this evaluation, the equivalent detection limit for the TC analysis is significantly higher than the total detection limit.

Table 4-3
Detected Total and Toxicity Characteristic Volatile Organic Compound
Laboratory Analysis Results for the Area 23,
Building 650 Leachfield Soil Samples

Constituents of Concern				Associated QA/QC Blank		
Sample Number	Total Acetone (µg/kg ^a)	2-Butanone		Sample Number	Total Acetone (µg/kg ^a)	Total 2-Butanone (µg/L ^c)
		TC (mg/L ^b)	Total (µg/L ^c)			
CRDL	10	0.10	10	CRDL	10	10
LCH00052	11	ND	ND	LCH00015 ^d	6.6	ND
				LCH00019 ^e	7.6	ND
				LCH00020 ^e	7.8	ND
LCH00096	ND	0.29	ND	LCH00027 ^e	ND	ND
				LCH00028 ^e		
				LCH00032 ^f		
LCH00099	ND	0.27	ND	LCH00027 ^e	ND	ND
				LCH00028 ^e		
				LCH00032 ^f		
LCH00105	ND	0.28	ND	LCH00027 ^e	ND	ND
				LCH00028 ^e		
				LCH00034 ^f	9.4	
LCH00136	12	0.27	ND	LCH00037 ^e	8.2	ND
				LCH00038 ^e	ND	

^aMicrogram(s) per kilogram

^bMilligram(s) per liter

^cMicrogram(s) per liter

^dField Rinsate Blank

^eTrip Blank

^fField Blank

Therefore, if the chemical was present as an environmental contaminant, it should have been seen in the total analysis because of the lower detection limit.

The following information is quoted from the EPA *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA, 1994a):

“.....there may be instances where little or no contamination was present in the associated blanks, but qualification of the sample is deemed necessary. If the reviewer determines that the contamination is from a source other than the sample, he/she should qualify the data. Contamination introduced through dilution water is one example. Although it is not always possible to determine, instances of this occurring can be detected from sample results. Since both results are not routinely reported, it may be impossible to verify this source of contamination. In this case, the “5x” or “10x” rules may not apply; the target compound should be reported as not detected, and an explanation of the data qualification should be provided in the data review narrative.”

Based on the results of the comparison between total and TC values and the above guidance, the TC 2-butanone detections cited are considered nondetects.

The total acetone detect from LCHB-11 yielded a concentration of 12 micrograms per kilogram ($\mu\text{g}/\text{kg}$). There is no evidence of laboratory contamination in the method and trip blanks corresponding to this sample or in other samples from the same sample group. This indicates that the acetone found in this sample is a valid number and acetone is present at this location.

4.1.3 Toxicity Characteristic Metals

The soil samples were analyzed for the TC metals (i.e., arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Toxicity characteristic arsenic, barium, chromium, lead, and mercury were identified at low levels, mostly below the CRDLs, in numerous samples from the site. Only TC metals chromium and mercury were identified above the CRDLs (see Table 4-4). The TC metals arsenic, barium, and lead were identified with maximum concentrations of $64.8 \mu\text{g}/\text{L}$, $1,525 \mu\text{g}/\text{L}$, and $22.9 \mu\text{g}/\text{L}$, which are below the CRDLs and are significantly below the respective TC limits of 5,000, 100,000, and 5,000 $\mu\text{g}/\text{L}$ (40 CFR 261.24) (CFR, 1996a), which represent background levels of these metals. The TC metals chromium and mercury were identified with maximum concentrations of $117 \mu\text{g}/\text{L}$ and $3.4 \mu\text{g}/\text{L}$ which are significantly below the respective TC limits of 5,000 $\mu\text{g}/\text{L}$ and 200 $\mu\text{g}/\text{L}$ (40 CFR 261.24) (CFR, 1996a), the

Table 4-4
Detected Toxicity Characteristic Metals
Laboratory Analysis Results for the
Area 23, Building 650 Leachfield Soil Samples

Sample Number	Constituents of Concern in µ/L (micrograms/liter)	
	TC Chromium	TC Mercury
CRDL	10.0	2.0
LCH00093	117	ND
LCH00096	ND	3.0
LCH00103	ND	3.4
LCH00105	ND	3.1
LCH00106	ND	3.2
LCH00107	ND	2.9
LCH00108	ND	2.7
LCH00112	10.9	ND
LCH00115	18.3	ND
LCH00135	ND	2.2
LCH00138	ND	3.1
LCH00140	ND	2.0
LCH00141	ND	2.6
LCH00142	ND	3.3

background levels of these metals. Furthermore, the random distribution of the metals suggests that their presence is not related to site contamination.

4.1.4 Total Petroleum Hydrocarbons and Polychlorinated Biphenyls

The soil samples were analyzed for TPH in the diesel and gasoline ranges (TPH-D and TPH-G) using EPA Method 8015 Modified (EPA, 1996). The results of the analyses indicated the presence of TPH at 570 mg/kg in the range of motor oil in only one of the subsurface samples (LCH00042) collected from the site. Total petroleum hydrocarbons in the gasoline and diesel

ranges were not detected in any of the collected samples. Although the result is above the NDEP limit of 100 mg/kg of TPH in soil, it is difficult to determine the validity of this result with respect to the site characterization since the samples above and below showed no indications of TPH contamination. The result may represent an anomaly or sampling error of some type; however, it is not associated with any significant volume of contamination.

The two uppermost samples (LCH00065 and LCH00066) from one soil boring adjacent to the distribution box (LCHB-2) yielded very low levels of PCB-1254 (80 µg/kg and 52 µg/kg) and PCB-1250 (75 µg/kg and 39 µg/kg). The total PCB concentration for LCH00065 is 155 µg/kg and the total for LCH00066 is 91 µg/kg. None of the samples from any of the other borings exhibited the presence of PCBs.

4.1.5 Semivolatile Organic Compounds

The soil samples were analyzed for total SVOCs. The common analytical laboratory contaminant, bis(2-ethylhexyl)phthalate, was identified in two soil samples (LCH00054 and LCH00065) below the CRDLs at very low levels (270 µg/kg and 620 µg/kg, respectively). No other SVOCs were detected in any of the 1997 subsurface soil samples.

4.1.6 Paint Filter Test

Most of the soil samples were analyzed for free liquids using the EPA Method 9095, the paint-filter test (EPA, 1996). All of the samples passed the test indicating a general lack of significant free liquid in the soil.

4.1.7 Hydrologic and Geotechnical Analysis Results

The geologic conditions in the shallow subsurface of the site have been evaluated through analysis of samples gathered during the drilling of subsurface soil borings. In general, the natural stratigraphy of the site to the total depths drilled can be characterized as a variable mixture of clays, silts, sands and gravels typical for this area. Distinct, mappable horizons were not evident in the stratigraphy. Appendix A provides copies of the soil boring logs from the drilling.

Samples LCH00083 and LCH00098 from borings LCHB-1 (11.2 to 11.9 m [37 to 39 ft] bgs) and LCHB-10 (14.3 to 14.9 m [47 to 49 ft] bgs), respectively, were analyzed for hydrologic and

geotechnical parameters. The results of the geologic, hydrologic, and geotechnical observations and analyses suggest the following:

- The stratigraphy is dominated by gravels with silt, clay, and sand typical of arid alluvial fan settings.
- The stratigraphy is characterized by fairly high permeability resulting in saturated hydraulic conductivities between approximately 10^{-2} to 10^{-5} centimeters per second.

The results of the laboratory analysis of the samples are presented in Tables 4-5 through 4-11.

Table 4-5
Summary of Particle Size Characteristics

Sample Number	d ₁₀ (mm) ^a	d ₅₀ (mm)	d ₆₀ (mm)	C _u	C _c	Method	Classification
LCH00083	0.13	2.8	3.7	28	3.5	DS ^b	Poorly graded sand with silt and gravel
LCH00098	0.13	2.8	6.4	49	1.7	DS	Well-graded gravel with clay and sand

^aMillimeter(s)

^bDry sieve

d₅₀ = Median particle diameter

C_u = d₆₀/d₁₀

C_c = (d₃₀)²/(d₁₀)(d₆₀)

Table 4-6
**Summary of Initial Moisture Content,
Dry Bulk Density, Wet Bulk Density, and
Calculated Porosity Results**

Sample Number	Initial Moisture Content		Dry Bulk Density (g/cm ³) ^a	Wet Bulk Density (g/cm ³)	Calculated Porosity (%) ^b
	Gravimetric (%, g/g) ^c	Volumetric (%, cm ³ /cm ³) ^d			
LCH00083	5.2	9.4	1.81	1.91	34.1
LCH00098	11.1	20.3	1.83	2.04	32.3

^aGram(s) per cubic centimeter

^bPercent

^cPercent, gram per gram

^dPercent, cubic centimeter per cubic centimeter

Table 4-7
**Summary of Particle Density/Specific Gravity and
Shrinkage Test Results**

Sample Number	Particle Density (g/cm ³) ^a	Shrinkage Limit	Shrinkage Ratio	Volume Shrinkage	Linear Shrinkage	Specific Gravity
LCH00083	2.75	27	1.6	28	8	2.799
LCH00098	2.71	20	1.8	10	8	2.677

^aGram(s) per cubic centimeter

Table 4-8
Summary of Atterberg Test Results

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
LCH00083	26.3	25.8	0.4	ML
LCH00098	43.3	22.4	20.9	CL

Table 4-9
Summary of Saturated Hydraulic Conductivity Test Results

Sample Number	Ksat ^a (cm/s) ^b	Method of Analysis
LCH00083	9.6E-03	Constant Head
LCH00098	2.5E-05	Constant Head

^aSaturated permeability

^bCentimeter(s) per second

Table 4-10
Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water) ^a	Moisture Content (%, cm ³ /cm ³) ^b
LCH00083	0	27.1
	9	21.5
	36	19.6
	80	16.9
	255	12.9
	3773	8.7
	16419	5.
LCH00098	0	35.9
	20	32.3
	51	30.2
	147	27.1
	510	23.4
	3671	16.6
	13971	13.4

^aCentimeter(s) of water

^bPercent cubic centimeter(s) per cubic centimeter

Table 4-11
Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm ⁻¹)			N (dimensionless)			q _r (%)	q _s (%)
	Calculated Value	95% Confidence Limits		Calculated Value	95% Confidence Limits			
		Lower	Upper		Lower	Upper		
LCH00083	0.1911	-0.0537	0.4358	1.1807	1.1263	1.2351	0.0000	0.2682
LCH00098	0.0386	0.0095	0.0676	1.1503	1.1246	1.1759	0.0000	0.3547

α (cm⁻¹) = Alpha per centimeter(s)

5.0 Quality Assurance

The results of quality assurance (QA) and QC activities for the 1997 characterization sampling are summarized below, including a discussion on measurement of the QA/QC objectives and documentation of nonconformances, if applicable. Detailed information about the QA program for this sampling event is contained in the Industrial Sites QAPP (DOE, 1996a).

5.1 Quality Control Samples

QC samples were collected and analyzed throughout the subsurface sample collection process. Table 5-1 lists the collected QC samples. Five field blanks, two equipment blanks, seventeen matrix spike/matrix spike duplicates (MS/MSDs), and twenty-two trip blanks were obtained for analysis by the off-site laboratory. For the field blanks, distilled water was poured into appropriate sample bottles and preserved according to the requirements specified in the Industrial Sites QAPP (DOE, 1996a). Equipment blanks were obtained by collecting distilled water that had been poured over the decontaminated sampling equipment into the appropriate sample bottles and preserved as applicable. Sealed and preserved trip blanks were received from the off-site laboratory and were placed in each cooler of samples sent to the off-site laboratory. The results of the QC samples are discussed in the following sections.

5.1.1 Field Quality Control Samples

The field blanks were analyzed for the parameters listed in Table 3-3. Review of the field blank analytical data for the characterization sampling indicated that cross-contamination related to weather conditions or field methods could have occurred to a limited extent during sample collection based on COCs detected in one of the field blanks (sample number LCH00025). All of the field blanks exhibited low levels of barium and chromium which were also present at low concentrations in many of the soil samples collected. The presence of these metals is common in both soil samples and field blanks collected in this area and probably indicates either the airborne transport of these COCs on the site, background levels of metals, or lab contamination. The blanks also contained very low concentrations of common laboratory contaminants (i.e., volatile organic compounds such as acetone and chloroform at concentrations significantly less than five times the concentration of the detection limit). Sample LCH00025 (a field blank) also contained

Table 5-1
Area 23, Building 650 Leachfield Field Quality Control Samples
Collected for Laboratory Analysis
(Page 1 of 2)

Sample Number	Sample Type	Notes
LCH00015	Field Blank	Field blank for LCH00040-LCH00059
LCH00016	Equipment Blank	First equipment blank
LCH00017	Trip Blank	Volatile organic compound (VOC) analysis only
LCH00018	Trip Blank	VOC analysis only
LCH00019	Trip Blank	VOC analysis only
LCH00020	Trip Blank	VOC analysis only
LCH00021	Trip Blank	VOC analysis only
LCH00022	Trip Blank	VOC analysis only
LCH00023	Trip Blank	VOC analysis only
LCH00024	Trip Blank	VOC analysis only
LCH00025	Field Blank	Field blank for LCH00060-LCH00079
LCH00026	Trip Blank	VOC analysis only
LCH00027	Trip Blank	VOC analysis only
LCH00028	Trip Blank	VOC analysis only
LCH00029	Trip Blank	VOC analysis only
LCH00030	Trip Blank	VOC analysis only
LCH00031	Trip Blank	VOC analysis only
LCH00032	Field Blank	Field blank for LCH00080-LCH00099
LCH00033	Trip Blank	VOC analysis only
LCH00034	Field Blank	Field blank for LCH00100-LCH00119
LCH00035	Trip Blank	VOC analysis only
LCH00036	Trip Blank	VOC analysis only
LCH00037	Trip Blank	VOC analysis only
LCH00038	Trip Blank	VOC analysis only
LCH00039	Trip Blank	VOC analysis only
LCH00043	Matrix Spike/Matrix Spike Duplicate	
LCH00048	Matrix Spike/Matrix Spike Duplicate	
LCH00056	Matrix Spike/Matrix Spike Duplicate	
LCH00060	Matrix Spike/Matrix Spike Duplicate	
LCH00065	Matrix Spike/Matrix Spike Duplicate	
LCH00067	Matrix Spike/Matrix Spike Duplicate	
LCH00073	Matrix Spike/Matrix Spike Duplicate	
LCH00075	Matrix Spike/Matrix Spike Duplicate	

Table 5-1
Area 23, Building 650 Leachfield Field Quality Control Samples
Collected for Laboratory Analysis
(Page 2 of 2)

Sample Number	Sample Type	Notes
LCH00080	Matrix Spike/Matrix Spike Duplicate	
LCH00082	Matrix Spike/Matrix Spike Duplicate	
LCH00084	Matrix Spike/Matrix Spike Duplicate	
LCH00088	Matrix Spike/Matrix Spike Duplicate	
LCH00092	Matrix Spike/Matrix Spike Duplicate	
LCH00094	Matrix Spike/Matrix Spike Duplicate	
LCH00104	Matrix Spike/Matrix Spike Duplicate	
LCH00122	Matrix Spike/Matrix Spike Duplicate	
LCH00140	Matrix Spike/Matrix Spike Duplicate	
LCH00143	Field Blank	Field blank for LCH00120-LCH00140
LCH00144	Equipment Blank	Final equipment blank
LCH00145	Trip Blank	VOC analysis only
LCH00153	Trip Blank	VOC analysis only

concentrations of plutonium-238 and plutonium-239/240 above the MDA and background levels. This sample was collected on the same day as the soil samples that were determined to contain elevated plutonium isotope levels. However, the samples were taken during different times of the day, and the soil samples taken closer to the time the field blank was collected, did not display elevated plutonium isotope concentrations. The presence of plutonium in the blank would suggest the possibility of false positive results in the soil samples. However, because the blank was collected at the beginning of the day and the contaminated soil samples at the end of the day, the soil sample results are considered to be valid.

During the subsurface sampling event, equipment blanks were collected from the sampling equipment used during the characterization and were analyzed for all of the COCs for the project. Very low concentrations of barium, chromium, chloroform, and bromodichloromethane were identified above and below the CRDLs in the equipment rinsate blanks, and they are indicative of background and/or laboratory contamination. No other COCs were identified above the CRDLs in the equipment rinsate blanks.

Trip blanks were analyzed for total VOCs only. None of the COCs, other than very low levels of common laboratory contaminants, were identified above the CRDLs in any of the trip blanks for the characterization.

Review of the analytical data from the off-site laboratory for the trip, field, and equipment blanks indicates that the soil samples were not significantly impacted during the field activities or shipment except as noted during the discussion of field blanks. Cross-contamination due to incomplete decontamination is not apparent.

5.1.2 Laboratory Quality Control Samples

Analysis of method QC blanks and laboratory control samples was performed for each parameter analyzed. Laboratory duplicate analysis was performed on samples from the characterization activities. Various samples were also designated for matrix spike/matrix spike duplicate analyses by the off-site laboratory in addition to those selected in the field for MS/MSD analysis. In general, the laboratory duplicate results were considered to be in agreement with the original sample results. The complete QC sample results are maintained in the IT project files.

5.2 Quality Assurance Objectives Measurements

The QA objectives ensure that the analytical data collected are meaningful, defensible, and usable for the desired purposes. Measurement of specific QA objectives is discussed in the following sections.

5.2.1 Precision

Precision is a quantitative measure of the variability of a group of measurements from their average value. Additional information regarding the measurement of precision may be found in the Industrial Sites QAPP (DOE, 1996a). Precision is assessed by collecting and analyzing duplicate field samples and comparing the results with the original sample. Precision is also assessed by creating, analyzing, and comparing laboratory duplicates from one or more field samples. It is reported as relative percent difference (RPD) which is calculated as the difference between the measured concentrations of duplicate samples, divided by the average of the two concentrations, and multiplied by 100. For the subsurface soil sampling project, the accepted

precision goals for the off-site laboratory analyses are specified in the Industrial Sites QAPP (DOE, 1996a) and are summarized on Table 5-2, which also presents the results of measurement of precision for the soil sampling data. The table lists the total number of RPD precision measurements by analysis type, the acceptable (i.e., target) summarized RPD range (i.e., the lowest and highest values for each analytical method are shown rather than each of the parameter-specific target ranges) per the Industrial Sites QAPP (DOE, 1996a), and the number and percent of precision RPD measurements within the acceptance range.

Although the values shown on Table 5-2 indicate good precision between sample duplicates, many of the samples analyzed returned nondetect values for the various constituents of concern. Nondetect values are not well-suited to this type of analysis and must be analyzed qualitatively in addition to the quantitative analysis results presented in Table 5-2. The qualitative analysis of the nondetect values indicated an acceptable precision. A total of 81.3 percent (i.e., 287 of 353 measurements) of the detected precision measurements were within the specified parameter-specific target ranges. If the nondetect results (e.g., if a sample result was nondetect, the sample duplicate result was also nondetect) are added to the measurements within the specified ranges the total increases to 85.6 percent precision (i.e., 392 of 459 measurements).

5.2.2 Accuracy

Analytical accuracy is defined as the nearness of a measurement to the true or accepted reference value. It is the composite of the random and systematic components of the measurement system and measures bias in the system. The random component of accuracy is measured and documented through the analyses of spiked samples. Sampling accuracy is assessed by evaluating the results of spiked samples and laboratory control samples. Accuracy measurements are calculated as percent recovery by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

The summarized (i.e., the lowest and highest values for each analytical method are shown rather than each of the parameter-specific target ranges) target accuracy ranges established for the subsurface soil samples analyzed by the off-site laboratory and the actual accuracies achieved are shown on Table 5-3 for both matrix spike and laboratory control samples. Based on the results

Table 5-2
Off-Site Laboratory Precision Measurements for the Area 23,
Building 650 Leachfield 1997 Subsurface Soil Sampling Activities

Parameter	Field Duplicate and Laboratory Duplicate Totals													Total
	Paint Filter	TC ^a Metals	TC VOCs ^b	VOCs	SVOC ^c	PCBs ^d	TPH-G ^e	TPH-D ^f	Gross A/B ^g	Gamma Scan	Pu ^h Isotopic	Sr ⁱ Isotopic	Tritium	
Total Number of RPD ^j Precision Measurements	6	15	63	40	110	10	10	9	18	34	12	4	8	339
Actual Range ^k of RPD Results	0 - 0	0.1 - 38	0 - 10	0 - 49	0 - 66	0 - 32	0 - 16	1 - 33	11 - 155	0.3 - 101	2 - 200	13 - 134	3 - 160	NA ^l
Target Range ^m for Precision RPD	0 - 20	0 - 20	0 - 15	0 - 24	0 - 50	0 - 30	0 - 30	0 - 42	0 - 30	0 - 20	0 - 20	0 - 25	0 - 20	NA
Number of Precision RPD Measurements within Target Range	6	13	63	30	100	10	10	9	6	24	3	2	2	278
Percent of Precision RPD Measurements within Target Range	100.0	86.7	100.0	75.0	90.9	90.0	100.0	100.0	33.3	70.6	25.0	50.0	25.0	82.0

Numbers in parentheses include the nondetect analytical results.

^aToxicity characteristic

^bVolatile organic compound(s)

^cSemivolatile organic compound(s)

^dPolychlorinated biphenyl(s)

^eTotal petroleum hydrocarbon in the gasoline range

^fTotal petroleum hydrocarbons in the diesel range

^gAlpha/beta

^hPlutonium

ⁱStrontium

^jRelative percent difference

^kThe actual ranges present are the total range from the lowest to the highest for all the parameters analyzed. The ranges for the individual parameters vary.

^lNot applicable

^mTarget ranges presented are the total range from lowest to highest for all the parameters analyzed. The ranges for the individual parameters may be different per the Industrial Sites Quality Assurance Project Plan (DOE, 1996a).

Table 5-3
Off-Site Laboratory Accuracy Measurements for the Area 23,
Building 650 Leachfield 1997 Subsurface Soil Sampling Activities

Parameter	TC ^a Metals	TC VOCs ^b	VOCs	SVOCs ^c	PCBs ^d	TPH-G ^e	TPH-D ^f	Gross A/B ^g	Gamma scan	Pu ^h Isotopic	Sr ⁱ -89/90	Tritium	Total
Total Number of %R ^j Measurements	208	356	280	459	78	108	48	28	30	16	17	15	1,643
Matrix Spike Samples (range ^k of actual %R)	87.6 - 113.7	0 - 115	35 - 152	28 - 127	73 - 131	44 - 124	52 - 127	82 - 140	NA ^l	77 - 100	80 - 90	97 - 111	NA
Laboratory Control Samples (range ^m of actual %R)	87.5 - 117.2	0 - 125	63 - 131	35 - 117	76 - 119	76 - 117	54 - 134	78 - 123	85 - 128	88 - 100	80 - 109	95 - 105	NA
%R Target Range ⁿ	75 - 125	27 - 146	54 - 138	10 - 147	21 - 158	57 - 146	25 - 162	70 - 130	80 - 120	80 - 120	75 - 125	80 - 120	NA
Number of %R Measurements within the Target Range	208	348	272	459	77	98	48	26	29	16	17	15	1610
Percent of %R Measurements within the Target Range	100.0	97.8	97.1	100.0	98.7	90.7	100.0	92.8	96.7	93.8	100.0	100.0	98.0

^aToxicity characteristic

^bVolatile organic compound(s)

^cSemivolatile organic compound(s)

^dPolychlorinated biphenyl(s)

^eTotal petroleum hydrocarbon in the gasoline range

^fTotal petroleum hydrocarbon in the diesel range

^gAlpha/beta

^hPlutonium

ⁱStrontium

^jPercent recovery

^kThe actual ranges present are the total range from the lowest to the highest for all the parameters analyzed. The ranges for the individual parameters vary.

^lNot applicable

^mThe actual ranges present are the total range from the lowest to the highest for all the parameters analyzed. The ranges for the individual parameters vary.

ⁿTarget ranges presented are the total range from lowest to highest for all the parameters analyzed. The ranges for the individual parameters may be different per the *Industrial Sites Quality Assurance Project Plan* (DOE, 1996a).

shown on this table, 98.0 percent of all QC sample recoveries were within the acceptable limits, indicating an acceptable analytical accuracy based on the requirements specified in the Industrial Sites QAPP (DOE, 1996a), which contains additional information about measurement of accuracy for these samples. Parameter-specific accuracy (percent recovery) measurements may be found in the off-site laboratory analytical report data package maintained in the IT project file. Field accuracy is assessed by confirming that the documents of record track the sample from its origin, through its transfer of custody, to its disposal. The goal of field accuracy is for all samples to be collected from the correct locations at the correct time, placed in a correctly labeled container with the correct preservative, and sealed with custody tape to prevent tampering. Any deviations from these requirements must be documented and explained, and the related data must be qualified accordingly. During the sampling project all field accuracy goals were met.

5.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Sample representativeness is achieved through the implementation of a sampling program designed to ensure proper sampling locations, number of samples, and the use of standardized analytical methods. Representativeness may also be assessed through analysis of replicate samples.

The soil sampling project identified the COCs present in the soils sampled and accurately and precisely quantified their concentrations. Samples were collected from predetermined intervals; collection and analysis were performed in accordance with approved procedures (IT, 1993). The soil sampling data are qualified as representative of site-specific environmental conditions.

Additional information about representativeness is found in the Industrial Sites QAPP (DOE, 1996a).

5.2.4 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid. All samples collected were judged to be usable. The soil sampling and final analytical program was executed in accordance with the Site Characterization Plan (DOE, 1997a) and Field Sampling

Instructions (IT, 1997). The specified sampling intervals were used as planned. However, not all specified samples were collected due to sample recovery problems in some intervals. All sample containers reached the laboratory intact. For all samples, sample chain of custody was maintained during sample storage and shipment. None of the noted deficiencies are considered to have significantly impacted the sample analysis results for the project.

5.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another. A standardized sampling approach and analytical methodology are used to achieve data comparability. To ensure comparability, all field and laboratory activities were performed and documented in accordance with approved procedures (IT, 1993). Approved, standardized methods and procedures were also used to analyze and report the data (e.g., contract laboratory program). This approach ensures that the data from this project can be compared to other datasets.

5.3 Field Deficiencies/Nonconformance

No surveillances were conducted during subsurface soil sampling field operations. To verify that sampling activities were performed in accordance with applicable requirements, the field documentation was reviewed by project coordination staff and the principle investigator. The results of the review indicated that there were no notable deficiencies or nonconformances.

5.4 Laboratory Nonconformances

Laboratory nonconformances are generally due to inconsistencies in analytical instrumentation operation and fluctuations in internal standard and calibration results. Several laboratory nonconformances were noted during analysis of the samples, particularly with respect to some of the radionuclide analyses. The nonconformances were not deemed to adversely affect the overall quality of the sampling event results. The laboratory data packages that detail nonconformances are maintained in the project files.

6.0 Data Quality Assessment and Modeling

6.1 Data Quality Assessment

All of the sampling for this project was conducted on a biased location basis. No statistically random or systematic sampling was conducted for the project. Due to the use of biased sampling techniques, no data quality assessment statistical evaluations were performed on the analytical data generated.

6.2 Contaminant Model

A simple cross-sectional map of the contamination that exists in the subsurface at that site was developed (see Figure 6-1). The contamination consists of man-made radionuclides and very low concentrations of PCBs and is present directly below the distribution box and the uppermost northeast portion of the leachfield. The contaminant zone exists completely within the boundaries of the site defined in the Site Characterization Plan (DOE, 1997a) and extends to a maximum depth of 6.7 m (22 ft) bgs or approximately 4.2 m (14 ft) below the base of the distribution box and 3.4 m (11 ft) bgs or approximately 0.6 m (2 ft) below the leachfield distribution lines.

The results of the contaminant analyses indicate a distribution of contamination concentrated directly below the leachfield distribution box and uppermost northeastern leachfield distribution lines. This distribution is likely the result of the small amount of liquids which entered the leachfield system during its early use and the later development of a hole in the bottom of the distribution box which then diverted the majority, if not all, of the flow through the bottom of the box rather than into the leachfield.

No COCs were identified in the samples collected from the two borings (LCHB-11 and LCHB-12) adjacent to the upper pipelines. The results from these two borings, along with the results of the previous sampling outlined in Section 2.0 of this report, indicate that no vertical or lateral migration has occurred along the upper piping.

MAP VIEW

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Figure 6-1
Cross-Sectional View of the Contaminant Areas
at the Area 23, Building 650 Leachfield

7.0 Conclusions

Analysis of data collected during the surface and subsurface characterization of the soils from the Area 23, Building 650 Leachfield indicates the presence of low levels of man-made radionuclides, very low levels of PCBs, and one acetone detect. The contaminants are present directly below the distribution box to a maximum depth of approximately 6.7 m (22 ft) and below the uppermost northeast corner of the leachfield to a maximum depth of 3.4 m (11 ft). The soil contamination below the distribution box originated from the release of contaminated liquids through the hole in the bottom of the distribution box. The soil contamination below the uppermost northeast corner of the leachfield originated from the infiltration of contaminated liquids through that portion of the distribution system.

Based on prior field investigations, sampling activities described in Section 2.0 of this report, and the analytical results from borings 11 and 12 of the 1997 investigation, no leakage from the upper pipelines was observed and no contamination was detected within the vicinity of the upper pipelines.

The remainder of the leachfield associated with the distribution lines is also considered clean as verified by borings 5 through 7, 9, and 10.

A clean closure or a closure in place is attainable for the Area 23, Building 650 Leachfield as described in Part B Permit (NDEP, 1995).

8.0 References

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Appendix A

Soil Boring Logs

SOIL BORING LOG				BORING NUMBER: LCHB-1		Page 1 of 1	
Project Name: 650 LEACHFIELD				Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS		Appendix A	
Easting UTM: 560026.20				Drilling Contractor: Soils Exploration		Revision: 1	
Northing UTM: 6211717.90				Elevation Datum: Mean Sea Level		Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.28		Page A-2 of A-13	
Date Hole Started: 04/02/97				Total Depth of Hole (feet): 49.00			
Date Hole Completed: 04/02/97				QA Check: Frank Baird			
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0		OPEN CONC. VAULT	Open concrete vault with a 2' by 2' square steel hatch at the ground surface.			Hammered through cement, surveyed hammer after use, no elevated readings.
1	1						
5	2		CONCRETE	Concrete			
			NO SAMPLE	Drilled no sample collected.			
10	3		GM	Very dense, dark yellowish brn 10 YR 4/4, silty gravel w/sand, moist.	24.0 27.0 79.0 89.0 88.0 106.0 87.0	LCH00074	Alpha - 0 dpm Beta - 890 dpm
			GM	Very dense, dark yellowish brn 10 YR 5/4, silty gravel w/sand, moist.		LCH00075	Alpha - 0 dpm Beta - 1090 dpm
	4		NO SAMPLE	Drilled, no sample collected.	91.0		
15	5		GC	Very dense, yellowish brown 10 YR 5/4, clayey gravel with sand, moist	42.0 88.0 106.0 74.0	LCH00076	Alpha - 0 dpm Beta - 1100 dpm
			NO SAMPLE	Drilled, no sample collected			
20	6		GW-GM	Very dense, well graded gravel with silt and sand, subangular gravel, moist.	50.0 56.0 100.0 130.0	LCH00077	Alpha - 0 dpm Beta - 970 dpm
			NO SAMPLE	Drilled, no samples collected			
25	7						
	8		GW-GM	Very dense, yellowish brown 10 YR 5/4, well graded gravel with silt and sand, moist.	36.0 113.0 200.0	LCH00078	Alpha - 0 dpm
			NO SAMPLE	Drilled, no samples collected			
30	9		SM	Very dense, yellowish brown 10 YR 5/4, silty sand with gravel, moist.	45.0 151.0 174.0 120.0	LCH00079	Alpha - 0 dpm Beta - 1100 dpm
			NO SAMPLE	Drilled, no sample collected			
35	10						
	11		SM	Very dense, yellowish brown 10 YR 5/4, silty sand with gravel, moist.	110.0 175.0	LCH00080	Alpha - 0 dpm
			NO SAMPLE	Drilled, no samples collected			
40	12		SM	Very dense, yellowish brown, 10 YR 5/4, silty sand with gravel, moist.	79.0 121.0 143.0 185.0	LCH00081	Alpha - 0 dpm Beta - 0 dpm
			NO SAMPLE	Drilled, no sample collected			
45	13						
	14		SM	Very dense, yellowish brown, 10 YR 5/4, silty sand with gravel, moist.	44.0 88.0 75.0 89.0	LCH00082	Alpha - 0 dpm Beta - 0 dpm
			SM			LCH00083	

SOIL BORING LOG				BORING NUMBER: LCHB-2		Page 1 of 1	
Project Name: 650 LEACHFIELD				Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS		Appendix A	
Easting UTM: 560027.90				Drilling Contractor: Soils Exploration		Revision: 1	
Northing UTM: 6211716.00				Elevation Datum: Mean Sea Level		Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.28		Page A-3 of A-13	
Date Hole Started: 04/01/97				Total Depth of Hole (feet): 47.00			
Date Hole Completed: 04/01/97				QA Check: Frank Baird			
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0		NO SAMPLE	Drilled, no sample.			
1	1						
5	2		SM	Very dense, yellowish brown 10 YR 4/4, silty sand with gravel, moist.	10.0 16.0 79.0 94.0 87.0 138.0 140.0 110.0	LCH00065	Alpha - 0 dpm Beta - 0 dpm HNU - 1.1 ppm
10	3		SC	Very dense, yellowish brown 10 YR 5/4, clayey sand with gravel, moist.	89.0 96.0 181.0 147.0	LCH00066	Alpha - 0 dpm Beta - 0 dpm
	4		NO SAMPLE	Drilled, no samples collected			
15	5		SC	Very dense, yellowish brown 10 YR 5/4, clayey sand with gravel, moist.	45.0 55.0 58.0 84.0	LCH00067	Alpha - 0 dpm Beta - 0 dpm
	6		NO SAMPLE	Drilled, no samples collected			
20	6		SM	Very dense, yellowish brown 10 YR 5/4, silty sand with gravel, moist.	77.0 107.0 114.0 150.0	LCH00068	Alpha - 860 dpm Beta - 0 dpm
	7		NO SAMPLE	Drilled, no sample collected			
25	8		GM	Very dense, 10 YR 5/4 yellowish brown, silty gravel with sand, moist.	88.0 90.0 132.0 174.0	LCH00069	Alpha - 15 dpm Beta - 967 dpm
	9		NO SAMPLE	Drilled, no samples collected			
30	9		GM	Very dense, 10 YR 5/4, yellowish brown, silty gravel with sand, moist.	41.0 50.0 68.0 87.0	LCH00070	Alpha - 0 dpm Beta - 0 dpm
	10		NO SAMPLE	Drilled, no samples collected			
35	11		GM	Very dense, dark yellowish brown 10 YR 4/4, silty gravel with sand, moist.	20.0 71.0 230.0	LCH00071	Alpha - 0 dpm
	12		NO SAMPLE	Drilled, no samples collected			
40	12		GM	Very dense, dark yellowish brown, 10 YR 4/4, silty gravel with sand, moist.	83.0 92.0 110.0 130.0	LCH00072	Alpha - 0 dpm Beta - 940 dpm
	13		NO SAMPLE	Drilled, no samples collected			
45	14		GM	Very dense, dark yellowish brown 10 YR 4/4, silty gravel with sand, moist.	33.0 42.0 44.0 81.0	LCH00073	Alpha - 0 dpm Beta - 0 dpm

SOIL BORING LOG		BORING NUMBER: LCHB-3		Page 1 of 1
Project Name: 650 LEACHFIELD		Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR
Project Number: 771054		Drilling Method: HS		Appendix A
Easting UTM: 560024.40		Drilling Contractor: Soils Exploration		Revision: 1
Northing UTM: 6211716.20		Elevation Datum: Mean Sea Level		Date: 1/27/98
Geologist: Tom Mulder		Hole Surface Elevation (Meters): 3753.28		Page A-4 of A-13
Date Hole Started: 03/27/97		Total Depth of Hole (feet): 47.00		
Date Hole Completed: 03/31/97		QA Check: Frank Baird		

Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0		NO SAMPLE	Drilled, no sample collected			
5	1						
	2						
	3		SM	Very dense, brown, 7.5 YR 5/4, angular gravel to 0.5 inch, silty sand with gravel, slightly moist.	40.0 85.0 107.0 47.0	LCH00040	Alpha - 0 dpm Beta - 50 dpm
10	3		SM	Very dense, brown 7.5 YR 5/4, subangular clasts to 0.5 inch, silty sand with gravel, dry.	40.0 54.0 40.0 56.0	LCH00041	Alpha - 0 dpm Beta - 0 dpm
	4		NO SAMPLE	Drilled, no sample collected			
15	5		SM	Very dense, yellowish brown 10 YR 5/6, silt sand, gravel to 0.75-inch, slightly moist	81.0 54.0 80.0 80.0	LCH00042	Alpha - 0 dpm Beta - 0 dpm
	6		NO SAMPLE	Drilled, no sample collected			
20	6		SM	Very dense, yellowish brown 10 YR 5/6, silty sand, with gravel, slightly moist.	80.0 94.0 90.0 86.0	LCH00043	Alpha - 0 dpm Beta - 0 dpm
	7		NO SAMPLE	Drilled, no sample collected			
25	8		GM	Very dense, light brown 7.5 YR 6/4, subangular clasts, silty gravel with sand, dry.	80.0 77.0 110.0 158.0	LCH00044	Alpha - 0 dpm Beta - 915 dpm
	9		NO SAMPLE	Drilled, no sample collected			
30	9		GM	Very dense, light brown 7.5 YR 6/4 subrounded clasts, silty gravel with sand, slightly moist.	50.0 98.0 142.0 101.0	LCH00045	Alpha - 0 dpm Beta - 0 dpm
	10		NO SAMPLE	Drilled, no sample collected			
35	11		GM	Very dense, light brown 7.5 YR 6/4, silty gravel with sand, dry, sample contained 10-inch long piece of 2-inch OD white PVC, 5ch. 40. Appears to be piece of vertically oriented PVC pipe.	110.0 115.0 127.0 141.0	LCH00046	Alpha - 0 dpm Beta - 0 dpm
	12		NO SAMPLE	Drilled, no sample collected. Pieces of PVC in cuttings.			
40	12		SM	Very dense, pale yellow 2.5 Y 7/4, subrounded gravels, silty sand with gravel to 0.5 inches, dry. No evidence of PVC in sample.	110.0 154.0 194.0 164.0	LCH00047	
	13		NO SAMPLE	Drilled, no sample collected			
45	14		SM	Very dense, pale yellow 2.5 Y 7/4, subrounded gravels, silty sand with gravel to 0.75 inches, dry.	50.0 75.0 80.0 115.0	LCH00048	Alpha - 0 dpm Beta - 0 dpm

SOIL BORING LOG				BORING NUMBER: LCHB-4 Page 1 of 1			
Project Name: 650 LEACHFIELD				Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS		Appendix A	
Easting UTM: 560026.50				Drilling Contractor: Soils Exploration		Revision: 1	
Northing UTM: 6211720.10				Elevation Datum: Mean Sea Level		Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.28		Page A-5 of A-13	
Date Hole Started: 04/01/97				Total Depth of Hole (feet): 47.00			
Date Hole Completed: 04/01/97				QA Check: Frank Baird			
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0		NO SAMPLE	Drilled, no sample.			
1	1			Very dense, very pale brown 10 YR 7/4, silty sand with gravel, dry.			
5	2	SM	NO SAMPLE	Drilled, no sample collected	44.0 100.0 50.0	LCH00058	Alpha - 0 dpm Beta - 0 dpm HNU - 1.6 ppm
10	3	SM		Very dense, yellowish brown 10 YR 5/4, subangular clasts to 1 inch, silty sand with gravel, moist; increase in gravel content at approximately 12'.	41.0 40.0 46.0 76.0 86.0 89.0 73.0 76.0 46.0	LCH00059	Alpha - 0 dpm Beta - 864 dpm HNU - 1.5 ppm
15	4	GM	NO SAMPLE	Very dense, yellowish brown 10 YR 5/4, subangular clasts to 3 inches, silty gravel with sand, moist.	101.0 107.0 97.0		
20	5			Drilled, no sample collected			
25	6	GM		Very dense, yellowish brown 10 YR 5/4, subangular clasts to 1 inch, silty gravel with sand, moist.	81.0 86.0 97.0 129.0	LCH00060	Alpha - 0 dpm Beta - 0 dpm
30	7		NO SAMPLE	Drilled, no sample collected			
35	8	SM		Very dense, brown 10 YR 5/3, subangular gravel to 2 inches, silty sand with gravel, moist.	154.0 220.0 210.0 161.0	LCH00061	Alpha - 0 dpm Beta - 920 dpm
40	9		NO SAMPLE	Drilled, no sample collected			
45	10	GM		Very dense, brown 10 YR 5/3, subrounded gravel to 0.75 inches, well graded gravel with sand, moist.	31.0 34.0 37.0 41.0	LCH00062	Alpha - 0 dpm Beta - 850 dpm
50	11		NO SAMPLE	Drilled, no sample collected			
55	12	SC		Very dense, brown 10 YR 5/3, subrounded gravel, clayey sand with gravel, moist.	26.0 44.0 57.0 120.0	LCH00063	Alpha - 0 dpm Beta - 0 dpm
60	13		NO SAMPLE	Drilled, no sample collected			
65	14	SC		Very dense, brown 10 YR 5/3, clayey sand with gravel, moist.	45.0 48.0 77.0 80.0	LCH00064	Alpha - 0 dpm Beta - 930 dpm

SOIL BORING LOG				BORING NUMBER: LCHB-5				Page 1 of 1	
Project Name: 650 LEACHFIELD				Environmental Contractor: IT CORP				CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS				Appendix A	
Easting UTM: 560023.80				Drilling Contractor: Soils Exploration				Revision: 1	
Northing UTM: 6211714.00				Elevation Datum: Mean Sea Level				Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.28				Page A-6 of A-13	
Date Hole Started: 04/08/97				Total Depth of Hole (feet): 47.00					
Date Hole Completed: 04/08/97				QA Check: Frank Baird					
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels		
0	0		NO SAMPLE	Drilled, no samples collected					
5	1			Very dense, yellowish brown 10 YR 5/4, gravel to 1 inch diameter, subangular, well graded sand with silt and gravel, dry.					
	2		SW-SM		17.0 21.0 25.0	LCH00109	Alpha - 0 dpm Beta - 819 dpm		
10	3		SW-SM	Very dense, light brown 10 YR 6/4, gravel to 0.75 inch, subangular, well graded sand with silt and gravel, dry	51.0 59.0 77.0 87.0 128.0	LCH00110	Alpha - 0 dpm Beta - 834 dpm		
	4		NO SAMPLE	Drilled, no sample collected					
15	5		GW-GM	Very dense, yellowish brown 10 YR 5/4, subangular gravel to 1 inch diameter, well graded gravel with silt and sand, dry.	48.0 93.0 105.0 115.0	LCH00111	Alpha - 0 dpm Beta - <814 dpm		
	6		SW-SM	Very dense, yellowish brown 10 YR 5/4, subangular gravel to 1/2 inch diameter, well graded sand with silt and gravel, moist.	42.0 72.0 78.0 94.0	LCH00112	Alpha - 0 dpm Beta - <814 dpm		
	7		NO SAMPLE	Drilled, no samples collected					
25	8		GM	Very dense, yellow brown 10 YR 5/4, gravel to 2.5 inches, subangular, silty gravel with sand, dry.	38.0 90.0 158.0 200.0	LCH00113	Alpha - 0 dpm Beta - <814 dpm		
	9		NO SAMPLE	Drilled, no samples collected					
30	10		GM	Very dense, yellow brown 10 YR 5/4, subangular gravel to 2 inches, silty gravel with sand, moist.	27.0 43.0 57.0 79.0	LCH00114	Alpha - 0 dpm Beta - <814 dpm		
	11		GM	Very dense, yellow brown 10 YR 5/4, subangular gravel to 3 inches diameter, silty gravel with sand, moist.	88.0 97.0 196.0 145.0	LCH00115	Alpha - 0 dpm Beta - <814 dpm		
	12		GM	Very dense, 10 YR 5/4, subangular gravel to 2 inches diameter, silty gravel with sand, dry.	35.0 57.0 70.0 76.0	LCH00116	Alpha - 0 dpm Beta - <814 dpm		
	13		NO SAMPLE	Drilled, no sample collected					
45	14		GM	Very dense, yellow brown 10 YR 5/4, gravel to 1 inch diameter, silty gravel with sand, dry.	38.0 54.0 84.0 128.0	LCH00117	Alpha - 4.2 dpm Beta - <814 dpm		

SOIL BORING LOG				BORING NUMBER: LCHB-6 Page 1 of 1			
Project Name: 850 LEACHFIELD				Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS		Appendix A	
Easting UTM: 560025.1				Drilling Contractor: Soils Exploration		Revision: 1	
Northing UTM: 6211714.20				Elevation Datum: Mean Sea Level		Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.28		Page A-7 of A-13	
Date Hole Started: 04/08/97				Total Depth of Hole (feet): 47.00			
Date Hole Completed: 04/08/97				QA Check: Frank Baird			
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0		NO SAMPLE	Drilled, no sample collected			
1	1						
5	2	GC		Very dense, yellowish brown 10 YR 5/4, gravel to 4 inch diameter, clayey gravel with sand.			
			NO SAMPLE		17.0	LCH00118	Alpha - < 16 dpm
			SM	Drilled, no samples collected	71.0		
					200.0		
10	3		NO SAMPLE	Very dense, yellowish brown 10 YR 5/4, subangular gravel to 1 inch diameter, silty sand with gravel, dry.	33.0	LCH00119	Alpha - < 16 dpm
					78.0		Beta - < 691 dpm
					137.0		
					147.0		
	4		NO SAMPLE	Drilled, no samples collected			
15	5	GW-GM		Very dense, yellowish brown 10 YR 5/4, subangular gravel, well graded gravel with silt and sand, moist.	38.0	LCH00120	Alpha - < 16 dpm
			NO SAMPLE		50.0		Beta - 711 dpm
					53.0		
					57.0		
20	6	GW-GM		Very dense, yellowish brown 10 YR 5/4, subangular gravel to 1 inch diameter, well graded gravel, with silt and sand, moist.	38.0	LCH00121	Alpha - < 16 dpm
			NO SAMPLE		51.0		Beta - < 691 dpm
					76.0		
					79.0		
	7		NO SAMPLE	Drilled, no samples collected			
25	8	GW-GM		Very dense, yellowish brown 10 YR 5/4, subangular gravel, well graded gravel with silt and sand, moist.	32.0	LCH00122	Alpha - < 16 dpm
					55.0		Beta - < 691 dpm
					59.0		HNU - 1.2 ppm
					54.0		
30	9		NO SAMPLE	Drilled, no samples collected			
					31.0		
					55.0		
					82.0		
					101.0		
35	11	GM		Very dense, yellowish brown 10 YR 5/4, subangular gravel to 3 inches, silty gravel with sand, dry	34.0	LCH00123	Alpha - < 16 dpm
			NO SAMPLE		55.0		
				Drilled, no samples collected	200.0		
40	12	GM		Very dense, yellowish brown 10 YR 5/4, subangular gravel to 3 inches, silty gravel with sand, dry.	31.0	LCH00124	Alpha - < 16 dpm
					51.0		Beta - 691 dpm
					74.0		
					195.0		
	13		NO SAMPLE	Drilled, no sample collected			
45	14	GM		Very dense, yellowish brown 10 YR 5/4, gravel to 1 inch diameter, silty gravel with sand moist.	44.0	LCH00125	Alpha - < 16 dpm
					78.0		Beta - < 691 dpm
					124.0		
					131.0		

SOIL BORING LOG			BORING NUMBER: LCHB-7		Page 1 of 1
Project Name: 850 LEACHFIELD			Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR
Project Number: 771054			Drilling Method: HS		Appendix A
Easting UTM: 560026.70			Drilling Contractor: Soils Exploration		Revision: 1
Northing UTM: 6211714.80			Elevation Datum: Mean Sea Level		Date: 1/27/98
Geologist: Tom Mulder			Hole Surface Elevation (Meters): 3753.28		Page A-8 of A-13
Date Hole Started: 04/08/97			Total Depth of Hole (feet): 47.00		
Date Hole Completed: 04/08/97			QA Check: Frank Baird		

Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0		NO SAMPLE	Drilled, no sample collected			
5	1						
	2		SM	Very dense, dark yellowish brown 10 YR 4/4, subangular gravel to 1 inch diameter, silty sand with gravel, moist.	41.0 82.0 85.0 113.0	LCH00126	Alpha - < 22 dpm Beta - < 674 dpm
10	3		GM	Very dense, dark yellowish brown 10 YR 4/4, subangular gravel to 2 inches diameter, silty gravel with sand, moist	72.0 78.0 85.0 143.0	LCH00127	Alpha - < 22 dpm Beta - < 674 dpm
	4		NO SAMPLE	Drilled, no sample collected			
15	5		GM	Very dense, dark yellowish brown 10 YR 4/4, subangular gravel to 2 inches, silty gravel with sand.	55.0 88.0 123.0 188.0	LCH00128	Alpha - < 22 dpm Beta - < 674 dpm
	6		NO SAMPLE	Drilled, no samples collected			
20	7		GM	Very dense, yellowish brown 10 YR 5/4, subangular gravel to 2 inches, silty gravel with sand.	45.0 82.0 92.0 115.0	LCH00129	Alpha - 0 dpm Beta - 424 dpm
	8		NO SAMPLE	Drilled, no sample collected.			
25	9		GM	Very dense, yellowish brown 10 YR 5/4, subangular gravel to 1 inch diameter, silty gravel with sand, dry.	48.0 151.0 145.0	LCH00130	Alpha - < 22 dpm
	10		NO SAMPLE	Drilled, no sample collected			
30	11		GM	Very dense, yellowish brown 10 YR 5/4, subangular gravel to 1.5 inch diameter, silty gravel with sand.	52.0 74.0 110.0 131.0	LCH00131	Alpha - < 22 dpm Beta - < 674 dpm
	12		NO SAMPLE	Drilled, no samples collected			
35	13		SM	Very dense, yellowish brown 10 YR 5/4, subangular gravel to 1 inch silty sand with gravel, dry.	54.0 134.0 137.0 135.0	LCH00132	Alpha - < 22 dpm Beta - < 674 dpm
	14		NO SAMPLE	Drilled, no samples collected			
40	15		GM	Very dense, yellowish brown 10 YR 5/4, Subangular gravel to 3 inch diameter silty gravel with sand, moist	34.0 75.0 79.0 102.0	LCH00133	Alpha - < 22 dpm Beta - < 674 dpm
	16		NO SAMPLE	Drilled, no samples collected			
45	17		GM	Very dense, yellowish brown 10 YR 5/4, subangular clasts to 2 inches, silty gravel with sand.	150.0 109.0 200.0	LCH00134	Alpha - < 22 dpm

SOIL BORING LOG				BORING NUMBER: LCHB-8 Page 1 of 1			
Project Name: 650 LEACHFIELD				Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS		Appendix A	
Easting UTM: 560028.30				Drilling Contractor: Soils Exploration		Revision: 1	
Northing UTM: 6211714.40				Elevation Datum: Mean Sea Level		Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.28		Page A-9 of A-13	
Date Hole Started: 04/09/97				Total Depth of Hole (feet): 47.00			
Date Hole Completed: 04/09/97				QA Check: Frank Baird			
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0		NO SAMPLE	Drilled, no samples collected			
5	1						
	2		GM	Very dense, yellowish brown 10 YR 5/4 subangular clasts to 2 inches diameter, silty gravel with sand, moist.	84.0 200.0 178.0 130.0	LCH00135	Alpha - 0 dpm Beta - 502 dpm
10	3		GC	Very dense, yellowish brown 10 YR, clasts to 2 inches diameter, clayey gravel with sand, dry.	31.0 84.0 157.0 200.0	LCH00136	Alpha - 0 dpm Beta - 487 dpm
	4		NO SAMPLE	Drilled, no samples collected			
15	5		GM	Very dense, yellowish brown 10 YR 5/4, subangular clasts to 2 inches diameter, silty gravel with sand, moist.	47.0 52.0 83.0 90.0	LCH00137	Alpha - 0 dpm Beta - 627 dpm
	6		NO SAMPLE	Drilled, no samples collected			
20	6		GW-GM	Very dense, yellowish brown 10 YR 5/4, clasts to 2.5 in diameter, well graded gravel with silt and sand, moist.	31.0 49.0 56.0 88.0	LCH00138	Alpha - 0 dpm Beta - 570 dpm
	7		NO SAMPLE	Drilled, no samples collected			
25	8		SM	Very dense, yellowish brown 10 YR 5/4, silty sand with gravel, moist.	33.0 39.0 43.0 59.0	LCH00139	Alpha - 0 dpm Beta - 647 dpm
	9		NO SAMPLE	Drilled, no samples collected			
30	9		SM	Very dense, yellowish brown 10 YR 5/4, silty sand with gravel, moist.	31.0 48.0 39.0 47.0 45.0 46.0 74.0 111.0	LCH00140	Alpha - 0 dpm Beta - 631 dpm HNU - 1.2 ppm
	10		SM	Very dense, yellowing brown 10 YR 5/4, silty sand with gravel, moist. Increasing gravel content going downward.			
35	11		NO SAMPLE	Drilled, no samples collected			
	12		GM	Very dense, yellowish brown 10 YR 5/4, clasts to 2 inches diameter, silty gravel with sand, moist.	28.0 58.0 59.0 88.0	LCH00141	Alpha - 0 dpm Beta - 680 dpm
40	13		NO SAMPLE	Drilled, no samples collected			
	14		GM	Very dense, yellowish brown 10 YR 5/4, clasts to 2 inches diameter, silty gravel with sand, moist.	52.0 54.0 57.0 47.0	LCH00142	Alpha - 0 dpm Beta - <644 dpm

SOIL BORING LOG				BORING NUMBER: LCHB-9 Page 1 of 1			
Project Name: 650 LEACHFIELD				Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS		Appendix A	
Easting UTM: 560023.50				Drilling Contractor: Soils Exploration		Revision: 1	
Northing UTM: 6211704.00				Elevation Datum: Mean Sea Level		Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.28		Page A-10 of A-13	
Date Hole Started: 04/07/97				Total Depth of Hole (feet): 47.00			
Date Hole Completed: 04/07/97				QA Check: Frank Baird			
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0			Refusal of spoon			
	1			Drilled, no sample collected			
5	2		NO SAMPLE	Very dense, yellowish brown 10 YR 5/4, gravel to 2 inches diameter, silty gravel with sand, moist.	70.0 33.0 57.0 88.0 84.0 79.0 106.0 86.0 86.0	LCH00101	Alpha - 0 dpm Beta - 600 dpm
	3		GM	Very dense, yellowish brown 10 YR 5/4, gravel to 2 inches diameter, silty gravel with sand, moist.		LCH00102	Alpha - 0 dpm Beta - <572 dpm
10	4		NO SAMPLE	Drilled, no samples collected			
	5		GM	Very dense, yellowish brown, 10 YR 5/4, gravel to 2 inches diameter, silty gravel with sand, dry.	30.0 47.0 59.0 72.0	LCH00103	Alpha - 0 dpm Beta - 631 dpm
15	6		NO SAMPLE	Drilled, no samples collected			
	7		SW-SM	Very dense, yellow brown 10 YR 5/4, gravel to 2 inches, well graded sand with silt and gravel, moist.	38.0 51.0 72.0 78.0	LCH00104	Alpha - 0 dpm Beta - 572 dpm
20	8		NO SAMPLE	Drilled, no samples collected			
	9		SW-SM	Very dense, yellow brown 10 YR 5/4, gravel to 1 inch diameter, silty sand with gravel.	29.0 36.0 48.0 64.0	LCH00104	Alpha - 0 dpm Beta - 592 dpm
25	10		NO SAMPLE	Drilled, no samples collected			
	11		GM	Very dense, yellow brown 10 YR 5/4, gravel to 2 inches diameter, silty gravel with sand, moist.	23.0 21.0 87.0 88.0	LCH00105	Alpha - 0 dpm Beta - 592 dpm
30	12		NO SAMPLE	Drilled, no sample collected			
	13		GM	Very dense, yellow brown 10 YR 5/4, gravel to 1 inch, silty gravel with sand.	38.0 44.0 59.0 45.0	LCH00106	Alpha - 0 dpm Beta - 572 dpm
35	14		NO SAMPLE	Drilled, no sample collected			
	15		GM	Very dense, yellow brown 10 YR 5/4, gravel to 2 inches diameter, silty gravel with sand, dry.	24.0 41.0 45.0 54.0	LCH00107	Alpha - 0 dpm Beta - 598 dpm
40	16		NO SAMPLE	Very dense, yellow brown 10 YR 5/4, gravel to 2 inches diameter, silty gravel with sand, dry.	33.0 58.0 81.0 103.0	LCH00108	Alpha - 0 dpm Beta - 600 dpm
45	17						

SOIL BORING LOG				BORING NUMBER: LCHB-10 Page 1 of 1			
Project Name: 650 LEACHFIELD				Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS		Appendix A	
Easting UTM: 560027.40				Drilling Contractor: Soils Exploration		Revision: 1	
Northing UTM: 6211704.00				Elevation Datum: Mean Sea Level		Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.28		Page A-11 of A-13	
Date Hole Started: 04/03/97				Total Depth of Hole (feet): 14.30			
Date Hole Completed: 04/03/97				QA Check: Frank Baird			
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0		NO SAMPLE	Drilled, no samples collected			
1	1						
2	2		GM	Very dense, yellowish brown 10 YR 5/4, gravel to 2 inches, silty gravel with sand, dry.	56.0 50.0 30.0 54.0 46.0 87.0 200.0	LCH00092	Alpha - 0 dpm Beta - 908 dpm
3	3					LCH00093	Alpha - 0 dpm
4	4		NO SAMPLE	Drilled, no samples collected			
5	5		GM	Very dense, yellowish brown 10 YR 5/4, clasts to 3 inches, silty gravel with sand, moist.	49.0 51.0 59.0 44.0 34.0 60.0 96.0 73.0	LCH00094	Alpha - 0 dpm Beta - 900 dpm
6	6		NO SAMPLE	Drilled, no sampling collected			
7	7						
8	8		GM	Very dense, yellowish brown 10 YR 5/4, clast to 7 inches, silty gravel with sand, moist.	50.0 50.0 87.0 122.0	LCH00095	Alpha - 0 dpm Beta - 978 dpm
9	9		SW-SM	Very dense, brown 10 YR 5/3, subangular gravel to 1 inch diameter well graded sand with silt and gravel, moist.	35.0 43.0 86.0 89.0	LCH00096	Alpha - 0 dpm Beta - 572 dpm
10	10		NO SAMPLE	Drilled, no samples collected.			
11	11		SM	Very dense, yellowish brown 10 YR 5/4, gravel to 2 inches, silty sand with gravel.	0.0 8.0 50.0 50.0 50.0 50.0 50.0	LCH00097	Alpha - 0 dpm Beta - 530 dpm
12	12		NO SAMPLE	Drilled, no samples collected.		LCH00098	Alpha - 0 dpm Beta - 0 dpm
13	13		SC	Very dense, grayish brown 10 YR 5/2, clayey sand with gravel.	39.0 58.0 131.0 72.0	LCH00099	Alpha - 0 dpm Beta - 456 dpm
14	14		SW	Very dense, brown 10 YR 5/3, gravel to 1 inch diameter, silty sand with gravel, moist.	45.0 88.0 87.0 112.0	LCH00100	Alpha - 0 dpm Beta - 584 dpm

SOIL BORING LOG				BORING NUMBER: LCHB-11 Page 1 of 1			
Project Name: 650 LEACHFIELD				Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS		Appendix A	
Easting UTM: 560020.00				Drilling Contractor: Soils Exploration		Revision: 1	
Northing UTM: 6211720.00				Elevation Datum: Mean Sea Level		Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.28		Page A-12 of A-13	
Date Hole Started: 03/31/97				Total Depth of Hole (feet): 47.00			
Date Hole Completed: 03/31/97				QA Check: Frank Baird			
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0			Refusal of spoon (Boulder, drilled thru)			Alpha - 0 dpm Beta - 0 dpm HNU - 0.3 ppm
5	1		NO SAMPLE	Drilled, no sample collected			
			SM	Very dense, very pale brown 10 YR 7/4, silty sand with gravel, dry.			
10	2		NO SAMPLE	Drilled, no sample collected	154.0		
			SC	Very dense, yellowish red 5 YR 4/6, clayey sand with gravel, moist.	25.0 22.0 24.0 22.0 16.0 16.0 22.0 24.0	LCH00049	Alpha - 0 dpm Beta - 0 dpm
	3		SC	Very dense, strong brown 7.5 YR clayey sand with gravel to 1 inch, irregular gravel, moist.		LCH00050	Alpha - 0 dpm Beta - 0 dpm
			NO SAMPLE	Drilled, no sample collected			
15	4		NO SAMPLE	Drilled, no sample collected			
			SC	Very dense, mottled v. dark brown 7.5 YR 2.5/3 and reddish yellow 7.5 YR 6/6, subangular clasts to .75 inch, clayey sand with gravel, moist.	28.0 50.0 52.0 51.0	LCH00051	Alpha - 0 dpm Beta - 0 dpm
	5		NO SAMPLE	Drilled, no sample collected			
			GC	Very dense, pale yellow 2.5 Y 7/4, subrounded gravel, clayey gravel with sand, dry	44.0 50.0 52.0 57.0	LCH00052	Alpha - 0 dpm Beta - 0 dpm
20	6		NO SAMPLE	Drilled, no sample collected			
			GC	Very dense, pale yellow 2.5 Y 7/4, subrounded gravel clayey gravel with sand, slightly moist.	38.0 42.0 50.0 49.0	LCH00053	Alpha - 0 dpm Beta - 0 dpm
25	8		NO SAMPLE	Drilled, no sample collected			
			SM	Very dense, pale yellow 2.5 Y 7/4 silty sand with gravel, low recovery, spoon plugged by cobble.	53.0 76.0 103.0 53.0	LCH00054	Alpha - 0 dpm Beta - 0 dpm
30	9		NO SAMPLE	Drilled, no sample collected			
			GM	Very dense, dark brown 10 YR 3/3 subrounded gravel, silty gravel with sand.	51.0 118.0 127.0 120.0	LCH00055	Alpha - 0 dpm Beta - 0 dpm
	11		NO SAMPLE	Drilled, no sample collected			
			GM	Very dense, pale yellow 2.5 Y 7/4, subangular gravel, silty gravel with sand, dry.	51.0 100.0 122.0 124.0	LCH00056	Alpha - 0 dpm Beta - 0 dpm
40	12		NO SAMPLE	Drilled, no sample collected			
			GM	Very dense, light yellowish brown 10 YR 6/4, subangular gravel, silty gravel with sand, dry.	24.0 26.0 70.0 115.0	LCH00057	Alpha - 0 dpm Beta - 0 dpm
45	13		NO SAMPLE	Drilled, no sample collected			
			GM				
	14						

SOIL BORING LOG				BORING NUMBER: LCHB-12 Page 1 of 1			
Project Name: 650 LEACHFIELD				Environmental Contractor: IT CORP		CAU 94 RCRA 650LF CR	
Project Number: 771054				Drilling Method: HS		Appendix A	
Easting UTM: 560027.00				Drilling Contractor: Soils Exploration		Revision: 1	
Northing UTM: 6211727.60				Elevation Datum: Mean Sea Level		Date: 1/27/98	
Geologist: Tom Mulder				Hole Surface Elevation (Meters): 3753.26		Page A-13 of A-13	
Date Hole Started: 04/02/97				Total Depth of Hole (feet): 48.00			
Date Hole Completed: 04/02/97				QA Check: Frank Baird			
Depth (feet)	Depth (Meters)	Legend	USCS	Classification (Description)	Blow Counts (per 6')	Sample Number	Onsite Screening All results are below or at background levels
0	0		NO SAMPLE				
5	1			Very dense, strong brown 7.5 YR 4/6, silty sand with gravel.		LCH00084	
	2		SM		34.0 43.0 52.0 55.0 58.0 64.0 66.0 67.0		Alpha - 0; Beta - 960; HNU - 1.6
			GC	Very dense, yellowish brown 10 YR 5/4, clayey gravel with sand, angular gravel to 1 inch diameter, moist.		LCH00085	Alpha - 0; Beta - 952; HNU - 1.6
10	3		NO SAMPLE	Drilled, no samples collected			
	4						
15	5		SC		28.0 49.0 60.0 72.0 51.0 58.0 60.0 102.0	LCH00086	Alpha - 0; Beta - 846; HNU - 1.7
				Very dense, dark yellowish brown 10 YR 4/4, subangular clasts to 1.5 inch, clayey sand with			
20	6		NO SAMPLE	Drilled, no sample collected			
	7						
25	8		GM	Very dense, yellowish brown, 10 YR 5/6, silty gravel with sand, moist.	45.0 101.0 64.0 95.0	LCH00087	Alpha - 0; Beta - 835; HNU - 1.2
			NO SAMPLE	Drilled, no samples collected			
30	9		GM	Very dense, yellowish brown, 10 YR 5/6, silty gravel with sand, moist.	45.0 61.0 83.0 86.0	LCH00088	Alpha - no reading; Beta - no reading; HNU - no detect
	10		NO SAMPLE	Drilled, no samples collected			
35	11		GM	Very dense, yellow brown 10 YR 5/4, silty gravel with sand, moist.	37.0 58.0 80.0 92.0	LCH00089	Alpha - 0; Beta - 938; HNU - 1.2
			NO SAMPLE	Drilled, no samples collected			
40	12		GM	Very dense, yellow brown 10 YR, cobble to 2 inches, silty gravel with sand.	34.0 60.0 61.0 66.0	LCH00090	Alpha - 0; Beta - 981; HNU - 1.4
	13		NO SAMPLE	Drilled, no samples collected			
45	14		GM	Very dense, strong brown 7.5 YR 5/6, silty gravel with sand, dry.	31.0 47.0 55.0 93.0 105.0 250.0		

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