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DOE/OR/20722-141

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

CHARACTERIZATION REPORT FOR THE HAZELWOOD INTERIM STORAGE SITE

Hazelwood, Missouri

June 1987

Bechtel National, Inc.

DOE/OR/20722-141

CHARACTERIZATION REPORT FOR THE HAZELWOOD INTERIM STORAGE SITE HAZELWOOD, MISSOURI

JUNE 1987

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

By

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ABSTRACT

During October and November 1986 a radiological survey was conducted at the Hazelwood Interim Storage Site (HISS) in Hazelwood, Missouri. The survey was performed as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a U.S. Department of Energy (DOE) program to identify, 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 conditions that Congress has mandated DOE to remedy. Although sampling for chemical contamination was not within the scope of this effort, chemical characterization of the site will be performed before remedial action commences.

It was established that contamination was present at the site on the basis of a radiological survey conducted by Oak Ridge National Laboratory in 1977. The purpose of the 1986 survey was to define the locations and boundaries of the contamination and to provide the data required to estimate the volume of contaminated material on the site. The survey was conducted by the FUSRAP Project Management Contractor, Bechtel National, Inc. (BNI) and its radiological subcontractor, Thermo Analytical/ Eberline (TMA/E).

Measurements taken during the 1986 survey indicate that contamination is present on the site in concentrations exceeding current DOE guidelines. Above-guideline contamination was found to extend to a depth of 6 ft below the ground surface at one location. The average depth of contamination at the HISS was found to be approximately 3 ft. The 1986 survey supports the finding of the 1977 ORNL survey that thorium-230 is the principal contaminant at the site.

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ABBREVIATIONS

cm	centimeter
cpm	counts per minute
ft	foot
h	hour
in.	inch
m^2	square meter
mi	mile
µR/h	microroentgens per hour
pCi/g	picocuries per gram

1.0 INTRODUCTION AND SUMMARY

1.1 INTRODUCTION

This report describes the procedures used to conduct a radiological survey during October and November 1986 at the Hazelwood Interim Storage Site (HISS) in Hazelwood, Missouri. The results of the survey are also discussed. The survey was conducted as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a U.S. Department of Energy (DOE) program to identify, 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 mandated DOE to remedy. Under contract to the DOE, Bechtel National, Inc. (BNI) acts as the Project Management Contractor (PMC) for FUSRAP. The 1986 survey was conducted by BNI and its radiological subcontractor, Thermo Analytical/Eberline (TMA/E).

1.2 PURPOSE AND OBJECTIVES

A radiological survey performed in 1977 by Oak Ridge National Laboratory (ORNL) established that contamination existed at the site (Ref. 1). Although the contamination at Hazelwood did not result directly from the atomic energy program, the Hazelwood properties were added to FUSRAP by Congress to expedite decontamination of the properties. The 1986 radiological survey was necessary to define the locations and boundaries of the contamination identified in the ORNL survey and permit estimation of the volume of contaminated material presently on the site. Although sampling for chemical contaminants was not within the scope of this survey, chemical characterization will be performed before remedial action commences.

1.3 SUMMARY

This characterization confirmed the finding of the 1977 survey that thorium-230 is the principal radioactive contaminant at the HISS, although analysis also identified elevated levels of radium-226 and uranium-238. Thorium-232 concentrations ranged from 0.7 to 5 pCi/g. The maximum concentrations of radium-226 and uranium-238 were found to be 700 and 800 pCi/g, respectively. Selected samples were also analyzed for thorium-230. The maximum thorium-230 concentration detected in these samples was 790 pCi/g; however, the samples that exhibited high concentrations of radium-226 and uranium-238 were not analyzed for thorium-230. Some of these samples can be expected to contain thorium-230 concentrations far in excess of 790 pCi/g.

External gamma radiation levels ranged from 13 to 55 uR/h. The normal background level for the St. Louis area is approximately 8 uR/h.

Gamma logging data and subsurface soil sample analyses were used to determine the depths of contamination. Analysis results indicate the presence of both surface and subsurface contamination. Contamination was found 6 ft below the ground surface at one location. The average depth of contamination at the HISS is approximately 3 ft.

The two contaminated waste storage piles on the HISS were not included as part of the 1986 survey.

2.0 SITE DESCRIPTION AND HISTORY

2.1 LOCATION AND DESCRIPTION

The HISS occupies the eastern half of the property located at 9200 Latty Avenue in northern St. Louis County within the city limits of Hazelwood, Missouri. It is approximately 2 mi northeast of the control tower of the Lambert-St. Louis International Airport. The location of the HISS is shown in Figure 2-1. The property is owned by Jarboe Realty and Investment Company. A chain link fence separates the HISS from the western half of the property at 9200 Latty Avenue, which is known as the Futura Coatings site (Figure 2-2).

2.2 SITE HISTORY AND PREVIOUS RADIOLOGICAL SURVEYS

In 1966, ore residues and uranium- and radium-bearing process wastes being stored at the St. Louis Airport Site (SLAPS) were purchased by the Continental Mining and Milling Company of Chicago, Illinois and placed in storage at 9200 Latty Avenue. These wastes were generated by a St. Louis plant between 1942 and the late 1950s under contracts with the Atomic Energy Commission (AEC) and its predecessor, the Manhattan Engineer District (MED). These residues included pitchblende raffinates, Colorado raffinates, uranium-bearing residues, and barium sulfate cake. The Commercial Discount Corporation of Chicago 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 material remaining at the Latty Avenue site was sold to the Cotter Corporation in December 1969. Between August and November of 1970, Cotter Corporation dried some of the residues remaining at the site and shipped them to its mill in Canon City. In December 1970, an estimated 10,000 tons of Colorado raffinate and 8,700 tons of leached barium sulfate remained at the Latty Avenue site.

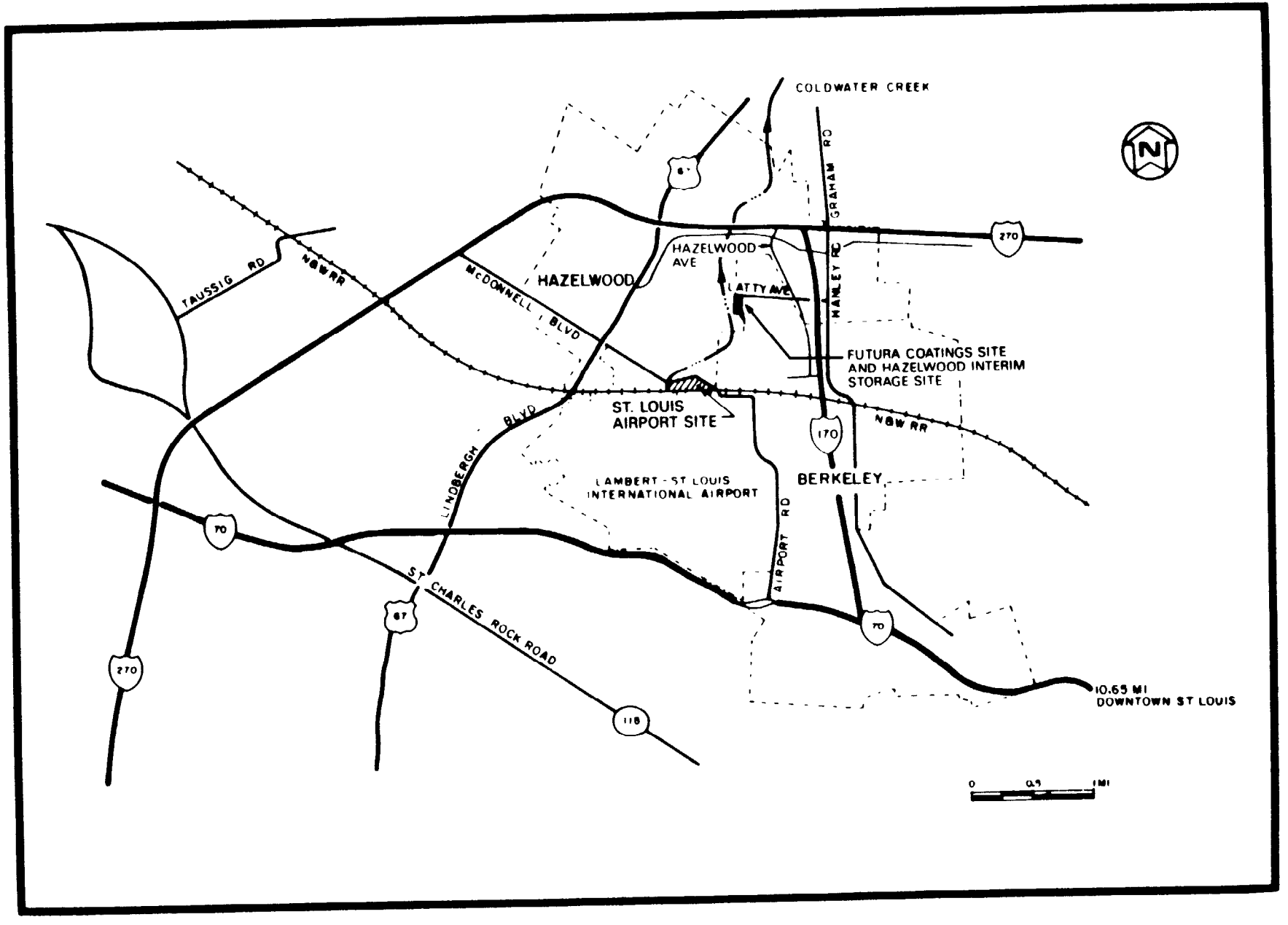

FIGURE 2-1 LOCATION OF THE HISS

In April 1974, the newly established Nuclear Regulatory Commission (NRC) was informed by Cotter Corporation that the remaining Colorado raffinate had been shipped in mid-1973 to Canon City without having been dried and that barium sulfate residues had been diluted with soil from the site and transported to a landfill area in St. Louis County. Reportedly, a 12- to 18-in. layer of topsoil was removed with the residues.

In 1976, measurements taken by the NRC of radiation levels and of radionuclide concentrations in the soil indicated that residual uranium and thorium concentrations and exposure levels at 9200 Latty Avenue exceeded existing guidelines for release for unrestricted use. A radiological characterization of the site was also performed by ORNL in the summer of 1977 prior to occupation of the site by the current owner (Ref. 1). Surface contamination exceeding DOE guidelines for thorium and radium was found in and around the buildings on the western half of the property (the Futura Coatings site). Subsurface soil contamination was found at depths as great as 18 in.

In 1981 Oak Ridge Associated Universities (ORAU) characterized the storage pile on the eastern half of the property (now called the HISS) and performed a radiological survey of the northern and eastern boundaries of the property (Ref. 2). Levels of contamination (principally thorium-230) similar to those on the property were found in both areas. As a follow-up to this survey, ORNL conducted a detailed radiological survey of the north and south shoulders of Latty Avenue for DOE in January and February 1984. Results indicated that contamination in excess of DOE guidelines was present along most of Latty Avenue, almost as far as Hazelwood Avenue. Properties adjacent to the HISS were also found to be contaminated.

2.3 PRESENT SITE CONDITIONS

The HISS currently consists of access roads, a vehicle decontamination facility, and two storage piles (Figure 2-2).

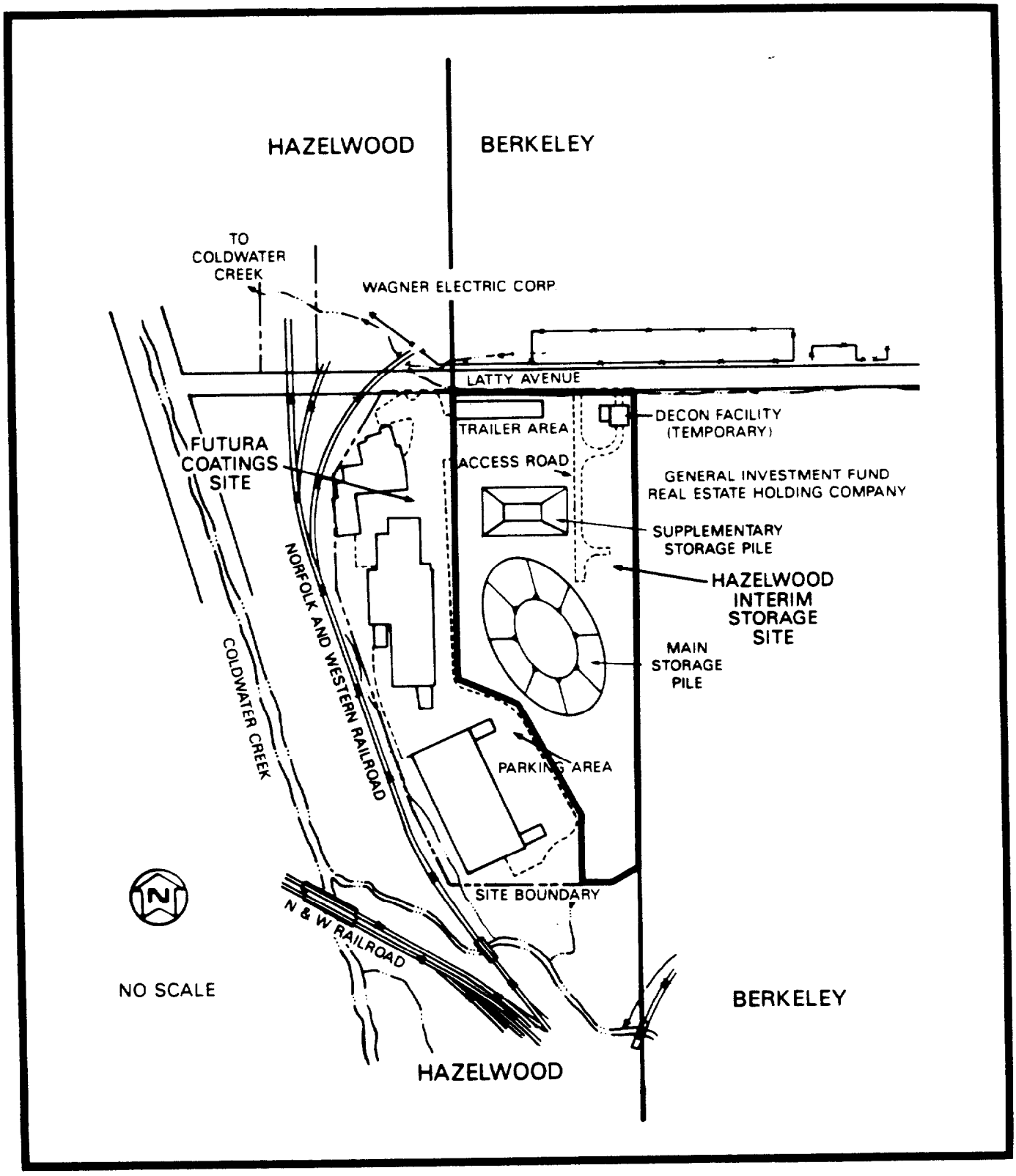

FIGURE 2-2 THE HISS AND ITS IMMEDIATE VICINITY

In preparing the western half of the property for commercial use, the owner demolished one building, excavated several areas, paved several others, and erected a number of new buildings. The materials excavated during these activities (approximately 13,000 yd^3) formed the original pile on the HISS.

Remedial action was conducted at Latty Avenue in 1984 and 1985; it continued in 1986, when it was performed concurrently with a drainage system improvement project being conducted by the cities of Hazelwood and Berkeley. The contaminated materials excavated from Latty Avenue during the course of construction activities were hauled to the HISS and placed in a supplementary storage pile that was developed specifically to accommodate these materials.

3.0 HEALTH AND SAFETY PLAN

BNI is responsible for protecting the health and safety of personnel assigned to work at the site. As such, BNI and Eberline personnel must comply with the requirements of the applicable Project Instructions (PI) contained in the FUSRAP Radiological Protection Program Manual (Ref. 3) as directed by the on-site BNI representative.

3.1 SUBCONTRACTOR TRAINING

Before the start of work, all characterization personnel attended an orientation session presented by the BNI representative to explain the nature of the material that would be encountered during the course of the characterization and the personnel monitoring and safety measures that would be required.

3.2 SAFETY REQUIREMENTS

Personnel were required to comply with the BNI safety requirements set forth in the applicable Project Instructions contained in Reference 3 and summarized below:

- Bioassay (PI 21.18) -- Personnel shall submit bioassay samples before or at the beginning of on-site activity, upon completion of the activity, and periodically during site activities as requested by BNI.
- Protective Clothing/Equipment (PI 21.12) -- Personnel must wear the protective clothing/equipment specified by the BNI representative.
- Dosimetry (PI 21.05) -- Personnel are required to wear the dosimeters and monitors issued by BNI and return them to the BNI representative at the end of each day.
- Controlled Area Access/Egress (PI 21.08, 21.10) -- Personnel and equipment entering areas where access and egress are controlled for the purpose of radiological safety will be radiologically surveyed by the BNI representative before leaving the area.

Health and safety surveillance of all activities related to the scope of work was conducted under the direct supervision of personnel representing BNI. The health protection requirements applicable to activities that involve radiation or the handling of radioactive materials are delineated in PI 20.01, Reference 3. Copies of the applicable Project Instructions were available at the site during the characterization.

4.0 SURVEY PROCEDURES

4.1 FIELD SURVEY PROCEDURES

A civil surveyor established a 50-ft grid on the HISS by staking the intersections of a series of mutually perpendicular lines. The grid spanned the entire HISS with the exception of the two contaminated waste storage piles, which were not included in the survey. The grid origin used during the remedial action conducted in 1984 along the Latty Avenue right-of-way was reestablished (Figure 4-1). All characterization data correspond to coordinates on this grid. The types of radiological measurements taken and the methods used are described in the following subsections.

4.1.1 Measurements Taken and Methods Used

An initial walkover survey was performed within the grid blocks of the entire HISS (with the exception of the storage piles) using an unshielded gamma scintillation detector. Areas in which readings exceeded twice normal background levels were marked on a site drawing.

Near-surface gamma measurements were made 12 in. above the ground surface at 12.5-ft intervals in areas identified as contaminated on the basis of the walkover survey. A 2- by 2-in. sodium-iodide (NaI) detector was used during this survey. This detector (EIC model SPA-3) was mounted in a probe assembly surrounded with a conical lead shield to reduce the gamma intensity through the sides, thus producing a downward directional response.

Gamma exposure rates at 3 ft above the ground were measured using a pressurized ionization chamber (PIC) with a response to

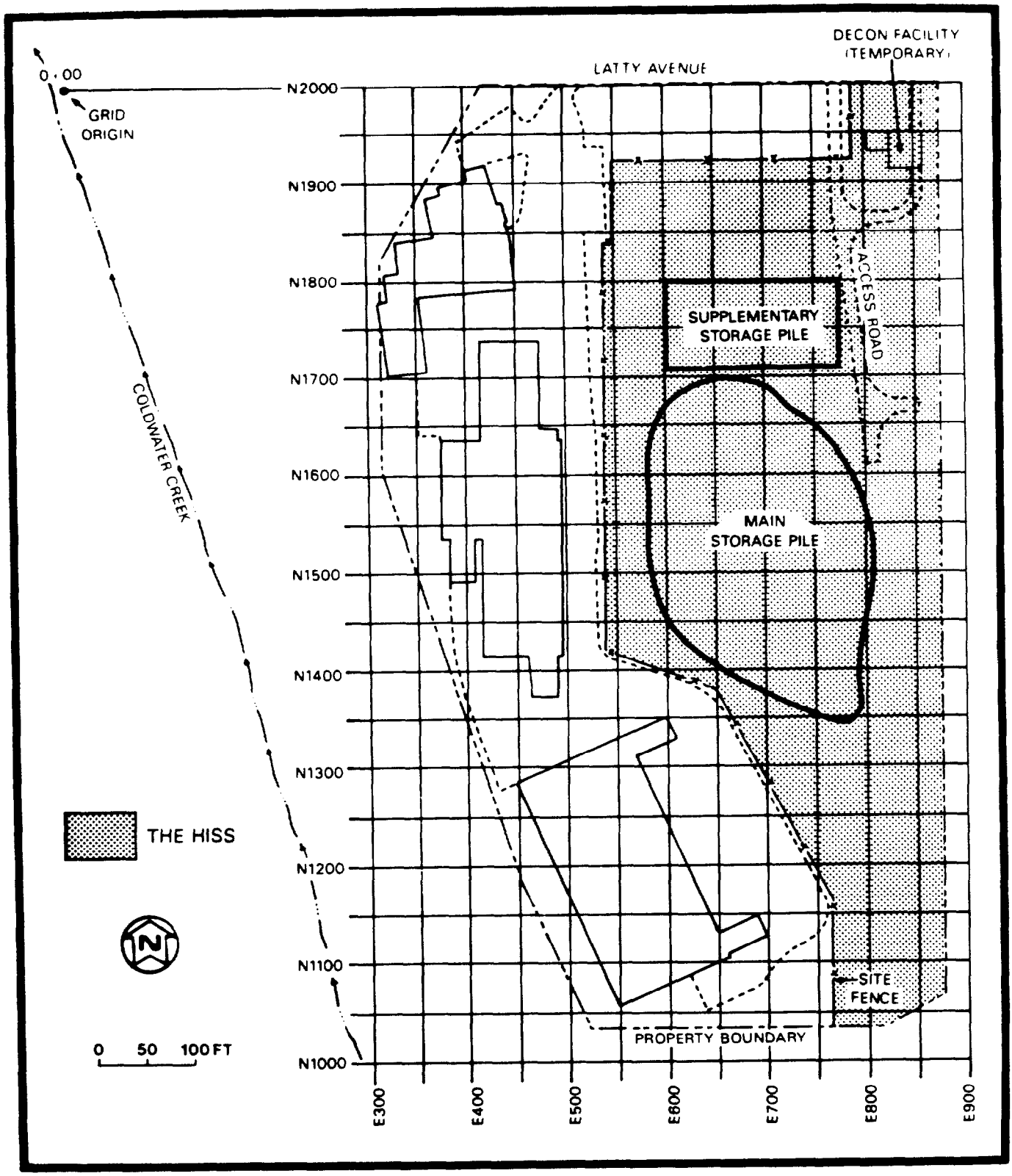

FIGURE 4-1 SURVEY GRID FOR THE HISS

gamma radiation that is proportional to exposure in roentgens. Readings were made at 15 selected grid points on the site (Figure 4-2).

The subsurface investigation was conducted by drilling 36 boreholes, each to a depth of 10 ft, at most 100-ft grid intersections. The 100-ft interval was designed to maximize the amount of information to be obtained in the most cost-effective manner possible. The number of boreholes in each area and the locations of the holes were based on near-surface gamma measurements made in the area.

Although gamma logging is typically used to determine the depth of subsurface contamination, thorium-230 (the principal contaminant) cannot be detected in situ; therefore, continuous subsurface soil samples were collected from the surface to a depth of 10 ft by rotating a Consolidated Mine Equipment (CME) sampler in advance of the auger. Each characterization hole was gamma logged to determine the depth of gamma-emitting contamination. Gamma logging was conducted by lowering a gamma scintillometer into the hole and taking radiation measurements at 6-in. vertical intervals in order to obtain a profile of the depth of gamma-emitting contamination.

4.1.2 Sample Collection and Analysis

Continuous sampling was performed in each hole in 1-ft increments. All samples were analyzed for uranium-238, radium-226, and thorium-232. Experience has shown that as long as radium-226 concentrations are elevated, it is reasonable to assume that the thorium-230 concentration exceeds the DOE guideline of 15 pCi/g for soil. Since analysis for thorium-230 is costly, the number of samples subjected to this type of analysis was minimized. For each borehole, samples were selected for thorium-230 analysis beginning at the depth where down-hole gamma logs indicated that radium-226 concentrations

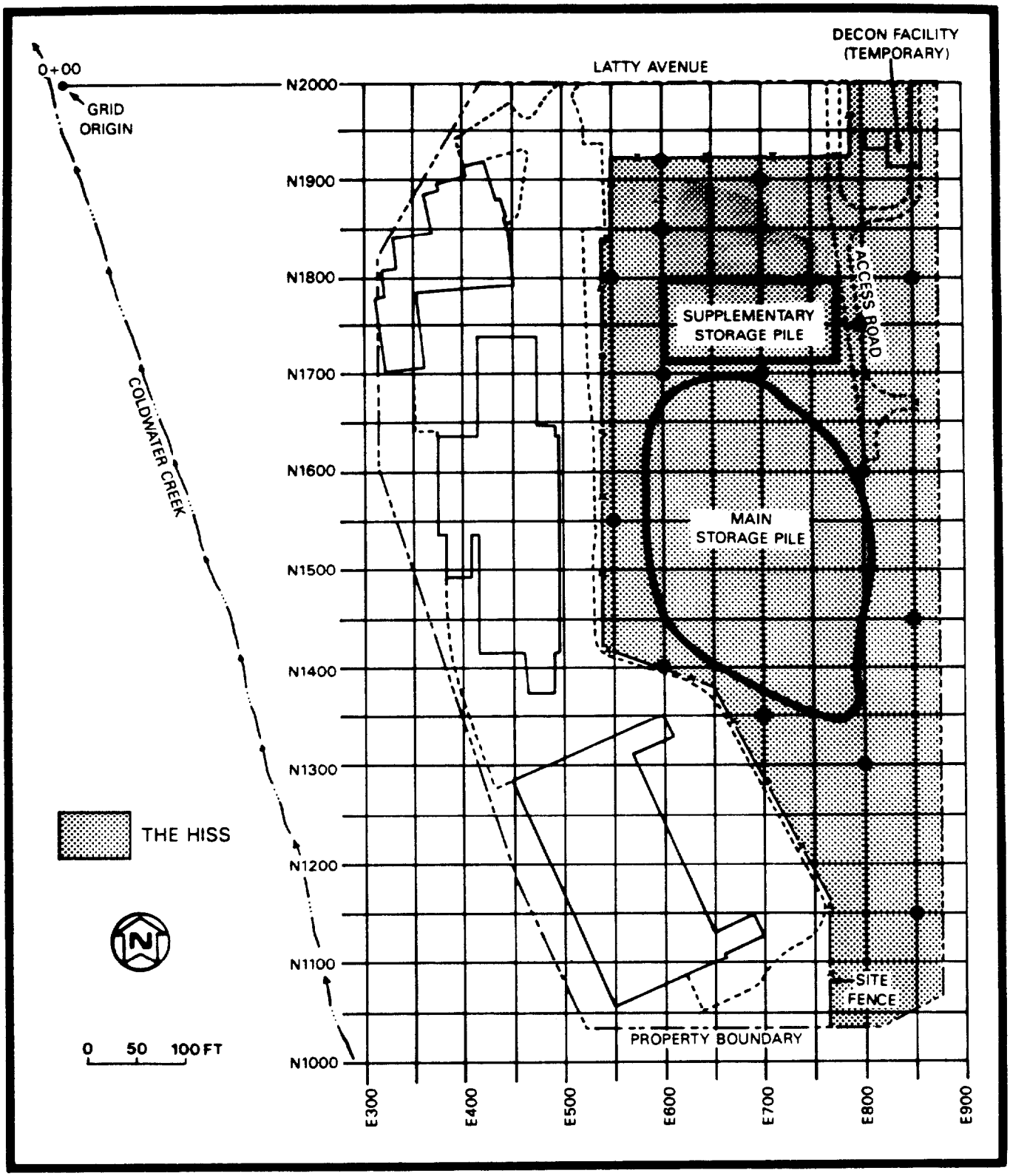

FIGURE 4-2 PIC MEASUREMENT LOCATIONS AT THE HISS

were below guidelines. From this point, samples from successively greater depths were analyzed for thorium-230 until below-guideline results for thorium-230 were also obtained. Based on what is known about the history of the site and the means by which it became contaminated, it was assumed that no stratified layer of thorium-230 existed below the depths at which sampling indicated thorium-230 concentrations to be in compliance with DOE remedial action guidelines.

For boreholes where gamma logs did not indicate the presence of gamma-emitting contamination exceeding guideline levels, samples were collected from areas of interest in the respective borehole and analyzed for thorium-230. Such areas of interest may include isolated spots that exhibit elevated gamma log results, areas that exhibit trends in the gamma log results regardless of level, and surface soil samples.

Soil samples were collected at the 36 borehole locations (Figure 4-3). Each sample was counted for 10 minutes using an intrinsic germanium detector housed in a lead shield lined with cadmium and copper. The pulse height distribution was sorted using a computer-based, multi-channel analyzer. Radionuclide concentrations were determined by comparing the gamma spectrum of each sample with the spectrum of a certified counting standard for the radionuclide of interest.

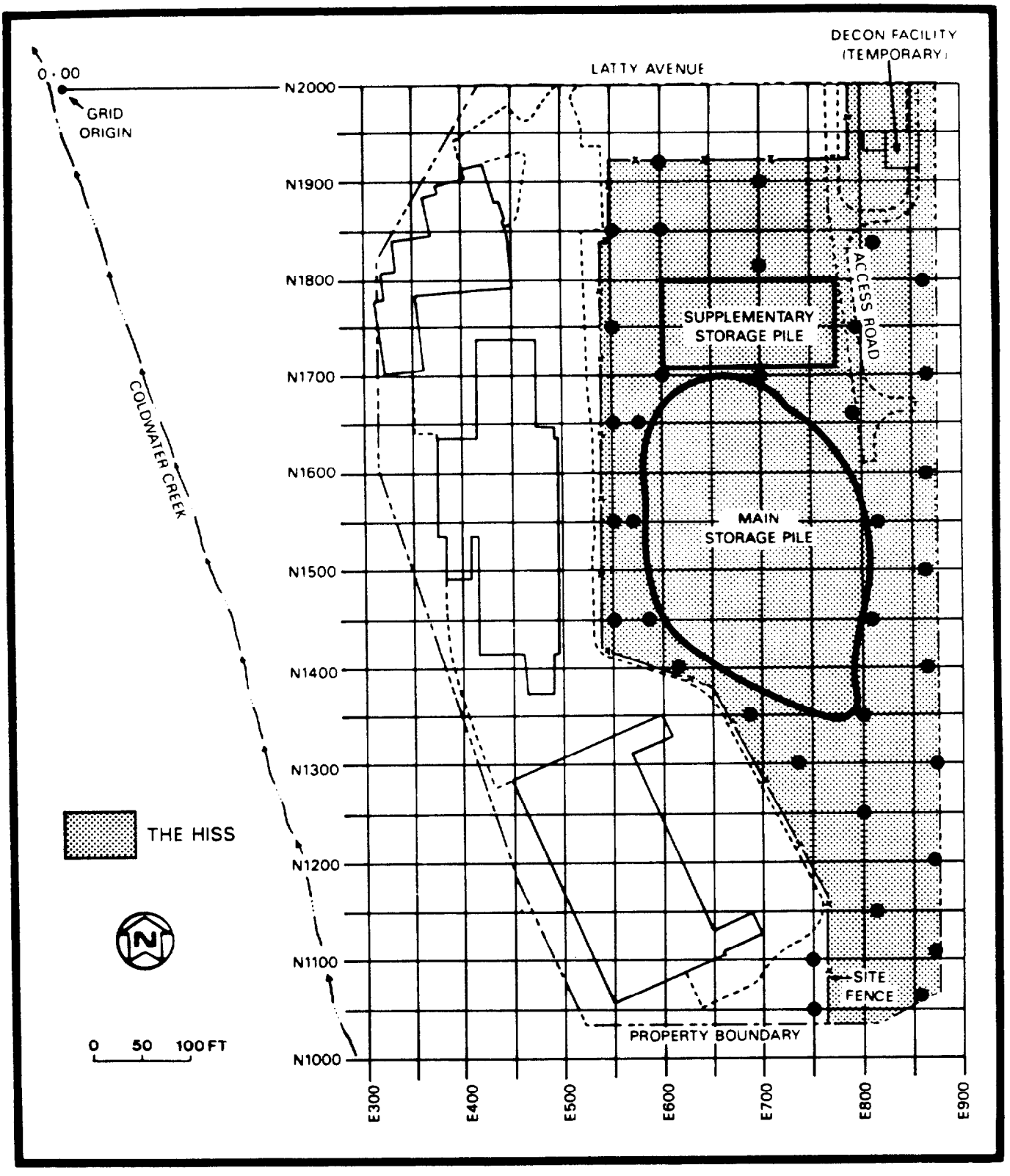

FIGURE 4-3 SOIL SAMPLING LOCATIONS AT THE HISS

5.0 SURVEY RESULTS

The results of the surveys described in Section 4.0 are presented in this section. To permit comparison of the results to current DOE guidelines for radionuclides in soil, these guidelines are presented in Table 5-1 (Ref. 4).

All direct field measurements and laboratory results in this report represent gross readings; background measurements and concentrations have not been subtracted.

5.1 BACKGROUND MEASUREMENTS

Near-surface gamma levels, gamma exposure rates, and gamma radiation at 3 ft above the ground surface were measured at three background locations in the St. Louis area. The average near-surface gamma level was approximately 4,000 cpm, and gamma radiation levels 3 ft above the ground surface averaged approximately 7,000 cpm. The average background gamma exposure rate was 8 uR/h. Individual background measurements are listed in Table 5-2.

Background external gamma exposure rates have also been measured in the St. Louis Area by Oak Ridge National Laboratory; the average rate was found to be approximately 6 uR/h (Ref. 5).

Average background concentrations of uranium-234, -235, and -238 measured in surface soils at the three background locations were 1.0, less than 0.1, and 1.0 pCi/g, respectively. The average background concentration of radium-226 was 0.5 pCi/g. Average background concentrations of thorium-230 and thorium-232 were 0.2 and 0.4 pCi/g, respectively. The average background concentration of lead-210 was 1.0 pCi/g. Analysis results for each background location are listed in Table 5-2.

5.2 SURFACE AND SUBSURFACE MEASUREMENTS

Near-surface gamma radiation levels at the HISS ranged from approximately 10,000 cpm to approximately 475,000 cpm. Gamma radiation exposure rates ranged from 13 to 55 uR/h. The average exposure rate for the site was 24 uR/h. Gamma radiation exposure rates at the HISS are presented in Table 5-3.

The field survey at the HISS revealed areas with elevated concentrations of radium-226 and thorium-230 in surface and subsurface samples. Thorium-230 was identified as the major contaminant.

Down-hole gamma logging was performed to indicate the general depth and concentration of gamma-emitting contamination. Detailed gamma logging results are reported in Table 5-4. The depth of contamination was found to range from surface contamination to subsurface contamination at a depth of 6 ft. Only one location exhibited contamination at the maximum depth of 6 ft. The average depth of contamination on the site is approximately 3 ft.

The areal limits of contamination were determined on the basis of the DOE guideline of 5 pCi/g for thorium-230, thorium-232, and radium-226 when averaged over the uppermost 15-cm layer of soil, and 15 pCi/g when averaged over 15-cm thick layers of soil more than 15 cm below the surface (Table 5-1). The areas and depths of contamination at the HISS are shown in Figure 5-1.

Analysis results for soil are provided in Table 5-5. Use of the "less than" ($<$) notation indicates that the radionuclide was not present in measurable concentrations. The value following the less than notation is the minimum detectable amount (MDA). The MDA is based on various factors, including the volume, size, and weight of the sample; the type of detector used; the counting time, and the background count rate. In addition,

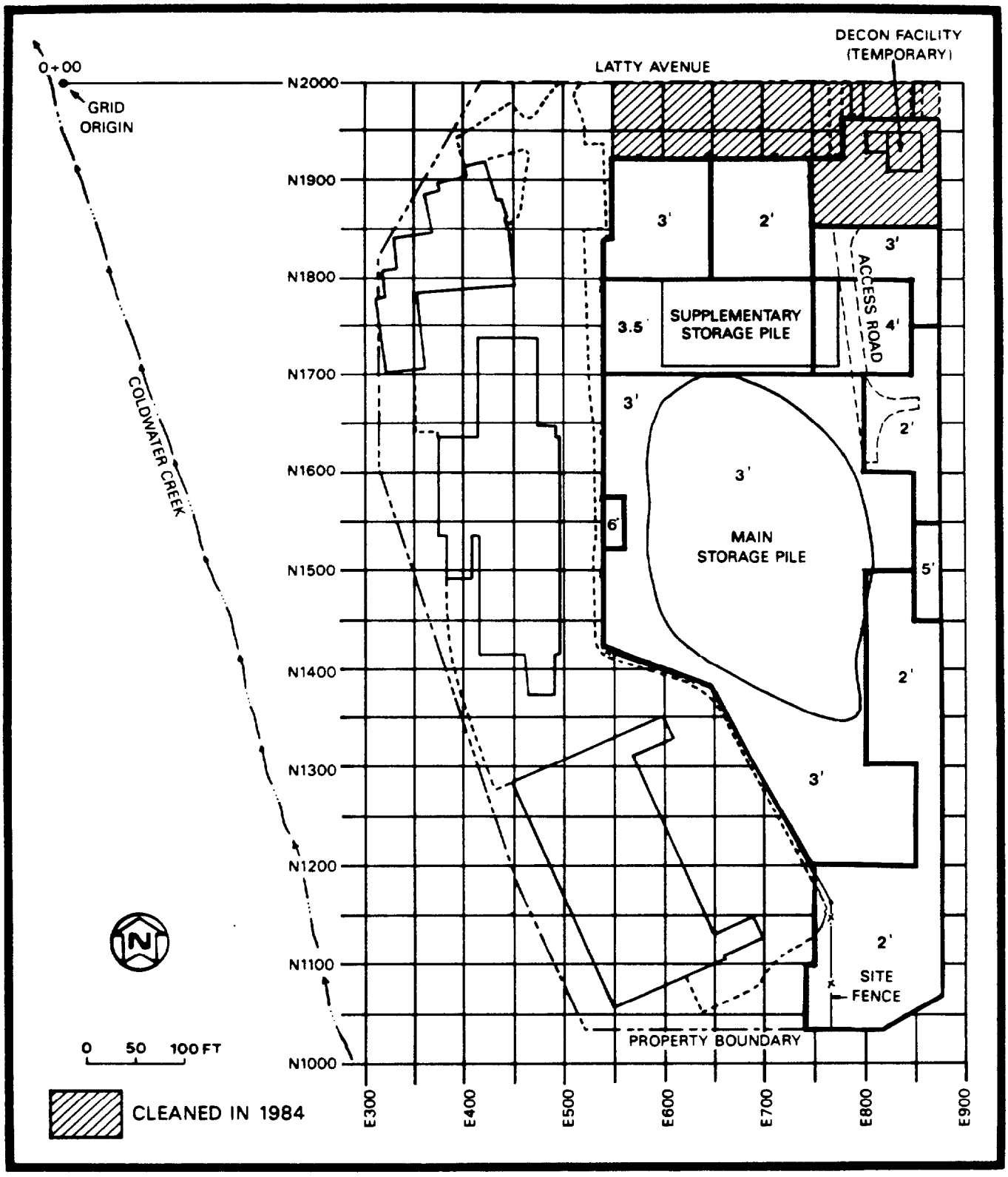

FIGURE 5-1 AREAS AND DEPTHS OF CONTAMINATION AT THE HISS

since radioactive decay is a random process, a correlation between the rate of disintegration and a given radionuclide concentration cannot be precisely established; therefore, the exact concentration of the radionuclide cannot be determined. As such, each value that is equal to or greater than the MDA has an associated uncertainty term ($\pm$), which represents the maximum amount by which the actual value can be expected to differ from the value given in the table. The uncertainty term has an associated confidence level of 95 percent.

Thorium-232 concentrations ranged from background levels to 5 pCi/g. Radium-226 concentrations above the DOE guideline were found in several samples, with concentrations up to 700 pCi/g. Uranium-238 concentrations ranged from 4 to 800 pCi/g. Concentrations of thorium-230 ranged from 0.8 to 790 pCi/g in the selected samples analyzed; however, it is highly probable that the maximum thorium-230 concentration on the property is much greater than was indicated by analysis results, since only those samples with no associated gamma-emitting radionuclides were analyzed for thorium-230.

TABLE 5-1

SUMMARY OF RESIDUAL CONTAMINATION GUIDELINES FOR THE HISS

BASIC DOSE LIMITS

The basic limit for the annual radiation dose received by an individual member of the general public is 100 mrem/yr.

SOIL (LAND) GUIDELINES (MAXIMUM LIMITS FOR UNRESTRICTED USE)

Radionuclide	Soil Concentration (pCi/g) above background[a,b,c]
Radium-226 Radium-228 Thorium-230 Thorium-232	5 pCi/g, averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over any 15-cm-thick soil layer below the surface layer.
Other radionuclides	Soil guidelines will be calculated on a site-specific basis using the DOE manual developed for this use.

[a]These guidelines take into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If either thorium-230 and radium-226 or thorium-232 and radium-228 are both present, not in secular equilibrium, the guidelines apply to the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that the dose for the mixtures will not exceed the basic dose limit.

[b]These guidelines represent unrestricted-use residual concentrations above background averaged across any 15-cm-thick layer to any depth and over any contiguous 100-m^2 surface area.

[c]Localized concentrations in excess of these limits are allowable provided that the average concentration over a 100-m^2 area does not exceed these limits.

TABLE 5-2

BACKGROUND RADIONUCLIDE CONCENTRATIONS AND RADIATION LEVELS IN SOIL IN THE ST. LOUIS AREA

Measurement Location	Gamma Exposure Rate at 3 ft (uR/h)	Gamma Radiation at 3 ft (cpm)	Near-Surface Gamma Radiation (cpm)	Radionuclide Concentration (pCi/g)						
				Uranium-234	Uranium-235	Uranium-238	Radium-226	Thorium-230	Thorium-232	Lead-210
1	8	7000	4000	1.2 ± 0.2	0.1	1.2 ± 0.2	0.7 ± 0.1	0.1 ± 0.1	0.3 ± 0.1	0.6 ± 0.4
2	8	7000	4000	0.6 ± 0.2	0.1	0.6 ± 0.1	0.3 ± 0.1	0.3 ± 0.1	0.5 ± 0.1	2.0 ± 0.5
3	8	8000	5000	1.3 ± 0.3	0.1 ± 0.1	1.3 ± 0.2	0.4 ± 0.1	0.3 ± 0.1	0.3 ± 0.1	0.5 ± 0.4
Average	8	7000	4000	1.0 ± 0.2	0.1	1.0 ± 0.2	0.5 ± 0.1	0.2 ± 0.1	0.4 ± 0.1	1.0 ± 0.4

TABLE 5-3

GAMMA RADIATION EXPOSURE RATES

AT THE HISS

Coordinates		µR/h
East	North	
550.0	1550.0	35
550.0	1800.0	55
600.0	1400.0	19
600.0	1700.0	47
600.0	1850.0	36
600.0	1925.0	14
700.0	1350.0	17
700.0	1700.0	23
700.0	1900.0	15
800.0	1300.0	16
800.0	1600.0	15
800.0	1750.0	16
850.0	1150.0	22
850.0	1450.0	22
850.0	1800.0	13

TABLE 5-4

DOWN-HOLE GAMMA LOGGING RESULTS FOR THE HISS

Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
550.0	1450.0	0.0	54000
550.0	1450.0	0.5	103000
550.0	1450.0	1.0	92000
550.0	1450.0	1.5	65000
550.0	1450.0	2.0	83000
550.0	1450.0	2.5	62000
550.0	1450.0	3.0	27000
550.0	1450.0	3.5	19000
550.0	1450.0	4.0	17000
550.0	1450.0	4.5	16000
550.0	1450.0	5.0	15000
550.0	1450.0	5.5	14000
550.0	1450.0	6.0	14000
550.0	1450.0	6.5	13000
550.0	1450.0	7.0	12000
550.0	1450.0	7.5	13000
550.0	1450.0	8.0	13000
550.0	1450.0	8.5	13000
550.0	1450.0	9.0	13000
550.0	1450.0	9.5	13000
550.0	1450.0	10.0	14000
550.0	1550.0	0.0	69000
550.0	1550.0	0.5	154000
550.0	1550.0	1.0	128000
550.0	1550.0	1.5	42000
550.0	1550.0	2.0	22000
550.0	1550.0	2.5	16000
550.0	1550.0	3.0	16000
550.0	1550.0	3.5	15000
550.0	1550.0	4.0	15000
550.0	1550.0	4.5	15000
550.0	1550.0	5.0	15000
550.0	1550.0	5.5	15000
550.0	1550.0	6.0	14000
550.0	1550.0	6.5	13000
550.0	1550.0	7.0	13000
550.0	1550.0	7.5	13000
550.0	1550.0	8.0	13000
550.0	1550.0	8.5	13000
550.0	1550.0	9.0	13000
550.0	1550.0	9.5	14000
550.0	1550.0	10.0	14000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
550.0	1650.0	0.0	149000
550.0	1650.0	0.5	324000
550.0	1650.0	1.0	564000
550.0	1650.0	1.5	613000
550.0	1650.0	2.0	611000
550.0	1650.0	2.5	300000
550.0	1650.0	3.0	79000
550.0	1650.0	3.5	34000
550.0	1650.0	4.0	21000
550.0	1650.0	4.5	17000
550.0	1650.0	5.0	16000
550.0	1650.0	5.5	15000
550.0	1650.0	6.0	15000
550.0	1650.0	6.5	15000
550.0	1650.0	7.0	15000
550.0	1650.0	7.5	14000
550.0	1650.0	8.0	14000
550.0	1650.0	8.5	14000
550.0	1650.0	9.0	14000
550.0	1650.0	9.5	14000
550.0	1650.0	10.0	17000
550.0	1750.0	0.0	118000
550.0	1750.0	0.5	352000
550.0	1750.0	1.0	523000
550.0	1750.0	1.5	237000
550.0	1750.0	2.0	97000
550.0	1750.0	2.5	46000
550.0	1750.0	3.0	28000
550.0	1750.0	3.5	21000
550.0	1750.0	4.0	18000
550.0	1750.0	4.5	16000
550.0	1750.0	5.0	15000
550.0	1750.0	5.5	15000
550.0	1750.0	6.0	15000
550.0	1750.0	6.5	15000
550.0	1750.0	7.0	15000
550.0	1750.0	7.5	15000
550.0	1750.0	8.0	14000
550.0	1750.0	8.5	14000
550.0	1750.0	9.0	14000
550.0	1750.0	9.5	13000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
550.0	1750.0	10.0	15000
550.0	1850.0	0.0	82000
550.0	1850.0	0.5	47000
550.0	1850.0	1.0	28000
550.0	1850.0	1.5	21000
550.0	1850.0	2.0	18000
550.0	1850.0	2.5	16000
550.0	1850.0	3.0	16000
550.0	1850.0	3.5	15000
550.0	1850.0	4.0	14000
550.0	1850.0	4.5	14000
550.0	1850.0	5.0	14000
550.0	1850.0	5.5	14000
550.0	1850.0	6.0	14000
550.0	1850.0	6.5	14000
550.0	1850.0	7.0	14000
550.0	1850.0	7.5	14000
550.0	1850.0	8.0	14000
550.0	1850.0	8.5	14000
550.0	1850.0	9.0	14000
550.0	1850.0	9.5	14000
550.0	1850.0	10.0	13000
573.0	1550.0	0.0	48000
573.0	1550.0	0.5	33000
573.0	1550.0	1.0	20000
573.0	1550.0	1.5	17000
573.0	1550.0	2.0	16000
573.0	1550.0	2.5	15000
573.0	1550.0	3.0	15000
573.0	1550.0	3.5	15000
573.0	1550.0	4.0	15000
573.0	1550.0	4.5	15000
573.0	1550.0	5.0	15000
573.0	1550.0	5.5	15000
573.0	1550.0	6.0	14000
573.0	1550.0	6.5	14000
573.0	1550.0	7.0	14000
573.0	1550.0	7.5	13000
573.0	1550.0	8.0	13000
573.0	1550.0	8.5	13000
573.0	1550.0	9.0	13000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
573.0	1550.0	9.5	14000
573.0	1550.0	10.0	16000
576.0	1650.0	0.0	100000
576.0	1650.0	0.5	164000
576.0	1650.0	1.0	244000
576.0	1650.0	1.5	333000
576.0	1650.0	2.0	400000
576.0	1650.0	2.5	190000
576.0	1650.0	3.0	58000
576.0	1650.0	3.5	26000
576.0	1650.0	4.0	20000
576.0	1650.0	4.5	16000
576.0	1650.0	5.0	15000
576.0	1650.0	5.5	15000
576.0	1650.0	6.0	15000
576.0	1650.0	6.5	15000
576.0	1650.0	7.0	14000
576.0	1650.0	7.5	14000
576.0	1650.0	8.0	14000
576.0	1650.0	8.5	13000
576.0	1650.0	9.0	14000
576.0	1650.0	9.5	14000
576.0	1650.0	10.0	14000
588.0	1450.0	0.0	152000
588.0	1450.0	0.5	324000
588.0	1450.0	1.0	173000
588.0	1450.0	1.5	61000
588.0	1450.0	2.0	26000
588.0	1450.0	2.5	19000
588.0	1450.0	3.0	17000
588.0	1450.0	3.5	16000
588.0	1450.0	4.0	16000
588.0	1450.0	4.5	15000
588.0	1450.0	5.0	15000
588.0	1450.0	5.5	15000
588.0	1450.0	6.0	14000
588.0	1450.0	6.5	14000
588.0	1450.0	7.0	13000
588.0	1450.0	7.5	14000
588.0	1450.0	8.0	13000
588.0	1450.0	8.5	13000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
588.0	1450.0	9.0	13000
588.0	1450.0	9.5	13000
588.0	1450.0	10.0	14000
600.0	1700.0	0.0	93000
600.0	1700.0	0.5	177000
600.0	1700.0	1.0	174000
600.0	1700.0	1.5	142000
600.0	1700.0	2.0	104000
600.0	1700.0	2.5	38000
600.0	1700.0	3.0	20000
600.0	1700.0	3.5	17000
600.0	1700.0	4.0	15000
600.0	1700.0	4.5	15000
600.0	1700.0	5.0	15000
600.0	1700.0	5.5	15000
600.0	1700.0	6.0	15000
600.0	1700.0	6.5	15000
600.0	1700.0	7.0	14000
600.0	1700.0	7.5	14000
600.0	1700.0	8.0	13000
600.0	1700.0	8.5	13000
600.0	1700.0	9.0	13000
600.0	1700.0	9.5	14000
600.0	1700.0	10.0	14000
600.0	1850.0	0.0	58000
600.0	1850.0	0.5	89000
600.0	1850.0	1.0	246000
600.0	1850.0	1.5	411000
600.0	1850.0	2.0	212000
600.0	1850.0	2.5	64000
600.0	1850.0	3.0	29000
600.0	1850.0	3.5	19000
600.0	1850.0	4.0	17000
600.0	1850.0	4.5	16000
600.0	1850.0	5.0	15000
600.0	1850.0	5.5	15000
600.0	1850.0	6.0	15000
600.0	1850.0	6.5	14000
600.0	1850.0	7.0	14000
600.0	1850.0	7.5	14000
600.0	1850.0	8.0	14000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
600.0	1850.0	8.5	13000
600.0	1850.0	9.0	13000
600.0	1850.0	9.5	14000
600.0	1850.0	10.0	14000
600.0	1925.0	0.0	23000
600.0	1925.0	0.5	27000
600.0	1925.0	1.0	46000
600.0	1925.0	1.5	121000
600.0	1925.0	2.0	359000
600.0	1925.0	2.5	428000
600.0	1925.0	3.0	251000
600.0	1925.0	3.5	81000
600.0	1925.0	4.0	32000
600.0	1925.0	4.5	20000
600.0	1925.0	5.0	17000
600.0	1925.0	5.5	16000
600.0	1925.0	6.0	16000
600.0	1925.0	6.5	15000
600.0	1925.0	7.0	14000
600.0	1925.0	7.5	14000
600.0	1925.0	8.0	13000
600.0	1925.0	8.5	13000
600.0	1925.0	9.0	13000
600.0	1925.0	9.5	13000
600.0	1925.0	10.0	14000
605.0	1400.0	0.0	28000
605.0	1400.0	0.5	48000
605.0	1400.0	1.0	62000
605.0	1400.0	1.5	26000
605.0	1400.0	2.0	20000
605.0	1400.0	2.5	17000
605.0	1400.0	3.0	16000
605.0	1400.0	3.5	15000
605.0	1400.0	4.0	15000
605.0	1400.0	4.5	15000
605.0	1400.0	5.0	14000
605.0	1400.0	5.5	14000
605.0	1400.0	6.0	13000
605.0	1400.0	6.5	13000
605.0	1400.0	7.0	13000
605.0	1400.0	7.5	13000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
605.0	1400.0	8.0	13000
605.0	1400.0	8.5	13000
605.0	1400.0	9.0	13000
605.0	1400.0	9.5	13000
605.0	1400.0	10.0	14000
695.0	1350.0	0.0	26000
695.0	1350.0	0.5	64000
695.0	1350.0	1.0	44000
695.0	1350.0	1.5	23000
695.0	1350.0	2.0	18000
695.0	1350.0	2.5	17000
695.0	1350.0	3.0	16000
695.0	1350.0	3.5	16000
695.0	1350.0	4.0	16000
695.0	1350.0	4.5	14000
695.0	1350.0	5.0	14000
695.0	1350.0	5.5	14000
695.0	1350.0	6.0	13000
695.0	1350.0	6.5	14000
695.0	1350.0	7.0	14000
695.0	1350.0	7.5	14000
695.0	1350.0	8.0	14000
695.0	1350.0	8.5	14000
695.0	1350.0	9.0	13000
695.0	1350.0	9.5	14000
695.0	1350.0	10.0	13000
700.0	1700.0	0.0	43000
700.0	1700.0	0.5	74000
700.0	1700.0	1.0	99000
700.0	1700.0	1.5	89000
700.0	1700.0	2.0	70000
700.0	1700.0	2.5	39000
700.0	1700.0	3.0	22000
700.0	1700.0	3.5	17000
700.0	1700.0	4.0	16000
700.0	1700.0	4.5	16000
700.0	1700.0	5.0	15000
700.0	1700.0	5.5	15000
700.0	1700.0	6.0	15000
700.0	1700.0	6.5	15000
700.0	1700.0	7.0	14000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
700.0	1700.0	7.5	13000
700.0	1700.0	8.0	14000
700.0	1700.0	8.5	13000
700.0	1700.0	9.0	13000
700.0	1700.0	9.5	14000
700.0	1700.0	10.0	14000
700.0	1823.0	0.0	21000
700.0	1823.0	0.5	37000
700.0	1823.0	1.0	50000
700.0	1823.0	1.5	25000
700.0	1823.0	2.0	18000
700.0	1823.0	2.5	16000
700.0	1823.0	3.0	15000
700.0	1823.0	3.5	15000
700.0	1823.0	4.0	15000
700.0	1823.0	4.5	15000
700.0	1823.0	5.0	15000
700.0	1823.0	5.5	14000
700.0	1823.0	6.0	14000
700.0	1823.0	6.5	14000
700.0	1823.0	7.0	14000
700.0	1823.0	7.5	14000
700.0	1823.0	8.0	14000
700.0	1823.0	8.5	13000
700.0	1823.0	9.0	13000
700.0	1823.0	9.5	13000
700.0	1823.0	10.0	14000
700.0	1900.0	0.0	18000
700.0	1900.0	0.5	25000
700.0	1900.0	1.0	25000
700.0	1900.0	1.5	19000
700.0	1900.0	2.0	17000
700.0	1900.0	2.5	16000
700.0	1900.0	3.0	16000
700.0	1900.0	3.5	16000
700.0	1900.0	4.0	15000
700.0	1900.0	4.5	15000
700.0	1900.0	5.0	15000
700.0	1900.0	5.5	15000
700.0	1900.0	6.0	14000
700.0	1900.0	6.5	13000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
700.0	1900.0	7.0	12000
700.0	1900.0	7.5	12000
700.0	1900.0	8.0	13000
700.0	1900.0	8.5	13000
700.0	1900.0	9.0	13000
700.0	1900.0	9.5	13000
700.0	1900.0	10.0	14000
737.5	1300.0	0.0	20000
737.5	1300.0	0.5	26000
737.5	1300.0	1.0	27000
737.5	1300.0	1.5	28000
737.5	1300.0	2.0	19000
737.5	1300.0	2.5	17000
737.5	1300.0	3.0	16000
737.5	1300.0	3.5	16000
737.5	1300.0	4.0	15000
737.5	1300.0	4.5	15000
737.5	1300.0	5.0	14000
737.5	1300.0	5.5	14000
737.5	1300.0	6.0	14000
737.5	1300.0	6.5	14000
737.5	1300.0	7.0	14000
737.5	1300.0	7.5	14000
737.5	1300.0	8.0	14000
737.5	1300.0	8.5	13000
737.5	1300.0	9.0	13000
737.5	1300.0	9.5	13000
737.5	1300.0	10.0	14000
750.0	1050.0	0.0	71000
750.0	1050.0	0.5	117000
750.0	1050.0	1.0	102000
750.0	1050.0	1.5	57000
750.0	1050.0	2.0	40000
750.0	1050.0	2.5	30000
750.0	1050.0	3.0	20000
750.0	1050.0	3.5	17000
750.0	1050.0	4.0	16000
750.0	1050.0	4.5	16000
750.0	1050.0	5.0	15000
750.0	1050.0	5.5	15000
750.0	1050.0	6.0	14000

TABLE 5-4

(continued)

Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
750.0	1050.0	6.5	14000
750.0	1050.0	7.0	14000
750.0	1050.0	7.5	14000
750.0	1050.0	8.0	14000
750.0	1050.0	8.5	14000
750.0	1050.0	9.0	14000
750.0	1050.0	9.5	14000
750.0	1050.0	10.0	15000
750.0	1100.0	0.0	55000
750.0	1100.0	0.5	81000
750.0	1100.0	1.0	61000
750.0	1100.0	1.5	29000
750.0	1100.0	2.0	20000
750.0	1100.0	2.5	17000
750.0	1100.0	3.0	16000
750.0	1100.0	3.5	16000
750.0	1100.0	4.0	16000
750.0	1100.0	4.5	16000
750.0	1100.0	5.0	15000
750.0	1100.0	5.5	15000
750.0	1100.0	6.0	14000
750.0	1100.0	6.5	14000
750.0	1100.0	7.0	14000
750.0	1100.0	7.5	14000
750.0	1100.0	8.0	13000
750.0	1100.0	8.5	13000
750.0	1100.0	9.0	13000
750.0	1100.0	9.5	13000
750.0	1100.0	10.0	13000
797.0	1653.0	0.0	24000
797.0	1653.0	0.5	34000
797.0	1653.0	1.0	55000
797.0	1653.0	1.5	106000
797.0	1653.0	2.0	230000
797.0	1653.0	2.5	166000
797.0	1653.0	3.0	45000
797.0	1653.0	3.5	23000
797.0	1653.0	4.0	20000
797.0	1653.0	4.5	16000
797.0	1653.0	5.0	16000
797.0	1653.0	5.5	15000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
797.0	1653.0	6.0	15000
797.0	1653.0	6.5	15000
797.0	1653.0	7.0	15000
797.0	1653.0	7.5	15000
797.0	1653.0	8.0	15000
797.0	1653.0	8.5	15000
797.0	1653.0	9.0	15000
797.0	1653.0	9.5	14000
797.0	1653.0	10.0	13000
800.0	1250.0	0.0	16000
800.0	1250.0	0.5	29000
800.0	1250.0	1.0	30000
800.0	1250.0	1.5	18000
800.0	1250.0	2.0	17000
800.0	1250.0	2.5	16000
800.0	1250.0	3.0	15000
800.0	1250.0	3.5	15000
800.0	1250.0	4.0	15000
800.0	1250.0	4.5	14000
800.0	1250.0	5.0	14000
800.0	1250.0	5.5	15000
800.0	1250.0	6.0	15000
800.0	1250.0	6.5	14000
800.0	1250.0	7.0	14000
800.0	1250.0	7.5	14000
800.0	1250.0	8.0	14000
800.0	1250.0	8.5	14000
800.0	1250.0	9.0	14000
800.0	1250.0	9.5	13000
800.0	1250.0	10.0	14000
800.0	1350.0	0.0	21000
800.0	1350.0	0.5	30000
800.0	1350.0	1.0	33000
800.0	1350.0	1.5	28000
800.0	1350.0	2.0	19000
800.0	1350.0	2.5	17000
800.0	1350.0	3.0	16000
800.0	1350.0	3.5	16000
800.0	1350.0	4.0	16000
800.0	1350.0	4.5	16000
800.0	1350.0	5.0	15000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
800.0	1350.0	5.5	15000
800.0	1350.0	6.0	15000
800.0	1350.0	6.5	14000
800.0	1350.0	7.0	14000
800.0	1350.0	7.5	15000
800.0	1350.0	8.0	15000
800.0	1350.0	8.5	14000
800.0	1350.0	9.0	14000
800.0	1350.0	9.5	14000
800.0	1350.0	10.0	15000
800.0	1750.0	0.0	16000
800.0	1750.0	0.5	21000
800.0	1750.0	1.0	23000
800.0	1750.0	1.5	22000
800.0	1750.0	2.0	19000
800.0	1750.0	2.5	17000
800.0	1750.0	3.0	19000
800.0	1750.0	3.5	21000
800.0	1750.0	4.0	21000
800.0	1750.0	4.5	17000
800.0	1750.0	5.0	14000
800.0	1750.0	5.5	14000
800.0	1750.0	6.0	15000
800.0	1750.0	6.5	15000
800.0	1750.0	7.0	14000
800.0	1750.0	7.5	14000
800.0	1750.0	8.0	14000
800.0	1750.0	8.5	13000
800.0	1750.0	9.0	13000
800.0	1750.0	9.5	13000
800.0	1750.0	10.0	13000
804.0	1839.0	0.0	48000
804.0	1839.0	0.5	105000
804.0	1839.0	1.0	147000
804.0	1839.0	1.5	223000
804.0	1839.0	2.0	100000
804.0	1839.0	2.5	42000
804.0	1839.0	3.0	28000
804.0	1839.0	3.5	22000
804.0	1839.0	4.0	18000
804.0	1839.0	4.5	16000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
804.0	1839.0	5.0	15000
804.0	1839.0	5.5	15000
804.0	1839.0	6.0	14000
804.0	1839.0	6.5	13000
804.0	1839.0	7.0	12000
804.0	1839.0	7.5	12000
804.0	1839.0	8.0	12000
804.0	1839.0	8.5	12000
804.0	1839.0	9.0	10000
804.0	1839.0	9.5	10000
804.0	1839.0	10.0	13000
805.0	1450.0	0.0	28000
805.0	1450.0	0.5	37000
805.0	1450.0	1.0	29000
805.0	1450.0	1.5	19000
805.0	1450.0	2.0	17000
805.0	1450.0	2.5	16000
805.0	1450.0	3.0	18000
805.0	1450.0	3.5	16000
805.0	1450.0	4.0	15000
805.0	1450.0	4.5	15000
805.0	1450.0	5.0	15000
805.0	1450.0	5.5	15000
805.0	1450.0	6.0	15000
805.0	1450.0	6.5	14000
805.0	1450.0	7.0	14000
805.0	1450.0	7.5	14000
805.0	1450.0	8.0	15000
805.0	1450.0	8.5	14000
805.0	1450.0	9.0	14000
805.0	1450.0	9.5	14000
805.0	1450.0	10.0	14000
806.0	1150.0	0.0	44000
806.0	1150.0	0.5	43000
806.0	1150.0	1.0	21000
806.0	1150.0	1.5	17000
806.0	1150.0	2.0	16000
806.0	1150.0	2.5	16000
806.0	1150.0	3.0	16000
806.0	1150.0	3.5	15000
806.0	1150.0	4.0	15000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
806.0	1150.0	4.5	14000
806.0	1150.0	5.0	14000
806.0	1150.0	5.5	14000
806.0	1150.0	6.0	14000
806.0	1150.0	6.5	14000
806.0	1150.0	7.0	14000
806.0	1150.0	7.5	14000
806.0	1150.0	8.0	13000
806.0	1150.0	8.5	13000
806.0	1150.0	9.0	13000
806.0	1150.0	9.5	13000
806.0	1150.0	10.0	14000
807.0	1550.0	0.0	18000
807.0	1550.0	0.5	26000
807.0	1550.0	1.0	32000
807.0	1550.0	1.5	32000
807.0	1550.0	2.0	27000
807.0	1550.0	2.5	28000
807.0	1550.0	3.0	22000
807.0	1550.0	3.5	17000
807.0	1550.0	4.0	16000
807.0	1550.0	4.5	15000
807.0	1550.0	5.0	15000
807.0	1550.0	5.5	15000
807.0	1550.0	6.0	15000
807.0	1550.0	6.5	15000
807.0	1550.0	7.0	15000
807.0	1550.0	7.5	15000
807.0	1550.0	8.0	14000
807.0	1550.0	8.5	14000
807.0	1550.0	9.0	14000
807.0	1550.0	9.5	13000
807.0	1550.0	10.0	14000
852.0	1062.5	0.0	12000
852.0	1062.5	0.5	14000
852.0	1062.5	1.0	17000
852.0	1062.5	1.5	16000
852.0	1062.5	2.0	15000
852.0	1062.5	2.5	15000
852.0	1062.5	3.0	15000
852.0	1062.5	3.5	16000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
852.0	1062.5	4.0	15000
852.0	1062.5	4.5	15000
852.0	1062.5	5.0	15000
852.0	1062.5	5.5	15000
852.0	1062.5	6.0	14000
852.0	1062.5	6.5	14000
852.0	1062.5	7.0	15000
852.0	1062.5	7.5	14000
852.0	1062.5	8.0	14000
852.0	1062.5	8.5	14000
852.0	1062.5	9.0	14000
852.0	1062.5	9.5	14000
852.0	1062.5	10.0	14000
859.0	1500.0	0.0	24000
859.0	1500.0	0.5	20000
859.0	1500.0	1.0	17000
859.0	1500.0	1.5	16000
859.0	1500.0	2.0	16000
859.0	1500.0	2.5	16000
859.0	1500.0	3.0	18000
859.0	1500.0	3.5	16000
859.0	1500.0	4.0	16000
859.0	1500.0	4.5	15000
859.0	1500.0	5.0	15000
859.0	1500.0	5.5	15000
859.0	1500.0	6.0	15000
859.0	1500.0	6.5	14000
859.0	1500.0	7.0	14000
859.0	1500.0	7.5	14000
859.0	1500.0	8.0	14000
859.0	1500.0	8.5	14000
859.0	1500.0	9.0	14000
859.0	1500.0	9.5	14000
859.0	1500.0	10.0	14000
860.0	1400.0	0.0	34000
860.0	1400.0	0.5	20000
860.0	1400.0	1.0	16000
860.0	1400.0	1.5	16000
860.0	1400.0	2.0	16000
860.0	1400.0	2.5	16000
860.0	1400.0	3.0	16000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
860.0	1400.0	3.5	16000
860.0	1400.0	4.0	16000
860.0	1400.0	4.5	15000
860.0	1400.0	5.0	15000
860.0	1400.0	5.5	15000
860.0	1400.0	6.0	15000
860.0	1400.0	6.5	15000
860.0	1400.0	7.0	15000
860.0	1400.0	7.5	15000
860.0	1400.0	8.0	15000
860.0	1400.0	8.5	14000
860.0	1400.0	9.0	15000
861.0	1600.0	0.0	116000
861.0	1600.0	0.5	449000
861.0	1600.0	1.0	354000
861.0	1600.0	1.5	95000
861.0	1600.0	2.0	40000
861.0	1600.0	2.5	25000
861.0	1600.0	3.0	20000
861.0	1600.0	3.5	18000
861.0	1600.0	4.0	17000
861.0	1600.0	4.5	17000
861.0	1600.0	5.0	16000
861.0	1600.0	5.5	16000
861.0	1600.0	6.0	16000
861.0	1600.0	6.5	16000
861.0	1600.0	7.0	16000
861.0	1600.0	7.5	16000
861.0	1600.0	8.0	16000
861.0	1600.0	8.5	16000
861.0	1600.0	9.0	15000
861.0	1600.0	9.5	16000
861.0	1600.0	10.0	15000
862.0	1700.0	0.0	33000
862.0	1700.0	0.5	29000
862.0	1700.0	1.0	20000
862.0	1700.0	1.5	17000
862.0	1700.0	2.0	17000
862.0	1700.0	2.5	16000
862.0	1700.0	3.0	16000
862.0	1700.0	3.5	15000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
862.0	1700.0	4.0	14000
862.0	1700.0	4.5	14000
862.0	1700.0	5.0	14000
862.0	1700.0	5.5	14000
862.0	1700.0	6.0	15000
862.0	1700.0	6.5	14000
862.0	1700.0	7.0	14000
862.0	1700.0	7.5	14000
862.0	1700.0	8.0	14000
862.0	1700.0	8.5	13000
862.0	1700.0	9.0	14000
862.0	1700.0	9.5	14000
862.0	1700.0	10.0	13000
862.0	1800.0	0.0	14000
862.0	1800.0	0.5	19000
862.0	1800.0	1.0	34000
862.0	1800.0	1.5	73000
862.0	1800.0	2.0	95000
862.0	1800.0	2.5	56000
862.0	1800.0	3.0	24000
862.0	1800.0	3.5	19000
862.0	1800.0	4.0	17000
862.0	1800.0	4.5	16000
862.0	1800.0	5.0	15000
862.0	1800.0	5.5	15000
862.0	1800.0	6.0	15000
862.0	1800.0	6.5	14000
862.0	1800.0	7.0	13000
862.0	1800.0	7.5	12000
862.0	1800.0	8.0	12000
862.0	1800.0	8.5	12000
862.0	1800.0	9.0	12000
862.0	1800.0	9.5	12000
862.0	1800.0	10.0	13000
870.0	1106.0	0.0	10000
870.0	1106.0	0.5	12000
870.0	1106.0	1.0	14000
870.0	1106.0	1.5	14000
870.0	1106.0	2.0	15000
870.0	1106.0	2.5	15000
870.0	1106.0	3.0	14000

TABLE 5-4

(continued)

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Coordinates East	Coordinates North	Depth (ft)	SPA-3 Count Rate (cpm)
870.0	1106.0	3.5	15000
870.0	1106.0	4.0	14000
870.0	1106.0	4.5	15000
870.0	1106.0	5.0	15000
870.0	1106.0	5.5	15000
870.0	1106.0	6.0	13000
870.0	1106.0	6.5	13000
870.0	1106.0	7.0	13000
870.0	1106.0	7.5	13000
870.0	1106.0	8.0	13000
870.0	1106.0	8.5	13000
870.0	1106.0	9.0	13000
870.0	1106.0	9.5	14000
870.0	1106.0	10.0	14000
870.0	1200.0	0.0	22000
870.0	1200.0	0.5	52000
870.0	1200.0	1.0	53000
870.0	1200.0	1.5	47000
870.0	1200.0	2.0	42000
870.0	1200.0	2.5	27000
870.0	1200.0	3.0	19000
870.0	1200.0	3.5	17000
870.0	1200.0	4.0	17000
870.0	1200.0	4.5	16000
870.0	1200.0	5.0	16000
870.0	1200.0	5.5	17000
870.0	1200.0	6.0	16000
870.0	1200.0	6.5	16000
870.0	1200.0	7.0	16000
870.0	1200.0	7.5	16000
870.0	1200.0	8.0	16000
870.0	1200.0	8.5	15000
870.0	1200.0	9.0	15000
870.0	1200.0	9.5	15000
870.0	1200.0	10.0	15000
872.0	1300.0	0.0	12000
872.0	1300.0	0.5	14000
872.0	1300.0	1.0	15000
872.0	1300.0	1.5	15000
872.0	1300.0	2.0	15000
872.0	1300.0	2.5	16000

TABLE 5-4

(continued)

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Coordinates		Depth	SPA-3 Count Rate
East	North	(ft)	(cpm)
872.0	1300.0	3.0	16000
872.0	1300.0	3.5	16000
872.0	1300.0	4.0	15000
872.0	1300.0	4.5	15000
872.0	1300.0	5.0	15000
872.0	1300.0	5.5	16000
872.0	1300.0	6.0	16000
872.0	1300.0	6.5	16000
872.0	1300.0	7.0	15000
872.0	1300.0	7.5	16000
872.0	1300.0	8.0	16000
872.0	1300.0	8.5	15000
872.0	1300.0	9.0	15000
872.0	1300.0	9.5	15000
872.0	1300.0	10.0	15000

TABLE 5-5

RADIONUCLIDE CONCENTRATIONS IN SOIL AT THE HISS

Page 1 of 15

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
550.0	1450.0	0- 1	32.0 +/- 10.0	26.0 +/- 2.0	2.4 +/- 1.2	-a-
550.0	1450.0	1- 2	23.0 +/- 6.0	12.0 +/- 2.0	< 1.0	-a-
550.0	1450.0	2- 3	<18.0	15.0 +/- 2.0	2.3 +/- 1.1	-a-
550.0	1450.0	3- 4	< 9.0	0.8 +/- 0.5	3.0 +/- 1.0	2.0 +/- 0.3
550.0	1450.0	4- 5	< 4.0	1.4 +/- 0.5	1.8 +/- 0.7	7.0 +/- 1.0
550.0	1450.0	5- 6	< 9.0	2.0 +/- 0.6	3.0 +/- 1.0	-a-
550.0	1450.0	6- 7	< 6.0	0.9 +/- 0.4	1.5 +/- 0.8	-a-
550.0	1450.0	7- 8	< 5.0	1.0 +/- 0.6	1.1 +/- 0.7	-a-
550.0	1450.0	8- 9	< 8.0	1.1 +/- 0.5	1.3 +/- 0.7	-a-
550.0	1450.0	9-10	< 9.0	2.1 +/- 0.6	3.0 +/- 1.0	-a-
550.0	1550.0	0- 1	36.0 +/- 29.0	37.0 +/- 5.0	< 3.0	-a-
550.0	1550.0	1- 2	-b-	-b-	-b-	-b-
550.0	1550.0	2- 3	51.0 +/- 14.0	44.0 +/- 3.0	< 2.0	-a-
550.0	1550.0	3- 4	<11.0	3.0 +/- 1.0	5.0 +/- 1.0	-a-
550.0	1550.0	4- 5	< 7.0	1.6 +/- 0.6	0.7 +/- 0.7	4.5 +/- 0.9
550.0	1550.0	5- 6	15.0 +/- 5.0	10.0 +/- 1.0	3.0 +/- 1.0	160.0 +/- 20.0
550.0	1550.0	6- 7	< 4.0	1.4 +/- 0.5	1.5 +/- 0.8	1.3 +/- 0.7
550.0	1550.0	7- 8	< 8.0	1.8 +/- 0.6	1.9 +/- 0.8	0.8 +/- 0.7
550.0	1550.0	8- 9	< 5.0	1.7 +/- 0.4	1.2 +/- 0.6	-a-
550.0	1550.0	9-10	< 5.0	0.9 +/- 0.5	1.1 +/- 0.8	-a-
550.0	1650.0	0- 1	43.0 +/- 16.0	32.0 +/- 2.0	2.0 +/- 1.0	-a-
550.0	1650.0	1- 2	450.0 +/- 40.0	310.0 +/- 10.0	< 4.0	-a-
550.0	1650.0	2- 3	<10.0	1.5 +/- 0.6	2.0 +/- 1.0	14.0 +/- 1.0

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
550.0	1650.0	3- 4	< 4.0	< 1.0	2.0 +/- 1.0	7.1 +/- 0.7
550.0	1650.0	4- 5	<15.0	1.5 +/- 0.4	2.0 +/- 1.0	3.5 +/- 0.4
550.0	1650.0	5- 6	< 8.0	1.6 +/- 0.6	2.0 +/- 1.0	-a-
550.0	1650.0	6- 7	<10.0	1.6 +/- 0.6	3.0 +/- 1.0	-a-
550.0	1650.0	7- 8	< 5.0	1.2 +/- 0.5	< 1.0	-a-
550.0	1650.0	8- 9	< 5.0	0.8 +/- 0.5	1.0 +/- 0.7	-a-
550.0	1650.0	9-10	< 9.0	1.1 +/- 0.4	1.6 +/- 0.7	-a-
550.0	1750.0	0- 1	800.0 +/-100.0	700.0 +/-100.0	< 4.0	-a-
550.0	1750.0	1- 2	11.0 +/- 7.0	11.0 +/- 2.0	2.0 +/- 1.0	730.0 +/- 10.0
550.0	1750.0	2- 3	<10.0	2.1 +/- 0.6	3.0 +/- 1.0	9.0 +/- 1.0
550.0	1750.0	3- 4	< 8.0	1.4 +/- 0.6	0.9 +/- 0.7	2.1 +/- 0.5
550.0	1750.0	4- 5	< 6.0	1.7 +/- 0.5	1.9 +/- 0.8	4.9 +/- 1.0
550.0	1750.0	5- 6	< 9.0	2.0 +/- 0.6	2.0 +/- 1.0	-a-
550.0	1750.0	6- 7	< 7.0	0.8 +/- 0.5	< 1.0	-a-
550.0	1750.0	7- 8	< 8.0	1.1 +/- 0.6	1.4 +/- 0.7	-a-
550.0	1750.0	8- 9	< 6.0	0.8 +/- 0.5	0.9 +/- 0.7	-a-
550.0	1850.0	0- 1	12.0 +/- 5.0	5.0 +/- 1.0	4.0 +/- 1.0	-a-
550.0	1850.0	1- 2	< 7.0	1.4 +/- 0.5	1.5 +/- 0.8	1.8 +/- 0.7
550.0	1850.0	2- 3	< 7.0	2.1 +/- 0.7	2.0 +/- 1.0	1.4 +/- 0.4
550.0	1850.0	3- 4	<10.0	1.5 +/- 0.5	1.7 +/- 0.9	1.7 +/- 0.5
550.0	1850.0	4- 5	< 9.0	1.8 +/- 0.6	1.8 +/- 0.9	3.2 +/- 0.6
550.0	1850.0	5- 6	< 6.0	1.6 +/- 0.5	1.6 +/- 0.8	-a-
550.0	1850.0	6- 7	< 8.0	1.3 +/- 0.5	2.2 +/- 0.8	-a-

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
550.0	1850.0	7- 8	< 8.0	1.5 +/- 0.4	< 1.0	-a-
550.0	1850.0	8- 9	< 9.0	2.7 +/- 0.7	2.1 +/- 0.9	-a-
573.0	1550.0	0- 1	30.0 +/- 6.0	27.0 +/- 2.0	2.0 +/- 1.0	-a-
573.0	1550.0	1- 2	< 7.0	1.2 +/- 0.5	1.2 +/- 0.8	2.6 +/- 0.5
573.0	1550.0	2- 3	< 6.0	1.7 +/- 0.6	1.3 +/- 0.7	1.7 +/- 0.8
573.0	1550.0	3- 4	< 8.0	2.0 +/- 0.6	3.0 +/- 1.0	3.6 +/- 2.2
573.0	1550.0	4- 5	< 6.0	1.5 +/- 0.6	1.7 +/- 0.8	2.9 +/- 1.4
573.0	1550.0	5- 6	< 5.0	1.5 +/- 0.6	2.2 +/- 0.8	-a-
573.0	1550.0	6- 7	< 8.0	1.2 +/- 0.4	1.1 +/- 0.6	-a-
573.0	1550.0	7- 8	< 6.0	1.7 +/- 0.5	1.2 +/- 0.7	-a-
573.0	1550.0	8- 9	< 8.0	1.4 +/- 0.5	2.1 +/- 0.9	-a-
573.0	1550.0	9-10	< 8.0	2.0 +/- 1.0	2.0 +/- 1.0	-a-
576.0	1650.0	0- 1	36.0 +/- 9.0	39.0 +/- 2.0	3.0 +/- 1.0	-a-
576.0	1650.0	1- 2	29.0 +/- 5.0	27.0 +/- 2.0	< 1.0	-a-
576.0	1650.0	2- 3	210.0 +/- 20.0	110.0 +/- 10.0	4.0 +/- 2.0	-a-
576.0	1650.0	3- 4	< 5.0	1.7 +/- 0.6	1.7 +/- 0.8	4.7 +/- 0.6
576.0	1650.0	4- 5	< 8.0	2.0 +/- 0.5	1.9 +/- 0.8	3.4 +/- 0.7
576.0	1650.0	5- 6	< 6.0	1.0 +/- 0.6	< 1.0	-a-
576.0	1650.0	6- 7	< 9.0	1.4 +/- 0.5	1.0 +/- 0.7	-a-
576.0	1650.0	7- 8	< 4.0	1.8 +/- 0.6	1.1 +/- 0.8	-a-
576.0	1650.0	8- 9	<10.0	1.3 +/- 0.5	1.8 +/- 0.9	-a-
576.0	1650.0	9-10	< 6.0	0.6 +/- 0.4	1.0 +/- 0.7	-a-
588.0	1450.0	0- 1	100.0 +/- 20.0	60.0 +/- 10.0	4.0 +/- 2.0	-a-

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
588.0	1450.0	1- 2	< 4.0	1.1 +/- 0.6	2.5 +/- 0.9	20.0 +/- 2.0
588.0	1450.0	2- 3	<10.0	1.6 +/- 0.5	3.0 +/- 1.0	1.9 +/- 0.5
588.0	1450.0	3- 4	<11.0	1.5 +/- 0.6	1.6 +/- 0.7	2.2 +/- 1.1
588.0	1450.0	4- 5	< 4.0	1.6 +/- 0.5	1.5 +/- 0.7	2.0 +/- 1.0
588.0	1450.0	5- 6	< 6.0	1.5 +/- 0.5	0.9 +/- 0.7	-a-
588.0	1450.0	6- 7	< 8.0	1.3 +/- 0.5	1.9 +/- 0.7	-a-
588.0	1450.0	7- 8	< 3.0	0.8 +/- 0.5	0.7 +/- 0.6	-a-
588.0	1450.0	8- 9	< 8.0	1.4 +/- 0.5	1.5 +/- 0.6	-a-
588.0	1450.0	9-10	< 5.0	1.2 +/- 0.5	0.9 +/- 0.6	-a-
600.0	1700.0	0- 1	56.0 +/- 13.0	41.0 +/- 3.0	2.0 +/- 1.0	-a-
600.0	1700.0	1- 2	6.0 +/- 5.0	5.0 +/- 1.0	1.1 +/- 0.7	-a-
600.0	1700.0	2- 3	< 6.0	1.6 +/- 0.6	1.2 +/- 0.7	2.5 +/- 0.5
600.0	1700.0	3- 4	< 5.0	1.0 +/- 0.5	1.0 +/- 0.7	4.9 +/- 0.7
600.0	1700.0	4- 5	< 8.0	1.6 +/- 0.6	1.9 +/- 0.8	3.8 +/- 1.2
600.0	1700.0	5- 6	< 6.0	1.3 +/- 0.5	1.8 +/- 0.8	-a-
600.0	1700.0	6- 7	<10.0	0.8 +/- 0.6	3.0 +/- 1.0	-a-
600.0	1700.0	7- 8	< 7.0	1.7 +/- 0.5	1.3 +/- 0.7	-a-
600.0	1700.0	8- 9	< 8.0	1.9 +/- 0.6	1.6 +/- 0.7	-a-
600.0	1700.0	9-10	< 8.0	0.9 +/- 0.5	1.6 +/- 0.7	-a-
600.0	1850.0	0- 1	26.0 +/- 8.0	17.0 +/- 2.0	2.0 +/- 1.0	-a-
600.0	1850.0	1- 2	130.0 +/- 40.0	220.0 +/- 20.0	5.0 +/- 3.0	-a-
600.0	1850.0	2- 3	< 8.0	1.9 +/- 0.6	1.4 +/- 0.8	4.6 +/- 0.7
600.0	1850.0	3- 4	< 8.0	1.7 +/- 0.5	2.1 +/- 0.8	3.2 +/- 0.6

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
600.0	1850.0	4- 5	< 8.0	0.9 +/- 0.5	1.4 +/- 0.7	2.3 +/- 0.6
600.0	1850.0	5- 6	< 8.0	2.8 +/- 0.7	1.4 +/- 0.8	-a-
600.0	1850.0	6- 7	<10.0	0.9 +/- 0.6	0.9 +/- 0.8	-a-
600.0	1850.0	7- 8	< 7.0	1.3 +/- 0.5	< 1.0	-a-
600.0	1850.0	8- 9	< 7.0	1.5 +/- 0.5	1.6 +/- 0.6	-a-
600.0	1850.0	9-10	< 8.0	3.0 +/- 0.8	4.0 +/- 1.0	-a-
600.0	1925.0	0- 1	28.0 +/- 14.0	39.0 +/- 3.0	< 1.0	-a-
600.0	1925.0	1- 2	100.0 +/- 20.0	210.0 +/- 20.0	< 1.0	-a-
600.0	1925.0	2- 3	47.0 +/- 16.0	120.0 +/- 10.0	2.0 +/- 2.0	-a-
600.0	1925.0	3- 4	< 8.0	1.6 +/- 0.7	1.3 +/- 0.9	3.7 +/- 0.5
600.0	1925.0	4- 5	<11.0	1.5 +/- 0.6	3.0 +/- 1.0	2.7 +/- 0.5
600.0	1925.0	5- 6	< 7.0	0.8 +/- 0.5	1.6 +/- 0.7	-a-
600.0	1925.0	6- 7	< 6.0	1.4 +/- 0.5	1.6 +/- 0.7	-a-
600.0	1925.0	7- 8	< 8.0	1.4 +/- 0.5	1.6 +/- 0.6	-a-
600.0	1925.0	8- 9	< 7.0	3.0 +/- 1.0	2.0 +/- 1.0	-a-
605.0	1400.0	1- 2	31.0 +/- 13.0	15.0 +/- 3.0	< 2.0	-a-
605.0	1400.0	2- 3	20.0 +/- 8.0	10.0 +/- 1.0	3.0 +/- 1.0	790.0 +/- 20.0
605.0	1400.0	3- 4	< 9.0	3.8 +/- 0.8	1.9 +/- 0.8	-a-
605.0	1400.0	4- 5	<10.0	2.9 +/- 0.7	2.0 +/- 1.0	3.5 +/- 1.3
605.0	1400.0	5- 6	< 6.0	1.3 +/- 0.6	1.4 +/- 0.8	-a-
605.0	1400.0	6- 7	< 7.0	2.1 +/- 0.6	1.5 +/- 0.7	-a-
605.0	1400.0	7- 8	< 5.0	1.2 +/- 0.5	3.0 +/- 1.0	-a-
605.0	1400.0	8- 9	< 8.0	1.1 +/- 0.5	2.6 +/- 0.8	-a-

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
695.0	1350.0	0- 1	6.0 +/- 6.0	6.0 +/- 1.0	< 1.0	-a-
695.0	1350.0	1- 2	10.0 +/- 8.0	14.0 +/- 2.0	1.3 +/- 1.0	-a-
695.0	1350.0	2- 3	< 6.0	0.7 +/- 0.6	1.1 +/- 0.9	3.5 +/- 1.0
695.0	1350.0	3- 4	< 5.0	1.6 +/- 0.5	< 1.0	-a-
695.0	1350.0	4- 5	< 5.0	2.0 +/- 0.6	2.1 +/- 0.8	1.2 +/- 0.6
695.0	1350.0	5- 6	< 8.0	1.8 +/- 0.5	2.0 +/- 0.7	-a-
695.0	1350.0	6- 7	< 5.0	1.7 +/- 0.5	1.9 +/- 0.8	-a-
695.0	1350.0	7- 8	< 5.0	1.1 +/- 0.5	1.5 +/- 0.8	-a-
695.0	1350.0	8- 9	< 9.0	1.2 +/- 0.5	2.8 +/- 0.9	-a-
700.0	1700.0	0- 1	18.0 +/- 7.0	12.0 +/- 2.0	< 1.0	-a-
700.0	1700.0	1- 2	<10.0	2.0 +/- 0.6	2.0 +/- 1.0	120.0 +/- 10.0
700.0	1700.0	2- 3	<10.0	4.0 +/- 1.0	4.0 +/- 1.0	-a-
700.0	1700.0	3- 4	< 6.0	1.7 +/- 0.6	1.6 +/- 0.9	1.6 +/- 0.4
700.0	1700.0	4- 5	<10.0	1.5 +/- 0.6	1.7 +/- 0.8	5.3 +/- 0.9
700.0	1700.0	5- 6	< 8.0	1.5 +/- 0.6	1.2 +/- 0.7	-a-
700.0	1700.0	6- 7	< 8.0	1.1 +/- 0.5	1.2 +/- 1.0	-a-
700.0	1700.0	7- 8	< 5.0	1.3 +/- 0.6	1.7 +/- 0.7	-a-
700.0	1700.0	8- 9	< 9.0	1.5 +/- 0.5	3.0 +/- 1.0	-a-
700.0	1823.0	0- 1	< 9.0	5.0 +/- 1.0	< 1.0	-a-
700.0	1823.0	1- 2	< 6.0	1.4 +/- 0.5	0.9 +/- 0.8	2.9 +/- 0.6
700.0	1823.0	2- 3	< 8.0	1.3 +/- 0.5	0.8 +/- 0.7	-a-
700.0	1823.0	3- 4	< 5.0	1.4 +/- 0.5	1.7 +/- 0.7	-a-

TABLE 5-5

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
700.0	1823.0	4- 5	< 9.0	1.0 +/- 0.5	1.8 +/- 0.9	1.6 +/- 0.5
700.0	1823.0	5- 6	< 7.0	1.3 +/- 0.4	2.0 +/- 0.7	1.3 +/- 0.6
700.0	1823.0	6- 7	< 8.0	1.1 +/- 0.4	1.3 +/- 0.7	-a-
700.0	1823.0	7- 8	< 6.0	1.0 +/- 0.5	1.3 +/- 0.8	-a-
700.0	1823.0	8- 9	< 7.0	1.4 +/- 0.5	1.3 +/- 0.6	-a-
700.0	1823.0	9-10	< 8.0	0.5 +/- 0.5	3.0 +/- 1.0	-a-
700.0	1900.0	0- 1	<11.0	6.0 +/- 1.0	2.0 +/- 0.7	-a-
700.0	1900.0	1- 2	< 9.0	1.6 +/- 0.5	3.0 +/- 1.0	1.9 +/- 1.0
700.0	1900.0	2- 3	< 7.0	0.6 +/- 0.5	1.1 +/- 0.7	1.2 +/- 0.8
700.0	1900.0	3- 4	< 7.0	0.8 +/- 0.5	1.3 +/- 0.7	1.8 +/- 0.5
700.0	1900.0	4- 5	< 9.0	1.3 +/- 0.5	2.0 +/- 1.0	1.2 +/- 0.3
700.0	1900.0	5- 6	< 8.0	1.0 +/- 0.4	1.7 +/- 0.7	-a-
700.0	1900.0	6- 7	< 5.0	1.5 +/- 0.5	0.9 +/- 0.6	-a-
700.0	1900.0	7- 8	< 5.0	1.0 +/- 0.5	0.8 +/- 0.6	-a-
700.0	1900.0	8- 9	< 7.0	1.7 +/- 0.5	1.8 +/- 0.7	-a-
737.5	1300.0	0- 1	9.0 +/- 6.0	5.0 +/- 1.0	< 1.0	-a-
737.5	1300.0	1- 2	7.0 +/- 4.0	2.6 +/- 0.7	1.0 +/- 1.0	-a-
737.5	1300.0	2- 3	< 5.0	1.7 +/- 0.5	1.3 +/- 0.8	1.9 +/- 0.7
737.5	1300.0	3- 4	< 6.0	1.6 +/- 0.6	1.8 +/- 0.9	-a-
737.5	1300.0	4- 5	< 4.0	1.1 +/- 0.5	1.3 +/- 0.6	2.3 +/- 1.2
737.5	1300.0	5- 6	< 5.0	1.5 +/- 0.5	2.0 +/- 0.8	-a-
737.5	1300.0	6- 7	< 7.0	1.0 +/- 0.5	1.0 +/- 0.7	-a-
737.5	1300.0	7- 8	< 4.0	1.5 +/- 0.5	1.5 +/- 0.7	-a-

TABLE 5-5

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
737.5	1300.0	8- 9	< 4.0	1.0 +/- 0.5	< 1.0	-a-
750.0	1050.0	0- 1	24.0 +/- 6.0	19.0 +/- 2.0	2.0 +/- 1.0	-a-
750.0	1050.0	1- 2	<17.0	9.0 +/- 1.0	< 1.0	190.0 +/- 10.0
750.0	1050.0	2- 3	<10.0	4.0 +/- 1.0	1.5 +/- 0.9	-a-
750.0	1050.0	3- 4	<12.0	1.6 +/- 0.6	1.1 +/- 0.7	2.4 +/- 0.9
750.0	1050.0	4- 5	< 8.0	1.0 +/- 0.5	2.0 +/- 1.0	1.5 +/- 0.8
750.0	1050.0	5- 6	<10.0	2.4 +/- 0.6	1.7 +/- 0.8	-a-
750.0	1050.0	6- 7	< 6.0	0.8 +/- 0.4	0.9 +/- 0.6	-a-
750.0	1050.0	7- 8	< 7.0	1.1 +/- 0.5	1.4 +/- 0.7	-a-
750.0	1050.0	8- 9	<15.0	1.5 +/- 0.7	3.0 +/- 2.0	-a-
750.0	1100.0	0- 1	25.0 +/- 11.0	18.0 +/- 2.0	1.5 +/- 1.1	-a-
750.0	1100.0	3- 4	< 9.0	1.4 +/- 0.5	1.8 +/- 0.9	5.6 +/- 1.2
750.0	1100.0	4- 5	< 7.0	1.2 +/- 0.5	0.8 +/- 0.7	2.9 +/- 1.3
750.0	1100.0	5- 6	<10.0	1.8 +/- 0.5	1.8 +/- 0.9	-a-
750.0	1100.0	6- 7	< 6.0	0.9 +/- 0.5	1.4 +/- 0.7	-a-
750.0	1100.0	7- 8	< 8.0	1.1 +/- 0.4	< 1.0	-a-
750.0	1100.0	8- 9	< 7.0	1.5 +/- 0.5	< 1.0	-a-
797.0	1653.0	0- 1	19.0 +/- 9.0	11.0 +/- 2.0	2.0 +/- 1.0	-a-
797.0	1653.0	1- 2	34.0 +/- 12.0	44.0 +/- 3.0	2.0 +/- 2.0	-a-
797.0	1653.0	2- 3	<10.0	3.1 +/- 0.8	2.1 +/- 0.9	-a-
797.0	1653.0	3- 4	< 5.0	1.2 +/- 0.5	1.3 +/- 0.9	1.6 +/- 0.3
797.0	1653.0	4- 5	<10.0	2.3 +/- 0.6	3.0 +/- 1.0	1.8 +/- 0.4

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
797.0	1653.0	5- 6	< 4.0	1.1 +/- 0.5	1.6 +/- 0.7	-a-
797.0	1653.0	6- 7	< 7.0	1.3 +/- 0.4	3.0 +/- 1.0	-a-
797.0	1653.0	7- 8	< 4.0	0.7 +/- 0.4	< 1.0	-a-
797.0	1653.0	8- 9	< 5.0	1.2 +/- 0.6	1.5 +/- 0.9	-a-
800.0	1250.0	0- 1	9.0 +/- 6.0	5.0 +/- 1.0	2.0 +/- 1.0	-a-
800.0	1250.0	1- 2	< 8.0	5.0 +/- 1.0	< 1.0	-a-
800.0	1250.0	2- 3	< 8.0	1.5 +/- 0.6	1.2 +/- 0.8	1.6 +/- 0.3
800.0	1250.0	3- 4	< 5.0	1.2 +/- 0.6	< 1.0	-a-
800.0	1250.0	4- 5	< 9.0	2.1 +/- 0.6	2.7 +/- 0.9	1.3 +/- 0.2
800.0	1250.0	5- 6	< 7.0	0.6 +/- 0.5	1.0 +/- 0.8	-a-
800.0	1250.0	6- 7	< 9.0	1.1 +/- 0.5	1.9 +/- 0.8	-a-
800.0	1250.0	7- 8	< 9.0	1.5 +/- 0.5	2.3 +/- 0.9	-a-
800.0	1250.0	8- 9	< 4.0	1.4 +/- 0.5	1.3 +/- 0.7	-a-
800.0	1250.0	9-10	< 4.0	1.1 +/- 0.6	1.0 +/- 0.7	-a-
800.0	1350.0	0- 1	10.0 +/- 5.0	5.0 +/- 1.0	3.0 +/- 1.0	-a-
800.0	1350.0	1- 2	< 7.0	4.0 +/- 1.0	1.6 +/- 0.9	-a-
800.0	1350.0	2- 3	<13.0	1.5 +/- 0.6	2.0 +/- 1.0	-a-
800.0	1350.0	3- 4	< 9.0	1.7 +/- 0.6	1.2 +/- 0.8	1.3 +/- 0.4
800.0	1350.0	4- 5	< 6.0	1.2 +/- 0.6	1.5 +/- 0.8	1.1 +/- 0.2
800.0	1350.0	5- 6	<10.0	1.5 +/- 0.6	1.9 +/- 0.8	-a-
800.0	1350.0	6- 7	< 6.0	1.1 +/- 0.6	1.5 +/- 0.7	-a-
800.0	1350.0	7- 8	< 4.0	1.3 +/- 0.5	1.3 +/- 0.7	-a-
800.0	1350.0	8- 9	<14.0	2.3 +/- 0.8	4.0 +/- 1.0	-a-

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
800.0	1750.0	0- 1	< 5.0	2.9 +/- 0.7	1.2 +/- 0.7	-a-
800.0	1750.0	1- 2	<10.0	3.3 +/- 0.9	2.2 +/- 0.9	-a-
800.0	1750.0	2- 3	< 5.0	1.2 +/- 0.5	0.9 +/- 0.7	-a-
800.0	1750.0	3- 4	<10.0	2.4 +/- 0.8	3.0 +/- 1.0	62.0 +/- 2.0
800.0	1750.0	4- 5	< 4.0	0.9 +/- 0.4	0.9 +/- 0.7	2.3 +/- 0.3
800.0	1750.0	5- 6	< 9.0	1.2 +/- 0.5	2.3 +/- 0.9	-a-
800.0	1750.0	6- 7	< 4.0	1.2 +/- 0.5	0.9 +/- 0.9	-a-
800.0	1750.0	7- 8	< 4.0	1.0 +/- 0.4	1.0 +/- 0.7	-a-
800.0	1750.0	8- 9	< 8.0	1.0 +/- 0.5	1.8 +/- 0.8	-a-
804.0	1839.0	0- 1	<19.0	7.0 +/- 1.0	1.7 +/- 0.8	-a-
804.0	1839.0	1- 2	22.0 +/- 11.0	23.0 +/- 2.0	2.0 +/- 1.0	-a-
804.0	1839.0	2- 3	15.0 +/- 7.0	7.0 +/- 1.0	1.4 +/- 0.9	200.0 +/- 10.0
804.0	1839.0	3- 4	< 9.0	1.5 +/- 0.5	1.8 +/- 0.8	10.0 +/- 1.0
804.0	1839.0	4- 5	< 8.0	1.9 +/- 0.6	1.1 +/- 0.8	3.7 +/- 0.7
804.0	1839.0	5- 6	< 6.0	1.5 +/- 0.5	1.4 +/- 0.7	-a-
804.0	1839.0	6- 7	< 9.0	1.8 +/- 0.6	2.0 +/- 0.8	-a-
804.0	1839.0	7- 8	<18.0	1.2 +/- 0.5	1.1 +/- 0.7	-a-
804.0	1839.0	8- 9	< 8.0	1.5 +/- 0.4	1.4 +/- 0.7	-a-
804.0	1839.0	9-10	<13.0	3.0 +/- 1.0	2.0 +/- 1.0	-a-
805.0	1450.0	0- 1	8.0 +/- 6.0	6.0 +/- 1.0	1.4 +/- 1.0	-a-
805.0	1450.0	1- 2	10.0 +/- 8.0	4.0 +/- 1.0	2.0 +/- 1.0	-a-
805.0	1450.0	2- 3	<10.0	1.7 +/- 0.5	2.2 +/- 0.8	-a-

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
805.0	1450.0	3- 4	< 5.0	1.3 +/- 0.7	1.1 +/- 0.7	1.5 +/- 0.2
805.0	1450.0	4- 5	<11.0	1.4 +/- 0.6	2.2 +/- 0.9	1.3 +/- 0.5
805.0	1450.0	5- 6	< 7.0	0.8 +/- 0.5	1.3 +/- 0.8	-a-
805.0	1450.0	6- 7	< 4.0	1.4 +/- 0.5	1.7 +/- 0.7	-a-
805.0	1450.0	7- 8	< 6.0	1.5 +/- 0.4	0.9 +/- 0.6	-a-
805.0	1450.0	8- 9	<15.0	3.0 +/- 2.0	5.0 +/- 2.0	-a-
806.0	1150.0	0- 1	9.0 +/- 7.0	9.0 +/- 2.0	2.0 +/- 1.0	-a-
806.0	1150.0	1- 2	<13.0	2.0 +/- 0.7	1.8 +/- 0.9	-a-
806.0	1150.0	2- 3	< 7.0	1.5 +/- 0.5	< 1.0	3.1 +/- 0.6
806.0	1150.0	3- 4	< 4.0	1.7 +/- 0.6	1.7 +/- 0.7	-a-
806.0	1150.0	4- 5	< 9.0	1.7 +/- 0.5	1.5 +/- 0.7	1.1 +/- 0.2
806.0	1150.0	5- 6	< 6.0	1.4 +/- 0.5	1.5 +/- 0.7	-a-
806.0	1150.0	6- 7	< 9.0	1.7 +/- 0.6	1.7 +/- 0.7	-a-
806.0	1150.0	7- 8	< 4.0	1.2 +/- 0.4	1.6 +/- 0.6	-a-
806.0	1150.0	8- 9	< 9.0	1.4 +/- 0.5	1.7 +/- 0.8	-a-
806.0	1150.0	9-10	< 7.0	1.3 +/- 0.6	1.5 +/- 0.7	-a-
807.0	1550.0	0- 1	< 7.0	4.0 +/- 1.0	2.0 +/- 1.0	-a-
807.0	1550.0	1- 2	4.0 +/- 3.0	3.6 +/- 0.8	< 1.0	-a-
807.0	1550.0	2- 3	12.0 +/- 4.0	3.0 +/- 1.0	< 1.0	-a-
807.0	1550.0	3- 4	< 7.0	0.9 +/- 0.6	< 1.0	1.2 +/- 0.2
807.0	1550.0	4- 5	< 8.0	0.9 +/- 0.4	2.2 +/- 0.8	1.3 +/- 0.2
807.0	1550.0	5- 6	< 6.0	1.8 +/- 0.5	1.0 +/- 0.7	-a-
807.0	1550.0	6- 7	< 8.0	1.5 +/- 0.5	2.7 +/- 0.9	-a-

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
807.0	1550.0	7- 8	< 4.0	1.1 +/- 0.4	1.0 +/- 0.6	-a-
807.0	1550.0	8- 9	< 5.0	1.2 +/- 0.5	< 1.0	-a-
852.0	1062.5	0- 1	<11.0	2.8 +/- 0.8	2.0 +/- 1.0	-a-
852.0	1062.5	1- 2	< 4.0	1.2 +/- 0.6	1.1 +/- 0.8	-a-
852.0	1062.5	2- 3	< 9.0	1.8 +/- 0.5	1.9 +/- 0.7	1.1 +/- 0.4
852.0	1062.5	3- 4	< 7.0	1.3 +/- 0.5	1.3 +/- 0.8	-a-
852.0	1062.5	4- 5	< 9.0	1.4 +/- 0.5	2.1 +/- 0.7	1.6 +/- 1.2
852.0	1062.5	5- 6	< 6.0	1.4 +/- 0.7	1.4 +/- 1.0	-a-
852.0	1062.5	6- 7	< 8.0	1.1 +/- 0.6	1.5 +/- 1.0	-a-
852.0	1062.5	7- 8	< 8.0	1.1 +/- 0.4	1.2 +/- 0.6	-a-
852.0	1062.5	8- 9	< 4.0	1.0 +/- 0.5	< 1.0	-a-
852.0	1062.5	9-10	< 7.0	1.0 +/- 0.5	< 1.0	-a-
859.0	1500.0	0- 1	5.0 +/- 4.0	4.4 +/- 0.9	1.2 +/- 0.9	-a-
859.0	1500.0	1- 2	< 6.0	0.9 +/- 0.6	2.0 +/- 0.9	-a-
859.0	1500.0	2- 3	< 4.0	1.5 +/- 0.5	2.1 +/- 0.8	-a-
859.0	1500.0	3- 4	<11.0	1.7 +/- 0.6	2.0 +/- 1.0	1.6 +/- 0.3
859.0	1500.0	4- 5	< 5.0	1.7 +/- 0.6	0.9 +/- 0.8	15.0 +/- 1.0
859.0	1500.0	5- 6	< 9.0	1.5 +/- 0.5	1.2 +/- 0.7	-a-
859.0	1500.0	6- 7	< 5.0	1.5 +/- 0.5	< 1.0	-a-
859.0	1500.0	7- 8	< 4.0	1.0 +/- 0.6	< 1.0	-a-
859.0	1500.0	8- 9	<11.0	1.6 +/- 0.6	3.0 +/- 1.0	-a-
859.0	1500.0	9-10	-b-	-b-	-b-	-b-
860.0	1400.0	0- 1	60.0 +/- 20.0	46.0 +/- 3.0	4.0 +/- 1.0	-a-

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
860.0	1400.0	1- 2	< 5.0	1.2 +/- 0.5	1.7 +/- 0.8	-a-
860.0	1400.0	2- 3	< 6.0	0.9 +/- 0.6	1.4 +/- 0.8	1.3 +/- 0.8
860.0	1400.0	3- 4	< 6.0	1.5 +/- 0.6	1.9 +/- 0.9	-a-
860.0	1400.0	4- 5	< 6.0	1.7 +/- 0.6	1.4 +/- 0.9	2.3 +/- 0.9
860.0	1400.0	5- 6	< 5.0	0.9 +/- 0.6	1.2 +/- 0.8	-a-
860.0	1400.0	6- 7	< 5.0	1.1 +/- 0.5	1.2 +/- 0.7	-a-
860.0	1400.0	7- 8	< 5.0	1.3 +/- 0.5	1.0 +/- 0.8	-a-
860.0	1400.0	8- 9	< 5.0	1.0 +/- 0.5	1.2 +/- 0.7	-a-
860.0	1400.0	9-10	< 5.0	1.2 +/- 0.5	1.5 +/- 0.7	-a-
861.0	1600.0	0- 1	21.0 +/- 6.0	9.0 +/- 1.0	3.0 +/- 1.0	-a-
861.0	1600.0	1- 2	430.0 +/- 50.0	250.0 +/- 10.0	4.0 +/- 3.0	-a-
861.0	1600.0	2- 3	< 5.0	1.6 +/- 0.6	1.6 +/- 0.8	-a-
861.0	1600.0	3- 4	< 9.0	1.6 +/- 0.5	3.0 +/- 1.0	1.8 +/- 0.3
861.0	1600.0	4- 5	< 4.0	1.2 +/- 0.5	1.2 +/- 0.8	1.5 +/- 0.3
861.0	1600.0	5- 6	< 8.0	1.7 +/- 0.5	0.8 +/- 0.7	-a-
861.0	1600.0	6- 7	< 4.0	1.1 +/- 0.5	1.3 +/- 0.6	-a-
861.0	1600.0	7- 8	< 4.0	1.4 +/- 0.5	1.3 +/- 0.6	-a-
861.0	1600.0	8- 9	-b-	-b-	-b-	-b-
861.0	1600.0	9-10	-b-	-b-	-b-	-b-
862.0	1700.0	0- 1	7.0 +/- 6.0	8.0 +/- 1.0	1.0 +/- 0.9	-a-
862.0	1700.0	1- 2	<11.0	1.1 +/- 0.6	2.0 +/- 1.0	-a-
862.0	1700.0	2- 3	< 4.0	1.1 +/- 0.5	0.8 +/- 0.7	-a-
862.0	1700.0	3- 4	< 8.0	1.5 +/- 0.5	1.3 +/- 0.7	3.5 +/- 1.7

TABLE 5-5

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
862.0	1700.0	4- 5	< 5.0	1.5 +/- 0.6	1.4 +/- 0.7	1.0 +/- 0.3
862.0	1700.0	5- 6	< 9.0	1.5 +/- 0.5	1.7 +/- 0.7	-a-
862.0	1700.0	6- 7	< 4.0	1.4 +/- 0.5	1.7 +/- 0.8	-a-
862.0	1700.0	7- 8	< 8.0	1.0 +/- 0.4	0.8 +/- 0.7	-a-
862.0	1700.0	8- 9	< 4.0	1.3 +/- 0.5	1.3 +/- 0.6	-a-
862.0	1700.0	9-10	-b-	-b-	-b-	-b-
862.0	1800.0	0- 1	< 6.0	4.0 +/- 1.0	1.1 +/- 0.7	-a-
862.0	1800.0	1- 2	10.0 +/- 6.0	9.0 +/- 1.0	< 1.0	-a-
862.0	1800.0	2- 3	12.0 +/- 7.0	1.7 +/- 0.7	1.3 +/- 0.9	-a-
862.0	1800.0	3- 4	< 5.0	1.9 +/- 0.6	3.0 +/- 1.0	1.2 +/- 0.5
862.0	1800.0	4- 5	<11.0	1.4 +/- 0.8	3.0 +/- 1.0	2.2 +/- 0.5
862.0	1800.0	5- 6	< 5.0	1.2 +/- 0.5	1.4 +/- 0.7	-a-
862.0	1800.0	6- 7	< 8.0	1.6 +/- 0.5	1.9 +/- 0.7	-a-
862.0	1800.0	7- 8	< 4.0	1.9 +/- 0.5	1.3 +/- 0.7	-a-
862.0	1800.0	8- 9	< 8.0	1.3 +/- 0.5	3.0 +/- 1.0	-a-
862.0	1800.0	9-10	< 5.0	1.5 +/- 0.5	0.9 +/- 0.6	-a-
870.0	1106.0	0- 1	<11.0	2.2 +/- 0.7	2.0 +/- 1.0	-a-
870.0	1106.0	1- 2	< 6.0	1.2 +/- 0.6	1.2 +/- 0.9	-a-
870.0	1106.0	2- 3	< 6.0	1.4 +/- 0.5	2.0 +/- 0.8	2.5 +/- 0.4
870.0	1106.0	3- 4	< 8.0	1.2 +/- 0.6	1.4 +/- 0.9	-a-
870.0	1106.0	4- 5	< 5.0	0.8 +/- 0.5	1.5 +/- 0.8	1.7 +/- 0.2
870.0	1106.0	7- 8	<24.0	2.0 +/- 1.0	2.0 +/- 1.0	-a-
870.0	1106.0	8- 9	< 6.0	1.2 +/- 0.5	0.8 +/- 0.8	-a-

TABLE 5-5

(continued)

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Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g +/- 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
870.0	1106.0	9-10	< 4.0	0.9 +/- 0.5	1.6 +/- 0.8	-a-
870.0	1200.0	0- 1	< 7.0	4.0 +/- 1.0	1.3 +/- 1.0	-a-
870.0	1200.0	1- 2	13.0 +/- 5.0	6.0 +/- 1.0	2.0 +/- 1.0	-a-
870.0	1200.0	2- 3	< 6.0	1.1 +/- 0.6	1.1 +/- 0.9	2.5 +/- 0.4
870.0	1200.0	3- 4	< 5.0	1.4 +/- 0.5	1.9 +/- 0.7	-a-
870.0	1200.0	4- 5	<12.0	1.7 +/- 0.6	1.9 +/- 0.8	1.5 +/- 0.5
870.0	1200.0	5- 6	< 7.0	1.7 +/- 0.6	1.2 +/- 0.9	-a-
870.0	1200.0	6- 7	<12.0	1.3 +/- 0.5	3.0 +/- 1.0	-a-
870.0	1200.0	7- 8	< 4.0	1.3 +/- 0.5	1.1 +/- 0.8	-a-
870.0	1200.0	8- 9	< 6.0	1.0 +/- 0.5	2.2 +/- 0.8	-a-
870.0	1200.0	9-10	<12.0	1.6 +/- 0.7	2.0 +/- 1.0	-a-
872.0	1300.0	0- 1	< 8.0	1.1 +/- 0.6	1.8 +/- 1.0	-a-
872.0	1300.0	1- 2	< 8.0	0.7 +/- 0.5	< 1.0	-a-
872.0	1300.0	2- 3	< 8.0	1.6 +/- 0.5	2.0 +/- 0.7	4.1 +/- 0.5
872.0	1300.0	3- 4	< 7.0	0.9 +/- 0.4	1.1 +/- 0.8	-a-
872.0	1300.0	4- 5	< 9.0	1.5 +/- 0.5	2.8 +/- 0.9	1.5 +/- 0.4
872.0	1300.0	7- 8	< 6.0	1.3 +/- 0.7	< 1.0	-a-
872.0	1300.0	8- 9	<10.0	1.2 +/- 0.5	2.5 +/- 0.9	-a-
872.0	1300.0	9-10	< 8.0	2.3 +/- 0.8	< 1.0	-a-

-a- Analysis not requested
-b- No sample collected due to poor sample recovery

REFERENCES

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3. Bechtel National, Inc. Radiological Protection Program Manual, Vol. I, Oak Ridge, TN, 1982.

4. Letter, John E. Baublitz, Jr. to E. L. Keller. "Guidelines for Residual Radioactivity at FUSRAP and Remote SFMP Sites" (Attachment: U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites, Rev. 1, July 1985), July 22, 1985.

5. Oak Ridge National Laboratory. Results of State Background Radiation Levels: Measurements Taken During 1975-1979, ORNL/TM-7343, Oak Ridge, TN, November 1981.