SGW-35574
Revision 0

Borehole Summary Report for 200-MW-1 Operable Unit Boreholes C5515, C5570, and C5571 Drilled in the 216-A-2 and 216-A-21 Cribs

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

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200-MW-1

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Document Type: RPT Program/Project: S&GRP

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Date Published
December 2009

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Release Approval Date

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Terms

bgs	below ground surface
cpm	counts per minute
dpm	disintegrations per minute
DPT	direct-push technology
FH	Fluor Hanford, Inc.
HEIS	Hanford Environmental Information System
HRLS	high-rate logging system
ID	inside diameter
OD	outside diameter
OU	operable unit
PUREX	Plutonium-Uranium Extraction (Plant)
QA	quality assurance
QC	quality control
RCT	radiological control technician
SAP	sampling and analysis plan
TD	total depth
VOA	volatile organic analysis
VOC	volatile organic compound
WAC	*Washington Administrative Code*

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1 Introduction

This report summarizes the characterization activities conducted during drilling of boreholes C5515, C5570, and C5571 at the 216-A-2 and 216-A-21 Cribs. The cribs are located south of the Plutonium-Uranium Extraction (PUREX) Plant in the Hanford Site's 200 East Area. Figure 1-1 shows the locations of the C5515, C5570, and C5571 boreholes with respect to the 216-A-2 and 216-A-21 Cribs. This report presents geologic and geophysical data to refine the conceptual contaminant distribution model associated with these crib waste sites. Activities conducted at boreholes C5515, C5570, and C5571 were performed in accordance with the *Sampling and Analysis Plan for Supplemental Remedial Investigation Activities at the 216-A-2 Crib and the 216-A-21 Crib* (DOE/RL-2006-77), which provides the detailed sampling design for characterizing the chemical and radioactive contamination and the physical conditions beneath the waste sites. Data collection activities and results presented in this report will be used in the 200-MW-1 Miscellaneous Waste Group Operable Unit (OU) remedial investigation and feasibility study.

All three boreholes were decommissioned after characterization activities were completed. During decommissioning, a subsurface electrical resistivity electrode was installed in borehole C5515 at 44.1 m (144.8 ft) below ground surface (bgs). This electrode probe will be available for measuring subsurface sediment electrical resistivity properties.

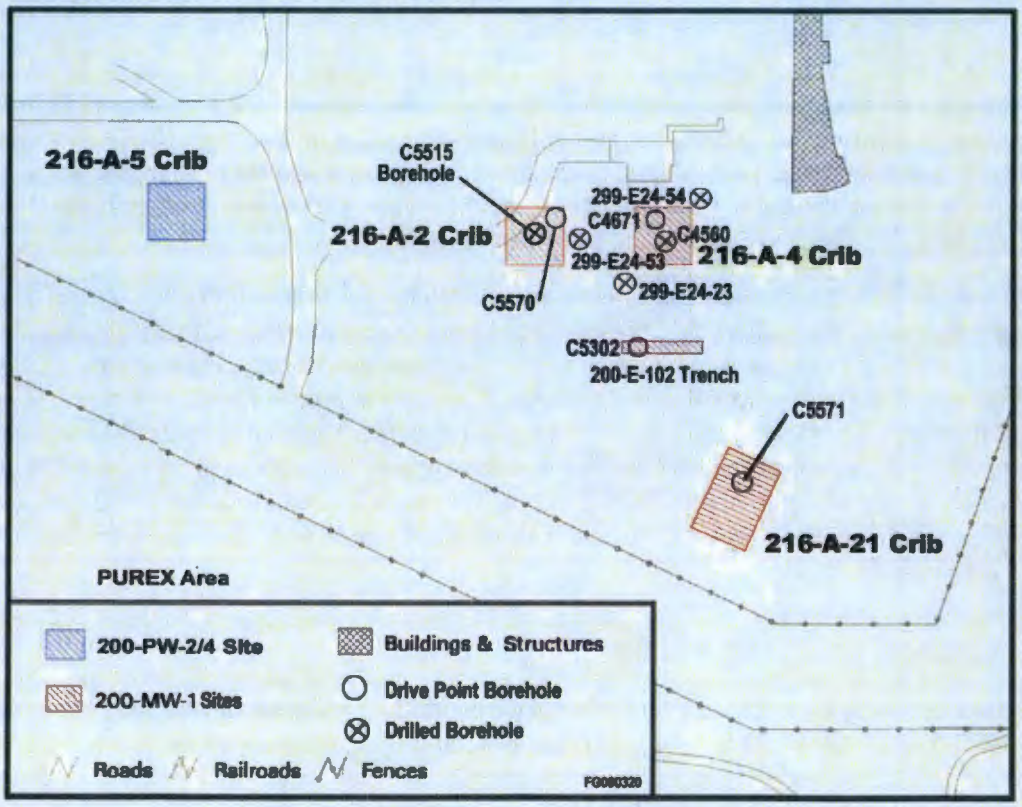


Figure 1-1. Borehole Locations

1.1 Background

1.1.1 216-A-2 Crib

The 216-A-2 Crib is an inactive liquid waste disposal site that operated from January 1956 to January 1963. Approximately 230,000 L (60,760 gal) of liquid waste effluent from the PUREX Plant was discharged to the 216-A-2 Crib. The crib was deactivated by removing a section of effluent piping when the specific retention capacity was reached. The unit was replaced by the 216-A-31 Crib. The 216-A-2 Crib, previously included in the 200-PW-3 Process Waste Group OU, was reassigned to the 200-MW-1 OU during the supplemental data quality objectives process described in sampling and analysis plan (SAP) (DOE/RL-2006-77).

This drain-field-type crib has two 15 cm (6-in.)-diameter, 6.1 m (20-ft) lengths of perforated vitrified clay discharge pipelines that form a cross pattern horizontally 6.4 m (21 ft) below grade. A section of coarse rock, approximately 1.8 m (6 ft) thick, is found at the bottom of the crib. The crib has a volume of 140 m^3 (5,000 ft^3) and it is overlain by sand and gravel backfill. The side slope from grade to 6.4 m (21 ft) is 1:1.5 and from 6.4 to 8.2 m (21 to 27 ft) is 1:2. Only a green, flanged pipe riser (previously used for a vent connection) is visible above the stabilized gravel surface. Figure 1-2 provides a construction sketch of the 216-A-2 Crib. The crib is located within a larger, surface-stabilized underground radioactive material area, known as the "200-E-103 PUREX stabilized area," and is marked with concrete posts.

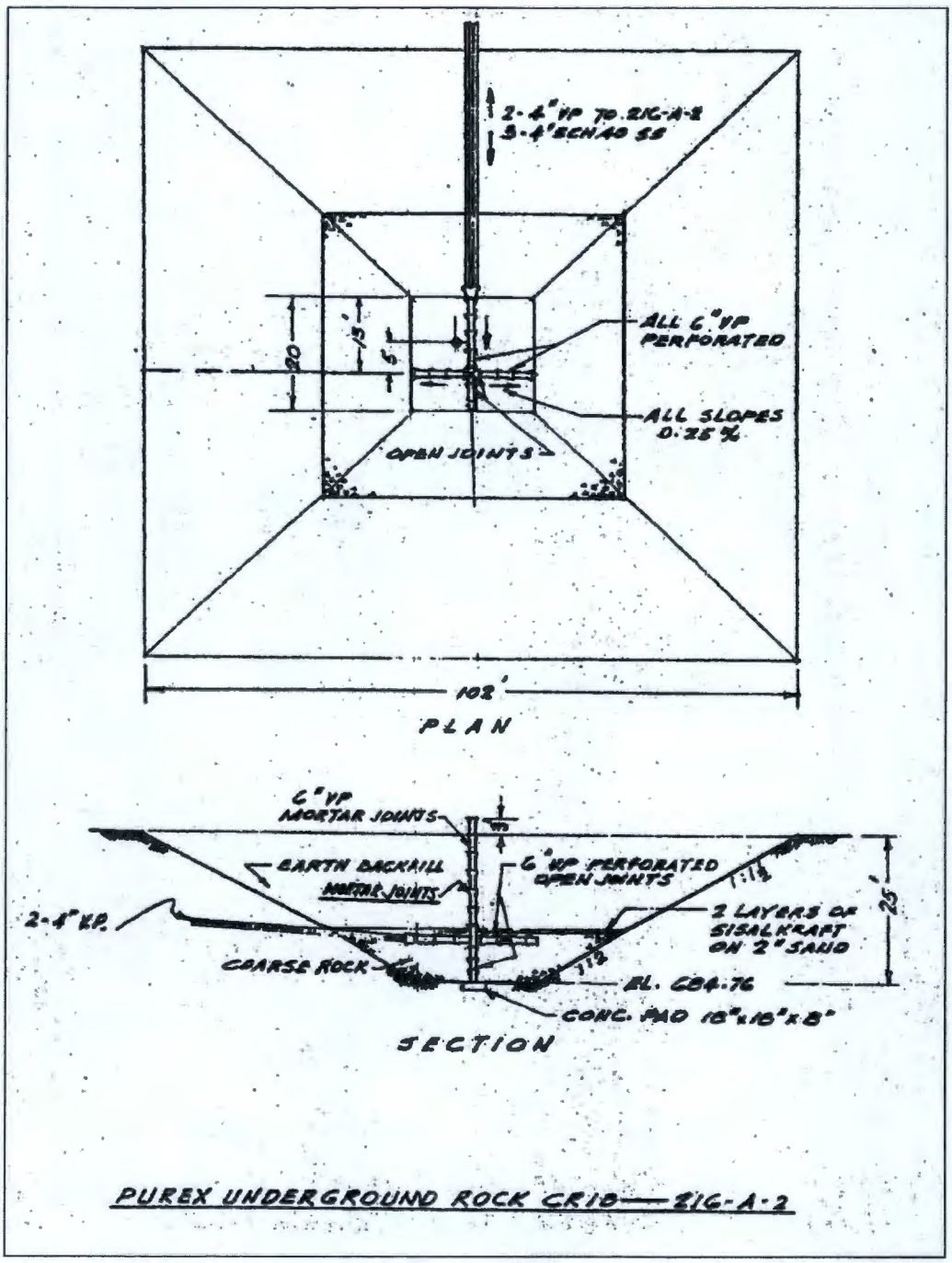
1.1.2 216-A-21 Crib

The 216-A-21 Crib is an inactive liquid waste disposal site that operated from October 1957 to June 1965 and received 77.9 million L (20.6 million gal) of liquid waste effluent from the PUREX Plant. The 216-A-21 Crib replaced the 216-A-4 Crib. When the effluent flow exceeded design capacity, the site was deactivated by sealing the end of the effluent pipeline. The waste stream was rerouted to the 216-A-27 Crib. The 216-A-21 Crib is assigned to the 200-MW-1 OU.

The crib's drain field has lateral dimensions of approximately 18.3 m by 4.9 m (60 ft by 16 ft) and a thickness of 4 m (13 ft), with a side slope of 1:1.5. Before June 1958, effluent was discharged to the unit using a 15.2 cm (6-in.) clay distribution pipe, which failed and was replaced in December 1958 with the existing 10 cm (4-in.) stainless-steel perforated pipe. The effluent pipe is placed horizontally along the length of the unit, 4.3 m (14 ft) below grade. A 680 m^3 (24,000-ft^3) section of coarse rock is found at the bottom of the crib. The crib rock is overlain with backfill gravel that extends to the surface. Figure 1-3 provides a construction sketch of the 216-A-21 Crib. The site is located inside the 200-E-103 PUREX stabilized area, south of the 216-A-4 Crib, and is marked and posted with underground radioactive material area signs.

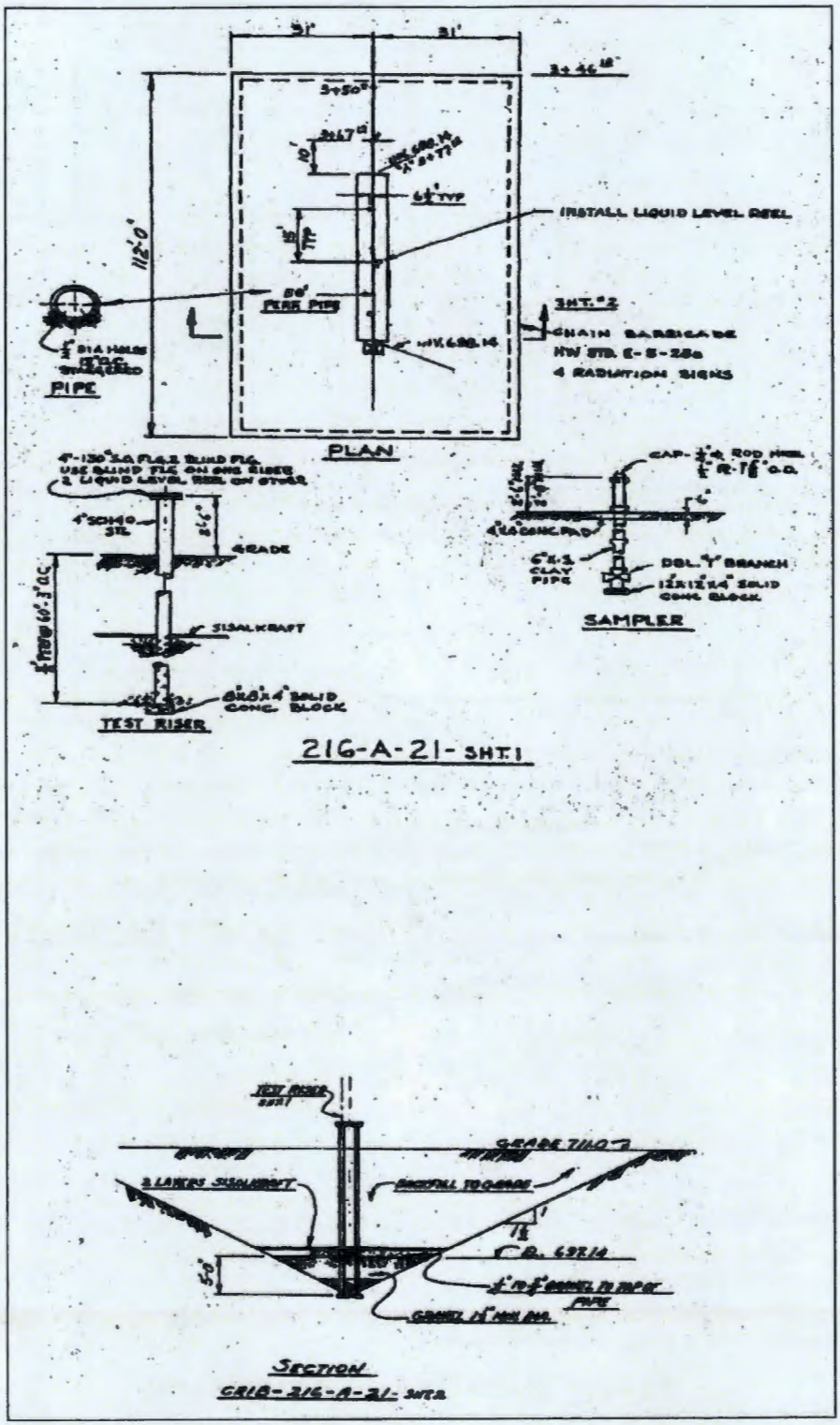
1.2 Summary of Drilling and Sampling Activities

This section discusses the technical data collected during drilling and decommissioning of boreholes C5515, C5570, and C5571. Table 1-1 summarizes general drilling information for the three boreholes. The drilling and sampling depths in this report are provided in both meters and feet. Tables that present borehole data indicate depths in feet only, which was the unit that was used for measurement in the field.



SOURCE: DOE/RL-2006-77, *Sampling and Analysis Plan for Supplemental Remedial Investigation Activities at the 216-A-2 Crib and the 216-A-21 Crib.*

Figure 1-2. Construction Sketch of the 216 A-2 Crib



SOURCE: DOE/RL-2006-77, *Sampling and Analysis Plan for Supplemental Remedial Investigation Activities at the 216-A-2 Crib and the 216-A-21 Crib.*

Figure 1-3. Construction Sketch of the 216 A-21 Crib

Table 1-1. Borehole Drilling Summary

Borehole	Area	Dates		Civil Survey Data for Borehole Location			Total Depth (ft bgs)
		Start	Finish	Northing[a] (m)	Easting[a] (m)	Elevation[b] (Brass Cap) (m)	
C5515	200 East	6/4/07	4/1/08	135530.89	575180.05	218.13	325.0
C5570	200 East	5/2/07	4/1/08	135530.51	575180.02	217.99	35.8
C5571	200 East	7/12/07	9/4/07	135465.01	575216.27	218.41	60.0

a. Measured at the center of the borehole/well in Washington State Plane Coordinates, NAD83(91) (North American Datum of 1983).

b. Measured at the brass survey marker associated with the borehole/well in NAVD88 (North American Vertical Datum of 1988).

bgs = below ground surface

1.2.1 Borehole C5515

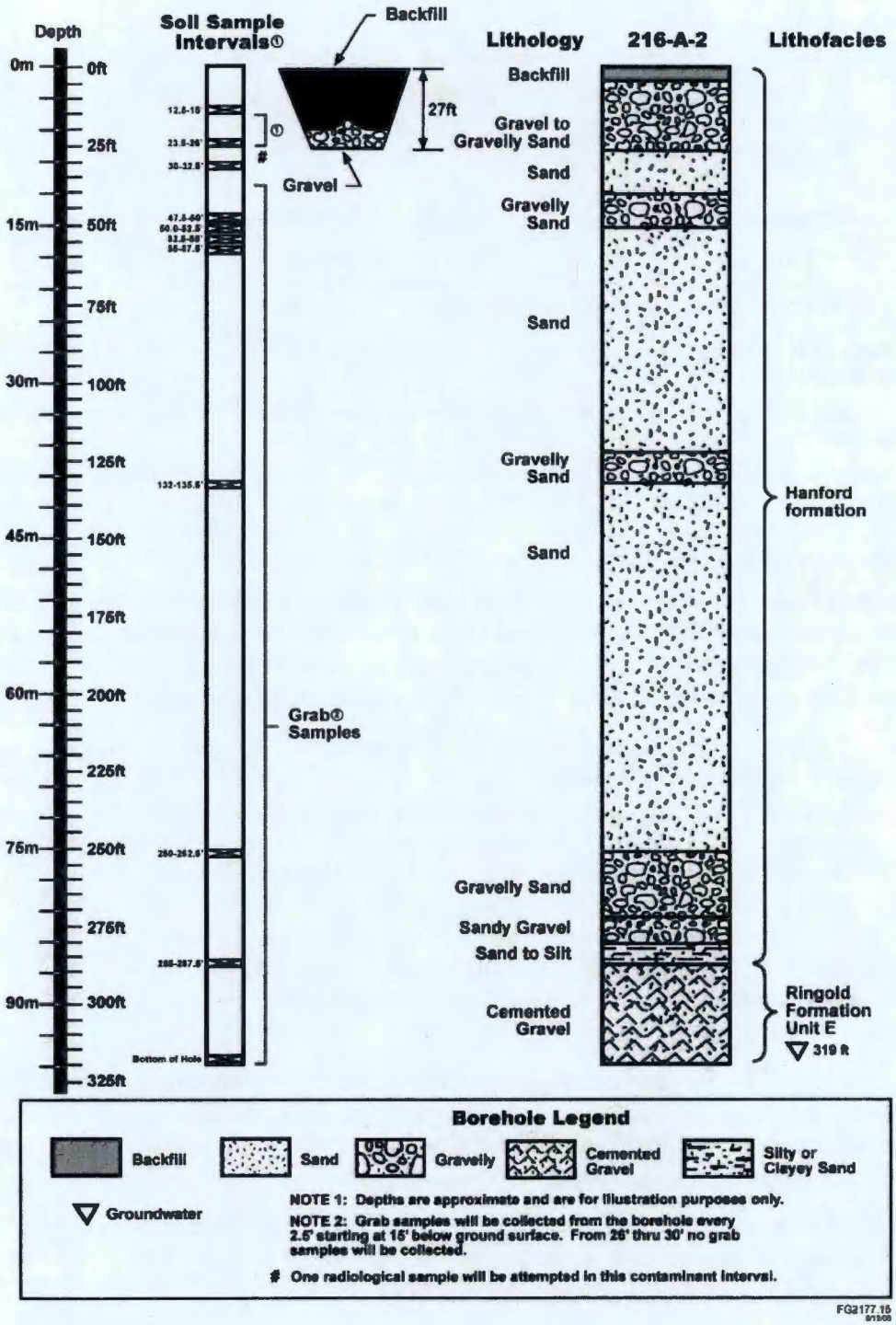
Borehole C5515 penetrated the 216-A-2 Crib and was drilled to a total depth (TD) of 99.1 m (325.0 ft). Drilling began on June 4, 2007. During advancement of the borehole, drill cuttings and samples were surveyed for the presence of radionuclides as part of environmental monitoring (Section 2.5.2). Additionally, the general work area was monitored for volatile organic compounds (VOCs).

Originally, 11 split-spoon soil samples were planned (Figure 1-4); however, 12 split-spoon soil samples were retrieved at modified depths during drilling activities (Section 2.4.1). Ten of the split-spoon soil samples were collected and submitted to laboratories for analysis. One of the 10 samples was submitted only for a radiological activity scan. Two of the targeted split-spoon sample intervals did not recover the quantity of sediment required for analyses; therefore, no samples were obtained. Additionally, 120 grab soil samples were collected during drilling of borehole C5515. Grab samples were submitted to analytical laboratories for analysis. One groundwater sample was collected near the water table, from the bottom of the cased borehole, for laboratory analysis. As described in the SAP (DOE/RL-2006-77), duplicate and split soil samples and liquid quality control (QC) samples (equipment and field blanks) also were obtained for laboratory analysis.

Because the 216-A-2 Crib is known to be radioactively contaminated, full-time radiological monitoring was conducted during borehole activities in the upper portion of the vadose zone. Several different radiation detectors were used for monitoring (see discussion in Section 2.5.2.1). Section 2.6 provides details on the geophysical logging survey conducted at borehole C5515.

Borehole C5515 was decommissioned from TD to ground surface on April 1, 2008. During decommissioning, a high-resolution resistivity electrode was installed from 43.6 m to 44.1 m (143 ft to 144.8 ft) bgs. Section 2.1 provides details of the electrode installation.

Appendices A and B include the well summary sheet and the well construction summary report, respectively. Appendix C provides the borehole log, and Appendix D includes the full geophysical log data report.



SOURCE: DOE/RL-2006-77, *Sampling and Analysis Plan for Supplemental Remedial Investigation Activities at the 216-A-2 Crib and the 216-A-21 Crib.*

Figure 1-4. Planned Sampling Intervals for Borehole C5515

1.2.2 Borehole C5570

As planned in SAP (DOE/RL-2006-77), borehole C5570 was installed within the northeast portion of the 216-A-2 Crib (Figure 1-1) using direct-push technology (DPT) to a TD of 10.9 m (35.8 ft) bgs. Installation began on May 2, 2007. The borehole was advanced using single-walled casing with a removable drive-point tip. Soil samples were not collected, and drill cuttings were not returned during borehole advancement. Section 2.6 provides details on the geophysical logging survey conducted in borehole C5570.

Following the geophysical logging event, the casing was backpulled to 10.6 m (34.7 ft) bgs, and the drive-point tip was removed from the temporary casing. A planned soil vapor sample was then collected from the bottom of borehole C5570 (Section 2.3). This soil vapor sample was analyzed using field screening instruments.

Because the 216-A-2 Crib is known to be radioactively contaminated, full-time radiological monitoring was conducted during vapor sampling and borehole decommissioning activities. Several different radiation detectors were used as part of the monitoring activities and are discussed in Section 2.5.2.

The removable drive-point tip was left in the ground at TD, and borehole C5570 was decommissioned from ground surface to 10.8 m (35.3 ft) bgs in April 2008. Section 2.1.2.2 provides details on the decommissioning.

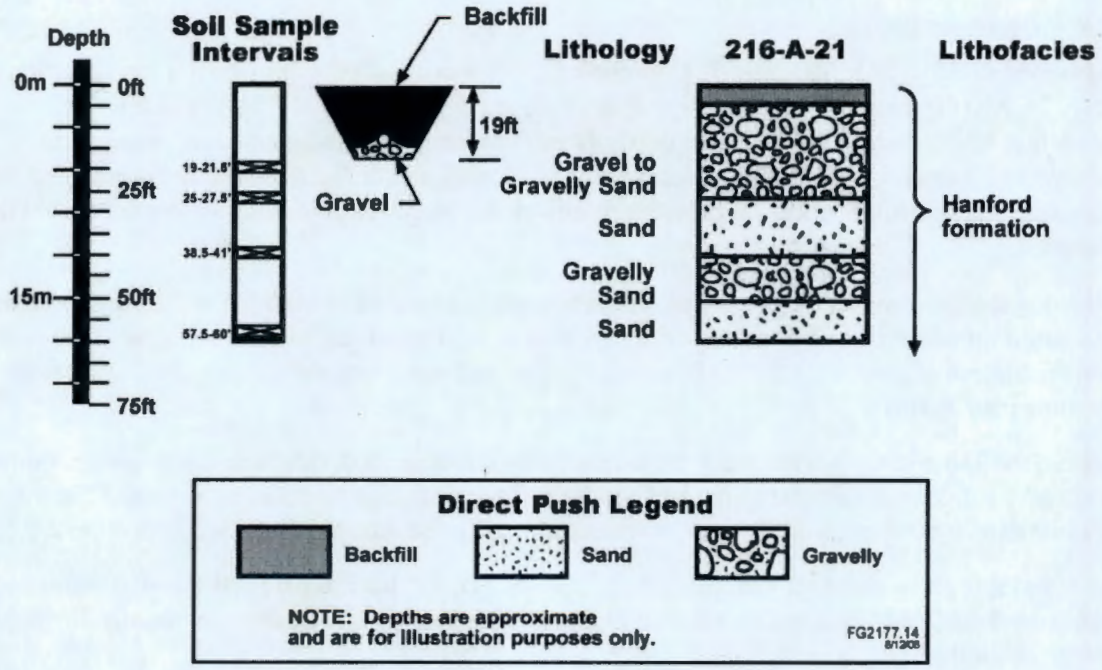
Appendices E and F include the well summary sheet and the well construction summary report, respectively. Appendix G provides the borehole log. A borehole log was not completed because this is a DPT borehole and soil samples could not be collected for lithologic observation.

1.2.3 Borehole C5571

Borehole C5571 was installed using DPT within the 216-A-21 Crib (Figure 1-1) to a TD of 18.3 m (60.0 ft) bgs. Installation began July 12, 2007. Originally, four split-spoon soil samples were planned (Figure 1-5); however, five split-spoon soil samples were collected at modified depths during drilling activities, as described in Section 2.4.2. During sampling, the soil was monitored for the presence of radionuclides (Section 2.5.2.3). All five of the split-spoon soil samples were submitted to the analytical laboratories for analysis.

Because the 216-A-21 Crib is known to be radioactively contaminated, full-time radiological monitoring was conducted during sampling and decommissioning. Several different radiation detectors were used during monitoring activities and are discussed in Section 2.5.2.3. Section 2.6 provides details about the geophysical logging survey conducted at borehole C5571. The borehole was decommissioned from ground surface to the TD in September 2007.

Appendices H and I include the well summary sheet and the well construction summary report, respectively. Appendix J provides the borehole log. Appendix K includes the full geophysical log data report.



SOURCE: DOE/RL-2006-77, *Sampling and Analysis Plan for Supplemental Remedial Investigation Activities at the 216-A-2 Crib and the 216-A-21 Crib.*

Figure 1-5. Planned Sampling Intervals for Borehole C5571

2 Technical Data

This chapter describes the drilling, sampling, waste management, environmental monitoring, and decommissioning activities. Work was performed under the guidelines and requirements presented in Fluor Hanford, Inc. (FH) procedures. Decommissioned borehole C5515, which contains the resistivity electrode, conforms to resource protection well standards as defined in *Washington Administrative Code* (WAC) 173-160, "Minimum Standards for Construction and Maintenance of Wells."

2.1 Drilling

This section provides technical details on the drilling or push methods used. Descriptions of the decommissioning process for boreholes C5515, C5570, and C5571, as well as the electrode installation at borehole C5515, are included in this section. General borehole information is presented in Table 1-1. Additional decommissioning information is located in Appendices A and B (borehole C5515), Appendices E and F (borehole C5570), and Appendices H and I (borehole C5571).

2.1.1 Drilling Methods

2.1.1.1 Borehole C5515

All drilling operations were conducted under medium- to high-risk radiological conditions. Drilling was initiated on June 4, 2007. A Bucyrus-Erie[1] cable-tool drill rig was used to drive a single-wall temporary casing with an outside diameter (OD) of 27.6 cm (10.9 in.) and an inside diameter (ID) of 24.4 cm (9.6 in.). The OD casing was advanced to a final depth of 25.6 m (84.0 ft) bgs on July 26, 2007. Following completion of geophysical logging within the first string of casing, drilling operations resumed using a downsized, single-wall temporary casing with an OD of 21.9 cm (8.6 in.) and an ID of 19.4 cm (7.6 in.). The OD casing was advanced to a final depth of 98.1 m (322.0 ft) bgs on August 22, 2007. The borehole was drilled beyond the bottom of the casing to a TD of 99.1 m (325.0 ft) bgs on August 22, 2007. The borehole would not remain open below a depth of 97.5 m (320.0 ft) bgs due to minor heaving conditions. A second round of borehole geophysical logging was completed on August 23 and 28, 2007, to obtain data for the deeper interval of the borehole. A water sample was collected from TD with a bailer in accordance with the SAP (DOE/RL-2006-77).

2.1.1.2 Borehole C5570

All drilling (casing advancement) operations were conducted under low radiological-risk conditions since the drive tip was kept in place. Installation began on May 2, 2007. A Foremost AP-1000[2] diesel-hammer drill rig was used to drive a single-wall temporary casing with an OD of 16.9 cm (6.6 in.) and an ID of 13.7 cm (5.4 in.). The DPT method included a removable and expendable tip attached to the bottom of the temporary casing. The removable tip was kept in place until the collection of a vapor sample at TD. On May 2, 2007, the OD casing was advanced to a final cased depth of 10.8 m (35.5 ft) bgs, and borehole geophysical logging was completed in the cased borehole. The casing was backpulled on May 3, 2007, to 10.6 m (34.7 ft) bgs, and the removable tip was pushed out below the bottom end of the casing to10.9 m (35.8 ft) bgs. A vapor sampling interval was taken from 10.6 to 10.8 m (34.7 to 35.5 ft) bgs.

1 Bucyrus-Erie® is a registered trademark of Bucyrus International, Inc., South Milwaukee, Wisconsin.
2 Foremost™ and AP-1000™ are trademarks of Foremost Industries, LP, Calgary, Alberta, Canada.

2.1.1.3 Borehole C5571

All drilling operations were conducted under low radiological-risk conditions. Installation began July 12, 2007. A Foremost AP-1000[2] diesel-hammer drill rig was used to drive a single-wall temporary casing with an OD of 17.9 cm (7.1 in.) and an ID of 14.9 cm (5.9 in.). The DPT method also included an inner string of drill rod with a removable tip attached at the bottom in the drive shoe of the temporary casing. This removable tip remained in the drive shoe during drilling, except when it was removed for the collection of split-spoon soil samples. The OD casing was advanced to TD of 18.3 m (60.0 ft) bgs on July 21, 2007. Borehole geophysical logging was completed in the cased borehole from August 1 to 6, 2007.

2.1.2 Borehole Decommissioning

2.1.2.1 Borehole C5515

Borehole C5515 was decommissioned from TD to ground surface. During the decommissioning process, a high-resolution subsurface resistivity electrode was installed from 43.6 to 44.1 m (143.0 to 144.8 ft) bgs, with the associated electrode cables leading to the ground surface. Decommissioning of this borehole was performed between September 12, 2007, and April 1, 2008, in accordance with a facility modification package[3]. Electrode installation and decommissioning summary data are provided in Table 2-1.

The borehole was decommissioned by removing all temporary casing and concurrently emplacing two intervals of 10/20-mesh Colorado silica sand[4], two intervals of 1.0 cm (0.4-in.) bentonite-chip seal, and a concrete-aggregate seal and surface pad. Table 2-1 lists the associated fill intervals. Additionally, a short section of stainless-steel protective casing was installed at the surface to protect the electrode cables, and four protective bollards were installed in the ground, out from the four corners of the concrete surface pad. A brass survey marker was installed in the surface pad and lists the borehole number and the completion date of decommissioning (April 1, 2008).

2.1.2.2 Borehole C5570

Borehole C5570 was decommissioned from TD to ground surface. Decommissioning of this borehole was carried out from January 8 to 15, 2008, and on April 1, 2008. Table 2-2 provides decommissioning summary data.

The borehole was decommissioned by removing all temporary casing and concurrently emplacing a 1.0 cm (0.4-in.) bentonite-chip seal from 0.2 to 10.8 m (0.5 to 35.3 ft) bgs and a concrete aggregate seal from ground surface to 0.2 m (0.5 ft) bgs. A brass survey marker was installed in the concrete aggregate seal and lists the borehole number and the completion date of decommissioning (April 1, 2008).

2.1.2.3 Borehole C5571

Borehole C5571 was decommissioned from borehole TD to ground surface. Decommissioning of this borehole was carried out from August 28 to September 4, 2007. Decommissioning summary data are provided in Table 2-2. The well summary sheet and the well completion summary report, which both contain details for the decommissioned borehole, are presented in Appendices H and I, respectively.

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[3] Facility modification package HNF-FMP-07-35734-R0.

[4] Colorado silica sand® is a registered trademark of Oglebay Norton Industrial Sands, Inc., Pittsburgh, Pennsylvania.

Table 2-1. Electrode Installation and Decommissioning Summary for Borehole C5515

Borehole	Waste Site Operable Unit	Date Decommissioned	Fill Material					Electrode Installation Interval (ft bgs)	Surface Completion
			Lower Sand Pack[a] Interval (ft bgs)	Lower Bentonite Seal[b] Interval (ft bgs)	Electrode Sand Pack[a] Interval (ft bgs)	Upper Bentonite Seal[b] Interval (ft bgs)	Concrete Seal[c] Interval (ft bgs)		
C5515	200-MW-1	4/1/08	308.5 to 320.0	150.0 to 308.5	141.6 to 150.0	0.2 to 141.6	+0.3 (above ground surface) to 0.2	143.0 to 144.8	6-in. stainless-steel protective casing and concrete surface pad[c] with brass survey marker

a. Sand pack consists of 10/20 mesh Colorado silica sand® (registered trademark of Oglebay Norton Industrial Sands, Inc., Pittsburgh, Pennsylvania.).

b. Bentonite seal consists of 0.4-in. bentonite chips.

c. Concrete seal and surface cap consist of pre-mixed concrete aggregate.

bgs = below ground surface

Table 2-2. Decommissioning Summary for Direct-Push Technology Boreholes C5570 and C5571

Borehole	Waste Site Operable Unit	Date Decommissioned	Fill Material			Surface Completion
			Sand Pack[a] Interval (ft bgs)	Bentonite Seal[b] Interval (ft bgs)	Concrete Seal[c,d] Interval (ft bgs)	
C5570	200-MW-1	4/1/08	N/A	0.5 to 35.3	0.0 to 0.5	Concrete surface cap[c] with brass survey marker
C5571	200-MW-1	9/4/07	N/A	0.5 to 60.0	0.0 to 0.5	Concrete surface cap[d] with brass survey marker

NOTE: Expendable drive tip left in ground at C5570 from 13.9 to 10.9 m (35.3 to 35.8 ft) bgs.

a. Sand pack consists of 10/20 mesh Colorado silica sand® (registered trademark of Oglebay Norton Industrial Sands, Inc., Pittsburgh, Pennsylvania).

b. Bentonite seal consists of 0.4-in. bentonite chips.

c. Concrete seal and surface cap at C5570 consist of pre-mixed concrete aggregate.

d. Concrete seal and surface cap at C5571 consist of field-mixed concrete aggregate.

bgs = below ground surface

N/A = not applicable

The borehole was decommissioned by removing all temporary casing and concurrently emplacing a 1.0 cm (0.4-in.) bentonite chip seal from 0.2 to 18.3 m (0.5 to 60.0 ft) bgs and a concrete aggregate seal from ground surface to 0.2 m (0.5 ft) bgs. A brass survey marker was installed in the concrete aggregate seal and lists the borehole number and the completion date of decommissioning (September 4, 2007).

2.2 Waste Management

Waste generated by the installation of boreholes C5515, C5570, and C5571 (including drill cuttings [soil] and miscellaneous solid waste) was managed using the strategy documented in the *Waste Control Plan for the 200-MW-1 Miscellaneous Waste Group Operable Unit* (WMP-20205). The following non-liquid waste streams were generated during field operations to drill and decommission boreholes C5515 and C5571:

- Drill cuttings (soil)
- Potentially contaminated miscellaneous solid waste
- Non-contaminated solid wastes
- Miscellaneous solid waste, which was the only waste stream generated during field operations to drill and decommission borehole C5570.

Purgewater was generated during the bailing and groundwater sampling from borehole C5515, and the purgewater was managed in accordance with the *Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington* (90-ERB-040). The drill cuttings (soil) and potentially contaminated miscellaneous solid waste streams were containerized as investigation-derived waste.

All drill cuttings were classified as low-level waste. More detailed information is provided in the waste control plan (WMP-20205). Table 2-3 contains details regarding the disposition of the soil waste stream portion of the investigation-derived waste from boreholes C5515 and C5571. The miscellaneous solid waste stream portion of the investigation-derived waste is not included in Table 2-3.

Table 2-3. Summary of Investigation-Derived Waste (Soil) from Boreholes C5515 and C5571

Waste Type	CIN	PIN	Borehole	Container Size/Type	Waste Description (ft bgs)
LLW	0035262	MW1-06-050	C5515	55 gal/drum	Soil, 0 to 19.5
LLW	0035263	MW1-06-051	C5515	55 gal/drum	Soil, 19.5 to 28.3
LLW	0037709	MW1-07-002	C5515	55 gal/drum	Soil, 28.3 to 29
LLW	0040289	MW1-07-042	C5515	55 gal/drum	Soil, 29 to 31.5
LLW	0037728	MW1-07-003	C5515	55 gal/drum	Soil 31.5 to 34.5
LLW	0037708	MW1-07-004	C5515	55 gal/drum	Soil, 34.5 to 37.5
LLW	0019423	MW1-07-052	C5515	55 gal/drum	Soil, 37.5 to 40
LLW	0040515	MW1-07-006	C5515	55 gal/drum	Soil, 40 to 43
LLW	0040254	MW1-07-007	C5515	55 gal/drum	Soil, 43 to 47.5
LLW	0040514	MW1-07-008	C5515	55 gal/drum	Soil, 47.5 to 52
LLW	0040255	MW1-07-009	C5515	55 gal/drum	Soil, 52 to 57

Table 2-3. Summary of Investigation-Derived Waste (Soil) from Boreholes C5515 and C5571

Waste Type	CIN	PIN	Borehole	Container Size/Type	Waste Description (ft bgs)
LLW	0037697	MW1-07-015	C5515	55 gal/drum	Soil, 57 t0 60
LLW	0040252	MW1-07-017	C5515	55 gal/drum	Soil, 60 to 67
LLW	0040251	MW1-07-018	C5515	55 gal/drum	Soil, 67 to 70
LLW	0040249	MW1-07-020	C5515	55 gal/drum	Soil, 70 to 73
LLW	0040307	MW1-07-021	C5515	55 gal/drum	Soil, 73 to 81
LLW	0040260	MW1-07-022	C5515	55 gal/drum	Soil, 81 to 86
LLW	0040308	MW1-07-023	C5515	55 gal/drum	Soil, 86 to 96
LLW	0040240	MW1-07-024	C5515	55 gal/drum	Soil, 96 to 103
LLW	0040259	MW1-07-027	C5515	55 gal/drum	Soil, 103 to 117.5
LLW	0040258	MW1-07-026	C5515	55 gal/drum	Soil, 117.5 to 130
LLW	0040233	MW1-07-028	C5515	55 gal/drum	Soil, 130 to 145
LLW	0040197	MW1-07-031	C5515	55 gal/drum	Soil, 145 to 157.5
LLW	0040196	MW1-07-032	C5515	55 gal/drum	Soil, 157.5 to 170
LLW	0040304	MW1-07-033	C5515	55 gal/drum	Soil, 170 to 182
LLW	0040303	MW1-07-034	C5515	55 gal/drum	Soil, 182 to 191.5
LLW	0040262	MW1-07-035	C5515	55 gal/drum	Soil, 191.5 - 200
LLW	0040261	MW1-07-036	C5515	55 gal/drum	Soil, 200 to 214
LLW	0040305	MW1-07-037	C5515	55 gal/drum	Soil, 214 to 230
LLW	0040306	MW1-07-038	C5515	55 gal/drum	Soil, 230 to 244
LLW	0040290	MW1-07-039	C5515	55 gal/drum	Soil, 244 to 253
LLW	0040182	MW1-07-041	C5515	55 gal/drum	Soil, 253 to 264.5
LLW	0037281	MW1-07-043	C5515	55 gal/drum	Soil, 264.5 to 275
LLW	0036116	MW1-07-045	C5515	55 gal/drum	Soil, 275.5 to 292
LLW	0036089	MW1-07-046	C5515	55 gal/drum	Soil, 292 to 300
LLW	0040521	MW1-07-044	C5515	55 gal/drum	Soil, 300 to 319
LLW	0037340	MW1-07-847	C5515	55 gal/drum	Soil, 319 to 350
LLW	0037339	MW1-07-852	C5515	55 gal/drum	Soil, 350 to 360
LLW	0040253	MW1-07-012	C5571	55 gal/drum	Soil, 0 to 60

Table 2-3. Summary of Investigation-Derived Waste (Soil) from Boreholes C5515 and C5571

Waste Type	CIN	PIN	Borehole	Container Size/Type	Waste Description (ft bgs)

bgs = below ground surface

CIN = container identification number (scannable barcode)

LLW = low-level waste

PIN = primary (drum) identification number (written number)

2.3 Field Screening

Field screening at borehole C5570 consisted of field analysis of one planned soil vapor sample. Field screening activities were not conducted for boreholes C5515 and C5571.

The soil vapor sample was collected on May 7, 2007, with a displacement pump from the open interval of 10.6 to 10.8 m (34.7 to 35.5 ft) bgs. The sample was analyzed using field screening methods (Table 2-4). It should be noted that the open borehole interval was isolated with an inflatable packer set at 9.9 m (32.5 ft) bgs. Tygon[5] tubing was inserted into the borehole, attached through the inflatable packer, with the displacement pump located at the surface. After the Tygon tubing and the isolated portion of the borehole were purged for approximately 50 minutes, the soil vapor sample was captured in four 12 L (3.2-gal) Tedlar[6] sampling bags.

The soil vapor sample was analyzed using the MIRAN SapphIRe ambient air analyzer[7] (MIRAN analyzer), which identifies up to five compounds with the highest concentrations in the vapor sample from a library of more than 100 VOCs. Field analytical results for the soil vapor sample are provided in Table 2-4.

2.4 Sampling for Laboratory Analysis

2.4.1 Borehole C5515

A total of 132 soil samples (12 split spoon and 120 grab) were collected from borehole C5515 for laboratory analysis (Table 2-5). Ten of the soil samples were collected with a 10 cm (4-in.)-diameter split spoon. Two additional split-spoon sampling attempts were made but a sample was not obtained due to the lack of an expected silt layer in either of the two split-spoon samples following retrieval. Each split-spoon sample was collected using four, 0.15 m (0.5-ft)-long, stainless-steel liners, in a 0.6 m (2-ft)-long split spoon (not including the drive shoe length). The remaining 120 soil samples were collected as grab samples from the soil brought to the surface with the drive barrel.

5 Tygon™ is a trademark of Norton Performance Plastics Corporation, a Saint-Gobain Company, Akron, Ohio.
6 Tedlar® is a registered trademark of E. I. du Pont de Nemours and Company, Wilmington, Delaware.
7 MIRAN® and SapphIRe® are registered trademarks of Thermo Scientific, Waltham, Massachusetts.

Table 2-4. Field Screening Results for Soil-Vapor Sample from Borehole C5570

			MIRAN SapphIRe Ambient Air Analyzer[b]				
			Acetylene (ppmv)	Carbon Dioxide[c] (ppmv)	1,1-Dichloroethane (ppmv)	Nitrous Oxide (ppmv)	Toluene (ppmv)
Sample Depth Start (ft bgs)[a]	Sample Depth End (ft bgs)	Sample Date and Time	CAS # 74-86-2	CAS # 124-38-9	CAS # 75-34-3	CAS # 10024-97-2	CAS # 108-88-3
34.7	35.5	5/7/07 13:15	8	343	1.2	2.4	11.2

a. The upper limit of this sample interval represents the upper extent of the open-borehole below the temporary casing. This interval was isolated with an inflatable packer.

b. The MIRAN SapphIRe (MIRAN® and SapphIRe® are registered trademarks of Thermo Scientific, Waltham, Massachusetts) ambient air analyzer identifies up to 5 compounds with the highest concentrations in the vapor sample. Only the compound(s) detected in the sample are included in this table.

c. Carbon dioxide levels are baselined to zero at ambient atmospheric conditions of 360 ppmv. Values shown are carbon dioxide concentrations above ambient.

bgs = below ground surface

CAS = Chemical Abstract Service

ppmv = parts per million by volume

A sample for analysis of VOCs was collected from 9 of the 10 split-spoon sample intervals. The remaining split-spoon soil sample was submitted only for radiological activity scan analysis. Each VOC sample consisted of a sub-sample collected for analysis at the low calibration range of the laboratory instrument (volatile organic analysis [VOA]-low), a sub-sample collected for analysis at the high calibration range of the laboratory instrument (VOA-high), and a methanol blank (described below). Methanol was added to the VOA-high sub-samples in the field to preserve them for analysis, as described in EPA Method 5035 (SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*). The sub-samples collected for analysis at the low calibration range (VOA-low) were not preserved. Initially, only the VOA-low sub-samples are analyzed. If the VOC concentrations in a VOA-low sub-sample exceed the calibration range, then the associated VOA-high sub-sample and methanol blank are analyzed.

The QC samples were collected in the field for soil samples. Soil samples were collected at a single depth for duplicate analysis and at another depth for split analysis. Liquid QC samples, including one equipment blank, nine field blanks, and five methanol blanks, were also collected.

Soil sample pairs to be used for duplicate analyses were taken at the depth interval of 8.8 to 9.6 m (29.0 to 31.5 ft) bgs. Field duplicates are collected to provide a measure of the overall precision of the complete sampling and analysis process. The requirement in the SAP (DOE/RL-2006-77) was to collect one field duplicate sample set. Because one duplicate sample set was collected, the requirement was met.

Soil samples to be used for split analyses were taken from the depth interval of 9.8 to 10.5 m (32.0 to 34.5 ft) bgs. Field split samples are collected and analyzed to detect whether analytical results are consistent among laboratories and analytical methods.

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
Soil Samples (132)					
I-001	13.0 to 15.0	Split spoon	B1NRB4 B1NRC4(VOA) B1NRC5(VOA) B1NRH0 B1NR90	6/12/07	No radiation detected; sample was taken outside the breakdown table.
I-002	15.5 to 16.0	Grab	B1NPB4 B1NPV9	6/12/07	No radiation detected; sample was taken in a clean stainless-steel bowl.
I-003	17.5 to 18.0	Grab	B1NPW0 B1NPB5	6/12/07	No radiation detected; sample was taken in a clean stainless-steel bowl.
I-004	20.5 to 21.0	Grab	B1NPW1 B1NPB6	6/13/07	No radiation detected; sample was taken in a clean stainless-steel bowl.
I-005	25.0 to 25.5	Grab	B1NPB7	6/12/07	Activity scan only; sample was taken from split spoon.
I-008	27.0 to 27.5	Grab	B1NRJ2	6/18/07	No radiation detected; sample was taken in a clean stainless-steel bowl.
I-007	29.0 to 31.5	Split spoon	B1NPB8 B1NPW3	6/13/07	Originally planned to be taken at 24.5 to 25.0 ft. The sample was moved to this sample interval depth because no material could be collected at the original depth because of the formation characteristics. Activity scan taken to 222-S Laboratory on 6/28/07.
I-009	30.0 to 30.5	Split spoon	B1NPB9 B1NPW4	6/28/07	Radiological screening only taken to 222-S Laboratory on 6/28/07.
I-010	32.0 to 34.5	Split spoon	B1NRB6 B1NRD0(VOA) B1NRD1(VOA) B1NRH2 B1NRH3(S) B1NRD2(S)(VOA) B1NRD3(S)(VOA) B1NRH3(S) B1NR92(R)	7/3/07	Collected split sample at this depth. Activity scan taken to WSCF <.5. 40 mL TPH-gasoline, 120 mL IC anions, and 120 mL cyanide to STLSL left at site.

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-011	31.5 to 32.0	Grab	B1NPC0 B1NPW5	7/2/07	Activity scan taken to WSCF <.5
I-012	34.0 to 34.5	Grab	B1NPC1 B1NPW6	7/3/07	Activity scan taken to WSCF <.5
I-013	37.0 to 37.5	Grab	B1NPC2 B1NPW7	7/9/07	Activity scan taken to WSCF <.5
I-014	39.5 to 40.0	Grab	B1NPC3 B1NPW8 B1NRP2(R)	7/9/07	Activity scan taken to WSCF <.5
I-015	42.5 to 43.0	Grab	B1NPC4 B1NPW9	7/10/07	Activity scan taken to WSCF <.5
I-016	45.0 to 45.5	Grab	B1NPC5 B1NPX0	7/10/07	Activity scan taken to WSCF <.5
I-017	47.5 to 49.5	Split spoon	B1NRB7 B1NRD4(VOA) B1NRD5(VOA) B1NRH4 B1NR93	7/12/07	Activity scan taken to WSCF <.5
I-018	47.0 to 47.5	Grab	B1NPC6 B1NPX1	7/10/07	Activity scan taken to WSCF <.5
I-019	50.0 to 52.5	Split spoon	B1NRB8 B1NRD6(VOA) B1NRD7(VOA) B1NRH5 B1P3J5 B1NR94(S)	7/16/07	No samples taken because of the absence of an organic silt layer.
I-020	49.0 to 49.5	Grab	B1NPC7 B1NPX2	7/12/07	Activity scan taken to WSCF <.5

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-021	52.0 to 54.5	Split spoon	B1NR95 B1NRB9 B1NRD8(VOA) B1NRD9(VOA) B1NRH6 B1P3J6	7/23/07	No samples taken because of the absence of an organic silt layer.
I-022	51.5 to 52.0	Grab	B1NPC8 B1NPX3	7/12/07	Activity scan taken to WSCF <.5
I-023	54.5 to 57.0	Split spoon	B1NRC0 B1NRF0(VOA) B1NRF1(VOA) B1NRH7 B1P3J7 B1NR96	7/24/07	Samples were collected and the activity scan was taken to WSCF <.5
I-024	54.0 to 54.5	Grab	B1NPC9 B1NPX4	7/23/07	Activity scan taken to WSCF <.5
I-025	57.0 to 57.5	Grab	B1NPD0 B1NPX5	7/24/07	Activity scan taken to WSCF <.5
I-026	59.5 to 60.0	Grab	B1NPD1 B1NPX6	7/24/07	Activity scan taken to WSCF <.5
I-027	62.0 to 62.5	Grab	B1NPD2 B1NPX7	7/24/07	Activity scan taken to WSCF <.5
I-028	64.0 to 64.5	Grab	B1NPD3 B1NPX8	7/24/07	Activity scan taken to WSCF <.5
I-029	66.5 to 67.0	Grab	B1NPD4 B1NPX9	7/24/07	Activity scan taken to WSCF <.5
I-030	70.0 to 70.5	Grab	B1NPD5 B1NPY0	7/24/07	Activity scan taken to WSCF <.5
I-031	72.0 to 72.5	Grab	B1NPD6 B1NPY1	7/25/07	Activity scan taken to WSCF <.5

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-032	74.0 to 74.5	Grab	B1NPD7 B1NPY2	7/25/07	Activity scan taken to WSCF <.5
I-033	77.5 to 78.0	Grab	B1NPD8 B1NPY3	7/26/07	Activity scan taken to WSCF <.5
I-034	79.5 to 80.0	Grab	B1NPD9 B1NPY4	7/26/07	Activity scan taken to WSCF <.5
I-035	82.0 to 82.5	Grab	B1NPF0 B1NPY5	7/26/07	Activity scan taken to WSCF <.5
I-036	84.5 to 85.0	Grab	B1NPF1 B1NPY6	7/26/07	Activity scan taken to WSCF <.5
I-037	86.5 to 87.0	Grab	B1NPF2 B1NPY7	8/1/07	Activity scan taken to WSCF <.5
I-038	90.0 to 90.5	Grab	B1NPF3 B1NPY8 B1NRP3(R)	8/1/07	Activity scan taken to WSCF <.5
I-039	92.5 to 93.0	Grab	B1NPF4 B1NPY9	78/6/07	Activity scan taken to WSCF <.5
I-040	94.5 to 95.0	Grab	B1NPF5 B1NR00	8/6/07	Activity scan taken to WSCF <.5
I-041	96.5 to 97.0	Grab	B1NPF6 B1NR01	8/6/07	Activity scan taken to WSCF <.5
I-042	99.5 to 100	Grab	B1NPF7 B1NR02	8/6/07	Activity scan taken to WSCF <.5
I-043	101.5 to 102	Grab	B1NPF8 B1NR03	8/6/07	Activity scan taken to WSCF <.5
I-044	104.5 to 105	Grab	B1NPF9 B1NR04	8/6/07	Activity scan taken to WSCF <.5

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-045	106.5 to 107	Grab	B1NPH0 B1NR05	8/6/07	Activity scan taken to WSCF <.5
I-046	109.5 to 110.0	Grab	B1NPH1 B1NR06	8/6/07	Activity scan taken to WSCF <.5
I-047	112.5 to 113.0	Grab	B1NPH2 B1NR07	8/6/07	Activity scan taken to WSCF <.5
I-048	114.0 to 114.5	Grab	B1NPH3 B1NR08	8/6/07	Activity scan taken to WSCF <.5
I-049	117.0 to 117.5	Grab	B1NPH4 B1NR09	8/6/07	Activity scan taken to WSCF <.5
I-050	120.0 to 120.5	Grab	B1NPH5 B1NR10	8/6/07	Activity scan taken to WSCF <.5
I-051	122.0 to 122.5	Grab	B1NPH6 B1NR11	8/6/07	Activity scan taken to WSCF <.5
I-052	124.5 to 125.0	Grab	B1NPH7 B1NR12	8/6/07	Activity scan taken to WSCF <.5
I-053	127.0 to 127.5	Grab	B1NPH8 B1NR13	8/6/07	Activity scan taken to WSCF <.5
I-054	129.5 to 130.0	Grab	B1NPH9 B1NR14	8/7/07	Activity scan taken to WSCF <.5
I-055	132.5 to 135.0	Grab	B1NPJ0 B1NR15	8/7/07	Activity scan taken to WSCF <.5
I-055	132.5 to 135.0	Split spoon	B1P3J8 B1NRC1 B1NRF2(VOA) B1NRF3(VOA) B1NRH8 B1NR97	8/7/07	Activity scan taken to WSCF <.5

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-056	132.0 to 132.5	Grab	B1NPJ1 B1NR16	8/7/07	Activity scan taken to WSCF <.5
I-057	134.5 to 135.0	Grab	B1NPJ2 B1NR17	8/7/07	Activity scan taken to WSCF <.5
I-058	137.0 to 137.5	Grab	B1NPJ3 B1NR18	8/7/07	Activity scan taken to WSCF <.5
I-059	139.5 to 140.0	Grab	B1NPJ4 B1NR19 B1NRP4	8/7/07	Activity scan taken to WSCF <.5
I-060	142.0 to 142.5	Grab	B1NPJ5 B1NR20	8/7/07	Activity scan taken to WSCF <.5
I-061	144.5 to 145	Grab	B1NPJ6 B1NR21	8/7/07	Activity scan taken to WSCF <.5
I-062	147.0 to 147.5	Grab	B1NPJ7 B1NR22	8/7/07	Activity scan taken to WSCF <.5
I-063	149.5 to 150.0	Grab	B1NPJ8 B1NR23	8/7/07	Activity scan taken to WSCF <.5
I-064	152.0 to 152.5	Grab	B1NPJ9 B1NR24	8/7/07	Activity scan taken to WSCF <.5
I-065	154.5 to 155.0	Grab	B1NPK0 B1NR25	8/7/07	Activity scan taken to WSCF <.5
I-066	157.0 to 157.5	Grab	B1NPK1 B1NR26	8/7/07	Activity scan taken to WSCF <.5
I-067	159.5 to 160.0	Grab	B1NPK2 B1NR27	8/7/07	Activity scan taken to WSCF <.5
I-068	162.0 to 162.5	Grab	B1NPK3 B1NR28	8/7/07	Activity scan taken to WSCF <.5

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-069	164.5 to 165.0	Grab	B1NPK4 B1NR29	8/8/07	Activity scan taken to WSCF <.5
I-070	167.0 to 167.5	Grab	B1NR30	8/9/07	No activity scans taken.
I-071	169.5 to 170.0	Grab	B1NR31	8/9/07	No activity scans taken.
I-072	172.0 to 172.5	Grab	B1NR32	8/9/07	No activity scans taken.
I-073	174.5 to 175.0	Grab	B1NR33	8/9/07	No activity scans taken.
I-074	177.0 to 177.5	Grab	B1NR34	8/9/07	No activity scans taken.
I-075	179.5 to 180.0	Grab	B1NR35	8/9/07	No activity scans taken.
I-076	182.0 to 182.5	Grab	B1NR36	8/9/07	No activity scans taken.
I-077	184.5 to 185.0	Grab	B1NR37	8/9/07	No activity scans taken.
I-078	187.0 to 187.5	Grab	B1NR38	8/9/07	No activity scans taken.
I-079	189.5 to 190.0	Grab	B1NR39 B1NRP5(R)	8/9/07	No activity scans taken.
I-080	192.0 to 192.5	Grab	B1NR40	8/9/07	No activity scans taken.
I-081	194.5 to 195.0	Grab	B1NR41	8/9/07	No activity scans taken.
I-082	197.0 to 197.5	Grab	B1NR42	8/9/07	No activity scans taken.
I-083	199.5 to 200.0	Grab	B1NR43	8/9/07	No activity scans taken.
I-084	202.0 to 202.5	Grab	B1NR44	8/13/07	No activity scans taken.
I-085	204.5 to 205.0	Grab	B1NR45	8/13/07	No activity scans taken.
I-086	207.0 to 207.5	Grab	B1NR46	8/13/07	No activity scans taken.
I-087	210.0 to 210.5	Grab	B1NR47	8/13/07	No activity scans taken.
I-088	212.0 to 212.5	Grab	B1NR48	8/13/07	No activity scans taken.

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-089	214.5 to 215.0	Grab	B1NR49	8/13/07	No activity scans taken.
I-090	217.0 to 217.5	Grab	B1NR50	8/13/07	No activity scans taken.
I-091	219.5 to 220.0	Grab	B1NR51	8/14/07	No activity scans taken.
I-092	222.0 to 222.5	Grab	B1NR52	8/14/07	No activity scans taken.
I-093	224.5 to 225.0	Grab	B1NR53	8/14/07	No activity scans taken.
I-094	227.0 to 227.5	Grab	B1NR54	8/14/07	No activity scans taken.
I-095	229.0 to 229.5	Grab	B1NR55	8/14/07	No activity scans taken.
I-096	232.0 to 232.5	Grab	B1NR56	8/14/07	No activity scans taken.
I-097	234.5 to 235.0	Grab	B1NR57	8/14/07	No activity scans taken.
I-098	237.0 to 237.5	Grab	B1NR58	8/14/07	No activity scans taken.
I-099	239.5 to 240.0	Grab	B1NR59 B1NRP6(R)	8/14/07	No activity scans taken.
I-100	242.0 to 242.5	Grab	B1NR60	8/14/07	No activity scans taken.
I-101	244.0 to 244.5	Grab	B1NR61	8/14/07	No activity scans taken.
I-102	247.0 to 247.5	Grab	B1NR62	8/14/07	No activity scans taken.
I-103	250.5 to 253.0	Split spoon	B1NR98 B1NRC2 B1NRF4(VOA) B1NRF5(VOA) B1NRH9 B1P3J9	8/15/07	No activity scans taken.
I-104	250.0 to 250.5	Grab	B1NR63	8/15/07	No activity scans taken.
I-105	252.0 to 252.5	Grab	B1NR64	8/16/07	No activity scans taken.
I-106	254.5 to 255.0	Grab	B1NR65	8/16/07	No activity scans taken.

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-107	257.0 to 257.5	Grab	B1NR66	8/16/07	No activity scans taken.
I-108	259.5 to 260.0	Grab	B1NR67	8/16/07	No activity scans taken.
I-109	262.0 to 262.5	Grab	B1NR68	8/16/07	No activity scans taken.
I-110	265.5 to 266	Grab	B1NR69	8/20/07	No activity scans taken.
I-111	267.0 to 267.5	Grab	B1NR70	8/20/07	No activity scans taken.
I-112	269.0 to 269.5	Grab	B1NR71	8/20/07	No activity scans taken.
I-113	272.0 to 272.5	Grab	B1NR72	8/20/07	No activity scans taken.
I-114	274.5 to 275.0	Grab	B1NR73	8/20/07	No activity scans taken.
I-115	277.0 to 277.5	Grab	B1NR74	8/20/07	No activity scans taken.
I-116	279.5 to 280.0	Grab	B1NR75	8/20/07	No activity scans taken.
I-117	282.0 to 282.5	Grab	B1NR76	8/20/07	No activity scans taken.
I-118	285.0 to 287.0	Split spoon	B1NRB2 B1NRF6(VOA) B1NRF7(VOA) B1NRJ0 B1NT09(RS) B1P3K0	8/21/07	Activity scan was taken. QC equipment blank taken.
I-119	284.5 to 285.0	Grab	B1NR77	8/20/07	No activity scans taken.
I-120	287.0 to 287.5	Grab	B1NR78	8/21/07	No activity scans taken.
I-121	289.5 to 290.0	Grab	B1NR79 B1NRP7(R)	8/21/07	No activity scans taken.
I-122	292.0 to 292.5	Grab	B1NR80	8/21/07	No activity scans taken.
I-123	294.5 to 295.0	Grab	B1NR81	8/21/07	No activity scans taken.
I-124	297.0 to 297.5	Grab	B1NR82	8/21/07	No activity scans taken.

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-125	299.5 to 300.0	Grab	B1NR83	8/21/07	No activity scans taken.
I-126	302.0 to 302.5	Grab	B1NR84	8/21/07	No activity scans taken.
I-127	304.5 to 305.0	Grab	B1NR85	8/22/07	No activity scans taken.
I-128	307.0 to 307.5	Grab	B1NR86	8/22/07	No activity scans taken.
I-129	309.5 to 310.0	Grab	B1NR87	8/22/07	No activity scans taken.
I-130	312.0 to 312.5	Grab	B1NR88	8/22/07	No activity scans taken.
I-131	315.0 to 315.5	Grab	B1NR89	8/22/07	No activity scans taken.
I-132	317.0 to 319.5	Split spoon	B1NR99 B1NRC3 B1NRF8(VOA) B1NRF9(VOA) B1NRJ1 B1P3K1	8/22/07	No activity scans taken.
Groundwater Sample (1)					
I-water	322.0	Bailer	B1PLH0 B1PLF8	9/6/07	
Field Blanks (9)					
I-001	13.0 to 15.0	QC	B1NRP8(FB)(VOA)	6/12/07	
I-006	29.0 to 31.5	QC	B1NRB5 B1NRC6(VOA) B1NRC7(VOA) B1NRC8(R)(VOA) B1NRC9(R)(VOA) B1NRH1(R) B1NT07 B1NR91 B1NRH1(R) B1NT08	6/27/07	Associated with split-spoon sample I-007.

Table 2-5. Sample Collection Summary for Borehole C5515

Interval Number	Sample Interval (ft bgs)	Sample Method	HEIS Number	Date Sampled	Comments (Activity Scans Measured in mrem)
I-010	32.0 to 34.5	QC	B1NRR0(FB)(VOA)	7/3/07	
I-017	47.5 to 49.5	QC	B1NRR1(FB)(VOA)	7/10/07	Activity scan taken to WSCF <.5
I-019	50.0 to 52.5	QC	B1NRR2(FB)(VOA)	7/16/07	No QC sample taken.
I-021	52.0 to 54.5	QC	B1NRR3(FB)(VOA)	7/23/07	No QC sample taken.
I-023	54.5 to 57.0	QC	B1NRR4(FB)(VOA)	7/24/07	Samples were collected.
I-055	131 to 131.5	QC	B1NRR5(FB)(VOA)	8/7/07	Activity scan taken to WSCF <.5
I-103	250.5 to 253.0	QC	B1NRR6(FB)(VOA)	8/15/07	
I-132	317.0 to 319.5	QC	B1NRR8(FB)(VOA)	8/22/07	
I-water	322.0	QC	B1PLF9	9/6/07	Collected during groundwater sampling.
Equipment Blank (1)					
I-118	Collected	QC	B1NRR7(FB)(VOA)	8/21/07	

bgs = below ground surface

HEIS = Hanford Environmental Information System

QC = quality control

TPH = total petroleum hydrocarbons

WSCF = Waste Sampling and Characterization Facility

An equipment rinsate water blank sample was obtained on August 21, 2007, in association with the split-spoon soil sample collected on the same day, from 86.9 to 87.5 m (285.0 to 287.0 ft) bgs. The equipment rinsate blank was analyzed for the same compounds as the associated soil sample to check the potential for sample contamination originating from the field sampling equipment or from equipment cleansing agents. Because no additional equipment rinsate blank samples were requested by the field geologist, as allowed in the SAP (DOE/RL-2006-77), this requirement for obtaining and analyzing at least one equipment rinsate blank sample was met.

Field blank water samples were collected in association with each of the nine split-spoon soil samples that were collected and submitted for VOC analysis. Field blanks normally are obtained to determine whether the VOCs detected might have resulted from ambient organic vapors, such as those generated by nearby internal combustion engine exhaust. The SAP (DOE/RL-2006-77) required that the field blanks be collected with each VOC-designated soil sample collected. Because the nine field blank samples were collected with the associated nine VOC-designated soil samples, the requirement was met.

As described above, methanol was added to selected soil samples in the field to preserve them for analysis of VOCs. All of the VOC samples reserved for analysis at a high calibration range (VOA-high) were treated with methanol. Methanol blank samples were obtained as a control for contamination that might occur in the process of preservation or for contamination that may be present in the methanol source. The blank samples were prepared by injecting methanol into an empty VOA sample bottle that had been opened briefly in the sampling environment. Each methanol blank was collected with a specific VOA-high sub-sample, so each methanol blank was associated with a specific depth. A methanol blank is analyzed only if the associated VOA-high sub-sample is also analyzed, as previously described.

One groundwater sample was collected from borehole C5515 for laboratory analysis (Table 2-5). This sample was collected after reaching TD and was taken at the final casing depth of 98.1 m (322.0 ft) bgs using a bailer. Table 2-5 summarizes the sample interval numbers, associated Hanford Environmental Information System (HEIS) database numbers, sample dates, sample depths, media sampled, and sampling methods employed. Laboratory analytical data for soil and groundwater samples will be provided in a separate report.

2.4.2 Borehole C5571

Five split-spoon soil samples were collected for laboratory analysis from borehole C5571 with an approximately 10 cm (4-in.)-diameter split spoon (Table 2-6). The split-spoon samples were collected using three stainless-steel liners in a 0.46 m (1.5-ft) long split spoon (not including the drive-shoe length). The first split-spoon sample collected, which was unplanned, was submitted to the 222-S Laboratory for radiological screening; the other four samples were submitted to analytical laboratories for sediment analysis.

The QC samples were collected in the field as controls for analysis of the soil samples. Soil samples were collected at a single depth for duplicate analysis. Liquid QC samples, including one equipment blank and four field blanks, were also collected.

A duplicate analysis of soil samples was to be performed on sample pairs taken at 6.4 to 6.9 m (21.0 to 22.5 ft) bgs. However, the sample did not have a sufficient quantity of sediment to perform a duplicate analysis, and no other duplicate samples were planned and/or extracted.

Table 2-6. Sample Collection Summary for Borehole C5571

Sample Interval Number	Sample Interval (ft bgs)	Media Sampled	Method	HEIS Number	Date Sampled	Comments
Soil Samples (5)						
I-003	19.1 to 20.9	Soil	Split spoon	B1P3K6 B1P3M3	7/20/07	Spoon was driven 7/14/07.
I-002	21.0 to 22.5	Soil	Split spoon	B1P3K4 B1P3K7 B1P3L1 B1P3L9	7/17/07	
I-005	25.1 to 26.8	Soil	Split spoon	B1P3K3 B1P3K8 B1P3L2 B1P3M0	7/19/07	
I-007	39.0 to 40.7	Soil	Split spoon	B1P3K5 B1P3K9 B1P3L3 B1P3M1	7/20/07	
I-009	58.2 to 59.9	Soil	Split spoon	B1P7Y1 B1P3L0 B1P3L4 B1P3M2	7/21/07	
Field Blanks (4)						
I-001	Collected	Water	QC	B1P3M4	7/17/07	
I-004	Collected	Water	QC	B1P3M5	7/19/07	
I-006	Collected	Water	QC	B1P3M6	7/20/07	
I-008	Collected	Water	QC	B1P3M7	7/21/07	
Equipment Blank (1)						
I-EB	N/A	Water	QC	B1P3M8	7/13/07	

bgs = below ground surface
HEIS = Hanford Environmental Information System
N/A = not applicable
QC = quality control

An equipment rinsate water blank sample was obtained on July 13, 2007, in association with the split-spoon soil sample collected on July 21, 2007, from 17.7 to 18.3 m (58.2 to 59.9 ft) bgs. The equipment rinsate blank was analyzed for the same compounds as the associated soil sample to check the potential for sample contamination originating from the field sampling equipment or from equipment cleansing agents. Because no additional equipment rinsate blank samples were requested by the field geologist (as allowed in the SAP [DOE/RL-2006-77]), the requirement for obtaining and analyzing at least one equipment rinsate blank sample was met.

Field blank water samples were collected in association with each of the four split-spoon soil samples that were submitted for VOC analysis. The SAP (DOE/RL-2006-77) required that the field blanks be taken with each VOC-designated soil sample collected. Because the four field blank samples were collected with the associated four VOC-designated soil samples, the requirement was met.

As described above, methanol was added to selected soil samples in the field to preserve them for VOC analysis. All of the VOC samples reserved for analysis at a high calibration range (VOA-high) were treated with methanol. Methanol blank samples were obtained as a control for contamination that might occur in the process of preservation or for contamination that may be present in the methanol source. The blank samples were prepared by injecting methanol into an empty VOA sample bottle that had been opened briefly in the sampling environment. Each methanol blank was collected with a specific VOA-high sub-sample, so each methanol blank was associated with a specific depth. A methanol blank was analyzed only if the associated VOA-high sub-sample was analyzed, as described earlier.

The VOA-low sub-samples were analyzed and did not exceed the calibration range. Consequently, VOA-high sub-samples were not analyzed, and the methanol blanks were canceled.

Table 2-6 summarizes the sample interval numbers, associated HEIS database numbers, sample dates, sample depths, media sampled, and sampling methods employed. Laboratory analytical data for soil samples will be provided in a separate report.

2.5 Environmental Monitoring

This section describes environmental monitoring conducted during drilling and decommissioning of boreholes C5515, C5570, and C5571.

2.5.1 Industrial Hygiene

2.5.1.1 Borehole C5515

Industrial hygiene monitoring was provided on a continuous basis during drilling activities from ground surface to 10.7 m (35 ft) bgs. The industrial hygiene monitoring included the soil from split-spoon samples during the drilling activity. Beyond 10.7 m (35 ft) bgs, industrial hygiene monitoring was provided on a periodic morning/afternoon basis. All readings were reported as less than detection.

2.5.1.2 Borehole C5570

Industrial hygiene monitoring was provided on a periodic morning/afternoon basis. Industrial hygiene coverage consisted of monitoring during drilling activities. All industrial hygiene soil readings were reported as less than detection.

2.5.1.3 Borehole C5571

Industrial hygiene monitoring was provided on a periodic morning/afternoon basis during drilling activities and primarily consisted of a check on the soil collected during split-spoon sampling activities. All industrial hygiene soil readings were reported as less than detection.

2.5.2 Radiation Control

2.5.2.1 Borehole C5515

Because borehole C5515 is located within an area of known radioactive contamination at the 216-A-2 Crib, full-time radiological control technician (RCT) monitoring was provided during initial drilling activities in the upper portion of the vadose zone from ground surface to 49.5 m (162.5 ft) bgs, which ended on August 8, 2007. Beyond 49.5 m (162.5 ft) bgs, RCT coverage was provided on a periodic morning/afternoon basis. Radiation control monitoring included direct reading of recovered soils and monitoring of drilling tools, sampling tools, personal protective equipment, and soil storage drums.

Table 2-7 lists the radiological equipment used and data recorded by onsite RCTs during drilling of borehole C5515. The table includes data from direct readings of recovered soil (as measured with the various meters) either from the borehole cuttings after removal from the drive barrel or from soil captured with a split-spoon sampler. Table 2-7 also lists the background measurements.

Several different radiation detectors were used during drilling, including the SPA-3[8] and Geiger-Müller gamma radiation meter. The SPA-3 meter is a hand-held, high-sensitivity gamma radiation meter used for measuring the amount of radioactive contamination present (in counts per minute [cpm]). The Geiger-Müller meter is a hand-held gamma radiation meter used for measuring the amount of radioactive contamination present (in cpm). Both detectors were routinely used to detect and quantify gamma radiation in soil recovered from drilling activities. A Hanford Site-produced portable alpha meter also was used during drilling operations, which consists of a count-rate detector and a Hanford Site-produced 50 cm^2 alpha scintillation detector. The portable alpha meter was periodically used to detect the presence or absence of alpha radioactive contamination on equipment, personnel, personal protective equipment, and other related surfaces in the work area. Alpha radiation was not detected above background at this site.

The Eberline RO-20[9] is a portable, air-filled ionization chamber rate meter used to detect beta, gamma, and x-ray radiation. The ionization chamber is contained within the instrument body. Indentations on the case indicate the center of the chamber.

Photon-sensitive probes (e.g., Portable Gamma-2[10]) typically consist of sodium-iodide (Tl) scintillating crystals. As the crystal absorbs energy in the form of photon or beta radiation, electrons in the valence band are moved to the conduction band. When electrons in the conduction band return to the valence band, energy must be released. This energy is released in the form of visible light (λ_{max} = 415 nm), assured by the thallium impurity; the amount of light is proportional to the amount of radiation originally absorbed. These probes are often used to perform pulse-height analysis/energy discrimination.

Crystals come in a variety of shapes and sizes. The most common crystals at the Hanford Site are 5 m by 5 m (2 in. by 2 in.) because they are appropriate for a wide energy range and offer relatively high efficiency. Larger and smaller crystals also are available. Larger crystals increase efficiency and energy

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8 SPA-3™ is a trademark of Thermo Electron Corporation, Waltham, Massachusetts.
9 RO-20™ is a trademark of Eberline Instruments, a subsidiary of Thermo Fisher Scientific, Waltham Massachusetts.
10 PG-2™ is a trademark of Eberline Instruments, a subsidiary of Thermo Fisher Scientific, Waltham, Massachusetts.

range. Crystal size and shape can be used as a mechanical discriminator, tuning detector response to low-energy radiation.

2.5.2.2 Borehole C5570

During drilling activities, RCT monitoring at borehole C5570 was not required. Additionally, no cuttings were retrieved from this borehole because of the sealed DPT drilling method used. Therefore, no soil-related radiological measurements were collected.

2.5.2.3 Borehole C5571

During drilling activities, RCT monitoring at borehole C5571 was generally provided during split-spoon sampling activities. For soil samples, the RCT reported values for the deep dose rate from <0.5 to 200 mrem/hr. Gross direct contamination of the soil samples had up to 30,000 disintegrations per minute (dpm)/100 cm^2 beta/gamma radiation, 200 dpm/100 cm^2 alpha. Removable contamination was detected from 1,000 to 40,000 dpm/100 cm^2 beta/gamma and <20 dpm^2/100 cm^2 alpha. Background during this sampling ranged from 50 to 70 cpm beta/gamma and 0 cpm alpha. The data are available in the original radiological survey reports.

2.6 Borehole Geophysical Logging

Borehole geophysical logging surveys were conducted on boreholes C5515, C5570, and C5571 by S. M. Stoller Corporation (Stoller). Borehole geophysical logging records the vertical distribution and the quantity of natural and manmade (process) gamma-emitting radionuclides in the soil next to the borehole. In addition, the logs assist in correlating and interpreting the subsurface stratigraphy. Borehole logging equipment is calibrated annually, with calibration data used to calculate casing attenuation factors that convert measured peak-area count rates to radionuclide concentrations. The logging system provided a continuous radiometric signature of the soils, measured through a single thickness of carbon-steel casing.

Borehole C5515 was geophysically logged using the spectral gamma logging system, the neutron moisture logging system, and the passive neutron logging system. Geophysical logging occurred after the borehole was drilled to a depth of 26.2 m (86.0 ft) bgs in July 2007, and after the borehole was drilled to the TD of 99.1 m (325.0 ft) bgs in August 2007. Additional geophysical logging of the borehole interval with highly elevated radiological activity was conducted in July 2007 using a high-rate logging system (HRLS).

Borehole C5570 was geophysically logged using the spectral gamma logging system and the HRLS in May 2007, after the borehole was advanced to the TD of 10.9 m (35.8 ft) bgs. Geophysical logging using the HRLS was conducted over the borehole interval and indicated highly elevated radiological activity.

Borehole C5571 was geophysically logged using the spectral gamma logging system, the neutron moisture logging system, the passive neutron logging system, and HRLS. Geophysical logging was performed in August 2007 after the borehole was drilled to the TD of 18.3 m (60.0 ft) bgs. Geophysical logging using the HRLS was conducted over the borehole interval and indicated highly elevated radiological activity.

Figure 2-1 shows plots of the geophysical logging results correlated with the borehole geology and sampling intervals for borehole C5515. The geophysical log data reports prepared by Stoller are included in Appendices D, G, and K.

Table 2-7. Radiation Control Direct Measurements from Soils at Borehole C5515

Date Surveyed	Depth (ft bgs)	Gross Direct Contamination Measurements SPA-3[a] (βγ cpm)	Background Measurements SPA-3[a] (βγ cpm)	Gross Direct Contamination Measurements PG-2[b] (βγ cpm)	Background Measurements PG-2[b] (βγ cpm)	Total Contamination Measurements Geiger-Müller[c] (βγ dpm/100 cm²)	Total Contamination Measurements PAM[d] (α dpm/100 cm²)	Direct Deep Dose Measurements RO-20 (mrem/hr, on Contact)	Direct Shallow Dose Measurements RO-20 (mrem/hr, on Contact)	Media/ Source	Survey (RSR)	Comments
6/4/07	0 to 2.5	1,600	1,615	1,100	1,132	--	--	--	--	Soil/drill cuttings	GW-07-0972	Full-time RCT coverage.
	2.5 to 3.5	1,600	1,615	1,100	1,132	--	--	--	--	Soil/drill cuttings		
6/6/07	3.5 to 5	NR	NR	NR	NR	--	--	--	--	Soil/drill cuttings	NR	No RSR provided.
6/11/07	7 to 9	1,700	1,700	1,600	1,600	--	--	--	--	Soil/drill cuttings	GW-07-1011	Full-time RCT coverage.
	9 to 11	1,700	1,700	1,600	1,600	--	--	--	--	Soil/drill cuttings		
	11 to 13	1,700	1,700	1,600	1,600	--	--	--	--	Soil/drill cuttings		
6/12/07	13 to 19.5	<1,760	1,760	<1,550	1,550	--	--	--	--	Soil/drill cuttings	GW-07-1025	Full-time RCT coverage. Depths given are based on geologist's notes.
6/13/07	19.5 to 21	1,500	1,700	1,600	2,100	--	--	--	--	Soil/drill cuttings	GW-07-1027	Full-time RCT coverage.
	25	1,400	1,700	1,600	2,100	--	--	--	--	Soil/drill cuttings		
	27	1,600	1,700	1,800	2,100	--	--	--	--	Soil/drill cuttings		
	27.5	2,700	1,700	2,300	2,100	400,000	42	<0.5	<0.5	Soil/drill cuttings		
6/14/07	26.5 to 28.5	--	--	--	--	--	--	30	970	Soil/split-spoon sample	GW-07-1038	Full-time RCT coverage. Depths given are based on geologist's notes.
6/18/07	26.5 to 28.5	--	--	--	--	--	--	<0.5	88	Soil/small activity-scan sample from larger split-spoon sample	GW-07-1059	Full-time RCT coverage. Dose values presented were from the small bottled (60 mL bottle) activity scan sample collected from the split-spoon soil sample collected on 6/14/07. Depths given are based on geologist's notes.
6/20/07	26.5 to 28.3	--	--	--	--	--	--	105	--	Soil/cleanout cuttings	GW-07-1071	Full-time RCT coverage. Dose values were measured through the side of the drive barrel and, thus, were "shielded" through the steel sidewall of the drive barrel. Depths given are based on geologist's notes.
6/21/07	26.5 to 28.3	--	--	--	--	--	--	200	1,800	Soil/cleanout cuttings	GW-07-1087	Full-time RCT coverage. Dose values were measured directly from the borehole cleanout cuttings collected on 7/20/2007 and were measured at 1 in. (not exact contact). Depths given are based on geologist's notes.
6/26/07	27 to 29	--	--	--	--	--	--	150	650	Soil/cleanout cuttings and drill cuttings	GW-07-1101	Full-time RCT coverage. Depths given are based on geologist's notes.
6/27/07	29 to 31.5	--	--	--	--	--	--	7.0	133	Soil/split-spoon sample	GW-07-1129	Full-time RCT coverage. Highest dose values (reported here) were measured from the soil representing an approximate depth of 29.5 ft bgs. Depths given are based on geologist's notes.
6/28/07	30 to 30.5	--	--	--	--	--	--	1.5	48	Soil/cleanout grab sample	GW-07-1141	Full-time RCT coverage. Dose values presented were from the grab soil sample collected from the cleanout cuttings. Depths given are based on geologist's notes.
7/2/07	31.5 to 32	--	--	--	--	--	--	<0.5	<0.5	Soil/grab sample	GW-07-1156	Full-time RCT coverage. Dose values presented were from the grab soil sample collected from the drill cuttings. Depths given are based on geologist's notes.

Table 2-7. Radiation Control Direct Measurements from Soils at Borehole C5515

Date Surveyed	Depth (ft bgs)	Gross Direct Contamination Measurements SPA-3[a] (βγ cpm)	Background Measurements SPA-3[a] (βγ cpm)	Gross Direct Contamination Measurements PG-2[b] (βγ cpm)	Background Measurements PG-2[b] (βγ cpm)	Total Contamination Measurements Geiger-Müller[c] (βγ dpm/100 cm²)	Total Contamination Measurements PAM[d] (α dpm/100 cm²)	Direct Deep Dose Measurements RO-20 (mrem/hr, on Contact)	Direct Shallow Dose Measurements RO-20 (mrem/hr, on Contact)	Media/ Source	Survey (RSR)	Comments
7/3/07	32 to 34.5	--	--	--	--	70,000	1,120	<0.5	2.2	Soil/split-spoon sample	GW-07-1164	Full-time RCT coverage. Depths given are based on geologist's notes.
	32 to 34.5	--	--	--	--	--	--	1.2	4.8	Soil/cleanout cuttings		
7/5/07	34.5	--	--	--	--	--	--	NR	NR	Soil/cleanout cuttings	GW-07-1181	Full-time RCT coverage.
7/9/07	34.5 to 37.5	--	--	--	--	--	--	<0.5	4.0	Soil/drill cuttings	GW-07-1191	Full-time RCT coverage. Depths given are based on geologist's notes.
	37.5 to 40	--	--	--	--	--	--	<0.5	<0.5	Soil/drill cuttings		
7/10/07	40 to 47.5	--	--	--	--	--	--	<0.5	3.2	Soil/drill cuttings	GW-07-1212	Full-time RCT coverage. Depths given are based on geologist's notes, and dose measurements are corrected from RSR values based on geologist's notes (shallow and deep dose values switched on RSR).
7/12/07	47.5 to 49.5	--	--	--	--	25,000	<100	<0.5	<0.5	Soil/split-spoon sample and cleanout cuttings	GW-07-1224	Full-time RCT coverage. Total contamination values presented were observed from the split-spoon sample at ~47.5 ft bgs based on geologists' notes.
7/16/07	49.5 to 52	--	--	--	--	<5,000	<100	<0.5	<0.5	Soil/split-spoon sample	GW-07-1252	Full-time RCT coverage. Depths given are based on geologist's notes.
7/23/07	52 to 54.5	--	--	--	--	100,000	120	<0.5	<0.5	Soil/split-spoon sample	GW-07-1293	Full-time RCT coverage. Depths given are based on geologist's notes.
7/24/07	54.5 to 57	--	--	--	--	<5,000	<100	<0.5	<0.5	Soil/split-spoon sample	GW-07-1303	Full-time RCT coverage. Depths given are based on geologist's notes.
	54.5 to 71	--	--	--	--	<5,000	<100	--	--	Soil/cleanout cuttings and drill cuttings		
7/25/07	71	--	--	--	--	--	--	<0.5	<0.5	Soil/cleanout cuttings	GW-07-1319	Full-time RCT coverage.
	73	--	--	--	--	--	--	<0.5	<0.5	Soil/drill cuttings		
	75	--	--	--	--	--	--	<0.5	<0.5	Soil/drill cuttings		
7/26/07	77 to 86	2,500	2,200	1,300	1,750	<5,000	<100	--	--	Soil/drill cuttings	GW-07-1332	Full-time RCT coverage. Depths given are based on geologist's notes.
8/1/07	87	2,800	2,000	--	--	--	--	--	--	Soil/drill cuttings	GW-07-1382	Full-time RCT coverage. Depth given is based on geologist's notes.
	89	2,650	2,000	--	--	--	--	--	--	Soil/drill cuttings		
	90	2,900	2,000	--	--	--	--	--	--	Soil/drill cuttings		
	91.5	2,700	2,000	--	--	--	--	--	--	Soil/drill cuttings		
8/6/07	91.5 to 127.5	2,900	2,300	3,100	2,300	--	--	--	--	Soil/drill cuttings	GW-07-1452	Full-time RCT coverage. Depths given are for the entire interval drilled based on geologist's notes.
8/7/07	127.5 to 162.5	2,400	2,300	1,800	1,800	--	--	--	--	Soil/drill cuttings	GW-07-1424	Full-time RCT coverage. Depths given are for the entire interval drilled based on geologist's notes.

Table 2-7. Radiation Control Direct Measurements from Soils at Borehole C5515

Date Surveyed	Depth (ft bgs)	Gross Direct Contamination Measurements SPA-3[a] (βγ cpm)	Background Measurements SPA-3[a] (βγ cpm)	Gross Direct Contamination Measurements PG-2[b] (βγ cpm)	Background Measurements PG-2[b] (βγ cpm)	Total Contamination Measurements Geiger-Müller[c] (βγ dpm/100 cm²)	Total Contamination Measurements PAM[d] (α dpm/100 cm²)	Direct Deep Dose Measurements RO-20 (mrem/hr, on Contact)	Direct Shallow Dose Measurements RO-20 (mrem/hr, on Contact)	Media/ Source	Survey (RSR)	Comments
8/8/07	162.5 to 166.5	2,200	2,200	--	--	--	--	--	--	Soil/drill cuttings	GW-07-1432	Full-time RCT coverage. Depths given are for the entire interval drilled based on geologist's notes.
8/9/07	176	2,000	2,100	--	--	--	--	--	--	Soil/drill cuttings	GW-07-1456	RCT coverage a.m./p.m. Depth given is based on geologist's notes.
8/13/07	200 to 219	2,200	1,900	--	--	--	--	--	--	Soil/drill cuttings	GW-07-1464	RCT coverage a.m./p.m. Depths given are for the entire interval drilled based on geologist's notes.
8/14/07	222.5	2,300	2,420	--	--	--	--	--	--	Soil/drill cuttings	GW-07-1479	RCT coverage a.m./p.m.
	244	2,300	2,420	--	--	--	--	--	--	Soil/drill cuttings		
8/15/07	250	2,300	2,400	--	--	--	--	--	--	Soil/drill cuttings	GW-07-1498	RCT coverage a.m./p.m. Depth given is based on geologist's notes.
	253	2,200	2,400	--	--	--	--	--	--	Soil/drill cuttings		
8/16/07	257.5	2,100	2,100	--	--	--	--	--	--	Soil/drill cuttings	GW-07-1504	RCT coverage a.m./p.m. Depth given is based on geologist's notes.
8/20/07	264 to 285	2,100	2,100	--	--	--	--	--	--	Soil/drill cuttings	GW-07-1510	RCT coverage a.m./p.m. Depths given are for the entire interval drilled based on geologist's notes.
8/21/07	285 to 304.5	2,100	2,200	--	--	--	--	--	--	Soil/drill cuttings	GW-07-1518	RCT coverage a.m./p.m. Depths given are for the entire interval drilled based on geologist's notes.
8/23/07	304.5 to 325	2,430	2,400	1,800	2,000	--	--	--	--	Soil/drill cuttings	GW-07-1538	RCT coverage a.m./p.m. Depths given are for the entire interval drilled based on geologist's notes.

a. SPA-3 high-sensitivity gamma radiation meter.

b. Portable Gamma-2 (PG-2) is a thin, window scintillation crystal probe that is used to detect gamma rays.

c. Geiger-Mueller is a gas-filled radiation detection probe. It is primarily a beta ray detector.

d. Portable alpha monitor (PAM) is used to detect alpha rays.

α = alpha radiation
β = beta radiation
γ = gamma radiation
-- = not measured
bgs = below ground surface
cpm = counts per minute
dpm = disintegrations per minute
NR = not recorded
RCT = radiological control technician
RSR = radiological survey report

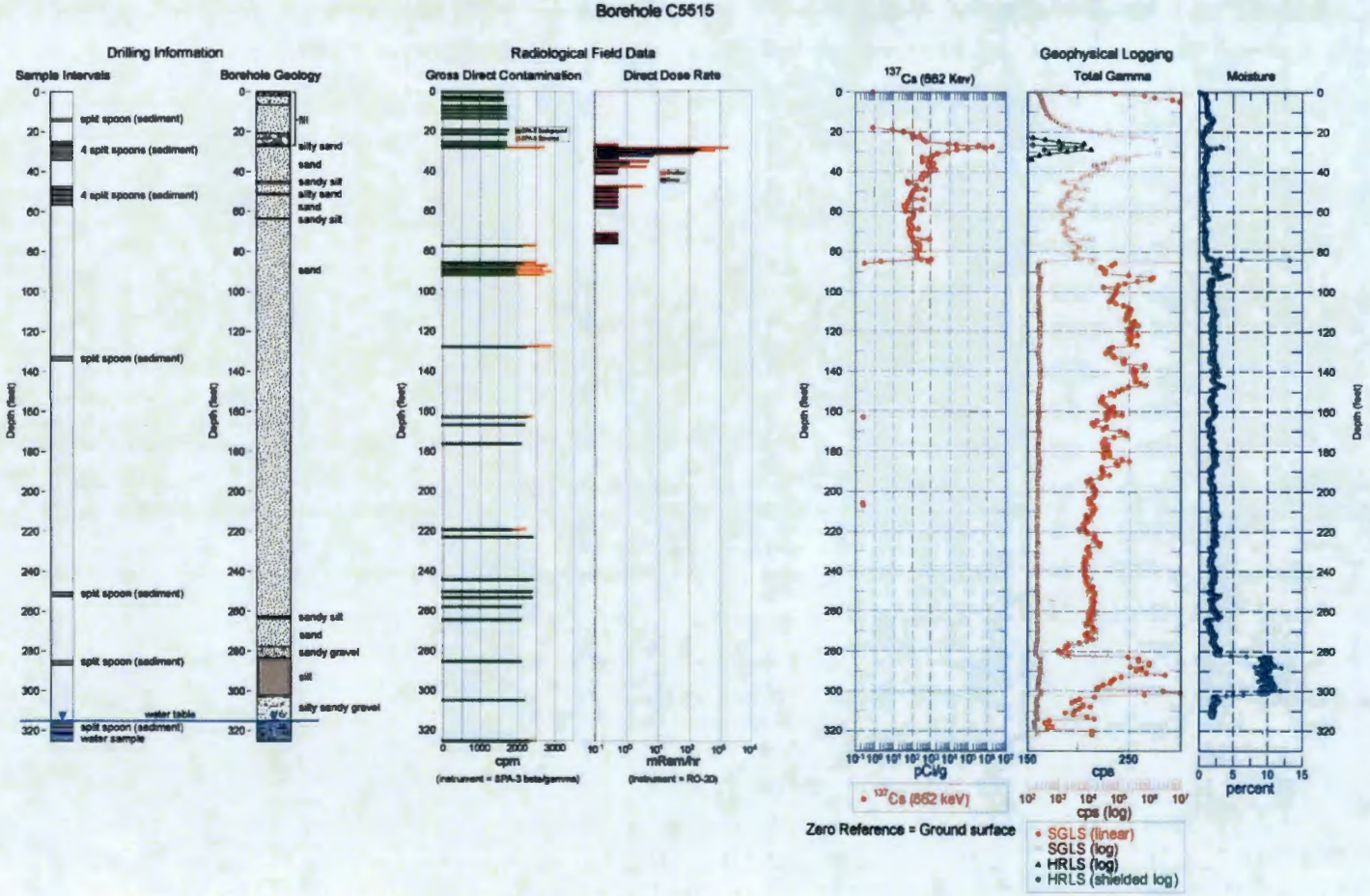

Figure 2-1. Soil-Sampling Intervals, General Lithology, Environmental Measurements, and Borehole Geophysical Logs for Borehole C5515 at the 216 A-2 Crib

2.7 Civil Survey

Civil surveys of boreholes C5515 and C5570 were performed on April 2, 2008. A civil survey of decommissioned borehole C5571 was conducted on June 5, 2008. The results for these surveys have been entered into the Hanford Well Identification System database and are summarized in Table 1-1.

2.8 Quality Assurance

A quality assurance (QA) surveillance of activities at borehole C5515 was performed by FH. The QA was conducted on July 23 and 24, August 8, and November 7, 2007. The QA surveillance at borehole C5515 was an in-process surveillance during drilling that reviewed the implementation of the SAP (DOE/RL-2006-77). The surveillance results were both "Satisfactory" and "Unsatisfactory – Corrected during Surveillance." The QA surveillance report (QA-ESA-GRP-SURV-08-009, *Implementation of the Sampling and Analysis Plan at 216-A-2 During the Drilling of C5515*) contains details of this QA surveillance activity. The QA surveillance activities were not conducted for boreholes C5570 and C5571.

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3 Subsurface Description

This section provides the generalized stratigraphy in the 200 East Area, a description of the geology encountered in boreholes C5515 and C5571, and the hydrogeology encountered in borehole C5515. Soils were not observed from borehole C5570 because of the DPT drilling method.

3.1 Geology of the 200 East Area

Generalized stratigraphy in the 200 East Area near the 216-A-2 and 216-A-21 Cribs includes a thin veneer of surficial sediments consisting of unconsolidated and unweathered Holocene aeolian sands and loess overlying unconsolidated sediments of the Hanford formation. The Hanford formation contains Pleistocene-age, cataclysmic flood, and inter-flood deposits, which consist of a basal gravel-dominated sequence and an overlying sand-dominated sequence. Hanford formation sediments disconformably overlie sand and gravel of the Miocene to Pliocene Ringold Formation. Pleistocene cataclysmic flooding removed portions of the Ringold Formation over much of the 200 East Area. Where the entire Ringold Formation is present, it consists of (in descending order) the Upper Ringold Unit (primarily gravelly sand), Unit E of the Ringold Formation (primarily sandy gravel), the Ringold Lower Mud (primarily silt and fine sand), and Unit A of the Ringold Formation (primarily sandy gravel). The Ringold Formation overlies flood basalt flows of the Miocene Columbia River Basalt Group. Basalt flows of the Elephant Mountain Member of the Saddle Mountains Basalt form the base of the suprabasalt aquifer.

3.1.1 Geology at Borehole C5515

At borehole C5515, in situ sediments are overlain by a thin backfill layer of drill pad construction material consisting of crushed rock, sand, and silt extending from the surface to 0.6 m (2 ft) bgs. Another non-native, disturbed interval of apparent backfill material was observed from 0.6 to 6.4 m (2 to 21 ft) bgs, likely related to past construction activities. This material consisted of fine to coarse sand with some gravels and cobbles to 7.6 cm (3 in.) diameter. Crib rock was seen from 6.4 to 8.2 m (21 to 27 ft) bgs and consisted largely of small to large cobbles, with smaller fractions of gravel and boulders to 30.5 cm (12 in.) in diameter. Silty sand was observed directly below the crib rock from 8.2 to 9.0 m (27 to 29.5 ft) bgs.

The overall interval from 9.0 to 84.8 m (29.5 to 278 ft) bgs generally consists of well-stratified, predominately fine to coarse sands belonging to the sand-dominated facies of the Hanford formation. Several very thin to thin interbedded silty sand and sandy silt layers were encountered at multiple depths within the sand-dominated facies, including at 14.2 m (46.5 ft) bgs, 15.9 m (52.0 ft) bgs, 19.7 m (64.5 ft) bgs, and 80.4 m (263.5 ft) bgs.

The interval from 84.8 to 86.6 m (278 to 284 ft) bgs consists of sandy gravel with gravel to 7.6 cm (3 in.), and the interval from 86.6 to 92.4 m (284 to 303 ft) bgs consists of silt with slight to moderate plasticity. The interval from 92.4 to TD of 99.1 m (303 to 325 ft) bgs consists of silty sandy gravel. The gravel is fine to coarse, and the cobbles are up to 20.3 cm (8 in.) in diameter.

The geologic log for this borehole was prepared in accordance with FH geologic logging procedures and is included in Appendix C. The log contains detailed geologic descriptions of the sediments recovered from borehole C5515. Figure 2-1 and Appendix B present summary sketches of the subsurface geology.

3.1.2 Geology at Borehole C5571

At borehole C5571, sediments were only observed in the five split-spoon soil samples collected at the depths shown in Table 2-6. The intervals consisted of Hanford formation fine to coarse sand with minor silt. The other portions of the borehole were drilled without removing the cuttings.

Although the DPT drilling method resulted in observation of minimal cuttings, a borehole log was completed and is provided in Appendix J. Appendix H provides a summary sketch of the observed lithology.

3.2 Hydrogeology at Borehole C5515

Although no perched water was encountered during drilling, several zones of soil moisture were observed. Intervals in which soil moisture was observed were included within the predominately sand and silty sand sediments from the ground surface to 5.2 m (17 ft) bgs, 8.2 to 9 m (27 to 29.5 ft) bgs, 19.7 m (64.5 ft) bgs, 62.5 m (205 ft) bgs, 66.9 m (219.5 ft) bgs, 76.9 m (252 ft) bgs, and 80.5 m (263.9 ft) bgs.

Soil moisture also was observed in the sandy gravel and silt sediments from 84.8 to 86.6 m (278 to 284 ft) bgs and at 92.4 m (303 ft) bgs. Saturated sediment was encountered at 96.2 m (315.5 ft) bgs on August 22, 2007. The water level was measured at 96.3 m (315.8 ft) on August 22, 2007, and at 96.0 m (314.7 ft) on September 5, 2007. Appendix C contains detailed soil moisture observations for the borehole sediments recovered.

4 References

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Appendix A

Well Summary Sheet for Borehole C5515

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A1 Well Summary Sheet for Borehole C5515

WELL SUMMARY SHEET

Start Date: 6/2/07
Finish Date: 4/1/08
Page 1 of 2

Well ID: C5515
Well Name: -N/A-
Location: 216-A-2 Crib, S. of PUREX, 200E
Project: 216-A-2 Crib Investigation
Prepared By: N Bender Date: 4/4/08
Reviewed By: L.D. Walker Date: 4/9/08
Signature:
Signature:

CONSTRUCTION DATA

Description	Diagram
Surface Completion[#]: Precast concrete aggregate; +0.3' ags to 0.2' bgs.	
Temporary Drive/casing: 10 3/4" OD; C.S.; thd; 0.0' (gs) to 84.0' bgs.	
HRR Electrode Cables[*]: 0.0' (gs) to 143.0' bgs.	
Bentonite Chip Seal: 3/8" Chips; 0.2' to 141.6' bgs.	
Temporary Drive/casing: 8 5/8" OD; C.S.; thd; 84.0' to 322.0' bgs.	
HRR Electrode[*]: ~1.8' Long; 143.0' to 144.8' bgs.	
Colorado Silica Sand Pack: 10/20 Mesh; 141.6' to 150.0' bgs.	
Bentonite Chip Seal: 3/8" Chips; 150.0' to 308.5' bgs.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		Non-Native Fill Materials 0.0' (gs) to 27.0' bgs: - 0.0' to 2.0', Gravel (G) - 2.0' to 7.0', Sandy Gravel (SG) - 7.0' to 21.0', Sand (S) - 21.0' to 27.0', Gravel (G)
50		Silty Sand (mS): 27.0' to 29.5' bgs
		Sand (S): 29.5' to 278.0' bgs
100		Note: - Very thin layers of Sandy Silt (SM) & Silty Sand (mS) Found @: → 46.5', (SM), ~ 6" Thick; → 52.0', (mS), ~ 3" Thick; → 64.5', (SM), ≤ 1" thick; & → 213.5', (SM), ~ 2" Thick.
150		
200		
250		Sandy Gravel (SG): 278.0' to 284.0' bgs
		Silt (M): 284.0' bgs to 303.0' bgs

A-6003-813 (03/03)

WELL SUMMARY SHEET

Start Date: 6/4/07
Finish Date: 4/1/08
Page 2 of 2

Well ID: C5515
Well Name: -N/A-
Location: 216-A-2 Crib, S. of PUREX, 200E
Project: 216-A-2 Crib Investigation
Prepared By: N. Bowles Date: 4/9/08
Reviewed By: L.B. Walker Date: 4/9/08
Signature:
Signature:

CONSTRUCTION DATA

Description

Colorado Silica Sand Pack:
10/20 Mesh;
308.5' to 320.0' bgs.

Native Backfill:
320.0' to 325.0' bgs.

Open Borehole:
Non-cased;
322.0' to 325.0' bgs.

Notes:
- * Borehole partially decommissioned, with an HRR "Subsurface Electrical Resistivity Electrode" (sensing) installed, as stated, and with the associated electrode cables existing from the electrode to the ground surface (for use in "High Resolution Resistivity" [HRR] Investigations).
- All temporary casing removed from borehole.
- All measurements are in Feet "below ground surface" (bgs).
- ** Surface completion installed as per "HNF-EMP-07-35339-Rev.3" (welded concrete surface pad, protective casing, & protective bollards, etc.). 4/1/08

Diagram

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
300		Silty Sandy Gravel (msG): 303.0' to 325.0' bgs.
WL ▽		Water Level (W.L.) = 314.7' bgs (on 9/5/07)
T.D.		Total Depth (TD) = 325.0' bgs
350		

A-6003-043 (03/03)

Appendix B

Well Construction Summary Report for Borehole C5515

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B1 Well Construction Summary Report for Borehole C5515

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 6/4/07
Finish Date: 4/1/08
Page 1 of 1

Well ID: C5515	Well Name: -N/A-
Project: 216-A-2 Crib Investigation.	Approximate Location: 216-A-2 Crib, S. of PUREX, 200E
Drilling Company: Fluor Hanford (FH)	Other Companies: FH, GRAM, Stoller
Driller: Louis Watkins	License #: 1271 (WA)
	Geologist(s): N. Bowles, M. Caron, J. Mahrer

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
10¾"od/9⅝"ID, C.S., Thd.	0.' - 84.0'	10¾"od/9⅝"ID
8⅝"od/7⅝"ID, C.S., Thd.	84.0' - 322.0'	8⅝"od/7⅝"ID
	-	
	-	
	-	

*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design

DRILLING METHOD

- Auger: (N/S)
- Cable Tool: ✓
- Air Rotary: (N/S)
- A.R. w/Sonic: (N/S)
- (N/S)
- (N/S)

HOLE DIAMETER (in.) / INTERVAL (ft)

Diameter	—	From —	to —
Diameter	10¾"	From 0.'	to 84.0'
Diameter	8⅝"	From 84.0'	to 322.0'
Diameter	7"	From 322.0'	to 325.0'
Diameter		From	to
Diameter		From	to
Diameter		From	to

(N/S)

Drilling Fluid: -N/A-

Total Drilled Depth: 325.0' bgs	Hole Dia @ TD: 7"
Total Amt. Of Water Added During Drilling: -N/A-	
Well Straightness Test Results: -N/A-	Static Water Level: 314.7' bgs Date: 9/5/07

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma (6/6LS)	0.0' - 85.0'	7/30/07	Passive Neutron (PNLS)	0.0' - 85.0'	7/31/07
(HRLS)-High Rate	21.0' - 36.0'	7/30/07	Spectral Gamma (6/6LS)	84.0' - 322.0'	8/23/07 & 8/28/07
Neutron Moisture (NMLS)	0.0' - 85.0'	7/31/07	Neutron Moisture (NMLS)	84.0' - 313.0'	8/28/07

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
HRR Electrode*	149.8 - 143.0	-N/A-	-N/A-	Native Backfill	325.0 - 320.0	bulk.	-N/A-
HRR Electrode Cables	143.0 - 0.0	-N/A-	-N/A-	10/20 Colorado Silica Sand	320.0 - 308.5	9.5 sacks	10/20
	-			⅜" (est.) Bentonite Chips	308.5 - 150.0	105 sacks	⅜"
	-			10/20 Colorado Silica Sand	150.0 - 141.6	6 sacks	10/20
	(N/S)			⅜" (est.) Bentonite Chips	141.6 - 0.2	120 Sacks	⅜"
				OTHER ACTIVITIES Concrete Approach	0.2 - 20.3' bgs	bulk.	-N/A-

Aquifer Test: Date	Well Decommission: Yes: ✓ No: Date:
Description:	Description: Partially decommissioned, with a "Subsurface Electrical Resistivity Electrode" (HRR) installed for High Resolution Resistivity (HRR) Investigation.

WELL SURVEY DATA (if applicable)

— Unknown at this time —	Protective Casing Elevation: — Unk. —
Washington State Plane Coordinates: — Unk. —	Brass Survey Marker Elevation: — Unk. —

COMMENTS / REMARKS

*Partially decommissioned, with an HRR - "Subsurface Electrical Resistivity Electrode" (approximate as-built) installed from 143.0 to 149.8' bgs (~6.8' long), within a Colorado Silica Sand Packe Interval from 141.6' to 150.0' bgs. The associated electrode cables exists in the decommissioned borehole from 0.0' to 143.0' bgs.

Reported By:	Title:	Signature:	Date:
N. Bowles	Geologist		4/4/08

A-6003-658 (04/03)

Note: Surface completion installed according to "FRAP", HNF-FRAP-07-35734-ROA, Rev.0; (N/S) 4/4/08 and consists of concrete surface pad, protective casing, & protective bollards, etc.

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Appendix C

Borehole Log for Borehole C5515

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C1 Borehole Log for Borehole C5515

BOREHOLE LOG (using GRP-EE-01-7.0, Rev. 1) Page 1 of 19 Date: 6/4/07 - Start 9/18/07 - Finish.

Well ID: C5515 Well Name: -N/A- Location: 216-A-2 Crib, S. of PUREX, 200 E.

Project: 216-A-2 Crib Investigation. Reference Measuring Point: Ground Surface.

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0				0'→2.0': Gravel (G) (crushed gravel overburden.	Cable-Tool drilling w/ hollow drive barrel
5				2'→7.0': gravelly Sand (S) Non-native backfill mat. Moist & loose, ~15% G, v.f. to pebbles to sm. cobbles (max ~3"), sub ang. to sub rd, ~85% S, f.m. to c.se, brn.	IHT ⇒ ∠D RCT ⇒ @ Bleq.
10				7.0→21.0': Sand (S) V.s. similar to as above w/out gravel content	Field blank (FB) collected @ 1315, 6/12/07. HEIS #: B1NRP8. (Assoc. w/ I-001).
15	S.S. I-001	100% Rec.			Split-Spoon (S.S.) soil sample from 13.0→15.0' bgs. HEIS #s: B1NRB4, B1NRC4, B1NRC5, B1NRH8 & B1NR90. @ 1330, 6/12/07 (I-001) RCT ⇒ @ Bleq. IHT ⇒ ∠D.
	S.S. I-002			→@ ~17' bgs: becoming more c.se. (mod. to c.se), incr. in basalt content (~40%) overall, brn & moist.	
	S.S. I-003				
20	S.S. I-004			→@ ~20.5' bgs: ~10% (<10%) G. (v.f. to v.c.se pebbles, rd.), much looser (some falling out of drive barrel)	Grab Sample (G.S.) from 15.5→16.0' bgs, HEIS #s: B1NPB4 & B1NPV9, @ 1425, 6/12/07 (I-002) RCT ⇒ @ Bleq, IH ⇒ ∠D.
25	G.S. I-007			21.0→27.0': Gravel (G). "Crib Rock", ~95% G, (20% v.f. to v.c.se pebbles, 60% sm. to lg. cobbles, 20% Boulders to max ~12"), basalt, sub rd. to sub ang., ~5% sand/silt mix (may partially be from crushed rock from drilling), clast supported & poorly sorted.	G.S. from 17.5→18.0' bgs, HEIS #s: B1NPB5 & B1NPW0, @ 1435, 6/12/07 (I-003) RCT ⇒ @ Bleq, IH ⇒ ∠D
	G.S. I-005	50% Rec.			
	S.S. I-006	~20% Rec.			
30	S.S. I-006	100% Rec.			
I-001	S.S. I-008				G.S. from 20.5'-p 21.0' bgs, HEIS #s: B1NPB6 & B1NPW1, @ 0840, 6/13/07 (I-004). RCT ⇒ @ Bleq, IH ⇒ ∠D
	S.S. I-009	100% Rec.			
35					
I-002	G.S. I-010			27.0→~29.5': silty Sand (mS) ~25% silt, >70% sand, <5% G. Appears moist, consol., poorly sorted. Overall, lt. brn. (observed mostly through sleeving).	Cont'd on Pg 2-0

Reported By: J. Bowles Reviewed By: L. D. Walker

Title: Geologist Title: Geologist

Signature: [signature] Date: 7/9/07 Signature: [signature] Date: 11/8/07

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 19
Date: 6/13/07 - Start; 6/27/07 - Finish

Well ID: C5515	Well Name: -N/A-	Location: 216-A-2 Crib, S. of PUREX, 200 E
Project: 216-A-2 Crib Investigation		Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample: Type No.	Sample: Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
	Not used (initials) 6/27/07			Not used (initials) 6/20/07	Cable-Tool drilling w/ hollow drive barrel
					(initials) 6/13/07
					S.S. from 24.5-25.0' bgs, HEIS # B1NPB8 & B1NPD3 @ 0920, 6/13/07 (I-007) RCT=D @ Bkgd., IHED=D
					S.S. sample from 25.0-27.0' bgs, HEIS # B1NPB7 (activity scan), @ 1020, 6/13/07 (*Full S.S. sample set not collected due to 100% rock, only collected activity scan of pulverized "rock" powder/chips). RCT=D @ Bkgd.
					S.S. sample from 26.5'→28.5' bgs. HEIS # B1NRJ2 (Activity Scan) @ 1030, 6/18/07 (*Full S.S. sample set not collected, only collected activity scan of powdery material) RCT=D (w/ RO-20) ~~...~~ (initials) 6/20/07 ~~...~~ (initials) 6/2 — I-00 (initials) 6/2
				w/ RO-20: { ... mR/hr @ 1 inch, open window / ~0.5 mR/hr @ 1 inch, closed " / (Note: Sample vol. reduced) }	
				Field Blank (FB) collected @ 1030, 6/27/07, HEIS # B1NR99, assoc. w/ I-006 SS	S.S. sample from 29.0'→31.5' bgs. HEIS #s: B1NRB5, B1NRC6, B1NRC7, B1NT07, B1NT08, & B1NR91; and Duplicates B1NRC8, B1NRC9, & B1NRH1, @ 1055, 6/27/07 (I-006). RCT=D Hottest @ (w/ RO-20) ~29.5' bgs w/ 133 µR/hr SDE & 79 µR/hr DPE (at contact) (initials) 6/27/07
				Not used (initials) 6/27/07	

Reported By: N. Beasley	Reviewed By: L. D. Walker
Title: Geologist	Title: Geologist
Signature: [signature] Date: 6/27/07	Signature: [signature] Date: 11/8/07

A-6003-642 (03/03)

BOREHOLE LOG

Page	3 of 19
Date	6/28/07 - Start; 11/26/07 - Finish
Well ID	C5515
Well Name	-N/A-
Location	216-A-2 Crib, S. of PUREX, 200E.
Project	216-A-2 Crib Investigation
Reference Measuring Point	Ground Surface.

Depth (Ft.)	Sample Type No.	Blows Recovery
40	S.S.	I-014
	S.S.	I-015
45	S.S.	I-016
	S.S.	I-018
	S.S.P.	I-017, 85% Rec.
50	S.S.	I-019, 100% Rec.
	S.S. (I-020)	I-022
	S.S. I-021	100% Rec.
55	S.S. I-023	I-024, 100% Rec.
	S.S.	I-025
60	S.S.	I-026
	S.S.	I-027
65	S.S.	I-028
	S.S.	I-029
70	S.S.	I-030
	S.S.	I-031
75	S.S.	I-032
	S.S.	I-033

Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)

- 29.5' → 37?.0': Sand (S) >95% S, mostly blk & wht ("salt & pepper Hanford Fm.), (90% med-cse, <5% fine, <5% v. cse). <5% Gr. (v. sparse) to max ~1/2" (md. pebbles).
- → @ ~31.5: Becoming more cse. (~25% v. cse), 6/28/07 more dry (v. slight moisture observed through sleeving).
- → @ ~32.0: No more Gr. content. No HCl Rxn.
- → @ ~46.5' bgs: v. thin, (discontinuous or horizontal) layer of lt. brn sandy silt (SM). only ~6" thick. Observed in bottom of Drive Barrel.
- → @ 52' bgs: v. thin section of silty Sand (mS), ~3" thick, ~25% silt, 75% v. fn. to md sand, v. dry, strong HCl rxn (calcite cmt.) Elevated Rad levels on mS layer → RCT => 100 k dpm/100 cm². (NB 7/2/07)
- → @ 52.5' bgs: return to 100% S content, "salt & pep", sim. to that @ 32' bgs., v. slight moist.
- → @ ~55' bgs. v. sparse (<5%) Gr. (cse/md. pebbles) to max 1.5", rd. <5% m
- → @ ~64.5': v. thin (~1/2 to 1" thk.) lay of sandy silt, non-plast. moist, lt. gray, signs of oxidation (~35 to 40% v. fn. S / ~60 to 65% m).

Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)

- Cable-Tool drilling w/ hollow drive barrel.
- S.S. from 30.0 → 30.5' bgs (clean out), HEIS #s B1NPB9 & B1NPW4 @ 1030, 6/28/07 (I-009). IH => ND, RCT => 7.0 mR/hr @ 1 in. open window; <0.5 mR/hr @ 1 in. closed window. on 500 mL-AG Act. Scan Jar.
- S.S. from 31.5' → 32.0' bgs, HEIS #s B1NPC? & B1NPW5, @ 1030, 7/2/07. (I-011) IH => ND; RCT => <0.5 mR/hr on cont., open; <0.5 mR/hr on cont., closed on 1.0 mL-AG Act. Scan Jar.
- S.S. soil sample from 32.0 → 34.5' bgs, HEIS #s: B1NRB6, B1NRD0, B1NRD1, B1NRD2*, B1NRD3*, B1NRH2, B1NRH3*, & B1NR92. (*samples are splits) @ 0935, 7/3/07. (I-010). IH => ND; RCT => [illegible] @ ~34.5' bgs, 2.2 mR/hr "open window" on contact, <0.5 mR/hr "closed window" on contact (w/ RO-20). Contam.: 706 dpm βγ (w/ [illegible]), 490 dpm α (w/ [illegible]) @ ~34.0' bgs)
- Field Blank (F.B.), HEIS #s B1NRB8 @ 0935, 7/3/07 (Assoc. w/ S.S. I-010). — 7.4 — D

Reported By	N. Bowles / J. Mehrer
Title	Geologist / Env. Scientist
Signature	[signature]
Date	7/26/07
Reviewed By	L. D. Walker
Title	Geologist
Signature	[signature]
Date	11/8/07

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 7/3/07 - Start
7/10/07 - Finish

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Crib, S. of PUREX, 200E

Project: 216-A-2 Crib Investigation | Reference Measuring Point: Ground Surface

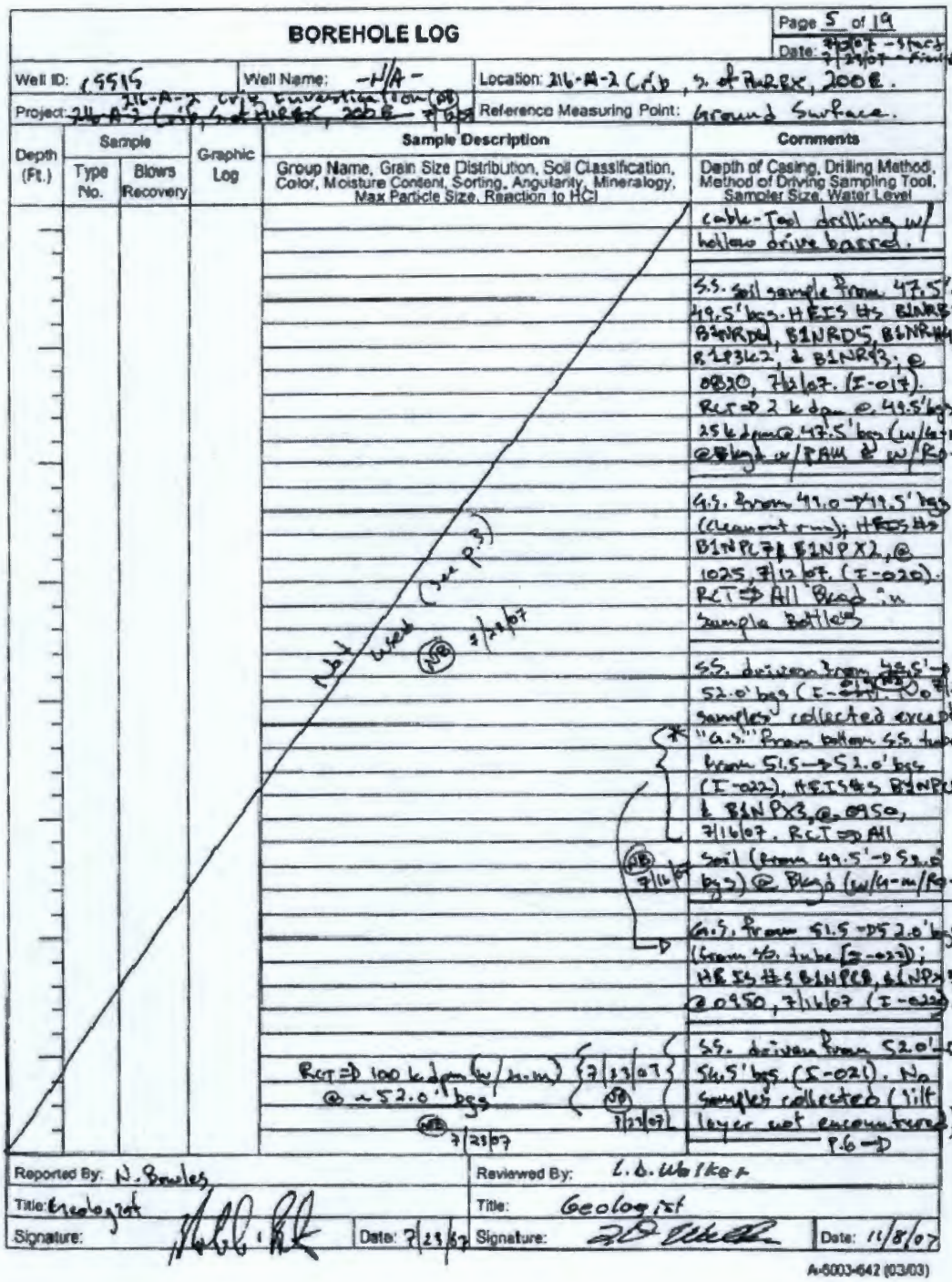
Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
					Cable-Tool drilling w/ 4 inch drive barrel.
					G.S. from 34.0'-34.5' bgs (cleaned); HEIS# B1NPC1 & B1NPW6, @ 1345, 7/3/07 (I-012). IH=>CD, RCT=> 20.5 mR/hr both open & closed window @ 1 in. (w/ RO-20) on 60 mL Alg Act. Steam jar; 1.2 mR/hr BDE @ 2.5 & 4.8 mR/hr SDE @ 5 in. on "Bulk" sample (w/ RO-20).
					G.S. from 37.0'-37.5' bgs; HEIS# B1NPC2 & B1NPW7; @ 1305, 7/9/07 (I-013).
					G.S. from 39.5'-40.0' bgs; HEIS# B1NPC3, B1NPW8, & Dup: B1NPB2; @ 1400, 7/9/07 (I-014)
					No Dose: G.S. from 42.5'-43.0' bgs; HEIS# B1NPC4 & B1NPW9, @ 0925, 7/10/07. (I-015).
					G.S. from 43.0'-45.5' bgs; HEIS# B1NPC5 & B1NPX0; @ 1015 7/10/07. (I-016). 3.2 mR/hr "open window" on contact (Bulk Sample).
					G.S. from 43.0-43.5' bgs, HEIS# B1NPC6 & B1NPX1, @ 1435, 7/10/07 (I-017) (I-018) 20 mR/hr "open window" on contact (Bulk sample).

Reported By: D. Bates | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 7/10/07 | Signature: [signature] Date: 11/1/07

A-6003-642 (03/03)



BORELOG

Page 5 of 19

Date: 7/20/07 - 7/24/07 - finish

Well ID: 15915 Well Name: -H/A- Location: 216-A-2 C.C.b, s. of PUREX, 200E.

Project: 216-A-2 C.C.b, s. of PUREX, 200E - 7/07 Reference Measuring Point: Ground Surface.

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
					Cable-Tool drilling w/ hollow drive barrel.
					S.S. soil sample from 47.5' -> 49.5' bgs. HEIS #s B1NR87, B1NRD4, B1NRD5, B1NRH4, B1P3K2, & B1NR93; @ 0820, 7/12/07. (I-017). RCT => 2 k dpm @ 49.5' bgs, 256 dpm @ 47.5' bgs (w/ G-M), @ Bkgd w/ PAM & w/ R9-20.
					G.S. from 49.0 -> 49.5' bgs (cleanout run); HEIS #s B1NPL7 & B1NPX2, @ 1025, 7/12/07. (I-020). RCT => All Bkgd in sample bottles
					S.S. driven from 49.5' -> 52.0' bgs (I-021). No samples collected except "G.S." from bottom SS tube from 51.5 -> 52.0' bgs (I-022), HEIS #s B1NPL8 & B1NPX3, @ 0950, 7/16/07. RCT => All soil (from 49.5' -> 52.0' bgs) @ Bkgd (w/ G-M/R9-20).
					G.S. from 51.5 -> 52.0' bgs (from 4th tube [I-022]); HEIS #s B1NPL8, B1NPX3, @ 0950, 7/16/07 (I-022).
				RCT => 100 k dpm (w/ G-M) @ ~52.0' bgs 7/23/07	SS. driven from 52.0' -> 54.5' bgs (I-023). No samples collected (silt layer not encountered).

P.6 ->

Reported By: N. Bowles Title: Geologist Signature: Date: 7/23/07

Reviewed By: L. D. Walker Title: Geologist Signature: Date: 11/8/07

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 19
Date: 7/17/07 – Start; 7/24/07 – Finish.

Well ID: C5515	Well Name: –N/A–	Location: 216-A-2 Crib, S. of PUREX, 200E
Project: 216-A-2 Crib Investigation		Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
				Not used (see p. 3) RB 7/24/07	Cable-Tool drilling w/ hollow drive barrel.
					G.S. from 54→54.5' bgs. HEIS #s B1NPC9 & B1NPX4 @ 1715, 7/23/07 (I-024); RCT ⇒ @ Bkgd.
					SS soil sample from 54.5'→57.0' bgs; HEIS #s B1NRF0, B1NRF0, B1NRF1, B1NRH7, B1NR96 & B1P3J7; @ 0835, 7/24/07. (I-023). RCT ⇒ All @ Bkgd.
					Field Blank (FB); HEIS # B1NRR4 @ 0850, 7/24/07 (Assoc. w/ I-023 SS sample).
					G.S. from 57.0→57.5' bgs; HEIS #s B1NPD0 & B1NPX5; @ 0940, 7/24/07 (I-025). RCT ⇒ 18k dpm β8 w/ G.M.; No Alpha.
					G.S. from 59.5→60.0' bgs; HEIS #s B1NPD1 & B1NPX6; @ 1030, 7/24/07 (I-026). RCT ⇒ @ Bkgd.
					G.S. from 62.0'→62.5' bgs; HEIS #s B1NPD2 & B1NPX7; @ 1320, 7/24/07 (I-027). RCT ⇒ @ Bkgd.
					G.S. from 64.0'→64.5' bgs; HEIS #s B1NPD3 & B1NPX8; @ 1350, 7/24/07. (I-028). RCT ⇒ 12 k dpm w/ G.M.

Reported By: N. Bowles	Reviewed By: L. D. Walker
Title: Geologist	Title: Geologist
Signature: [signature] Date: 7/24/07	Signature: [signature] Date: 11/8/07

A-6003-642 (03/03)

BOREHOLE LOG

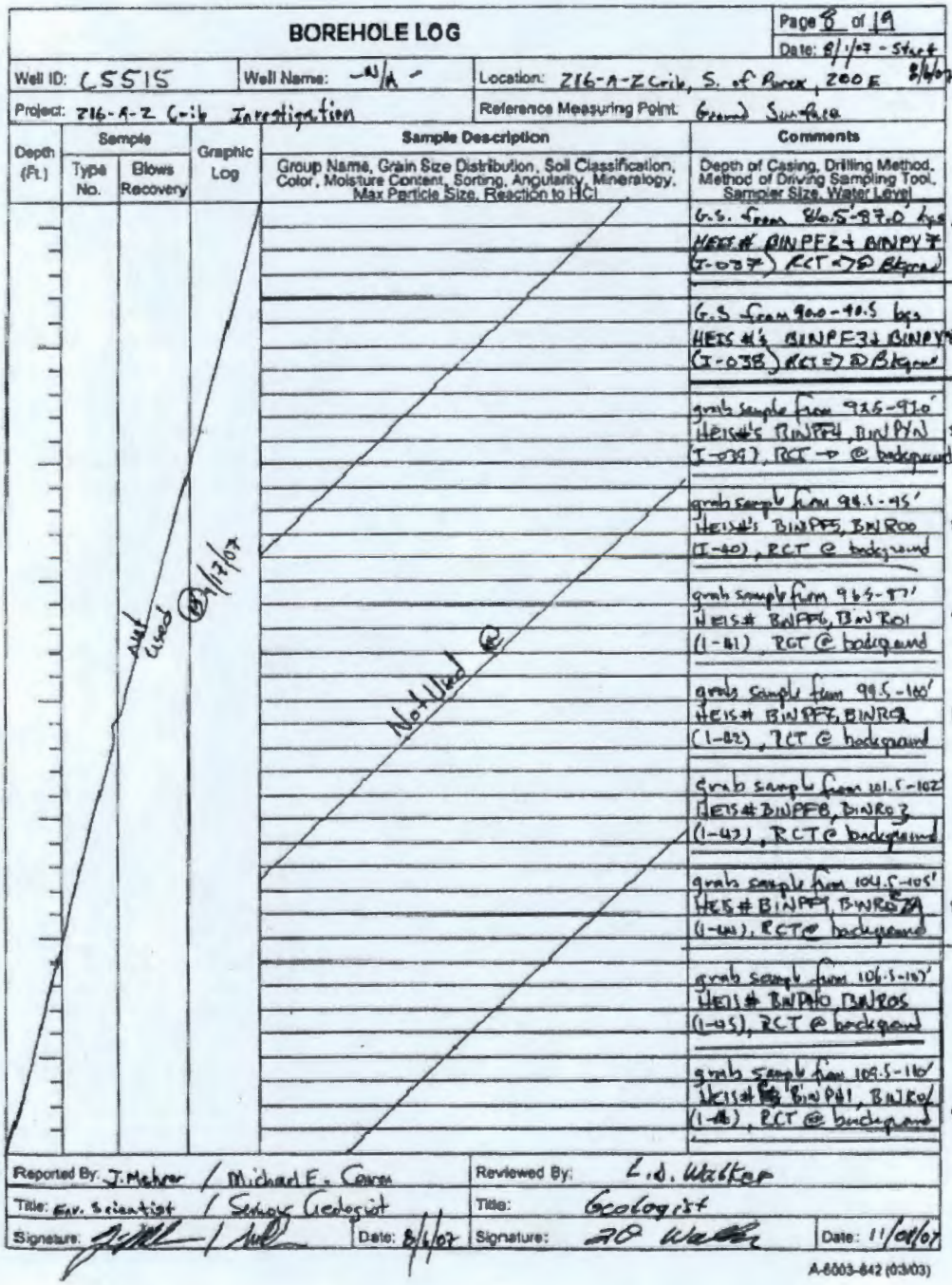
Page 7 of 19
Date: 8/2/07 - Start

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Crib, S. of PUREX, 200E
Project: 216-A-2 Crib Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	G.S.	I-34		765.0 – return to 100% S content "Salt n Pepper" v. slightly moist little to no silt - NO RXN TO HCl	Cable-Tool drilling, w/ hollow drive barrel
	G.S.	I-35			G.S. from 66.5' → 67.0' bgs;
85	G.S.	I-36		=> 850 – Silt % increases Still Sand moderate RXN TO HCl	HEIS #'s B1NPD4 & B1NPX9; @1425, 7/27/07; RCT'd Bkgd. (I-029)
	G.S.	I-37			G.S. from 70.0' → 70.5' bgs;
90	G.S.	I-38		91.5-92': well-sorted medium sand (S), felsic, some muscovite, mostly quartz	HEIS #'s B1NPD5 & B1NPX8; @1445, 7/24/07 (I-030). RCT'd @ Bkgd.
		I-39			G.S. from 72.5' → 73.0' bgs;
		I-40		94': thin layer (1-2") of fine sand	HEIS #'s B1NPD6 & B1NPX2; @1415, 7/25/07.
95		I-41		94.5-95': sand with sparse, thin silty layers, moderate HCl reaction	(I-031). RCT'd @ Bkgd.
		I-42		96.5-97': sand with sparse, calcareous silty layers, medium felsic sand	G.S. from 77.0 → 77.5' bgs; HEIS #'s B1NPD7 & B1NPX2; @1425, 7/25/07.
100		I-43		102': medium felsic sand, well-sorted	(I-032). RCT'd @ Bkgd.
		I-44		105': medium felsic sand, well-sorted	G.S from 77.5 - 78.0' bgs HEIS #'s B1NPD8 & B1NPY3 (I-033). RCT => 2 Bkg 7-26-
105		I-45		107': slightly coarser sand	G.S from 79.5 - 80.0' bgs HEIS #'s B1NPD9 & B1NPY4 (I-034) RCT => 2 Bkg 7-26-
		I-46		110': medium sand, well-sorted, felsic (mostly quartz)	G.S from 82.0 - 82.5' bgs HEIS #'s B1NPE0 & B1NPY5 (I-035) RCT => 2 Bkgnd 7-26-
110		I-47			
		I-48		117.5': medium sand, well-sorted, felsic	G.S from 84.5 - 85.0' bgs HEIS #'s B1NPE1 & B1NPY6 (I-036) RCT => 2 Bkgnd 7-26-
115		I-49			

Reported By: N. Bowles / J. Mehrer / M E Corn | Reviewed By: L. D. Walker
Title: Geologist / Env. Scientist / Sr. Geologist | Title: Geologist
Signature: [signature] Date: 8-6-07 | Signature: [signature] Date: 11/8/07

A-6003-642 (03/03)



BOREHOLE LOG

Page 8 of 19
Date: 8/1/07 - Start
8/6/07 - Finish

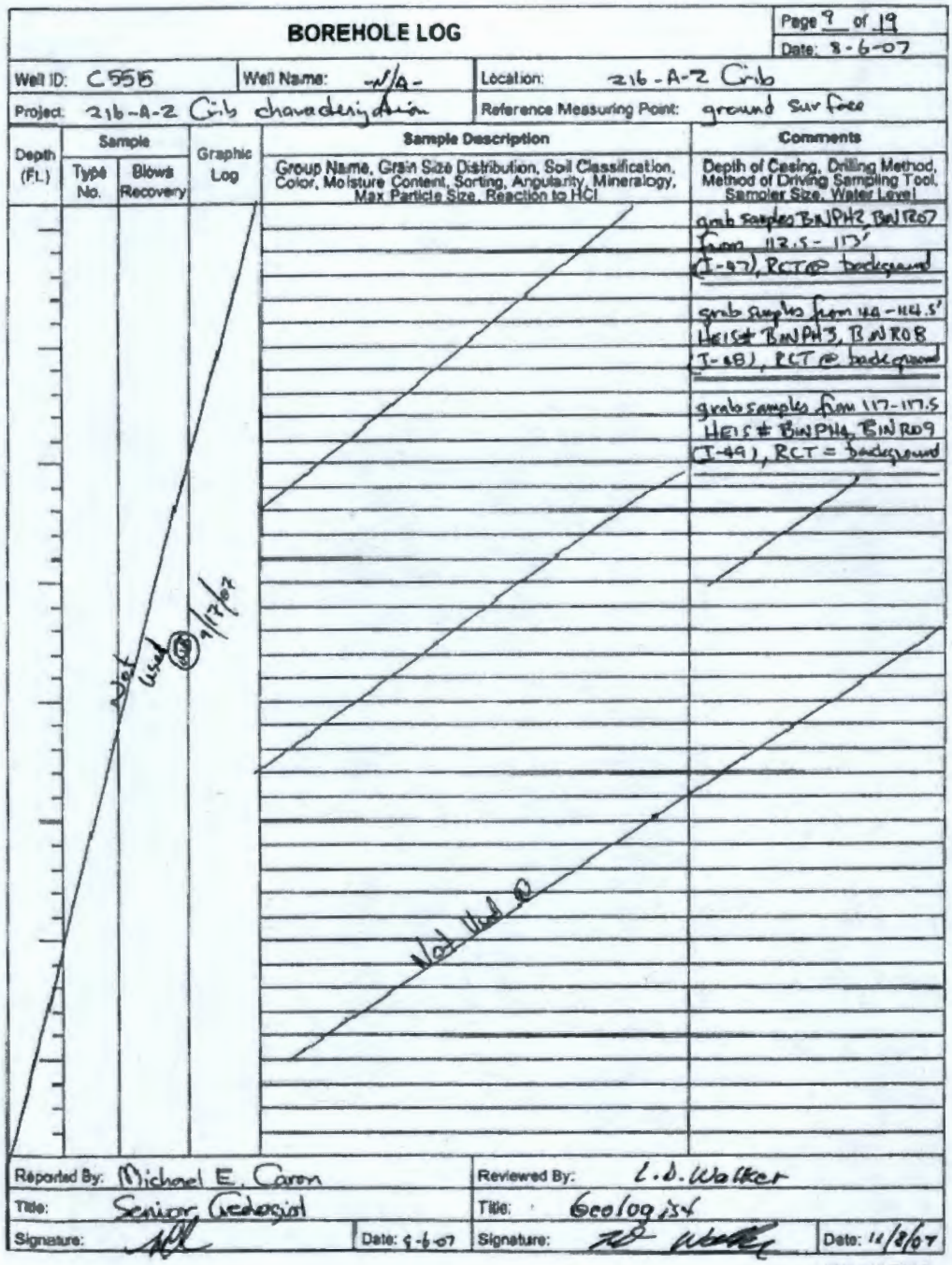
Well ID: C5515 | Well Name: -#1/A- | Location: Z16-A-Z Crib, S. of Power, 200 E
Project: Z16-A-Z Crib Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
					G.S. from 86.5-87.0 bgs HEIS #'s BINPF2+BINPY7 (I-037) RCT=2 Bkgrnd 8-1-07
					G.S from 90.0-90.5 bgs HEIS #'s BINPF3+BINPY8 (I-038) RCT=2 Bkgrnd 8-1-07
					grab sample from 93.5-94.0' HEIS#'s BINPF4, BINPY9 (I-039), RCT=0 @ background 8-6-07
					grab sample from 94.5-95' HEIS#'s BINPF5, BINR00 (I-40), RCT @ background 8-6-07
					grab sample from 96.5-97' HEIS# BINPF6, BINR01 (I-41) RCT @ background 8-6-07
					grab sample from 99.5-100' HEIS# BINPF7, BINR02 (I-42), RCT @ background 8-6-07
					grab sample from 101.5-102' HEIS# BINPF8, BINR03 (I-43), RCT @ background 8-6-07
					grab sample from 104.5-105' HEIS# BINPF9, BINR04 (I-44), RCT @ background 8-6-07
					grab sample from 106.5-107' HEIS# BINPA0, BINR05 (I-45), RCT @ background 8-6-07
					grab sample from 109.5-110' HEIS# BINPA1, BINR06 (I-46), RCT @ background 8-6-07

Not Used
Not Used 8/17/07

Reported By: J. Mahrer / Michael E. Cearn | Reviewed By: L.D. Walker
Title: Env. Scientist / Senior Geologist | Title: Geologist
Signature: [signature] / [signature] Date: 8/6/07 | Signature: [signature] Date: 11/01/07

A-6003-842 (03/03)



BOREHOLE LOG

Page 9 of 19
Date: 8-6-07

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Crib
Project: 216-A-2 Crib characterization | Reference Measuring Point: ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
					grab samples BWPH2, BWR07 from 113.5-113' (J-97), RCT@ background 8-6-07
					grab samples from 114-114.5' HEIS# BWPH3, BWR08 (J-98), RCT@ background 8-6-07
					grab samples from 117-117.5 HEIS# BWPH4, BWR09 (J-99), RCT = background 8-6-07

Start Used @ 9/17/07

Not Used @

Reported By: Michael E. Caron | Reviewed By: L.D. Walker
Title: Senior Geologist | Title: Geologist
Signature: [signature] Date: 8-6-07 | Signature: [signature] Date: 11/8/07

A-6003-642 (03/03)

BOREHOLE LOG

Page 10 of 19

Date: 8-6-07 - Started 8/7/07 - Finished

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Crib

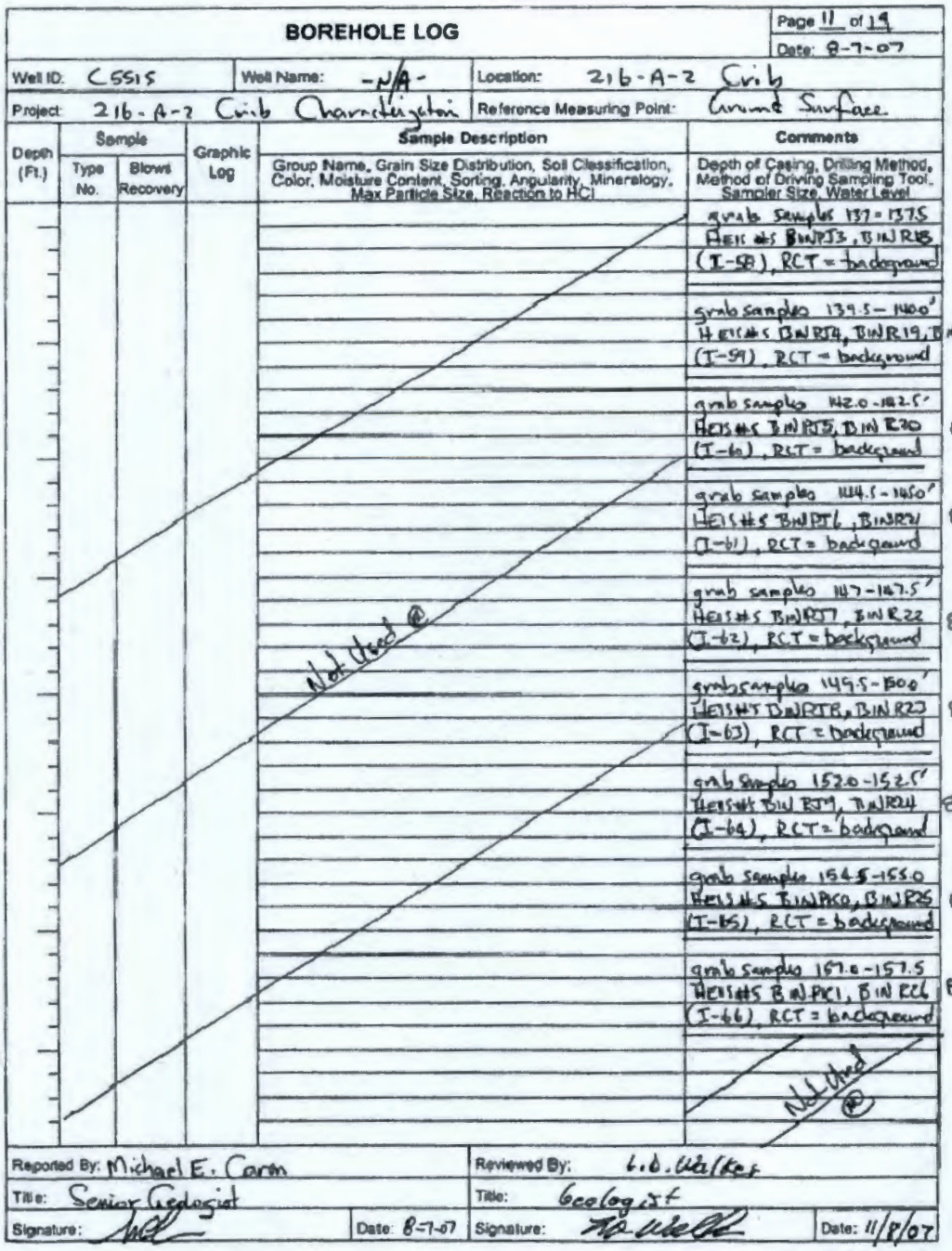
Project: 216-A-2 Crib Characterization | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
120		I-50		121.5': medium sand (S), mostly felsic with <25% mafic clasts, well-sorted	Cable tool with 2' drive barrel (7" dia.)	
		I-51			grab sample 119.5-120'	
				123.5': Sand as above, dry, harden drilling	HEIS # B1NPH5, B1NR10 (I-50), RCT = background	8-6-07
125		I-52				
		I-53		128': medium sand, felsic, <20% mafic clasts, quartzose, some surviving micas (granitic provenance?)	grab sample 122.0-122.5' HEIS # B1NPH6, B1NR11 (I-51), RCT = background	8-6-07
130		I-54			grab sample 124.5-125'	
		I-55		130': medium sand, 30-40% mafic clasts, most clasts angular	HEIS # B1NPH7, B1NR12 (I-52), RCT = background	8-6-07
		I-56		132': medium - coarse sand, moderately sorted, 30-40% mafic	grab sample 127.0-127.5	
		I-56			HEIS # B1NPH8, B1NR13 (I-53), RCT = background	8-6-07
135		I-57		136': coarse sand, >60% mafic clasts	grab sample 129.5-130.0	
		I-58			HEIS #s B1NPH9, B1NR14 (I-54), RCT = background	8-7-07
140		I-59		137.5': medium sand 30-40% mafic clasts, qtz dominated	grab sample 131.0-131.5	
		I-60		138': medium sand, minor iron oxide, moderate HCl reaction, <25% mafic	HEIS #s B1NPJ0, B1NR15 (I-55), RCT = background	8-7-07
145		I-61		140': medium sand, moderate carbonate cement	grab sample 132.0-132.5	
		I-62		141': medium sand, no carbonate	HEIS #s B1NPJ1, B1NR16 (I-56), RCT = background	8-7-07
				142': medium sand, moderate carbonate		
				145': medium sand, no carbonate (I-56)		
150		I-63		147.5': medium sand, moderate carbonate		
				148': fine sand, moderate carbonate	split spoon 132.5-135.0	
		I-64		151.5': medium sand, no carbonate	HEIS #s B1NPC1, B1NRF2, B1NR97, B1NRH8 (I-55), RCT = background	8-7-07
				154': fine - medium sand, weak carbonate		
155		I-65		156.6': medium sand, no carbonate		
				159': medium felsic sand, well-sorted, ~25% mafic clasts, some mica, no carbonate	grab sample 134.1-135' HEIS #s B1NPJ2, B1NR17 (I-57), RCT = background	8-7-07
		I-66				

Reported By: Michael E. Carm | Title: Senior Geologist | Signature: [signature] | Date: 8/7/07

Reviewed By: L. D. Walker | Title: Geologist | Signature: [signature] | Date: 11/8/07

A-6003-842 (03/03)



BOREHOLE LOG

Page 11 of 19
Date: 8-7-07

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Crib
Project: 216-A-2 Crib Characterization | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
					grab Samples 137-137.5 HEIS #S BINPT3, BINR18 (I-58), RCT = background	8-7-07
					grab samples 139.5-140' HEIS #S BINRT4, BINR19, BINRP4 (I-59), RCT = background	8-7-07
					grab samples 142.0-142.5' HEIS #S BINRT5, BINR20 (I-60), RCT = background	8-7-07
					grab samples 144.5-145.0' HEIS #S BINPT6, BINR21 (I-61), RCT = background	8-7-07
					grab samples 147-147.5' HEIS #S BINRT7, BINR22 (I-62), RCT = background	8-7-07
					grab samples 149.5-150' HEIS #S BINRT8, BINR23 (I-63), RCT = background	8-7-07
					grab Samples 152.0-152.5' HEIS #S BINRT9, BINR24 (I-64), RCT = background	8-7-07
					grab samples 154.5-155.0 HEIS #S BINPR10, BINR25 (I-65), RCT = background	8-7-07
					grab samples 157.0-157.5 HEIS #S BINPR11, BINR26 (I-66), RCT = background	8-7-07

Not Used

Not Used

Reported By: Michael E. Caron | Reviewed By: L.C. Walker
Title: Senior Geologist | Title: Geologist
Signature: [signature] Date: 8-7-07 | Signature: [signature] Date: 11/8/07

A-6003-642 (03/03)

12

BOREHOLE LOG

Page 1 of 11
Date: 8/1/07 - start
8/13/07 - finish

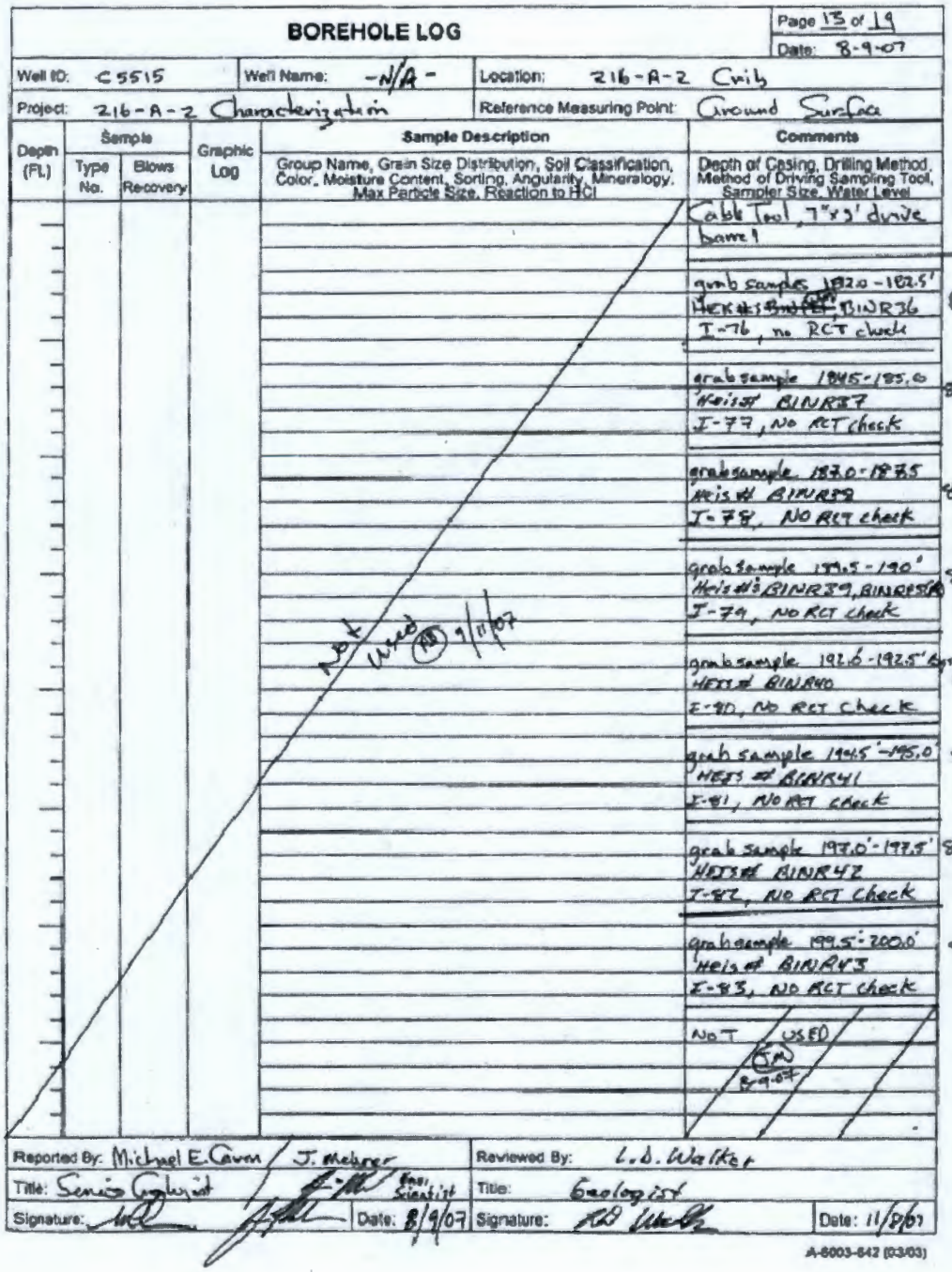
Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Crib
Project: 216-A-2 Characterization | Reference Measuring Point: Ground Surface

Depth (Ft)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level	
160	I-67			160': medium felsic sand, ~25% mafic clasts, no carbonate, well-sorted	Cable Tool rig, 7"x2' drive barrel	
	I-68			161.5': fine-medium sand		
				163': medium felsic sand, no carbonate	grab samples 159.5-160'	
				165': medium sand, <25% mafic clasts	HEIS #'S B1NPK2, B1NR27	8-8-07
165	I-69			167.5': medium sand, 25-30% mafic clast, moderate carbonate cement	(I-67) RCT = background	
	I-70				grab samples 162.0-162.5 HEIS #'S B1NPK3, B1NR28 (I-68), RCT = background	8-8-07
	I-71			170.0': fine-medium sand, poorly sorted, 30-35% mafic clasts, weak to moderate carbonate cement		
170				172': medium sand, <25% mafic clasts, moderate carbonate cement	grab samples 164.5-165 HEIS #'S ~~B1NPK4~~, B1NR29	8-9-07
	I-72			175': medium sand, ~25% mafic clasts, moderate carbonate cement	(I-69) - no RCT check	
175	I-73			very	grab samples 167.0-167.5 HEIS #'S ~~B1NPK5~~, B1NR30	8-9-07
	I-74			179': medium sand, ^sparse mafic clasts to 1-2 mm, weak to moderate carbonate cement, ~25% mafic clasts	(I-70), RCT = background	
	I-75				grab samples 169.5-170.0 HEIS #'S ~~B1NPK6~~, B1NR31	8-9-07
180				185': medium sand; mafic; weak → moderate Rxn w/ HCl	(I-71) - no RCT check	
	I-76				grab samples 172.0-172.5	
	I-77			190': medium sand; sparse mafic clasts weak → moderate Rxn to HCl; poorly sorted	HEIS #'S ~~B1NPK7~~, B1NR32 (I-72) - no RCT check	8-9-07
185	I-78			195': medium sand; 35-40% mafic clasts; moderate Rxn to HCl; moderate carbonate cement (sand is a little more course).	grab samples 177.5-178.0 HEIS #'S ~~B1NPK8~~, B1NR33 (I-73) - no RCT check	8-9-07
	I-79					
190	I-80			200': Same desc. as above	grab samples 177.0-177.5 HEIS #'S ~~B1NPK9~~, B1NR34 (I-74) - no RCT check	8-9-07
				D@ ~201' bgs: V. fine sand ~90% v. l. s, <10% s.lt.		
195	I-81			90% felsic, lt. brn, dry mod. HCl Rxn, V. calcareous.	grab samples 179.5-180' HEIS #'S ~~B1NPK10~~, B1NR35 (I-75) - no RCT check	8-9-07
	I-82					

Reported By: Michael E. Caron / N. Bowles
Title: Senior Geologist / Geologist
Signature: [signature] Date: 8/13/07

Reviewed By: L. D. Webster
Title: Geologist
Signature: [signature] Date: 11/8/07

A-6003-642 (03/03)



BOREHOLE LOG

Page 13 of 19
Date: 8-9-07

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Crib
Project: 216-A-2 Characterization | Reference Measuring Point: Ground Surface

Depth (FL)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
					Cable Tool, 7"x3' drive barrel
					grab sample 182.0-182.5' Hels# BINR36 I-76, no RCT check 8-9-07
					grab sample 184.5-185.0 Hels# BINR37 I-77, No RCT check 8-9-07
					grab sample 187.0-187.5 Hels# BINR38 I-78, NO RCT check 8-9-07
					grab sample 189.5-190' Hels#'s BINR39, BINR39A I-79, NO RCT check 8-9-07
					grab sample 192.0-192.5' Hels# BINR40 I-80, NO RCT check 8-9-07
					grab sample 194.5'-195.0' Hels# BINR41 I-81, NO RCT check 8-9-07
					grab sample 197.0'-197.5' Hels# BINR42 I-82, NO RCT check 8-9-07
					grab sample 199.5'-200.0' Hels# BINR43 I-83, NO RCT check 8-9-07
					NOT USED 8-9-07

Not used 9/11/07

Reported By: Michael E. Caven / J. Metzger | Title: Senior Geologist / Engineering Scientist | Signature: | Date: 8/9/07
Reviewed By: L.D. Walker | Title: Geologist | Signature: | Date: 11/5/07

A-6003-642 (03/03)

BOREHOLE LOG

Page 14 of 19 — Date: 8/14/07

Well ID: C5575 — Well Name: -N/A- — Location: 216-A-2 Crib, S. Area, 200 E.

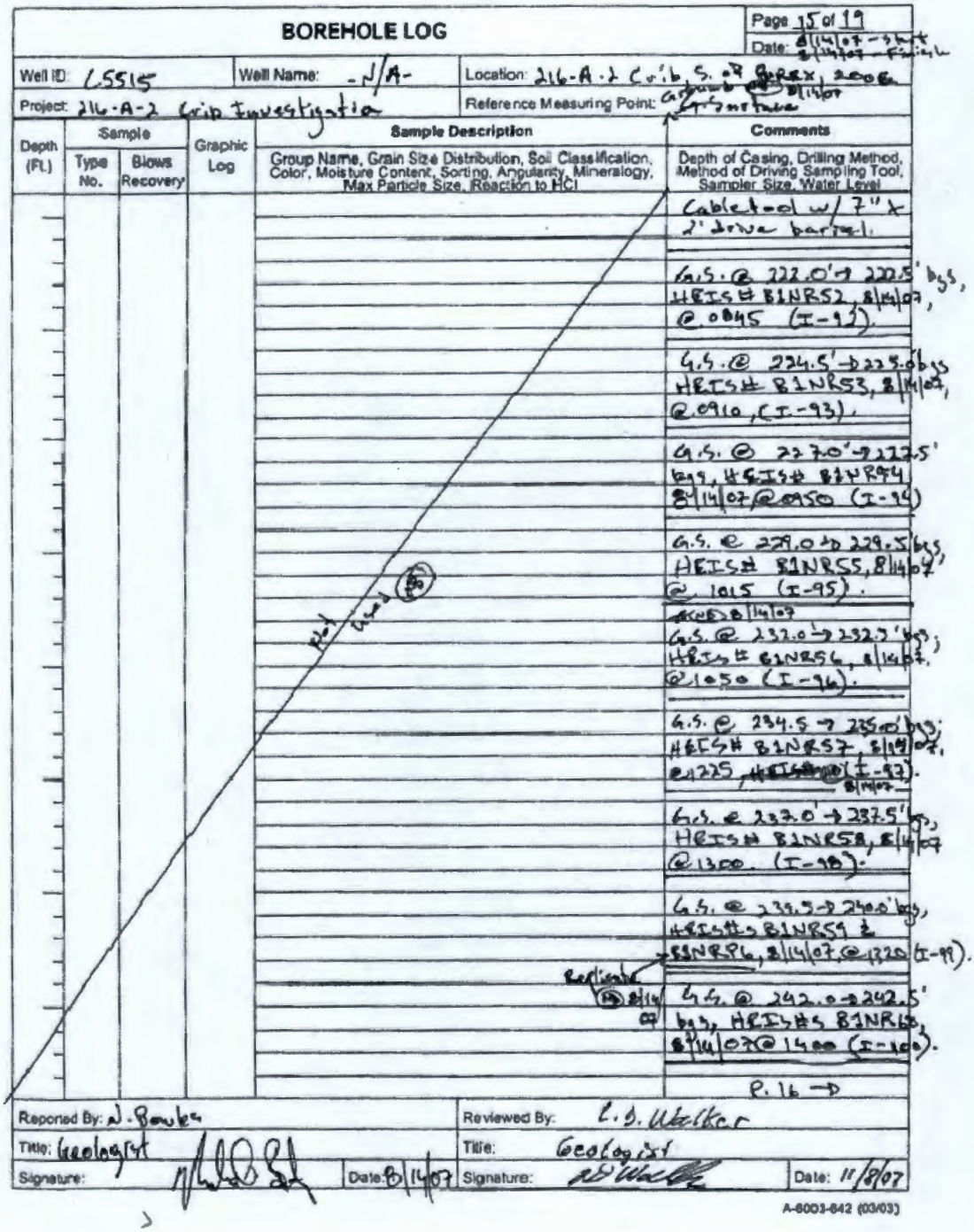
Project: A-Z Characterization Borehole — Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200		I-83			Cable tool w/ 7" x 2' drive barrel
	G.S.	I-84		→ @ 202.0' bgs: inc. in consol. to mod. consol., slight inc. in HCl rxn to mod to strong, lt. gray to grayish brn, ~30%	Clean out drive barrel to 4" x @ ~ 201.5' bgs.
205	G.S.	I-85		→ @ 205' bgs: slight inc. in moisture to slight, locally clumping, lt. grayish brn, inc. in grain size to fn. to med. sand, <5% silt, ~35 to 40% med. mod. consol, v. thin carbonate layers.	@ 8/13/07 Collect G.S. @ 202.0' bgs. HEIS # B1NR44, @ 1000, 8/13/07 (I-84). Collect G.S. @ 205.0' bgs. HEIS # B1NR45, @ 1025, 8/13/07 (I-85).
	G.S.	I-86			
210	G.S.	I-87			
	G.S.	I-88			
215	G.S.	I-89			Collect G.S. @ 207.0' bgs. 207.5' bgs. HEIS # B1NR46, @ 1255, 8/13/07 (I-86).
	G.S.	I-90			
220	G.S.	I-91		→ @ 219.5': inc. grain size. <5% silt, 10% VFS, 45% v.fn. pebbles (basalt). Sand is v.fn. to fn. use. V. poorly sorted, overall ~70% Basalt, slight moisture, No HCl Rxn.	G.S. @ 209.5' → 210.0' bgs HEIS # B1NR47 @ 1330, 8/13/07 (I-87)
	G.S.	I-92			G.S. @ 212.0' → 212.5' bgs HEIS # B1NR48 @ 1405, 8/13/07 (I-88)
225	G.S.	I-93			
	G.S.	I-94			Switch back to 7" D.B.
230	G.S.	I-95		→ @ 227': dec. grain size overall No gravel, ~5% M., 95% S (80% v.fn. to med, 20% use to v. use) V. Slight HCl Rxn.	G.S. @ 214.5' → 215.0' bgs HEIS # B1NR49 @ 1515, 8/13/07 (I-89)
	G.S.	I-96		→ @ 230': G. cont: >95% v.fn to med. S (silt <5%	G.S. @ 217.0' → 217.5' bgs HEIS # B1NR50 @ 1545, 8/13/07 (I-90).
235	G.S.	I-97			
	G.S.	I-98			G.S. @ 219.5' → 220.0' bgs HEIS # B1NR51 @ 0830, 8/14/07 (I-91).

Reported By: J. Mackey / N. Bowles — Title: Fac. Scientist / Geologist — Signature: [signature] — Date: 8/14/07

Reviewed By: C. D. Walker — Title: Geologist — Signature: [signature] — Date: 11/2/07

A-6003-642 (03/03)



BOREHOLE LOG

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Date: 8/14/07 – 8/14/07

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Cr'b, S. of BARRX, 200E

Project: 216-A-2 Grid Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
					Cable-tool w/ 7" x 2' Drive barrel.
					G.S. @ 222.0' → 222.5' bgs, HEIS # B1NRS2, 8/14/07, @ 0845 (I-93).
					G.S. @ 224.5' → 225.0' bgs HEIS # B1NRS3, 8/14/07, @ 0910, (I-93).
					G.S. @ 227.0' → 227.5' bgs, HEIS # B1NRS4 8/14/07 @ 0950 (I-94)
					G.S. @ 229.0' → 229.5' bgs, HEIS # B1NRS5, 8/14/07, @ 1015 (I-95).
					8/14/07 G.S. @ 232.0' → 232.5' bgs; HEIS # B1NRS6, 8/14/07, @ 1050 (I-96).
					G.S. @ 234.5' → 235.0' bgs; HEIS # B1NRS7, 8/14/07, @ 1225, HEIS # [illegible] @ (I-97). 8/14/07
					G.S. @ 237.0' → 237.5' bgs, HEIS # B1NRS8, 8/14/07 @ 1300. (I-98).
					G.S. @ 239.5' → 240.0' bgs, HEIS #s B1NRS9 & B1NRS10, 8/14/07 @ 1320 (I-99).
					8/14/07 G.S. @ 242.0' → 242.5' bgs, HEIS #s B1NRB0, 8/14/07 @ 1400 (I-100).
					P. 16 →

Reported By: N. Bowles | Reviewed By: L. J. Walker

Title: Geologist | Title: Geologist

Signature: [signature] | Date: 8/14/07 | Signature: [signature] | Date: 11/8/07

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 8/14/07 - start; 8/20/07 - finish

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Crib, S. of PUREX, 200E

Project: 216-A-2 Crib Investigation | Reference Measuring Point:

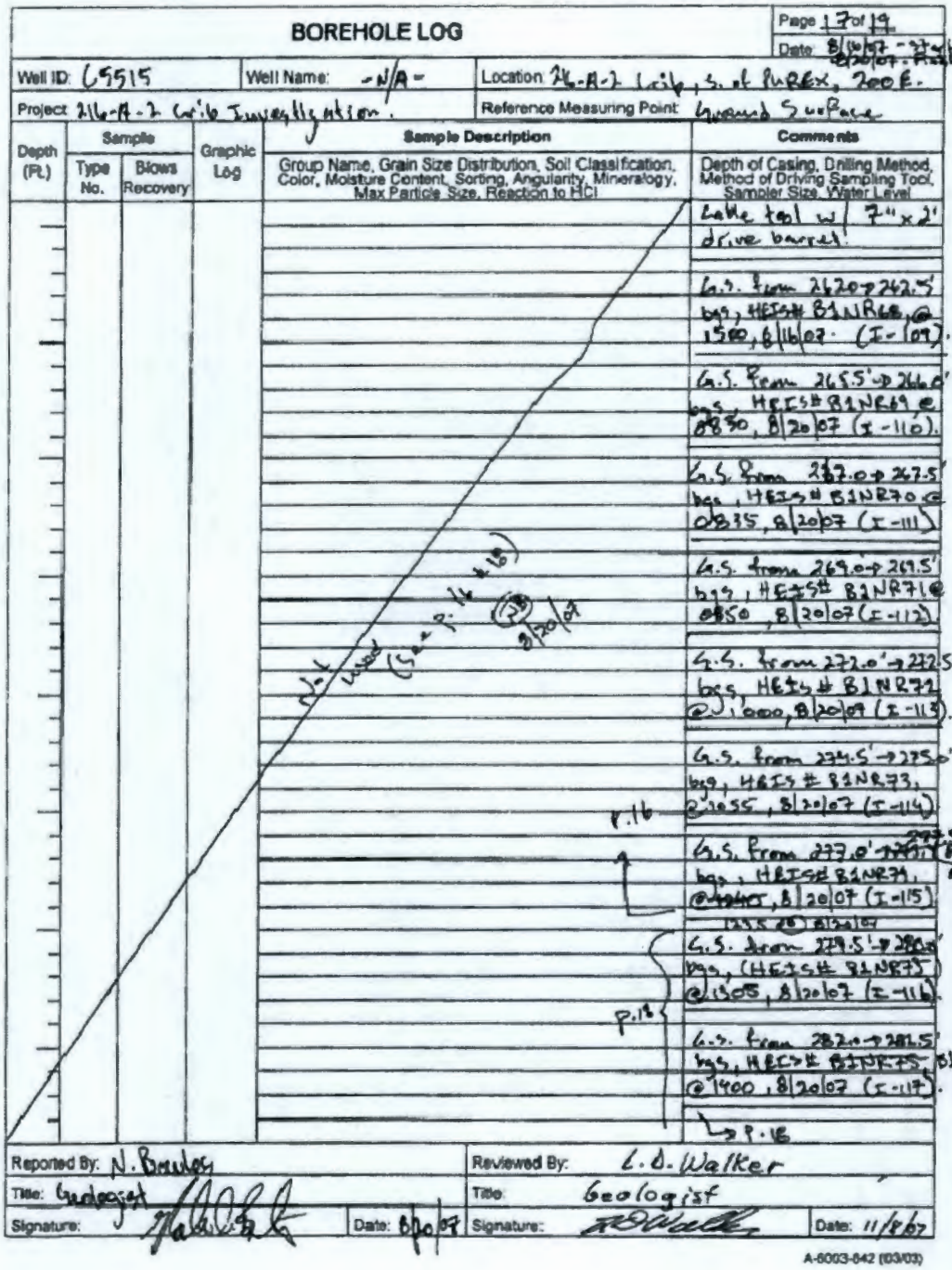
Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240	G.S.	I-99 (9.15)		(@ 4ft)	Cable tool w/ 7" x 2' drive barrel.
	G.S.	I-100 (9.15)			G.S. from 244.0' → 244.5' bgs, HEIS# B1NR61, @ 1420, 8/14/07 (I-101)
245	G.S. Catch	I-101			
	G.S.	I-102		→ @ 247' bgs: v. slight inc. in v.fn to fn. portion of sand content (S: 80% v.fn to fn., 20% med)	G.S. from 247.0' → 247.5' bgs, HEIS# B1NR62, @ 1505, 8/14/07 (I-102).
250	G.S. S.S. (I-103)	I-104			G.S. from 250.0' → 250.5' bgs, HEIS# B1NR63, @ 1100, 8/14/07 (I-104).
	G.S. (I-105)			→ @ 252' bgs: Slight inc. in silt cont. (<10% overall), in v. thin layers, sparse, <½" thk., brn., moist.	S.S. soil sample from 250.5' → 253.0' bgs, HEIS#s B1NRC2, B1NRF4, B1NRF5, B1NRH9 & B1NR98, @ 1225, 8/15/07 (I-103)
255	G.S.	I-106		→ @ 253': thin silt layers no longer present. [F.B. @ 1220, 8/15/07, HEIS# B1NRR6 8/15/07]	
	G.S.	I-107			
260	G.S.	I-108		→ @ ~259': more consol., v. thin (<½") silty sand layers, (silt portion is grayish brn). V. slight HCl Rxn., v. slightly moist to dry. ~10% m. brwn	G.S. from 252.5 → 253.0' bgs (from cleanout); HEIS# B1NR64, @ 1050, 8/16/07 (I-10
	G.S.	I-109			
265	G.S.	I-110		→ @ ~263.5' bgs: v. thin sand/silt layer (~2" thk.). ~35 to 40% v.fn to fn sand, 60 to 65% m. brn, low plasticity, No HCl Rxn. moist.	G.S. from 254.5' → 255.0' bgs, HEIS# B1NR65, @ 1320, 8/16/07 (I-106).
	G.S.	I-111			
270	G.S.	I-112		→ @ ~264': inc. in G content to ~<10% (v.fn to csa pebbles) smaller G (v.fn to fn ~80%, ang to subang); (med to csa ~20%, rd. to subrd.), oxidation.	G.S. from 257.0 → 257.5' bgs, HEIS# B1NR66, @ 1335, 8/16/07 (I-107).
	G.S.	I-113			G.S. from 259.5 → 260.0' bgs, HEIS# B1NR67, @ 1435, 8/16/07 (I-108).
275	G.S.	I-114		→ @ ~270: less G (<5%) more dry (slight moisture), <5% m. Mod to strong HCl Rxn.	
	G.S.	I-115		→ @ ~277: slight inc. in G (to <10%) more consol.	→ p.17.

Reported By: N. Bowles | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 8/20/07 | Signature: [signature] Date: 11/8/07

A-6003-642 (03/03)



BOREHOLE LOG

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Date: 8/10/07 - 8/20/07 - Final

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Leib, S. of PUREX, 200 E.

Project: 216-A-2 Cr'ib Investigation. | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
					Cable tool w/ 7" x 2' drive barrel.
					G.S. from 262.0' to 262.5' bgs, HEIS# B1NR68, @ 1500, 8/16/07. (I-109).
					G.S. from 265.5' to 266.0' bgs, HEIS# B1NR69 @ 0830, 8/20/07 (I-110).
					G.S. from 267.0' to 267.5' bgs, HEIS# B1NR70 @ 0835, 8/20/07 (I-111)
					G.S. from 269.0' to 269.5' bgs, HEIS# B1NR71 @ 0850, 8/20/07 (I-112).
					G.S. from 272.0' to 272.5' bgs, HEIS # B1NR72 @ 1000, 8/20/07 (I-113).
					G.S. from 274.5' to 275.0' bgs, HEIS # B1NR73, @ 1055, 8/20/07 (I-114).
					G.S. from 277.0' to 277.5' bgs, HEIS# B1NR74, @ 1140, 8/20/07 (I-115).
					G.S. from 279.5' to 280.0' bgs, (HEIS# B1NR75) @ 1305, 8/20/07 (I-116).
					G.S. from 282.0' to 282.5' bgs, HEIS# B1NR75, @ 1400, 8/20/07 (I-117).

p.16 → p.16

Reported By: N. Bowles | Title: Geologist | Signature: | Date: 8/20/07

Reviewed By: L. D. Walker | Title: Geologist | Signature: | Date: 11/8/07

A-6003-842 (03/03)

BOREHOLE LOG

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Date: 8/20/07 - Start; 8/21/07 - Finish

Well ID: C5515	Well Name: -N/A-	Location: 216-A-2 Crib, S. of 4th St, 200E	
Project: 216-A-2 Crib Investigation		Reference Measuring Point: Ground Surface	

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
280	G.S.	I-116 (p.17)			Cable tool w/ 7" x 2'
				~~-> @ ~~ (initialed) 8/20/07	drive barrel.
				278' -> 284.0': Sandy Gravel (sG)	
	G.S.	I-117 (p.17)		~45 to 50% G (v. fn to v. csc	G.S. from 284.5' -> 285.0'
				pebbles, max ~2") subrd, ~60%	bgs, HEIS # B1NR77,
285	G.S.	I-119		basalt, 40% felsic	@ 1450, 8/20/07 (~~I-118~~) (I-119) (initialed 8/20)
	S.S.	I-118 (100% Rec.)		~~~50 to 55%~~ 40 to 45% S, ang.	
				(~~[illegible]~~ initialed 8/20/07), ~<10% silt,	S.S. soil sample from
	G.S.	I-120		poorly sorted, weathered, moist,	285.0' -> 287.0' bgs,
				semi-consol, matrix supported.	HEIS #s B1NR76, B1NR77,
290	G.S.	I-121		No to slight HCL Rxn.	B1NR50, B1NT09, &
					B1NR82; @ 0805,
				-> ~281': inc. in G. size to	8/21/07 (I-118).
	G.S.	I-122		max ~3", subrd., ~60% G,	Also, FB. @ 0800, 8/21/07,
				~30% S, <10% m.	HEIS # B1NRR7.
295	G.S.	I-123			
				284.0' -> 303': Silt (m) (initialed 8/21/07)	G.S. from 287.0' -> 287.5' bgs,
				≥90% m, <10% v. fn. S. (initialed 8/21/07)	HEIS #s B1NR78, 8/21/07,
	G.S.	I-124		Silt is lt. to md. brown,	@ 0830 (I-120).
				non-plastic, overall moist,	
300	G.S.	I-125		weathered w/ thin (v. thin, ~1 to	G.S. from 289.5' -> 290.0' bgs,
				2mm thick) layers of oxidized	HEIS # B1NR79, 8/21/07,
				(reddish / iron oxides).	@ 0900 (I-121).
	G.S.	I-126		<5% v. fn. G, ≥80% basalt,	
				ang.; v. dense/compacted.	G.S. from 292.0' -> 292.5'
305	G.S.	I-127			bgs, HEIS # B1NR80,
				-> @ ~288': less moisture,	@ 0940, 8/21/07 (I-122).
				no Gravel content, & <5%	
	G.S.	I-128		v. fn. S.	G.S. from 294.5 -> 295.0'
				-> @ ~290': 100% m, slight	bgs, HEIS # B1NR81
310	G.S.	I-129		plasticity	@ 1225, 8/21/07 (I-123).
				-> @ ~294': significant inc. in	
				clay cont. -> to ~25%,	G.S. from 297.0' -> 297.5'
	G.S.	I-130		v. compacted/dense, mod. plast.,	bgs, HEIS # B1NR82
		W.L.		v. sparse G. for max ~3" subrd.	@ 1315, 8/21/07 (I-124).
315	G.S.	I-131		-> @ 295': inc. in G. to <10%	
				-> @ ~297': less G (<5%), more	G.S. from 299.5 -> 300.0'
				olive brown, less oxidation bands	bgs, HEIS # B1NR83,
	S.S.	I-132 (p.19)		-> @ 299': No G., 100% silt, no	@ 1410, 8/21/07 (I-125).
				plasticity (0% clay), slightly moist	-> p. 19

Reported By: N. [illegible]	Reviewed By: L. D. Walker
Title: Geologist	Title: Geologist
Signature: [signature] Date: 8/[illegible] (initialed 9/6/07)	Signature: [signature] Date: 11/8/07

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 8/28/07 - start; 9/6/07 - finish

Well ID: C5515 | Well Name: -N/A- | Location: 216-A-2 Crib, S. of PUREX, 200E

Project: 216-A-2 Crib Investigation | Reference Measuring Point: Ground Surface

Depth (FL)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
324	SS.	I-132 (water @ 322')			Cable tool w/ 3"x2' drive barrel.
	W.S.	I-water		303'-D 325.0': silty sandy gravel (wet) ~75% fg, vfg pebbles to sm. cobbles, to max 4", subrd. to subang., ~10 to 20% basalt, ~15% silt & ~10% sand (v. fn. to v. crse). Overall clast supported, poorly sorted, moist, mod. cmtd, no HCl fizz.	G.S. from 302.0'-D 302.5' bgs, HEIS# B1NRB4, @1450, 8/21/07 (I-126). p.18
325			T.D.		G.S. from 304.5-D 305.0' bgs, HEIS# B1NRB5, @0815, 8/22/07 (I-127).
330				→ @ ~304.5': becoming much less moist to v. slightly moist, more uncmtd, less silt (~10%), more sand (~15%). Possibly matrix supported.	G.S. from 307.0'-D 307.5' bgs, HEIS# B1NRB6, @0915, 8/22/07 (I-128).
				→ @ 311': max 4 size to ~8", subrd., Dry	G.S. from 309.5'-D 310.0' bgs, HEIS# B1NRB7, @1005, 8/22/07 (I-129).
				→ @ 315.5' bgs: encounter saturated cuttings.	G.S. from 312.0-D 312.5' bgs, HEIS# B1NRB8, @1030, 8/22/07 (I-130).
				TD = 325.0' bgs	G.S. from 315.0'-D 315.5' bgs, HEIS# B1NRB9, @1130, 8/22/07 (I-131).
				(WS) 9/6/07 (W.S.) - Groundwater sample collected from 322.0' bgs @ 0825, 9/6/07, HEIS#s B1PLH0 & B1PLF8 (I-water). - Field Blank (FB) collected at 0825, 9/6/07, HEIS# B1PLF9.	S.S. soil Sample Perm 317.0'-D 319.5' bgs, HEIS#s B1NRC5, B1NRP8, B1NRP9, B1NR32, & B1NR99, @1310, 8/22/07 (I-132). Note: 2 S.S. runs: - Used & capped liner from 1st run - All other samples composited from bottle S.S. tubes.
					Tag W.L. @ 315.8' bgs on 8/22/07. Tag W.L. @ 314.7' bgs on 9/5/07.

Reported By: N. Bowles | Title: Geologist | Signature: [signature] | Date: 9/6/07

Reviewed By: L.D. Walker | Title: Geologist | Signature: [signature] | Date: 11/8/07

A-6003-642 (03/03)

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Appendix D

Geophysical Log Data Report for Borehole C5515

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D1 Geophysical Log Data Report for Borehole C5515

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HGLP-LDR-090

C5515
Log Data Report

Borehole Information:

Borehole: C5515			Site: 216-A-2 Crib		
Coordinates (WA St Plane)		GWL* (ft):	313.9	GWL Date:	08/23/07
North (m)	East (m)	Drill Date	TOC Elevation	Total Depth (ft)	Type
Not Available	Not Available	08/07	Not Available	322	Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	2.2	13⅜	9 5/8	9/16	2.2	85
Not Available	4.0	8 3/4	7 ¼	½	4.0	321.9

Borehole Notes:

The logging engineer measured the casing diameters using a caliper and steel tape. The driller provided the casing depth. Logging data acquisition is referenced to the ground surface.

The first casing string (10-in.) was logged in July 2007. The casing was internally contaminated during drilling. To remove the contamination before logging, the casing was swabbed with wet "towels." As a further precaution, the logging sondes and cable were sleeved to prevent contamination of equipment. After completion of logging, the borehole was deepened with an 8-in. casing. Additional logging was conducted from 84 to 322 ft during August 2007.

Logging Equipment Information:

Logging System:	Gamma 1E		Type:	SGLS (70%) SN: 34TP40587A
Effective Calibration Date:	05/22/07	Calibration Reference:	HGLP-CC-016	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Logging System:	Gamma 4L		Type:	SGLS (60%) SN: 47TP32211A
Effective Calibration Date:	07/09/07	Calibration Reference:	HGLP-CC-020	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Logging System:	Gamma 1C		Type:	HRLS SN: 39-A314
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-004	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Logging System:	G Gamma 4 H (with AmBe source)		Type:	NMLS SN: H310700352
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-002	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Logging System:	G Gamma 4 H (with AmBe source)		Type:	FNLS SN: H310700352
Effective Calibration Date:	NA	Calibration Reference:	None required.	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

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established 1959

HGLP-LDR-090

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 Repeat
Date	07/30/07	07/30/07	07/30/07	07/30/07
Logging Engineer	Pearson	Pearson	Pearson	Pearson
Start Depth (ft)	0.0	22.0	36.0	69.0
Finish Depth (ft)	22.0	37.0	85.0	79.0
Count Time (sec)	100	20	100	100
Live/Real	R	R	R	R
Shield (Y/N)	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0
ft/min	N/A[2]	N/A	N/A	N/A
Pre-Verification	AE227CAB	AE227CAB	AE227CAB	AE227CAB
Start File	AE227000	AE227023	AE227039	AE227089
Finish File	AE227022	AE227038	AE227088	AE227099
Post-Verification	AE227CAA	AE227CAA	AE227CAA	AE227CAA
Depth Return Error (in.)	N/A	N/A	N/A	- 1
Comments	None	Dead Time > 40 %	Fine gain adjustment after file -086	None

Log Run	11	12	13 Repeat	
Date	08/23/07	08/28/07	08/28/07	
Logging Engineer	Pearson	Pearson	Pearson	
Start Depth (ft)	322.0	84.0	108.0	
Finish Depth (ft)	161.0	162.0	84.0	
Count Time (sec)	100	100	100	
Live/Real	R	R	R	
Shield (Y/N)	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	
ft/min	N/A	N/A[3]	N/A	
Pre-Verification	DL021CAB	DL031CAB	DL031CAB	
Start File	DL021000	DL031000	DL031079	
Finish File	DL021161	DL031078	DL031103	
Post-Verification	DL021CAA	DL031CAA	DL031CAA	
Depth Return Error (in.)	- 2.5	N/A	+ 1	
Comments	Fine gain adjustment after files -035, 101, 135, 144	None	None	

High Rate Logging System (HRLS) Log Run Information:

Log Run	5	6			
Date	07/30/07	07/30/07			
Logging Engineer	Pearson	Pearson			
Start Depth (ft)	21.0	26.0			
Finish Depth (ft)	36.0	29.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	N	Y (Internal)			
MSA Interval (ft)	1.0	0.5			
ft/min	N/A	N/A			
Pre-Verification	AC175CAB	AC175CAB			
Start File	AC175000	AC175016			
Finish File	AC175015	AC175022			
Post-Verification	AC175CAA	AC175CAA			
Depth Return Error (in.)	- 0.5	- 0.5			
Comments	No fine gain adjustment	Fine gain adjustment after file -018			

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Hanford Office
established 1959

HGLP-LDR-090

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	7	8 Repeat	14	15	16 Repeat
Date	07/31/07	07/31/07	08/28/07	08/28/07	08/28/07
Logging Engineer	Pearson	Pearson	Pearson	Pearson	Pearson
Start Depth (ft)	0.0	25.0	84.0	284.0	305.0
Finish Depth (ft)	85.0	35.0	284.0	313.0	280.0
Count Time (sec)	15	15	15	15	15
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.25	0.25	0.25	0.25	0.25
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	DH622CAB	DH622CAB	DH672CAB	DH672CAB	DH672CAB
Start File	DH622000	DH622341	DH672000	DH682000	DH682117
Finish File	DH622340	DH622381	DH672801	DH682116	DH682217
Post-Verification	DH622CAA	DH622CAA	DH682CAA	DH682CAA	DH682CAA
Depth Return Error (in.)	N/A	0	N/A	N/A	-1.5
Comments	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment	No fine gain adjustment

Passive Neutron Logging System (PNLS) Log Run Information:

Log Run	9	10 Repeat			
Date	07/31/07	07/31/07			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	0.0	24.0			
Finish Depth (ft)	85.0	30.0			
Count Time (sec)	60	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	0.25			
ft/min	N/A	N/A			
Pre-Verification	DH632CAB	DH632CAB			
Start File	DH632000	DH632086			
Finish File	DH632085	DH632110			
Post-Verification	DH632CAA	DH632CAA			
Depth Return Error (in.)	N/A	-1			
Comments	No fine gain adjustment	No fine gain adjustment			

Logging Operation Notes:

For log runs 1 through 10 (0 to 85 ft), a plastic sleeve was placed over the sondes and cable to prevent internal casing contamination from adhering to the equipment. Logging was conducted with a centralizer on each sonde. Measurements are referenced to ground surface.

Analysis Notes:

Analyst:	P.D. Henwood	Date:	09/24/07	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the logging systems were performed before and after each day's data acquisition. Acceptance criteria were met for all systems. A casing correction for 9/16-in.-thick casing was applied to the spectral log data (SGLS and HRLS) from the ground surface to 85 ft. A casing correction for 1/2-in. thick casing was applied to SGLS data acquired below 85 ft.

SGLS and HRLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G1EMay07.xls and G4LJuly07.xls for the SGLS and G1CNov06.xls for the HRLS using efficiency functions and

corrections for casing and dead time as determined from annual calibrations. Where dead time is excessive, HRLS data (with and without the internal shield) are substituted for the SGLS data. Moisture data were converted to volumetric moisture using calibrations acquired from 6- and 8-in. casings. Therefore, the data acquired in the 10-in. casing (0 to 85 ft) are not accurate and indicate only relative moisture changes and the data below 85 ft are based on calibrations. There is no calibration for passive neutron data that are reported in counts per second.

Results and Interpretations:

Cs-137 is detected in this borehole at the ground surface and from 18 to 86 ft. The maximum concentration is measured at approximately 2 million pCi/g at 27.5 ft in depth. However, because the contamination appears to lie in a thin interval (probably 0.5 ft or less) this assay could be significantly underestimated. The calibration of the logging system response is based on an infinite, uniform distribution that is not consistent with thin bed responses. Internal casing contamination appears to be reflected in the data. Concentration data below 28 ft most likely is solely due to casing contamination rather than contamination in the formation.

From 21 to 24 ft, and again from 32 to 37 ft, Cs-137 concentrations determined from the SGLS are about an order of magnitude higher than those determined by the HRLS. In these intervals, the values are at or below the low end of the HRLS measurement range and the SGLS values are considered more reliable.

Moisture data reflect some thin intervals of slightly higher moisture content. The data from 282 to 302 ft reflect a relatively large interval of higher moisture that coincides with an interval of high K-40, U-238, and Th-232 concentrations that represent a lithologic change. The relatively high moisture represented at approximately 27.5 ft may not be accurate. The detector is influenced by the extremely high gamma activity at this depth. High moisture is indicated in the data acquired in July near the bottom of the extent of the first casing string at approximately 85 ft. It is believed this moisture is the result of attempts to swab the borehole to remove internal contamination rather than formation moisture. It is not known if the relatively high moisture between 85 and 92 ft is also an artifact of the swabbing.

Passive neutron logging was performed in the borehole. This logging method has been shown to be effective in qualitatively detecting zones of alpha-emitting contaminants from secondary neutron flux generated by the (α,n) reaction and may indicate the presence of transuranic radionuclides. Many transuranic radionuclides decay predominantly by alpha particle emission and the passive neutron system may be useful to identify the existence of these radionuclides where no gamma emissions are available for detection. There is no calibration for this logging system and the data provided are to be used qualitatively.

The passive neutron indicates approximately 100 cps at 27.5 ft. This count rate is believed to be influenced by the high gamma activity at this depth rather than representing the existence of alpha emitting contaminants. The count rate exhibited by the passive neutron logging is subtracted from the moisture count rate data acquired at the same depths to better approximate the true moisture content.

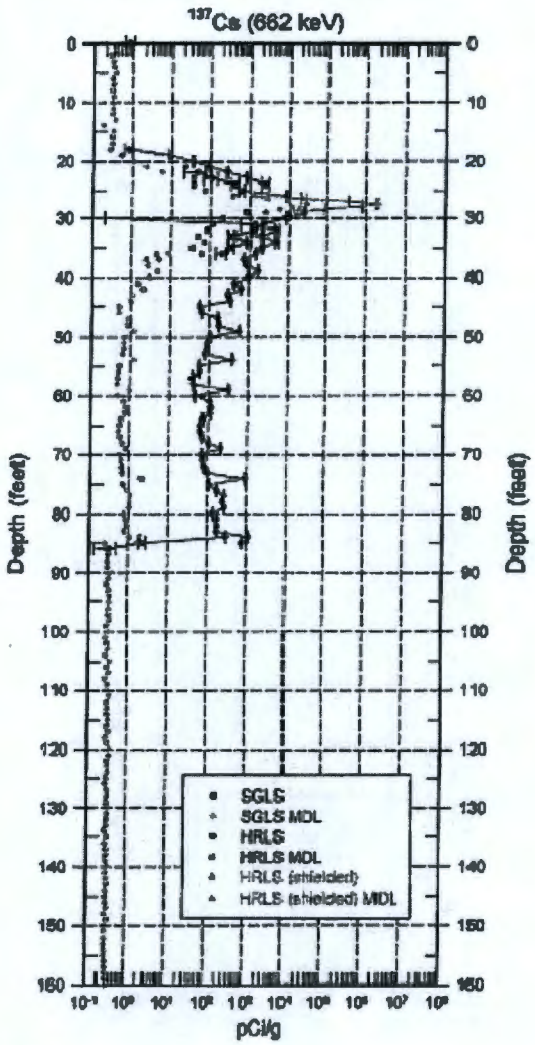
The repeat sections for the SGLS, NMLS, and PNLS indicate good agreement.

List of Plots:

Manmade Radionuclides (2 pages)
Natural Gamma Logs (2 pages)
Combination Plot (3 pages)
Combination Plot (0-325 ft) (1 page)
Total Gamma, Moisture, & Passive Neutron (2 pages)
Total Gamma & Dead Time (2 pages)
Repeat of Manmade Radionuclides (1 page)
Repeat Section of Natural Gamma Logs (1 page)
Repeat of Moisture & Passive Neutron (1 page)

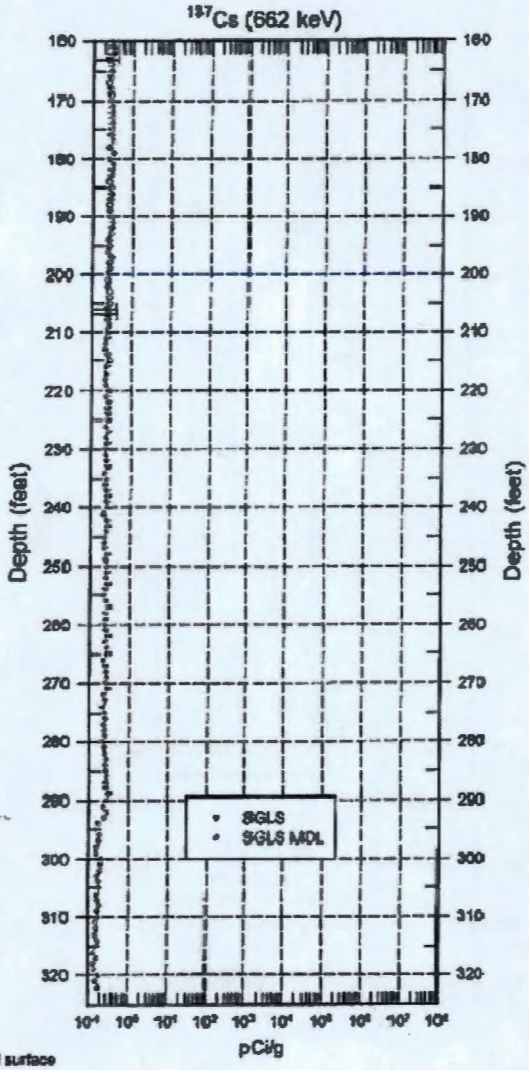
[1] GWL – groundwater level

C5515
Manmade Radionuclides



Zero Reference = Ground surface

C5515
Manmade Radionuclides



Zero Reference = Ground surface

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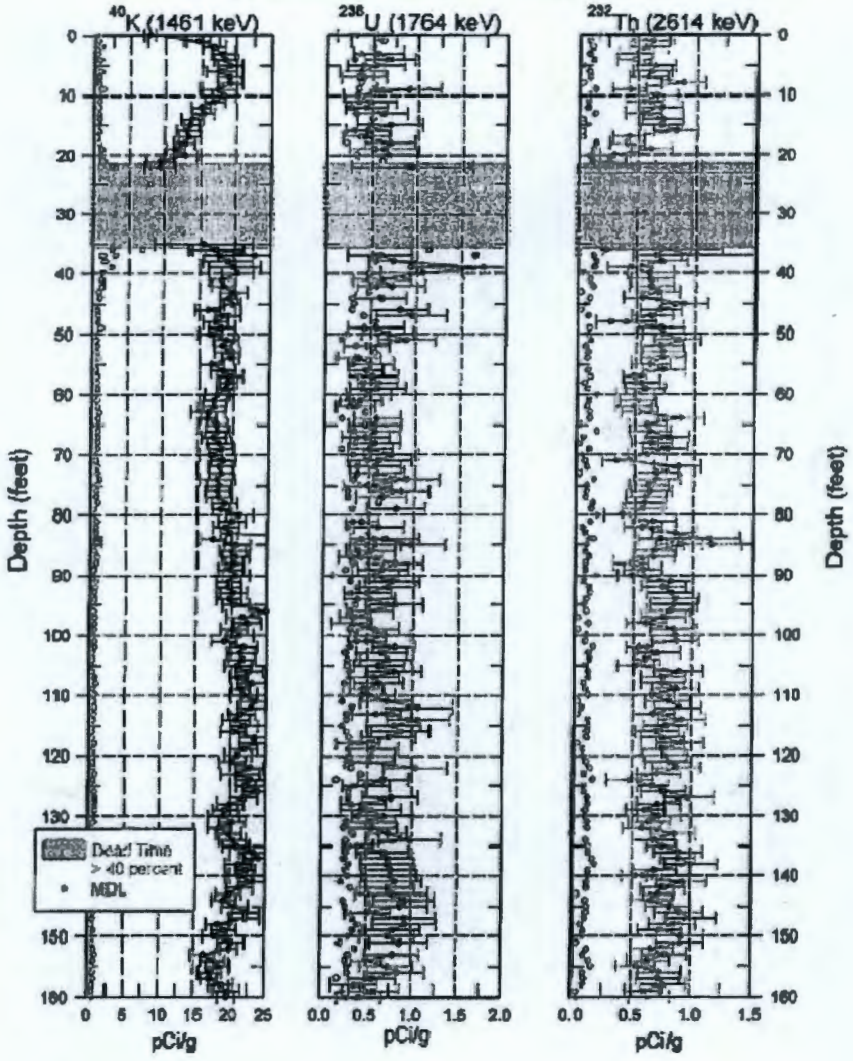
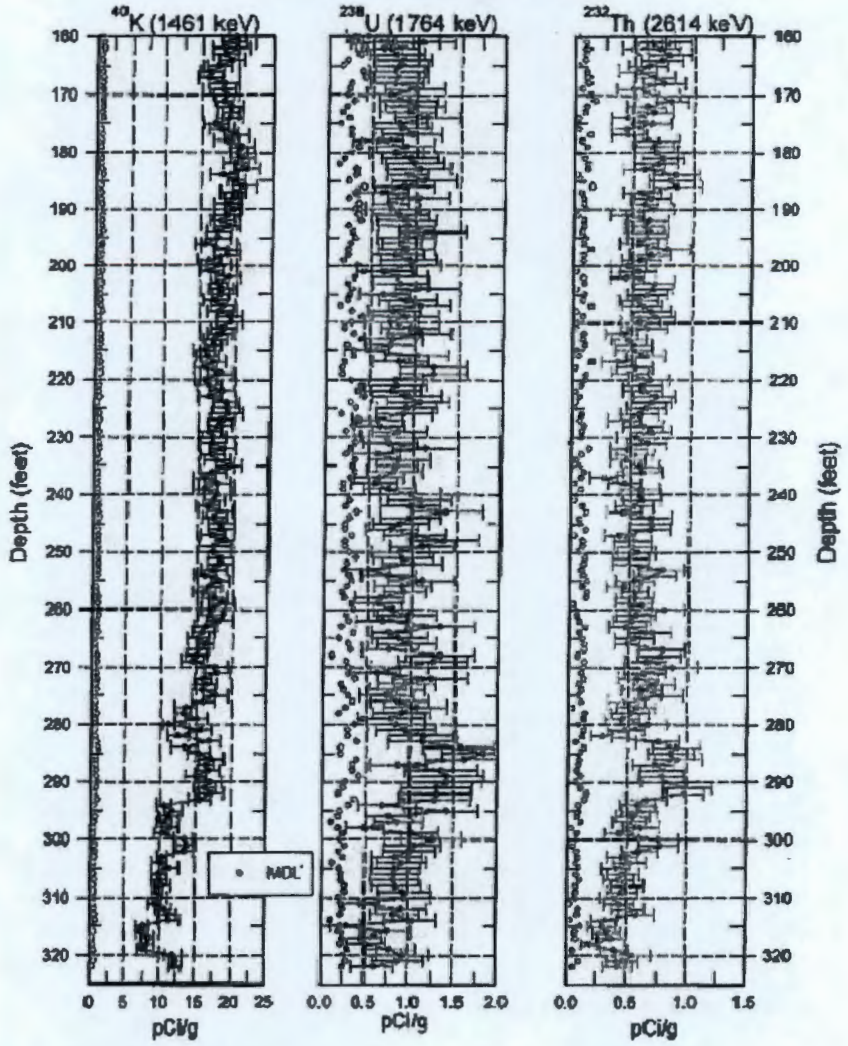
C5515
Natural Gamma Logs



Zero Reference = Ground surface

C5515
Natural Gamma Logs



Zero Reference = Ground surface

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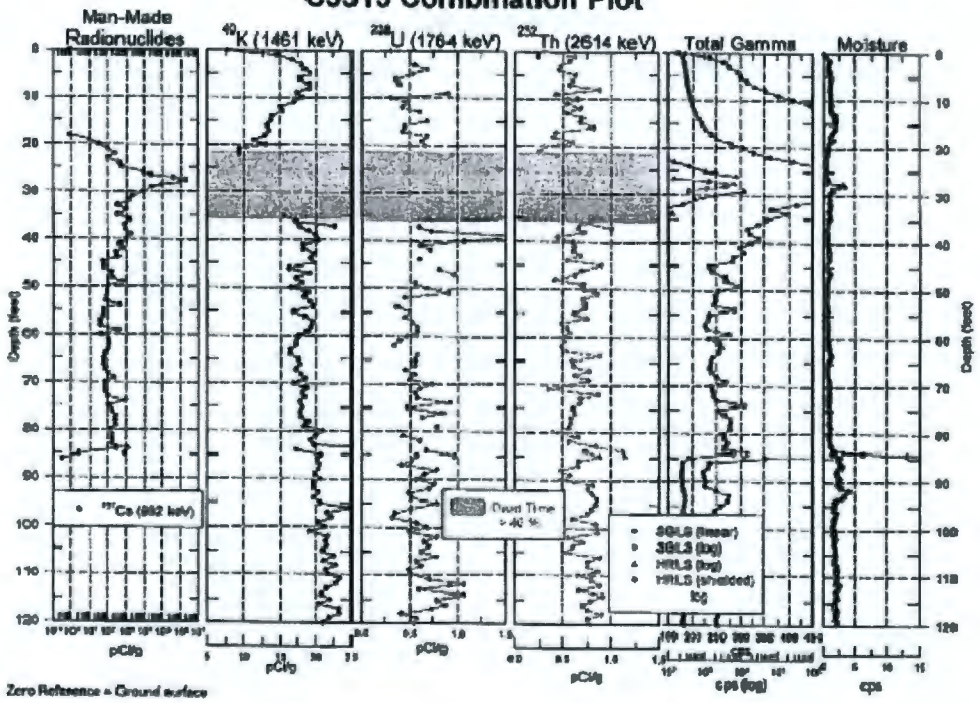
C5515 Combination Plot



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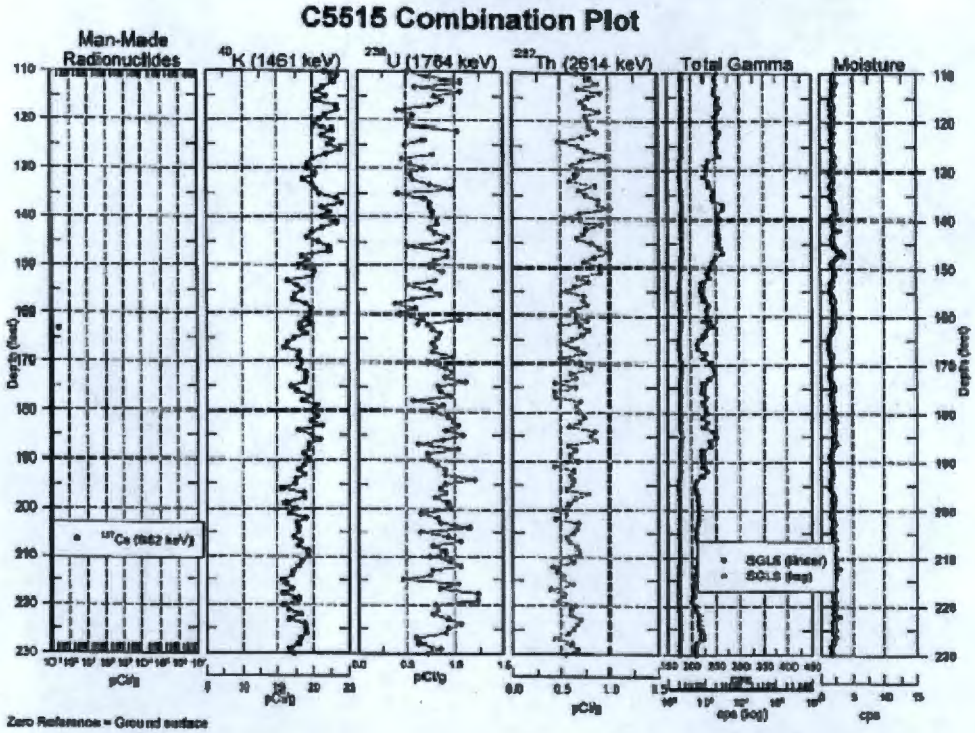

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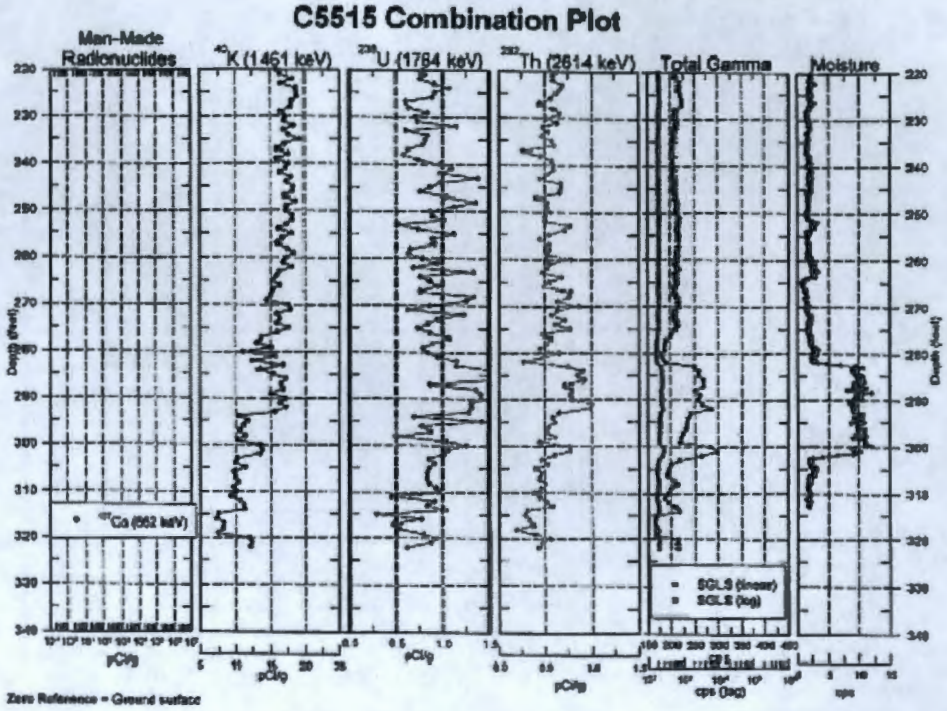

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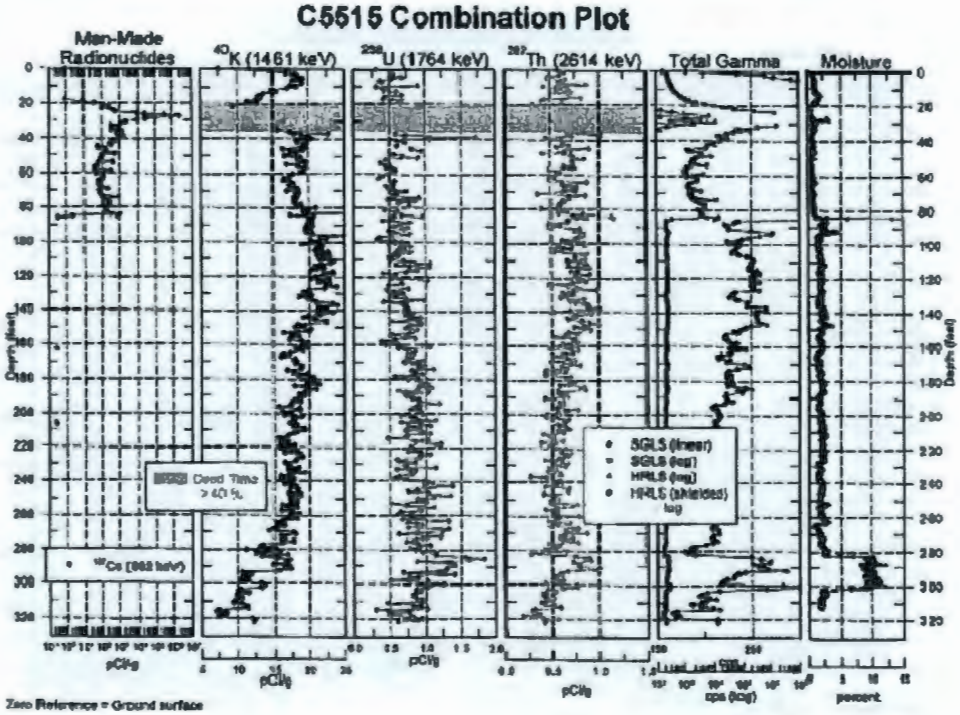

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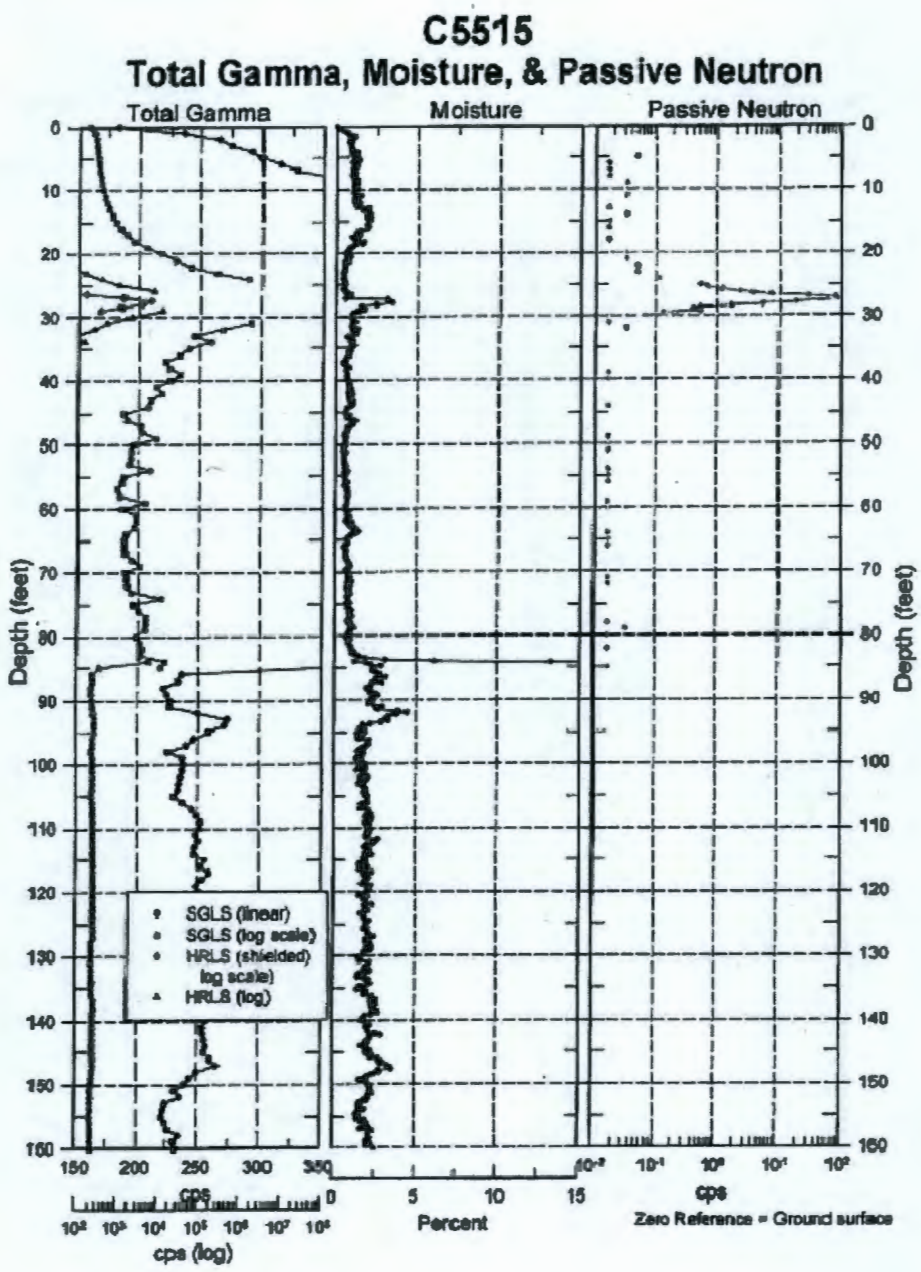

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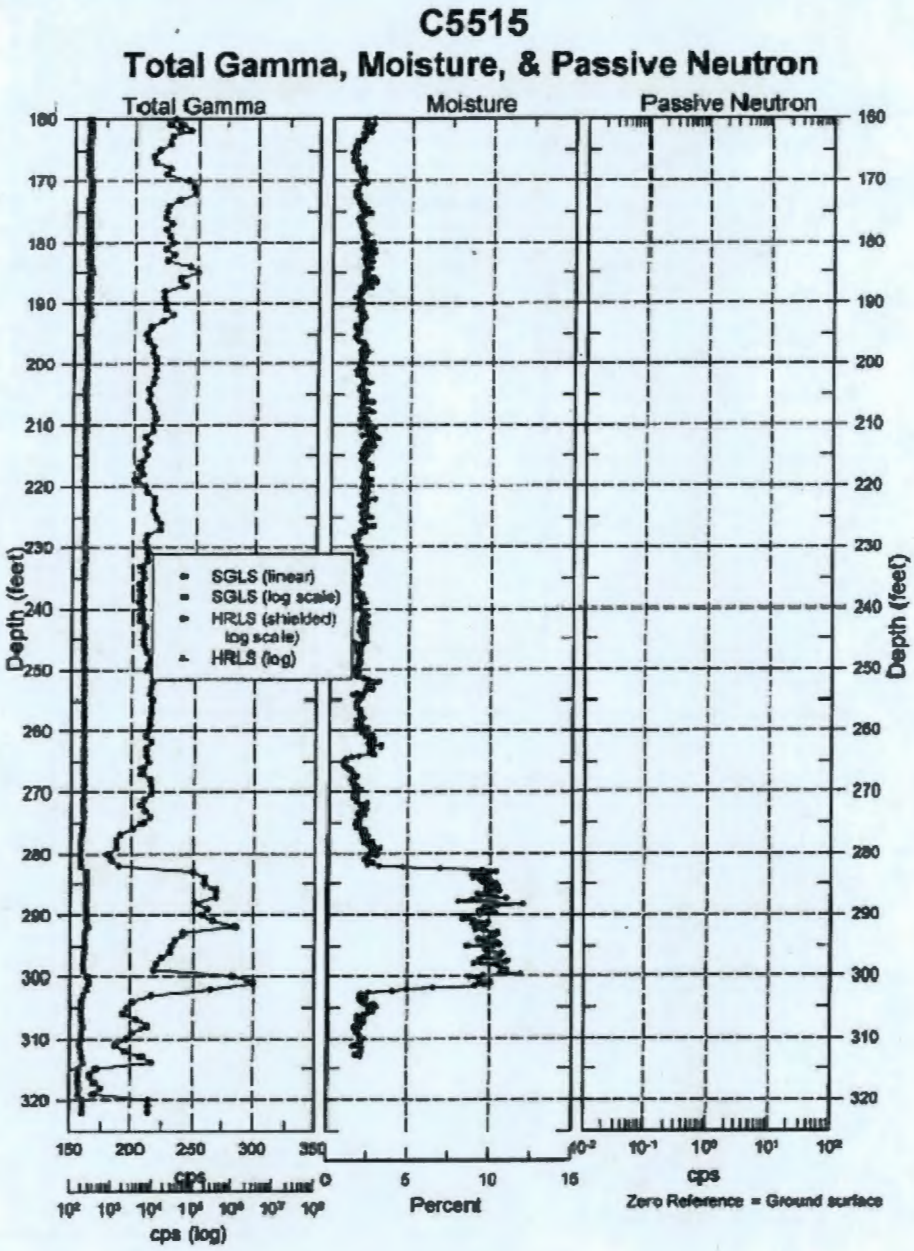

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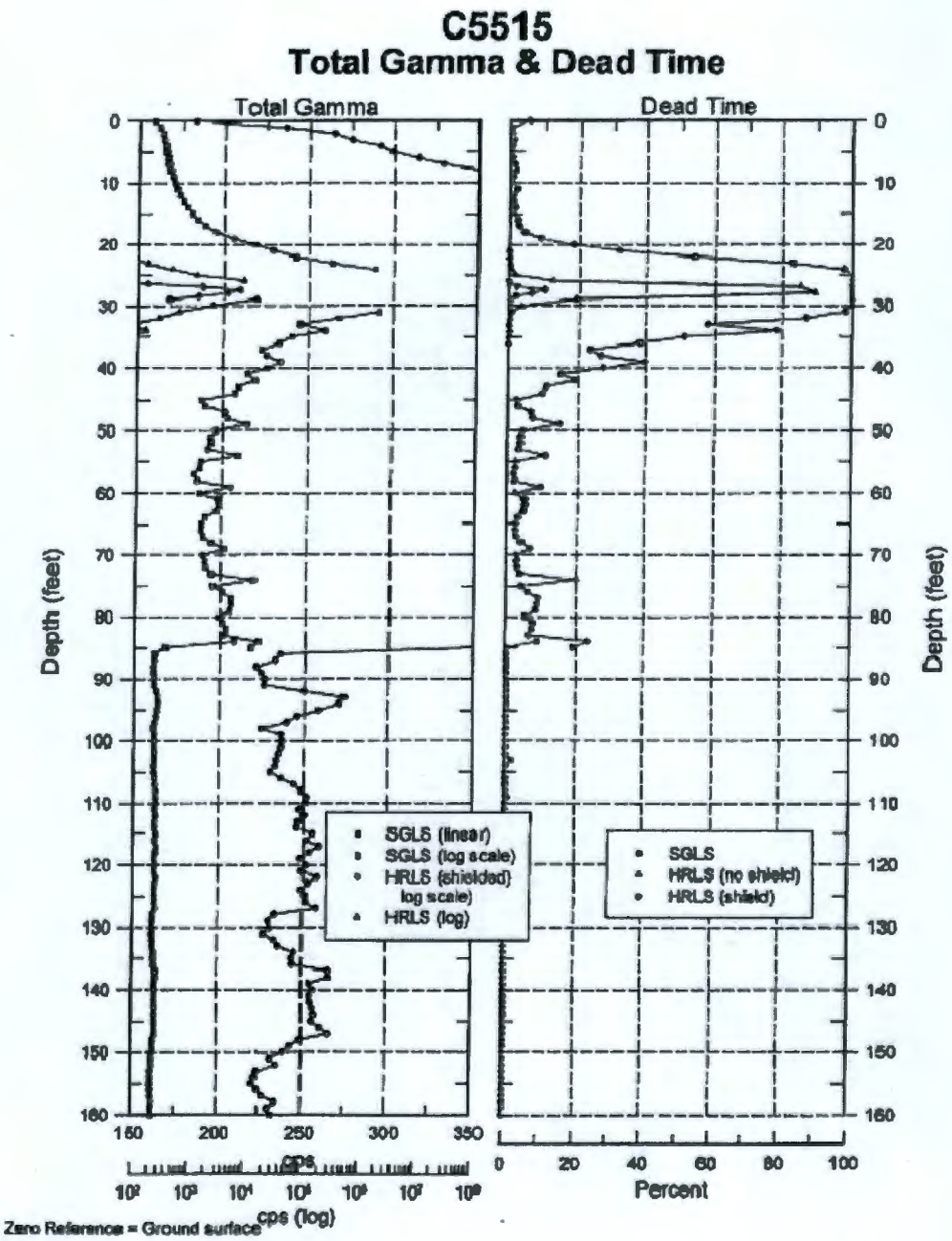
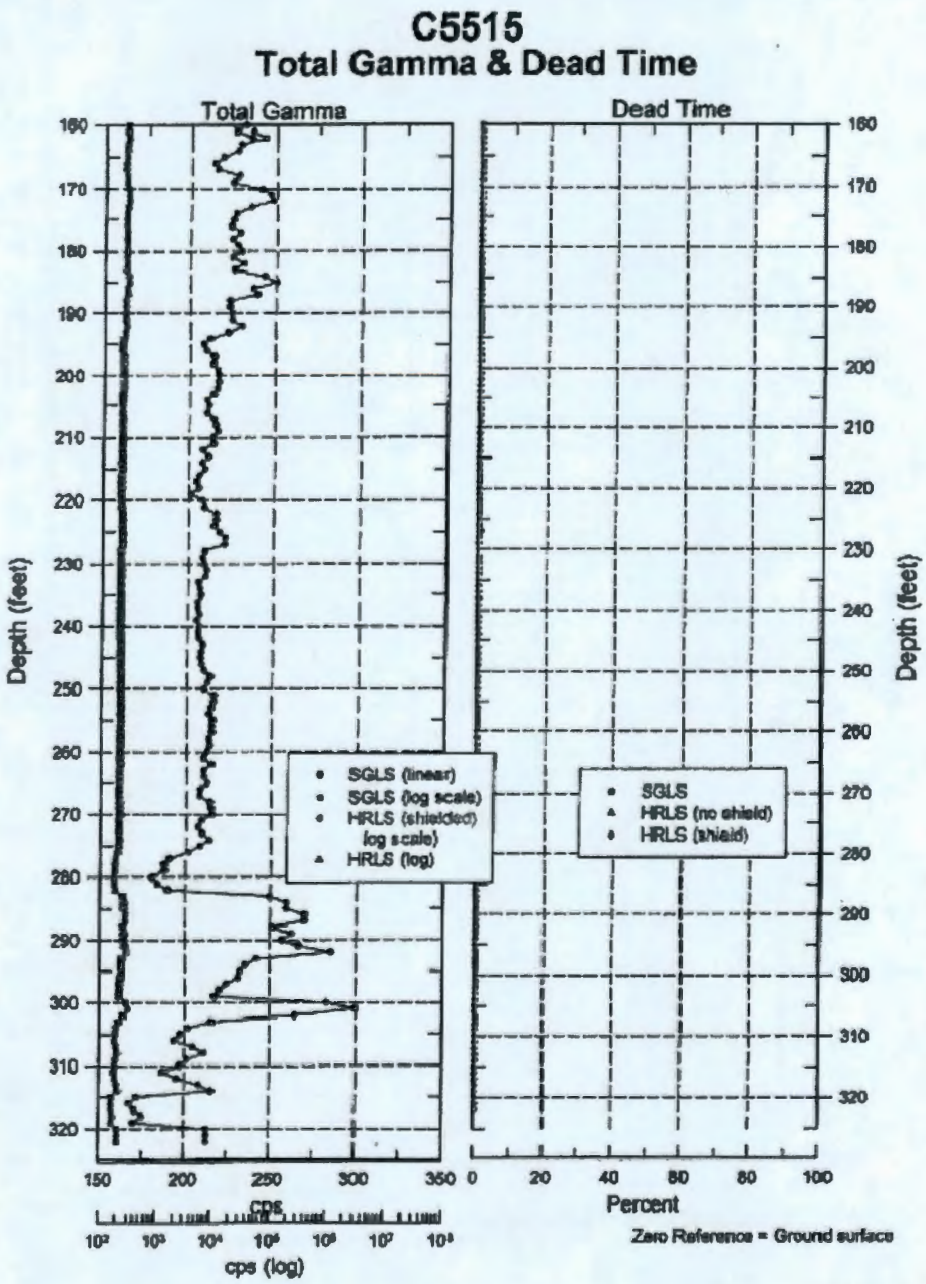
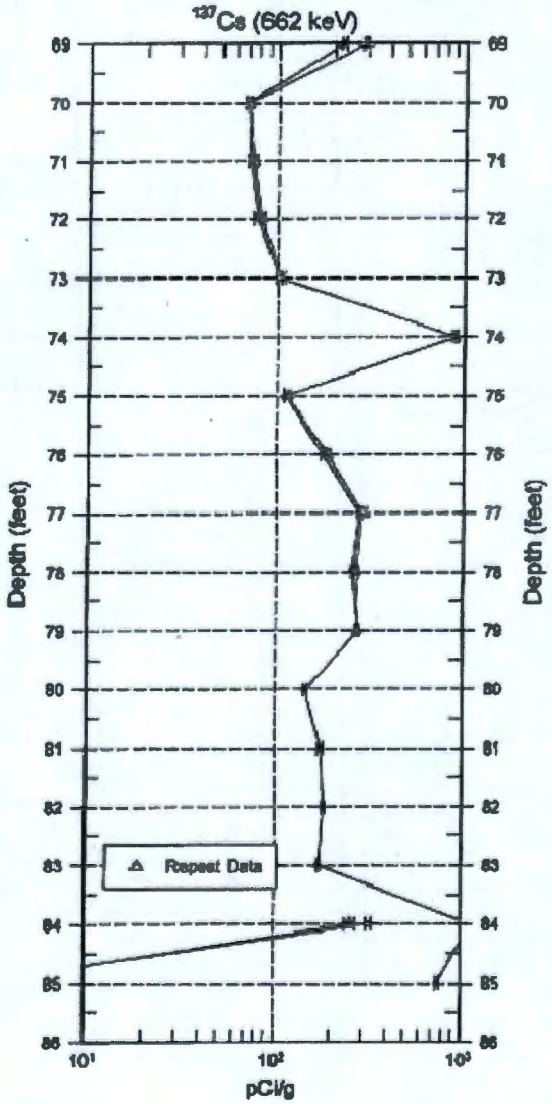



C5515
Total Gamma & Dead Time
Total Gamma
Dead Time
Depth (feet)
Depth (feet)
SGLS (linear)
SGLS (log scale)
HRLS (shielded) log scale)
HRLS (log)
SGLS
HRLS (no shield)
HRLS (shield)
cps
cps (log)
Percent
Zero Reference = Ground surface

C5515
Repeat of Manmade Radionuclides



Zero Reference = Ground surface

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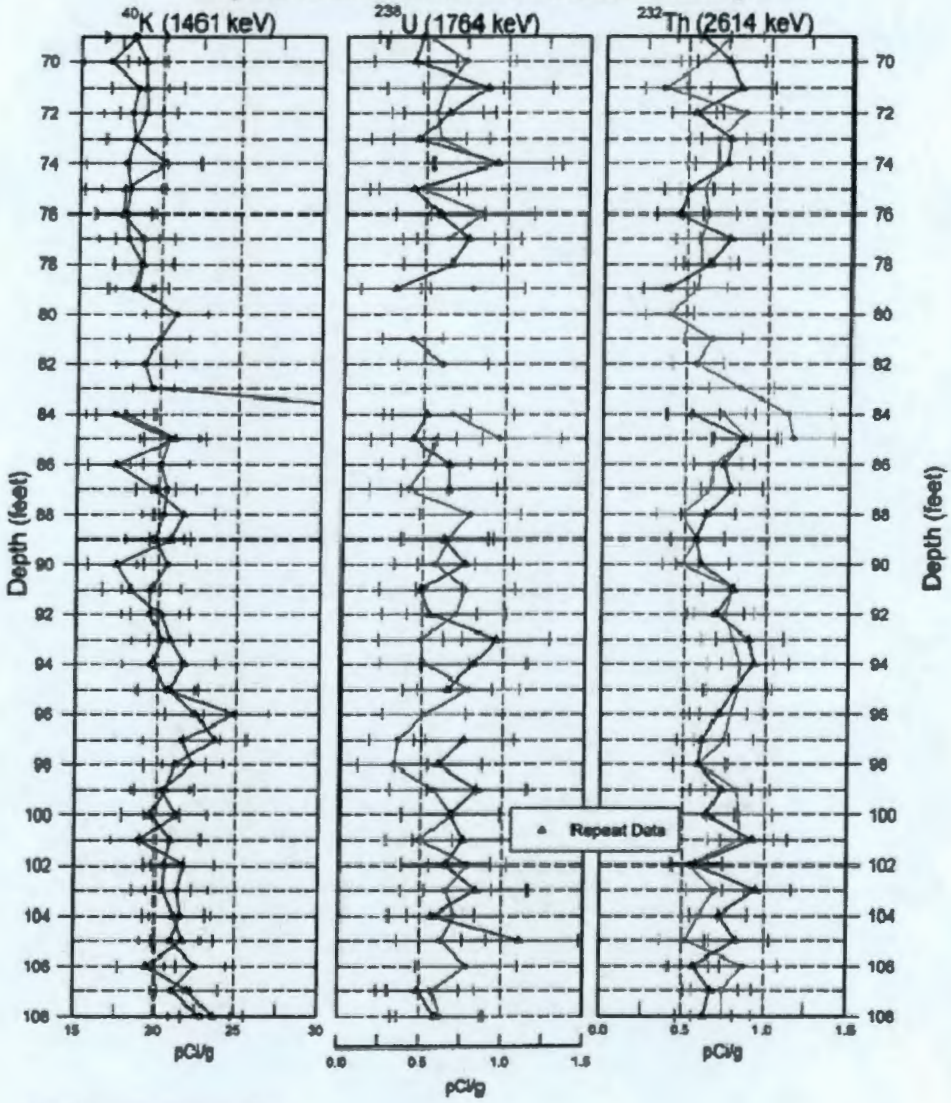
C5515

Repeat Section of Natural Gamma Logs



Zero Reference = Ground surface

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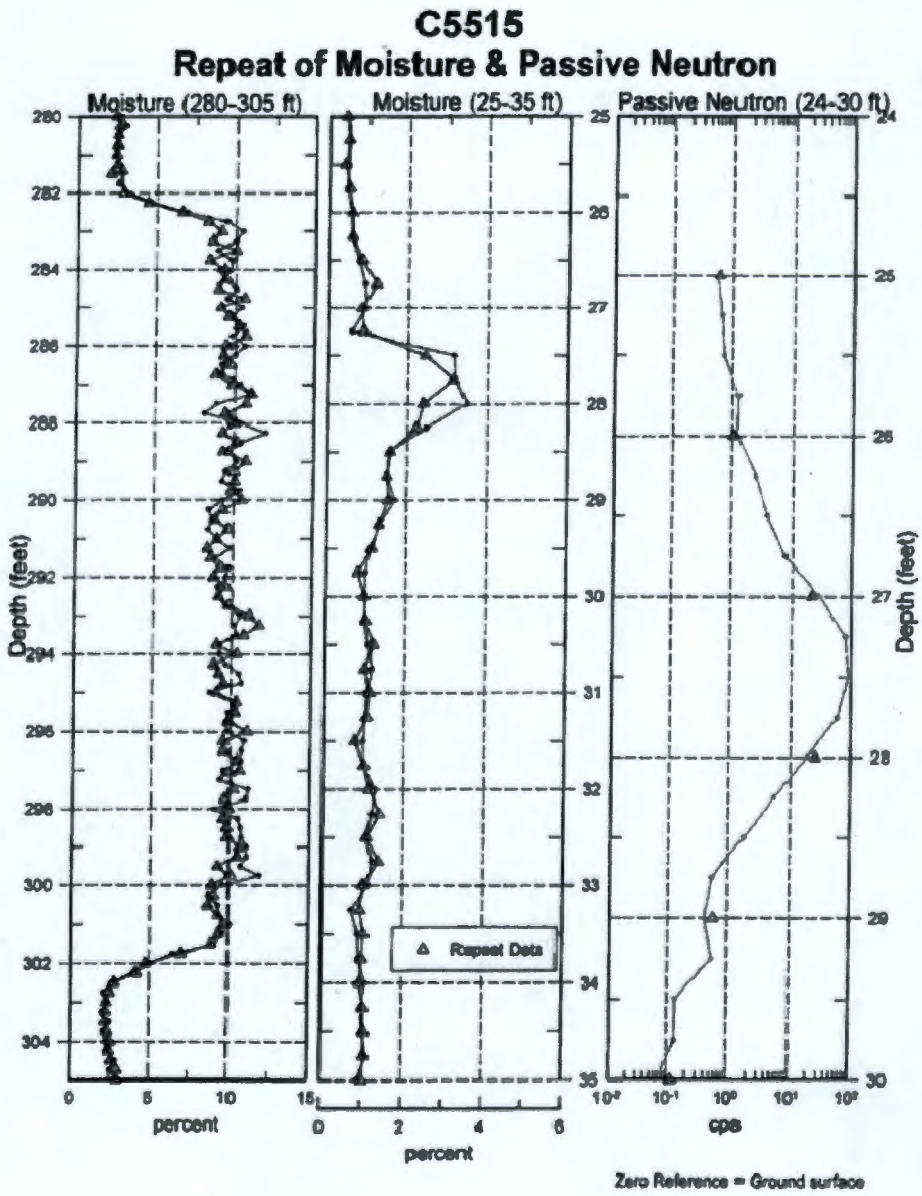

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Appendix E

Well Summary Sheet for Borehole C5570

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E1 Well Summary Sheet for Borehole C5570

WELL SUMMARY SHEET

Start Date: 5/2/07
Finish Date: 4/1/08
Page 1 of 1

Well ID: C5570
Well Name: A-2 Push
Location: 216-A-2 Crib, 200E.
Project: A-2 Crib Investigation.
Prepared By: N. Bowles
Date: 4/4/08
Reviewed By:
Date:
Signature:
Signature:

CONSTRUCTION DATA

Description

Concrete Surface Seal/Pad:
Pre-Mix Concrete Aggregate:
0.0' (g.s.) to 0.5' bgs.

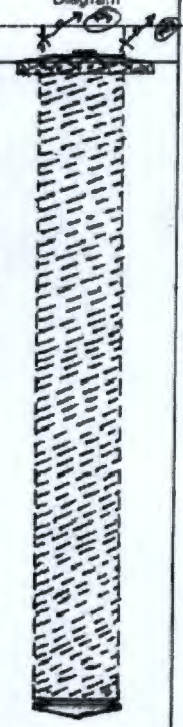
Temporary Drive Casing:
6 5/8" OD; C.S.; Rev. Thk.;
0.0' (g.s.) to 35.5' bgs.

Bentonite Chip Seal:
3/8" Chips;
0.5' to 35.3' bgs.

Removable Drive Tip:
6 5/8" OD; C.S.;
35.3' to 35.8' bgs
(remains in place)

Notes:
- Drive-point borehole fully decommissioned (except tip).
- All temporary casing removed from borehole (except tip).
- All measurements are in feet "below ground surface" (bgs).

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		Lithology not observed due to drilling method (Direct-Push) → No cuttings.
10		
20		
30		
T.O.		T.D. = 35.8' bgs.
40		

(1) Not used

A-6003-643 (03/03)

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Appendix F

Well Construction Summary Report for Borehole C5570

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F1 Well Construction Summary Report for Borehole C5570

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 5/2/07
Finish Date: 4/1/08
Page 1 of 1

Well ID: C5570	Well Name: A-2 Push	Approximate Location: 216-A-2 Crib, 200E.	
Project: A-2 Crib Investigation		Other Companies: Layne, FH, GRAM	
Drilling Company: Layne Christensen, Inc. (Layne)		Geologist(s): N. Bowles	
Driller: Willy Franklin/Lewis Watkins	License #: WA-1929/2281		

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger: —	Diameter — From — to —
6 5/8" OD/5 1/8" ID, GS. thd (Rev.), 40.8 lb/ft	0.0' - 35.5'	-N/A-	Cable Tool: —	Diameter — From — to —
	— - —	(Rem. Tip).	Air Rotary: —	Diameter — From — to —
	— - —		A.R. w/Sonic: —	Diameter — From — to —
N/A not used (SB) 1/9/08	— - —	1/9/08	Direct-Push w/ Diesel Hammer & Rem. Tip.	Diameter 6 5/8" From 0.0' to 35.8'
	— - —			Diameter — From — to —
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter — From — to —

Removable tip punched out of end of temporary casing @ 35.5 to 35.8' bgs. 35.3' (SB) 1/9/08

not used (SB) 1/9/08

Total Drilled Depth: 35.8'	Hole Dia @ TD: 6 5/8"	Drilling Fluid: -N/A-	
Well Straightness Test Results: -N/A-		Total Amt. Of Water Added During Drilling: -N/A-	
		Static Water Level: -N/A-	Date: -N/A-

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma (SGLS)	~~0.0~~ 0.2' - 34.5'	5/2/07		— - —	
~~Neutron Moisture (NMO)~~ (SB) 1/9/08	—	5/2/07 (SB) 1/9/08		not used (SB) 1/9/08	
High Rate (HRLS)	23.5' - 34.5'	5/2/07		— - —	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Backfill or Pack	Volume	Mesh Size
-N/A-	— - —	—	—	Mud (5/8") Bentonite Chips	35.3' - 0.5'	14.5 sacks	3/8"
—	— - —	—	—	Premix Concrete Aggregate	0.5' - 0.0'	bulk	N/A
—	— - —	—	—	—	— - —	—	—
—	— - —	—	—	—	— - —	—	—
—	— - —	—	—	—	— - —	—	—

OTHER ACTIVITIES

Aquifer Test: -N/A-	Date: —	Well Decommission: *	Yes: ✓	No:	Date:
Description: not used (SB) 1/9/08		Description: Drive point borehole fully decommissioned except for removable tip left in borehole.			

WELL SURVEY DATA (if applicable)

-Unknown @ this time-	Protective Casing Elevation: -Unk.-
Washington State Plane Coordinates: -Unk.-	Brass Survey Marker Elevation: -Unk.-

COMMENTS / REMARKS

-*Removable C.S. drive tip remains in ground from 35.5 to 35.8' bgs.
-Surface completion includes small (~1' diameter, rd) pad of concrete w/ labeled brass survey marker installed.

Reported By:	Title:	Signature:	Date:
N. Bowles	Geologist		4/9/08

A-6003-658 (04/03)

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Appendix G

Geophysical Log Data Report for Borehole C5570

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G1 Geophysical Log Data Report For Borehole C5570

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C5570
Log Data Report

Borehole Information:

Borehole:	C5570		Site:	216-A-2 Crib	
Coordinates (WA St Plane)		GWL[a] (ft):	261.15	GWL Date:	07/05/05
North (m)	East (m)	Drill Date	TOC Elevation	Total Depth (ft)	Type
Not available	Not available	05/07	Not available	35	Percussion

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	4.4	6 5/8	5 3/8	5/8	4.4	35

Borehole Notes:

The logging engineer measured the casing diameters using a caliper and steel tape. The driller provided the casing depth. Logging data acquisition is referenced to the ground surface.

Logging Equipment Information:

Logging System:	Gamma 1N		Type:	SGLS (60%) SN: 45TP22010A
Effective Calibration Date:	02/20/07	Calibration Reference:	HGLP-CC-010	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Logging System:	Gamma 1C		Type:	HRLS SN: 39-A314
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-004	
		Logging Procedure:	HGLP-MAN-002, Rev 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 Repeat			
Date	05/02/07	05/02/07			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	34.5	23.5			
Finish Depth (ft)	23.5	0.5			
Count Time (sec)	20	100			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A[2]	N/A			
Pre-Verification	AN052CAB	AN052CAB			
Start File	AN052000	AN052012			
Finish File	AN052011	AN052035			
Post-Verification	AN052CAA	AN052CAA			
Depth Return Error (in.)	N/A	+ 0.25			
Comments	High rate interval; dead time > 40%	Gain adjustment after file -027			

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High Rate Logging System (HRLS) Log Run Information:

Log Run	3	4 Repeat			
Date	05/02/07	05/02/07			
Logging Engineer	Pearson	Pearson			
Start Depth (ft)	34.5	29.5			
Finish Depth (ft)	23.5	26.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	N	Internal			
Sample Interval (ft)	1.0	0.5			
ft/min	N/A	N/A			
Pre-Verification	AC173CAB	AC173CAB			
Start File	AC173000	AC173012			
Finish File	AC173011	AC173019			
Post-Verification	AC173CAA	AC173CAA			
Depth Return Error (in.)	- 0.5	N/A			
Comments	Fine gain adjustment after file -000	No fine gain adjustment			

Logging Operation Notes:

Logging was conducted with a centralizer on each sonde. Measurements are referenced to ground surface.

Analysis Notes:

Analyst:	P.D. Henwood	Date:	05/03/07	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the logging systems were performed before and after data acquisition. Acceptance criteria were met for all systems.

A casing correction for 5/8-in.-thick casing was applied to the spectral log data (SGLS and HRLS).

SGLS and HRLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G1NFeb07.xls for the SGLS and G1CNov06.xls for the HRLS using efficiency functions and corrections for casing and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed approximately 11 percent for both the SGLS and HRLS. Where dead time is excessive HRLS data (with and without the internal shield) are substituted.

Results and Interpretations:

^{137}Cs is detected in this borehole from 18.5 ft to the bottom of the borehole (34.5 ft). The maximum concentration is measured at approximately 20 million pCi/g at 27.5 ft in depth. However, because the contamination appears to lie in a thin interval (probably 0.5 ft or less), this assay could be significantly underestimated. The calibration of the logging system response is based on an infinite, uniform distribution that is not consistent with thin bed responses.

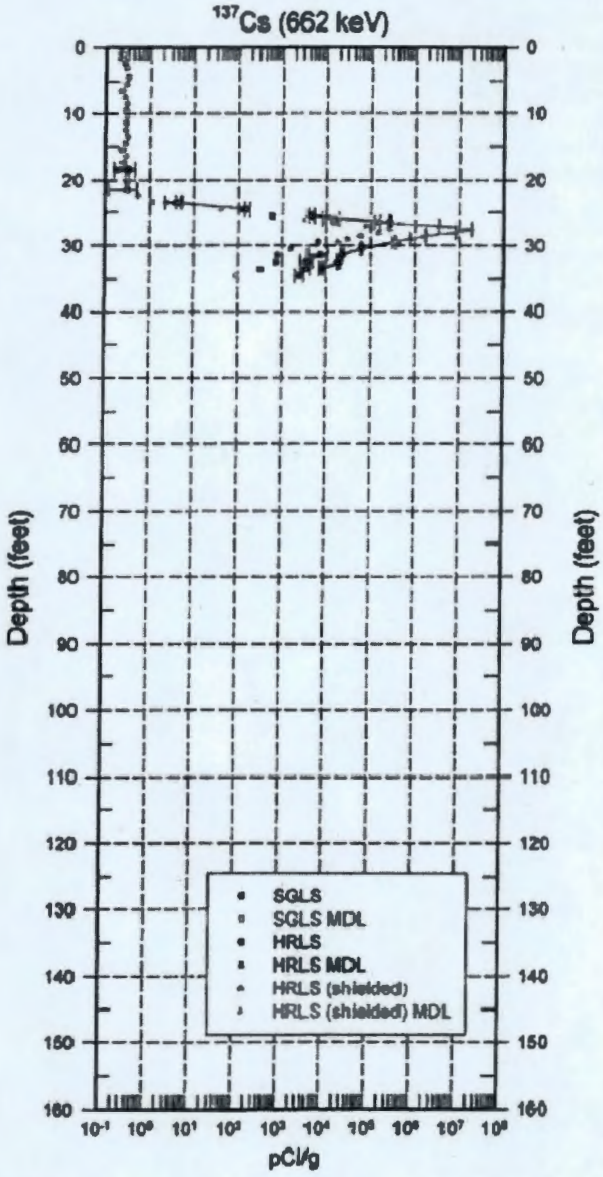
The repeat section for the SGLS indicates good agreement.

List of Log Plots:

Manmade Radionuclides
Natural Gamma Logs
Combination Plot (0-120 ft)
Combination Plot (0-40 ft)
Total Gamma & Dead Time
Repeat Section of Natural Gamma Logs

[1] GWL – groundwater level

C5570
Manmade Radionuclides



Zero Reference = Ground surface

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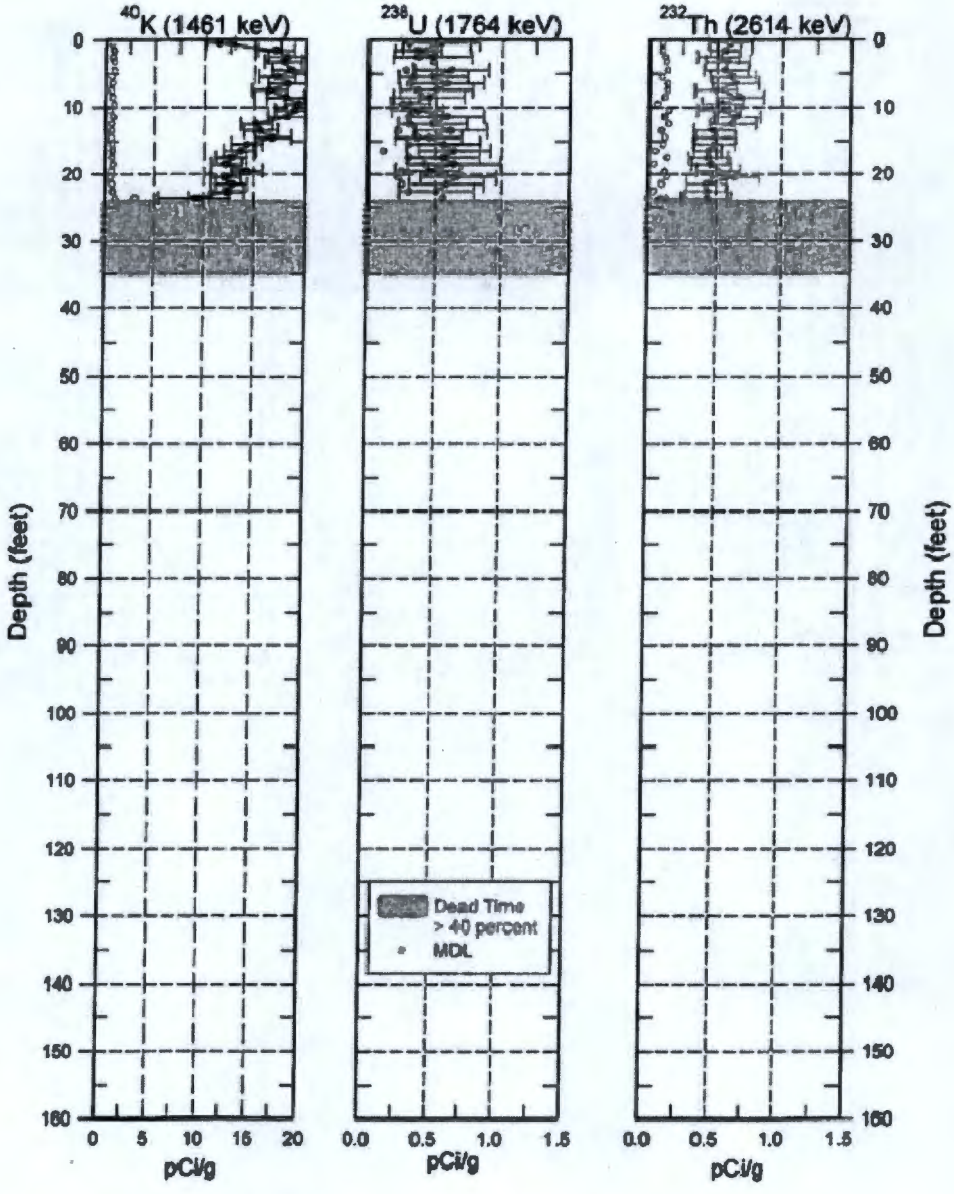
C5570
Natural Gamma Logs



Zero Reference = Ground surface

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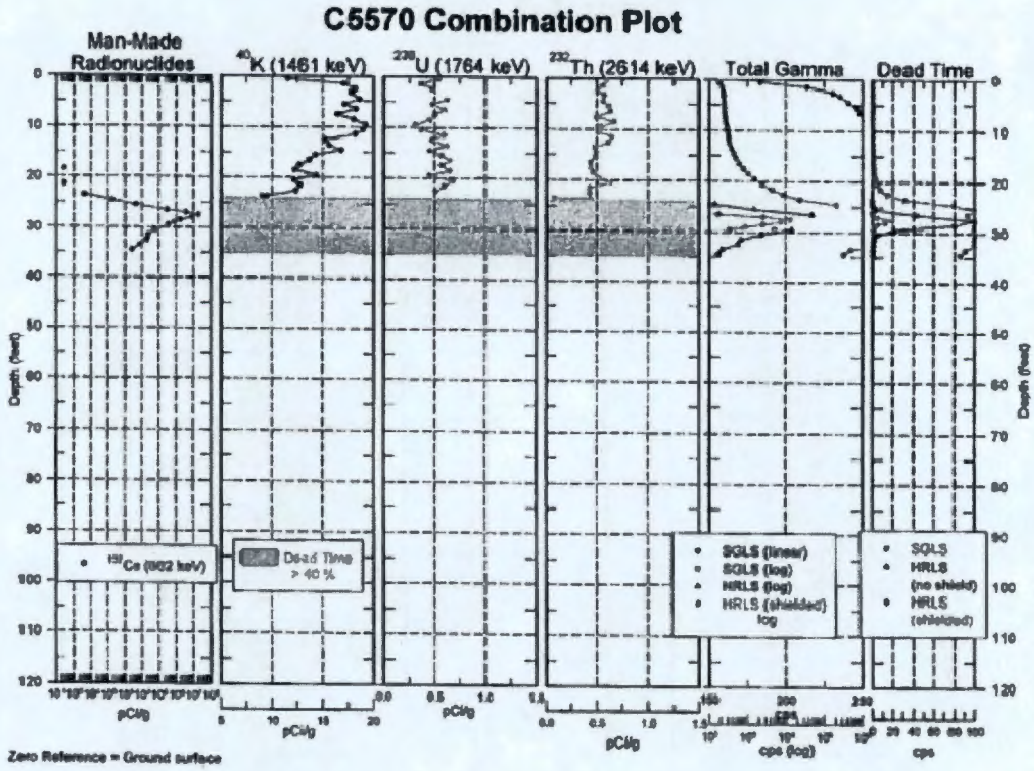

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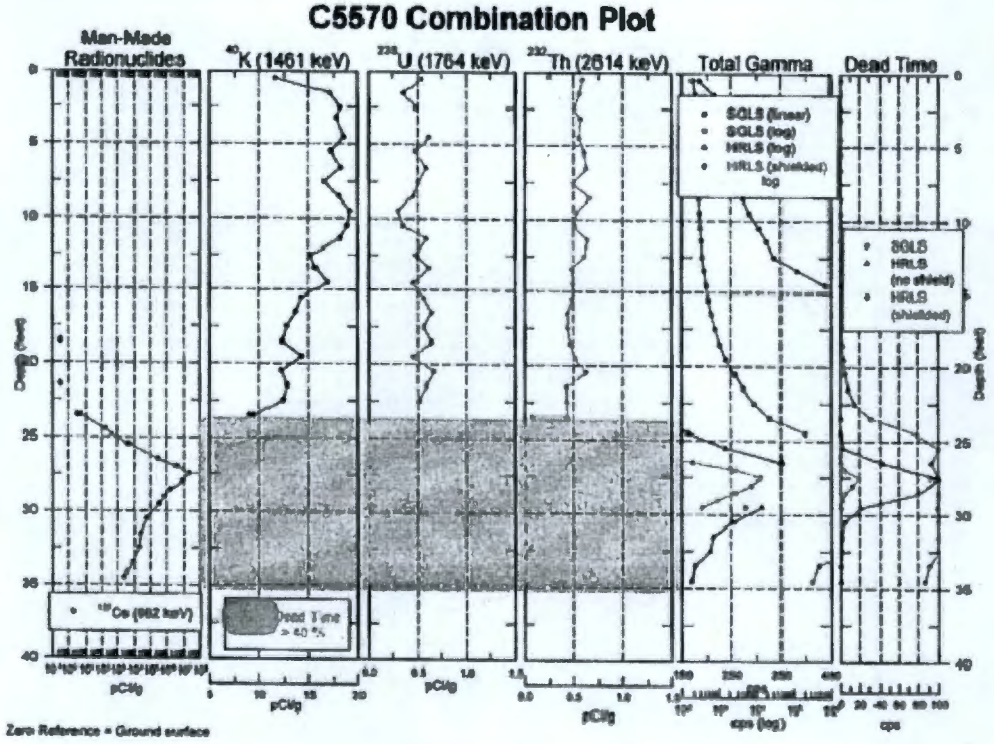

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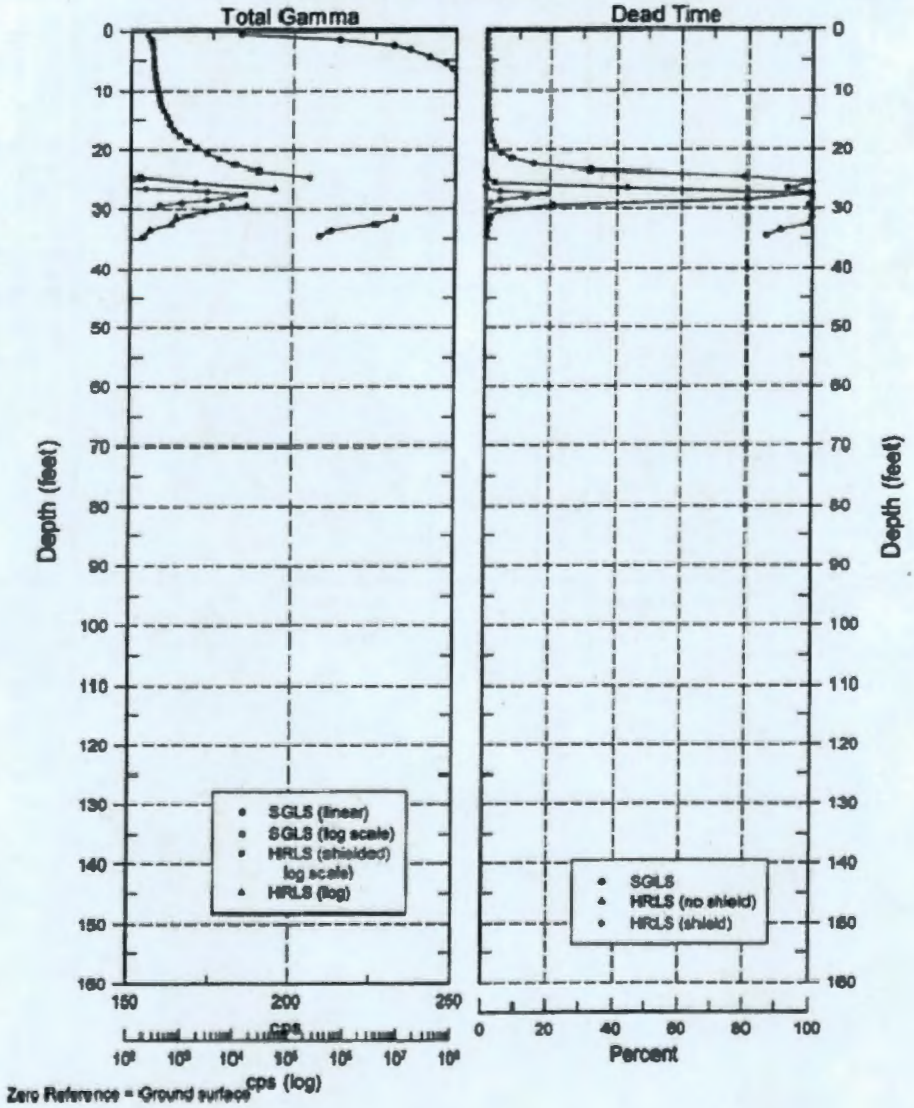
C5570
Total Gamma & Dead Time



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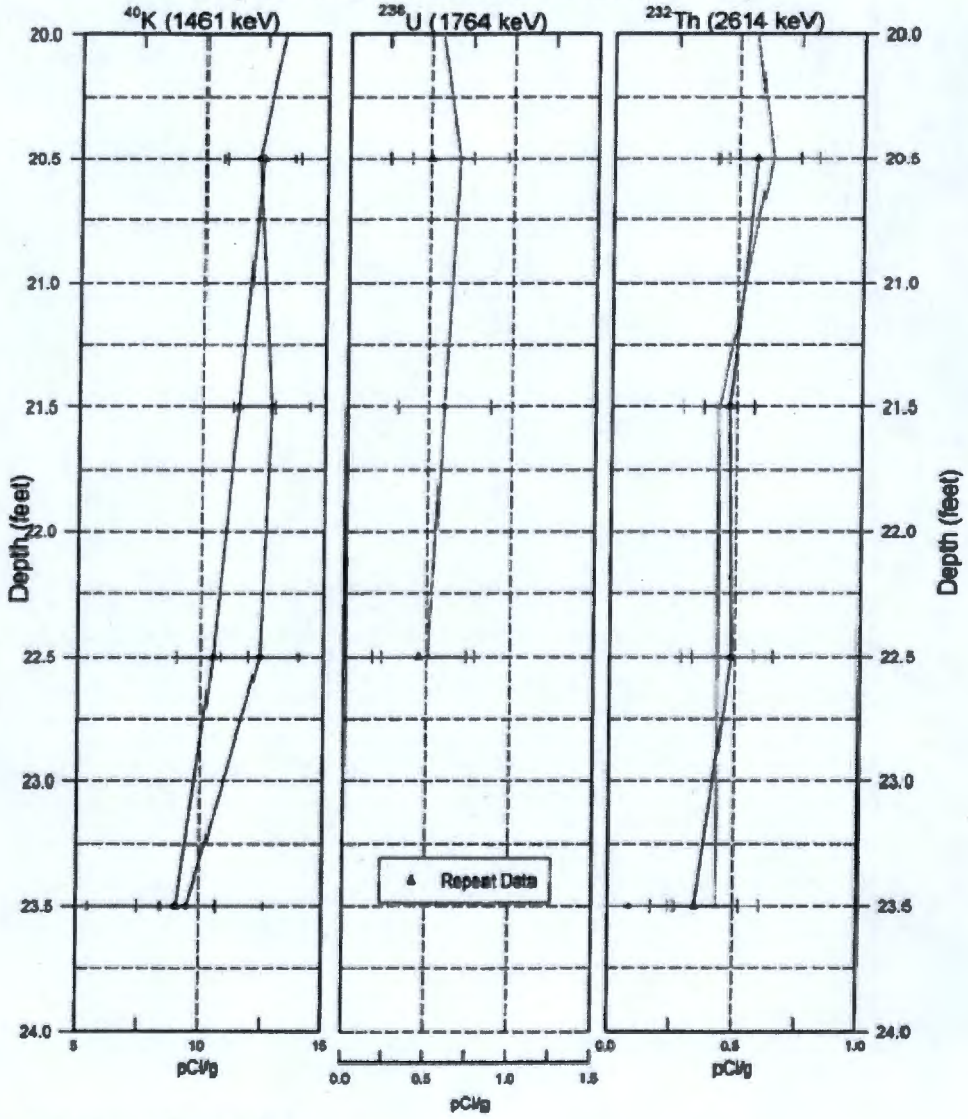
HGLP-LDR-071

C5570

Repeat Section of Natural Gamma Logs



Zero Reference = Ground surface

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Appendix H

Well Summary Sheet for Borehole C5571

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H1 Well Summary Sheet for Borehole C5571

WELL SUMMARY SHEET

Start Date: 7/12/07
Finish Date: 9/4/07
Page 1 of 1

Well ID: C5571
Well Name: -N/A- (A-21 Dpt).
Location: 216-A-21 Crib, S. of PUREX, 200 E
Project: 216-A-21 Direct Push
Prepared By: N. Bowles Date: 9/4/07
Reviewed By: L.D. Walker Date: 1/18/08
Signature: Signature:

CONSTRUCTION DATA

Description	Diagram
Concrete Surface Seal/Pad: 0.0' (ags.) to ~0.5' bgs.	
Temporary Drive Casing: 7⅛" OD; C.S.; Rem. thd; 0.0' (ags.) to 60.0' bgs.	
Bentonite Chip Seal: 3/8" Chips; ~0.5' bgs to 60.0' bgs.	
Notes: - Drive-Point borehole full decommissioned. - All temporary casing removed from borehole. - All measurements are in Feet "below ground surface" (bgs).	TD

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		Borehole lithology is unknown from: - 0.0' (ags.) to 19.1' bgs; - 22.5' to 25.1' bgs; - 26.8' to 39.0' bgs; & - 40.7 to 58.2' bgs. (Due to direct-push/drive-point drilling method).
10		
20		Sand (S) was generally observed from: - 19.1' to 22.5' bgs; - 25.1' to 26.8' bgs; - 39.0' to 40.7' bgs; & - 58.5' to 59.9' bgs.
30		Silty Sand (mS) was observed from: - 58.2' to 58.5' bgs.
40		
50		
60		TD = 60.0' bgs

A-6003-643 (03/03)

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Appendix I

Well Construction Summary Report for Borehole C5571

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I1 Well Construction Summary Report For Borehole C5571

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 7/12/07
Finish Date: 9/4/07
Page 1 of 1

Well ID: C5571 | Well Name: -N/A- (A-21 DPT) | Approximate Location: 216-A-21 Crib, S. of PUREX, 200E
Project: 216-A-21 Direct Push. | Other Companies: Layne, FH, GRAM, Stoller
Drilling Company: Layne Christensen / Flint Hauland | Geologist(s): M. Caron, N. Bowles, J. Weaver
Driller: | License #:

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
7 1/16" O/5 7/8" ID,	0.0 - 60.0'	7/8" OD/4 7/16" ID
- Carbon Stl. / Rev. Thd.	— - —	—
	— - —	
Not used (FH) 9/4/07		
	— - —	

*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design

Not used (FH) 9/4/07

DRILLING METHOD / HOLE DIAMETER (in.) / INTERVAL (ft)

Auger:	Diameter —	From —	to —
Cable Tool:	Diameter Not used	From —	to —
Air Rotary:	Diameter Not used	From (NB)	to 9/4/07
A.R. w/Sonic:	Diameter —	From —	to —
Direct Push (using Becker hammer)	Diameter 7 7/8"	From 0.0	to 60.0
	Diameter —	From —	to —
	Diameter —	From —	to —

Not used (NB) 9/4/07

Drilling Fluid: -N/A-

Total Drilled Depth: 60.0'bgs | Hole Dia @ TD: 7 7/8"
Total Amt. Of Water Added During Drilling: -N/A-
Well Straightness Test Result: -N/A- | Static Water Level: -N/A- | Date: -N/A-

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma (GRLS)	0.0 - 59.0	8/2/07	Boron Neutron (BNLS)	0.0 - 59.0	8/1/07
High Rate (HRLS)	11.0 - 37.0	8/2/07 & 8/4/07		Not used (NB) 9/4/07	
Neutron Moisture (NMLS)	0.0 - 59.25	8/1/07			

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval (Annular Seal/Filter Pack)	Volume	Mesh Size
	— - —			Mid-Plug Bentonite Chips	60.0' - 0.5'	15.75 ft³ 50 lb bags	7/8"
	— - —			Concrete Aggregate	0.5' - 0.0'	2.5 yd³	-N/A-
Not used (NB) 9/4/07					— - —		
	— - —			Not used (NB) 9/4/07			
	— - —				— - —		

OTHER ACTIVITIES (SB) 9/4/07

Aquifer Test: -N/A- | Date:
Description: Not used (SB) 9/4/07 (NB)

Borehole Will Decommission: Yes ✓ No | Date: 9/4/07
Description: Full decommissioned on 9/4/07
Not used (NB) 9/4/07

WELL SURVEY DATA (if applicable)

Unknown @ Hanford (not yet surveyed) | Protective Casing Elevation: - Unk. -
Washington State Plane Coordinates: — Unk. — | Brass Survey Marker Elevation: - Unk. -

COMMENTS / REMARKS

Borehole full decommissioned. Brass survey marker installed in surface seal/pad.

Reported By: N. Bowles | Title: Geologist | Signature: [signature] | Date: 9/4/07

A-6008-658 (04/03)

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Appendix J

Borehole Log for Borehole C5571

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J1 Borehole Log for Borehole C5571

BOREHOLE LOG C5571	Page 1 of 2 7/31/07 Date: 7-12-07 – Start 7/20/07 – Finish

Well ID: NA	Well Name: C5571 NA	Location: C5571
Project: 216-A-21 Direct Push		Reference Measuring Point: ground surface (g.s.)

Depth (Ft.)	Sample Type No.	Blows Recovery	Graphic Log	Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)
0–19.1			X	*Note: No lithology observed from: – ground surface to 19.1' bgs, – 22.5' to 25.1' bgs, – 26.8' to 39.0' bgs, and – 40.7' to 58.2' bgs.	Direct-Push Technology w/ removable inner-string/tip using Becker-Hammer drill rig.
					Split-Spoon soil sample from 19.1' → 20.9' bgs, HEIS #s B1P3K6 & B1P3M3 @ 0830, 7/20/07 (Note: Sample tube driven on 7/19/07 @ 0825). RCT → 10 mR/hr DDE on contact & 270 mR/hr SDE on contact (bulk sample, w/ RO-20, composited). (I-003)
19.1–20.9	S.S.	100% Rec. I-003		19.1' → 20.9': Sand (S) ≥90% S (fn. to csc), mostly tan/brn, unconsol, s. moist to moist ≤10% m (silt), brn to dk brn @ 19.5': less m content (<5%) (all material observed in sample table while sampling).	
				B1P3K4 7/31/07	S.S. soil sample from 21.0 → 22.5' bgs, HEIS #s B1P3K7, B1P3L1, & B1P3L9, @ 1350, 7/19/07. RCT → 60 mR/hr SDE & 20 mR/hr DDE @ ~22' bgs (on contact w/ RO-20); ≥1 mil cpm w/ G-M. (I-002)
21.0–22.5	S.S.	100% Rec. I-002		21.0' → 22.5': Sand (S) overall, similar to S from 19.1 to 20.9' w/ v. little silt cont. (<5%), less moisture (moist).	
25.1–26.8	S.S.	100% Rec. I-005		25.1' → 26.8': Sand (S) similar to above w/ ~ ≤10% m, and w/ <5% G (v. fn. to fn. pebbles, sparse) loose/unconsol, moist. B1P3K3 7/31/07	S.S. soil sample from 25.1' → 26.8' bgs, HEIS #s B1P3K5, B1P3L2, & B1P3M0, @ 1350, 7/19/07. RCT → 4 mR/hr DDE on contact, 1.5 mR/hr DDE @ 1 ft (w/ RO-20). ≥1 mil cpm w/ G-M @ ~26' bgs. (I-005)

Reported By: Michael E. Caron / N. Banks	Reviewed By: L. D. Walker
Title: Senior Geologist / Geo.	Title: Geologist
Signature: [signature] [signature] Date: 7/31/07	Signature: [signature] Date: 8/7/07

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 2

Date: 7/20/07 - Start; 7/21/07 - Finish.

LW 11-7-07

Well ID: C5571	Well Name: ~~C5571~~ NA	Location: 216-A-21 Crib, Soil Desiccation Pilot Test (PUREX), 200E.
Project:		Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)
40	S.S.	100% Rec. S-007		~~→ @ ~~ (initials) 7/20/07	Direct-Push (see p. 1).
				39.0' → 40.7' bgs: Sand (S)	Split-Spoon soil sample
				>95% S, <5% G.	from 39.0' → 40.5' bgs,
				S: Blk & wht ("salt & pepper") Hanford Fm.	HEIS #s B1P3K5, B1P3K9,
45				~85% med. to crse, ~5% fine, ~10% v. crse;	B1P3L3, & B1P3M1; @
				ang. to subang.;	1420, 7/20/07. RCT →
				G: v. sparse, v. fine to fine pebbles.	200 k dpm w/ G-M @ 39.0' bgs
				Overall: less moisture (Slight),	20 k dpm w/ G-M @ 40.5' bgs
				loose/unconsol., poorly sorted.	0.7 mR/hr open w/ RO-3B (CP)
50					1.0.3 mR/hr closed w/ RO-3B (CP)
					(overall bulk sample). (S-007).
55				(initials) 7/21/07	Split-Spoon soil sample
				↓ 58.5	from 58.2' → 59.9' bgs (shoe incl.), HEIS #s B1P7Y1, B1P3L0,
					B1P3L4, & B1P3M2; @
	S.S.	100% Rec.		58.2' → 58.5': Silty Sand (mS)	1335, 7/21/07. RCT →
60		S-009	T.D.	~25% m, 75% v. fine to med. S	30 k dpm w/ G-M @ 58.5' bgs.
				dry, grayish brn, consol., non-plastic	(in silty sand layer). (S-009).
				58.5 → 59.9': Sand (S)	
				return to S similar to that	T.D. = 60.0' bgs.
				from 39.0 to 40.7' bgs w/out G cont.,	
				and w/ ~5% Silt (m) cont.,	
				Slight moisture	
				(59.9 → 60.0: Not observed)	

Reported By: N. Bradley (initials) 7/21/07	Reviewed By: L. D. Walker
Title: Geologist	Title: Geologist
Signature: [signature] Date: 7/21/07	Signature: [signature] Date: 11/7/07

A-6003-647 (03/03)

Appendix K

Geophysical Log Data Report for Borehole C5571

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K1 Geophysical Log Data Report For Borehole C5571

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C5571
Log Data Report

Borehole Information:

Borehole: C5571			Site: 216-A-21		
Coordinates (WA St Plane)		GWL[1] (ft):	None	GWL Date:	07/31/07
North (m)	East (m)	Drill Date	TOC Elevation	Total Depth (ft)	Type
Not available	Not available	07/07	Not available	60	Push

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	1.75	6	5	1/2	1.75	60
PVC	3.9	4 1/2	4 1/4	1/8	3.9	60

Borehole Notes:

The threaded steel casing was internally contaminated. A PVC liner was introduced inside the steel casing to prevent the logging equipment from being contaminated. The PVC casing thickness was measured by the logging engineer. The steel casing dimensions were determined from the driller. Ground surface is the zero ft depth reference for data acquisition.

Logging Equipment Information:

Logging System:	Gamma 1 G		Type:	SGLS 35% HPGe SN: 34-TP10951A
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-003	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 1 C		Type:	HRLS planar HPGe SN: 39A314
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-004	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 4 H (with AmBe source)		Type:	NMLS SN: H310700352
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-002	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 4 H (without AmBe source)		Type:	PNLS SN: H310700352
Effective Calibration Date:	11/22/06	Calibration Reference:	HGLP-CC-002	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	5	6	7	8 Repeat	
Date	08/02/07	08/02/07	08/02/07	08/02/07	
Logging Engineer	McClellan	McClellan	McClellan	McClellan	
Start Depth (ft)	0.0	11.0	36.0	44.0	

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Log Run	5	6	7	8 Repeat	
Finish Depth (ft)	12.0	37.0	59.0	51.0	
Count Time (sec)	200	20	200	200	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
ft/min	N/A	N/A	N/A	N/A	
Pre-Verification	AG131CAB	AG131CAB	AG131CAB	AG131CAB	
Start File	AG131000	AG131013	AG131040	AG131064	
Finish File	AG131012	AG131039	AG131063	AG131071	
Post-Verification	AG131CAA	AG131CAA	AG131CAA	AG131CAA	
Depth Return Error (in.)	N/A	N/A	N/A	N/A	
Comments	No fine gain adjustment	No fine gain adjustment Dead time > 40%	No fine gain adjustment	No fine gain adjustment	

High Rate Logging System (HRLS) Log Run Information:

Log Run	9	10	11	12	13 Repeat
Date	08/02/07	08/06/07	08/06/07	08/06/07	08/06/07
Logging Engineer	McClellan	McClellan	McClellan	McClellan	McClellan
Start Depth (ft)	11.0	14.0	19.0	23.0	19.0
Finish Depth (ft)	15.0	20.0	24.0	37.0	23.0
Count Time (sec)	300	300	30	300	300
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	Y (internal)
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	AG176CAB	AG177CAB	AG177CAB	AG177CAB	AG177CAB
Start File	AG176000	AG177000	AG177007	AG177013	AG177028
Finish File	AG176004	AG177006	AG177012	AG177027	AG177036
Post-Verification	AG176CAA	AG177CAA	AG177CAA	AG177CAA	AG177CAA
Depth Return Error (in.)	0	N/A	N/A	0	0
Comments	None	None	Dead Time > 40 %	None	Fine gain adjustment after file -028

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2 Repeat			
Date	08/01/07	08/01/07			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	0	16.0			
Finish Depth (ft)	59.25	26.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	N/A	N/A			
Pre-Verification	DH642CAB	DH642CAB			
Start File	DH642000	DH642238			
Finish File	DH642237	DH642278			
Post-Verification	DH642CAA	DH642CAA			
Depth Return Error (in.)	N/A	0			
Comments	None	None			

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Passive Neutron Logging System (PNLS) Log Run Information:

Log Run	3	4 Repeat			
Date	08/01/07	08/01/07			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	0	14.0			
Finish Depth (ft)	59.0	23.0			
Count Time (sec)	60	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	0.25			
ft/min	N/A	N/A			
Pre-Verification	DH652CAB	DH652CAB			
Start File	DH652000	DH652060			
Finish File	DH652059	DH652096			
Post-Verification	DH652CAA	DH652CAA			
Depth Return Error (in.)	N/A	0			
Comments	None	None			

Logging Operation Notes:

Logging was conducted with no centralizer on the sondes. Repeat sections were acquired to evaluate system performance.

Analysis Notes:

Analyst:	Henwood	Date:	08/15/07	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications for the logging systems were performed before and after each day's data acquisition. The acceptance criteria were met. A combined casing correction for 0.5-in. thick steel casing and 1/8 in. thick PVC casing was applied to the spectral log data. Correction for the steel casing was derived from calibration data. A model was developed to determine the correction for the PVC casing. There is no available calibration for this casing configuration to correct moisture data to percent volumetric moisture. Therefore, the data are reported in counts per second (cps). The passive neutron data are also qualitative and are reported in cps.

SGLS and HRLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G1GNov06.xls and G1CNov06.xls for the SGLS and HRLS, respectively, using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Where dead time exceeds 40 percent, HRLS data are substituted for the SGLS data. Where the HRLS dead time exceeds 40 percent, HRLS data acquired using an internal shield are substituted.

Results and Interpretations:

Cs-137 was detected throughout this borehole at concentrations ranging from 0.3 to 1.3 million pCi/g. The maximum concentration was measured at 21 ft in depth. Because there is known to be internal contamination in this borehole, concentration measured at 1 pCi/g or less is probably not valid.

Moisture data indicate very little variation. It is not known to what degree the PVC casing that contains significant hydrogen and chlorine content affects the measurement, which normally responds to the hydrogen content in formation moisture. Additionally, the instrument is sensitive to gamma rays when the Cs-137 content exceeds approximately 100,000 pCi/g so that the count rate data could be slightly over estimated between 15 and 28 ft.

The passive neutron count rate data indicate slight elevation (i.e., 2 cps) between 15 and 28 ft. In the absence of the high gamma activity caused by Cs-137, elevated readings could indicate the existence of alpha emitting

radionuclides interacting with light elements, referred to as alpha - neutron reactions (α,n). These reactions create neutron activity that may reflect the existence of transuranic radionuclides such as Pu-239. However, in high gamma activity zones, it cannot be determined with certainty whether the elevated neutron count rate is caused by these reactions or is caused by the high gamma activity. Logging experience suggests, in this case, the apparent neutron activity is actually caused by the gamma activity.

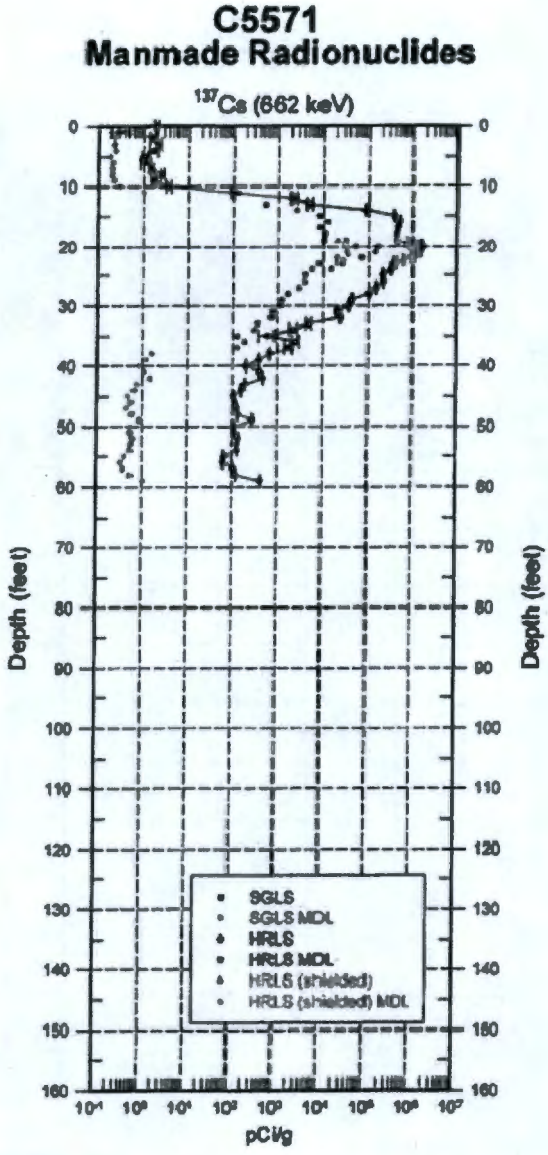
The repeat sections generally indicate good agreement of the naturally occurring KUT, manmade radionuclides, and moisture and passive neutron count rates.

List of Log Plots:

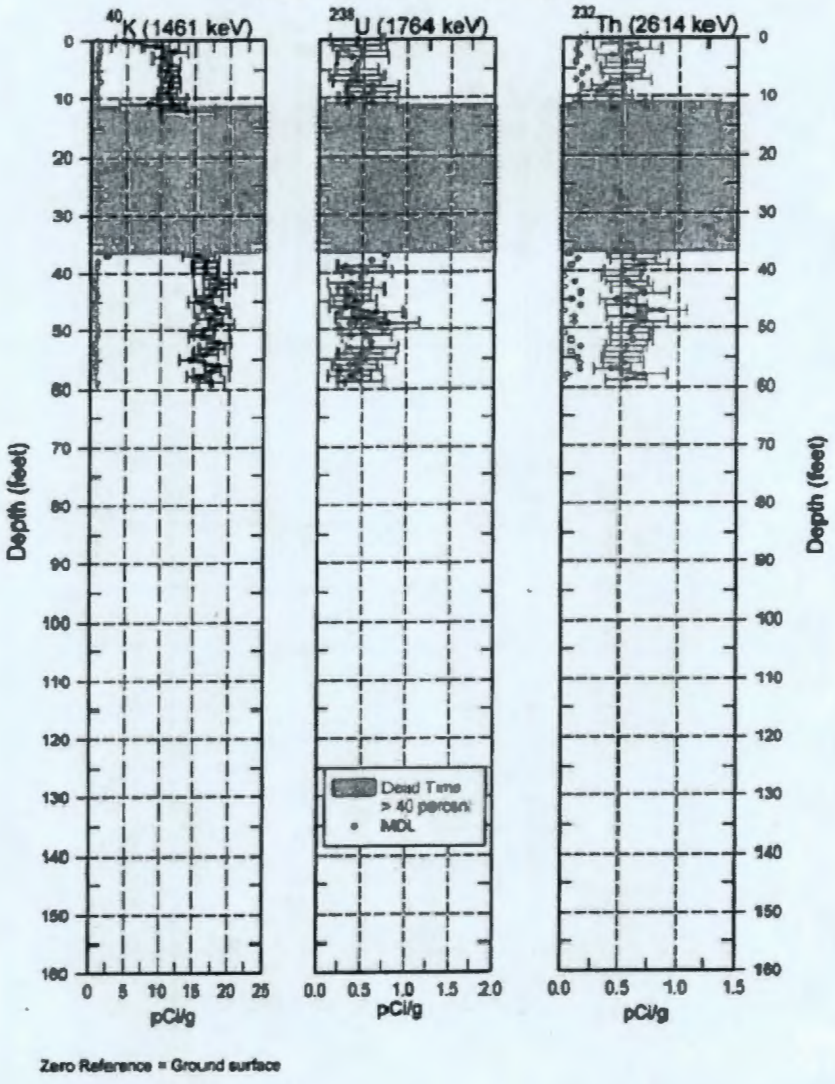
Depth Reference is ground surface

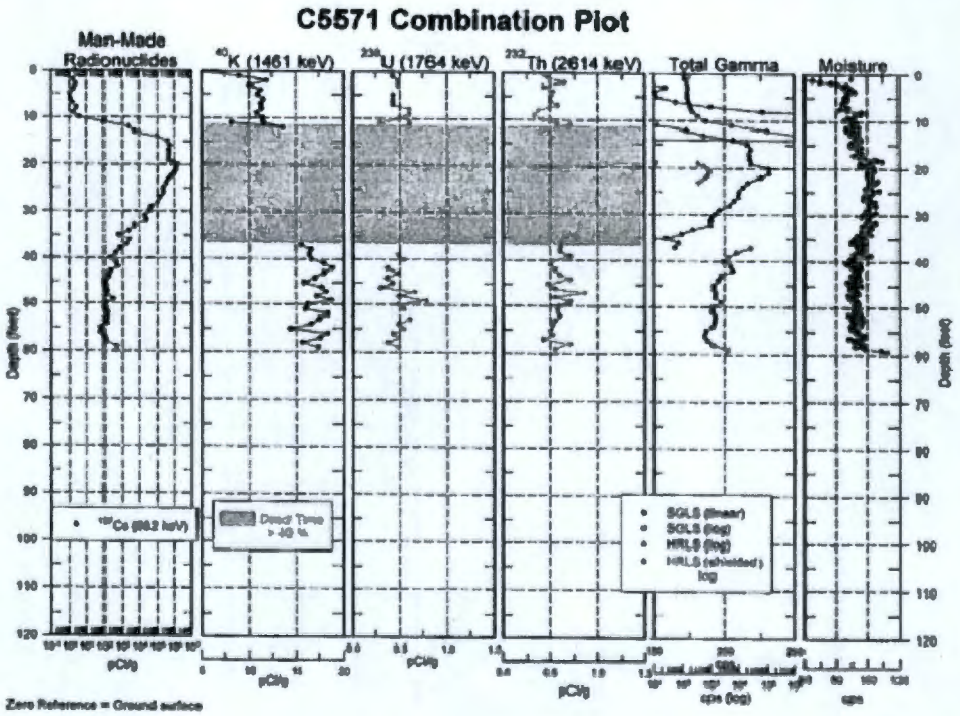
Manmade Radionuclides
Natural Gamma Logs
Combination Plot
Total Gamma & Dead Time
Moisture & Passive Neutron
Repeat of Manmade Radionuclides
Repeat Section of Natural Gamma Logs
Repeat of Moisture & Passive Neutron

[1] GWL – groundwater level



Zero Reference = Ground surface


C5571
Natural Gamma Logs
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Depth (feet)
pCi/g
Dead Time
> 40 percent
MDL
Zero Reference = Ground surface


C5571 Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
Zero Reference = Ground surface

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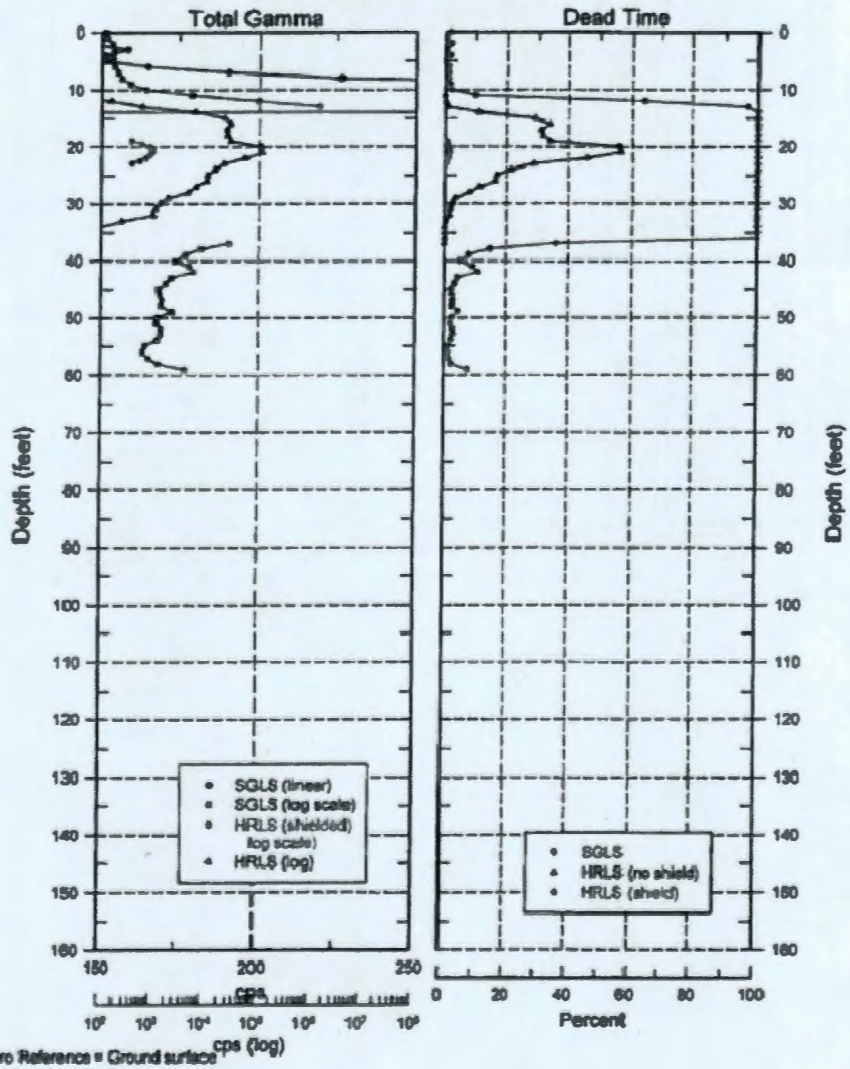
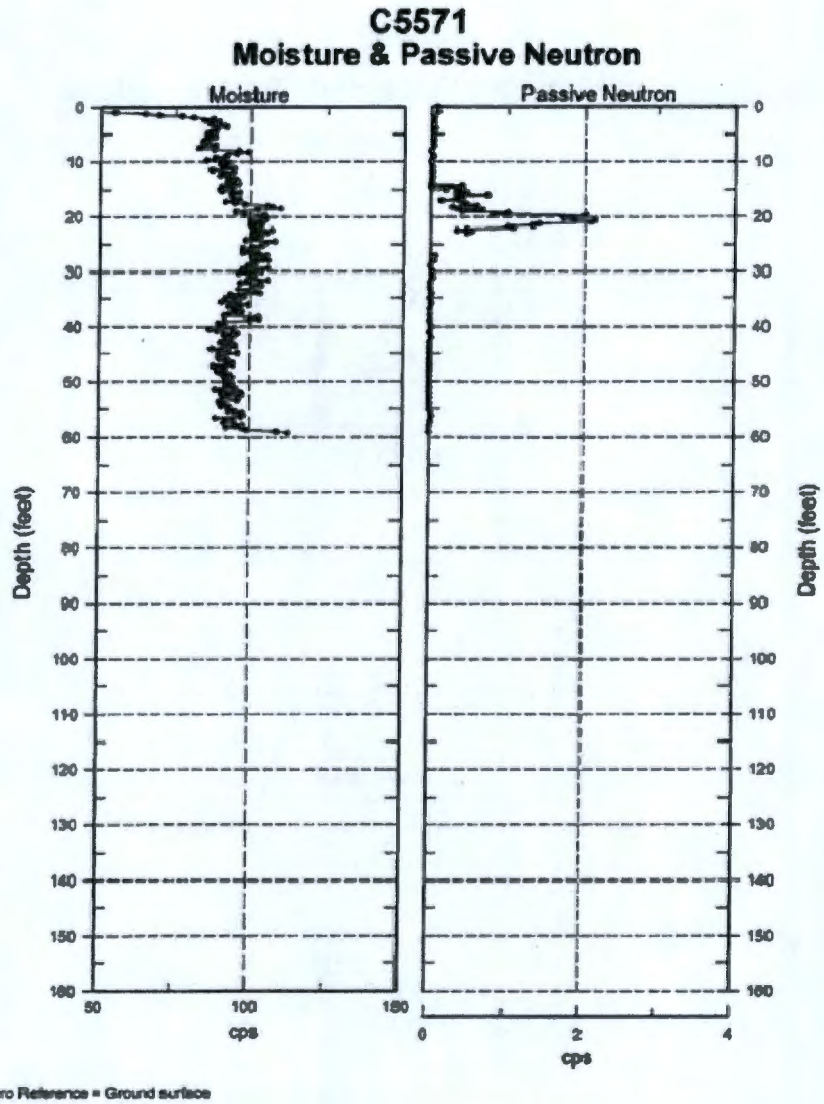
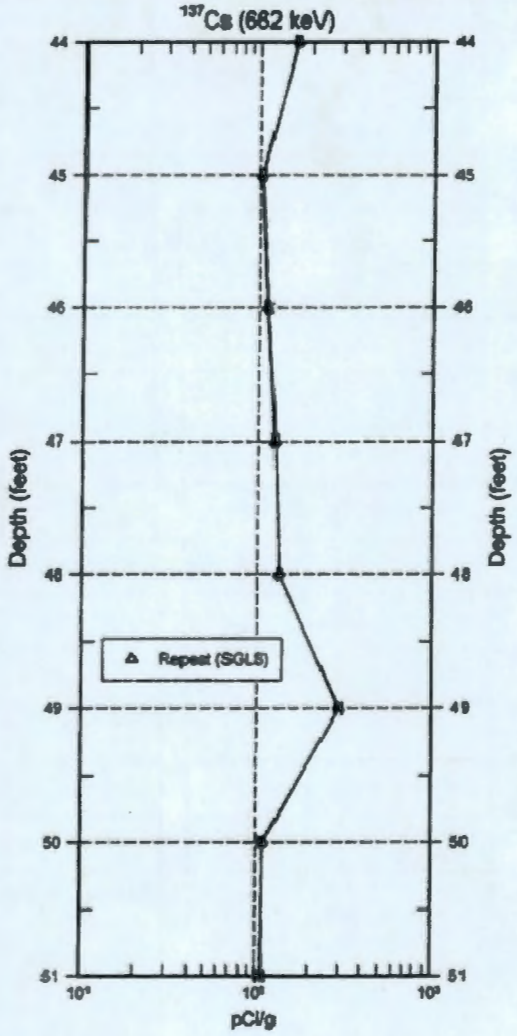
C5571
Total Gamma & Dead Time




C5571
Moisture & Passive Neutron
Moisture
Passive Neutron
Depth (feet)
Depth (feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
50
100
150
cps
0
2
4
cps
Zero Reference = Ground surface

C5571
Repeat of Manmade Radionuclides



Zero Reference = Ground surface

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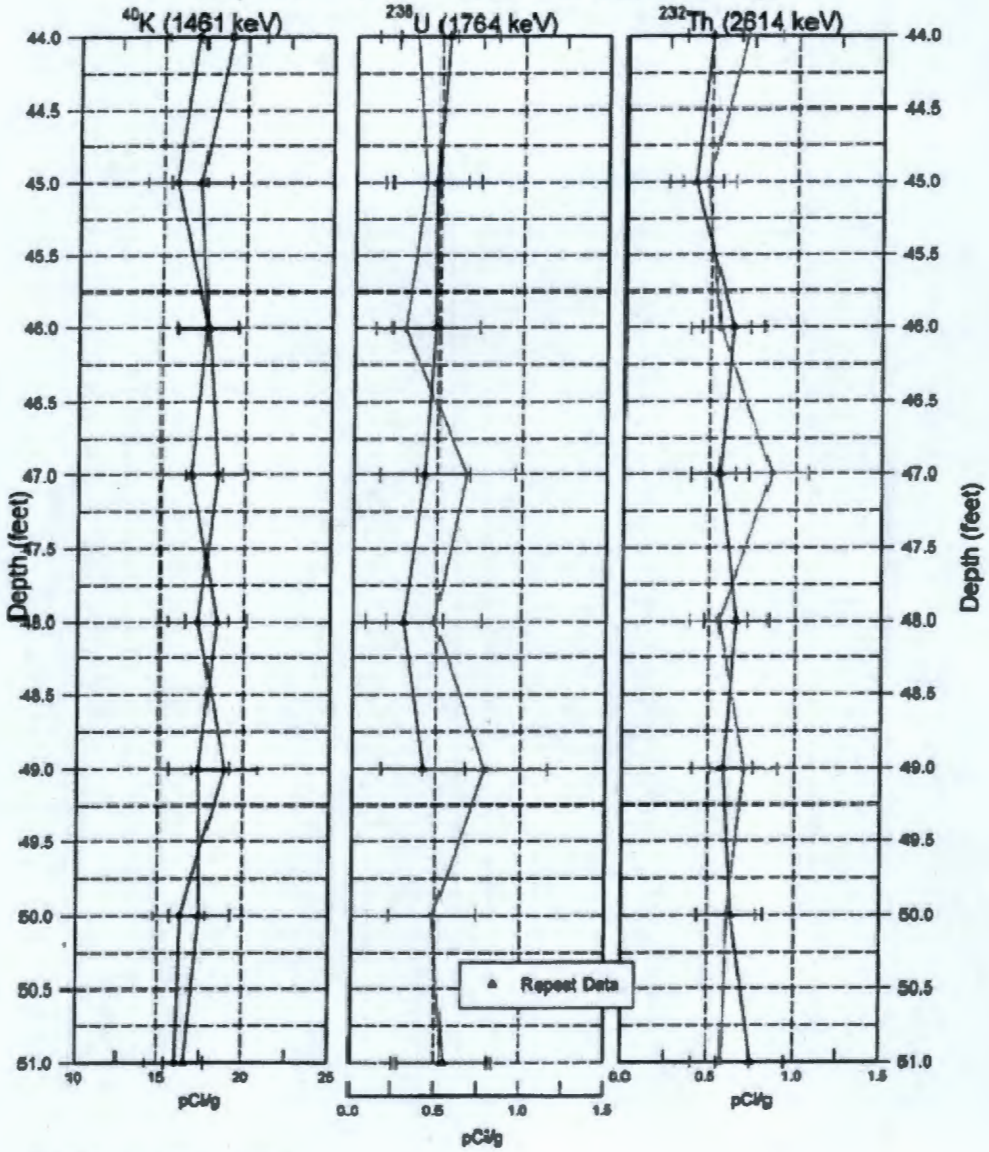
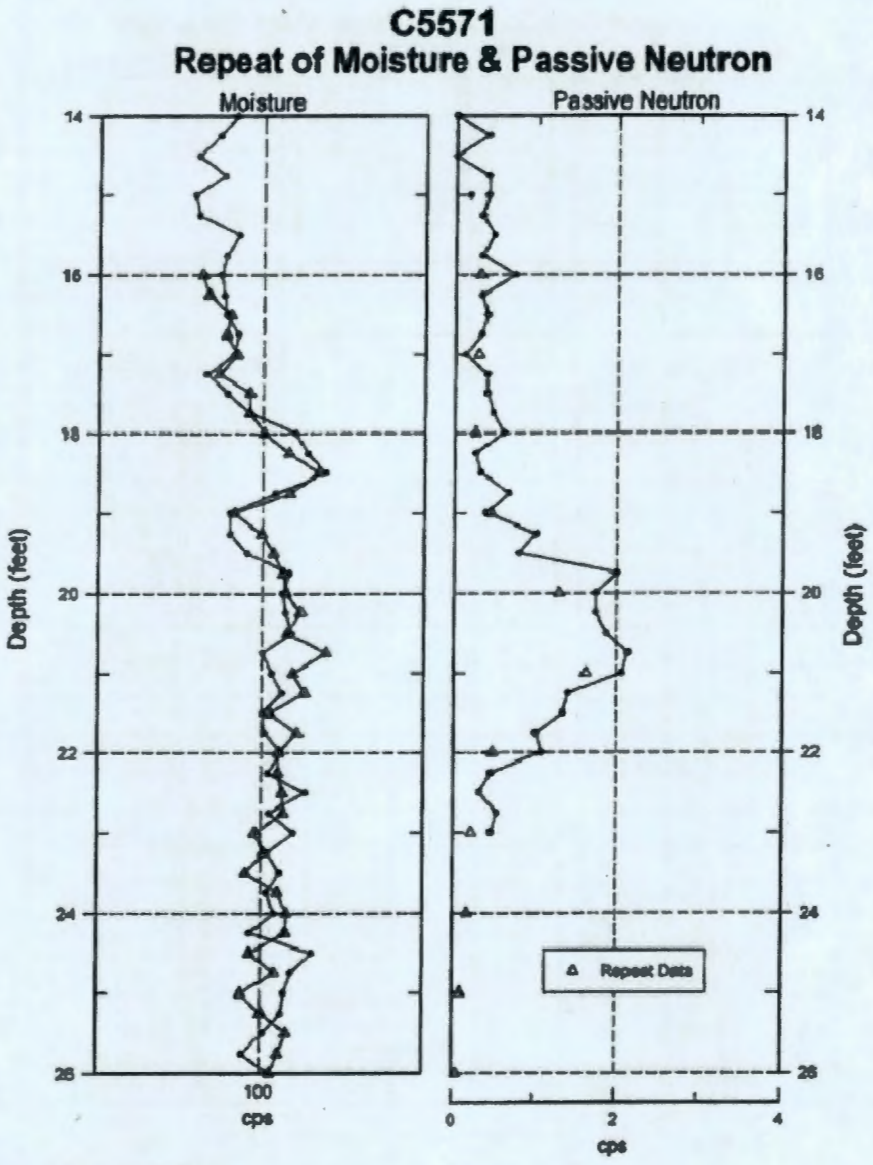
C5571

Repeat Section of Natural Gamma Logs



Zero Reference = Ground surface



Zero Reference = Ground surface

Distribution

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