

Appendix A.4.1

**PRE-DESIGN INVESTIGATION DATA SUMMARY REPORT
HEINTZ STEEL AND MANUFACTURING VICINITY PROPERTY (DT-6)
FUSRAP ST. LOUIS DOWNTOWN SITE
ST. LOUIS, MISSOURI**

**TOTAL ENVIRONMENTAL RESTORATION CONTRACT
CONTRACT NO. DACW41-98-D-9006
TASK ORDER NO. 0002**

Submitted to:

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U.S. Army Engineer District, Kansas City
Corps of Engineers
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IT CORPORATION

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July, 2001

Revision 0

UNCONTROLLED

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1.0 Introduction

This Pre-Design Investigation Data Summary Report (Report) describes investigation activities conducted at the Heintz Steel and Manufacturing Vicinity Property (DT-6) (HSVP) of the St. Louis Downtown Site (SLDS) and results obtained during these activities. The pre-design investigation was performed for the United States Army Corps of Engineers (USACE), St. Louis District. Investigation activities included in this report are summarized from the *Remedial Investigation Report for the St. Louis Downtown Site, St. Louis, Missouri* (RI) (BNI, 1994); the *Remedial Investigation Addendum for the St. Louis Site*, (Science Applications International Corporation [SAIC], 1995); the *Radiological, Chemical, and Hydrogeological Characterization Report for the St. Louis Downtown Site in St. Louis, Missouri* (BNI, 1990); the *Background Soils Characterization Report for the St. Louis Downtown Site* (USACE, 1999), and the pre-design investigation activities performed by IT Corporation (IT) from October 11, 2000 through December 6, 2000. Investigation activities at the HSVP were performed under the Formerly Utilized Sites Remedial Action Program (FUSRAP).

The HSVP is approximately 132,946 square feet (ft²) in area and is located south of the Thomas & Proetz Lumber Company VP (DT-10) across Angelrodt Street. The property is bordered to the south by the Gunther Salt – South VP (DT-4), to the east by the Midwest Waste VP (DT-7), and to the west by the St. Louis Terminal Railroad Association VP (DT-9) tracks (DT-9). Although not specifically investigated during RI activities, samples were collected from two RI boring locations (E2300N984 and E2500N983) adjacent to the HSVP's northern property boundary along Angelrodt Street. These borings were sampled to a maximum depth of 0.5 feet below ground surface (bgs). Analytical results from these samples did not indicate the presence of radiological contamination. Radiological contamination is defined as the presence of radiological contaminants of concern (COCs) in soil at concentrations exceeding the remediation criteria as established by the *Record of Decision for the St. Louis Downtown Site, St. Louis, Missouri* (ROD) (USACE, 1998). In accordance with the ROD, the radiological COCs at SLDS are radium-226, radium-228, thorium-230, thorium-232, and uranium-238.

A review of available aerial photographs indicates that a number of changes to the property have occurred that may have affected the ground surface. These changes include the removal of two buildings previously located in the northwest corner of the property between 1941 and 1947. Aerial photographs taken in January 1949 and March 1952 indicate the addition of structures along the eastern boundary and the northwest corner of the property, respectively. The property

appears to remain unchanged from 1952 to 1973. An aerial photograph taken in 1973 indicates that several buildings previously located on the southwestern corner of the property had been removed. The large building currently located on the southwestern portion of the property first appears in a photograph dated July 30, 1974. In addition, according to HSVP personnel, the cellular tower and associated support building currently located on the northeast corner of the property were constructed in 1997. The historical changes to the property configuration, as discussed above, may have resulted in alterations to the original ground surface.

As a first step in the pre-design investigation, the HSVP walkover survey was conducted to verify the RI data indicating that no near-surface radiological activity existed at the property. However, areas of elevated radiological activity were identified during the walkover survey, thus indicating the need for further investigation. The purpose of the pre-design investigation was to delineate the nature and extent of the radiological contamination identified during the walkover survey prior to the initiation of remedial action (e.g., soil excavation).

The pre-design investigation of HSVP consisted of the collection of three near-surface borings to evaluate the depth and horizontal extent of radiological contamination. Concurrent with the pre-design investigation, a final status radiological survey of Class 2 areas on the HSVP was performed in accordance with Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)(DoD et al., 2000). A total of 39 Class 2 borings were completed.

2.0 Pre-Design Investigation

2.1 Overview

Pre-design Investigation activities were conducted at the HSVP in accordance with the *Pre-Design Investigation Work Description, Vicinity Properties* (Work Description) (IT, 2000) as modified by Field Work Variance (FWV) 74. The near-surface boring activities described in FWV 74 were completed to further delineate the extent of radiological contamination identified by the walkover survey and associated sampling. The following sections discuss the rationale, methods, and results for activities conducted.

2.2 Walkover Screening and Sampling

A walkover survey was conducted, by SAIC on October 11, 2000, in accordance with the MARSSIM to identify whether or not areas of elevated radiological activity existed on the HSVP. The walkover survey was conducted utilizing a 2x2-sodium iodide detector. Areas of elevated radiological activity detected during this survey were marked on the ground surface and appropriate discrete samples collected from these areas. Four areas of potential elevated radiological activity were identified on the HSVP. SAIC personnel collected continuous samples, from each of these four areas, at 0.5 ft intervals to a maximum depth of 2.0 ft bgs. The locations of these samples are shown on Figure HS-2. Two of the four samples, HTZ00258 and HTZ00262, indicated the presence of radiological contamination at a maximum depth of 0.5 ft. Radiological COC analytical data for these locations are summarized in Table 2-1. The areas surrounding the locations from which HTZ00258 and HTZ00262 were collected were further investigated as discussed in the following sections.

2.3 Near-Surface Sampling

Three near-surface sample borings were completed on November 29, 2000. Samples were collected from these borings to a maximum depth of 2 ft bgs.

2.3.1 Near-Surface Sampling Activities

A review of the walkover survey data indicated two areas located on the HSVP exhibiting elevated radiological activity. In order to determine the lateral and vertical extent of these areas of elevated activity, three near-surface pre-design borings (SLD06589, SLD06591, and SLD06593) were completed. Near-surface locations SLD06589 and SLD06591 were sampled to delineate the horizontal extent of radiological contamination detected in walkover sample

HTZ00262. Near-surface location SLD06593 was completed to investigate one area of elevated radiological activity indicated during the walkover survey in the southeast corner of the property.

2.3.2 *Near-Surface Sampling Results*

Soil samples collected from the three near-surface boring locations were placed in one-quart sample containers with tight-fitting lids and submitted to the on-site or Hazelwood Interim Storage Site (HISS) laboratory for analysis of SLDS radiological COCs. Analytical results indicate that the near-surface sample location SLD06591 yielded samples that exhibited radiological contamination. The maximum depth of these samples were 0.5 ft bgs. Analytical data for radiologically contaminated samples are summarized in Table 2-1. Radiological data for all near-surface samples collected during pre-design activities are presented in Attachment 1.

3.0 Final Status Survey

3.1 Overview

Final Status Surveys, including biased and systematic soil sampling, are conducted in accordance with MARSSIM. Final Status Surveys of areas requiring remediation (Class 1 areas) are performed after remediation to verify compliance with ROD criteria. Final Status Surveys of Class 2 and Class 3 areas are performed prior to remediation to allow inclusion of any elevated areas of contamination in the remedial design. A Post Remediation Action Report (PRAR) summarizing remedial action information and final status survey results is prepared upon completion of remediation to document residual site conditions. A copy of the PRAR is provided to the regulators, United States Environmental Protection Agency (USEPA) Region VII and the Missouri Department of Natural Resources (MDNR), and to each property owner concurrent with transmittal of official notification that the property meets the established release criterion.

Based on data obtained from the walkover survey, it was concluded that the HSVP contained two potential Class 1 areas that were investigated through the completion of three near-surface borings. The remainder of the HSVP was identified as a Class 2 area based on the absence of radiological contamination from available historical data and walkover results. After the completion of the Class 2 final status sampling, one additional Class 1 area was identified. No Class 3 survey units were identified in the HSVP.

3.2 Class 1 and 2 Areas

The Class 2 survey area was initially identified in the Work Description. Thirty-nine Class 2 borings were completed, from October 11, 2000 through December 6, 2000, within the designated Class 2 area to verify the absence of radiological contamination. Soil samples from two Class 2 borings (SLD06515 and SLD06551) completed in the HSVP exhibited radiological contamination. The analytical data from SLD06515 and SLD 06551 resulted in the identification of two additional Class 1 areas. The analytical results for these samples are included in Table 2-1. Radiological contamination was noted in samples collected from a maximum depth of 0.5 ft bgs. The locations of these samples are identified on Figure HS-2 as Class 2 borings with associated depth to contamination contours. The analytical data from SLD06515 and SLD06551 resulted in the identification of two additional Class 1 areas. The PRAR prepared by SAIC at a later date will include complete results of the Class 2 and walkover survey sampling activities.

The location of Class 1 and 2 areas within the HSVP are shown on Figure HS-3. The total surface area of Class 1 areas in the HSVP is approximately 1,100.39 ft². The Class 1 areas were identified utilizing the data from the walkover survey, pre-design investigation, and Class 2 sampling.

4.0 Summary and Evaluation of Radiological Results

4.1 Summary of Radiological Results

The following presents a summary of the radiological sampling results for HSVP from the pre-design investigation and the final status survey. Analytical results from five soil samples collected from the HSVP exhibited radiological contamination. These soil samples were collected from two walkover, one near-surface, and two Class 2 sample locations.

Radium-226, radium-228, thorium-230, thorium-232, and uranium-238 were detected in the five near surface soil samples exhibiting radiological contamination. However, thorium-230 is the primary COC contribution to the radiological contamination in each of these samples.

4.2 Evaluation of Pre-Design Investigation Results

The HSVP was investigated to a maximum depth of approximately 2 ft bgs during pre-design investigation activities. According to lithologic descriptions from boring logs completed for each near-surface and Class 2 boring location, the upper 2 ft of the HSVP subsurface is composed of fill material consisting of loosely compacted cinders, silty clay, and gravel.

Three areas with radiological contamination are present at the HSVP. Radiological contamination from these three areas appears to be confined to the upper 0.5 ft bgs of fill material. One of these areas is located in the southeast corner of the HSVP and the other area is located on the southeast corner of the northwest storage building at the HSVP. The third area, identified by walkover sample HTZ00262 and near-surface sample SLD06591, is located on the northwest side of the northwest storage building at the HSVP. Analytical data from these samples indicate radiological contamination at a maximum depth of 0.5 ft bgs. Based on a review of historical aerial photographs, radiological contamination identified by samples SLD06591, HTZ00262, HTZ00258, and SLD06551 may extend beneath the northwest and southwest corners of the structure located on the northwest corner of the property. These aerial photographs indicate that the area occupied by the current structure was vacant during much of the time that MED/AEC activities occurred on the adjacent MI property. Sample locations with radiological contamination and associated depth to contamination contours are shown on Figure HS-2. The three areas of radiological contamination appear to be randomly located with no specifically identifiable source. The remediation of these areas will be addressed in the HSVP Remediation Activity Work Description (RAWD).

5.0 References

Bechtel National, Incorporated (BNI), 1994, *Remedial Investigation Report for the St. Louis Downtown Site, St. Louis, Missouri*, DOE/OR/21949-280, Oak Ridge, TN.

Bechtel National, Incorporated (BNI), 1990, *Radiological, Chemical, and Hydrogeological Characterization Report for the St. Louis Downtown Site in St. Louis, Missouri*, Revision 1, DOE/OR/20722-258, Oak Ridge, TN.

IT Corporation (IT), 2000 *Pre-Design Investigation Work Description Vicinity Properties St. Louis Downtown Site, St. Louis, MO*.

Science Applications International Corporation (SAIC), 1995, *Remedial Investigation Addendum for the St. Louis Site, St. Louis, Missouri*, DOE/OR/21950-132, St. Louis, MO.

U.S Army Corps of Engineers, St. Louis District (CEMVS), 1998, *Record of Decision for the St. Louis Downtown Site, St. Louis, Missouri*, Formerly Utilized Sites Remedial Action Program, St. Louis, MO.

U.S Army Corps of Engineers, St. Louis District (USACE), 1999, *Background Soils Characterization Report for St. Louis Downtown Site, St. Louis, Missouri*, Formerly Utilized Sites Remedial Action Program, St. Louis, MO.

U.S. Department of Defense (DoD) et al., 2000, *Multi-Agency Radiation Survey and Site Investigation Manual, NUREG-157, Revision 1, EPA 402-R-97-016, Revision 1, DOE/EH-0624, Revision 1*.

TABLE

Table 2-1
Heintz Steel and Manufacturing Vicinity Property
Pre-Design Investigation Summary of Radionuclide COC Analytical Results for Walkover, Near-Surface, and Class 2 Samples With
Radiological Contamination
Page 1 of 1

Sample Location	Sample ID	Collection Date	Start Depth (ft ¹ bgs ²)	End Depth (ft bgs)	Thickness of Cover Material (ft)	Parameter	Result ³ (pCi/g) ⁴	Error	Detection Limit (pCi/g)	Sum of Ratios Value ⁵
SLD06515	SLD06515	12/9/00	0	0.5	0	RADIUM-226	3.74	0.19	0.08	1.01
						RADIUM-228	1.20	0.12	0.11	
						THORIUM-230	5.06	1.49	0.44	
						THORIUM-232	2.52	0.94	0.17	
						URANIUM-238	4.48	1.62	4.29	
SLD06551	SLD06551	11/29/00	0	0.5	0	RADIUM-226	3.00	0.19	0.07	2.49
						RADIUM-228	0.72	0.11	0.10	
						THORIUM-230	13.46	2.88	0.14	
						THORIUM-232	1.30	0.57	0.26	
						URANIUM-238	7.00	2.82	6.12	
SLD06591	SLD06591	11/29/00	0	0.5	0	RADIUM-226	4.57	0.26	0.09	9.36
						RADIUM-228	1.04	0.13	0.12	
						THORIUM-230	46.02	14.46	14.81	
						THORIUM-232	1.04	0.13	0.12	
						URANIUM-238	27.54	2.80	5.40	
HTZ00262	HTZ00262	10/11/00	0	0.5	NA ⁶	RADIUM-226	4.71	0.24	0.1	9.99
						RADIUM-228	1.25	0.13	0.13	
						THORIUM-230	42.44	25.53	31	
						THORIUM-232	1.25	0.13	0.13	
						URANIUM-238	92.96	7.55	5.07	
HTZ00258	HTZ00258	10/11/00	0	0.5	NA	RADIUM-226	3.64	0.19	0.08	1.27
						RADIUM-228	0.82	0.1	0.11	
						THORIUM-230	7.74	7.85	14.56	
						THORIUM-232	0.82	0.1	0.11	
						URANIUM-238	6.95	1.59	4.51	

¹ ft - feet

² bgs - below ground surface

³ Analytical data includes background values (i.e., concentrations reflect gross radionuclide values)

⁴ pCi/g - Picocuries per gram

⁵ Prior to calculating the SOR, background values for each radionuclide were subtracted from their respective gross radionuclide values.

Background Values:

- Radium-226=2.80 pCi/g
- Radium-228=0.95 pCi/g
- Thorium-230=1.90 pCi/g
- Thorium-232=0.95 pCi/g
- Uranium-238=1.40 pCi/g

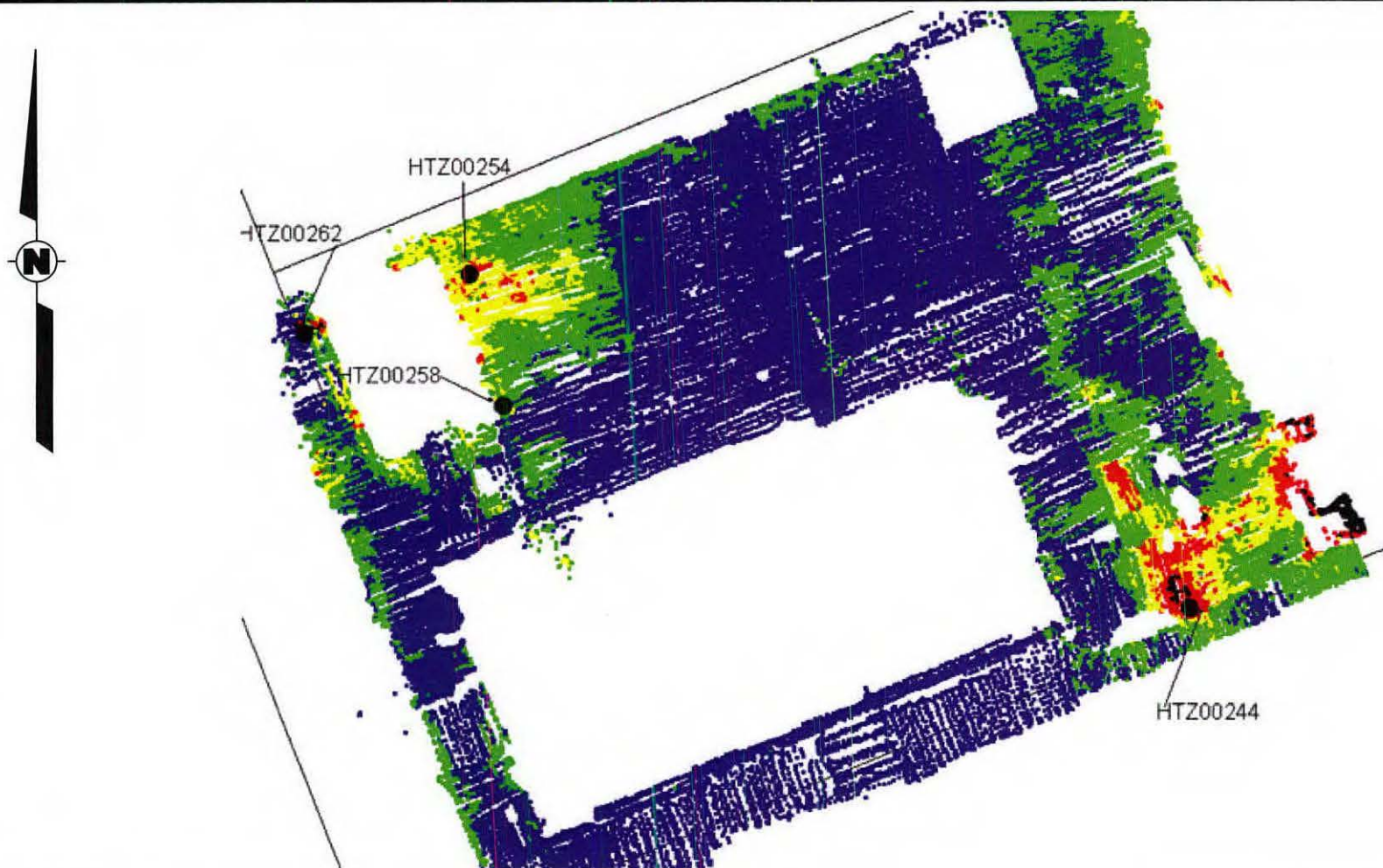
⁶NA-Information not available

FIGURES

O:\Project\775575\Hientz Steel (Steele & Hubbard)\775575A57.dwg
 Plot Date/Time: 02/27/02 08:51am Image: HEINTZSTEEL
 Format Revised: 12/15/99 Xref: HEINTZSTEEL_1

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
PGH	B.B.O'Connor	1-15-01	D.V. Jones	2/12/01

DRAWING NUMBER 775575-A57



LEGEND:

Counts per Minute (CPM)

- 0 - 8000
- 8001 - 11000
- 11001 - 13000
- 13001 - 16000
- 16001 - 100000

HTZ00244 ● WALKOVER SAMPLE

SOURCE: SAIC, MODIFIED BY IT CORPORATION



FUSRAP

U.S. ARMY CORPS OF ENGINEERS
 KANSAS CITY DISTRICT (CENWK)
 ST. LOUIS DISTRICT (CEMVS)

FIGURE HS-1

WALKOVER SURVEY DATA
 HEINTZ STEEL AND MANUFACTURING VICINITY PROPERTY (DT-6)
 ST. LOUIS DOWNTOWN SITE
 ST. LOUIS, MISSOURI

THIS DRAWING NOT TO SCALE

DRAWING NUMBER 775575-E152

PLANT No. 5

ANGELRODT STREET

HALL STREET

BUCHANAN STREET

GUNTHER SALT - NORTH
VICINITY PROPERTY
(DT-4)

AMEREN/UE
VICINITY PROPERTY
(DT-5)

THOMAS AND PROETZ
LUMBER COMPANY
VICINITY PROPERTY
(DT-10)

HEINTZ STEEL
AND MANUFACTURING
VICINITY PROPERTY
(DT-6)

MIDWEST WASTE
VICINITY PROPERTY
(DT-7)

GUNTHER SALT - SOUTH
VICINITY PROPERTY
(DT-4)

TERMINAL RAILROAD
ASSOCIATION
VICINITY PROPERTY
(DT-9)

LEGEND:

- AS022 EXISTING BORING LOCATION
- E1700N984 EXISTING BORING LOCATION WITH RADIOLOGICAL RESULT ABOVE SUM OF RATIO (SOR)
- SLD06594 CLASS 2 BORING LOCATION
- SLD05264 NEAR-SURFACE SAMPLE LOCATION
- HTZ00244 WALKOVER SAMPLE LOCATION
- STUDY BOUNDARY
- PROPERTY BOUNDARY
- 0.5 RADIOLOGICAL CONTAMINATION DEPTH CONTOUR (BGS)
- CLASS 1 AREA
- CLASS 2 AREA
- BUILDING OR STRUCTURE NOT ACCESSIBLE FOR SAMPLING

SCALE
0 30 60 90 FEET

Revisions			
Symbol	Descriptions	Date	Approved



Designed by:
B. Kellman
Drawn by:
A. Smith

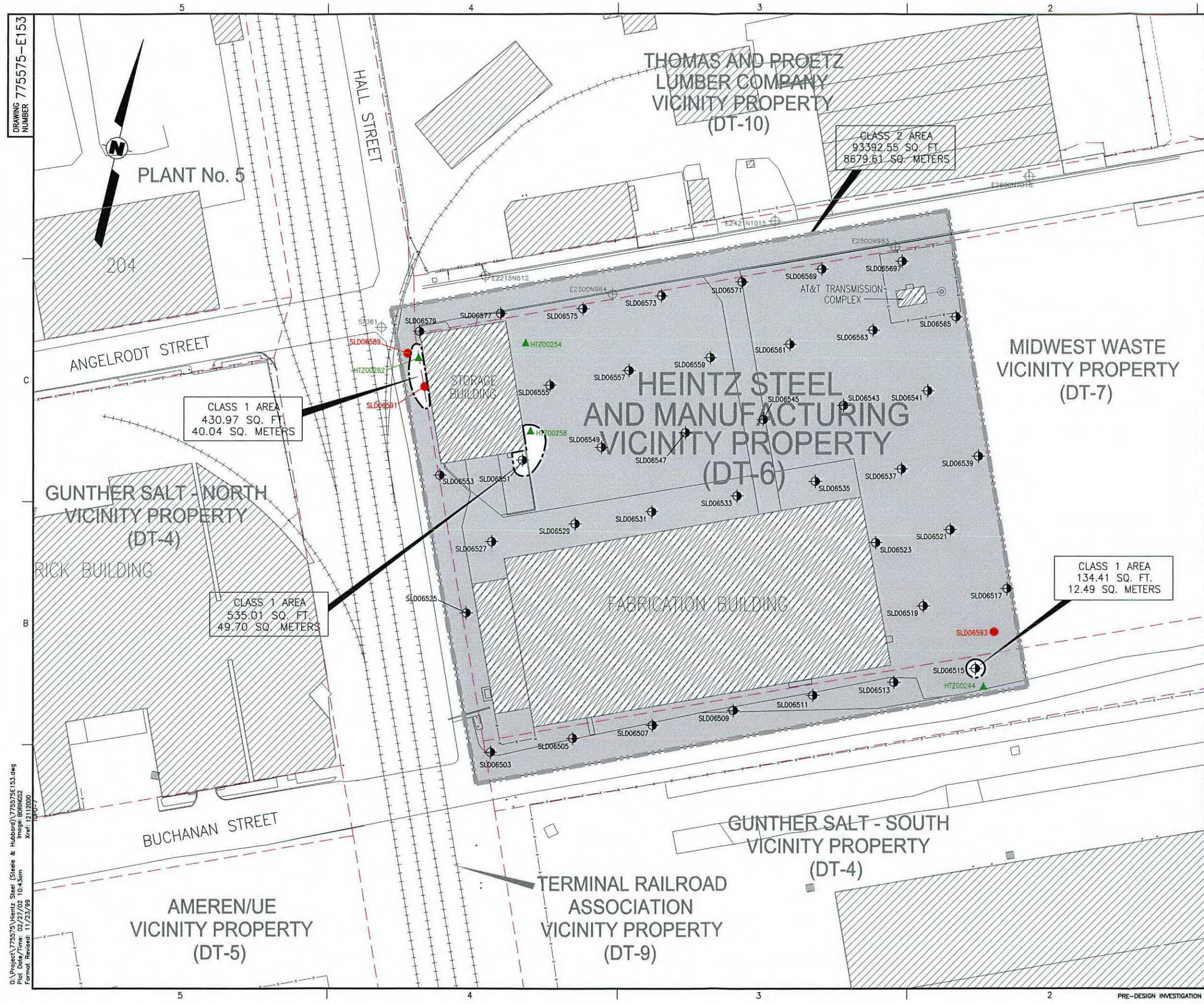
Checked by:
B. Kellman
Approved by:
K. Beach



RADIOLOGICAL CONTAMINATION DEPTH
CONTOURS AND BORING LOCATIONS
HEINTZ STEEL AND MANUFACTURING VICINITY PROPERTY (DT-6)
ST. LOUIS DOWNTOWN SITE
ST. LOUIS, MISSOURI

Scale: AS SHOWN
Date: 2/12/01
Drawing Number: 775575-E152
Sheet reference number:
FIGURE HS-2
Contract No.
DACW41-98-D-9006

DRAWING
NUMBER 775575-E153



LEGEND:

- AS022: EXISTING BORING LOCATION
- E1700N984: EXISTING BORING LOCATION WITH RADIOLOGICAL RESULT ABOVE SUM OF RATIO (SOR)
- SLD06594: CLASS 2 BORING LOCATION
- SLD05264: NEAR-SURFACE SAMPLE LOCATION
- HTZ00244: WALKOVER SAMPLE LOCATION
- : STUDY BOUNDARY
- - - : PROPERTY BOUNDARY
- - - : CLASS 1/CLASS 2 AREA BOUNDARY
- : CLASS 1 AREA
- : CLASS 2 AREA
- ▨: BUILDING OR STRUCTURE NOT ACCESSIBLE FOR SAMPLING



Revisions			
Symbol	Descriptions	Date	Approved

IT CORPORATION

FUSRAP
U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

Designed by:
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Scale: AS SHOWN
Date: 2/12/01
Drawing Number: 775575-E153

Sheet reference number:
FIGURE HS-3
Contract No.
DACW41-98-D-9006

CLASS 1 AND 2 AREAS
HEINTZ STEEL AND MANUFACTURING VICINITY PROPERTY (DT-6)
ST. LOUIS DOWNTOWN SITE
ST. LOUIS, MISSOURI

D:\Project\775575\Heintz Steel (Steele & Hubbard)\775575E153.dwg
Plot Date/Time: 02/12/01 10:43am
Format: Revise: 11/23/99 Xref: 11/23/99

ATTACHMENT

Attachment 1
Heintz Steel and Manufacturing Vicinity Property
Pre-Design Investigation Radiological Data
Page 1 of 6

Sample Location	Sample ID	Collection Date	Start Depth (ft' bgs ²)	End Depth (ft bgs)	Thickness of Cover Material (ft)	Parameter	Result ³ (pCi/g) ⁴	Error	Detection Limit (pCi/g)	Sum of Ratios Value ⁵
SLD06515	SLD06515	12/5/00	0	0.5	0	ACTINIUM-227	0.34	0.12	0.24	1.01
						AMERICIUM-241	0.06	0.11	0.16	
						CESIUM-137	0.03	0.03	0.04	
						PROTACTINIUM-231	-0.06	0.73	1.13	
						POTASSIUM-40	10.36	1.23	0.38	
						RADIUM-226	3.74	0.19	0.08	
						RADIUM-228	1.20	0.12	0.11	
						THORIUM-228	1.74	0.75	0.33	
						THORIUM-230	5.06	1.49	0.44	
						THORIUM-232	2.52	0.94	0.17	
						URANIUM-235	0.26	0.21	0.26	
						URANIUM-238	4.48	1.62	4.29	
SLD06515	SLD06516	12/5/00	1.5	2		ACTINIUM-227	0.06	0.13	0.19	0.16
						AMERICIUM-241	0.06	0.08	0.12	
						CESIUM-137	0.01	0.02	0.03	
						PROTACTINIUM-231	0.05	0.60	0.94	
						POTASSIUM-40	8.16	1.04	0.33	
						RADIUM-226	2.21	0.12	0.06	
						RADIUM-228	0.79	0.09	0.09	
						THORIUM-228	0.96	0.52	0.49	
						THORIUM-230	4.08	1.20	0.28	
						THORIUM-232	0.65	0.40	0.28	
						URANIUM-235	0.18	0.22	0.21	
						URANIUM-238	1.97	1.11	4.91	
SLD06551	SLD06551	11/29/00	0	0.5	0	ACTINIUM-227	0.71	0.15	0.24	2.49
						AMERICIUM-241	-0.03	0.24	0.37	
						CESIUM-137	0.06	0.03	0.04	
						PROTACTINIUM-231	0.94	0.84	1.34	
						POTASSIUM-40	9.66	1.22	0.33	
						RADIUM-226	3.00	0.19	0.07	
						RADIUM-228	0.72	0.11	0.10	
						THORIUM-228	0.91	0.48	0.35	
						THORIUM-230	13.46	2.88	0.14	
						THORIUM-232	1.30	0.57	0.26	
						URANIUM-235	0.44	0.18	0.27	
						URANIUM-238	7.00	2.82	6.12	
SLD06551	SLD06552	11/29/00	1.5	2		ACTINIUM-227	0.70	0.17	0.25	0.97
						AMERICIUM-241	-0.12	0.29	0.44	
						CESIUM-137	0.01	0.03	0.04	
						PROTACTINIUM-231	0.83	0.72	1.34	
						POTASSIUM-40	8.35	1.20	0.41	
						RADIUM-226	2.90	0.18	0.08	
						RADIUM-228	1.03	0.13	0.11	
						THORIUM-228	1.14	0.52	0.30	
						THORIUM-230	7.36	1.75	0.25	
						THORIUM-232	1.05	0.49	0.14	
						URANIUM-235	1.66	0.28	0.32	
						URANIUM-238	31.31	4.34	4.72	

Attachment 1
Heintz Steel and Manufacturing Vicinity Property
Pre-Design Investigation Radiological Data
Page 2 of 6

Sample Location	Sample ID	Collection Date	Start Depth (ft ¹ bgs ²)	End Depth (ft bgs)	Thickness of Cover Material (ft)	Parameter	Result ³ (pCi/g) ⁴	Error	Detection Limit (pCi/g)	Sum of Ratios Value ⁵
SLD06589	SLD06589	11/29/00	0	0.5	0	ACTINIUM-227	0.06	0.06	0.09	0.00
						AMERICIUM-241	0.01	0.02	0.03	
						CESIUM-137	0.01	0.01	0.01	
						PROTACTINIUM-231	0.15	0.21	0.43	
						POTASSIUM-40	4.78	0.56	0.13	
						RADIUM-226	0.57	0.04	0.02	
						RADIUM-228	0.14	0.03	0.04	
						THORIUM-228	0.14	0.03	0.04	
						THORIUM-230	0.52	1.76	2.80	
						THORIUM-232	0.14	0.03	0.04	
						URANIUM-235	0.04	0.06	0.09	
						URANIUM-238	0.51	0.32	1.96	
SLD06589	SLD06590	11/29/00	1.5	2		ACTINIUM-227	0.19	0.14	0.20	0.05
						AMERICIUM-241	0.03	0.04	0.06	
						CESIUM-137	0.00	0.02	0.03	
						PROTACTINIUM-231	0.27	0.54	0.84	
						POTASSIUM-40	11.28	1.25	0.28	
						RADIUM-226	2.26	0.14	0.05	
						RADIUM-228	0.81	0.10	0.07	
						THORIUM-228	0.81	0.10	0.07	
						THORIUM-230	0.91	3.91	6.16	
						THORIUM-232	0.81	0.10	0.07	
						URANIUM-235	0.25	0.13	0.17	
						URANIUM-238	3.77	0.79	3.37	
SLD06591	SLD06591	11/29/00	0	0.5	0	ACTINIUM-227	4.17	0.33	0.31	9.36
						AMERICIUM-241	0.07	0.09	0.15	
						CESIUM-137	0.15	0.04	0.05	
						PROTACTINIUM-231	5.32	1.26	1.47	
						POTASSIUM-40	7.81	1.11	0.46	
						RADIUM-226	4.57	0.26	0.09	
						RADIUM-228	1.04	0.13	0.12	
						THORIUM-228	1.04	0.13	0.12	
						THORIUM-230	46.02	14.46	14.81	
						THORIUM-232	1.04	0.13	0.12	
						URANIUM-235	2.33	0.36	0.38	
						URANIUM-238	27.54	2.80	5.40	
SLD06591	SLD06592	11/29/00	1.5	2		ACTINIUM-227	0.33	0.22	0.35	0.33
						AMERICIUM-241	-0.01	0.07	0.11	
						CESIUM-137	-0.04	0.03	0.04	
						PROTACTINIUM-231	0.16	0.89	1.40	
						POTASSIUM-40	8.93	1.33	0.50	
						RADIUM-226	2.20	0.15	0.10	
						RADIUM-228	1.05	0.14	0.12	
						THORIUM-228	1.05	0.14	0.12	
						THORIUM-230	9.49	8.16	10.05	
						THORIUM-232	1.05	0.14	0.12	
						URANIUM-235	0.37	0.24	0.32	
						URANIUM-238	5.71	1.29	5.55	

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SLD06593	SLD06593	11/29/00	0	0.5	0	ACTINIUM-227	0.33	0.16	0.24	0.83
						AMERICIUM-241	0.06	0.04	0.07	
						CESIUM-137	-0.02	0.02	0.03	
						PROTACTINIUM-231	0.18	0.64	0.98	
						POTASSIUM-40	8.96	1.07	0.34	
						RADIUM-226	3.80	0.21	0.06	
						RADIUM-228	0.99	0.10	0.09	
						THORIUM-228	1.48	0.68	0.29	
						THORIUM-230	5.16	1.42	0.29	
						THORIUM-232	1.59	0.66	0.15	
						URANIUM-235	0.34	0.18	0.21	
						URANIUM-238	3.70	0.77	4.27	
SLD06593	SLD06594	11/29/00	1.8	2		ACTINIUM-227	0.34	0.15	0.24	0.08
						AMERICIUM-241	0.05	0.04	0.07	
						CESIUM-137	0.02	0.02	0.03	
						PROTACTINIUM-231	-0.02	0.64	0.97	
						POTASSIUM-40	7.67	1.00	0.36	
						RADIUM-226	2.24	0.14	0.06	
						RADIUM-228	0.99	0.11	0.08	
						THORIUM-228	0.99	0.11	0.08	
						THORIUM-230	3.05	3.95	6.69	
						THORIUM-232	0.99	0.11	0.08	
						URANIUM-235	0.23	0.15	0.21	
						URANIUM-238	1.62	0.67	4.65	
HTZ00244	HTZ00244	10/11/00	0	0.5	NA ⁶	ACTINIUM-227	0.44	0.14	0.22	0.83
						AMERICIUM-241	0.05	0.05	0.09	
						CESIUM-137	-0.01	0.02	0.04	
						PROTACTINIUM-231	0.97	0.76	1.19	
						POTASSIUM-40	11.12	1.28	0.41	
						RADIUM-226	5.58	0.29	0.07	
						RADIUM-228	1.44	0.13	0.11	
						THORIUM-228	1.44	0.13	0.11	
						THORIUM-230	5.08	6.17	8.54	
						THORIUM-232	1.44	0.13	0.11	
						URANIUM-235	0.65	0.23	0.24	
						URANIUM-238	6.40	1.06	4.93	
HTZ00244	HTZ00245	10/11/00	0.5	1		ACTINIUM-227	0.40	0.18	0.27	0.18
						AMERICIUM-241	0.04	0.05	0.08	
						CESIUM-137	0.00	0.02	0.04	
						PROTACTINIUM-231	-0.32	1.00	1.07	
						POTASSIUM-40	11.01	1.30	0.39	
						RADIUM-226	3.03	0.18	0.07	
						RADIUM-228	1.38	0.13	0.09	
						THORIUM-228	1.38	0.13	0.09	
						THORIUM-230	3.55	5.27	7.20	
						THORIUM-232	1.38	0.13	0.09	
						URANIUM-235	0.27	0.19	0.21	
						URANIUM-238	3.61	0.83	4.40	

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HTZ00254	HTZ00254	10/11/00	0	0.5	NA	ACTINIUM-227	0.32	0.13	0.19	0.07
						AMERICIUM-241	0.04	0.02	0.06	
						CESIUM-137	0.14	0.03	0.03	
						PROTACTINIUM-231	0.23	0.51	0.79	
						POTASSIUM-40	7.08	0.85	0.27	
						RADIUM-226	2.53	0.15	0.05	
						RADIUM-228	0.63	0.07	0.07	
						THORIUM-228	0.63	0.07	0.07	
						THORIUM-230	2.17	3.98	5.57	
						THORIUM-232	0.63	0.07	0.07	
						URANIUM-235	0.24	0.13	0.17	
						URANIUM-238	2.73	0.50	3.17	
HTZ00254	HTZ00255	10/11/00	0.5	1		ACTINIUM-227	0.27	0.12	0.18	0.24
						AMERICIUM-241	0.01	0.03	0.05	
						CESIUM-137	0.07	0.02	0.02	
						PROTACTINIUM-231	0.39	0.47	0.73	
						POTASSIUM-40	7.36	0.84	0.23	
						RADIUM-226	2.58	0.14	0.04	
						RADIUM-228	0.70	0.08	0.06	
						THORIUM-228	0.70	0.08	0.06	
						THORIUM-230	5.11	4.16	4.92	
						THORIUM-232	0.70	0.08	0.06	
						URANIUM-235	0.18	0.11	0.16	
						URANIUM-238	2.94	0.55	3.01	
HTZ00254	HTZ00256	10/11/00	1	1.5		ACTINIUM-227	0.50	0.16	0.23	0.10
						AMERICIUM-241	0.03	0.04	0.06	
						CESIUM-137	0.01	0.02	0.03	
						PROTACTINIUM-231	-0.08	0.60	0.89	
						POTASSIUM-40	11.92	1.27	0.33	
						RADIUM-226	3.36	0.19	0.06	
						RADIUM-228	1.15	0.11	0.08	
						THORIUM-228	1.15	0.11	0.08	
						THORIUM-230	2.37	4.53	6.23	
						THORIUM-232	1.15	0.11	0.08	
						URANIUM-235	0.27	0.16	0.21	
						URANIUM-238	3.87	0.77	3.69	
HTZ00254	HTZ00257	10/11/00	1.5	2		ACTINIUM-227	0.04	0.15	0.23	0.00
						AMERICIUM-241	0.07	0.08	0.14	
						CESIUM-137	0.00	0.02	0.04	
						PROTACTINIUM-231	0.80	0.80	1.07	
						POTASSIUM-40	9.96	1.17	0.31	
						RADIUM-226	2.28	0.13	0.06	
						RADIUM-228	0.90	0.11	0.11	
						THORIUM-228	0.90	0.11	0.11	
						THORIUM-230	1.03	7.12	11.21	
						THORIUM-232	0.90	0.11	0.11	
						URANIUM-235	0.17	0.13	0.23	
						URANIUM-238	1.29	1.15	4.59	

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HTZ00258	HTZ00258	10/11/00	0	0.5	NA	ACTINIUM-227	0.88	0.16	0.23	1.27
						AMERICIUM-241	0.06	0.14	0.17	
						CESIUM-137	0.08	0.03	0.04	
						PROTACTINIUM-231	1.34	0.85	1.34	
						POTASSIUM-40	8.21	1.03	0.43	
						RADIUM-226	3.64	0.19	0.08	
						RADIUM-228	0.82	0.10	0.11	
						THORIUM-228	0.82	0.10	0.11	
						THORIUM-230	7.74	7.85	14.56	
						THORIUM-232	0.82	0.10	0.11	
						URANIUM-235	0.57	0.21	0.26	
						URANIUM-238	6.95	1.59	4.51	
HTZ00258	HTZ00259	10/11/00	0.5	1		ACTINIUM-227	0.70	0.20	0.26	0.20
						AMERICIUM-241	0.06	0.12	0.18	
						CESIUM-137	0.12	0.04	0.04	
						PROTACTINIUM-231	0.03	0.83	1.29	
						POTASSIUM-40	9.79	1.18	0.45	
						RADIUM-226	4.15	0.22	0.09	
						RADIUM-228	1.09	0.13	0.12	
						THORIUM-228	1.09	0.13	0.12	
						THORIUM-230	-1.77	9.64	15.02	
						THORIUM-232	1.09	0.13	0.12	
						URANIUM-235	0.41	0.19	0.28	
						URANIUM-238	6.43	1.71	4.91	
HTZ00258	HTZ00260	10/11/00	1	1.5		ACTINIUM-227	0.33	0.21	0.30	0.20
						AMERICIUM-241	-0.02	0.11	0.17	
						CESIUM-137	0.00	0.03	0.05	
						PROTACTINIUM-231	0.64	0.83	1.33	
						POTASSIUM-40	10.87	1.28	0.42	
						RADIUM-226	3.91	0.20	0.08	
						RADIUM-228	1.21	0.13	0.11	
						THORIUM-228	1.21	0.13	0.11	
						THORIUM-230	-1.61	9.59	14.94	
						THORIUM-232	1.21	0.13	0.11	
						URANIUM-235	0.53	0.19	0.27	
						URANIUM-238	6.73	1.60	6.23	
HTZ00258	HTZ00261	10/11/00	1.5	2		ACTINIUM-227	0.08	0.18	0.28	0.60
						AMERICIUM-241	0.01	0.10	0.16	
						CESIUM-137	0.04	0.03	0.05	
						PROTACTINIUM-231	0.33	0.80	1.28	
						POTASSIUM-40	10.11	1.29	0.39	
						RADIUM-226	3.02	0.17	0.08	
						RADIUM-228	1.17	0.14	0.11	
						THORIUM-228	1.17	0.14	0.11	
						THORIUM-230	10.16	8.43	14.52	
						THORIUM-232	1.17	0.14	0.11	
						URANIUM-235	0.47	0.31	0.29	
						URANIUM-238	3.37	1.23	5.22	

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Sample Location	Sample ID	Collection Date	Start Depth (ft ¹ bgs ²)	End Depth (ft bgs)	Thickness of Cover Material (ft)	Parameter	Result ³ (pCi/g) ⁴	Error	Detection Limit (pCi/g)	Sum of Ratios Value ⁵
HTZ00262	HTZ00262	10/11/00	0	0.5	NA	ACTINIUM-227	14.64	0.67	0.37	9.99
						AMERICIUM-241	0.36	0.24	0.35	
						CESIUM-137	0.05	0.03	0.05	
						PROTACTINIUM-231	14.96	1.44	1.58	
						POTASSIUM-40	8.38	1.04	0.40	
						RADIUM-226	4.71	0.24	0.10	
						RADIUM-228	1.25	0.13	0.13	
						THORIUM-228	1.25	0.13	0.13	
						THORIUM-230	42.44	25.53	31.00	
						THORIUM-232	1.25	0.13	0.13	
						URANIUM-235	6.98	0.58	0.50	
						URANIUM-238	92.96	7.55	5.07	
HTZ00262	HTZ00263	10/11/00	0.5	1		ACTINIUM-227	1.23	0.15	0.22	0.50
						AMERICIUM-241	0.03	0.13	0.18	
						CESIUM-137	0.00	0.02	0.04	
						PROTACTINIUM-231	2.20	1.13	1.30	
						POTASSIUM-40	8.34	0.98	0.30	
						RADIUM-226	2.90	0.15	0.07	
						RADIUM-228	1.08	0.11	0.10	
						THORIUM-228	1.08	0.11	0.10	
						THORIUM-230	-6.24	9.71	15.01	
						THORIUM-232	1.08	0.11	0.10	
						URANIUM-235	1.62	0.23	0.27	
						URANIUM-238	25.52	2.77	4.09	
HTZ00262	HTZ00264	10/11/00	1	1.5		ACTINIUM-227	1.87	0.16	0.20	0.87
						AMERICIUM-241	0.12	0.11	0.17	
						CESIUM-137	0.00	0.02	0.03	
						PROTACTINIUM-231	2.78	0.68	0.95	
						POTASSIUM-40	7.37	0.91	0.28	
						RADIUM-226	2.16	0.12	0.06	
						RADIUM-228	1.02	0.10	0.08	
						THORIUM-228	1.02	0.10	0.08	
						THORIUM-230	9.59	10.20	14.37	
						THORIUM-232	1.02	0.10	0.08	
						URANIUM-235	1.53	0.24	0.25	
						URANIUM-238	19.27	2.20	3.68	
HTZ00262	HTZ00265	10/11/00	1.5	2		ACTINIUM-227	0.56	0.14	0.21	0.49
						AMERICIUM-241	0.00	0.12	0.15	
						CESIUM-137	0.00	0.02	0.04	
						PROTACTINIUM-231	0.38	0.69	1.10	
						POTASSIUM-40	8.89	1.11	0.36	
						RADIUM-226	3.11	0.17	0.07	
						RADIUM-228	1.02	0.11	0.09	
						THORIUM-228	1.02	0.11	0.09	
						THORIUM-230	7.59	7.72	13.14	
						THORIUM-232	1.02	0.11	0.09	
						URANIUM-235	0.68	0.20	0.24	
						URANIUM-238	7.13	1.25	4.31	

¹ ft - feet

² bgs - below ground surface

³ Analytical data includes background values (i.e., concentrations reflect gross radionuclide values)

⁴ pCi/g - Picocuries per gram

⁵ Prior to calculating the SOR, background values for each radionuclide were subtracted from their respective gross radionuclide values.

Background Values:

Radium-226=2.80 pCi/g

Radium-228=0.95 pCi/g

Thorium-230=1.90 pCi/g

Thorium-232=0.95 pCi/g

Uranium-238=1.40 pCi/g

NA⁶-Information not available

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