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Formerly Utilized Sites Remedial Action Program (FUSRAP)  
Contract No. DE-AC05-81OR20722

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CHEMICAL CHARACTERIZATION REPORT  
FOR THE ST. LOUIS AIRPORT SITE AND  
LATTY AVENUE PROPERTIES

St. Louis, Missouri

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July 1990



Bechtel National, Inc.

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Prepared for

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OAK RIDGE OPERATIONS OFFICE  
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## ABSTRACT

A chemical characterization of the St. Louis Airport Site (SLAPS) and the Latty Avenue Properties in St. Louis, Missouri, and the vicinity was conducted in 1987 as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a U.S. Department of Energy (DOE) program to identify and clean up or otherwise control sites where residual radioactive contamination exceeding current guidelines remains from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. This report describes the chemical characterization activities. The primary objectives of the characterization were to:

- Identify and quantify the contaminants present
- Define the potential migration pathways of any chemical contaminants

The soil samples taken during this effort were analyzed for metals, mobile ions, volatile and semivolatile organic compounds, and the Resource Conservation and Recovery Act- (RCRA-) hazardous waste characteristics (reactivity, corrosivity, ignitability, and extraction procedure toxicity).

### SLAPS

The soil samples taken from SLAPS and analyzed for metals confirmed the presence of 15 metals with concentrations above background levels. Levels of antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, magnesium, molybdenum, nickel, selenium, thallium, vanadium, and zinc varied from concentrations slightly above background to substantially greater than background.

Analyses performed on these samples for RCRA-hazardous waste characteristics verified that the material at SLAPS is not hazardous under RCRA.

Analyses performed for the mobile ions fluoride, nitrate, and sulfate indicated two ions (sulfate and fluoride) at concentrations exceeding background levels.

Of 90 samples submitted for analysis, 37 were found to contain the volatile organics toluene, trichloroethene, and trans-1,2-dichloroethene. Fifty-two of the 90 samples contained semivolatile organic compounds.

#### Latty Avenue Properties

At the Hazelwood Interim Storage Site (HISS), 16 metals were found at concentrations exceeding background levels. Levels of antimony, arsenic, barium, boron, cadmium, cobalt, copper, lead, magnesium, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc varied from slightly above background levels to substantially greater than background levels.

Analytical results of samples from HISS showed that the material at HISS is not hazardous based on RCRA-hazardous waste characteristics.

Samples taken from HISS and analyzed for mobile ions had only two ions (sulfate and nitrate) at concentrations exceeding background levels.

Toluene was found in only 1 of the 12 samples submitted for volatile organic analysis. No semivolatile organic compounds were detected.

At the Futura Coatings Site, 12 metals were detected at concentrations exceeding background levels. Antimony, arsenic, barium, boron, cadmium, cobalt, copper, lead, magnesium, molybdenum, nickel, selenium, thallium, and vanadium were found in varying concentrations in samples taken across the site.

Thirteen samples from Futura were analyzed for the mobile ions sulfate, nitrate, and fluoride. Results for these analyses indicate that no ion is present on site at concentrations exceeding background.

Four of the 16 boreholes at Futura were found to contain the volatile organic compounds toluene and trichlorofluoromethane.

No semivolatile organic compounds on the Target Compound List (TCL) were detected. Two compounds (a benzene compound and 2-propanol-1,3-dichlorophosphate), however, were found at Futura.

Ten samples were submitted for RCRA-hazardous waste characteristics analysis and showed that the material at Futura is not hazardous, based on these characteristics.

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## ABBREVIATIONS

ft	foot
h	hour
in.	inch
mi	mile
ppb	parts per billion
ppm	parts per million
yd	yard
yr	year

## ACRONYMS

AEC	Atomic Energy Commission
BNI	Bechtel National, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
DOE	Department of Energy
EP	extraction procedure
EPA	Environmental Protection Agency
FUSRAP	Formerly Utilized Sites Remedial Action Program
GS	gas chromatography
HISS	Hazelwood Interim Storage Site
MED	Manhattan Engineer District
MS	mass spectroscopy
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
PMC	project management contractor
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
SARA	Superfund Amendments and Reauthorization Act
SLAPS	St. Louis Airport Site
SLDS	St. Louis Downtown Site
TCL	Target Compound List
TOC	total organic carbon
TOX	total organic halides

## ELEMENTS

Ag	silver
Al	aluminum
As	arsenic
B	boron
Ba	barium
Be	beryllium
Br	bromine
C	carbon
Ca	calcium
Cd	cadmium
Ce	cerium
Cl	chlorine
Co	cobalt
Cr	chromium
Cs	cesium
Cu	copper
F	fluorine
Fe	iron
Ga	gallium
Ge	germanium
Hf	hafnium
Hg	mercury
I	iodine
K	potassium
La	lanthanum
Li	lithium
Mg	magnesium
Mn	manganese
Mo	molybdenum
N	nitrogen
Na	sodium
Ni	nickel
O	oxygen
P	phosphorus
Pb	lead
Ra	radium
Rb	rubidium
S	sulfur
Sb	antimony
Sc	scandium
Se	selenium
Si	silicon
Sn	tin
Sr	strontium
Ti	titanium
Tl	thallium
U	uranium
V	vanadium
Y	yttrium
Zn	zinc
Zr	zirconium

## 1.0 INTRODUCTION

A chemical characterization of several sites in St. Louis, Missouri, and its vicinity has been conducted as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a U.S. Department of Energy (DOE) program to identify and clean up or otherwise control sites where residual radioactive contamination exceeding current guidelines remains from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. Under contract to DOE, Bechtel National, Inc., (BNI) is the project management contractor (PMC) for FUSRAP and performed the characterization under DOE direction. This report describes the characterization activities performed at the St. Louis Airport Site (SLAPS) and the Latty Avenue Properties. The locations of these sites are shown in Figure 1-1.

Before the Superfund Amendments and Reauthorization Act (SARA) of 1986 was enacted, FUSRAP activities were conducted in accordance with the requirements of the National Environmental Policy Act (NEPA). With the enactment of SARA, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 was amended, and the responsibilities of federal agencies under CERCLA were clarified. Subsequent to the enactment of SARA, DOE developed an approach to comply with the requirements of both CERCLA/SARA and NEPA. This approach is referred to as the CERCLA/NEPA process, and is being implemented by DOE at SLAPS and the Latty Avenue Properties to determine the preferred remedial action alternative for each site. The information obtained from this characterization as well as from the scoping process (during which information was collected and evaluated) provided the necessary information for subsequent phases of the CERCLA/NEPA process. This characterization is part of the remedial investigation (RI) phase of the CERCLA/NEPA process. The information collected during the RI will be used as the basis for the feasibility study-environmental impact study to evaluate remedial action alternatives.

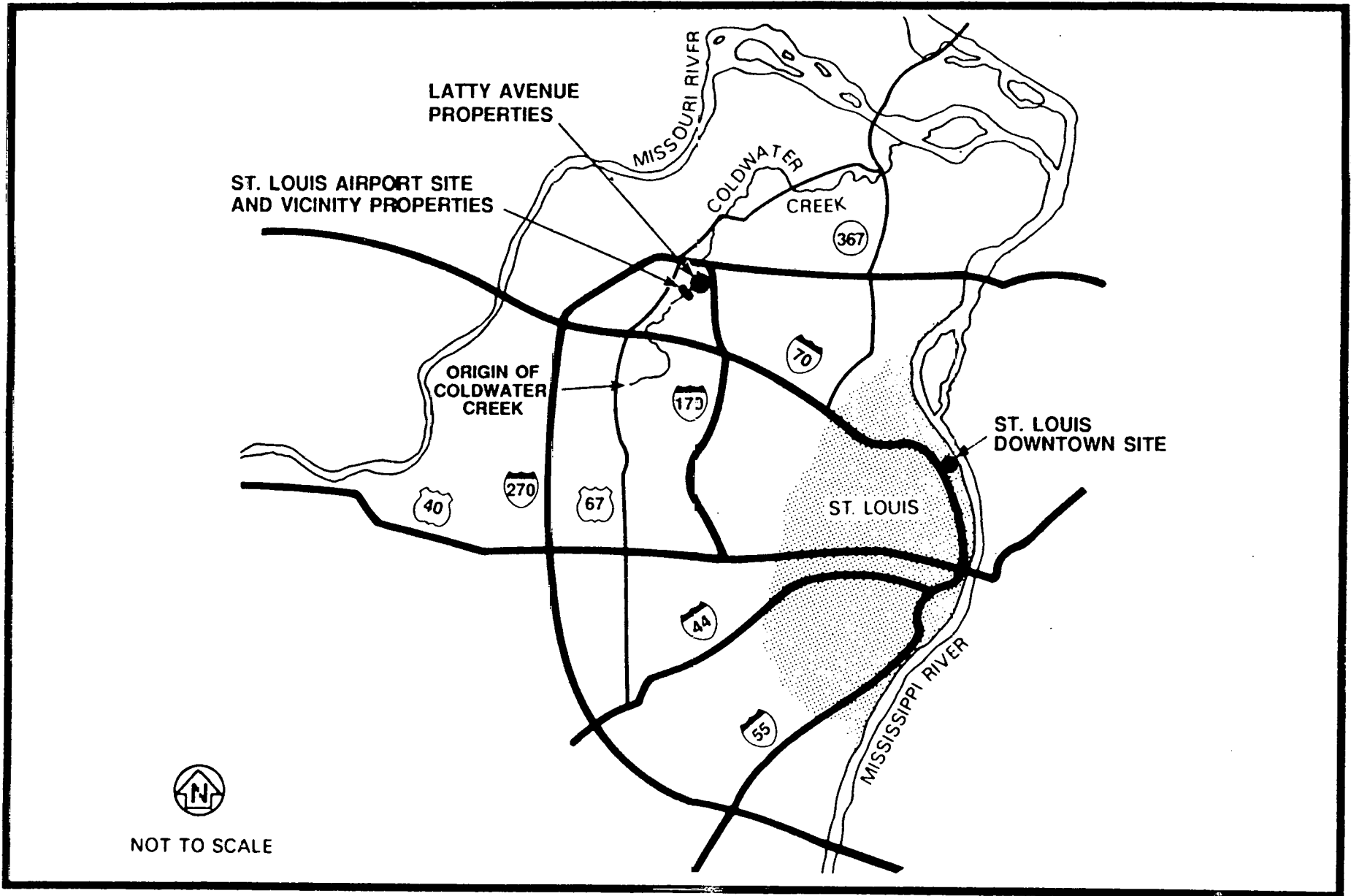


FIGURE 1-1 LOCATIONS OF FUSRAP SITES IN THE ST. LOUIS AREA

Because only limited information is available regarding the chemical constituents present at the St. Louis sites, this characterization work was performed to:

- Identify and quantify the contaminants present
- Define the potential migration pathways of any chemical contaminants
- Determine whether the material is classified as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) by analyzing for the RCRA-hazardous waste characteristics
- Provide data to assess potential health hazards from this material to workers performing remedial action
- Define the locations of chemical constituents in relation to radioactive wastes; i.e., determine whether chemical wastes are associated with radioactive wastes, and determine whether any chemical contamination had migrated beyond the known boundaries of radioactive contamination

## 2.0 SITE LOCATIONS, DESCRIPTIONS, AND HISTORIES

### 2.1 SITE LOCATIONS AND DESCRIPTIONS

#### 2.1.1 SLAPS

SLAPS is a 21.7-acre site located in St. Louis County, Missouri, approximately 15 mi from downtown St. Louis and immediately north of the Lambert-St. Louis International Airport. SLAPS is bounded by the Norfolk and Western Railroad and Banshee Road on the south, Coldwater Creek on the west, and McDonnell Boulevard and adjacent recreational fields on the north and east (Figure 2-1).

#### 2.1.2 Latty Avenue Properties

The Latty Avenue Properties consist of the Hazelwood Interim Storage Site (HISS) and the Futura Coatings Site (Figure 2-1). These properties are located at 9200 Latty Avenue in northern St. Louis County within the city limits of Hazelwood, Missouri, approximately 2,500 ft northeast of SLAPS. The eastern property is HISS, which occupies approximately 5.5 acres and is separated from the western property by a chain-link fence. The western property is approximately 5 acres and is leased to Futura Coatings, Inc., which manufactures plastic coatings in the three buildings on the property.

### 2.2 SITE HISTORIES

#### 2.2.1 SLAPS

The Manhattan Engineer District (MED) [predecessor to the Atomic Energy Commission (AEC)] consented to use and occupy the property on March 2, 1946. The property was acquired on January 3, 1947, to store residues from manufacturing operations at the Mallinckrodt Chemical Company [referred to in this report as the St. Louis Downtown Site (SLDS)] (Ref. 1).

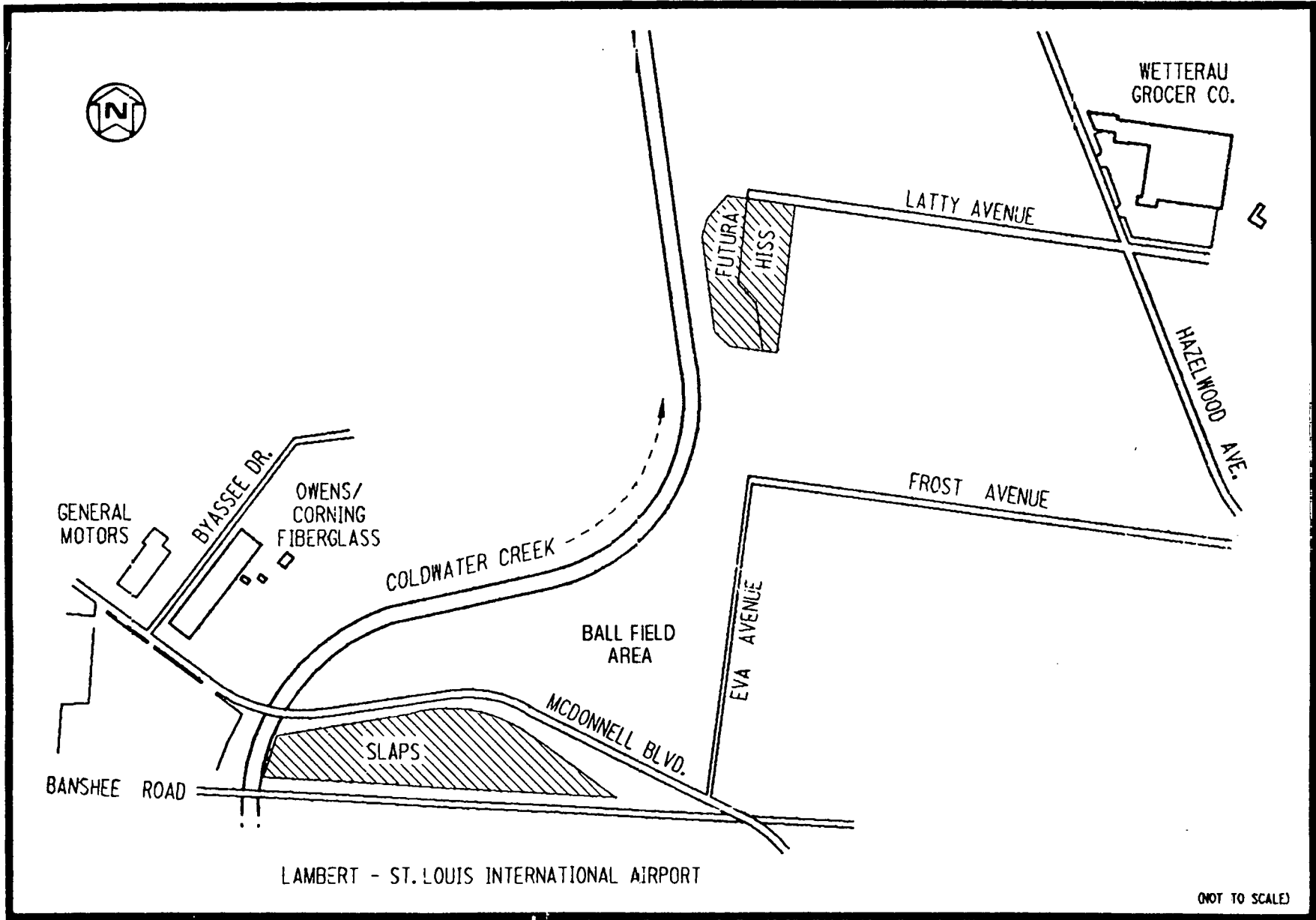


FIGURE 2-1 LOCATIONS OF SLAPS AND LATTY AVENUE PROPERTIES



The original contour of the site was uneven, varying as much as 12 ft in some areas. The severe contour resulted in standing water that made approximately one-third of the site unusable. All surface water drained to Coldwater Creek at the western edge of the property.

Contaminated scrap metal and other debris were initially stored on the western one-third of the property, which was covered in 1952 with 6 to 8 ft of fill material to level the area. As a result, approximately 9 acres on the western side of the property became usable. In 1948 a concrete pit, 202 ft long by 42 ft wide by 16 ft deep, was constructed to store radium-bearing residue, although it was never used for this purpose. Instead, the residue was stored in drums at the site from 1946 until early 1948. In 1948 and 1949, the residue was transferred to the Lake Ontario Storage Area, located at Lake Ontario Ordnance Works, Model City, New York. SLAPS was enclosed by a chain-link fence. In 1950, a covered concrete storage pad, 45 by 250 ft, was constructed to store empty drums. Approximately fifty thousand, 30- and 55-gal drums were stored on the site, together with 3,000 tons of contaminated steel and alloy scrap. Later a small building containing a shower, change room, and office space was moved to the site. A railroad siding and loading facility was completed in April 1959.

The site was operated by MED and AEC from 1946 until July 1953 when the operation was turned over to the owners of SLDS. Access to the site was limited by guards who were posted on site from 1946 to 1951 (Ref. 1). The slag from the reduction step of the metals operations at SLDS was separated into two parts. The magnesium fluoride slag immediately above the uranium was sent to the Vitro Corporation at Canonsburg, Pennsylvania, for uranium recovery. The shipments of slag began on March 10, 1946, and continued until early 1953, when the dolomite liner was replaced by a recycled magnesium fluoride liner (Ref. 1). The remaining slag, consisting mainly of dolomite liner with less than 2 percent uranium content, was stored at SLAPS in bulk on the soil surface.

SLDS began operations in 1946 and continued using pitchblende ores as a feedstock until 1955. The procurement contract for these ores with the African Metals Corporation required the U.S. government to store the raffinate and the radium-bearing residues, which contained metals such as nickel, cobalt, and copper. African Metals retained ownership of all the materials except the uranium content. Although ore concentrates from other sources were processed during this period, there was no segregation of the raffinates, and they were stored in bulk on the soil surface at SLAPS (Ref. 1). Numerous other residues were also stored at SLAPS, including captured Japanese uranium precipitates and residues called "vitro residues" (Ref. 1).

The raffinate produced from subsequent operations using nonpitchblende feeds was stored separately. The raffinate is also referred to as Colorado raffinate because it is the result of processing primarily domestic uranium concentrates. A barium sulfate cake residue produced by the refinery was also stored at SLAPS. The residue resulted from precipitation with barium carbonate and a digestion liquor to reduce its sulfate content. African Metals relinquished ownership of the barium cake (Ref. 1).

In 1955, an interim residue plant was constructed at SLDS to reclaim a major portion of the uranium content from the magnesium fluoride slag produced there. Tailings from the operation were also stored in the concrete pit at SLAPS (Ref. 1). During the later years of site operation, most of the residues were removed from the site. The magnesium fluoride slag, half of the dolomite liner, and tailings were shipped to the Fernald plant in Ohio for reprocessing over a 2-yr period beginning in 1960 (Ref. 1).

During the operation of the site, drums were sold for reconditioning and scrap. In 1962, AEC contracted for the removal of all remaining scrap (including drums) from the site. This process took about 1 yr to complete (Ref. 2). AEC included an

approximate composition of the residues in the bid package for sale of the residues stored at the site.

In 1966, the Continental Mining and Milling Company of Chicago bought the following:

Pitchblende raffinate	74,000 tons
Colorado raffinate	32,500 tons
Barium sulfate cake residue (leached)	1,500 tons
Barium sulfate cake residue (unleached)	8,700 tons
Vitro residues	290 tons
Japanese uranium	60 tons
Dolomite liner	3,500 tons
(Ref. 3)	

From 1966 to 1969, all the materials except the barium sulfate cake residues were moved from SLAPS to HISS by Continental Mining and Milling. In 1969, the residues were moved to Weldon Spring, Missouri. After removing residues from the site in 1969, the buildings and site facilities were demolished and buried on site; the site was covered with 1 to 3 ft of clean backfill. Additional fill and some rubble were placed at SLAPS in 1971, 1977, and 1978 (Ref. 4).

In 1973, final signatures were obtained for the Quitclaim Deed, transferring title to the site from AEC to the City of St. Louis.

BNI has performed site studies at SLAPS since 1982, most of which have been radiological characterizations; however, in 1986, a limited chemical characterization was conducted (Ref. 5).

Samples were analyzed for metals, total organic carbon (TOC), and total organic halogens (TOX). Analytical results showed concentrations of heavy metals exceeding background and TOC concentrations above 1 percent, which may indicate the presence of organic contamination or naturally occurring detritus. There was also a TOX measurement of 19 ppm. The work indicated the need for additional chemical characterization.

### 2.2.2 Latty Avenue Properties

In 1966, ore residues and uranium- and radium-bearing process wastes stored at SLAPS were purchased and moved to storage at 9200 Latty Avenue by Continental Mining and Milling. These wastes had been generated at SLDS from 1942 through the late 1950s under contracts with AEC and MED. Residues at SLAPS at that time included pitchblende raffinate residues, Colorado raffinate residues, radium-bearing residues, and barium sulfate cake. The Commercial Discount Corporation of Chicago, Illinois, purchased the residues in January 1967; much of the material was then dried and shipped to the Cotter Corporation facilities in Canon City, Colorado. The source material remaining at 9200 Latty Avenue was sold to the Cotter Corporation in December 1969. From August through November 1970, Cotter Corporation dried some of the remaining residues at the site and shipped them to its mill in Canon City.

In April 1974, the Cotter Corporation informed the newly established Nuclear Regulatory Commission (NRC) that the remaining Colorado raffinate had been shipped in mid-1973 to Canon City without drying and that the barium sulfate residues had been diluted with 12 to 18 in. of topsoil and transported, without NRC consent, to a landfill area in St. Louis County. An NRC license for storage was terminated, and the property was released for sale.

The site currently contains two piles of contaminated soil that will be held in interim storage until a suitable disposal site is selected. The piles were generated as a result of a partial cleanup at the site in 1977 and from roadway improvements along Latty Avenue in 1986. The piles contain approximately 32,000 yd<sup>3</sup> of soil and are covered with low-permeability liners.

In 1985, composite samples were taken from the existing interim storage pile at HISS to determine whether the material exhibited any of the four RCRA-hazardous waste characteristics. The samples were taken using a simple random sampling scheme based on the Environmental Protection Agency (EPA) SW-846 methodology. Results confirmed that the material did not exhibit RCRA-hazardous characteristics.

### 3.0 HEALTH AND SAFETY

Under DOE direction, the PMC is responsible for protecting the health of personnel assigned to work at the site. During characterization work, all subcontractors and their personnel were required to comply with the health provisions of their contracts or as directed by the onsite PMC representative.

## 4.0 CHARACTERIZATION PROCEDURES

The following sections describe the sampling and analytical methods used to complete the chemical characterization of SLAPS and the Latty Avenue Properties. Included are descriptions of specific analyses, sampling locations, sample collection and handling, and quality control. This report focuses on the collection and analyses of soil samples. Other media, including groundwater and surface water, are sampled quarterly for chemical constituents as part of DOE's ongoing environmental monitoring program for these sites and are reported annually (Refs. 6 and 7).

### 4.1 SAMPLE ANALYSES

The following analyses were completed for soil samples collected from the sites:

- Metals
- Mobile ions
- Volatile organic compounds
- Semivolatile organic compounds
- RCRA-hazardous waste characteristics

Methods of analysis are given in Table 4-1.

#### 4.1.1 Metals

Metals, including aluminum, arsenic, antimony, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc, were measured in soil samples. Metals were chosen because they are typically found in uranium ores that were processed at SLDS (Ref. 8). Barium was specifically targeted because barium carbonate was used in the process as a co-precipitator of sulfates and radium.

TABLE 4-1  
METHODS FOR SOIL ANALYSIS

Parameter	Analytical Technique	EPA Method No.	Standard <sup>a</sup> Method No.	ASTM <sup>b</sup> Method No.
Metals <sup>c</sup>	ICPAES <sup>d</sup>	6010	305	D4190-82
Sulfate	Colorometric	9035	426A,B	-
Nitrate	Kjeldahl, distillation, titration	351	418	D3590-84
Fluoride	Distillation, ISE	340.1	413	D1179-80
Volatile organics	GC/FID <sup>e</sup>	Modified <sup>f</sup> 8010/8015	-	-
Semivolatile organics	GC/FID	Modified <sup>g</sup> 8250	-	-

<sup>a</sup>Standard Methods for the Examination of Water and Wastewater, 1985.

<sup>b</sup>American Society for Testing and Materials, Section 11, Volume 11.02, 1985.

<sup>c</sup>Includes aluminum, arsenic, antimony, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

<sup>d</sup>ICPAES - Inductively coupled plasma atomic emission spectrophotometry.

<sup>e</sup>GC - gas chromatography; FID - flame ionization detector

<sup>f</sup>Modified to include use of GC/Hall detector/photoionization detector instead of GC/mass spectroscopy.

<sup>g</sup>Modified to include use of GC/PID instead of GC/MS.



#### 4.1.2 Mobile Ions

Mobile ions, including sulfate, fluoride, and nitrate, were sampled as indicators of contaminant migration beyond previously determined boundaries. These ions were chosen because of their use in uranium processing at SLDS.

The guidelines used to determine whether soil samples contained unusual concentrations of metals and mobile ions were obtained from two sources: analytical results from soil samples taken in the surrounding area (Ref. 9) and the average concentration ranges for metals in soil at various locations in the United States (see Table 4-2) (Ref. 10). Both of these guidelines give the average range of concentrations of metals expected to be found in natural soil. Results from this characterization were compared to these guidelines.

#### 4.1.3 Volatile and Semivolatile Organic Compounds

Analyses were performed for priority pollutant organics, including volatile and semivolatile organic compounds. These parameters were selected to define the organic constituents in the material at the subject sites.

#### 4.1.4 RCRA-Hazardous Waste Characteristics

Samples were analyzed to determine whether the material exhibited any of the RCRA-hazardous waste characteristics (i.e., reactivity, corrosivity, ignitability, and extraction procedure (EP) toxicity) that are described in this subsection. If a material exhibits any of these characteristics, it may be considered hazardous under RCRA. Reactive materials, as defined in RCRA, include those that have any of the following properties:

- Readily undergo violent chemical change
- React violently or are potentially explosive when mixed with water

TABLE 4-2  
COMPOSITION OF SOILS<sup>a</sup>

Page 1 of 2

Element	Mean (range) in dry soil (ppm) <sup>b</sup>
Ag	0.1 (0.01 - 5)
Al	71,000 (10,000 - 300,000)
As	6 (0.1 - 40)
B	10 (2.0 - 100)
Ba	500 (100 - 3,000)
Be	6 (0.1 - 40)
Br	5 (1 - 10)
C	200,000
Ca	137,000 (7,000 - 500,000)
Cd	0.06 (0.01 - 0.7)
Ce	50
Cl	100
Co	8 (1 - 40)
Cr	100 (5 - 3,000)
Cs	6 (0.3 - 25)
Cu	20 (2 - 100)
F	200 (30 - 300)
Fe	38,000 (7,000 - 550,000)
Ga	30 (0.4 - 300)
Ge	1 (1 - 50)
Hf	6
Hg	0.03 (0.01 - 0.3)
I	5
K	14,000 (400 - 30,000)
La	30 (1 - 5,000)
Li	30 (7 - 200)
Mg	5,000 (600 - 6,000)
Mn	850 (100 - 4,000)
Mo	2 (0.2 - 5)
N	1,000 (200 - 2,500)
Na	6,300 (750 - 7,500)
Ni	40 (10 - 1,000)
O	490,000
P	650
Pb	10 (2 - 200)
Ra	$8 \times 10^{-7}$ ( $3 - 20 \times 10^{-7}$ )
Rb	100 (20 - 600)
S	700 (30 - 900)
Sb	(2 - 10?)
Sc	7 (10 - 25)
Se	0.2 (0.01 - 2)
Si	330,000 (250,000 - 350,000)
Sn	10 (2 - 200)
Sr	300 (50 - 1,000)
Th	5 (0.1 - 12)

TABLE 4-2  
(Continued)

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Element	Mean (range) in dry soil (ppm) <sup>b</sup>
Ti	5,000 (1,000 - 10,000)
Tl	0.1
U	1 (0.9 - 9)
V	100 (20 - 500)
Y	50 (25 - 250)
Zn	50 (10 - 300)
Zr	300 (60 - 2,000)

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<sup>a</sup>The figures refer to oven-dried soils. Soils near mineral deposits have been omitted in computing ranges. Insufficient data are available for Ag, Be, Cd, Ce, Cs, Ge, Hf, Hg, La, Sb, Sn, Tl, and U, and the values quoted for these elements may require revision.

<sup>b</sup>See Reference 10.

- Generate toxic fumes when mixed with water, or in the case of cyanide or sulfide-bearing material, when exposed to mild acidic or alkaline conditions
- Explode when subjected to a strong force
- Explode at normal temperatures and pressures
- Are classified as Class A or B explosives by the U.S. Department of Transportation

Soil samples were tested for reactivity by determining whether fumes were generated when the material was exposed to mild acidic or alkaline conditions. The criterion for the reactivity characteristic is the generation of at least 250 ppm of cyanide or 500 ppm of sulfide.

As defined in RCRA, the corrosivity characteristic is designed to identify material that might pose a hazard to human health or the environment because of its ability to:

- Mobilize toxic metal if discharged into a landfill environment
- Corrode handling, storage, transportation, and management equipment
- Destroy human or animal tissue in the event of inadvertent contact

To identify such potentially hazardous materials, EPA has selected two properties as the basis for defining a corrosive waste: pH and corrosivity on Type SAE 1020 steel. The samples taken during this characterization were tested for pH. Using test method 9040, the criterion for pH is a value less than or equal to 2 or greater than 12.5.

Samples exhibit ignitability if, under conditions of standard temperature and pressure, they cause fire through friction, absorption of moisture, or spontaneous chemical changes and, when ignited, burn so vigorously that they create a hazard.

The EP toxicity test is designed to simulate the leaching a waste will undergo if disposed of in a sanitary landfill. It is a laboratory test in which a representative sample of material is extracted with distilled water that is maintained at a pH of 5 using acetic acid. The extract is then analyzed to determine whether any of the thresholds established for the eight elements (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), four pesticides (Endrin, Lindane, Methoxychlor, and Toxaphene), and two herbicides (2,4,5-trichlorophenoxypropionic acid and 2,4-dichlorophenoxyacetic acid) have been exceeded. If the EP extract contains any of the these substances in a concentration equal to or exceeding the levels specified in RCRA, the material possesses the characteristic of EP toxicity and is considered a RCRA-hazardous waste.

#### 4.2 SAMPLING LOCATIONS

##### 4.2.1 SLAPS

Soil samples were collected from biased and randomly selected locations (Figure 4-1). Biased locations were selected based on historical information regarding site activities, radiological data obtained from previous characterizations, and current site conditions. Biased sampling locations were selected first from locations where radiological boreholes had been drilled previously. The biased locations were sampled in randomly selected 2-ft intervals (two to five per borehole) and samples were analyzed for

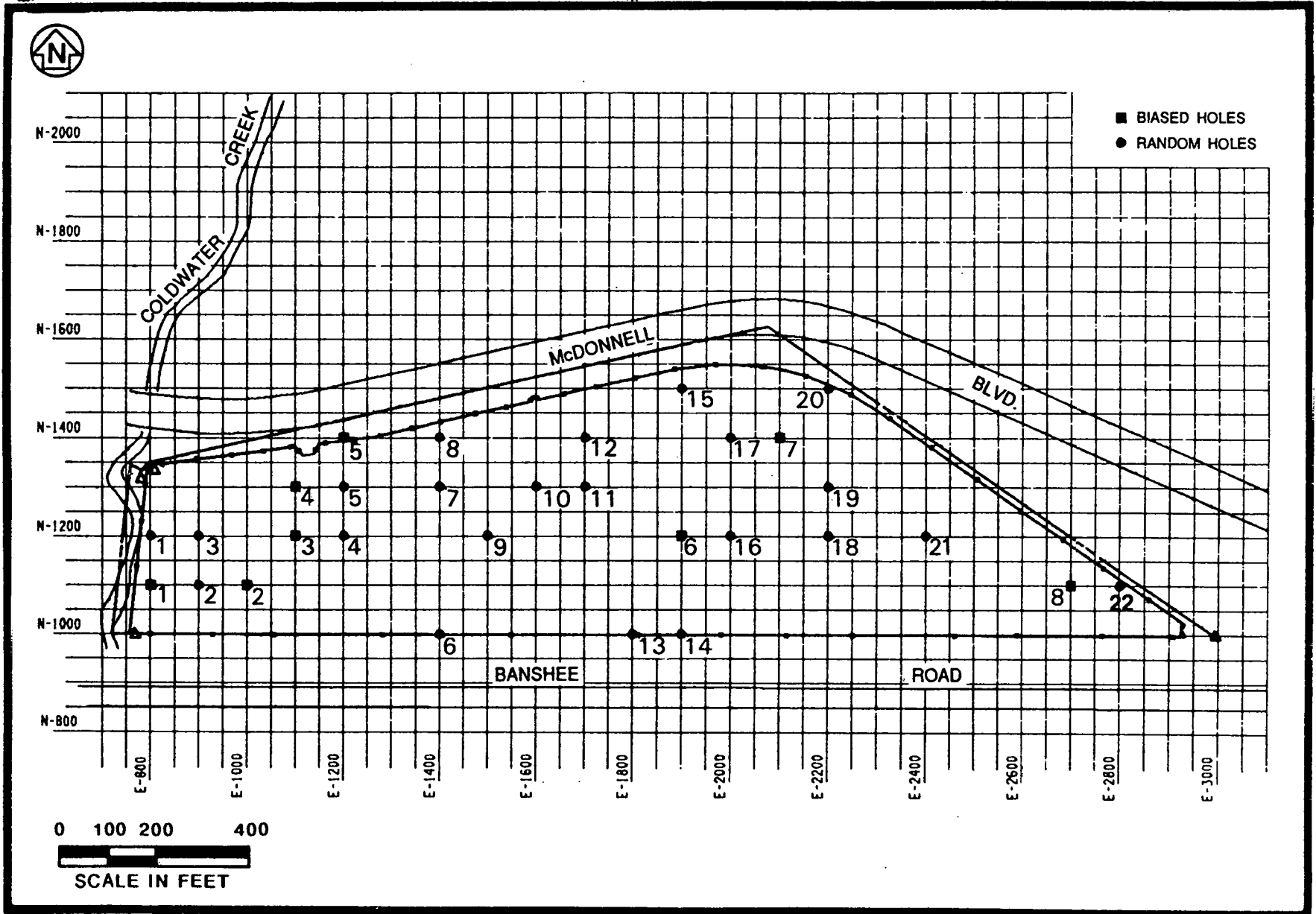


FIGURE 4-1 SOIL SAMPLING LOCATIONS AT SLAPS

RCRA-hazardous waste characteristics, volatile and semivolatile organic compounds, and metals. One sample per borehole was taken below the radioactive waste boundary defined in previous radiological characterizations to determine whether any previously detected chemical contamination had migrated outside the boundaries of the radioactive contamination (Ref. 3). Analyses for volatile and semivolatile organic compounds and metals were performed on these samples.

Borehole locations already selected for biased sampling were excluded from the selection process for random sampling locations. These random locations were selected across the site at the intersections of the previously established 100-ft grid system at locations where radiological samples had been taken. The entire depth of each borehole in the radioactively contaminated area was composited and tested for RCRA-hazardous waste characteristics. Two sample intervals in the radioactive waste profile were randomly selected and analyzed for volatile and semivolatile organic compounds and metals. One sample per borehole below the radioactive waste was taken and analyzed for the above mentioned parameters to determine whether chemical contamination had migrated below the radioactive contamination.

A total of 22 and 8 boreholes were drilled for random and biased locations, respectively. As shown in Table 4-3, 109 soil samples were submitted for analysis.

#### 4.2.2 Latty Avenue Properties

Information concerning material storage at these sites is limited. As a result, the locations for the biased samples were chosen primarily in relation to the physical features of the sites, i.e., buildings and interim storage piles. In addition, one location was selected because previous characterization work had shown it to have the highest concentration of radioactivity and because an undefined sludge was encountered in a borehole at a depth of 11 ft.

TABLE 4-3

## ANALYSES PERFORMED ON BIASED AND RANDOM SAMPLES FROM SLAPS

Page 1 of 4

Sample Type	Depth (ft)	RCRA	Mobile Ions	Metals	Volatile Organics	Semi-volatile Organics
<u>Biased</u>						
B1	0-2	X <sup>a</sup>	X	X	X	X
	4-6	X	X	X	X	X
	8-10	X	X	X	X	X
	14-16	0 <sup>b</sup>	X	X	X	X
B2	0-2	X	X	X	X	X
	4-6	X	X	X	X	X
	8-10	X	X	X	X	X
	12-14	X	X	X	X	X
	16-18	X	X	X	X	X
	20-22	0	X	X	X	X
B3	4-6	X	X	X	X	X
	7-8	X	X	X	X	X
	10-12	0	X	X	X	X
B4	0-2	X	X	X	X	X
	4-6	X	X	X	X	X
	8-10	0	X	X	X	X
B5	0-2	X	X	X	X	X
	4-6	0	X	X	X	X
B6	0-2	X	X	X	X	X
	4-6	X	X	X	X	X
	8-10	X	X	X	X	X
	14-16	0	X	X	X	X
B7	0-2	X	X	X	X	X
	4-6	X	X	X	X	X
	8-10	0	X	X	X	X
B8	0-2	X	X	X	X	X
	4-6	X	X	X	X	X
	10-12	0	X	X	X	X



TABLE 4-3  
(Continued)

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Sample Type	Depth (ft)	RCRA	Mobile Ions	Metals	Volatile Organics	Semi-volatile Organics
<u>Random</u>						
R1	0-2	0	X	X	X	X
	0-6	X	0	0	0	0
	4-6	0	X	X	X	X
	8-10	0	X	X	X	X
R2	0-2	0	X	X	X	X
	6-8	0	X	X	X	X
	0-8	X	0	0	0	0
	10-12	0	X	X	X	X
R3	3-5	X	X	X	X	X
	6-8	0	X	X	X	X
R4	4-6	0	X	X	X	X
	14-16	0	X	X	X	X
	0-18	X	0	0	0	0
	20-22	0	X	X	X	X
R5	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-10	X	0	0	0	0
	12-14	0	X	X	X	X
R6	0-2	0	X	X	X	X
	4-6	0	X	X	X	X
	0-6	X	0	0	0	0
	8-10	0	X	X	X	X
R7	0-2	0	X	X	X	X
	0-3	X	0	0	0	0
	4-6	0	X	X	X	X
R8	0-1	X	X	X	X	X
	2-4	0	X	X	X	X
R9	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-8	X	0	0	0	0
	10-12	0	X	X	X	X

TABLE 4-3  
(Continued)

Page 3 of 4

Sample Type	Depth (ft)	RCRA	Mobile Ions	Metals	Volatile Organics	Semi-volatile Organics
R10	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-6	X	0	0	0	0
	8-10	0	X	X	X	X
R11	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-6	X	0	0	0	0
	8-10	0	X	X	X	X
R12	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-7	X	0	0	0	0
	8-10	0	X	X	X	X
R13	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-5	X	0	0	0	0
	6-8	0	X	X	X	X
R14	0-1	0	X	X	X	X
	2-4	0	X	X	X	X
	0-5	X	0	0	0	0
	6-8	0	X	X	X	X
R15	4-6	0	X	X	X	X
	8-10	0	X	X	X	X
	0-15	X	0	0	0	0
	18-20	0	X	X	X	X
R16	2-4	0	X	X	X	X
	6-8	0	X	X	X	X
	0-8	X	0	0	0	0
	10-12	0	X	X	X	X
R17	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-7	X	0	0	0	0
	8-10	0	X	X	X	X
R18	0-2	0	X	X	X	X
	4-6	0	X	X	X	X
	0-8	X	0	0	0	0
	10-12	0	X	X	X	X

TABLE 4-3  
(Continued)

Page 4 of 4

Sample Type	Depth (ft)	RCRA	Mobile Ions	Metals	Volatile Organics	Semi-volatile Organics
R19	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-5	X	0	0	0	0
	6-8	0	X	X	X	X
R20	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-6	X	0	0	0	0
	8-10	0	X	X	X	X
R21	0-2	0	X	X	X	X
	2-4	0	X	X	X	X
	0-6	X	0	0	0	0
	8-10	0	X	X	X	X
R22	1-2	X	X	X	X	X
	4-6	0	X	X	X	X

<sup>a</sup>x - analysis performed.

<sup>b</sup>0 - no analysis performed.

The random sampling locations at the Latty Avenue Properties were selected by the same method used to select the SLAPS locations. Sampling locations for the Latty Avenue Properties are shown in Figure 4-2.

At the Futura Coatings Site, samples were taken at 1- to 2-ft intervals within and below the known boundaries of radioactivity. At biased locations, samples from within the wastes were analyzed for RCRA-hazardous waste characteristics, metals, volatile and semivolatile organic compounds, and mobile ions. Samples taken from below the waste were analyzed for volatiles and semivolatile organic compounds and mobile ions.

Samples from random locations were analyzed for volatile and semivolatile organic compounds and mobile ions both within and below the radioactive waste. A section of each borehole was then composited, and the samples were tested for RCRA-hazardous waste characteristics.

Biased locations at HISS were sampled in 1- to 2-ft intervals within and below the radioactive waste as defined in a previous characterization (Ref. 11). Samples from within the waste were analyzed for metals, volatiles and semivolatile organic compounds, mobile ions, and RCRA-hazardous waste characteristics. Samples taken below the waste were analyzed for metals, volatile and semivolatile organic compounds, and mobile ions.

Random locations were sampled in 2- to 3-ft intervals within and below the radioactive waste. The samples were analyzed for metals, volatile and semivolatile organic compounds, and mobile ions. A sample taken at a 3-ft interval from each borehole was composited and analyzed for RCRA-hazardous waste characteristics.

A total of six random and six biased locations were drilled at HISS and the Futura Coatings Site. Thirty-two soil samples were submitted for analysis (Tables 4-4 and 4-5).

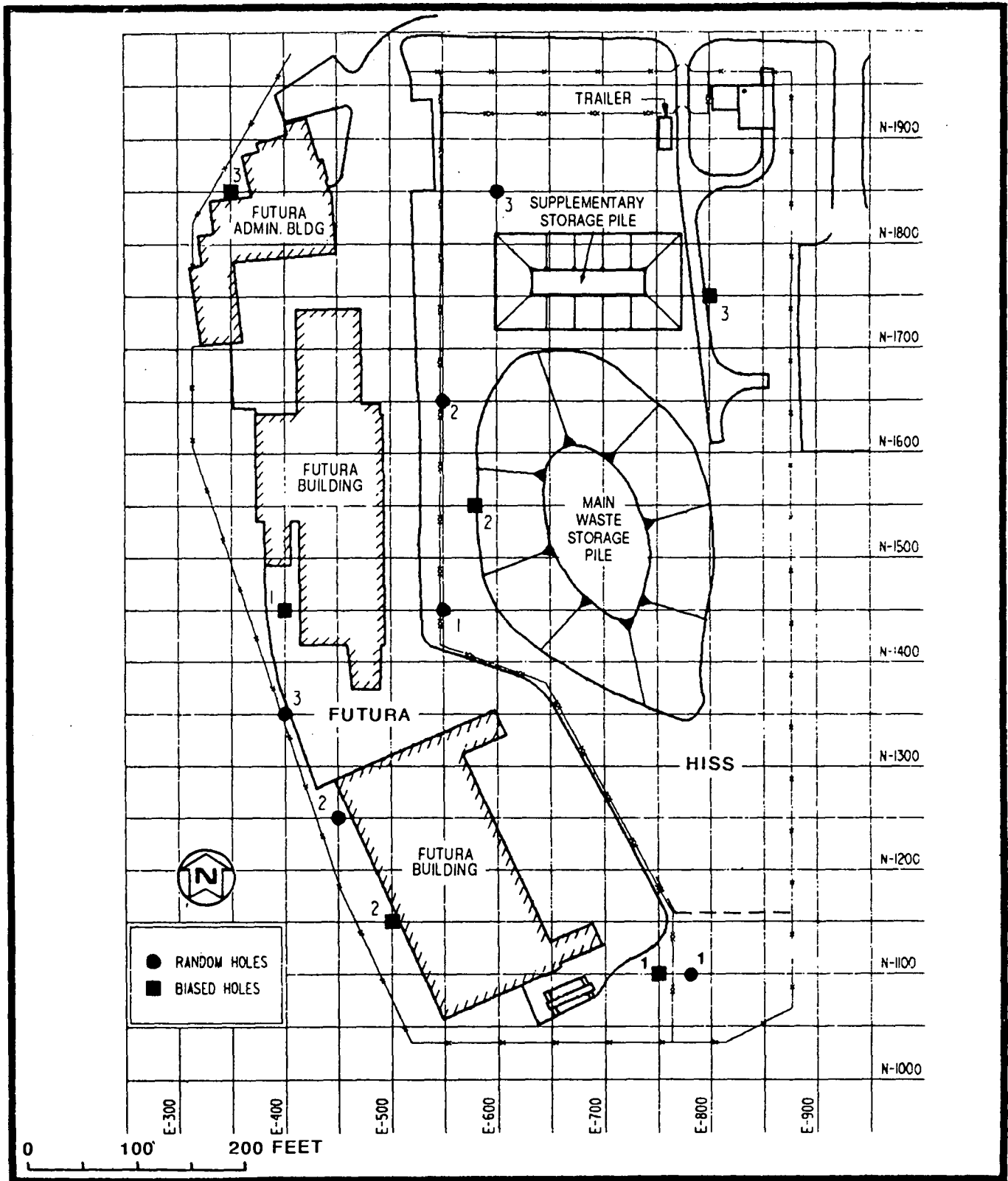


FIGURE 4-2 SOIL SAMPLING LOCATIONS AT THE LATTY AVENUE PROPERTIES

TABLE 4-4  
ANALYSES PERFORMED ON BIASED AND RANDOM SAMPLES FROM HISS

Sample Type	Depth (ft)	RCRA	Mobile Ions	Metals	Volatile Organics	Semi-volatile Organics
<u>Biased</u>						
B1	0-1	X <sup>a</sup>	X	X	X	X
	2-4	0 <sup>b</sup>	X	X	X	X
B2	0-1	X	X	X	X	X
	2-4	0	X	X	X	X
B3	3-4	X	X	X	X	X
	6-8	0	X	X	X	X
<u>Random</u>						
R1	0-2	0	X	X	X	X
	0-3	X	0	0	0	0
	4-6	0	X	X	X	X
R2	0-2	0	X	X	X	X
	0-3	X	0	0	0	0
	4-6	0	X	X	X	X
R3	0-2	0	X	X	X	X
	0-3	X	0	0	0	0
	4-6	0	X	X	X	X

<sup>a</sup>X - analysis performed.

<sup>b</sup>0 - no analysis performed.

TABLE 4-5  
ANALYSES PERFORMED ON BIASED AND RANDOM  
SAMPLES FROM THE FUTURA COATINGS SITE

Sample Type	Depth (ft)	RCRA	Mobile Ions	Metals	Volatile Organics	Semi-volatile Organics
<u>Biased</u>						
B1	0-2	X <sup>a</sup>	X	X	X	X
	4-6	X	X	X	X	X
	8-10	X	X	X	X	X
	12-14	X	X	X	X	X
	20-22	0 <sup>b</sup>	X	0	X	X
B2	0-1	X	X	X	X	X
	2-4	0	X	0	X	X
B3	0-2	X	X	X	X	X
	4-5	X	X	X	X	X
	6-8	0	X	0	X	X
<u>Random</u>						
R1	0-2	X	X	X	X	X
	4-6	0	X	0	X	X
R2	0-2	0	X	X	X	X
	0-3	X	0	0	0	0
	4-6	0	X	0	X	X
R3	0-2	X	X	X	X	X
	4-6	0	X	0	X	X

<sup>a</sup>X - analysis performed.

<sup>b</sup>0 - no analysis performed.

#### 4.3 SAMPLE COLLECTION AND HANDLING

Soil samples were collected using stainless steel, split-spoon samplers. A seven-step decontamination procedure outlined by EPA was used for the samplers between chemical boreholes. Samplers were washed with soap and water, rinsed with deionized water, rinsed with 3 percent hydrochloric acid solution, rinsed with deionized water, rinsed with methanol, rinsed with deionized water, and then air dried. Glass containers for sample shipment were supplied by the laboratory. Samples were collected, stored in the appropriate containers, packed in Styrofoam pellets to minimize breakage, and shipped to the laboratory for analysis. Samples were shipped on ice by priority mail the same day they were taken. Chain-of-custody documentation was completed for all samples. No field preservatives were required for soil samples before shipment to the laboratory for analysis.

#### 4.4 QUALITY CONTROL

Quality control samples were analyzed to evaluate the effectiveness of field techniques and the quality of laboratory results. These controls and the frequency of collection/analysis are described below.

Field Duplicates - To evaluate the matrix effects on accuracy and precision, 10 percent of all samples were collected and analyzed in duplicate.

Field Blanks - To detect possible cross contamination of samples during collection, field packaging, and transport, a field blank was prepared for each sample batch. A batch is defined as all samples shipped to the laboratory within a 24-h. period.

Method Blanks - To detect possible contamination of laboratory reagents, solvents, glassware, etc., a minimum of one method blank (or a number not exceeding 10 percent of the total



number of samples, whichever was greater) was analyzed with each batch of samples regardless of the number of samples per set. Method blanks consisted of laboratory water subjected to the full set of analyses performed on the samples. The method blanks were analyzed randomly throughout the course of analysis of a sample batch sequence.

Spikes (Matrix and Matrix Spike Duplicates) - The accuracy of analytical results was determined by analyzing samples and laboratory water blanks spiked with known concentrations of materials for which analyses were performed. A minimum of three spiked blanks representative of the soil matrix were prepared by the laboratory and analyzed per batch of samples. One blank was prepared for each of the following concentrations: the low end, mid-point, and high end of the linear concentration range of the method. In addition, one sample in each batch was spiked with analytes of interest. The recoveries on this sample were compared to the accuracy determined from the blank spikes as an indication of matrix effects. Matrix spikes falling outside this range were reanalyzed to determine whether corrective action was required.

Replicates - A minimum of one sample per batch was analyzed in replicate. Soil sample replicates were prepared by homogenizing an aliquot of the sample sufficient in size for the specified analysis, dividing the aliquot into the requisite number of replicates, and carrying each replicate through the entire extraction and analytical procedure.

Evaluation of the quality control data involved several checks. To determine whether any data were missing, a chart listing samples versus analyses requested was completed. A similar chart was designed to determine whether Contract Laboratory Program (CLP) holding times for volatile and semivolatile organic analyses were exceeded. Chain-of-custody documentation was verified.

Statistical calculations performed on quality control data by the analytical subcontractor, Roy F. Weston Laboratory, were checked. Data checked included percent recovery between matrix spikes and matrix spike duplicates, percent difference in spiked amount versus spike recovery, and percent difference in sample and sample replicate recovery.

Quality control samples were analyzed according to EPA CLP protocol. The results generally indicated acceptable analytical precision and accuracy. Holding times were met for all quality control samples, and no data were rejected based on quality control results.

## 5.0 CHARACTERIZATION RESULTS

This section presents the chemical characterization results for SLAPS and the Latty Avenue Properties.

### 5.1 SLAPS

A total of 109 samples obtained from boreholes at SLAPS were analyzed for metals, volatile organic compounds, semivolatile organic compounds, mobile ions, and RCRA-hazardous waste characteristics (see Table 4-3).

#### 5.1.1 Metals

Results of the analyses for metal at SLAPS indicate that 15 metals are present in the soil at concentrations exceeding background levels. Levels of antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, magnesium, molybdenum, nickel, selenium, thallium, vanadium, and zinc vary from slightly exceeding background to substantially greater than background concentrations. The locations and depths of contamination are given in Table 5-1.

To determine whether metals were present at concentrations exceeding background levels, analytical sample results were compared to a range of background metal concentrations for soil (see Table 4-2). To be conservative, the highest value of this range was used as the limit against which the sample results were compared; the concentration of metals detected on site should not exceed the maximum concentrations found in soil across the United States.

Because of sample characteristics, actual concentrations for some metals were not measurable and were noted. Analytical results for these metals were reported as sample detection limits.

Summary statistics (see Table 5-2) were calculated for each of the metals found on site at concentrations exceeding background levels. Values have been reported for the mean, minimum, and maximum values;

TABLE 5-1  
METALS DETECTED ABOVE BACKGROUND AT SLAPS

Page 1 of 14

Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)	
<u>Biased</u>					
B1	0-2	Cd	0.86 <sup>C</sup>	0.7	
		Mg	6,110	6,000	
		Mo	17.2 <sup>C</sup>	5	
		Sb	10.3 <sup>C</sup>	10	
		Se	17.2 <sup>C</sup>	2	
		Tl	17.2 <sup>C</sup>	0.1	
	4-6	Cd	0.98 <sup>C</sup>	0.7	
		Mo	19.6 <sup>C</sup>	5	
		Sb	11.8 <sup>C</sup>	10	
		Se	19.6 <sup>C</sup>	2	
		Tl	19.6 <sup>C</sup>	0.1	
		Cd	1.0 <sup>C</sup>	0.7	
	8-10	Mo	20.9 <sup>C</sup>	5	
		Sb	12.5 <sup>C</sup>	10	
		Se	20.9 <sup>C</sup>	2	
		Tl	20.9 <sup>C</sup>	0.1	
		Cd	1.2 <sup>C</sup>	0.7	
		Mg	12,300	6,000	
	B2	0-2	Mo	23.2 <sup>C</sup>	5
			Sb	13.9 <sup>C</sup>	10
			Se	23.2 <sup>C</sup>	2
Tl			23.2 <sup>C</sup>	0.1	
Cd			0.86 <sup>C</sup>	0.7	
Mg			14,700	6,000	
4-6		Mo	17.2 <sup>C</sup>	5	
		Sb	10.3 <sup>C</sup>	10	
		Se	17.2 <sup>C</sup>	2	
		Tl	17.2 <sup>C</sup>	0.1	
	Cd	2.7	0.7		
	Co	770	40		
	Cu	909	100		
	Mg	10,200	6,000		
	Mo	74.7	5		
	Ni	1,460	1,000		
Pb	377	200			
Sb	13.0 <sup>C</sup>	10			
Se	21.7 <sup>C</sup>	2			
Tl	21.7 <sup>C</sup>	0.1			
Zn	657	300			

TABLE 5-1  
(Continued)

Page 2 of 14

Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
<u>Biased</u>				
B2 (Cont'd)	8-10	Cd	1.3 <sup>c</sup>	0.7
		Co	46.7	40
		Mo	25.9 <sup>c</sup>	5
		Sb	15.5 <sup>c</sup>	10
		Se	25.9 <sup>c</sup>	2
	12-14	Tl	25.9 <sup>c</sup>	0.1
		Cd	1.4	0.7
		Mo	28.0 <sup>c</sup>	5
		Sb	16.8 <sup>c</sup>	10
		Se	28.0 <sup>c</sup>	2
	16-18	Tl	28.0 <sup>c</sup>	0.1
		Cd	1.2 <sup>c</sup>	0.7
		Mo	24.1 <sup>c</sup>	5
		Sb	14.4 <sup>c</sup>	10
		Se	24.1 <sup>c</sup>	2
	20-22	Tl	24.1 <sup>c</sup>	0.1
		Cd	1.4 <sup>c</sup>	0.7
		Mg	20,200	6,000
		Mo	27.5 <sup>c</sup>	5
		Sb	16.5 <sup>c</sup>	10
		Se	27.5 <sup>c</sup>	2
B3	4-6	Tl	27.5 <sup>c</sup>	0.1
		Cd	1.0 <sup>c</sup>	0.7
		Mo	20.3 <sup>c</sup>	5
		Sb	12.2 <sup>c</sup>	10
		Se	20.3 <sup>c</sup>	2
	7-8	Tl	20.3 <sup>c</sup>	0.1
		Cd	2.0 <sup>c</sup>	0.7
		Mo	39.7 <sup>c</sup>	5
		Sb	23.8 <sup>c</sup>	10
		Se	39.7 <sup>c</sup>	2
	10-12	Tl	39.7 <sup>c</sup>	0.1
		Cd	1.1 <sup>c</sup>	0.7
		Mo	23.0 <sup>c</sup>	5
		Sb	13.8 <sup>c</sup>	10
		Se	23.0 <sup>c</sup>	2
		Tl	23.0 <sup>c</sup>	0.1

TABLE 5-1  
(Continued)

Page 3 of 14

Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
<u>Biased</u>				
B4	0-2	As	237	40
		Cd	5.9	0.7
		Co	203	40
		Cu	440	100
		Mg	8,180	6,000
		Mo	118	5
		Sb	12.8 <sup>C</sup>	10
		Se	21.3 <sup>C</sup>	2
		Tl	21.3 <sup>C</sup>	0.1
		V	862	500
	4-6	Cd	1.2 <sup>C</sup>	0.7
		Mo	23.6 <sup>C</sup>	5
		Sb	14.1 <sup>C</sup>	10
		Se	23.6 <sup>C</sup>	2
		Tl	23.6 <sup>C</sup>	0.1
	8-10	Cd	1.2 <sup>C</sup>	0.7
		Mo	23.6 <sup>C</sup>	5
		Sb	14.2 <sup>C</sup>	10
		Se	23.6 <sup>C</sup>	2
		Tl	23.6 <sup>C</sup>	0.1
	B5	0-2	Cd	0.82 <sup>C</sup>
Mo			16.4 <sup>C</sup>	5
Se			16.4 <sup>C</sup>	2
Tl			16.4 <sup>C</sup>	0.1
4-6		Cd	1.2 <sup>C</sup>	0.7
		Mo	24.2 <sup>C</sup>	5
		Sb	14.5 <sup>C</sup>	10
		Se	24.2 <sup>C</sup>	2
		Tl	24.2 <sup>C</sup>	0.1
B6	0-2	Cd	0.98 <sup>C</sup>	0.7
		Mg	13,500	6,000
		Mo	19.6 <sup>C</sup>	5
		Sb	11.8 <sup>C</sup>	10
		Se	19.6	2
		Tl	19.6 <sup>C</sup>	0.1
		4-6	Cd	1.0 <sup>C</sup>
	Mo		28.6	5
	Sb		(12.4) <sup>C</sup>	10
	Se		(20.7) <sup>C</sup>	2
	Tl		(20.7) <sup>C</sup>	0.1

TABLE 5-1  
(Continued)

Page 4 of 14

Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)		
<u>Biased</u>						
B6 (Cont'd)	8-10	Cd	1.2 <sup>c</sup>	0.7		
		Mg	10,300	6,000		
		Mo	24.7 <sup>c</sup>	5		
		Sb	14.8 <sup>c</sup>	10		
		Se	24.7 <sup>c</sup>	2		
		Tl	24.7 <sup>c</sup>	0.1		
	14-16	Cd	1.2 <sup>c</sup>	0.7		
		Mg	10,600	6,000		
		Mo	24.1 <sup>c</sup>	5		
		Sb	14.5 <sup>c</sup>	10		
		Se	24.1 <sup>c</sup>	2		
		Tl	24.1 <sup>c</sup>	0.1		
		B7	0-2	As	50.8	40
				Ba	10,000	3,000
Cd	4.5			0.7		
Co	1,510			40		
Cu	876			100		
Mg	13,200			6,000		
Mo	71.9			5		
Ni	2,010			1,000		
Pb	408			200		
Se	29.3			2		
Sb	(12.4) <sup>c</sup>			10		
Tl	(20.6) <sup>c</sup>			0.1		
4-6	Cd			(1.1) <sup>c</sup>	0.7	
	Mo			(22.8) <sup>c</sup>	5	
	Sb	(13.7) <sup>c</sup>	10			
	Se	(22.8) <sup>c</sup>	2			
	Tl	(22.8) <sup>c</sup>	0.1			
	8-10	Cd	(1.2) <sup>c</sup>	0.7		
		Mg	13,200	6,000		
		Mo	(23.9) <sup>c</sup>	5		
Sb		(14.4) <sup>c</sup>	10			
Se		(23.9) <sup>c</sup>	2			
Tl		(23.9) <sup>c</sup>	0.1			
B8		0-2	Cd	1.1 <sup>c</sup>	0.7	
			Co	62.3	40	
	Mo		22.1 <sup>c</sup>	5		
	Sb		13.3 <sup>c</sup>	10		
	Se		22.1 <sup>c</sup>	2		
	Tl		22.1 <sup>c</sup>	0.1		

TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)	
<u>Biased</u>					
B8 (Cont'd)	4-6	Cd	1.1 <sup>c</sup>	0.7	
		Mo	21.1 <sup>c</sup>	5	
		Sb	12.7 <sup>c</sup>	10	
		Se	21.1 <sup>c</sup>	2	
		Tl	21.1 <sup>c</sup>	0.1	
	10-12	Cd	(1.2) <sup>c</sup>	0.7	
		Mo	(24.2) <sup>c</sup>	5	
		Sb	(14.5) <sup>c</sup>	10	
		Se	(24.2) <sup>c</sup>	2	
		Tl	(24.2) <sup>c</sup>	0.1	
<u>Random</u>					
R1	0-2	Cd	0.88 <sup>c</sup>	0.7	
		Mg	10,200	6,000	
		Mo	17.7	5	
		Sb	10.6 <sup>c</sup>	10	
		Se	17.6 <sup>c</sup>	2	
		Tl	17.6 <sup>c</sup>	0.1	
		4-6	Cd	0.96 <sup>c</sup>	0.7
			Mo	19.1 <sup>c</sup>	5
			Sb	11.5 <sup>c</sup>	10
			Se	19.1 <sup>c</sup>	2
	Tl		19.1 <sup>c</sup>	0.1	
	8-10	Cd	0.96 <sup>c</sup>	0.7	
		Mo	19.1 <sup>c</sup>	5	
		Sb	11.5 <sup>c</sup>	10	
		Se	19.1 <sup>c</sup>	2	
		Tl	19.1 <sup>c</sup>	0.1	
	R2	0-2	Cd	1.0 <sup>c</sup>	0.7
			Mg	12,700	6,000
			Mo	20.2 <sup>c</sup>	5
			Sb	12.1 <sup>c</sup>	10
Se			20.2 <sup>c</sup>	2	
Tl			20.2 <sup>c</sup>	0.1	
6-8			Cd	1.2 <sup>c</sup>	0.7
			Mo	24.1 <sup>c</sup>	5
			Sb	14.5 <sup>c</sup>	10
			Se	24.1 <sup>c</sup>	2
		Tl	24.1 <sup>c</sup>	0.1	
10-12		Cd	1.2 <sup>c</sup>	0.7	
		Mo	23.4 <sup>c</sup>	5	
		Sb	14.0 <sup>c</sup>	10	
		Se	23.4 <sup>c</sup>	2	
		Tl	23.4 <sup>c</sup>	0.1	



TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
<u>Random</u>				
R3	3-5	Cd	0.97 <sup>C</sup>	0.7
		Mo	19.4 <sup>C</sup>	5
		Sb	11.6 <sup>C</sup>	10
		Se	19.4 <sup>C</sup>	2
		Tl	19.4 <sup>C</sup>	0.1
	6-8	Cd	1.1 <sup>C</sup>	0.7
		Mo	22.4 <sup>C</sup>	5
		Sb	13.4 <sup>C</sup>	10
		Se	22.4 <sup>C</sup>	2
		Tl	22.4 <sup>C</sup>	0.1
R4	4-6	Cd	0.96 <sup>C</sup>	0.7
		Mo	19.2 <sup>C</sup>	5
		Sb	11.5 <sup>C</sup>	10
		Se	19.2 <sup>C</sup>	2
		Tl	19.2 <sup>C</sup>	0.1
	14-16	Cd	1.2 <sup>C</sup>	0.7
		Mo	23.5 <sup>C</sup>	5
		Sb	14.1 <sup>C</sup>	10
		Se	23.5 <sup>C</sup>	2
		Tl	23.5 <sup>C</sup>	0.1
	20-22	Cd	0.9 <sup>C</sup>	0.7
		Mo	18.8 <sup>C</sup>	5
		Sb	11.3 <sup>C</sup>	10
		Se	18.8 <sup>C</sup>	2
		Tl	18.8 <sup>C</sup>	0.1
R5	0-2	Cd	0.95 <sup>C</sup>	0.7
		Mo	18.9 <sup>C</sup>	5
		Sb	11.4 <sup>C</sup>	10
		Se	18.9 <sup>C</sup>	2
		Tl	18.9 <sup>C</sup>	0.1
	2-4	As	205	40
		Cd	4.4	0.7
		Co	97.3	40
		Cu	295	100
		Mg	9,400	6,000
		Mo	151	5
		Sb	10.9 <sup>C</sup>	10
		Se	18.2 <sup>C</sup>	2
		Tl	18.2 <sup>C</sup>	0.1
		V	782	500

TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)	
<u>Random</u>					
R5 (Cont'd)	12-14	Cd	1.2 <sup>C</sup>	0.7	
		Mo	23.5 <sup>C</sup>	5	
		Sb	14.1 <sup>C</sup>	10	
		Se	23.5 <sup>C</sup>	2	
		Tl	23.5 <sup>C</sup>	0.1	
R6	0-2	Cd	0.98 <sup>C</sup>	0.7	
		Mo	19.6 <sup>C</sup>	5	
		Sb	11.8 <sup>C</sup>	10	
		Se	19.6 <sup>C</sup>	2	
		Tl	19.6 <sup>C</sup>	0.1	
	4-6	Cd	1.6	0.7	
		Co	230	40	
		Cu	135	100	
		Mo	29.8	5	
		Sb	13.8 <sup>C</sup>	10	
		Se	23.1 <sup>C</sup>	2	
		Tl	23.1 <sup>C</sup>	0.1	
		8-10	Cd	1.2 <sup>C</sup>	0.7
			Mg	21,300	6,000
			Mo	24.3 <sup>C</sup>	5
Sb	14.6 <sup>C</sup>		10		
Se	24.3 <sup>C</sup>		2		
Tl	24.3 <sup>C</sup>	0.1			
R7	0-2	Cd	1.1 <sup>C</sup>	0.7	
		Mo	21.5 <sup>C</sup>	5	
		Sb	12.9 <sup>C</sup>	10	
		Se	21.5 <sup>C</sup>	2	
		Tl	21.5 <sup>C</sup>	0.1	
	4-6	Cd	1.0 <sup>C</sup>	0.7	
		Mo	20.1 <sup>C</sup>	5	
		Sb	12.0 <sup>C</sup>	10	
		Se	20.1 <sup>C</sup>	2	
		Tl	20.1 <sup>C</sup>	0.1	
R8	0-1	Cd	1.1 <sup>C</sup>	0.7	
		Mo	21.8 <sup>C</sup>	5	
		Sb	13.1 <sup>C</sup>	10	
		Se	21.8 <sup>C</sup>	2	
		Tl	21.8 <sup>C</sup>	0.1	

TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
<u>Random</u>				
R8 (Cont'd)	2-4	Cd	0.99 <sup>C</sup>	0.7
		Mo	19.8 <sup>C</sup>	5
		Sb	11.9 <sup>C</sup>	10
		Se	19.8 <sup>C</sup>	2
		Tl	19.8 <sup>C</sup>	0.1
R9	0-2	Cd	1.0 <sup>C</sup>	0.7
		Mg	9,000	6,000
		Mo	20.1 <sup>C</sup>	5
		Sb	12.0 <sup>C</sup>	10
		Se	20.1 <sup>C</sup>	2
		Tl	20.1 <sup>C</sup>	0.1
	2-4	Cd	50.4	0.7
		Cr	3,240	3,000
		Mo	58.9	5
		Pb	1,200	200
		Sb	53.2	10
		Se	19.5 <sup>C</sup>	2
		Tl	19.5 <sup>C</sup>	0.1
	10-12	Zn	4,330	300
		Cd	1.2	0.7
		Mg	8,870	6,000
		Mo	22.6 <sup>C</sup>	5
Sb		13.5 <sup>C</sup>	10	
Se		22.6 <sup>C</sup>	2	
Tl		22.6 <sup>C</sup>	0.1	
R10	0-2	Cd	1.1	0.7
		Co	228	40
		Cu	187	100
		Mg	24,900	6,000
		Mo	30.3	5
		Sb	10.2 <sup>C</sup>	10
		Se	17.0 <sup>C</sup>	2
		Tl	17.0 <sup>C</sup>	0.1
		2-4	Cd	1.1 <sup>C</sup>
	Co		46.7	40
	Mg		8,320	6,000
	Mo		22.5 <sup>C</sup>	5
	Sb		13.5 <sup>C</sup>	10
	Se		22.5 <sup>C</sup>	2
	Tl	22.5 <sup>C</sup>	0.1	

TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
<u>Random</u>				
R10 (Cont'd)	8-10	Cd	(0.97) <sup>c</sup>	0.7
		Mo	19.5 <sup>c</sup>	5
		Sb	11.7 <sup>c</sup>	10
		Se	19.5 <sup>c</sup>	2
		Tl	19.5 <sup>c</sup>	0.1
R11	0-2	Cd	1.0	0.7
		Mo	19.1 <sup>c</sup>	5
		Sb	11.5 <sup>c</sup>	10
		Se	19.1 <sup>c</sup>	2
		Tl	19.1 <sup>c</sup>	0.1
	2-4	Cd	0.88 <sup>c</sup>	0.7
		Mo	17.5 <sup>c</sup>	5
		Sb	10.5 <sup>c</sup>	10
		Se	17.5 <sup>c</sup>	2
		Tl	17.5 <sup>c</sup>	0.1
	8-10	Cd	1.1 <sup>c</sup>	0.7
		Mo	22.4 <sup>c</sup>	5
		Sb	13.4 <sup>c</sup>	10
		Se	22.4 <sup>c</sup>	2
		Tl	22.4 <sup>c</sup>	0.1
R12	0-2	Cd	0.96 <sup>c</sup>	0.7
		Co	41.9	40
		Mo	19.1 <sup>c</sup>	5
		Sb	11.5 <sup>c</sup>	10
		Se	19.1 <sup>c</sup>	2
	2-4	Tl	19.1 <sup>c</sup>	0.1
		Ba	3,750	3,000
		Cd	1.1 <sup>c</sup>	0.7
		Co	162	40
		Mo	31.8	5
		Pb	268	200
		Sb	13.0 <sup>c</sup>	10
		Se	21.7 <sup>c</sup>	2
		Tl	21.7 <sup>c</sup>	0.1
		8-10	Cd	1.1 <sup>c</sup>
Mg	10,700		6,000	
Mo	22.2 <sup>c</sup>		5	
Sb	13.3 <sup>c</sup>		10	
Se	22.2 <sup>c</sup>		2	
Tl	22.2 <sup>c</sup>	0.1		

TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
<u>Random</u>				
R13	0-2	Ba	4,550	3,000
		Cd	(1.1) <sup>c</sup>	0.7
		Co	67.2	40
		Mo	22.5 <sup>c</sup>	5
		Sb	13.5 <sup>c</sup>	10
		Se	22.5 <sup>c</sup>	2
	2-4	Tl	22.5 <sup>c</sup>	0.1
		Cd	0.91 <sup>c</sup>	0.7
		Co	59.1	40
		Mo	18.1 <sup>c</sup>	5
		Sb	10.9 <sup>c</sup>	10
		Se	18.1 <sup>c</sup>	2
	6-8	Tl	18.1 <sup>c</sup>	0.1
		Cd	1.1 <sup>c</sup>	0.7
		Mo	22.6 <sup>c</sup>	5
Sb		13.5 <sup>c</sup>	10	
Se		22.6 <sup>c</sup>	2	
Tl		22.6 <sup>c</sup>	0.1	
R14	0-1	Cd	1.1 <sup>c</sup>	0.7
		Mo	21.7 <sup>c</sup>	5
		Sb	13.0 <sup>c</sup>	10
		Se	21.7 <sup>c</sup>	2
		Tl	21.7 <sup>c</sup>	0.1
	2-4	Cd	1.1 <sup>c</sup>	0.7
		Co	211	40
		Mo	27.9	5
		Sb	13.6 <sup>c</sup>	10
		Se	22.7 <sup>c</sup>	2
		Tl	22.7 <sup>c</sup>	0.1
	6-8	Cd	1.2	0.7
		Mg	10,600	6,000
		Mo	20.0 <sup>c</sup>	5
		Sb	12.0 <sup>c</sup>	10
Se		20.0 <sup>c</sup>	2	
Tl		20.0 <sup>c</sup>	0.1	
R15	4-6	Cd	1.1 <sup>c</sup>	0.7
		Mo	22.3 <sup>c</sup>	5
		Sb	13.4 <sup>c</sup>	10
		Se	22.3 <sup>c</sup>	2
		Tl	22.3 <sup>c</sup>	0.1

TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
<u>Random</u>				
R15 (Cont'd)	8-10	Cd	1.1	0.7
		Mg	13,900	6,000
		Mo	22.4 <sup>c</sup>	5
		Sb	13.4 <sup>c</sup>	10
		Se	22.4 <sup>c</sup>	2
	18-20	Tl	22.4 <sup>c</sup>	0.1
		Cd	1.3 <sup>c</sup>	0.7
		Mo	25.4 <sup>c</sup>	5
		Sb	15.2 <sup>c</sup>	10
		Se	25.4 <sup>c</sup>	2
		Tl	25.4 <sup>c</sup>	0.1
R16	2-4	Cd	4.2	0.7
		Mo	21.9	5
		Sb	(12.7) <sup>c</sup>	10
		Se	(21.2) <sup>c</sup>	2
		Tl	(21.2) <sup>c</sup>	0.1
	6-8	Cd	(1.2) <sup>c</sup>	0.7
		Mg	10,800	6,000
		Mo	(24.8) <sup>c</sup>	5
		Sb	(14.9) <sup>c</sup>	10
		Se	(24.8) <sup>c</sup>	2
	10-12	Tl	(24.8) <sup>c</sup>	0.1
		Cd	1.2 <sup>c</sup>	0.7
		Mg	11,700	6,000
		Mo	24.4 <sup>c</sup>	5
		Sb	14.6 <sup>c</sup>	10
		Se	24.4 <sup>c</sup>	2
		Tl	24.4 <sup>c</sup>	0.1
R17	0-2	Cd	(1.1) <sup>c</sup>	0.7
		Co	386	40
		Cu	221	100
		Mo	(22.2) <sup>c</sup>	5
		Sb	(13.3) <sup>c</sup>	10
		Se	(22.2) <sup>c</sup>	2
		Tl	(22.2) <sup>c</sup>	0.1
	2-4	Cd	1.1 <sup>c</sup>	0.7
		Co	72.1	40
		Mo	(21.1) <sup>c</sup>	5
		Sb	(12.7) <sup>c</sup>	10
		Se	(21.1) <sup>c</sup>	2
		Tl	(21.1) <sup>c</sup>	0.1

TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)	
<u>Random</u>					
R17 (Cont'd)	8-10	Cd	0.96 <sup>c</sup>	0.7	
		Mg	15,300	6,000	
		Mo	19.1 <sup>c</sup>	5	
		Sb	11.5 <sup>c</sup>	10	
		Se	19.1 <sup>c</sup>	2	
		Tl	19.1 <sup>c</sup>	0.1	
		R18	0-2	Cd	1.1 <sup>c</sup>
Co	246			40	
Mo	21.9 <sup>c</sup>			5	
Sb	13.1 <sup>c</sup>			10	
Se	21.9 <sup>c</sup>			2	
Tl	21.9 <sup>c</sup>			0.1	
4-6	Cd			1.6	0.7
	Mo		23.9 <sup>c</sup>	5	
	Sb		14.3 <sup>c</sup>	10	
	Se		23.9 <sup>c</sup>	2	
	Tl		23.9 <sup>c</sup>	0.1	
	10-12		Cd	1.1 <sup>c</sup>	0.7
			Mg	16,500	6,000
Mo			22.1 <sup>c</sup>	5	
Sb		13.2 <sup>c</sup>	10		
Se		22.1 <sup>c</sup>	2		
Tl		22.1 <sup>c</sup>	0.1		
R19		0-2	Cd	1.1 <sup>c</sup>	0.7
	Co		304	40	
	Cu		155	100	
	Mo		22.5 <sup>c</sup>	5	
	Sb		13.5 <sup>c</sup>	10	
	Se		22.5 <sup>c</sup>	2	
	Tl		22.5 <sup>c</sup>	0.1	
	2-4	Cd	1.1 <sup>c</sup>	0.7	
		Co	308	40	
		Cu	191	100	
		Mo	21.3 <sup>c</sup>	5	
		Sb	12.8 <sup>c</sup>	10	
		Se	21.3 <sup>c</sup>	2	
		Tl	21.3 <sup>c</sup>	0.1	
	6-8	Cd	1.2 <sup>c</sup>	0.7	
		Mg	12,600	6,000	
		Mo	23.6 <sup>c</sup>	5	
		Sb	14.2 <sup>c</sup>	10	
		Se	23.6 <sup>c</sup>	2	
		Tl	23.6 <sup>c</sup>	0.1	

TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)	
<u>Random</u>					
R20	0-2	Ba	12,800	3,000	
		Cd	3.2	0.7	
		Co	6,050	40	
		Cu	4,400	100	
		Mo	255	5	
		Ni	7,570	1,000	
		Pb	933	200	
		Sb	(12.1) <sup>c</sup>	10	
		Se	183	2	
		Tl	(20.2) <sup>c</sup>	0.1	
		V	630	500	
		2-4	Ba	13,600	3,000
			Cd	1.5	0.7
			Co	3,650	40
	Cu		2,810	100	
	Mo		170	5	
	Ni		4,530	1,000	
	Pb		677	200	
	Sb		(13.6) <sup>c</sup>	10	
	Se		96.0	2	
	Tl		(22.7) <sup>c</sup>	0.1	
	8-10		Cd	(1.0) <sup>c</sup>	0.7
			Co	55.6	40
			Mg	7,230	6,000
		Mo	(20.3) <sup>c</sup>	5	
		Sb	(12.2) <sup>c</sup>	10	
		Se	(20.3) <sup>c</sup>	2	
Tl		(20.3) <sup>c</sup>	0.1		
R21	0-2	Cd	(1.0) <sup>c</sup>	0.7	
		Mg	26,900	6,000	
		Mo	(20.7) <sup>c</sup>	5	
		Sb	(12.4) <sup>c</sup>	10	
		Se	(20.7) <sup>c</sup>	2	
		Tl	(20.7) <sup>c</sup>	0.1	
		2-4	Cd	(0.93) <sup>c</sup>	0.7
	Mo		(18.6) <sup>c</sup>	5	
	Sb		(11.2) <sup>c</sup>	10	
	Se		(18.6) <sup>c</sup>	2	
	Tl		(18.6) <sup>c</sup>	0.1	



TABLE 5-1  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
<u>Random</u>				
R21 (Cont'd)	8-10	Cd	1.1 <sup>c</sup>	0.7
		Mg	11,700	6,000
		Mo	21.7 <sup>c</sup>	5
		Sb	13.0 <sup>c</sup>	10
		Se	21.7 <sup>c</sup>	2
		Tl	21.7 <sup>c</sup>	0.1
		R22	1-2	Cd
Mg	12,200			6,000
Mo	(22.2) <sup>c</sup>			5
Sb	(13.3) <sup>c</sup>			10
Se	(22.2) <sup>c</sup>			2
Tl	(22.2) <sup>c</sup>			0.1
4-6	Cd			(0.98) <sup>c</sup>
	Mo		(19.5) <sup>c</sup>	5
	Sb		(11.7) <sup>c</sup>	10
	Se		(19.5) <sup>c</sup>	2
	Tl		(19.5) <sup>c</sup>	0.1

<sup>a</sup>Locations of boreholes are shown in Figure 4-1.

<sup>b</sup>Concentrations are presented as they were reported by the laboratory; no values have been rounded.

<sup>c</sup>The compound was analyzed for but was not detected. The sample detection limit is given in parentheses and is the value used in all calculations.

TABLE 5-2  
SUMMARY STATISTICS FOR METAL CONTAMINANTS AT SLAPS

Metal	Concentration (ppm) <sup>a</sup>			Number of Samples		
	Mean <sup>b</sup>	Min.	Max.	Analyzed	Above Background <sup>c</sup>	Above Background And SDL <sup>d</sup>
Antimony	13.0	9.9	53.2	90	1	1
Arsenic	27.0	16.4	237	90	3	3
Barium	810.0	62.3	13,600	90	5	5
Cadmium	1.9	0.82	50.4	90	90 <sup>e</sup>	16
Chromium	48.0	3.1	3,240	90	1	1
Cobalt	170.0	8.6	6,050	90	22	22
Copper	100.0	9.0	4,400	90	11	11
Lead	82.0	19.1	1,200	90	5	5
Magnesium	6,200.0	1,360	26,900	90	30	30
Molybdenum	31.0	16.4	255	90	90 <sup>d</sup>	14
Nickel	240.0	7.7	7,570	90	4	4
Selenium	24.0	16.4	183	90	90 <sup>e</sup>	3
Thallium	22.0	16.4	39.7	90	90 <sup>f</sup>	0
Vanadium	95.0	16.1	862	90	3	3
Zinc	110.0	21.1	4,330	90	2	2

<sup>a</sup> Maximum and minimum values include results reported below background values.

<sup>b</sup> All values, including those reported as the sample detection limit, were used to calculate the mean.

<sup>c</sup> Sample detection limit values were included when the actual sample concentration was less than the sample detection limit.

<sup>d</sup> Sample detection limit.

<sup>e</sup> Elevated sample detection limits were encountered in most samples. All sample detection limits and measurable concentrations were above background levels.

<sup>f</sup> Elevated sample detection limits were encountered in all samples.

total number of samples analyzed; and the number of samples with concentrations of metals exceeding the background level. Three metals were detected in all samples at concentrations exceeding background: cadmium, molybdenum, and selenium. Of the 90 samples analyzed, cobalt and magnesium occurred in 23 and 30 samples, respectively, in concentrations exceeding background. Cobalt, molybdenum, and selenium are commonly found in sulfide and sandstone uranium ore deposits (Ref. 8) and would be expected to be present at the site, given the origin of the material.

As indicated previously, the presence of barium at the site was also of interest because of its use during uranium processing. Barium exceeded the background level in only 5 of the 90 samples. The highest concentrations of barium were found in the northeast portion of the site near borehole R20 (Figure 4-1). This location corresponds closely with the known disposal location of barium sulfate cake.

With minor exceptions, most of the metals at SLAPS appear to range from 0 to 6 ft below the surface. Exceptions include magnesium, which was found in concentrations exceeding background to a depth of 22 ft (see Figure 4-1, B2). Magnesium may be present in elevated concentrations as a result of its presence in metal scrap known to have been present at the site.

In previous studies, radioactive contamination was detected at depths of 0 to 18 ft at the locations from which biased samples were collected in this chemical study. In these boreholes, metals were found within and below this range. Magnesium, cadmium, molybdenum, nickel, cobalt, copper, lead, zinc, arsenic, selenium, and barium were found within the known boundaries of radioactive contamination. Magnesium was detected in an area below the radioactive waste.

At the random borehole locations, radioactive contamination was detected at depths between 0.5 and 18 ft. Cadmium, cobalt, copper, molybdenum, chromium, lead, antimony, zinc, magnesium, barium,

nickel, and selenium were detected in areas within the radioactive waste. Magnesium, cadmium, and cobalt were detected in samples obtained from a depth greater than 18 ft.

#### 5.1.2 Mobile Ions

Analyses were performed on soil samples for the mobile ions fluoride, nitrate, and sulfate. These ions were selected for analysis because they were present in material used to process uranium ore. In addition, because these ions are negatively charged, they will not bind with negatively charged clay particles as will many positively charged metal ions. As a result, the presence of these ions in concentrations exceeding background levels may indicate the migration of waste. Background levels were obtained for this area from a chemical survey of 37 boreholes located in the St. Louis vicinity (Ref. 9). Soils at SLAPS had two of the three ions present in concentrations slightly higher than those reported in the background samples. Sulfate results included one sample with a content of 860 ppm (B5 at 4 to 6 ft) (Figure 4-1). The highest background sample had a sulfate content of 610 ppm. All other sulfate results were well within the reported range of those in the background survey.

Fluoride at SLAPS was slightly higher than background (1.2 to 31 ppm) in four samples. Results for the sample taken at R5 (12 to 14 ft) indicated a fluoride content of 32.4 ppm. Borehole B8 (4 to 6 ft) had a concentration of 40.7 ppm, and R12 (0 to 2 ft) had a concentration of 43.3 ppm. This result was the sample detection limit, meaning that fluoride was detected in the sample, but sample characteristics prohibited an exact measurement of the concentration. This sample contained fluoride at a concentration that does not exceed 43.3 ppm. The fourth sample, taken from R22 (1 to 2 ft), had a fluoride content of 62.9 ppm.

Nitrate at a concentration exceeding those in the background survey was not detected in any samples from SLAPS.

### 5.1.3 Volatile Organic Compounds

Thirty-seven of the 90 soil samples submitted for volatile organic analysis had concentrations exceeding detection limits. The concentrations of these compounds, however, were very low, generally in the low parts per billion. Three compounds were found: toluene, trichloroethene, and trans-1,2-dichloroethene. Table 5-3 gives the sample locations, depths, and concentrations of the organic contaminants.

Toluene was found in 26 of the samples. Concentrations ranged from 1.5 to 1,200 ppb. Trichloroethene was found in six samples, with concentrations ranging from 1.6 to 15 ppb. Trans-1,2-dichloroethene was found in five samples in concentrations ranging from 1.3 to 7.7 ppb.

With the exception of toluene, the distribution of volatile organics showed no discernable pattern at SLAPS. Highest concentrations of toluene were found grouped in the eastern portion of the site (R18, R19, and R21; see Figure 4-1), primarily at depths of 0 to 4 ft. Other volatile organics were typically found throughout the site and at depths of 10 to 22 ft.

None of the volatiles found at the site are believed to have been used during uranium processing. The presence of these compounds is probably the result of disposal from activities unrelated to the processing of uranium. Toluene, in particular, may be indicative of a breakdown of petroleum products such as gasoline or diesel fuel.

### 5.1.4 Semivolatile Organic Compounds

Fifty-two of the 90 soil samples contained semivolatile compounds. To better define the massive hydrocarbon and large, late peak identified during initial gas chromatography (GC) screening in the sample results, four holes were selected for a second analysis.

TABLE 5-3  
LOCATIONS OF VOLATILE ORGANIC CONTAMINATION AT SLAPS

Page 1 of 2

Location <sup>a</sup>	Depth (ft)	Compound	Concentration (ppb) <sup>b</sup>
<u>Biased</u>			
B1	0-2	toluene	3.1
	14-16	trichloroethene	6.6
		trans-1,2-dichloroethene	3.0
B3	4-6	toluene	11.0
	10-12	trichloroethene	3.4
		trans-1,2-dichloroethene	3.1
B6	0-2	toluene	2.4
<u>Random</u>			
R1	0-2	toluene	3.0
R2	10-12	trans-1,2-dichloroethene	1.9
		trichloroethene	1.8
R4	0-2	toluene	1.5
	4-6	toluene	12.0
	14-16	trans-1,2-dichloroethene	7.7
		trichloroethene	15.0
	20-22	trans-1,2-dichloroethene	1.3
		trichloroethene	1.6
R6	8-10	trichloroethene	4.3
		toluene	2.6
R7	4-6	toluene	6.6
R8	0-1	toluene	2.5
	2-4	toluene	10.4
R9	0-2	toluene	55.0
	2-4	toluene	40.0
R10	2-4	toluene	9.2
R11	0-2	toluene	9.2
	2-4	toluene	4.5
	8-10	toluene	2.2

TABLE 5-3  
(Continued)

Page 2 of 2

Location <sup>a</sup>	Depth (ft)	Compound	Concentration (ppb) <sup>b</sup>
R12	0-2	toluene	8.9
	2-4	toluene	120.0
	8-10	toluene	3.0
R13	2-4	toluene	5.4
R14	2-4	toluene	6.8
R17	0-2	toluene	1.8
	2-4	toluene	3.0
R18	0-2	toluene	230.0
R19	0-2	toluene	900.0
R21	8-10	toluene	1,200.0

<sup>a</sup>Locations of boreholes are shown in Figure 4-1.

<sup>b</sup>Concentrations are presented as they were reported by the laboratory; no values have been rounded.

Boreholes R1 (0 to 2 ft), R8 (0 to 1 ft), R9 (2 to 4 ft), and R17 (0 to 2 ft) were resampled in mid-March 1988 and submitted for GC/mass spectroscopy (MS) analysis to verify peaks present in the initial screen. No compounds on the EPA Target Compound List (TCL) were detected. One unidentified non-target compound (i.e., not on the TCL) was detected.

#### 5.1.5 RCRA-Hazardous Waste Characteristics

Biased samples taken from within the radioactive waste and composite samples from random boreholes were tested for RCRA-hazardous waste characteristics. All samples were below the criteria for reactivity, ignitability, corrosivity, and EP toxicity. These results indicate that the material at SLAPS is not hazardous on the basis of RCRA-hazardous waste characteristics.

#### 5.2 HISS

Samples obtained from HISS were analyzed for metals, mobile ions, volatile organic compounds, semivolatile organic compounds, and RCRA-hazardous waste characteristics. Six boreholes were drilled at the site; three were at random locations and three were at biased locations (see Figure 4-2). A total of 15 samples were analyzed.

##### 5.2.1 Metals

Results of the metal analyses for HISS indicate that 16 metals are present in the soil at concentrations exceeding background. Levels of antimony, arsenic, barium, boron, cadmium, cobalt, copper, lead, magnesium, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc varied from slightly exceeding background to substantially greater than background concentrations. Table 5-4 is a summary of the locations and depths of the concentrations of the samples taken for metals.



TABLE 5-4  
METALS DETECTED ABOVE BACKGROUND AT HISS

Page 1 of 2

Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)		
<u>Biased</u>						
B1	2-4	Cd	(1.1) <sup>c</sup>	0.7		
		Mo	(21.2) <sup>c</sup>	5		
		Sb	(12.7) <sup>c</sup>	10		
		Se	(21.2) <sup>c</sup>	2		
		Tl	(21.2) <sup>c</sup>	0.1		
B2	0-1	Cd	1.4	0.7		
		Co	222	40		
		Cu	157	100		
		Mo	(23.6) <sup>c</sup>	5		
		Sb	(14.2) <sup>c</sup>	10		
		Se	(23.6) <sup>c</sup>	2		
		Tl	(23.6) <sup>c</sup>	0.1		
	2-4	Cd	(1.3) <sup>c</sup>	0.7		
		Mo	(25.0) <sup>c</sup>	5		
		Sb	(15.0) <sup>c</sup>	10		
		Se	(25.0) <sup>c</sup>	2		
		Tl	(25.0) <sup>c</sup>	0.1		
		<u>Random</u>				
		B3	3-4	As	51.3	40
Co	154			40		
Cd	2.8			0.7		
Cu	109			100		
Mo	50.8			5		
Sb	(11.8) <sup>c</sup>			10		
Se	41.1			2		
Tl	51.8			0.1		
6-8	Cd		(1.2) <sup>c</sup>	0.7		
	Mg		8,180	6,000		
	Mo		(24.9) <sup>c</sup>	5		
	Sb		(14.9) <sup>c</sup>	10		
	Se		(24.9) <sup>c</sup>	2		
	Tl		(24.9) <sup>c</sup>	0.1		
<u>Random</u>						
R1	0-2	Cd	1.2	0.7		
		Co	125	40		
		Mo	19.1	5		
		Sb	(10.8) <sup>c</sup>	10		
		Se	(18.0) <sup>c</sup>	2		
		Tl	(18.0) <sup>c</sup>	2		

TABLE 5-4  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
R1 (Cont'd)	4-6	Cd	(1.1) <sup>c</sup>	0.7
		Mo	(23.0) <sup>c</sup>	5
		Sb	(13.8) <sup>c</sup>	10
		Se	(23.0) <sup>c</sup>	2
		Tl	(23.0) <sup>c</sup>	0.1
R2	0-2	Ag	18.3	5
		As	1,010	40
		B	1,010	100
		Ba	4,360	3,000
		Cd	26.6	0.7
		Co	1,470	40
		Cu	946	100
		Mg	7,690	6,000
		Mo	1,100	5
		Ni	1,780	1,000
		Pb	464	200
		Sb	242	10
		Se	1,020	2
		Tl	959	0.1
		V	712	500
	Zn	308	300	
	4-6	Cd	1.3	0.7
		Mo	(26.1) <sup>c</sup>	5
		Sb	(15.6) <sup>c</sup>	10
		Se	(26.1) <sup>c</sup>	2
Tl		(26.1) <sup>c</sup>	0.1	
R3	0-2	Ba	3,010	3,000
		Cd	(1.2) <sup>c</sup>	0.7
		Co	131	40
		Mo	23.8 <sup>c</sup>	5
		Sb	(14.3) <sup>c</sup>	10
	4-6	Se	(23.8) <sup>c</sup>	2
		Tl	(23.8) <sup>c</sup>	0.1
		Cd	(1.2) <sup>c</sup>	0.7
		Mo	(23.8) <sup>c</sup>	5
		Sb	(14.3) <sup>c</sup>	10
Se	(23.8) <sup>c</sup>	2		
Tl	(23.8) <sup>c</sup>	0.1		

<sup>a</sup>Locations of boreholes are shown in Figure 4-1.

<sup>b</sup>Concentrations are presented as they were reported by the laboratory; no values have been rounded.

<sup>c</sup>The compound was analyzed for but was not detected. The sample detection limit is given in parentheses and is the value used in all calculations.

Summary statistics were calculated for each of the metals found on site at concentrations exceeding background and are shown in Table 5-5. The table shows the mean, minimum, and maximum concentrations and the number of samples with concentrations of metals above background.

As was observed for SLAPS, cadmium, molybdenum, and selenium (when present at levels exceeding the detection limit) were found in all samples at concentrations exceeding background. Cobalt and copper occurred with the next highest frequency (five and three respectively of the 11 samples analyzed) in concentrations exceeding background.

Barium was detected at concentrations exceeding background in only two of 11 samples (R2 and R3; see Figure 4-2). The maximum concentration of barium at HISS was 4,360 ppm (R2), while the maximum concentration at SLAPS was 13,600 ppm (R20).

The distribution of metals with depth at HISS was similar to that observed at SLAPS; i.e., most of the metals appear to be confined to depths at or near the surface. Magnesium occurred in low concentrations at HISS (maximum concentration of 8,180 ppm at HISS, as apposed to 26,900 ppm at SLAPS) and extended to a maximum depth of 6 to 8 ft at HISS as compared to a depth of 20 to 22 ft at SLAPS.

In previous studies, radioactive contamination was detected from the surface to a depth of 4 ft at HISS. To determine whether chemicals had migrated below this depth, soil from a total of four intervals below this depth was tested for the presence of metals. Cadmium and magnesium were detected in these samples at concentrations above background.

Six boreholes were drilled into the radioactive waste at depths of 0 to 4 ft. Samples from intervals in these boreholes had arsenic, copper, cadmium, cobalt, molybdenum, selenium, antimony, barium, magnesium, nickel, lead, vanadium, boron, zinc, and silver detected at concentrations exceeding background.

TABLE 5-5  
SUMMARY STATISTICS FOR METAL CONTAMINANTS AT HISS

Metal	Concentration (ppm) <sup>a</sup>			Number of Samples		
	Mean <sup>b</sup>	Min.	Max.	Analyzed	Above Background <sup>c</sup>	Above Background And SDL <sup>d</sup>
Antimony	34.0	10.8	242	11	11 <sup>e</sup>	1
Arsenic	120.0	18.0	1,010	11	2	2
Barium	930.0	83.3	4,360	11	2	2
Boron	120.0	21.9	1,010	11	1	1
Cadmium	3.7	1.1	26.6	11	11 <sup>e</sup>	5
Cobalt	200.0	10.6	1,470	11	5	5
Copper	140.0	8.5	946	11	3	3
Lead	82.0	21.2	464	11	1	1
Magnesium	4,400.0	1,450	8,180	11	2	2
Molybdenum	120.0	19.1	1,100	11	11 <sup>e</sup>	3
Nickel	240.0	9.3	1,780	11	1	1
Selenium	120.0	18.0	1,020	11	11 <sup>e</sup>	11
Silver	3.8	1.8	18.3	11	1	2
Thallium	110.0	18.0	959	11	11	2
Vanadium	100.0	13.3	712	11	1	1
Zinc	67.0	22.7	308	11	1	1

<sup>a</sup> Maximum and minimum values include results reported below background values.

<sup>b</sup> All values, including those reported as the sample detection limit, were used to calculate the mean.

<sup>c</sup> Sample detection limit values were included when the actual sample concentration was less than the sample detection limit.

<sup>d</sup> Sample detection limit.

<sup>e</sup> All sample detection limits and measurable concentrations were above background levels.

### 5.2.2 Mobile Ions

Mobile ions (fluoride, nitrate, and sulfate) were analyzed in 11 samples as an indication of waste migration because they were present in materials used for uranium processing. Only two samples had concentrations exceeding background levels (Ref. 9). The sample taken from R2 (0 to 2 ft) contained sulfate at a concentration of 824 ppm. The highest result from the background survey was 610 ppm. The only other sample result that exceeded the background range was at B2 (2 to 4 ft), with a nitrate content of 1,030 ppm. The background survey result for nitrate indicated a maximum concentration of 868 ppm.

### 5.2.3 Volatile Organic Compounds

Only one of the 12 samples submitted for volatile organic analysis exhibited concentrations exceeded sample detection limits. The sample, obtained from R2 (4 to 6 ft), had a toluene concentration of 2.9 ppm. Analytical results are summarized in Table 5-6.

### 5.2.4 Semivolatile Organic Compounds

Initial GC results for soil samples obtained from HISS identified two peaks grossly defined as massive hydrocarbons and a large, late peak. Two boreholes (B1 and R3) were resampled in March 1988 and were submitted for full GC/MS analysis to identify completely the peaks scanned in the screening analysis. While the full analysis failed to identify the compounds, it is assumed that the peaks represent breakdown products of substances from activities unrelated to those at the MED/AEC properties and SLAPS, where one peak was identified as a benzene compound. It is most probable that off-specification fuel was disposed of on the sites and chemical analyses have detected the weathered remains of the original substance. No TCL compounds were detected at concentrations exceeding the sample detection limit.

TABLE 5-6  
LOCATIONS OF VOLATILE ORGANIC  
CONTAMINATION AT HISS AND FUTURA

Location <sup>a</sup>	Depth (ft)	Compound	Concentration (ppb) <sup>b</sup>
<u>HISS</u>			
R2	4-6	toluene	2.9
<u>FUTURA</u>			
B1	0-2	toluene	15.0
		trichlorofluoromethane	1.3
B2	0-1	toluene	1.5
B3	4-5	toluene	1.7
R1	0-2	toluene	2.8

<sup>a</sup>Locations of boreholes are shown in Figure 4-1.

<sup>b</sup>Concentrations are presented as they were reported by the laboratory; no values have been rounded.

#### 5.2.5 RCRA-Hazardous Waste Characteristics

Three samples taken from within the waste and three samples composited over the depth of the boreholes were tested for RCRA-hazardous waste characteristics. Results for reactivity, ignitability, EP toxicity, and corrosivity did not exceed criteria. Results indicate that the material on site is not hazardous on the basis of RCRA-hazardous waste characteristics.

#### 5.3 FUTURA COATINGS SITE

Samples obtained from boreholes at Futura Coatings Site were analyzed for metals, mobile ions, volatile organic compounds, semivolatile compounds, and RCRA-hazardous waste characteristics according to the schedule shown in Table 4-5. A total of 17 samples were analyzed.

##### 5.3.1 Metals

Results of the metal analyses for Futura indicate that 12 metals are present at concentrations exceeding background levels. Arsenic, barium, boron, cadmium, cobalt, copper, lead, magnesium, molybdenum, nickel, selenium, and vanadium were found in measurable concentrations in samples taken across the site. Table 5-7 summarizes the locations and depths of the contamination.

In previous studies, radioactive contamination from locations near boreholes B2 and B3 was detected at depths from 0 to 7 ft. Cobalt, cadmium, magnesium, molybdenum, and copper were detected at these depths at concentrations above background. Only cobalt was found below the radioactivity. Radioactivity was detected at B1 at a depth of 15 ft; magnesium, molybdenum, arsenic, boron, copper, cobalt, nickel, lead, vanadium, barium, cadmium, and selenium were found at depths of 0 to 15 ft. No metals were detected within or below the radioactivity.

TABLE 5-7

## METALS DETECTED ABOVE BACKGROUND AT THE FUTURA COATINGS SITE

Page 1 of 3

Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)
<u>Biased</u>				
B1	0-2	Cd	0.99 <sup>c</sup>	0.7
		Mg	37,200	6,000
	4-6	Mo	20.9	5
		Sb	(11.9) <sup>c</sup>	10
		Se	(19.8) <sup>c</sup>	2
		Tl	(19.8) <sup>c</sup>	0.1
		As	320	40
		B	182	100
		Ba	3,480	3,000
		Cd	15.5	0.7
		Co	14,000	40
		Cu	9,090	100
		Mg	43,400	6,000
		Mo	947	5
		Ni	17,300	1,000
		Pb	529	200
		Sb	(17.9) <sup>c</sup>	10
		Se	1,040	2
		Tl	(29.9) <sup>c</sup>	0.1
		V	2,180	500
	8-10	Cd	(1.2) <sup>c</sup>	0.7
		Co	62.5	40
		Mg	7,360	6,000
		Mo	28.5	5
		Sb	(14.2) <sup>c</sup>	10
		Se	(23.7)	2
		Tl	(23.7) <sup>c</sup>	0.1
		Cd	(1.1) <sup>c</sup>	0.7
	12-14	Mg	8,500	6,000
		Mo	25.3	5
		Sb	13.1 <sup>c</sup>	10
		Se	21.8 <sup>c</sup>	2
Tl		21.8 <sup>c</sup>	0.1	
20-22		Cd	(1.1) <sup>c</sup>	0.7
		Mo	(21.9) <sup>c</sup>	5
		Sb	(13.1) <sup>c</sup>	10
	Se	(21.9) <sup>c</sup>	2	
	Tl	(21.9) <sup>c</sup>	0.1	
B2	0-1	Cd	(1.1) <sup>c</sup>	0.7
		Co	75.1	40
		Sb	(13.0) <sup>c</sup>	10
		Tl	(21.7) <sup>c</sup>	0.1



TABLE 5-7  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)				
B2 (Cont'd)	0-1	Mg	24,300	6,000				
		Mo	(21.7) <sup>C</sup>	5				
		Se	(21.7) <sup>C</sup>	2				
	2-4	Cd	2.1	0.7				
		Co	520	40				
		Cu	401	100				
		Mo	38.0	5				
		Sb	(11.8) <sup>C</sup>	10				
		Se	(19.6) <sup>C</sup>	2				
		Tl	(19.6) <sup>C</sup>	0.1				
B3	0-2	Cd	(1.2) <sup>C</sup>	0.7				
		Mo	(24.0) <sup>C</sup>	5				
		Sb	(14.4) <sup>C</sup>	10				
		Se	(24.0) <sup>C</sup>	2				
		Tl	(24.0) <sup>C</sup>	0.1				
	4-5	Cd	(1.1) <sup>C</sup>	0.7				
		Co	55.5	40				
		Mo	(22.8) <sup>C</sup>	5				
		Sb	(13.7) <sup>C</sup>	10				
		Se	(22.8) <sup>C</sup>	2				
	6-8	Tl	(22.8) <sup>C</sup>	0.1				
		Cd	1.4	0.7				
		Co	42.4	40				
		Mo	(25.9) <sup>C</sup>	5				
		Sb	(15.5) <sup>C</sup>	10				
<u>Random</u>	R1							
					0-2	Cd	0.99 <sup>C</sup>	0.7
						Co	141	40
						Cu	123	100
						Mg	11,400	6,000
						Mo	22.6	5
					4-6	Sb	(11.9) <sup>C</sup>	10
						Se	(19.9) <sup>C</sup>	2
						Tl	(19.9) <sup>C</sup>	0.1
						Cd	0.9 <sup>C</sup>	0.7
Mg	10,800	6,000						
	Mo	(18.1) <sup>C</sup>	5					
	Sb	(10.8) <sup>C</sup>	10					
	Se	(18.1) <sup>C</sup>	2					
	Tl	(18.1) <sup>C</sup>	0.1					

TABLE 5-7  
(Continued)

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Location <sup>a</sup>	Depth (ft)	Metal	Concentration (ppm) <sup>b</sup>	Background (ppm)		
R2	0-2	Cd	1.3	0.7		
		Mg	19,500	6,000		
		Mo	(19.8) <sup>c</sup>	5		
		Sb	(11.9) <sup>c</sup>	10		
		Se	(19.8) <sup>c</sup>	2		
		Tl	(19.8) <sup>c</sup>	0.1		
	4-6	Cd	1.2 <sup>c</sup>	0.7		
		Mo	(23.1) <sup>c</sup>	5		
		Sb	(13.9) <sup>c</sup>	10		
		Se	(23.1) <sup>c</sup>	2		
		Tl	(23.1) <sup>c</sup>	0.1		
		R3	0-2	Cd	(1.2) <sup>c</sup>	0.7
				Mo	(23.3) <sup>c</sup>	5
				Sb	(14.0) <sup>c</sup>	10
Se	(23.3) <sup>c</sup>			2		
Tl	(23.3) <sup>c</sup>			0.1		
4-6	Cd		(1.1) <sup>c</sup>	0.7		
	Mo		(21.3) <sup>c</sup>	5		
	Sb		(12.8) <sup>c</sup>	10		
		Se	(21.3) <sup>c</sup>	2		
		Tl	(21.3) <sup>c</sup>	0.1		

<sup>a</sup>Locations of boreholes are shown in Figure 4-1.

<sup>b</sup>Concentrations are presented as they were reported by the laboratory; no values have been rounded.

<sup>c</sup>The compound was analyzed for but was not detected. The sample detection limit is given in parentheses and is the value used in all calculations.

TABLE 5-8  
SUMMARY STATISTICS FOR METAL CONTAMINANTS AT THE FUTURA COATINGS SITE

Metal	Concentration (ppm) <sup>a</sup>			Number of Samples		
	Mean <sup>b</sup>	Min.	Max.	Analyzed	Above Background <sup>c</sup>	Above Background And SDL <sup>d</sup>
Antimony	13.0	10.8	17.9	16	16 <sup>e</sup>	0
Arsenic	40.0	18.1	320	16	1	1
Barium	530.0	101	3,480	16	1	1
Boron	55.0	22.8	182	16	1	1
Cadmium	2.0	0.9	15.5	16	16 <sup>f</sup>	4
Cobalt	940.0	9.9	14,000	16	7	7
Copper	630.0	6.2	9,090	16	3	3
Lead	75.0	21.8	529	16	1	1
Magnesium	11,000.0	1,200	43,400	16	8	8
Molybdenum	82.0	18.1	947	16	16 <sup>f</sup>	6
Nickel	1,200.0	9.6	17,300	16	1	1
Selenium	85.0	18.1	1,040	16	16 <sup>f</sup>	1
Thallium	22.0	18.1	29.9	16	16 <sup>e</sup>	0
Vanadium	170.0	12.8	2,180	16	1	1

<sup>a</sup>Maximum and minimum values include results reported below background values.

<sup>b</sup>All values, including those reported as the sample detection limit, were used to calculate the mean.

<sup>c</sup>Sample detection limits were included when the actual sample concentration was less than the sample detection limit.

<sup>d</sup>Sample detection limit.

<sup>e</sup>Elevated sample detection limits were encountered in all samples as a result of matrix interference during analysis.

<sup>f</sup>Elevated sample detection limits were encountered in most samples. All sample detection limits and measurable concentrations were above background levels.

In previous studies, radioactive contamination was detected at depths from 1 to 4 ft at the locations from which all random samples were collected in this chemical characterization. Cobalt, copper, magnesium, molybdenum, and cadmium were detected above this depth, and magnesium and cadmium were detected within the radioactivity. Only magnesium was found below the known boundary of radioactivity.

Summary statistics were calculated for each of the metals found on site at concentrations exceeding background levels and are shown in Table 5-8. The table shows the mean, minimum, and maximum concentrations and the total number of samples with concentrations exceeding background. As was observed for SLAPS and HISS, cadmium, molybdenum, and selenium (when present at levels exceeding the detection limit) were found in all samples at concentrations exceeding background. Cobalt and magnesium occurred in the next highest frequency (seven and eight of the 16 samples analyzed, respectively) in concentrations exceeding background.

Barium was observed in concentrations exceeding background in only one of 16 samples (B1, 4 to 6 ft; see Figure 4-2). The maximum concentration of barium at the Futura Coatings Site was 3,480 ppm, while the maximum observed at HISS and at SLAPS was 4,360 ppm (R2) and 13,600 ppm, respectively.

The metals exceeding background levels were found at depths greater than those at HISS (see Table 5-5). Molybdenum and magnesium were found in concentrations exceeding background to a maximum depth of 14 ft (B1). Magnesium occurred in higher concentrations at Futura (maximum concentration was 37,200 ppm at B1) than at HISS (8,180 ppm at B3) and at SLAPS (26,900 ppm at R21).

### 5.3.2 Mobile Ions

Thirteen samples were analyzed for the mobile ions sulfate, nitrate, and fluoride. Results of these analyses indicate that no ion is present on site at Futura in concentrations exceeding those found in the background soils survey (Ref. 9).

### 5.3.3 Volatile Organic Compounds

Four of the 16 soil samples submitted for volatile organic analyses exhibited concentrations above the detection limit (see Table 5-6). Toluene was detected in each of the samples in the 1.5 to 15 ppb range. Trichlorofluoromethane was detected in one sample, at a concentration of 1.3 ppb.

### 5.3.4 Semivolatile Organic Compounds

Initial GC analysis of samples from Futura identified two peaks grossly defined as massive hydrocarbons and a large, late peak. One borehole (B2) was resampled for analysis in March 1988 and was submitted for GC/MS analysis to verify peaks present in the initial screen. The analysis confirmed a non-target compound identified as a benzene compound at a concentration of 6,300 ppb. Another non-target compound identified was 2-propanol-1,3-dichlorophosphate at a concentration of 250,000 ppb. No HSL compounds were detected at levels exceeding the sample detection limits.

### 5.3.5 RCRA-Hazardous Waste Characteristics

Ten samples were submitted for RCRA-hazardous waste characteristic analysis. No analysis results exceeded criteria for reactivity, ignitability, corrosivity, or EP toxicity. Results indicate that the material on site is not hazardous on the basis of RCRA-hazardous waste characteristics.

## 6.0 SUMMARY

During the fall of 1987, a chemical characterization was conducted at SLAPS and the Latty Avenue Properties to:

- Define the chemical characteristics and potential migration pathways of the wastes
- Provide data to assess the potential health hazard from this waste to workers performing remedial action.

Analyses were performed for metals, mobile ions, volatile organic and semivolatile organic compounds, and RCRA-hazardous waste characteristics.

Analytical results for metals confirmed the presence of 17 metals at concentrations exceeding background levels. These include:

antimony	lead
arsenic	magnesium
barium	molybdenum
boron	nickel
cadmium	selenium
chromium	silver
cobalt	thallium
copper	vanadium
	zinc

Concentrations ranged from slightly exceeding to substantially exceeding background levels. Most of the metals observed, including cobalt, selenium, and molybdenum, are commonly found in uranium ores.

Analyses for the mobile ions fluoride, sulfate, and nitrate indicate that none of the samples had ion concentrations substantially exceeding background levels.

Volatile organic compounds in significant concentrations were not a problem at any site. Detected in these analyses were four compounds: toluene, trichloroethene, trans-1,2-dichloroethene, and trichlorofluoromethane.

Semivolatile analysis did not identify any HSL compounds at the sites. Two non-target compounds were identified at Futura: a benzene compound and 2-propanol-1,3-dichlorophosphate.

RCRA-hazardous waste characteristic analyses include tests for ignitability, reactivity, corrosivity, and EP toxicity. Soil samples analyzed for these characteristics did not exceed RCRA criteria. The conclusion was made that material present at SLAPS, HISS, and Futura are not hazardous on the basis of these characteristics.

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