SGW-60265
Revision 0

200-DV-1 Operable Unit BY Cribs Field Summary Report

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

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
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Terms

BDS	Borehole Deviation System
bgs	below ground surface
CCUg	Cold Creek unit gravel
CCUz	Cold Creek unit silt
ERT	electrical resistivity tomography
FY	fiscal year
H1	Hanford 1
H2	Hanford 2
HEIS	Hanford Environmental Information System
HRLS	High Rate Logging System
ID	identification
NMLS	Neutron Moisture Logging System
OU	Operable Unit
PNLS	Passive Neutron Moisture Logging System
PNNL	Pacific Northwest National Laboratory
PVC	polyvinyl chloride
QA	quality assurance
SGLS	Spectral Gamma Logging System
TBP	tributyl phosphate
TD	Total Depth
TPH	total petroleum hydrocarbon

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1 Introduction

This field summary report documents the drilling, sampling, and construction of four vadose zone characterization boreholes installed in the 200 DV-1 Operable Unit (OU) within the Central Plateau of the Hanford Site in fiscal year (FY) 2016. These four boreholes were drilled to characterize the deep vadose zone within and surrounding the BY Cribs, located in the B-Complex Area within the Inner Area. The boreholes were constructed as ERT monitoring points following drilling and sampling; depth discrete electrical resistivity sensors were installed during construction and left in the borehole for future geophysical monitoring. The boreholes were drilled and sampled as defined in the DOE/RL-2011-104, *Characterization Sampling and Analysis Plan for the 200-DV-1 Operable Unit*. The purpose of this document is to compile field methods and results from the drilling and sampling of the four characterization boreholes in the BY Cribs.

1.1 Background on 200 DV-1 OU and the BY Cribs

The 200-DV-1 OU comprises 43 waste sites that are located in three distinct geographical areas within the Central Plateau, including: the B Complex Area, the T Complex Area, and the S Complex Area. The 200-DV-1 OU includes the vadose zone from the ground surface to the water table at these 43 waste sites. The 200-DV-1 OU was created in 2010 to support remedy selection for waste sites with deep vadose contamination. The deep vadose zone begins at a depth of approximately 50 ft below ground surface (bgs) and extends to the water table at depths ranging from approximately 180 to 270 ft bgs. The disposal of hazardous waste associated with the plutonium separation process and the subsequent contamination of the deep vadose zone is a significant issue because it represents a potential source for continued release of mobile contamination to the groundwater. The deep vadose zone is being characterized by drilling boreholes and collecting soil samples at selected depths. The primary contaminants in the deep vadose zone driving long-term risk are uranium and technetium-99 because of their potential adverse health effects, persistence, high inventory in the vadose zone, mobility, difficulty in predicting subsurface behavior, and long half-lives. Additional mobile contaminants of long-term concern are iodine-129, chromium, cyanide, and nitrate (DOE/RL-2010-89).

The BY cribs are located in the B Complex Area just north of the BY tank farm (Figure 1-1). The B Complex Area includes the B, BX, and BY tank farms and 23 waste sites in the 200-DV-1 OU. Each of the eight BY cribs (216-B-43 through 216-B-50) contains four 4 ft by 4 ft concrete culverts buried vertically 15 ft bgs and fed by a steel pipe. The culverts were arranged in a square (Figure 1-2). During site stabilization activities the BY Cribs were covered with 0.61 to 2 m (2 to 6 ft) of fill. After B plant was shut down in 1952, the high level waste from the tank farms was sent to U plant for uranium recovery and fission product scavenging and back to BY tank farm for settling. In 1954, 33.8 million L (8.9 million gal) of supernatant was discharged to seven of the BY cribs (216-B-43 through 216-B-49), which were taken out of service as they reached their radionuclide capacity based on breakthrough of cesium-137 and cobalt-60 to the groundwater. The eighth BY crib (216-B-50) received the condensate from the BY tank farm's in-tank solidification process from 1965 to 1974. This process added heat to the inside of the tank in an effort to remove liquid waste supernatant from the tanks. The BY Cribs received 89% of the technetium-99 and 51% of nitrate waste released across the B Complex.

Table 1-1 shows the total estimated inventory of mobile contaminants discharged to the BY cribs. There was a large mass of uranium, technetium-99, nitrate, fluoride, cyanide, and chromium.

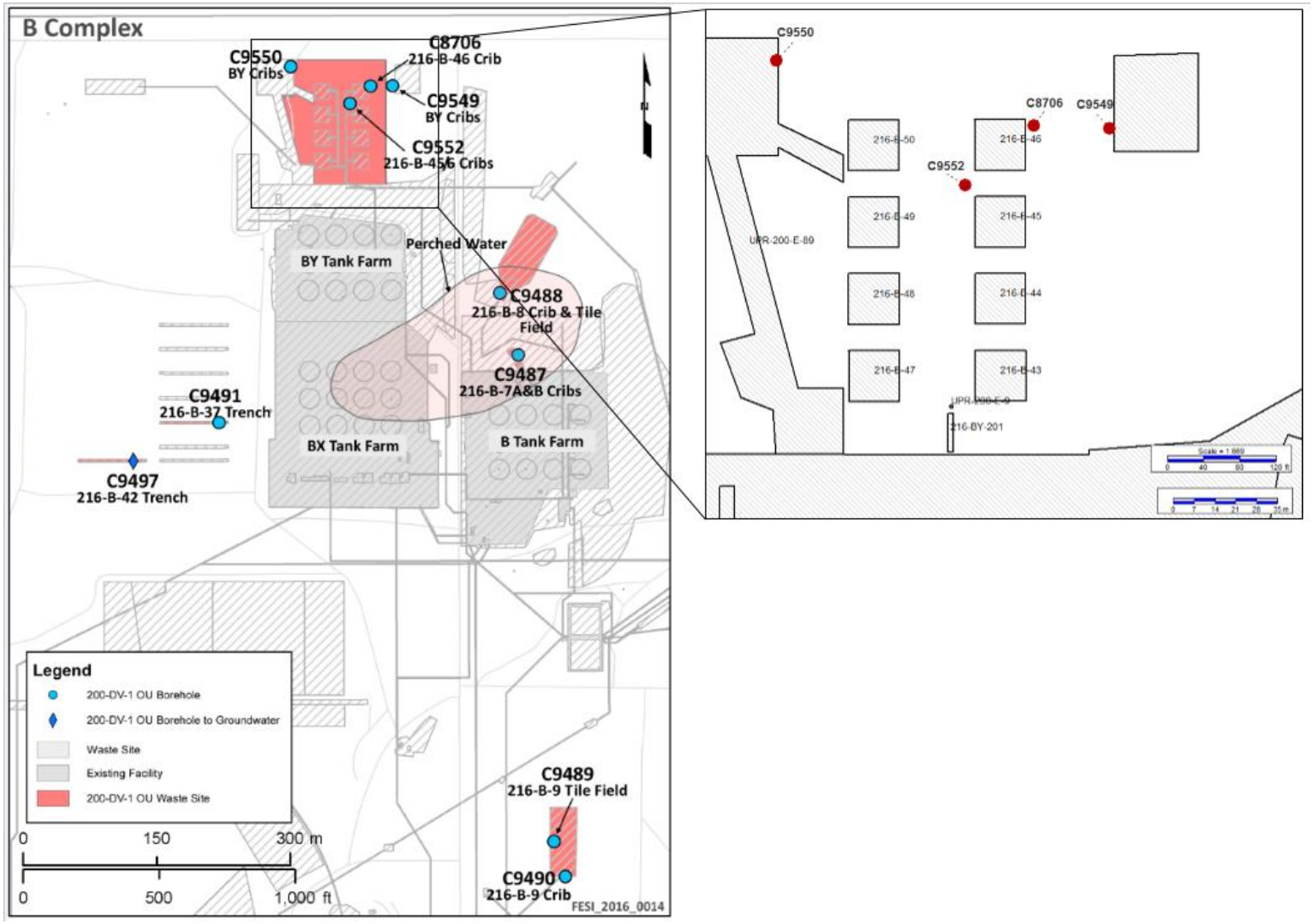


Figure 1-1. Map of B Complex Area Showing 200-DV-1 OU Characterization Borehole Locations, Including the Four BY Crib Borehole Locations.

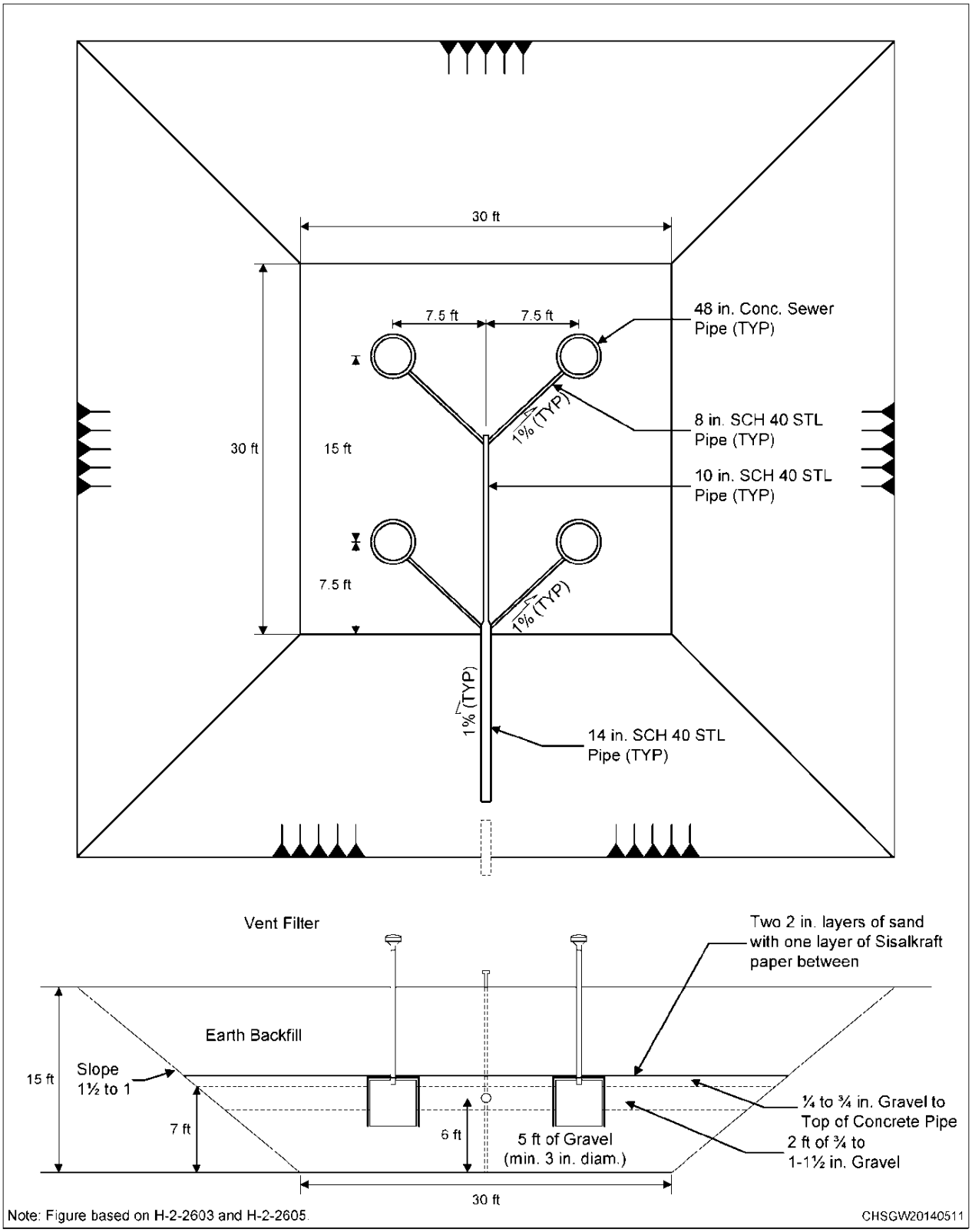


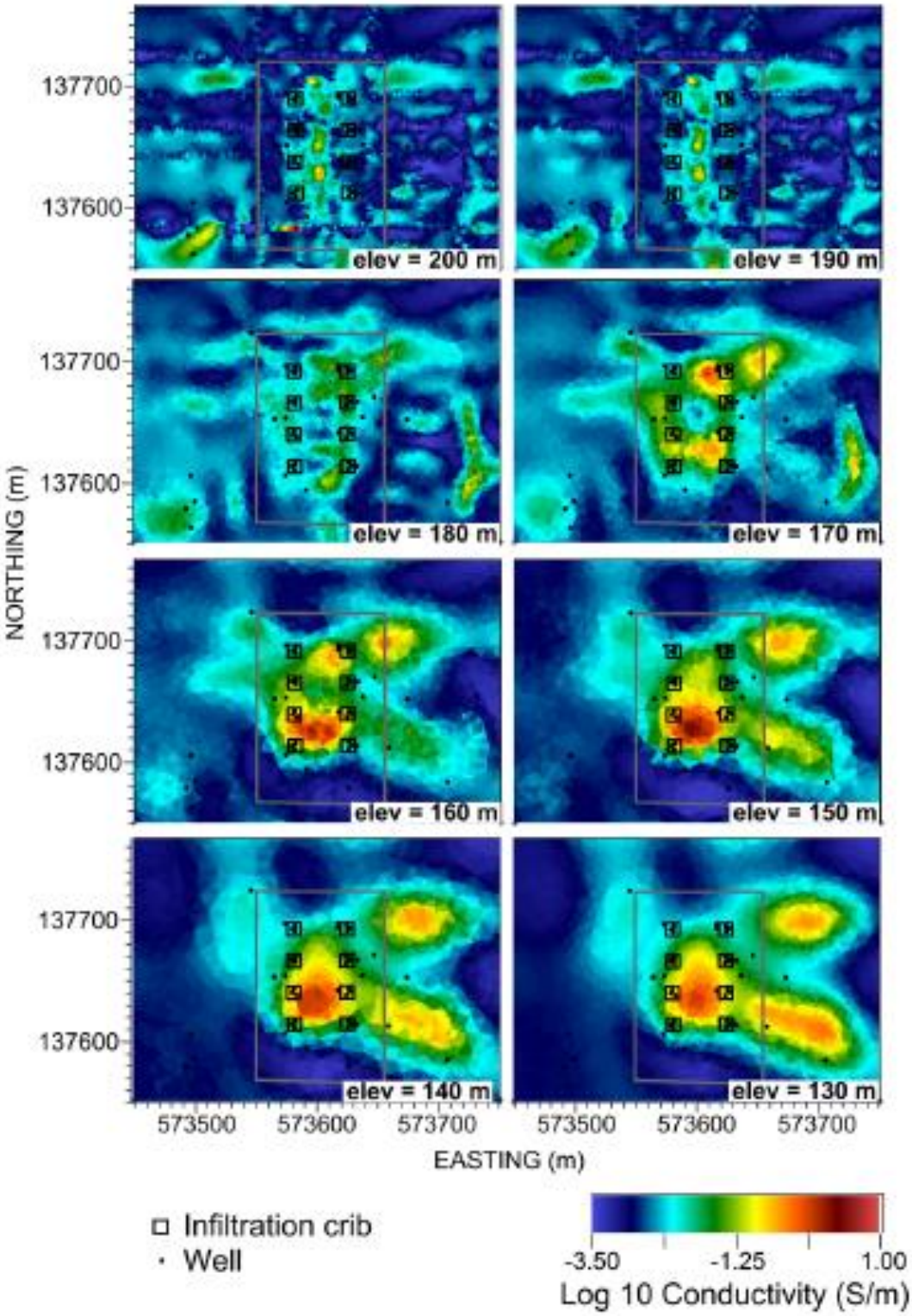
Figure 1-2. Construction Drawing of a BY crib

Table 1-1. BY Cribs Inventory of Mobile Contaminants

Contaminant	Inventory
Uranium (total)	1.06×10^{3} kg
Technetium-99	1.29×10^{2} Ci
Iodine-129	1.65×10^{-1} Ci
Cobalt-60	6.39 Ci
Tritium	3.37×10^{2} Ci
Nitrate	6.71×10^{6} kg
Fluoride	1.35×10^{5} kg
Ferrocyanide	1.89×10^{4} kg
Chromium	5.83×10^{3} kg

Four boreholes (C9550, C9549, C9552, and C8706) were drilled within or near the BY Cribs (Figure 1-1), as described in DOE/RL-2011-104. Continuous sediment core and geophysical logs were collected as part of this characterization effort. The four locations were selected to evaluate the vertical distribution and the lateral extent of the mobile contamination.

1. The location northwest of the BY Cribs (C9550) was selected because (a) borehole geophysical logging at nearby well 299-E33-40 indicates mobile contaminants from approximately 100 to 200 ft bgs, (b) the 216-B-50 Crib received the largest volume of liquid waste, compared to the other BY Cribs, and (c) there is some uncertainty regarding the disposal history to the 216-B-50 Crib. This location will be used to help define the northwestern extent of mobile contaminants associated with the BY Cribs.
2. The location northeast of the BY Cribs (C9549) was selected because (a) the soil resistivity survey indicates that the highest conductivity region (see Figure 1-3) is in the vicinity of the 216-B-46 Crib and (b) the highest technetium-99 concentrations in groundwater are in this vicinity. Electrically conductive contaminants increase the ionic strength of pore fluids in the soil relative to the native conditions (PNNL-22520). This location will be used to help define the northeastern extent of mobile contaminants associated with the BY Cribs.
3. The location at the center of the BY Cribs (C9552) was selected because (a) this area is anticipated to have the highest contaminant concentrations based on the likely comingling of discharged wastes and (b) this area is near both the 216-B-46 Crib and the 216-B-49 Crib, which received the largest contaminant inventories compared to the other BY Cribs.
4. The location at the northeastern corner of the 216-B-46 Crib (C8706) was selected because (a) compared to the other BY Cribs, the 216-B-46 Crib received the largest inventories of technetium-99 and chromium, (b) the soil resistivity survey indicates that the highest conductivity region (Figure 1-3) is in the vicinity of the 216-B-46 Crib, (c) the highest technetium-99 concentrations in groundwater are in the vicinity of the 216-B-46 Crib, and (d) no deep analytical data are available for this area.



Source: PNNL-22520, Re-inversion of Surface Electrical Resistivity Tomography Data from the Hanford Site B-Complex

Figure 1-3. ERT inversion results in the BY-Cribs

1.2 Geology of the 200 DV-1 OU

The 200-DV-1OU project is located in the Central Plateau of the Hanford Site, which is defined by the topographically elevated region formed during the Pleistocene Missoula paleo-floods (Bjornstad, 2002). These ancestral floods deposited thick sequences of unconsolidated silt, sand, and gravel known as the Hanford formation onto older Plio-Pleistocene sediments defined as the Cold Creek unit and Ringold Formation creating a giant mega flood bar. The unique glacial-fluvial depositional setting of these sediments created a series of erosional unconformities that can be very challenging to model or predict in the subsurface. All of the DV-1 waste sites are located within the Central Plateau on this ancestral flood bar.

The 55-82 meter (180-270 feet) thick vadose zone extends through the entire Hanford formation and the upper portion of the Cold Creek and Ringold Formation. The Hanford formation is the thickest vadose zone interval on the Central Plateau and comprises broadly mappable facies consisting of silt-, sand-, and gravel-dominated sediment layers. The Hanford sediments typically have the highest permeability and hydraulic conductivity compared to the older more consolidated Cold Creek unit and Ringold Formation. The vadose zone overlies an unconfined aquifer system that is primarily contained within older Cold Creek and Ringold Formation sediments composed of semi- to- unconsolidated silt, sand, and gravel. Basalt bedrock or Ringold Formation mud (clay) units form the base of the unconfined aquifer system at the Hanford Site (PNNL-13858). Many groundwater contaminant plumes originated from past liquid waste disposal to cribs, ponds, and ditches in the Central Plateau waste complex. Some plumes continue to receive residual contamination migrating through the overlying vadose zone.

2 Field Methods

Drilling and installation of ERT monitoring points were carried out in accordance with SGW-58552, *Description of Work for the Characterization 200-DV-1 Operable Unit*. Sampling, sample quality assurance, and quality control were carried out under the direction of the DOE-RL-2011-104. The four boreholes were drilled and completed with ERT installation between October 2015 and May 2016 by the drilling contractors Stillwater LLC, its subcontractor Layne Christensen Company, and Cascade Drilling L.P., under the direction of CH2M HILL Plateau Remediation Company. Well-site geology services were provided by Freestone Environmental Services. Geophysical logging services were provided by Stoller Newport News Nuclear.

2.1 Drilling

Four boreholes (C9550, C9549, C9552, and C8706) were drilled at the BY Cribs to characterize the mobile contaminants in the vadose zone at or near the waste site. A zone of high radiological contamination extending through a depth of approximately 15 to 50 ft bgs had been identified using geophysical logs from existing nearby wells. In order to protect the work site personnel, samples and drill cuttings from this zone of high radiological contamination were not allowed to be brought to the surface. Therefore, a drill rig was needed with the ability to advance the casing through the known contamination without bringing the contaminated drill cuttings to the surface.

Initially, a GeoProbe DT8040 (Figure 2-1) was used because it can both push through the radiological contamination and then collect continuous core through the remainder of the vadose zone. The GeoProbe hit refusal at three locations in the BY cribs. At two of the locations the GeoProbe hit refusal at approximately 30 ft bgs, and at the third location drilling (and coring) was successful to 90 ft bgs before hitting refusal. It was concluded that the GeoProbe was not powerful enough to drill through the geologically diverse subsurface of the Hanford formation.

Figure 2-1. 200-DV-1 OU Drill Rigs: GeoProbe, Becker Hammer, Sonic (left to right)

A phased drilling approach was then implemented since it became evident that two different drill rigs were needed to 1) push through the high radiological zone and 2) core through the vadose zone (Figure 2-2).

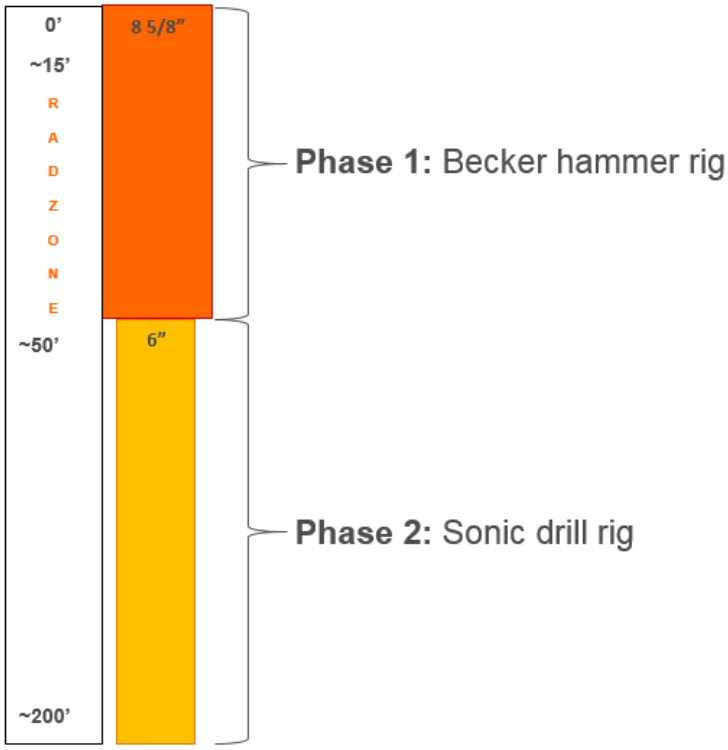


Figure 2-2. 200-DV-1 OU Drilling Schematics

The first phase of drilling used a Foremost AP 1000 Becker hammer drill rig (Figure 2-1) to push through the high radiological zone to approximately 50 ft bgs. The Becker hammer rig drove 8.625 in. diameter temporary casing with a removable 6.625 in. diameter inner drive rod using a 600 horsepower diesel hammer. Following installation of casing, the borehole was geophysically logged to determine if the Becker hammer had drilled through the radiological contamination. If the high radiological zone had successfully been drilled through, then drilling proceeded to the second phase. The second phase of drilling used a 600C full sized track mounted sonic drill rig (Figure 2-1) to core from the bottom of the high radiological zone to total depth. The sonic drill rig used vibrational, rotational, and downward force to drive 6 in temporary casing to depths around 200 ft bgs.

2.2 Sampling

Soil samples were collected in the shallow vadose zone above 15 ft bgs and from ~50 ft bgs to total depth. Samples collected using a GeoProbe were taken from 5-ft-long by 2-in diameter core (Figure 2-3). The soil samples from pre-selected intervals were processed (i.e. subsampled, bottled, and labeled) at the drill site. The GeoProbe collected samples during the three borehole attempts in the BY cribs.

During phase 1 of drilling the Becker hammer used a split spoon sampler (Figure 2-3) to collect shallow soil samples at pre-selected intervals. Split spoon soil samples were processed at the drill site. During phase 2 of drilling, the sonic rig collected intact continuous core samples using 5-ft-long by 4-in diameter plastic Lexan liners (Figure 2-3). The cores were surveyed for temperature, radiological contamination, labeled, and sent to the 6267 Building to be temporarily stored in a refrigerator while awaiting transport to RJ Lee's soil laboratory for lithological logging and sub-sampling. After the sonic rig reached total depth the borehole was geophysically logged. The planned sample intervals were compared to the results from the geophysical borehole logs and adjustments to those sample interval depths were made based on identification of man-made radiological contaminants, high moisture peaks, and lithologic transitions. Additionally, the core samples were assessed based on the core temperature readings to assure that cores with the lowest (or acceptable) temperature readings were selected for subsampling. Heat generated during sonic drilling can result in increased core temperatures; therefore the temperature of the core was measured using both an infrared gun and temperature tape. All soil samples were analyzed for contaminants of potential concern per DOE/RL-2011-104.

Figure 2-3. 200-DV-1 OU Soil Samples: GeoProbe core, Becker hammer split spoon, Sonic core (left to right)

2.3 Geologic Logging

Geologic logging was conducted concurrently with borehole drilling in accordance with SGRP-PRO-EN-50025, *Geologic Logging*. Geologic logging included daily reports, borehole logs, and well summary sheets. In most cases, due to sediment collection via the continuous core, detailed geologic descriptions were not possible in the field, but were completed in the RJ Lee laboratory when the cores were opened for core logging and subsampling. Appendix A contains the well site geologist's drilling summary reports for C9550, C9549, C9552, and C8706.

2.4 Geophysical Logging

Geophysical logging was conducted to characterize the nature and extent of gamma contamination, identify sediment layers suitable for sampling, define possible lateral geologic correlation, and evaluate the straightness of the borehole.

Multiple downhole logging systems were used during the 200-DV-1 OU investigation of the sediments surrounding the BY cribs. The Spectral Gamma Logging System (SGLS), High Rate Logging System (HRLS), Neutron Moisture Logging System (NMLS), Borehole Deviation System (BDS), and Passive Neutron Logging System (PNLS) were all used during this project. Each borehole consisted of two casing strings (Becker and Sonic), with each casing string logged separately with the exception of the BDS, which was deployed once when total depth was reached within the second casing string.

Once drilling of each casing string was completed, the borehole was swabbed and checked by the attending Radiological Control Technician to assess the downhole environment, and determine if there was any internal contamination in the borehole that could potentially contaminate the logging tools. As a matter of practice, it was decided to sleeve the logging tools in 4 mil (0.004 in thick) plastic during logging to prevent the Sonde from coming in contact with the casing (Figure 2-4).

Figure 2-4. Geophysical Logging: Sonde Above Borehole, Sonde Getting Sleeved, Sleeved Sonde Lowered in a Borehole (left to right)

Prior to using each logging system, verification checks were conducted to ensure proper tool operation. Logging was conducted to within ~1 ft of the bottom of the borehole. The bottom 1 ft was not logged to limit the potential for contaminated material to be brought up to the surface following a log run. The HRLS and PNLS log runs focused on intervals of high radioactivity, as determined during initial SGLS logging. A centralizer was used during logging of each first casing string to keep the logging tool near the center of the borehole axis. Due to the smaller diameter of the second casing string, no centralizer was used except when logging with the BDS. Verification checks were conducted following each logging day. Repeat log runs were conducted over 10% of the logged intervals as another quality check to confirm both proper tool operation and depth repeatability. Appendix B contains the Geophysical Log Data Reports.

2.5 Core Logging

The intact 5 ft continuous cores collected during sonic drilling were sent to the RJ Lee soil laboratory for lithologic logging and subsampling. Prior to cutting the core, the outside of the Lexan liner was surveyed with hand held instruments for alpha, beta, and gamma radiation. Each Lexan liner was then cut lengthwise on each side (Figure 2-5). Once opened, the soil was surveyed again. Pictures of each core were taken using a digital camera. The lithology of each core was logged in detail per the geologic logging procedure SGRP-PRO-EN-50025. Pre-selected soil intervals were subsampled, bottled, labelled, and shipped to Test America for analysis. Appendix C contains the detailed core descriptions, and digital photographs.

Figure 2-5. Example Core from 77 to 82 ft bgs in Borehole C8706 Showing Thin Silt Lens from approximately 79.4 to 76.5 ft.

2.6 ERT Installation and Borehole Completion

Electrical resistivity tomography (ERT) electrodes were installed within the four boreholes during borehole decommissioning. Electrical resistivity surveys using electrodes placed at the surface have been conducted at B-complex in the past and provided information regarding the spatial extent of contaminant plumes at the site (Figure 1-3). Borehole ERT surveys can potentially provide much higher imaging resolution and once installed can be used to collect repeat surveys for monitoring transport of contaminants through the vadose zone.

ERT electrodes are an electrically conductive material that is placed in contact with the soil and connected to instrumentation at the surface with an insulated wire. Current is injected and extracted through a pair of selected electrodes, generating an electrical potential in the ground that is measured by adjacent electrodes. This measurement process is repeated using different combinations (imaging typically requires thousands of measurements) of current and potential electrodes. 20 ERT electrodes were installed in each borehole and were constructed using 0.4 in diameter 316 stainless steel mesh for the contact material and integrated within a 0.375 in diameter polyurethane insulated cable. The individual electrode wires are connected at one end to the stainless steel mesh and terminate on a weatherproof connector at the surface (Figure 2-6).

After the boreholes were drilled each ERT electrode was emplaced by attaching it to the outside of a 1 in diameter PVC pipe prior to backfilling the borehole with Portland cement grout (Figure 2-6). Electrode installation was completed in two stages by separate drilling contractors (Becker and Sonic) on different days. Installation during the first, deeper decommissioning stage went smoothly but damage to the cables and temporary casing occurred during the second, shallower decommissioning stage and it is recommended that grouting occur in a single pour for future installations. An 18 in diameter flush mounted vault was installed at the surface to house the ERT cable connector and protect it from damage.

Figure 2-6. ERT installation: ERT Electrode Cable (left), Field installation of ERT cable (right)

2.7 Borehole Decommissioning

The GeoProbe hit refusal at boreholes C8711, C8707, and C9548 prior to reaching the planned total depths; the Becker hammer also hit refusal at boreholes C8709 and C9551. Those boreholes were decommissioned from total depth to ~2 ft below grade with bentonite chips. Concrete was poured from 0-2 ft, and a brass marker was placed for identification. Boreholes C9550, C9549, C9552, and C8706 were decommissioned after reaching total depth by adding the electrodes, removing the temporary casing, and filling the borehole with cement grout (Section 2.6).

2.8 Waste Management

The waste generated from 200-DV-1 OU drilling, sampling, geophysical logging, ERT installation, and well construction activities were managed according to DOE/RL-2012-20, *Waste Control Plan for the 200-DV-1 Operable Unit*.

3 Borehole Results

This section describes the borehole electrode completions, provides the borehole analytical results (sediment and geophysical log plot), and presents a graphic log showing the overall borehole lithology for each of the four BY Crib characterization boreholes.

At a minimum, all the required data analyses were completed; however, due to the changes in drilling and sampling methods and subsequent changes in analytical labs, additional contaminants were screened. The Quality Assurance (QA) activities (i.e. data review, verification, and validation) began once all the data collection and analysis were complete. The data from the BY Cribs have been reviewed and verified as part of the QA process. Data validation will take place once all 200-DV-1 OU soil samples have been analyzed. Detailed interpretations of these data and an updated 200 DV-1 OU Conceptual Site Model will be presented in future reports.

Each borehole, whether it was a success or an attempt, was assigned a borehole identification (ID). Table 3-1 provides the borehole ID, final depth, and drilling rig used for all boreholes at each of the four BY Cribs site locations.

Table 3-1. Final Depths of BY Crib Boreholes and Drill Rigs Used

Site Location	Borehole ID	Final Depth (ft bgs)	Drilling Rig Used
1) BY Cribs (NW)	C8711	27.6 (refusal)	GeoProbe
	C9550	200.5	Becker Hammer/Sonic
2) BY Cribs (NE)	C8707	29.7 (refusal)	GeoProbe
	C9548	89.1 (refusal)	GeoProbe
	C9549	200.5	Becker Hammer/Sonic
3) BY Cribs (B-45/46)	C8709	16.3 (refusal)	Becker Hammer
	C9551	12.9 (refusal)	Becker Hammer
	C9552	202.2	Becker Hammer/Sonic
4) BY Cribs (B-46)	C8706	202.3	Becker Hammer/Sonic

3.1 C9550 (C8711)

Borehole C9550 is located northwest of the BY Cribs. The Becker Hammer rig pushed 8.625 in diameter casing to 43.8 ft bgs and the Sonic rig drove 6 in diameter casing to 200.5 ft bgs (Figure 3-1). Borehole C8711 was a prior attempt by the Geoprobe; refusal occurred at 27.6 ft bgs. Depth discrete sediment samples were collected from both C9550 and C8711 (Table 3-2 and Table 3-3). C9550 was logged for geophysics (Figure 3-2) and lithology (Figure 3-3). 20 ERT electrodes were installed (Figure 3-1).

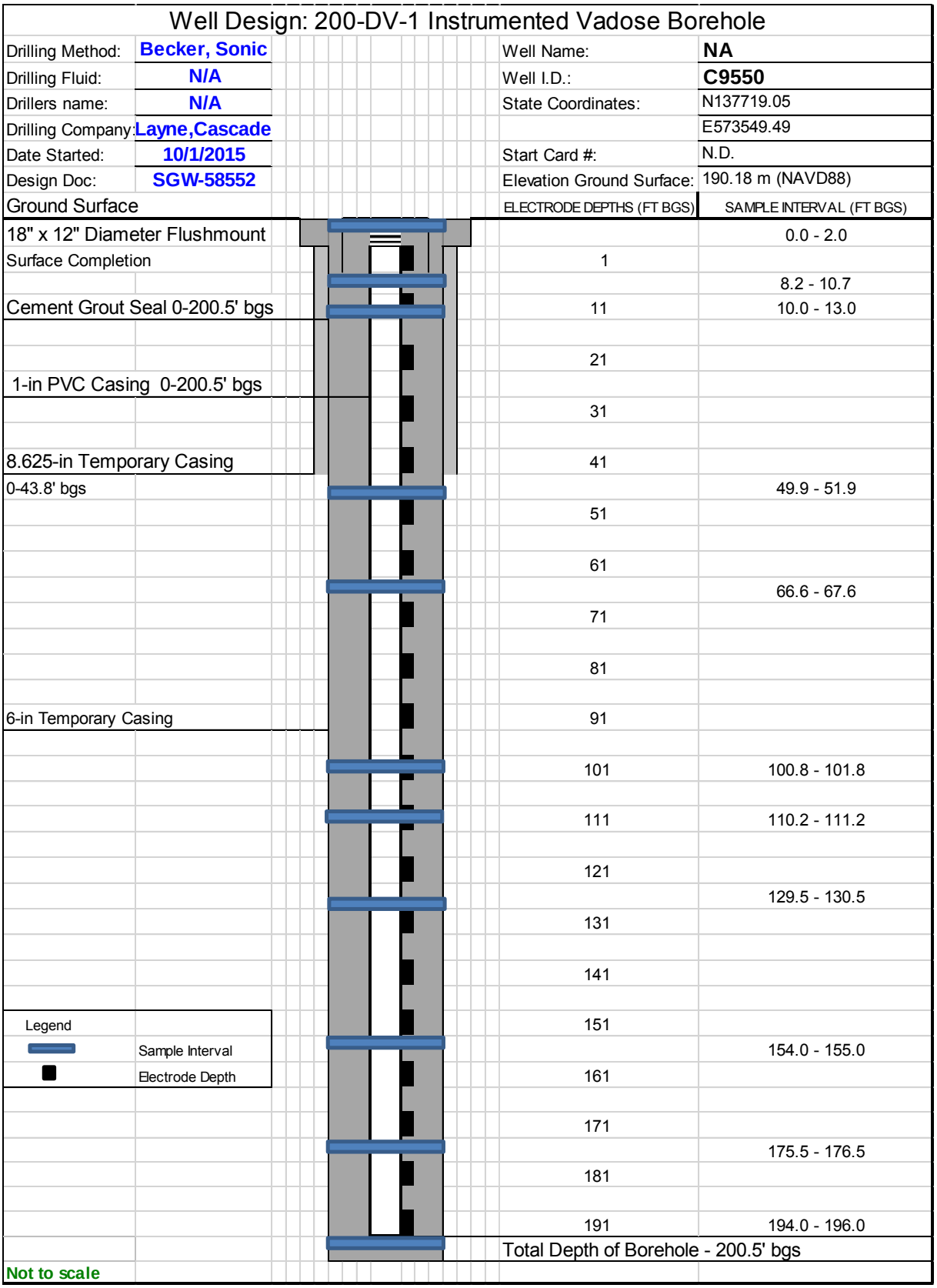


Figure 3-1. Borehole Design and Electrode Completion for C9550

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Table 3-2. Radiological Contaminant Concentrations in Samples Collected from C8711 and C9550

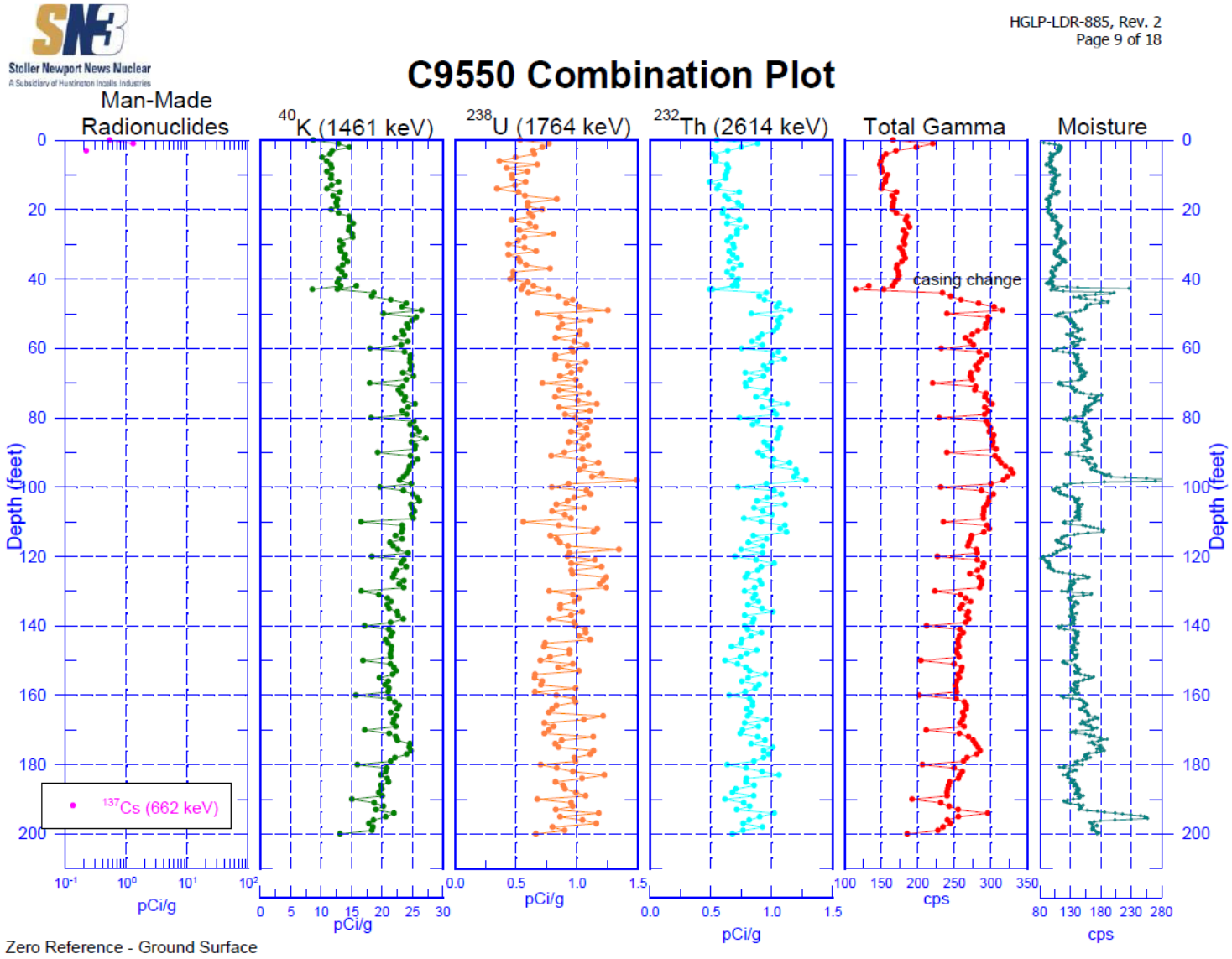
Location	Actual Sample Interval	Sample Number	Am-241	C-14	I-129	Np-237	Ni-63	Pu-238	Pu-239/240	Tc-99	H-3	U-233/234	U-235	U-238
Well ID	**(ft bgs)**	**HEIS #**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**
C8711	0 - 2	B320V6	1 U	5 U	–	1 U	30 U	1 U	1 U	–	30 U	1 U	1 U	0.74
C9550	8.2 - 10.7	B320W0	1 U	5 U	2 U	1 U	30 U	1 U	1 U	15 U	30 U	0.717	1 U	1 U
C8711	10 - 13	B320W3	1 U	5 U	–	1 U	30 U	1 U	1 U	15 U	30 U	0.832	1 U	0.533
		B320W8	1 U	5 U	–	1 U	30 U	1 U	1 U	15 U	30 U	0.698	1 U	0.491
C9550	49.9 - 51.9	B34T20	–	–	–	–	–	–	–	1.5 U	–	–	–	–
	66.6 - 67.6	B34T22	–	–	–	–	–	–	–	1.5 U	–	–	–	–
	100.8 - 101.8	B34T24	–	–	–	–	–	–	–	1.5 U	–	–	–	–
	110.2 - 111.2	B34T26	–	–	–	–	–	–	–	11.1	–	–	–	–
	129.5 - 130.5	B34T28	–	–	–	–	–	–	–	28.4	–	–	–	–
	154 - 155	B34T30	–	–	–	–	–	–	–	45.8	–	–	–	–
	175.5 - 176.5	B34T32	–	–	–	–	–	–	–	0.995	–	–	–	–
	194 - 196	B34T34	–	–	–	–	–	–	–	16	–	–	–	–

– = no data obtained
U = not detected above limiting criteria

Table 3-3. Non-Radiological Contaminant Concentrations Collected from C8711 and C9550

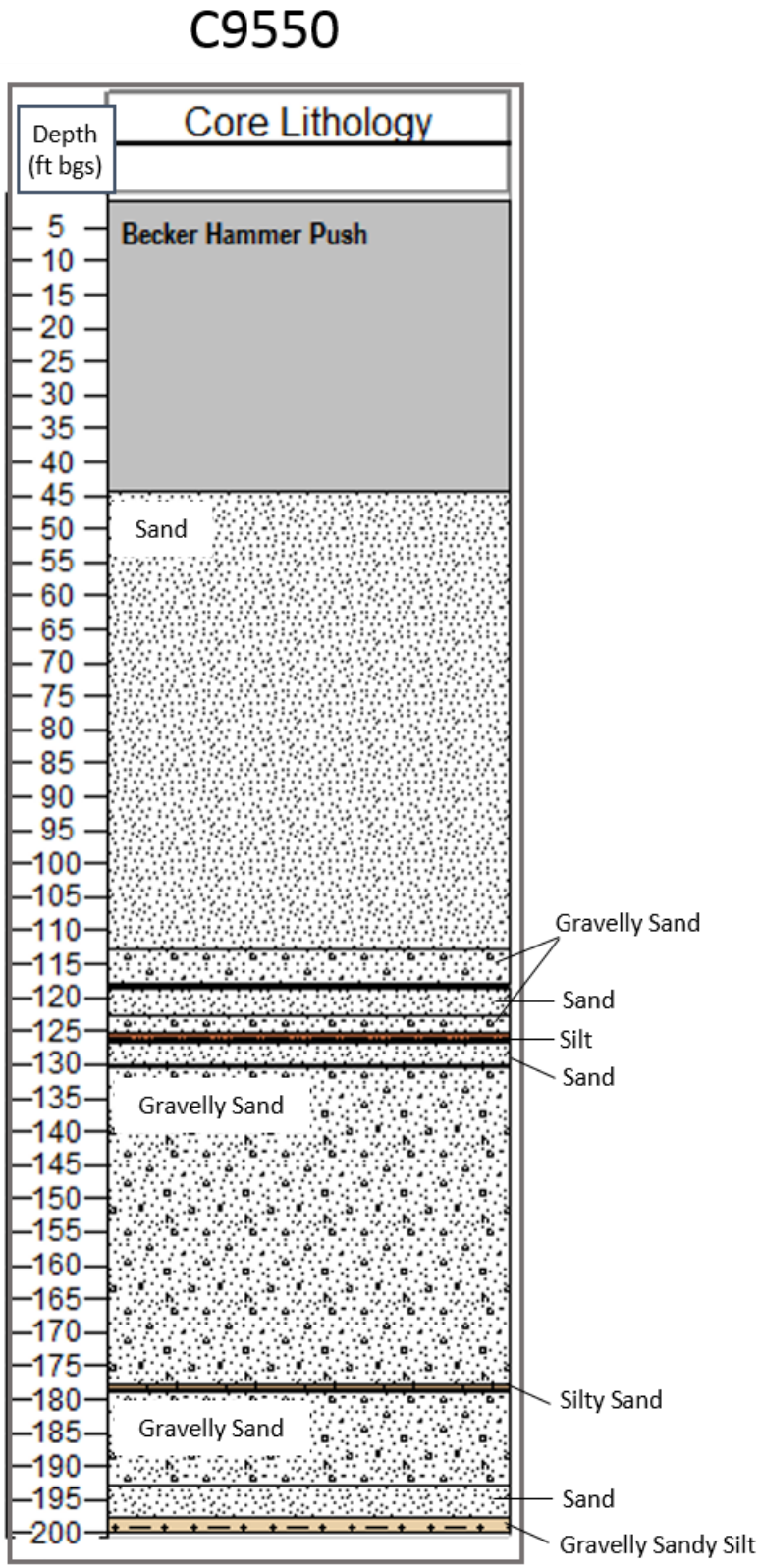
Location	Actual Sample Interval	Sample Number	Al	Sb	As	Ba	Cd	Cl^-	Cr	Cu	CN^-	Fl^-	Pb	Mn	Hg	Ni	NO_3^-	NO_2^-	PO_4^{3-}	Se	Ag	SO_4^{2-}	U
Well ID	**(ft bgs)**	**HEIS #**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
C8711	0 - 2	B320V7	–	–	–	–	–	1650	–	–	–	1000	–	–	–	–	13600	1130 U	3340	–	–	4750	–
		B320W0	6580000	1650	1380	87300	156	–	12200	14200	84.1 U	–	2640	294000	–	6990	–	–	–	345 U	268	–	482
C9550	8.2 - 10.7	B32195	–	–	–	–	–	3040	–	–	–	1760	–	–	–	–	11400	1120 U	3060	–	–	17900	–
		B320W3	7110000	1200	1720	83900	177	–	8300	15600	87.6 U	–	5730	333000	3.95 U	9550	–	–	–	326 U	88.8 U	–	636
		B320W4	–	–	–	–	–	1420	–	–	–	1420	–	–	–	–	7390	1130 U	2150 U	–	–	4450	–
C8711	10 - 13	B320W8	6390000	1280	1350	71300	115	–	5850	13300	76.5 U	–	3370	225000	4.08 U	6150	–	–	–	300 U	103 U	–	580
	49.9 - 51.9	B34T21	9040000	580	2900	51500	85	2400	16400	14900	110 U	200	5600	381000	–	16500	6200	217	580 U	880	120 U	7800	750
	66.6 - 67.6	B34T23	9530000	280 U	2900	61800	120	2900	12700	11600	110 U	310	3700	287000	–	11800	3850	263	580 U	1300	250	8200	880
	100.8 - 101.8	B34T25	10200000	320 U	5500	125000	92	1500	18000	15400	110 U	290	7800	611000	–	22500	4870	184 U	580 U	1500	200	14000	800
	110.2 - 111.2	B34T27	10300000	320	5700	83500	81	4200	19600	17500	110 U	360	4600	422000	–	23400	323000	292	580 U	1500	110 U	160000	640
	129.5 - 130.5	B34T29	9470000	320	4500	66800	80 U	7000	13600	16300	110 U	240	3900	348000	–	16600	620000	394	580 U	1600	120 U	130000	980
	154 - 155	B34T31	11400000	290 U	3700	94800	79 U	4500	14700	17300	130	210	3600	416000	–	15400	575000	187 U	580 U	1700	120 U	31000	580
	175.5 - 176.5	B34T33	8080000	300 U	5600	76800	170	1900	11600	10600	120 U	160	4200	358000	–	12300	7970	187 U	590 U	880	190	57000	500
C9550	194 - 196	B34T35	10300000	310	6000	72400	140	8200	16700	22700	260	470	6100	497000	–	19500	620000	302	610 U	1300	170	450000	680

– = no data obtained
U = not detected above limiting criteria



See Appendix B for the complete geophysical log report.

Figure 3-2. Geophysical Log of Borehole C9550 Using HGLS and NMLS



See Appendix C for the complete borehole core log report and photographs.

Figure 3-3. Borehole Core Log of C9550

3.2 C9549 (C8707, C9548)

Borehole C9549 is located northeast of the BY Cribs. The Becker Hammer rig pushed 8.625 in diameter casing to 45.4 ft bgs and the Sonic rig drove 6 in diameter casing to 200.5 ft bgs (Figure 3-4). Boreholes C8707 and C9548 were prior attempts by the Geoprobe; refusal occurred at 29.7 ft bgs and 89.1 ft bgs, respectively. Depth discrete sediment samples were collected from C9549, C8707, and C9548 (Table 3-4 and Table 3-5). C9549 was logged for geophysics (Figure 3-5) and lithology (Figure 3-6). 20 electrodes were installed in the borehole for ERT (Figure 3-4).

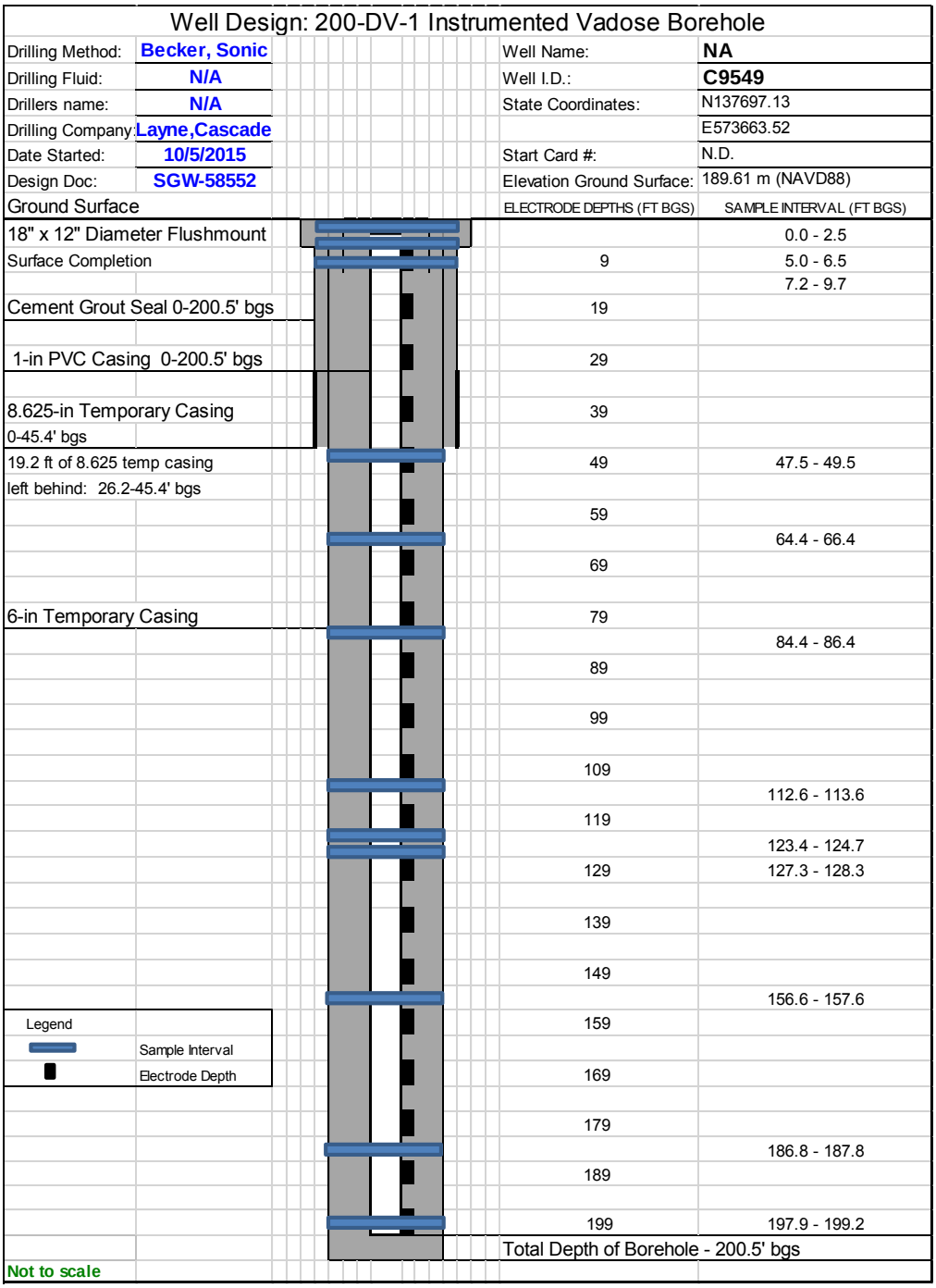


Figure 3-4. Borehole Design and Electrode Completion for C9549

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Table 3-4. Radiological Contaminant Concentrations in Samples Collected from C8707, C9548, C9549

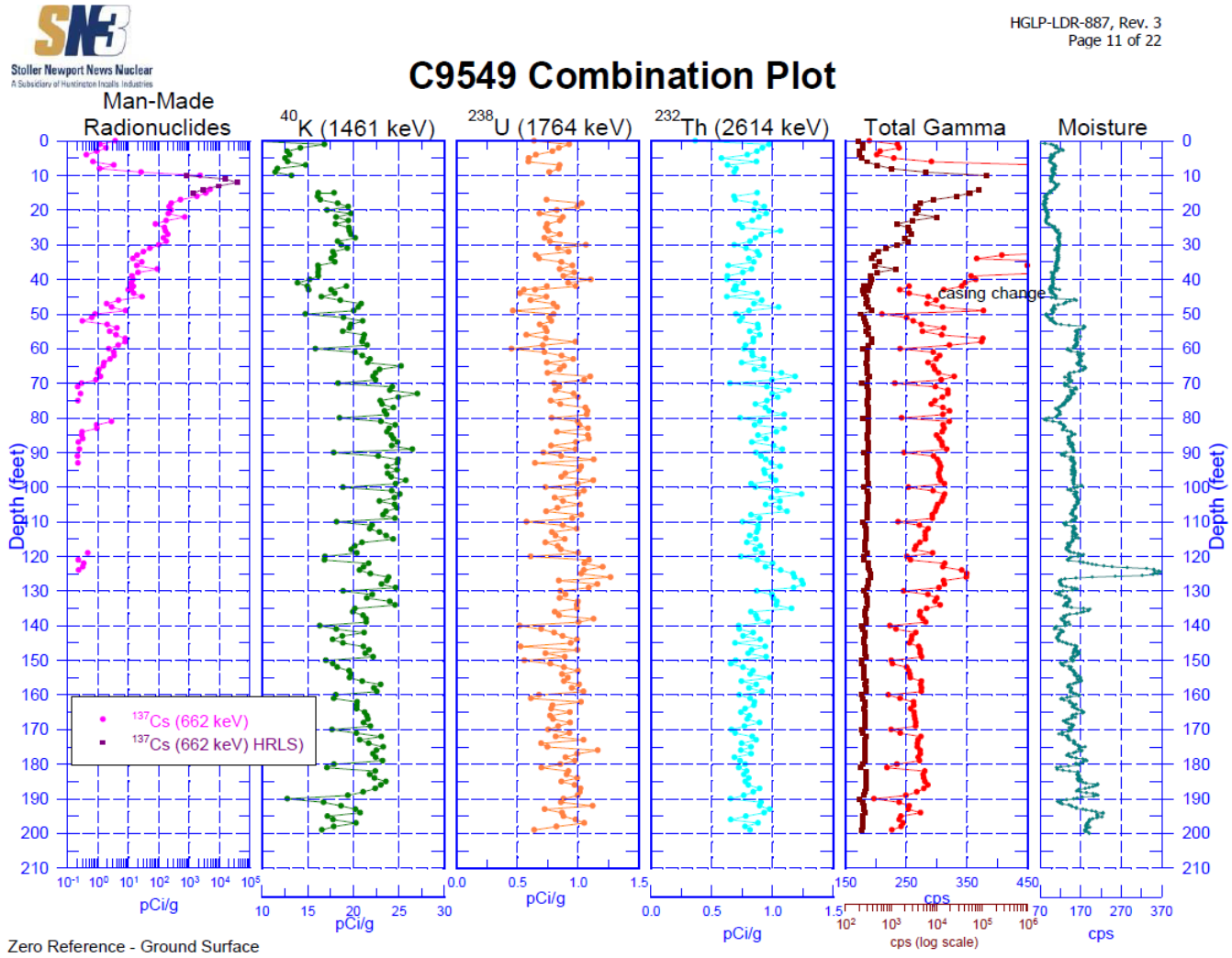
Location	Actual Sample Interval	Sample Number	Am-241	C-14	I-129	Np-237	Ni-63	Pu-238	Pu-239/240	Tc-99	H-3	U-233/234	U-235	U-238
Well ID	**(ft bgs)**	**HEIS #**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**	**pCi/g**
C8707	0 - 2.5	B320N6	1 U	5 U	–	1 U	30 U	1 U	1 U	–	30 U	1.4	1 U	1 U
	5 - 6.5	B320P2	1 U	5 U	–	1 U	30 U	1 U	1 U	15 U	30 U	1.1	1 U	2.14
C9549	7.2 - 9.7	B33122	1 U	5 U	–	1 U	30 U	1 U	1 U	15 U	30 U	1.22	1 U	1.03
C9548	47.5 - 49.5	B320P8	–	–	–	–	–	–	–	15 U	–	1 U	1 U	1.18
	64.4 - 66.4	B320R1	–	–	–	–	–	–	–	15 U	–	1.93	1 U	1.06
	84.4 - 86.4	B320R4	–	–	–	–	–	–	–	40.6	–	1.45	1 U	0.858
C9549	112.6 - 113.6	B352W7	–	–	–	–	–	–	–	134	–	0.195	1 U	0.237
	123.4 - 124.7	B352W9	–	–	–	–	–	–	–	441	–	0.141	0.0565	0.154
	127.2 - 128.3	B352X1	–	–	–	–	–	–	–	85	–	0.218	0.0512	0.349
	156.6 - 157.6	B352X3	–	–	–	–	–	–	–	119	–	0.251	1 U	0.191
	186.8 - 187.8	B352X5	–	–	–	–	–	–	–	55.3	–	0.0873	1 U	0.317
	197.9 - 199.2	B352X7	–	–	–	–	–	–	–	82.3	–	0.155	1 U	0.113

– = no data obtained
U = not detected above limiting criteria

Table 3-5. Non-Radiological Contaminant Concentrations in Samples Collected from C8707, C9548, C9549

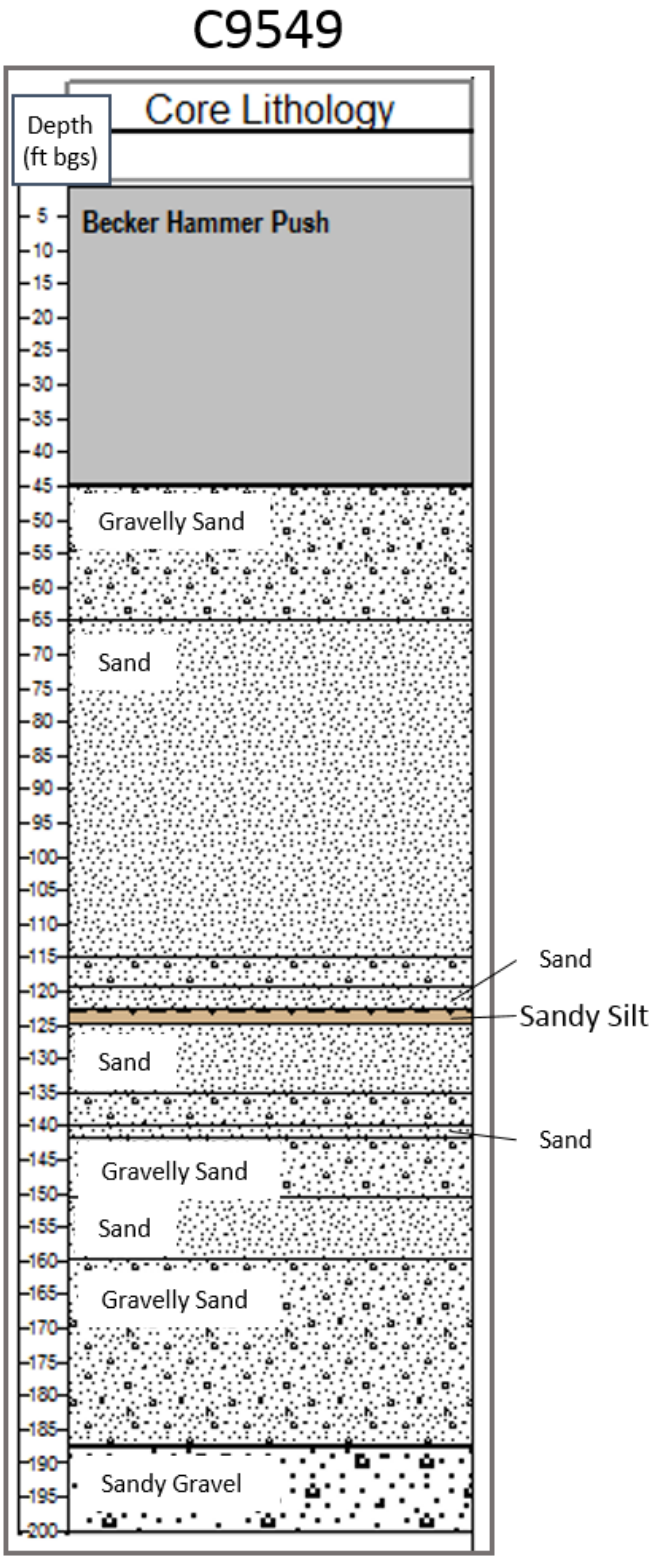
Location	Actual Sample Interval	Sample Number	Al	Sb	As	Ba	Cd	Cl^-	Cr	Cu	CN^-	Fl^-	Pb	Mn	Hg	Ni	NO_3^-	NO_2^-	PO_4^{3-}	Se	Ag	SO_4^{2-}	TPH	TPB	U
Well ID	(ft bgs)	HEIS #	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
C8707	0 - 2.5	B320N6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1170 U	105 U	596
		B320N7	–	–	–	–	–	3260	–	–	–	754	–	–	–	–	98700	1140 U	5460	–	–	15000	–	–	–
	5 - 6.5	B320P2	6540000	2970	3750	139000	227	–	9270	25000	62.6 U	–	3670	385000	4.04 U	11500	–	–	–	339	212	–	1150 U	103 U	635
		B320P3	–	–	–	–	–	5330	–	–	–	1790	–	–	–	–	11100	1120 U	2410	–	–	17700	–	–	–
C9549	7.2 - 9.7	B33122	–	–	–	–	–	–	–	–	126		–	–	–	–	–	–	–	–	–	–	1160 U	105 U	611
		B33123	–	–	–	–	–	5280	–	–		1510	–	–	–	–	45200	1130 U	2930	–	–	27400	–	–	–
C9548	47.5 - 49.5	B320P8	7230000	1890	2410	64800	45	–	12500	13400	186		3100	225000	46.2	9140	–	–	–	931	98.7 U	–	–	–	1630
		B320P9	–	–	–	–	–	1790	–	–	–	502	–	–	–	–	7300	1110 U	49400	–	–	21300	–	–	–
	64.4 - 66.4	B320R1	6480000	1540	2180	62800	39.3	–	9050	10600	204		2650	273000	105	9110	–	–	–	781	102 U	–	–	–	1680
		B320R2	–	–	–	–	–	1570	–	–	–	341 U	–	–	–	–	8150	1120 U	110000	–	–	20500	–	–	–
	84.4 - 86.4	B320R4	7440000	1880	3280	56400	46.6	–	14800	12000	1060		2980	292000	68	13000	–	–	–	515	99.3 U	–	–	–	464
		B320R5	–	–	–	–	–	8570	–	–	–	334 U	–	–	–	–	1550000	3280	2300	–	–	519000	–	–	–
C9549	112.6 - 113.6	B352W8	5250000	330 U	3100	50400	270	23000	10200	10700	1400	150	3400	265000	–	12000	2610000	1450	580 U	1100	230	230000	–	–	560
	123.4 - 124.7	B352X0	18700000	490	15400	339000	290	89000	51400	64100	6100	170 U	9100	976000	–	52200	14200000	3150	6400	2200	130 U	2000000	–	–	1100
	127.2 - 128.3	B352X2	8330000	280 U	5000	91600	86	7000	18900	18200	580	220	4100	415000	–	25500	1150000	361	650	1100	190	380000	–	–	500
	156.6 - 157.6	B352X4	8140000	310 U	3700	113000	77 U	4900	12700	16400	170	150 U	4000	375000	–	14500	1020000	723	580 U	1400	120 U	190000	–	–	790
	186.8 - 187.8	B352X6	10000000	310 U	4100	81500	220	4300	15400	16500	490	170 U	5600	403000	–	16600	531000	187 U	590 U	1600	120 U	130000	–	–	620
	197.9 - 199.2	B352X8	8640000	280 U	2700	127000	100	12000	9900	22700	740	350	4900	393000	–	13800	1020000	187 U	580 U	2100	100 U	620000	–	–	660

– = no data obtained
U = not detected above limiting criteria



See Appendix B for the complete geophysical log report

Figure 3-5. Geophysical Log for C9549 Using HGLS, HRLS, and NMLS



See Appendix C for the complete borehole core log report and photographs.

Figure 3-6. Borehole Core Log for C9549

3.3 C9552 (C8709, C9551)

Borehole C9552 is located in the center of the BY Cribs. The Becker Hammer rig pushed 8.625 in diameter casing to 45 ft bgs and the Sonic rig drove 6 in diameter casing to 202.2 ft bgs (Figure 3-7). Borehole C8709 and C9551 were previous attempts by the Becker Hammer; refusal occurred at 16.3 ft bgs and 12.9 ft bgs, respectively. Depth discrete sediment samples were collected from C9552 and C8709 (Table 3-6 and Table 3-7). C9552 was logged for geophysics (Figure 3-8) and lithology (Figure 3-9). 20 electrodes were installed in the borehole for ERT (Figure 3-7).

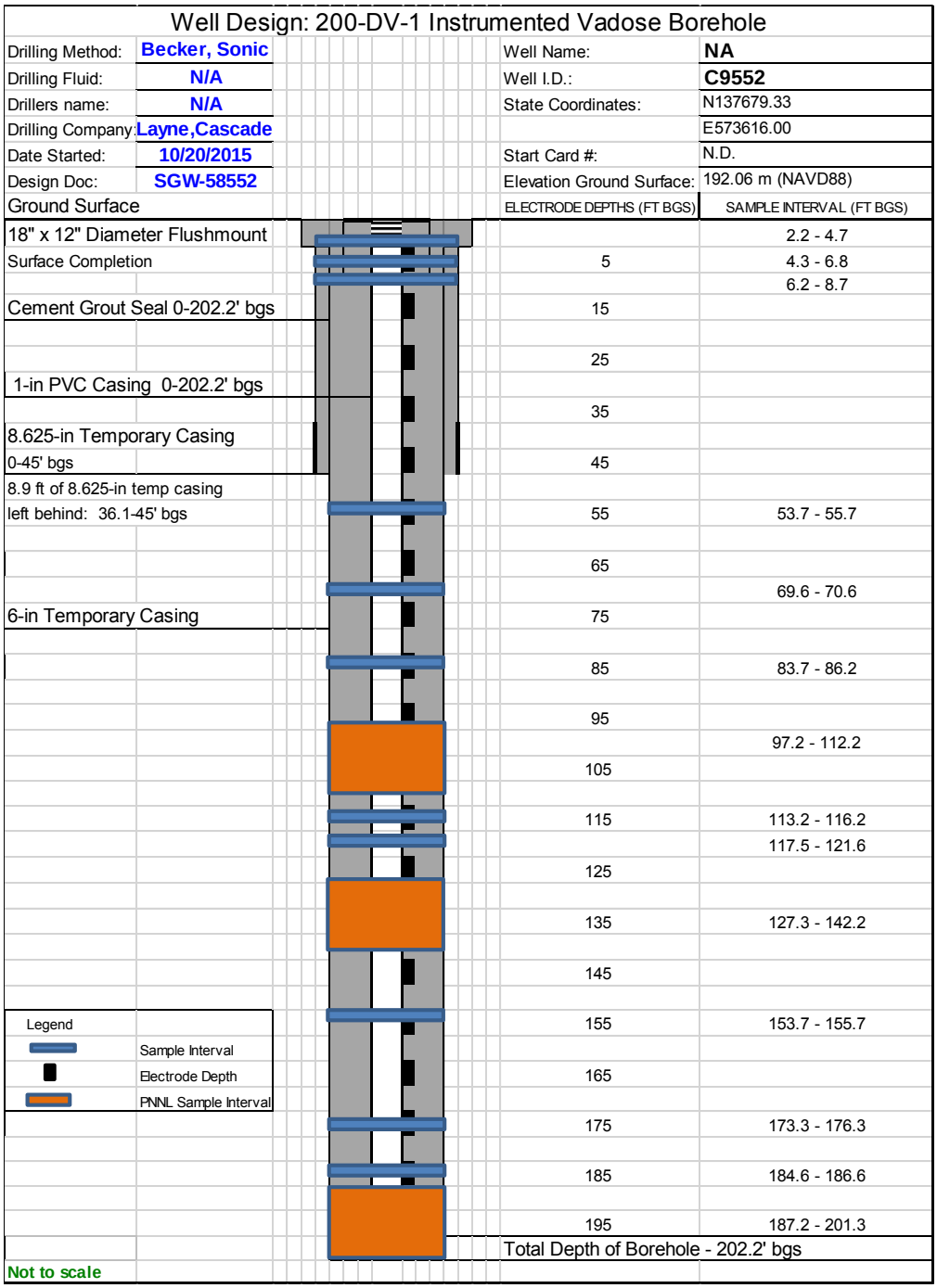


Figure 3-7. Borehole Design and Electrode Completion of C9552

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Table 3-6. Radiological Contaminant Concentrations in Samples Collected from C8709 and C9552

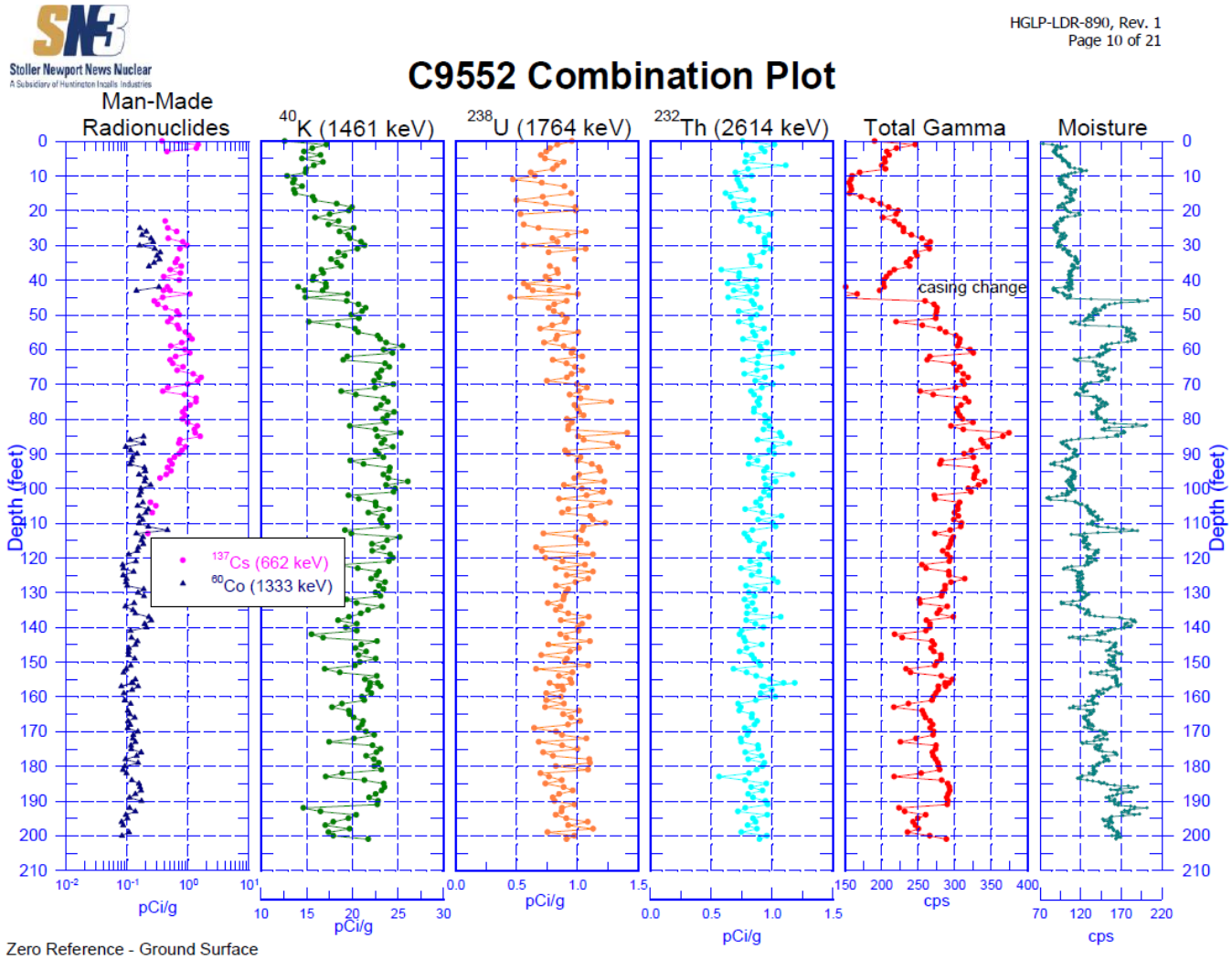
Location	Actual Sample Interval	Sample Number	Am-241	C-14	Cs-137	Co-60	Eu-152	Eu-154	Eu-155	I-129	Np-237	Ni-63	Pu-238	Pu-239/240	Ra-226	Tc-99	H-3	U-233/234	U-235	U-238
Well ID	(ft bgs)	HEIS #	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
C8709	2.2 - 4.7	B339Y4	1 U	5 U	–	–	–	–	–	–	1 U	30 U	1 U	1 U	–	–	30 U	0.406	1 U	0.437
	4.3 - 6.8	B339Y9	1 U	5 U	1.24	0.0891	0.255	0.255	0.218	1.75	1 U	30 U	1 U	1 U	1.49	15 U	30 U	0.637	1 U	0.814
	6.2 - 8.7	B33B04	1 U	5 U	0.513	0.0437	0.108	0.149	0.137	0.14	1 U	30 U	1 U	1 U	0.847	15 U	30 U	0.573	1 U	0.81
C9552	53.7 - 55.7	B354H6	1 U	9.45	0.333	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	6.22	1 U	1 U	–	1.15	30 U	0.397	1 U	0.421
	69.6 - 70.6	B35531	1 U	1.61	0.794	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	7.77	0.0953	1 U	–	3.02	3.68	0.213	1 U	0.142
	83.7 - 86.2	B35597	1 U	12.8	0.632	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	9.36	1 U	1 U	–	87.3	12.3	0.251	1 U	0.428
	113.2 - 116.2	B355V8	1 U	1.98	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	4.98	1 U	1 U	–	128	7.93	0.317	1 U	0.201
	117.5 - 121.6	B355W0	1 U	1.91	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	4.57	1 U	1 U	–	116	10.4	0.268	1 U	0.213
	153.7 - 155.7	B355W3	1 U	0.512	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	10 U	1 U	1 U	–	156	14	0.469	1 U	0.624
	173.3 - 176.3	B35JF0	1 U	0.466	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	10 U	1 U	0.0658	–	150	12.2	0.17	1 U	0.312
	184.6 - 186.6	B35JF3	1 U	0.4	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	10 U	1 U	1 U	–	177	10.5	0.166	1 U	0.222

– = no data obtained
U = not detected above limiting criteria

Table 3-7. Non-Radiological Contaminant Concentrations in Samples Collected from C8709 and C9552

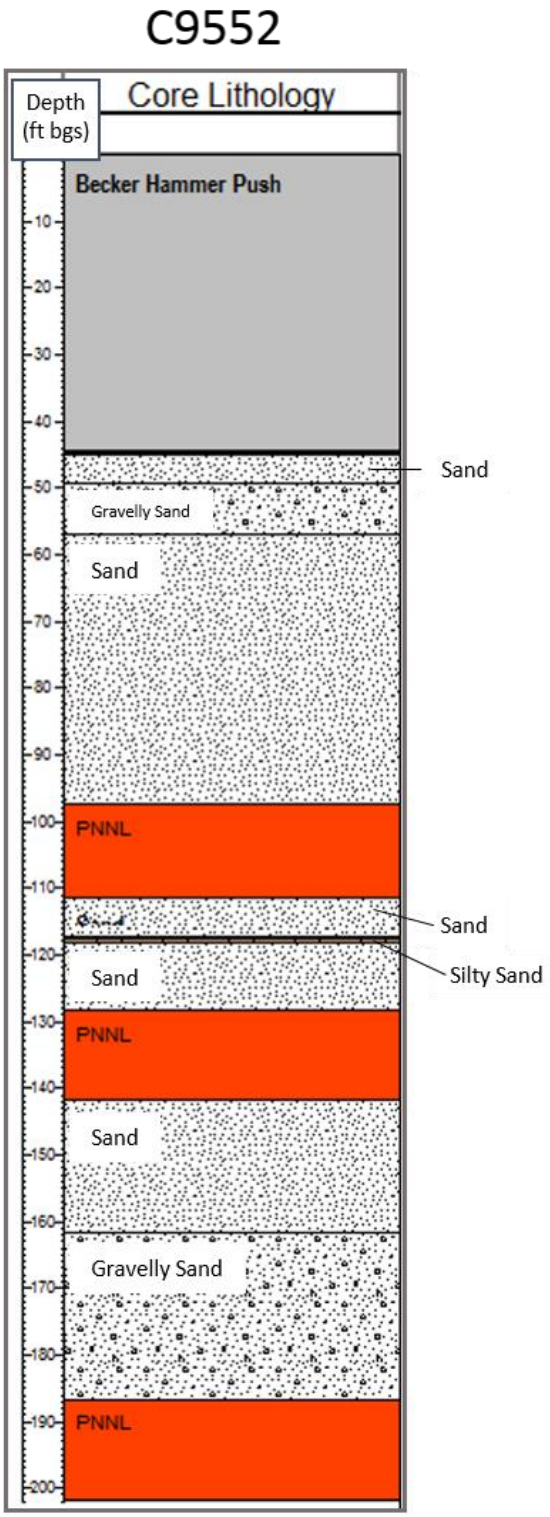
Location	Actual Sample Interval	Sample Number	Al	NH_3	Sb	As	Ba	Cd	Cl^-	Cr	Cu	CN^-	Fl^-	Cr(VI)	Pb	Mn	Hg	Ni	NO_3^-	NO_2^-	PO_4^{3-}	Se	Ag	SO_4^{2-}	TPH	TBP	U
Well ID	(ft bgs)	HEIS #	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
C8709	2.2 - 4.7	B339Y5	–	–	–	–	–	–	4340	–	–	–	474	–	–	–	–	–	180000	1120 U	2470	–	–	24600	–	–	–
	4.3 - 6.8	B339Y9	8100000	22600	1560	3120	89100	467	–	8830	12800	66.3 U	–	471	6610	333000	4.46	9450	–	–	–	769	485	–	–	–	490
		B33B00	–	–	–	–	–	–	6540	–	–	–	587	–	–	–	–	–	276000	1120 U	2710	–	–	41900	–	–	–
	6.2 - 8.7	B33B04	8430000	20600	1220	2410	84300	472	–	9000	11800	79.7 U	–	154	5450	325000	5.92	9410	–	–	–	333	449	–	–	–	412
		B33B05	–	–	–	–	–	–	9140	–	–	–	712	–	–	–	–	–	344000	1120 U	2610	–	–	58100	–	–	–
C9552	53.7 - 55.7	B35530	7200000		690	4200	83400	77 U	3300	10200	12000	–	150 U	–	3900	326000	41	13400	12400	184 U	4900	1200	110 U	18000	–	–	970
		B354H6	–	–	–	–	–	–	–	–	–	110 U	–	150 U	–	–	–	–	–	–	–	–	–	–	–	–	–
		B354H7	7160000	499	720	4900	93500	85		10000	153000	110 U			3800	412000	28	14100				1300	120 U		340 U	47 U	820
	69.6 - 70.6	B35531	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–	–	–	–	–	–
		B35532	8440000	1460	740	4200	237000	87	4400	13100	15000	110	150 U		4900	439000	32	15500	33200	184 U	4600	940	200	160000	340 U	47 U	1200
	83.7 - 86.2	B35597	–	–	–	–	–	–	–	–	–	–	150 U	150 U	–	–	–	–	–	–	–	–	–	–	–	–	–
		B35598	5520000	2190	740	3900	45700	80 U	–	11800	16500	610	–	–	3600	261000	110	14200	–	–	–	860	240	–	340 U	430	–
		B35599	8030000	–	840	5300	77300	88	33000	14000	15800	–	150 U	–	5200	401000	110	18900	3500000	493	2700	1100	110 U	840000	–	–	730
	113.2 - 116.2	B355V8	–	–	–	–	–	–	–	–	–	–	150 U	150 U	–	–	–	–	–	–	–	–	–	–	–	–	–
		B355V9	7820000	1950	750	4500	80900	80	11000	10300	14500	190	150 U		3400	375000	92	12800	1770000	184 U	570 U	950	110	230000	340 U	89	590
	117.5 - 121.6	B355W0	–	–	–	–	–	–	–	–	–	–	150 U	150 U	–	–	–	–	–	–	–	–	–	–	–	–	–
		B355W1	8450000	1700	730	4500	85300	78 U	–	14200	16100	300		–	4800	402000	41	15100	–	–	–	920	120 U	–	340 U	49	620
		B355W2	7770000	–	720	3600	76300	89	7900	14900	16500	–	150 U	–	3700	397000	47	17100	1510000	184 U	570 U	1000	110 U	280000	–	–	630
	153.7 - 155.7	B355W3	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–	–	–	–	–	–
		B355W4	7780000	961	880	5300	86100	94	2800	15200	20300	320	150 U	–	5500	500000	41	18500	11500	184 U	5500	950	110	17000	340 U	47 U	720
	173.3 - 176.3	B35JF0	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–	–	–	–	–	–
		B35JF1	8030000	1050	790	3000	75900	80	–	13600	15000	210		–	3800	354000	30	12400	–	–	–	900	110 U	–	340 U	47 U	770
		B35JF2	8560000		660	3400	102000	76	9900	11800	17900	–	150 U	–	3900	354000	33	15000	2040000	184 U	570 U	730 U	110 U	200000	–	–	730
	184.6 - 186.6	B35JF3	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–	–	–	–	–	–
		B35JF4	9890000	693	790	3800	90600	130	58000	11200	17000	300	150	–	5200	615000	60	12900	3140000	187 U	570 U	1300	110 U	77000	340 U	55	520

– = no data obtained
U = not detected above limiting criteria



See Appendix B for the complete geophysical log report

Figure 3-8. Geophysical Log for C9552 Using SGLS and NMLS



Note: Cores from depth intervals 97-112 ft, 127-142 ft, and 187-202 ft bgs were sent to PNNL; lithology will be documented by PNNL. See Appendix C for the complete borehole core log report and photographs

Figure 3-9. Borehole Core Log for C9552

3.4 C8706

Borehole C8706 is located in the northeastern corner of the BY Cribs. The Becker Hammer rig pushed 8.625 in diameter casing to 45.3 ft bgs and the Sonic rig drove 6 in diameter casing to 202.3 ft bgs (Figure 3-10). Depth discrete sediment samples were collected from C8706 (Table 3-8 and Table 3-9). C8706 was logged for geophysics (Figure 3-11) and lithology (Figure 3-12). 20 electrodes were installed in the borehole for ERT (Figure 3-10).

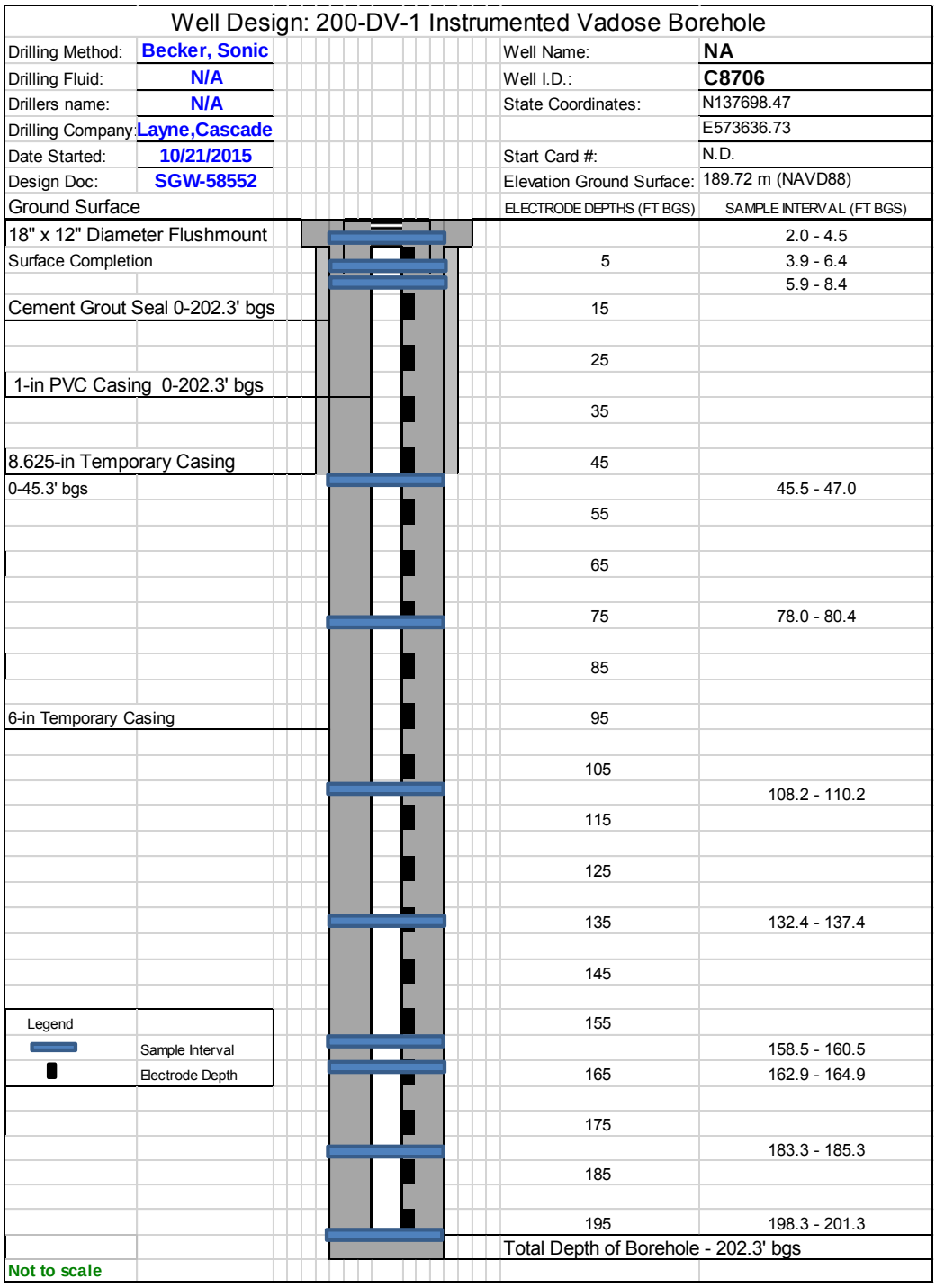


Figure 3-10. Borehole Design and Electrode Completion for C8706

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Table 3-8. Radiological Contaminant Concentrations in Samples Collected form C8706

Location	Actual Sample Interval	Sample Number	Am-241	C-14	Cs-137	Co-60	Eu-152	Eu-154	Eu-155	I-129	Np-237	Ni-63	Pu-238	Pu-239/240	Tc-99	H-3	U-233/234	U-235	U-238
Well ID	(ft bgs)	HEIS #	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
C8706	2 - 4.5	B33B16	1 U	–	–	–	–	–	–	–	1 U	30 U	1 U	1 U	–	30 U	1 U	1 U	0.604
	3.9 - 6.4	B33B20	1 U	5 U	0.43	0.1 U	0.116	0.147	0.101	2 U	1 U	30 U	1 U	1 U	15 U	30 U	0.646	1 U	1 U
		B33B24	1 U	5 U	0.163	0.1 U	0.111	0.113	0.112	2 U	1 U	30 U	1 U	1 U	15 U	30 U	0.783	1 U	0.518
	5.9 - 8.4	B33B29	1 U	5 U	0.115	0.1 U	0.108	0.128	0.121	2 U	1 U	30 U	1 U	1 U	15 U	30 U	0.598	1 U	0.91
	45.5 - 47.0	B35N87	0.13	50	545	0.1	0.1 U	0.1 U	0.1 U	2 U	1 U	10 U	1 U	1.08	5 U	30 U	1.42	1 U	1.01
	78 - 80.4	B35N91	1 U	36.6	0.222	0.151	0.1 U	0.1 U	0.1 U	2 U	1 U	16.2	1 U	1 U	289	76.3	4.71	0.222	5.15
	108.2 - 110.2	B35N93	1 U	2.61	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	10 U	1 U	0.285	83.3	24.1	0.366	1 U	0.303
	132.4 - 137.4	B35N95	1 U	3.53	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	10 U	1 U	1 U	2.29	22.2	0.172	1 U	0.318
	158.5 - 160.5	B35N97	1 U	0.317	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	10 U	1 U	1 U	1.61	33	0.178	1 U	0.235
	162.9 - 164.9	B35N89	1 U	14.7	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	9.17	1 U	1 U	251	23.5	0.68	1 U	0.679
	183.3 - 185.3	B35N99	1 U	0.389	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	10 U	1 U	1 U	4.1	27.9	0.12	1 U	0.219
	198.3 - 201.3	B35NB1	1 U	0.656	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	2 U	1 U	10 U	1 U	1 U	17.3	16.8	0.211	1 U	0.194

– = no data obtained
U = not detected above limiting criteria

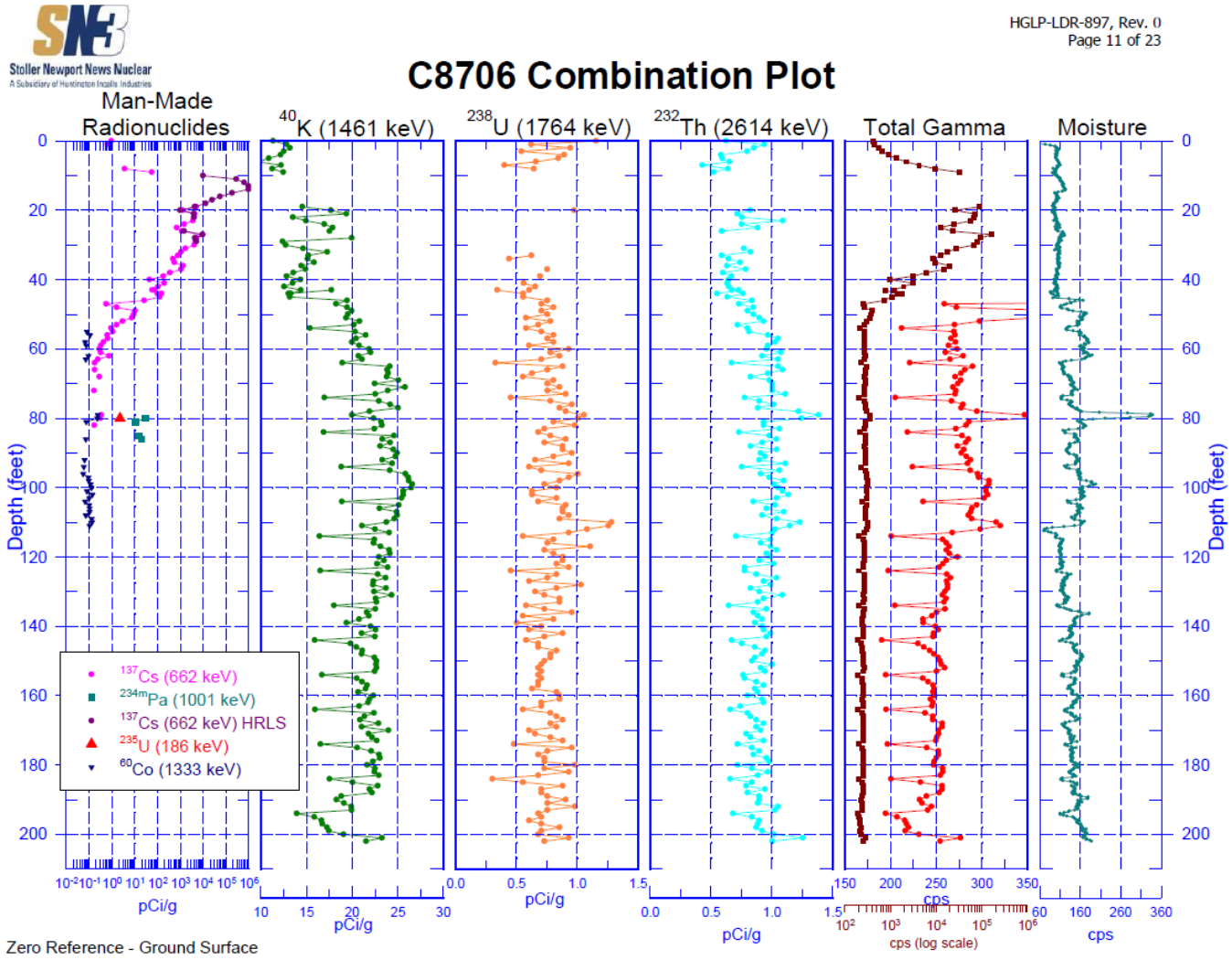
Table 3-9. Non-Radiological Contaminant Concentrations in Samples Collected form C8706 (Page 1 of 2)

Location	Actual Sample Interval	Sample Number	Al	NH_3	Sb	As	Ba	Cd	Cl^-	Cr	Cu	CN^-	Fl^-	Cr(VI)	Pb	Mn	Hg	Ni	NO_3^-	NO_2^-	PO_4^{3-}	Se
Well ID	(ft bgs)	HEIS #	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
C8706	2 - 4.5	B33B17	–	–	–	–	–	–	2060	–	–	–	1250	–	–	–	–	–	29400	1110 U	2110 U	–
	3.9 - 6.4	B33B20	8350000	7460	1160	2690	78600	68.1	–	9470	13100	83.8 U	–	205	4430	292000	4.06 U	7930	–	–	–	793
		B33B22	–	–	–	–	–	–	2670	–	–	–	1400	–	–	–	–	–	37700	1110 U	2100 U	–
		B33B24	6370000	6350	1350	2390	59900	55.9	–	6870	10300	455	–	124 U	3660	252000	3.86 U	7270	–	–	–	629
		B33B26	–	–	–	–	–	–	2410	–	–	–	1220	–	–	–	–	–	19800	1110 U	2110 U	–
	5.9 - 8.4	B33B29	8420000	3240	1140	2390	83900	60.6	–	12800	14100	78.4 U	–	124 U	3510	302000	3.82 U	8490	–	–	–	726
		B33B31	–	–	–	–	–	–	2570	–	–	–	1760	–	–	–	–	–	24300	1110 U	2090 U	–
	45.5 - 47.0	B35N87	–	–	–	–	–	–	–	–	–	–	–	220	–	–	–	–	–	–	–	–
		B35N88	6320000	3650	320	2100	103000	94	19000	16900	11500	440	310	–	3200	308000	110	11400	75300	493	91000	2200
	78 - 80.4	B35N91	–	–	–	–	–	–	–	–	–	–	–	310	–	–	–	–	–	–	–	–
		B35N92	12400000	4860	480	9800	110000	120	110000	22000	27100	5300	160 U	–	8600	527000	210	25100	9740000	46000	21000	1500
	108.2 - 110.2	B35N93	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–
		B35N94	10300000	657	350	6400	79000	93	14000	21700	22800	160	150 U	–	5900	459000	44	24500	2040000	19700	580	960
	132.4 - 137.4	B35N95	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–
		B35N96	6090000	608	280 U	2500	57300	73 U	3800	8600	11100	110 U	210	–	3300	266000	25	10300	18600	184	580	910
	158.5 - 160.5	B35N97	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–
		B35N98	6250000	462	300 U	2300	61400	79 U	22000	9300	10700	110 U	150	–	2900	245000	17	10600	10600	187	580	1400
	162.9 - 164.9	B35N89	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–
		B35N90	9860000	717	300 U	3800	71000	78	15000	19100	18200	2700	150 U	–	4800	415000	98	29800	3140000	591	9500	720
	183.3 - 185.3	B35N99	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–
		B35NB0	7000000	438	320 U	3200	83600	80	800	16200	12900	110 U	190	–	3700	488000	11 U	16500	53100	184	580	1500
	198.3 - 201.3	B35NB1	–	–	–	–	–	–	–	–	–	–	–	150 U	–	–	–	–	–	–	–	–
		B35NB2	8850000	1580	300 U	3400	127000	85	3800	12700	18500	180	330	–	4600	440000	11	13900	372000	187	580	1900

Table 3-9. Non-Radiological Contaminant Concentrations in Samples Collected form C8706. (Page 2 of 2)

Location	Actual Sample Interval	Sample Number	Ag	SO_4^{2-}	TPH	TBP	U
Well ID	**(ft bgs)**	**HEIS #**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**	**µg/kg**
C8706	2 - 4.5	B33B17	–	8150	–	–	–
	3.9 - 6.4	B33B20	103 U	–	–	–	533
		B33B22	–	11500	–	–	–
		B33B24	101 U	–	–	–	647
		B33B26	–	9470	–	–	–
	5.9 - 8.4	B33B29	96.8 U	–	–	–	572
		B33B31	–	14900	–	–	–
	45.5 - 47.0	B35N88	120 U	120000	350 U	48 U	2300
	78 - 80.4	B35N91	–	–	–	–	–
		B35N92	120 U	670000	370 U	52 U	17500
	108.2 - 110.2	B35N93	–	–	–	–	–
		B35N94	120 U	110000	340 U	47 U	720
	132.4 - 137.4	B35N95	–	–	–	–	–
		B35N96	110 U	5500	340 U	47 U	400
	158.5 - 160.5	B35N97	–	–	–	–	–
		B35N98	140	5300	340 U	47 U	460
	162.9 - 164.9	B35N89	–	–	–	–	–
		B35N90	110 U	250000	340 U	47 U	930
	183.3 - 185.3	B35N99	–	–	–	–	–
		B35NB0	120 U	27000	340 U	47 U	470
	198.3 - 201.3	B35NB1	–	–	–	–	–
		B35NB2	150	44000	340 U	47 U	650

– = no data obtained
U = not detected above limiting criteria



See Appendix B for the complete geophysical log report

Figure 3-11. Geophysical Log for C8706 Using SGLS, HRLS, and NMLS

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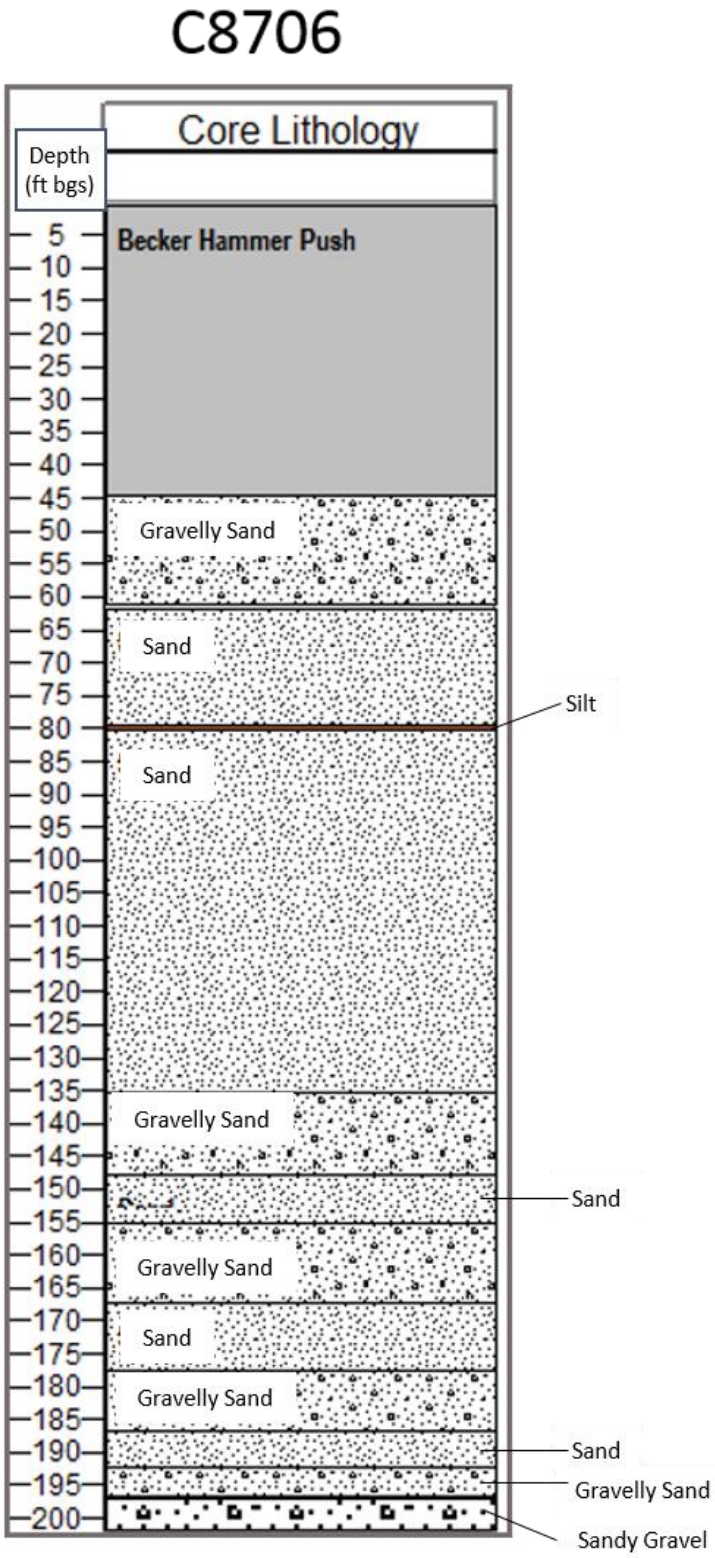


See Appendix C for the complete borehole core log report and photographs

Figure 3-12. Borehole Core Log for C8706

4 Discussion

Four characterization boreholes (C9550, C9549, C9552, and C8706) were drilled at the BY Cribs in the B Complex Area during FY16 as part of the 200-DV-1 OU remedial investigation. The purpose of this characterization project was to identify the nature and extent of the contamination in the vadose zone at or near BY Cribs waste sites. A phased drilling approach was used to drill these boreholes to prevent worker exposure to contaminated soil cuttings from a zone of high radiological contamination (approximately 15-50 ft bgs). A Becker hammer rig was used for the first phase of drilling to push casing from ground surface through the zone of high radiological contamination. During the second phase of drilling a sonic rig was used to drill from the bottom of the high radiological contamination zone to total depth. Soil samples were collected in the shallow vadose zone above 15 ft bgs using split spoon samplers, and from the vadoze zone below 50 ft bgs using continuous core. The soil samples were analyzed for contaminants of potential concern in accordance with DOE/RL-2011-104. The next step is to interpret these data to update the conceptual site model and support completion of the Remedial Investigation/Feasibility Study.

Some preliminary observations based on the data from the four characterization boreholes are outlined below. These observations focused on the mobile contaminants with the largest mass discharged to the BY Cribs (uranium, technetium-99, nitrate, cyanide, and chromium). A large inventory of fluoride was also documented, however the sediment analytical data only show low concentrations.

1. C9550 is located northwest of the BY Cribs near the 216-B-50 Crib which received the largest volume of liquid waste and lowest inventory of contaminants compared to the other BY Cribs.
    - Data: The sediment analytical data indicate that technetium-99, cyanide, and nitrate are present at or above detectable levels in the deep vadose zone. The borehole geophysical logs show no indication of manmade gamma-emitting radiological contamination in this borehole.
    - Geology/Stratigraphy: The Hanford 2 (H2) unit extends from ~45 to 197 ft bgs. The H2 is sand dominated from 45 to 113 ft and coarsens from 113 to 197 ft, with the gravel increasing to 30%. There is a 2 ft thick silt layer at 125 to 127 ft and a 1 ft thick silty sand layer at 178 ft within the larger H2 unit. The Cold Creek Unit was encountered from 193.2 ft to TD (200.5 ft). The Cold Creek silt in this well is very thin, and composed of fine felsic sand grading into gravelly sandy silt, with gravels and sands mostly quartzofeldspathic in composition at about 196 ft.
2. C9549 is located northeast of the BY Cribs. The soil in this area has high conductivity and the groundwater has elevated concentrations of technetium-99.
    - Data: The sediment analytical results show detectable technetium-99, cyanide, and nitrate contamination throughout the deep vadose zone. Concentration peaks of technetium-99 (441 pCi/g), nitrate (14,200,000 ug/kg), cyanide (6,100 ug/kg), and chromium (51,400 ug/kg) are present in a high moisture silt layer at ~124 ft bgs. Uranium was not detected above background concentrations. Borehole geophysical logs indicate cesium-137 contamination from ground surface to 125 ft bgs.
    - Geology/Stratigraphy: The gravel-dominated Hanford 1 (H1) unit extends from the base of fill (about 15 ft bgs) to the H1/H2 contact at 65 ft bgs. The H2 unit from 65 to 123 ft is a sandy facies dominated by massive, unstructured sands. A fine-grained unit at 123.4 ft bgs is composed of a 0.6 ft thick silt lens overlying a 1.7 ft thick sandy silt layer. Below the silt layer the gravel component of the H2 unit increases with more graded bedding in the sands. The H2/Cold Creek gravel (CCUg) contact is at 187 ft bgs with the Cold Creek silt not

present. The CCUg ranges from sandy gravel to silty-sandy-gravel with a higher felsic composition than the gravels overlying it. The CCUg persists until TD of the well at 201 ft bgs.

3. C9552 is located in the middle of the BY cribs near the 216-B-46 Crib and 216-B-49 Crib. These cribs received the largest contaminant inventories compared to the other BY Cribs.

   – Data: The sediment analytical results show an increase in technetium-99 activity (87 to 177 pCi/g) with depth. Nitrate is present above background in the deep vadose zone. Low levels of cyanide were also detected. Uranium was not detected above background concentrations. Borehole geophysical log analysis indicated mobile cobalt-60 contamination through most of the borehole, and less mobile cesium-137 extending from 20 to 115 ft bgs.

   – Geology/Stratigraphy: The gravel-dominated Hanford 1 (H1) unit extends from the base of fill (about 15 ft bgs) to the H1/H2 contact at 57 ft bgs. The H2 is sand dominated to 162 ft bgs, the sands are largely massive with occasional sandy-silty rhythmites. At 162 ft the gravel fraction increases, with gravelly sands prevailing down to 187 ft bgs. Samples from three sample intervals were sent to PNNL for analysis; lithologic descriptions of those intervals will be completed by PNNL. The H2/Cold Creek contact likely falls in the deepest interval from 187 to 202 ft bgs.

4. C8706 is located at the northeastern corner of the 216-B-46 Crib, which received the largest inventory of technetium-99 and chromium and other highly conductive contaminants (i.e. nitrate).

   – Data: Concentrations of technetium-99 (289 pCi/g), uranium (17,500 ug/kg), nitrate (9,700,000 ug/kg), and cyanide (5,300 ug/kg) were elevated in a high moisture silt layer at ~80 ft bgs. Another spike of technetium-99 (251 pCi/g), and smaller spikes of nitrate (3,000,000 ug/kg) and cyanide (2,700 ug/kg) were detected at ~163 ft bgs in a gravelly sand. Chromium concentrations were slightly above background at three sample depths, 80 ft, 109 ft, and 163 ft bgs. Borehole geophysical log analysis indicated the presence of mobile cobalt-60 contamination from 55 ft to 112 ft bgs, and less mobile cesium-137 contamination from 10 to 70 ft. bgs. Manmade uranium-235 and -238 was detected in the silt zone at 80 ft. bgs.

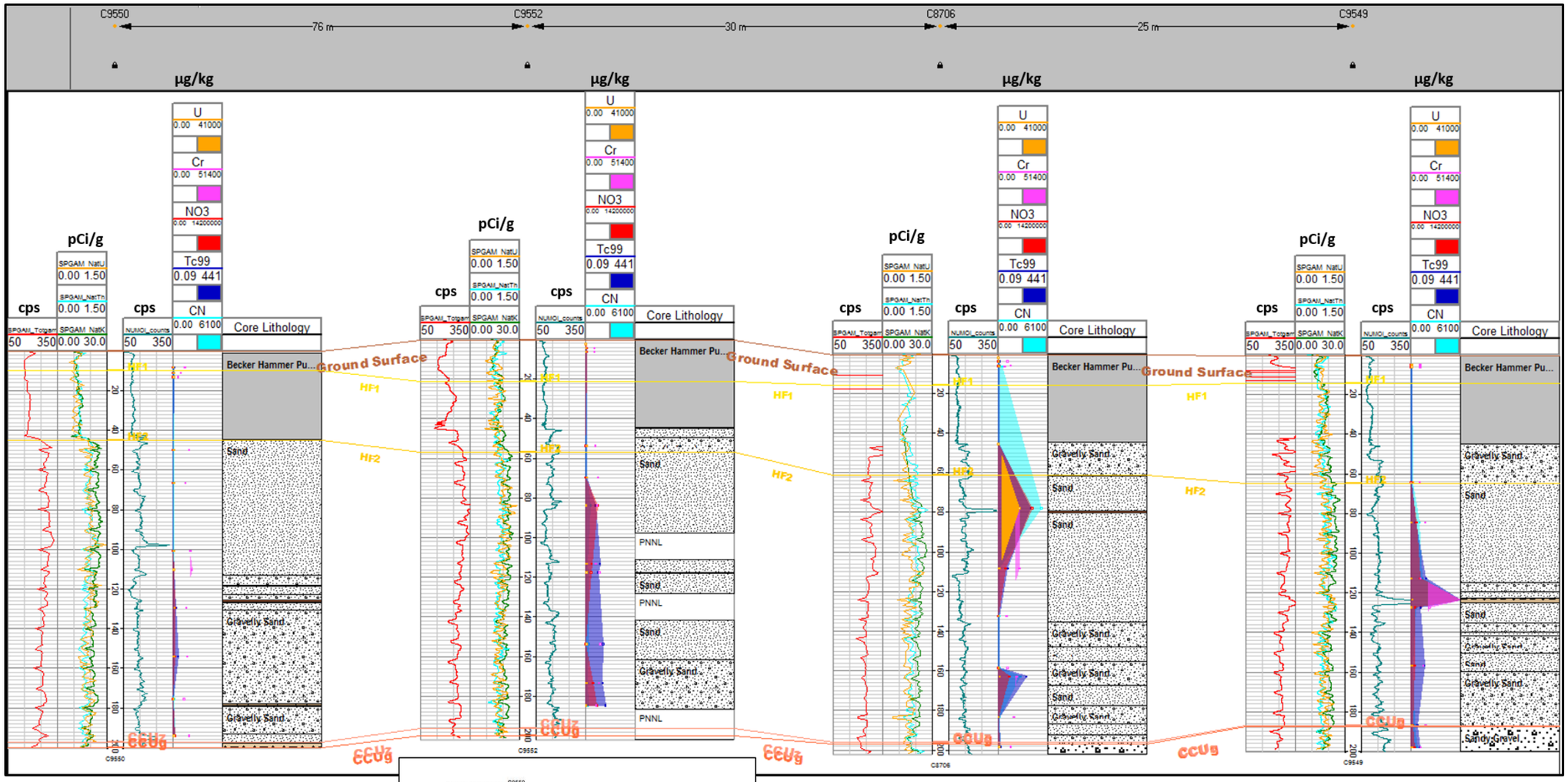
   – Geology/Stratigraphy: The gravel-dominated H1 unit extends from the base of fill (about 15 ft bgs) to the H1/H2 contact at 61 ft bgs. The H2 is dominated by a massive, unstructured sand down to 135 ft bgs, where the gravel fraction increases. From 135 ft to 197 ft bgs the H2 is coarse, gravelly sands and interbedded rhythmites. The H2/CCUg contact is at 194.5 ft bgs and the CCUg persists to TD at 202 ft bgs. The CCUg is a sandy gravel with a marked increase in well-rounded felsic pebbles and cobbles.

The preliminary observations indicate that contamination within the deep vadose zone is highly variable both vertically as well as laterally. Elevated contaminant concentrations are observed throughout boreholes northeast of the BY Cribs (C9549 and C8706). The borehole in the middle of the BY Cribs revealed a more uniform distribution of contamination throughout the lower portion of the borehole. The borehole northwest of the BY Cribs (C9550) had low contamination.

A cross section through the BY Cribs (Figure 4-1) illustrates the variations in contaminant distribution and concentration. Contaminant hot spots are correlated more often with low permeability silt zones, some only 6-12 inches in thickness. In most cases these low permeability zones correlate well with neutron moisture and natural gamma peaks in the geophysical logs and can be visually inspected in the core photographs. Consider the one-foot thick silt layer observed in well C9549 (Figure 4-2).

Sub sampling just above and below this silt layer shows high concentrations of the contaminants of concern above the silt and almost undetectable concentrations below the silt. These results indicate this thin silt layer is acting as a barrier to vertical contaminant migration and may create a surface causing liquid effluents to spread laterally much further than expected as seen in the elevated contaminant concentrations northeast of the BY Cribs. The continuous intact coring for DV-1 has revealed how important some of the small-scale structures are to the migration of mobile contaminants.

Pacific Northwest National Laboratory (PNNL) has instrumented the four BY Crib boreholes with depth discrete ERT sensors that will be used in conjunction with surface ERT to revise the resistivity model of BY Cribs. This model will help monitor the moisture and by reference the mobile contaminant extent in the BY Cribs. In addition, PNNL has taken supplemental samples at C9552 to study soil properties such as hydraulic transport and biological reactivity. These findings will help understand contaminant fate and transport in the BY Cribs and will be included in a separate report.



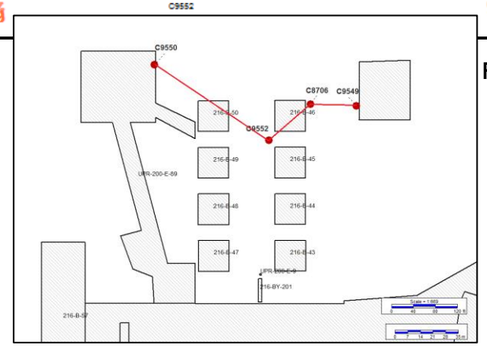


Figure 4-1. BY Cribs Cross Section

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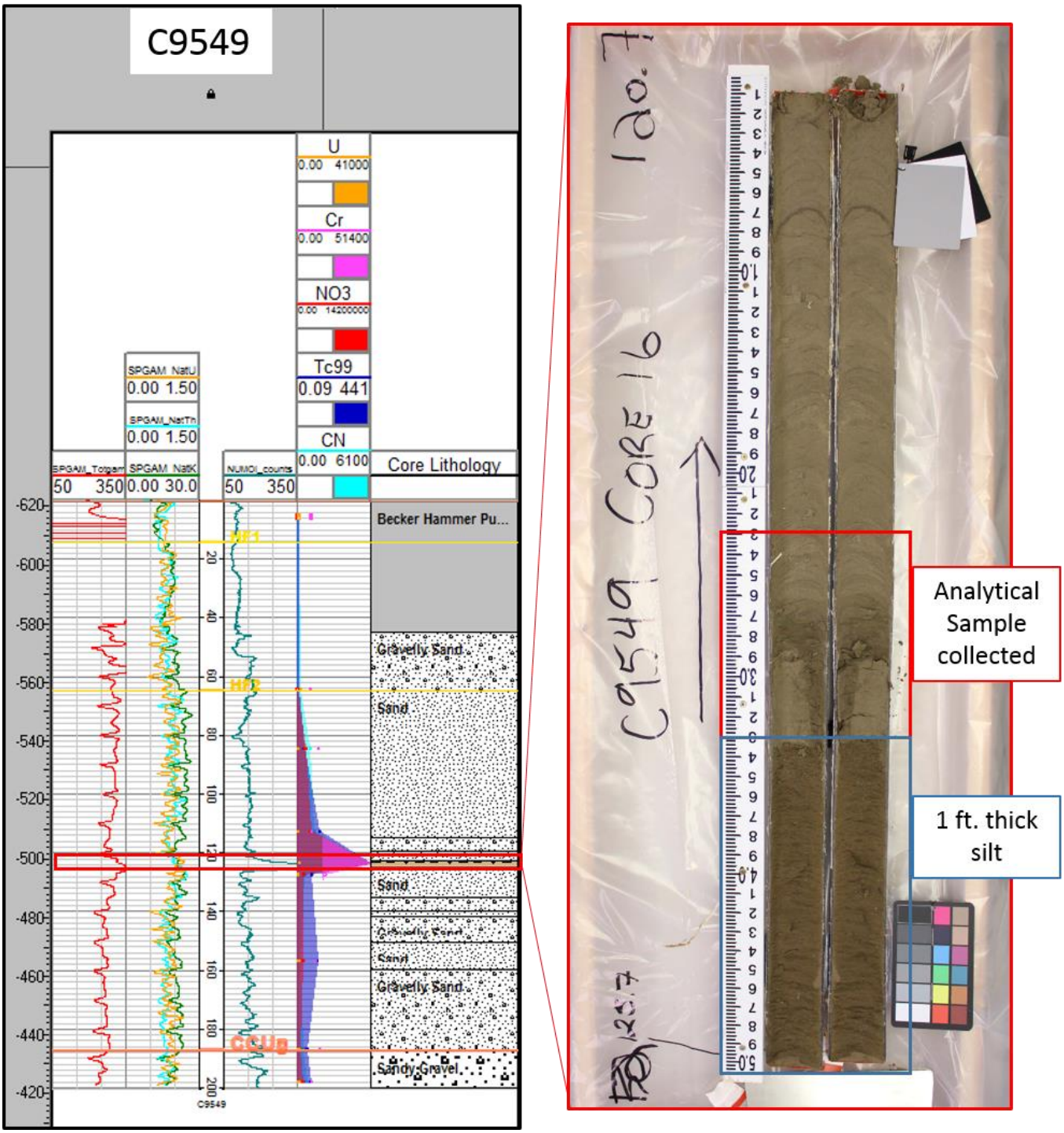

Figure 4-2. Borehole Profile of C9549 with Core Photo from 120.7 to 125.7 ft bgs in C9549.

5 References

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Appendix A

Borehole Drilling Summaries

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Appendix A contains the drilling summaries for the characterization boreholes (C9550, C9549, C9552, and C8706) drilled in the BY Cribs. These summaries were compiled by the onsite geologist.

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Borehole ID: C9550 (replacement borehole for C8711) Start Date: 10/01/2015

Date	Sample Time	Interval Footage	Core/Push	RAD	Recovery %	Soil Classification	Push Time (min)	Phase	Comment
10/1/2015	-	0 -8.2	Push	-	-	msG (C8711 borehole log)	10	Phase I Becker Hammer	
	1215	8.2 - 10.7	Split Spoon		100	msG	2		
	-	10.7 - 20.7	Push		-	-	20		
		20.7 - 23.7					17		
10/2/2015	-	23.7 - 30.0	Push	-	-	-	50		
		30.0 - 40.0					58		
		40.0 - 43.8					10		
12/17/2015	900	43.7 - 48.7	Core	-	100	S	2		
	-	47.9 -52.9		-			-		The core was not recovered (collected) on 12/17/2015 due to radiological contamination
1/11/2016	1235	47.9-52.9	Core	0	100	S	1		The core was collected and radiological contamination was not detected
	1335	53.0-58.0	Core	0	100	S	2		The temperature of the split core barrel was measured as~ 59° F using an IR gun. The temperature tape was unreadable
	1432	58.0-63.0	Core	0	100	S	1		**Temperature of Lexan liner (using IR thermometer)** 58.0 ft bgs = ~69.8° F 60.0 ft bgs = ~63.5° F 63.0 ft bgs = ~105.9° F **The temperature tape was unreadable**
1/12/2016	830	63.2 - 68.2	Core	0	100	S	3		**Temperature of Lexan liner (using IR thermometer)** 63.2 ft bgs = ~78.2° F 65.7 ft bgs = ~78.0° F 68.2 ft bgs = ~116.9° F **Heat Tape Readings** 63.2 & 65.7 = Not hot enough to register 68.2 ft bgs = 99° F
	910	68.0 - 73.0	Core	1,000 dpm beta/gamma on liner	100	S	2		**Temperature of Lexan liner (using IR thermometer)** 68.0 ft bgs = ~92.6° F 70.5 ft bgs = ~74.1° F 73.0 ft bgs = ~129° F
	1025	73.1 - 78.1	Core	0	100	S	3		**Temperature of Lexan liner (using IR thermometer)** 73.1 ft bgs = ~83.8° F 75.6 ft bgs = ~100° F 78.1 ft bgs = ~127° F **Heat Tape Readings** 73.1 ft bgs= Not hot enough to register 75.6 ft bgs = 84° F 78.1 ft bgs = 129° F
	1215	78.1 - 83.1	Core	0	100	S	4		**Temperature of Lexan liner (using IR thermometer)** 78.1 ft bgs = ~70.7° F 80.6 ft bgs = ~80.6° F 83.1 ft bgs = ~97.3° F **Heat Tape Readings** Not hot enough to register
	835	83.2 - 88.2	Core	0	100	S	2		**Temperature of Lexan liner (using IR thermometer)** 83.2 ft bgs = ~70.8° F 85.7 ft bgs = ~65° F 88.2 ft bgs = ~77° F **Heat Tape Readings** 85.7 ft bgs = 84° F Other depths did not register

	935	88.0 - 93.0	Core	0	100	S	2	**Temperature of Lexan liner (using IR thermometer)** 88.0 ft bgs = ~58.6° F 90.5 ft bgs = ~71.7° F 93.0 ft bgs = ~83.3° F **Heat Tape Readings** Not hot enough to register
	1010	93.3 - 98.3	Core	0	100	S	2	**Temperature of Lexan liner (using IR thermometer)** 93.3 ft bgs = ~61.7° F 95.8 ft bgs = ~72.8° F 98.3 ft bgs = ~103.6° F **Heat Tape Readings** Not hot enough to register
	1050	98.1 - 103.1	Core	0	100	S	1	**Temperature of Lexan liner (using IR thermometer)** 98.1 ft bgs = ~50.0° F 100.3 ft bgs = ~72.8° F 103.1 ft bgs = ~77.0° F **Heat Tape Readings** Not hot enough to register
1/13/2016	1225	103.2 - 108.2	Core	0	100	S	2	**Temperature of Lexan liner (using IR thermometer)** 103.2 ft bgs = ~73.5° F 105.7 ft bgs = ~88.4° F 108.2 ft bgs = ~105.8° F **Heat Tape Readings** Not hot enough to register
	1320	108.2 - 113.2	Core	0	100	S	2	**Temperature of Lexan liner (using IR thermometer)** 108.2 ft bgs = ~78.0° F 110.7 ft bgs = ~83.3° F 113.2 ft bgs = ~137.8° F **Heat Tape Readings** 108.2 & 110.7 = Not hot enough to register 137 ft bgs = 115° F
	1400	113.0 - 118.0	Core	0	100	S	2	**Temperature of Lexan liner (using IR thermometer)** 113.0 ft bgs = ~72.8° F 115.5 ft bgs = ~86.0° F 118.0 ft bgs = ~115° F **Heat Tape Readings** 113.0 & 115.5 = Not hot enough to register 118 ft bgs = 84° F
	1445	118.0 - 123.0	Core	0	100	S	1	**Temperature of Lexan liner (using IR thermometer)** 118.0 ft bgs = ~87° F 120.5 ft bgs = ~90° F 123.0 ft bgs = ~125° F **Heat Tape Readings** 118.0 = Not hot enough to register 120.5 ft bgs = 84° F 123.0 ft bgs = 111° F
	835	123.1 - 128.1	Core	0	100	sG	2	**Temperature of Lexan liner (using IR thermometer)** 123.1 ft bgs = ~54.8° F 125.6 ft bgs = ~66.5° F 128.1 ft bgs = ~80.2° F **Heat Tape Readings** Not hot enough to register

1/14/2016	1000	128.0 - 133.0	Core	0	100	gS	1	Phase II Sonic	**Temperature of Lexan liner (using IR thermometer)** 128.0 ft bgs = ~62.7° F 130.5 ft bgs = ~66.0° F 133.0 ft bgs = ~87.8° F **Heat Tape Readings** Not hot enough to register
	1040	133.2 - 138.2	Core	0	100	sG	2		**Temperature of Lexan liner (using IR thermometer)** 133.2 ft bgs = ~87.0° F 135.7 ft bgs = ~77.5° F 138.2 ft bgs = ~126.5° F **Heat Tape Readings** 133.2 ft bgs = 84° F 135.7 = Not hot enough to register 138.2 ft bgs = 115° F
	1212	138.0 - 143.0	Core	0	100	sG	2		**Temperature of Lexan liner (using IR thermometer)** 138.0 ft bgs = ~86.1° F 140.5 ft bgs = ~81.5° F 143.0 ft bgs = ~118.2° F **Heat Tape Readings** 138.0 ft bgs = 84° F 140.5 = 84° F 143.0 ft bgs = 111° F
	1307	143.0 - 148.0	Core	0	100	sG	2		**Temperature of Lexan liner (using IR thermometer)** 143.0 ft bgs = ~77.8° F 145.5 ft bgs = ~73.9° F 148.0 ft bgs = ~109.2° F **Heat Tape Readings** 143.0 & 145.5 = Not hot enough to register 148.0 ft bgs = 111° F
1/18/2016	920	148.0 - 153.0	Core	0	100	sG	1		**Temperature of Lexan liner (using IR thermometer)** 148.0 ft bgs = ~71.3° F 150.5 ft bgs = ~74.8° F 153.0 ft bgs = ~118.5° F **Heat Tape Readings** 143.0 = 84° F 150.5 = 84° F 153.0 ft bgs = 104° F
	1010	153.3 - 158.3	Core	0	100	sG	2		**Temperature of Lexan liner (using IR thermometer)** 153.3 ft bgs = ~71.0° F 155.8 ft bgs = ~64.0° F 158.3 ft bgs = ~99.8° F **Heat Tape Readings** 153.3 & 155.8= Did not register 158.3 ft bgs = 84° F
	1100	158.0 - 163.0	Core	0	100	msG	1		**Temperature of Lexan liner (using IR thermometer)** 158.0 ft bgs = ~72.9° F 160.5 ft bgs = ~63.8° F 163.0 ft bgs = ~96.6° F **Heat Tape Readings** 158.0 = 84° F 160.5 = Did not register 163.0 ft bgs = 84° F

1/18/2016	1250	163.1 - 168.1	Core	0	100	msG	1	**Temperature of Lexan liner (using IR thermometer)** 163.1 ft bgs = ~73.2° F 165.6 ft bgs = ~73.7° F 168.1 ft bgs = ~111.7° F **Heat Tape Readings** 163.1 & 165.6 = Did not register 168.1 ft bgs = 99° F
	1410	168.0 - 173.0	Core	0	100	sG	2	**Temperature of Lexan liner (using IR thermometer)** 168.0 ft bgs = ~75.9° F 170.5 ft bgs = ~72.6° F 173.0 ft bgs = ~98.8° F **Heat Tape Readings** 168.0 & 170.5 = Did not register 173.0 ft bgs = 84° F
	1515	173.2 - 178.2	Core	0	100	gS	1	**Temperature of Lexan liner (using IR thermometer)** 173.2 ft bgs = ~70.3° F 175.7 ft bgs = ~74.1° F 178.2 ft bgs = ~98.8° F **Heat Tape Readings** 173.2 & 175.7 = Did not register 178.2 ft bgs = 99° F
1/19/2016	830	178.0 - 183.0	Core	0	100	sG	2	**Temperature of Lexan liner (using IR thermometer)** 178.0 ft bgs = ~92.3° F 180.5 ft bgs = ~90.5° F 183.0 ft bgs = ~147.9° F **Heat Tape Readings** 178.0 = 102.3° F 180.5 = Did not register 183.0 ft bgs = 129° F
	940	183.1 - 188.1	Core	0	100	msG	2	**Temperature of Lexan liner (using IR thermometer)** 183.1 ft bgs = ~102.3° F 185.6 ft bgs = ~86.5° F 188.1 ft bgs = ~102.0° F **Heat Tape Readings** 183.1 = 84° F 185.6 = Did not register 188.1 ft bgs = 93° F
	1040	188.1 - 193.1	Core	0	100	msG	1	**Temperature of Lexan liner (using IR thermometer)** 188.1 ft bgs = ~95.0° F 190.6 ft bgs = ~76.2° F 193.1 ft bgs = ~107.6° F **Heat Tape Readings** 188.1 & 190.6 = Did not register 193.1 ft bgs = 93° F
	1240	193.2 - 198.2	Core	0	100	193.2 - 195.2: sM 195.2 - 198.2: sG	3	**Temperature of Lexan liner (using IR thermometer)** 193.2 ft bgs = ~75.7° F 195.7 ft bgs = ~105.9° F 198.2 ft bgs = ~118.0° F **Heat Tape Readings** 193.2 = Did not register 195.7 = 99° F 198.2 ft bgs = 111° F

	1310	198.0 - 200.0	Core	0	41.67	sG	2		**Temperature of Lexan liner (using IR thermometer)** ~ 200.0 ft bgs = ~74.6° F **Heat Tape Readings** Did not register

Borehole ID: C9549 (replacement borehole for C8707) Location: Approx. 31 m E of 216-B-46

Date	Sample Time	Interval Footage	Core/Push	RAD (dpm) Beta/Gamma	RAD (pCi/g)	Recovery %	Soil Classification	Push Time (minutes)	Phase	Comment
10/5/2015	-	0 - 7.2	Push	-	-	-	msG (C8707)	7	Phase I Becker Hammer	
10/6/2015	0735	7.2 - 9.7	Split Spoon			75%	msG	30 (sec)		
	-	9.7 - 10	Push			-	msG (C8707)	1		
		10 - 20						13		
		20 - 30					G (C5856 borehole log)	40		
		30 - 36.78		45,000 direct 8,000 removable				151		
10/7/2015		36.78 - 40		15,000 direct 1,000 removable			gS (C5856 borehole log)	11		
		40 - 45.38						26		
1/20/2016	1030	45.6 - 50.6	Core	8,000 - 14,000 direct		100%	sG	1.5		**Temperature of Lexan liner (using IR thermometer)** 45.6 ft bgs = 70.5° F 48.1 ft bgs = 70.1° F 50.6 ft bgs = 84.4° F **Heat Tape Readings** 45.6 = 84° F 48.1 & 50.6 ft bgs = Did not register **IR High on Spilt Barrel 84° F - 70 min to open**
	1330	50.7 - 55.7	Core	3,000 direct		100%	sG	1		**Temperature of Lexan liner (using IR thermometer)** 50.7 ft bgs = 62.7° F 53.2 ft bgs = 47.4° F 55.7 ft bgs = 77.9° F **Heat Tape Readings** 50.7 = Did not register 53.2 = 84° F 55.7 = 84° F **IR High on Spilt Barrel 107.4° F - 24 min to open**
	1440	55.6 - 60.6	Core	0		100%	sG	1		**Temperature of Lexan liner (using IR thermometer)** 55.6 ft bgs = 71.6° F 58.1 ft bgs = 70.7° F 60.6 ft bgs = 88.5° F **Heat Tape Readings** 55.6 & 58.1 ft bgs = Did not register 60.6 = 84° F **IR High on Spilt Barrel 61.3° F - 22 min to open**
1/21/2016	820	60.6 - 65.6	Core	0		100%	sG	0.5		**Temperature of Lexan liner (using IR thermometer)** 60.6 ft bgs = 64.5° F 63.1 ft bgs = 64.5° F 65.6 ft bgs = 80.9° F **Heat Tape Readings** 60.6 = 84° F 63.1 = 84° F 65.6 = 84° F **IR High on Spilt Barrel 61.5° F - 17 min to open**
	900	65.7 - 70.7	Core	0		100%	S	1		**Temperature of Lexan liner (using IR thermometer)** 65.7 ft bgs = 70.7° F 68.2 ft bgs = 68.3° F 70.7 ft bgs = 107.8° F **Heat Tape Readings** 65.7 = 84° F 68.2 = 84° F 70.7 = 93° F **IR High on Spilt Barrel 77° F - 16 min to open**
	940	70.6 - 75.6	Core	0		100%	S	2		**Temperature of Lexan liner (using IR thermometer)** 70.6 ft bgs = 66.7° F 73.1 ft bgs = 65.4° F 75.6 ft bgs = 89.2° F **Heat Tape Readings** 70.6 = 93° F 73.1 & 75.6 = Did not register **IR High on Spilt Barrel 78° F - 11 min to open**

	1035	75.6 - 80.6	Core	0	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 75.6 ft bgs = 62.0° F 78.1 ft bgs = 65.4° F 80.6 ft bgs = 73.9° F **Heat Tape Readings** 75.6 = 84° F 78.1 = Did not register 80.6 = 93° F **IR High on Spilt Barrel 65.3° F - 28 min to open**
	1200	80.7 - 85.7	Core	0	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 80.7 ft bgs = 64.4° F 83.2 ft bgs = 65.1° F 85.7 ft bgs = 81.6° F **Heat Tape Readings** All = Did not register **IR High on Spilt Barrel 55.5° F - 13 min to open**
	1305	85.6 - 90.6	Core	0	100%	(m)S	2	**Temperature of Lexan liner (using IR thermometer)** 85.6 ft bgs = 80.4° F 88.1 ft bgs = 82.7° F 90.6 ft bgs = 114.0° F **Heat Tape Readings** 85.6 & 88.1 = Did not register 90.6 = 108° F **IR High on Spilt Barrel 102.9° F - 18 min to open**
	1005	90.6 - 95.6	Core	0	100%	S	2	**Temperature of Lexan liner (using IR thermometer)** 90.6 ft bgs = 69° F 93.1 ft bgs = 91° F 95.6 ft bgs = 112° F **Heat Tape Readings** 90.6 = 111° F * 93.1 = 144° F * 95.6 = 129° F * *heat tapes were damaged may not reflect actual temp **IR High on Spilt Barrel 136.2° F - 18 min to open**
	1050	95.7 - 100.7	Core	0	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 95.7 ft bgs = 68° F 98.2 ft bgs = 48° F 100.7 ft bgs = 89° F **Heat Tape Readings** 95.7 & 98.2 = Did not register 100.7 = 84° F **IR High on Spilt Barrel 61.2° F - 23 min to open**
	1210	100.8 - 105.8	Core	0	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 100.8 ft bgs = 63° F 103.3 ft bgs = 67° F 105.8 ft bgs = 84° F **Heat Tape Readings** 100.8 & 103.3 = Did not register 105.8 = 84° F **IR High on Spilt Barrel 73.3° F - 15 min to open**
1/25/2016	1255	105.7 - 110.7	Core	0	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 105.7 ft bgs = 62° F 108.2 ft bgs = 65° F 110.7 ft bgs = 87° F **Heat Tape Readings** 105.7 & 108.2 = Did not register 110.7 = 84° F **IR High on Spilt Barrel 76.8° F - 19 min to open**

	1340	110.6 - 115.6	Core	0		100%	S	1		**Temperature of Lexan liner (using IR thermometer)** 110.6 ft bgs = 71° F 113.1 ft bgs = 68° F 115.6 ft bgs = 75° F **Heat Tape Readings** 110.6 & 113.1 = Did not register 115.6 = 84° F **IR High on Spilt Barrel 83.1° F - 17 min to open**
	1425	115.8 - 120.8	Core	0		100%	S	1		**Temperature of Lexan liner (using IR thermometer)** 115.8 ft bgs = 67° F 118.3 ft bgs = 75° F 120.8 ft bgs = 108° F **Heat Tape Readings** 115.8 & 118.3 = Did not register 120.8 = 93° F **IR High on Spilt Barrel 84.7° F - 18 min to open**
	1505	120.7 -125.7	Core	0	-	100%	S	0.5	Phase II Sonic	**Temperature of Lexan liner (using IR thermometer)** 120.7 ft bgs = 67° F 123.2 ft bgs = 57° F 125.7 ft bgs = 83° F **Heat Tape Readings** All = Did not register **IR High on Spilt Barrel 82.7° F - 17 min to open**
	1015	125.8 - 130.8	Core	0		100%	S	1		**Temperature of Lexan liner (using IR thermometer)** 125.8 ft bgs = 51° F 128.3 ft bgs = 69° F 130.8 ft bgs = 96° F **Heat Tape Readings** 125.8 & 128.3 = Did not register 130.8 = 84° F **IR High on Spilt Barrel 91.2° F - 17 min to open**
	1115	130.8 - 135.8	Core	0		100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 130.8 ft bgs = 57° F 133.3 ft bgs = 60° F 135.8 ft bgs = 71° F **Heat Tape Readings** All = Did not register **IR High on Spilt Barrel 58.6° F - 22 min to open**
1/26/2016	1245	135.7 - 140.7	Core	0		100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 135.7 ft bgs = 58° F 138.2 ft bgs = 59° F 140.7 ft bgs = 71° F **Heat Tape Readings** All = Did not register **IR High on Spilt Barrel 75.5° F - 14 min to open**
	1345	140.6 - 145.6	Core	0		100%	gS	0.5		**Temperature of Lexan liner (using IR thermometer)** 140.6 ft bgs = 61° F 143.1 ft bgs = 65° F 145.6 ft bgs = 72° F **Heat Tape Readings** All = Did not register **IR High on Spilt Barrel 73.5° F - 17 min to open**
	1425	145.8 - 150.8	Core	0		100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 145.8 ft bgs = 58° F 148.3 ft bgs = 58° F 150.8 ft bgs = 64° F **Heat Tape Readings** All = Did not register **IR High on Spilt Barrel 75.5° F - 18 min to open**

1/27/2016	800	150.7 - 153.2	Core	0	100%	sG	1	**Temperature of Lexan liner (using IR thermometer)** 150.7 ft bgs = 61° F 153.2 ft bgs = 107° F **Heat Tape Readings** 150.7 = Did not register 153.2 = 84° F **IR High on Spilt Barrel 98.2° F - 25 min to open**
	830	153.2 - 155.7	Core	0	20%	sG	0.5	**Temperature of Lexan liner (using IR thermometer)** Mid Sample = 55° F **Heat Tape Readings** Did not register **IR High on Spilt Barrel 83.2° F - 18 min to open**
	925	155.6 - 160.6	Core	0	100%	gS	1	**Temperature of Lexan liner (using IR thermometer)** 155.6 ft bgs = 69° F 158.1 ft bgs = 69° F 160.6 ft bgs = 77° F **Heat Tape Readings** All = Did not register **IR High on Spilt Barrel 87.2° F - 15 min to open**
	1020	160.6 - 165.6	Core	0	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 160.6 ft bgs = 67° F 163.1 ft bgs = 69° F 165.6 ft bgs = 61° F **Heat Tape Readings** 160.6 & 163.1 = Did not register 165.6 ft bgs = 84° F **IR High on Spilt Barrel 62.4° F - 16 min to open**
	1200	165.8 - 170.8	Core	0	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 165.8 ft bgs = 61° F 168.3 ft bgs = 61° F 170.8 ft bgs = 71° F **Heat Tape Readings** 165.8 & 168.3 = Did not register 165.6 ft bgs = 93° F **IR High on Spilt Barrel 56.4° F - 18 min to open**
	1250	170.7 - 175.7	Core	0	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 170.7 ft bgs = 61° F 173.2 ft bgs = 61° F 175.7 ft bgs = 71° F **Heat Tape Readings** All = Did not register **IR High on Spilt Barrel 53.0° F - 15 min to open**
	1345	175.8 - 180.8	Core	0	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 175.8 ft bgs = 62° F 178.3 ft bgs = 65° F 180.8 ft bgs = 69° F **Heat Tape Readings** 175.8 & 178.3 = Did not register 180.8 ft bgs = 84° F **IR High on Spilt Barrel 68.7° F - 18 min to open**
	1445	180.6 - 185.6	Core	0	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 180.6 ft bgs = 55° F 183.1 ft bgs = 53° F 185.6 ft bgs = 62° F **Heat Tape Readings** 180.6 & 183.1 = Did not register 185.6 ft bgs = 84° F **IR High on Spilt Barrel 70.7° F - 16 min to open**

	825	185.8 - 190.8	Core	0		100%	S	1		**Temperature of Lexan liner (using IR thermometer)** 185.8 ft bgs = 61° F 188.3 ft bgs = 71° F 190.8 ft bgs = 93° F **Heat Tape Readings** 185.8 & 188.3 = Did not register 190.8 ft bgs = 111° F **IR High on Spilt Barrel 74.6° F - 22 min to open**
1/28/2016	930	190.7 - 195.7	Core	0		100%	sG	1		**Temperature of Lexan liner (using IR thermometer)** 190.7 ft bgs = 49° F 193.2 ft bgs = 53° F 195.7 ft bgs = 75° F **Heat Tape Readings** 190.7 & 193.2 = Did not register 195.7 ft bgs = 84° F **IR High on Spilt Barrel 72.6° F - 101.3 min to open**
	1040	195.7 - 200.7	Core	0		100%	sG	1		**Temperature of Lexan liner (using IR thermometer)** 195.7 ft bgs = 80° F 198.2 ft bgs = 95° F 200.7 ft bgs = 110° F **Heat Tape Readings** 195.7 = 99° F 198.2 = 129° F 200.7 ft bgs = 104° F **IR High on Spilt Barrel 101.3° F - 30 min to open**

Borehole ID: C9552 (Replacement for C8709) Location: Approx. SW corner of 216-B-46

Date	Sample Time	Interval Footage	Core/Push	RAD (dpm) Beta/Gamma	RAD (pCi/g)	Recovery %	Soil Classification	Push Time (minutes)	Phase	Comment	HEIS #
10/20/2015	-	0 - 9	Push	-	-	-	-	4	Phase I Becker Hammer	-	-
		9 - 19						94			
		19 - 29						41			
		29 - 36.6						56			
10/21/2015	-	36.6 - 39	Push	-	-	-	-	21			
		39 - 44						25			
		44 - 45						7			
2/8/2016	955	45.5 - 47.0	Sonic Core			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 45.5 ft bgs = 65° F 47.0 ft bgs = 67° F **Heat Tape Underground Readings** 45.5 = Did not register 47.0 = 93° F **IR High on Spilt Barrel 103.4° F - 13 min to open**	B34177
	1020	47.2 - 49.7	Sonic Core			100%	sG	0.5		**Temperature of Lexan liner (using IR thermometer)** 47.2 ft bgs = 65° F 49.7 ft bgs = 82° F **Heat Tape Underground Readings** 47.2 = 93° F 49.7 = Did not register **IR High on Spilt Barrel 48.9° F - 8 min to open**	B34179
	1040	49.5 - 52.0	Sonic Core			100%	sG	1		**Temperature of Lexan liner (using IR thermometer)** 49.5 ft bgs = 56° F 52.0 ft bgs = 73° F **Heat Tape Underground Readings** 49.5 = 56° F 52.0 = 73° F **IR High on Spilt Barrel 59.7° F - 10 min to open**	B34181
	1215	52.2 - 57.2	Sonic Push			100%	sG	0.5		**Temperature of Lexan liner (using IR thermometer)** 52.2 ft bgs = 46° F 54.7 ft bgs = 57° F 57.2 ft bgs = 70° F **Heat Tape Underground Readings** 52.2 & 54.7 = Did not register 57.2 ft bgs = 93° F **IR High on Spilt Barrel 70.3° F - 14 min to open**	B34183
	1300	57.2 - 62.2	Sonic Push			100%	sG	0.5		**Temperature of Lexan liner (using IR thermometer)** 57.2 ft bgs = 45° F 59.7 ft bgs = 61° F 62.2 ft bgs = 89° F **Heat Tape Underground Readings** 52.2 ft bgs = 111° F 54.7 ft bgs = 84° F 57.2 ft bgs = 99° F **IR High on Spilt Barrel 81.6° F - 14 min to open**	B34185
	1330	62.1 - 67.1	Sonic Push			100%	gS	1		**Temperature of Lexan liner (using IR thermometer)** 62.1 ft bgs = 36° F 64.6 ft bgs = 36° F 67.1 ft bgs = 48° F **Heat Tape Underground Readings** 62.1 ft bgs = 84° F 64.6 ft bgs = 84° F 67.1 ft bgs = 93° F **IR High on Spilt Barrel 61.1° F - 9 min to open**	B34187
	1410	67.1 - 72.1	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 67.1 ft bgs = 53° F 69.6 ft bgs = 61° F 72.1 ft bgs = 72° F **Heat Tape Underground Readings** 67.1 ft bgs = 111° F 69.6 ft bgs = Did not register 72.1 ft bgs = 99° F **IR High on Spilt Barrel 70° F - 12 min to open**	B34189
	1440	72.2 - 77.2	Sonic Push			100%	S	1		**Temperature of Lexan liner (using IR thermometer)** 72.2 ft bgs = 72° F 74.7 ft bgs = 51° F 77.2 ft bgs = 63° F **Heat Tape Underground Readings** 72.2 ft bgs = 115° F 74.7 ft bgs = 84° F 77.2 ft bgs = 84° F **IR High on Spilt Barrel 62.9° F - 11 min to open**	B34191

	755	77.2 - 82.2	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 77.2 ft bgs = 58° F 79.7 ft bgs = 58° F 82.2 ft bgs = 62° F **Heat Tape Underground Readings** 77.2 & 79.7 ft bgs = Did not register 82.2 ft bgs = 84° F **IR High on Spilt Barrel 54.1° F - 15 min to open**	B34193
	830	82.2 - 87.2	Sonic Push	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 82.2 ft bgs = 61° F 84.7 ft bgs = 61° F 87.2 ft bgs = 75° F **Heat Tape Underground Readings** Did not register **IR High on Spilt Barrel 68.1° F - 13 min to open**	B34195
	915	87.1 - 92.1	Sonic Push	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 87.1 ft bgs = 108° F 89.6 ft bgs = 69° F 92.1 ft bgs = 91° F **Heat Tape Underground Readings** 87.1 ft bgs = 115° F 89.6 ft bgs = 84° F 92.1 ft bgs = 104° F **IR High on Spilt Barrel 64.1° F - 14 min to open**	B34197
	1005	92.2 - 97.2	Sonic Push	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 92.2 ft bgs = 67° F 94.7 ft bgs = 61° F 97.2 ft bgs = 62° F **Heat Tape Underground Readings** 92.2 ft bgs = 93° F 94.7 ft bgs = Did not register 97.2 ft bgs = 84° F **IR High on Spilt Barrel 55.4° F - 11 min to open**	B34K31
2/9/2016	1045	97.2 - 98.2	Sonic Push	100%	S	1	**Temperature of Lexan liner (using IR thermometer)** 97.2-98.2 ft bgs = 84° F 98.2-99.2 ft bgs = 67° F 99.2-100.2 ft bgs = 61° F 100.2-101.2 ft bgs = 62° F 101.2-102.2 ft bgs = 67° F **Heat Tape Underground Readings** 97.2-98.2 ft bgs = 84° F 99.2-100.2 ft bgs = 84° F 101.2-102.2 ft bgs = 84° F **IR High on Spilt Barrel 61.8° F - 12 min to open**	B34199
		98.2 - 99.2		100%	S			B34H32
		99.2 - 100.2		100%	S			B34H33
		100.2 -101.2		100%	S			B34H34
		101.2 - 102.2		100%	S			B34H35
	1215	102.2 - 103.2	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 102.2-103.2 ft bgs = 69° F 103.2-104.2 ft bgs = 58° F 104.2-105.2 ft bgs = 59° F 105.2-106.2 ft bgs = 59° F 106.2-107.2 ft bgs = 60° F **Heat Tape Underground Readings** 102.2-103.2 ft bgs = 84° F 104.2-105.2 ft bgs = 84° F 106.2-107.2 ft bgs = 84° F **IR High on Spilt Barrel 59.3° F - 16 min to open**	B341B1
		103.2 - 104.2		100%	S			B34H36
		104.2 - 105.2		100%	S			B34H37
		105.2 - 106.2		100%	S			B34H38
		106.2 - 107.2		100%	S			B34H39
	1300	107.2 - 108.2	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 107.2-108.2 ft bgs = 80° F 108.2-109.2 ft bgs = 78° F 109.2-110.2 ft bgs = 76° F 110.2-111.2 ft bgs = 76° F 111.2-112.2 ft bgs = 85° F **Heat Tape Underground Readings** 107.2-108.2 ft bgs = 84° F 109.2-110.2 ft bgs = 104° F 111.2-112.2 ft bgs = 93° F **IR High on Spilt Barrel 109.6° F - 22 min to open**	B341B3
		108.2 - 109.2		100%	S			B34H40
		109.2 - 110.2		100%	S			B34H41
		110.2 - 111.2		100%	S			B34H42
		111.2 - 112.2		100%	S			B34H43
	1340	112.2 - 117.2	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 112.2 ft bgs = 51° F 114.7 ft bgs = 45° F 117.2 ft bgs = 48° F **Heat Tape Underground Readings** 112.2 ft bgs = 84° F 114.7 ft bgs = 84° F 117.2 ft bgs = 84° F **IR High on Spilt Barrel 47.8° F - 12 min to open**	B341B5

2/10/2016	805	117.1 - 122.1	Sonic Push	-	-	100%	mS	0.5	Phase II Sonic	**Temperature of Lexan liner (using IR thermometer)** 117.1 ft bgs = 66° F 119.6 ft bgs = 59° F 122.1 ft bgs = 94° F **Heat Tape Underground Readings** 117.1 ft bgs = Destroyed tape 119.6 & 122.1 ft bgs = Did not register **IR High on Spilt Barrel 81.6° F - 15 min to open**	B341B7
	1200	122.5 - 127.5	Sonic Push			100%	mS	0.5		**Temperature of Lexan liner (using IR thermometer)** 122.5 ft bgs = 117° F 125.0 ft bgs = 67° F 127.5 ft bgs = 91° F **Heat Tape Underground Readings** 122.5 ft bgs = 129° F 125.0 & 127.5 ft bgs = Did not register **IR High on Spilt Barrel 68.1° F - 14 min to open**	B341B9
	1300	127.3 - 128.3	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 127.3-128.3 ft bgs = 75° F 128.3-129.3 ft bgs = 71° F 129.3-130.3 ft bgs = 66° F 130.3-131.3 ft bgs = 65° F 131.3-132.3 ft bgs = 80° F **Heat Tape Underground Readings** 127.3-128.3 ft bgs = 84° F 129.3-130.3 ft bgs = 84° F 131.3-132.3 ft bgs = 84° F **IR High on Spilt Barrel 62.2° F - 16 min to open**	B341C1
		128.3 - 129.3				100%	S				B34H45
		129.3 - 130.3				100%	S				B34H47
		130.3 - 131.3				100%	S				B34H49
		131.3 - 132.3				100%	S				B34H51
2/11/2016	845	132.1 - 133.2	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 132.1-133.1 ft bgs = 70° F 133.1-134.1 ft bgs = 72° F 134.1-135.1 ft bgs = 72° F 135.1-136.1 ft bgs = 73.2° F 136.1-137.1 ft bgs = 113.2° F **Heat Tape Underground Readings** 132.1-133.1 ft bgs = 84° F 134.1-135.1 ft bgs = 84° F 136.1-137.1 ft bgs = 104° F **IR High on Spilt Barrel 77.7° F - 16 min to open**	B341C3
		133.1 - 134.1				100%	S				B34H53
		134.1 - 135.1				100%	S				B34H55
		135.1 - 136.1				100%	S				B34H57
		136.1 - 137.1				100%	S				B34H59
	935	137.2 - 138.2	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 137.2-138.2 ft bgs = 90° F 138.2-139.2 ft bgs = 68° F 139.2-140.2 ft bgs = 66° F 140.2-141.2 ft bgs = 68° F 141.2-142.2 ft bgs = 113° F **Heat Tape Underground Readings** 137.2-138.2 ft bgs = 93° F 139.2-140.2 ft bgs = Did not register 141.2-142.2 ft bgs = 84° F **IR High on Spilt Barrel 91.4° F - 16 min to open**	B341C5
		138.2 - 139.2				100%	S				B34H61
		139.2 - 140.2				100%	S				B34H63
		140.2 - 141.2				100%	S				B34H65
		141.2 - 142.2				100%	S				B34H67
	1025	142.3 - 147.3	Sonic Push			100%	sG	0.5		**Temperature of Lexan liner (using IR thermometer)** 142.3 ft bgs = 103° F 144.8 ft bgs = 66° F 147.3 ft bgs = 91° F **Heat Tape Underground Readings** 142.3 ft bgs = 93° F 144.8 ft bgs = 84° F 147.3 ft bgs = 84° F **IR High on Spilt Barrel 74.4° F - 16 min to open**	B341C7
	1110	147.3 - 152.3	Sonic Push			100%	sG	0.5		**Temperature of Lexan liner (using IR thermometer)** 147.3 ft bgs = 70° F 149.8 ft bgs = 63° F 152.3 ft bgs = 95° F **Heat Tape Underground Readings** 147.3 & 149.8 ft bgs = Did not register 152.3 ft bgs = 84° F **IR High on Spilt Barrel 76.2° F - 15 min to open**	B341C9

	1240	152.2 - 157.2	Sonic Push	100%	sG	0.5	**Temperature of Lexan liner (using IR thermometer)** 152.2 ft bgs = 82° F 154.7 ft bgs = 70° F 157.2 ft bgs = 109° F **Heat Tape Underground Readings** 152.2 ft bgs = 84° F 154.7 ft bgs = Did not register 157.2 ft bgs = 104° F **IR High on Spilt Barrel 81.5° F - 17 min to open**	B341D1
	1330	157.2 - 162.2	Sonic Push	100%	gS	0.5	**Temperature of Lexan liner (using IR thermometer)** 157.2 ft bgs = 77° F 159.7 ft bgs = 68° F 162.2 ft bgs = 106° F **Heat Tape Underground Readings** 157.2 ft bgs = 93° F 159.7 ft bgs = 84° F 162.2 ft bgs = 84° F **IR High on Spilt Barrel 85.2° F - 15 min to open**	B341D3
	945	162.2 - 167.2	Sonic Push	100%	gS	0.5	**Temperature of Lexan liner (using IR thermometer)** 162.2 ft bgs = 68° F 164.7 ft bgs = 64° F 167.2 ft bgs = 80° F **Heat Tape Underground Readings** 162.2 ft bgs = 84° F 164.7 ft bgs = 84° F 167.2 ft bgs = 96° F **IR High on Spilt Barrel 67.4° F - 18 min to open**	B341D5
	1035	167.3 - 172.3	Sonic Push	100%	gS	0.5	**Temperature of Lexan liner (using IR thermometer)** 167.3 ft bgs = 69° F 169.8 ft bgs = 66° F 172.3 ft bgs = 77° F **Heat Tape Underground Readings** 167.3 ft bgs = 84° F 169.8 ft bgs = 84° F 172.3 ft bgs = 84° F **IR High on Spilt Barrel 53.4° F - 16 min to open**	B341D7
2/16/2016	1230	172.3 - 177.3	Sonic Push	100%	gS	0.5	**Temperature of Lexan liner (using IR thermometer)** 172.3 ft bgs = 75° F 174.8 ft bgs = 71° F 177.3 ft bgs = 84° F **Heat Tape Underground Readings** 172.3 ft bgs = 84° F 174.8 ft bgs = 84° F 177.3 ft bgs = 84° F **IR High on Spilt Barrel 71.4° F - 13 min to open**	B341D9
	1330	177.1 - 182.1	Sonic Push	100%	gS	0.5	**Temperature of Lexan liner (using IR thermometer)** 177.1 ft bgs = 72° F 179.6 ft bgs = 69° F 182.1 ft bgs = 80° F **Heat Tape Underground Readings** 177.1 ft bgs = 90° F 179.6 ft bgs = 84° F 182.1 ft bgs = 104° F **IR High on Spilt Barrel 66.5° F - 16 min to open**	B341F1
	1420	182.2 - 187.2	Sonic Push	100%	gS	0.5	**Temperature of Lexan liner (using IR thermometer)** 182.2 ft bgs = 78° F 184.7 ft bgs = 73° F 187.2 ft bgs = 70° F **Heat Tape Underground Readings** 182.2 ft bgs = 93° F 184.7 ft bgs = 84° F 187.2 ft bgs = 84° F **IR High on Spilt Barrel 71.9° F - 19 min to open**	B34K33
	755	187.2 - 188.2	Sonic Push	100%	sG	0.5	**Temperature of Lexan liner (using IR thermometer)** 187.2-188.2 ft bgs = 65° F 188.2-189.2 ft bgs = 63° F 189.2-190.2 ft bgs = 65° F 190.2-191.2 ft bgs = 66° F 191.2-192.2 ft bgs = 89° F **Heat Tape Underground Readings** 187.2-188.2 ft bgs = 84° F 189.2-190.2 ft bgs = Did not register 191.2-192.2 ft bgs = 93° F **IR High on Spilt Barrel 74.6° F - 20 min to open**	B341F3
		188.2 - 189.2		100%				B34H69
		189.2 - 190.2		100%				B34H71
		190.2 - 191.2		100%				B34H73
		191.2 - 192.2		100%				B34H75
		192.2 - 193.2		100%			**Temperature of Lexan liner (using IR thermometer)** 192.2-193.2 ft bgs = 71° F	B34H74

2/17/2016	850	193.2 - 194.2	Sonic Core			100%	sG	1		193.2-194.2 ft bgs = 69° F 194.2-195.2 ft bgs = 64° F 195.2-196.2 ft bgs = 70° F 196.2-197.2 ft bgs = 81° F **Heat Tape Underground Readings** 192.2-191.2 ft bgs = Did not register 194.2-195.2 ft bgs = Tape destroyed 196.2-197.2 ft bgs = 108° F **IR High on Spilt Barrel 89.9° F - 19 min to open**	B34H77
		194.2 - 195.2				100%					B34H79
		195.2 - 196.2				100%					B34H81
		196.2 - 197.2				100%					B34H83
	950	197.3 - 198.3	Sonic Core			100%	sG	0.5		**Temperature of Lexan liner (using IR thermometer)** 197.3-198.3 ft bgs = 74° F 198.3-199.3 ft bgs = 69° F 199.3-200.3 ft bgs = 75° F 200.3-201.3 ft bgs = 82° F 201.3-202.3 ft bgs = 108° F **Heat Tape Underground Readings** 197.3-198.3 ft bgs = 111° F 199.3-200.3 ft bgs = 84° F 201.3-202.3 ft bgs = 99° F **IR High on Spilt Barrel 80.7° F - 20 min to open**	B341F7
		198.3 - 199.3				100%					B34H85
		199.3 - 200.3				100%					B34H87
		200.3 - 201.3				100%					B34H89
		201.3 - 202.3				100%					B34H91

Borehole ID: C8706 Location: Approx. NE corner of 216-B-46

Date	Sample Time	Interval Footage	Core/Push	RAD (dpm) Beta/Gamma	RAD (pCi/g)	Recovery %	Soil Classification	Push Time (minutes)	Phase	Comment	HEIS #
10/21/2015	-	0 - 2	Push	-	0	-	-	13 (sec)	Becker Hammer Phase I		
10/22/2015	0835	2 - 4.5	Split Spoon	-	0	65	msG	28 (sec)			B33B16, B33B17
	0907	3.9 - 6.4			0	70		37 (sec)			B33B19, B33B20, B33B22, B33B23, B33B24, B33B26
	0952	5.9 - 8.4			0	75		42 (sec)			B33B25, B33B29, B33B31
	-	8.4 -19.2	Push		9 ft: 1,000 10 ft: 4,000 11 ft: 88,000 12 ft: 252,000 13 ft: 465,000 13.5 ft: 720,000 14 ft: 480,000 15 ft: 111,000 16 ft: 25,000 17 ft: 9,000 18 ft: 5,000 19 ft: 1,000	-	-	23			
		19.2 - 29.2			20 ft: 0 21 ft: 0 22 ft: 1,000 23 ft: 1,000			61			
		29.2 - 35.7			24 - 26 ft: 0 27 ft: 1,000 28 ft: 1,000 29 ft: 1,000 30 ft: 1,000 35 - 45.3 ft: 0			61			
10/23/2015	-	35.7 - 39.2	Push	-	0	-	-	23			
		39.2 - 44.2						28			
		44.2 - 45.3						7			
2/17/2016	1435	45.5 - 47.0	Sonic Push	5,000 direct on soil, 10,000 direct through liner		100%	gS	10 (sec)		**Temperature of Lexan liner (using IR thermometer)** 45.5 ft bgs = 68° F 47.0 ft bgs = 64° F **IR High on Spilt Barrel 70° F - 33 min to open**	B324N7, B34PN6
2/22/2016	910	47.0 - 49.5	Sonic Push			100%	gS	0.5		**Temperature of Lexan liner (using IR thermometer)** 47.0 ft bgs = 53° F 49.5 ft bgs = 75° F **IR High on Spilt Barrel 62.8° F - 13 min to open**	B324N8
	940	49.5 - 52.0	Sonic Push			100%	gS	0.5		**Temperature of Lexan liner (using IR thermometer)** 49.5 ft bgs = 65° F 52.0 ft bgs = 80° F **IR High on Spilt Barrel 65° F - 13 min to open**	B324N9
	1015	52.2 - 57.2	Sonic Push			100%	sG	0.5		**Temperature of Lexan liner (using IR thermometer)** 52.2 ft bgs = 85° F 54.7 ft bgs = 68° F 57.2 ft bgs = 104° F **IR High on Spilt Barrel 76.8° F - 11 min to open**	B324P0
	1120	57.2 - 62.2	Sonic Push			100%	sG	0.5		**Temperature of Lexan liner (using IR thermometer)** 57.2 ft bgs = 89° F 59.7 ft bgs = 74° F 62.2 ft bgs = 113° F **IR High on Spilt Barrel 87.2° F - 42 min to open**	B324P1
	1245	62.2 - 67.2	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 62.2 ft bgs = 87° F 64.7 ft bgs = 70° F 67.2 ft bgs = 97° F **IR High on Spilt Barrel 113.6° F - 11 min to open**	B324P2
	1315	67.3 - 72.3	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 67.3 ft bgs = 85° F 69.8 ft bgs = 65° F 72.3 ft bgs = 80° F **IR High on Spilt Barrel 79.4° F - 12 min to open**	B324P3

	1350	72.1 - 77.1	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 72.1 ft bgs = 73° F 74.6 ft bgs = 66° F 77.1 ft bgs = 85° F **IR High on Spilt Barrel 72.6° F - 12 min to open**	B324P4
	1420	77.0 - 82.0	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 77.0 ft bgs = 77° F 79.5 ft bgs = 62° F 82.0 ft bgs = 80° F **IR High on Spilt Barrel 82.4° F - 11 min to open**	B324P5
	900	82.2 - 87.2	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 82.2 ft bgs = 53° F 84.7 ft bgs = 54° F 87.2 ft bgs = 85° F **IR High on Spilt Barrel 68.8° F - 14 min to open**	B324P6
	935	87.3 - 92.3	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 87.3 ft bgs = 71° F 89.8 ft bgs = 64° F 92.3 ft bgs = 92° F **IR High on Spilt Barrel 61° F - 18 min to open**	B324P7
	1015	92.2 - 97.2	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 92.2 ft bgs = 71° F 94.7 ft bgs = 67° F 97.2 ft bgs = 120° F **IR High on Spilt Barrel 107.2° F - 18 min to open**	B324P8
	1055	97.1 - 102.1	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 97.1 ft bgs = 84° F 99.6 ft bgs = 68° F 102.1 ft bgs = 107° F **IR High on Spilt Barrel 86.8° F - 18 min to open**	B324P9
2/23/2016	1220	102.1 - 107.1	Sonic Push			100%	S	1		**Temperature of Lexan liner (using IR thermometer)** 102.1 ft bgs = 72° F 104.6 ft bgs = 69° F 107.1 ft bgs = 113° F **IR High on Spilt Barrel 59.2° F - 16 min to open**	B324R0
	1300	107.2 - 112.2	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 107.2 ft bgs = 82° F 109.7 ft bgs = 71° F 112.2 ft bgs = 104° F **IR High on Spilt Barrel 85.4° F - 17 min to open**	B324R1
	1340	112.1 - 117.1	Sonic Push			100%	S	10 (sec)		**Temperature of Lexan liner (using IR thermometer)** 112.1 ft bgs = 79° F 114.6 ft bgs = 68° F 117.1 ft bgs = 78° F **IR High on Spilt Barrel 76.6° F - 15 min to open**	B324R2
	1435	117.2 - 122.2	Sonic Push		-	100%	S	0.5	Sonic Phase II	**Temperature of Lexan liner (using IR thermometer)** 117.2 ft bgs = 74° F 119.7 ft bgs = 69° F 122.2 ft bgs = 80° F **IR High on Spilt Barrel 72.4° F - 22 min to open**	B324R3
	755	122.5 - 127.5	Sonic Push	0		100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 122.5 ft bgs = 68° F 125.0 ft bgs = 73° F 127.5 ft bgs = 96° F **IR High on Spilt Barrel 72.4° F - 15 min to open**	B324R4
	850	127.0 - 132.0	Sonic Push			100%	S	0.5		**Temperature of Lexan liner (using IR thermometer)** 127.0 ft bgs = 109° F 129.5 ft bgs = 71° F 132.0 ft bgs = 93° F **IR High on Spilt Barrel 78.2° F - 21 min to open**	B324R5

	930	132.4 - 137.4	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 132.4 ft bgs = 77° F 134.9 ft bgs = 65° F 137.4 ft bgs = 95° F **IR High on Spilt Barrel 76.8° F - 15 min to open**	B324R6
	1020	137.2 - 142.2	Sonic Push	100%	gS	0.5	**Temperature of Lexan liner (using IR thermometer)** 137.2 ft bgs = 88° F 139.7 ft bgs = 68° F 142.2 ft bgs = 114° F **IR High on Spilt Barrel 87.6° F - 15 min to open**	B324R7
2/24/2016	1105	142.3 - 147.3	Sonic Push	100%	gS	0.5	**Temperature of Lexan liner (using IR thermometer)** 142.3 ft bgs = 82° F 144.8 ft bgs = 68° F 147.3 ft bgs = 107° F **IR High on Spilt Barrel 82.8° F - 16 min to open**	B324R8
	1235	147.1 - 152.1	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 147.1 ft bgs = 80° F 149.6 ft bgs = 71° F 152.1 ft bgs = 127° F **IR High on Spilt Barrel 87.2° F - 17 min to open**	B324R9
	1315	152.1 - 157.1	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 152.1 ft bgs = 81° F 154.6 ft bgs = 69° F 157.1 ft bgs = 102° F **IR High on Spilt Barrel 87.4° F - 14 min to open**	B324T0
	1400	157.0 - 162.0	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 157.0 ft bgs = 81° F 159.5 ft bgs = 69° F 162.0 ft bgs = 101° F **IR High on Spilt Barrel 82.2° F - 15 min to open**	B324T1
	1440	162.1 - 167.1	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 162.1 ft bgs = 88° F 164.6 ft bgs = 78° F 167.1 ft bgs = 107° F **IR High on Spilt Barrel 89° F - 16 min to open**	B324T2
	805	167.1 - 172.1	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 167.1 ft bgs = 56° F 169.6 ft bgs = 57° F 172.1 ft bgs = 87° F **IR High on Spilt Barrel 61.2° F - 18 min to open**	B324T3
	855	172.3 - 177.3	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 172.3 ft bgs = 65° F 174.8 ft bgs = 61° F 177.3 ft bgs = 79° F **IR High on Spilt Barrel 70.6° F - 18 min to open**	B324T4
	945	177.3 - 182.3	Sonic Push	100%	S	0.5	**Temperature of Lexan liner (using IR thermometer)** 177.3 ft bgs = 61° F 179.8 ft bgs = 60° F 182.3 ft bgs = 89° F **IR High on Spilt Barrel 78.6° F - 17 min to open**	B324T5
2/25/2016	1040	182.3 - 187.3	Sonic Push	100%	gS	0.5	**Temperature of Lexan liner (using IR thermometer)** 182.3 ft bgs = 65° F 184.8 ft bgs = 65° F 187.3 ft bgs = 86° F **IR High on Spilt Barrel 80.2° F - 18 min to open**	B324T6
	1200	187.3 - 192.3	Sonic Push	28%	sG - color change and noticable finer grains through liner at 187.8 - 188.8. Possible CCU?	0.5	**Temperature of Lexan liner (using IR thermometer)** 187.3 ft bgs = 72° F 188.8 ft bgs = 72° F **IR High on Spilt Barrel 114.8° F - 20 min to open**	B324T7

	1255	192.3 - 197.3	Sonic Push			100%	sG	1		**Temperature of Lexan liner (using IR thermometer)** 192.3 ft bgs = 80° F 194.8 ft bgs = 70° F 197.3 ft bgs = 117° F **IR High on Spilt Barrel 87.4° F - 20 min to open**	B324T8
2/29/2016	845	197.3 - 202.3	Sonic Push			100%	sG	1		**Temperature of Lexan liner (using IR thermometer)** 197.3 ft bgs = 57° F 200.8 ft bgs = 68° F 202.3 ft bgs = 82° F **IR High on Spilt Barrel 66.8° F - 20 min to open**	B324T9

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Appendix B

Borehole Geophysical Log Reports

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Appendix B contains the geophysical log reports for the characterization boreholes (C9550, C9549, C9552, and C8706) drilled in the BY Cribs. These reports were compiled by Stoller Newport News Nuclear.

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C9550
Log Data Report

Borehole Information:

Log Date:	2016-01-21	Filename:	C9550_HG-NM_2016-01-21	Site:	216-B-50 (DV-1)
Coordinates (WA St Plane)		DTW[1] (ft) :	None	DTW Date:	01/20/16

North (m)	East (m)	Drill Date	TOC[2] Elevation	Total Depth (ft)
N/A	N/A	01/19/16	N/A	200.5

Casing Information:

Casing Type	Drill Type	Stickup (ft)	Diameter (in.) Outer	Diameter (in.) Inside	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	Becker Push	0.65	8 5/8	7 5/8	1/2	0.65	43.5
Threaded Steel	Sonic Core	.65	6	5	1/2	0.65	200.5

Borehole Notes:

This borehole is a replacement for borehole C8711 (HGLP-LDR-844), which was drilled to approximately 27 ft.

The onsite geologist provided the total depth and casing depth. The logging engineer measured casing stick-up and casing diameter (rounded to the nearest 1/16-in.). No water was in this borehole. The maximum logging depth achieved was 200 ft.

Zero reference is ground surface.

A borehole deviation survey was conducted after logging was complete and is included as Appendix A (HGLP-LDR-892).

Logging Equipment Information:

Logging System:	Gamma 5T	Type:	60% HPGe SGLS[3]
Effective Calibration Date:	03/19/15	Serial No.:	54-TP13441B
Calibration Reference:	HGLP-CC-115, Rev. 0	Logging Procedure:	SGRP-PRO-OP-53023, Rev. 0

Logging System:	Gamma 5P	Type:	NMLS[4]
Effective Calibration Date:	04/15/15	Serial No.:	H34055445
Calibration Reference:	HGLP-CC-116, Rev. 0	Logging Procedure:	SGRP-PRO-OP-53024, Rev. 0

Logging System:	Gamma 5T	Type:	60% HPGe SGLS
Effective Calibration Date:	01/13/16	Serial No.:	54-TP13441B
Calibration Reference:	HGLP-CC-134, Rev. 0	Logging Procedure:	SGRP-PRO-OP-53023, Rev. 0

[1] depth to water inside casing
[2] top of casing
[3] Spectral Gamma Logging System
[4] Neutron Moisture Logging System

SGLS Log Run Information:

Log Run	1	2 Repeat	5	6 Repeat	
HEIS Number	1013065	1013066	1013067	1013068	
Date	10/05/15	10/05/15	01/20/16	01/20/16	
Logging Engineer	Meisner/Spatz	Meisner/Spatz	Spatz	Spatz	
Start Depth (ft)	0.0	18.0	42.0	42.0	
Finish Depth (ft)	43.0	24.0	200.0	58.0	
Count Time (sec)	200	200	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	
Log Speed (ft/min)	N/A	N/A	N/A	N/A	
Pre-Verification	C9550FTB2015 1005AV00CAB 1	C9550FTB2015 1005AV00CAB 1	C9550FTB2016 0120AV00CAB 1	C9550FTB2016 0120AV00CAB 1	
Start File	AD000000	AD001800	AD004200	AD004200	
Finish File	AD004300	AD002401	AD020000	AD25800	
Post-Verification	RV00CAA1	RV00CAA1	BV00CAA	BV00CAA	
Depth Return Error (in.)	N/A	High 4	N/A	High 4	
Comments	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	

NMLS Log Run Information:

Log Run	3	4 Repeat	7	8 Repeat	
HEIS Number	1013069	1013070	1013071	1013072	
Date	10/05/15	10/05/15	01/21/15	01/21/15	
Logging Engineer	Meisner/Spatz	Meisner/Spatz	Felt	Felt	
Start Depth (ft)	0.0	12.0	41.0	45.0	
Finish Depth (ft)	42.75	17.25	200.0	61.25	
Count Time (sec)	15	15	15	15	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	0.25	0.25	0.25	0.25	
Log Speed (ft/min)	N/A	N/A	N/A	N/A	
Pre-Verification	C9550FPB20151 005AV00CAB1	C9550FPB20151 005AV00CAB1	C9550FPB20160 121AV00CAB1	C9550FPB20160 121AV00CAB1	
Start File	AD000000	RD001200	AD004100	BD004500	
Finish File	AD004275	RD001725	AD002000	BD006125	
Post-Verification	C9550FPB20151 005RV00CAA1	C9550FPB20151 005RV00CAA1	C9550FPB20151 005RV00CAA1	C9550FPB20151 005RV00CAA1	
Depth Return Error (in.)	N/A	High 1	N/A	High 1	
Comments	None	None	None	None	

Logging Operation Notes:

A centralizer was installed on the sondes during logging of the first casing. No centralizer was used from 43 to 200 ft because of the small internal diameter.

Pre- and post-survey verification measurements met the acceptance criteria for the established systems.

Analysis Notes:

Analyst	P.D. Henwood	**Date**	02/23/16
Reference(s)	SGRP-PRO-OP-53040, Rev. 0; SGRP-PRO-OP-53051, Rev. 0		

A casing correction for a 1/2-in. thick casing was applied throughout the borehole.

No correction for water was necessary throughout the borehole.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL templates identified as FTB20150319_CC115 and FTB20160113_CC134 using an efficiency function and corrections for casing and dead time as determined by annual calibrations.

NMLS data are reported in counts per second.

HGU[5] is an empirical unit of gamma activity proposed as a means to standardize gamma log response across multiple logging systems with different response characteristics. The HGU is defined in terms of measurements in the Hanford Borehole Calibration Facility, and the magnitude is selected such that 1 HGU is approximately equivalent to typical Hanford background activity, based on data from background samples as reported in *Hanford Site Background: Part 2, Soil Background for Radionuclides* (DOE/RL-96-12).

Results and Interpretations:

Cs-137 was detected near the ground surface at a maximum concentration of approximately 1 pCi/g.

No other manmade radionuclides were detected in the borehole. MDLs are plotted for manmade uranium which is indicated by the Pa-234m gamma ray at 1001 keV for U-238 and the U-235 gamma ray at 186 keV.

The neutron moisture log primarily responds to moisture present in the surrounding formation. In general, an increase in count rate reflects an increase in moisture content. Moisture content may increase in sediments of relatively high silt or clay content.

KUT and moisture repeat plots indicate that the respective systems were working properly.

Casing joints are indicated in the second casing at ten ft intervals where the radionuclide concentrations, total gamma, and moisture exhibit relatively lower values. This log was not corrected for the effects of the casing joints.

List of Log Plots:

Depth Reference is ground surface.

Manmade Radionuclides (0-210 ft)
Natural Gamma Logs (0-160 ft)
Natural Gamma Logs (150-310 ft)
Combination Plot (0-120 ft)
Combination Plot (110-230 ft)
Combination Plot (0-210 ft)
Total Gamma & Moisture (0-210 ft)
Total Gamma & Hanford Gamma Unit (0-210 ft)
Repeat Section of Natural Gamma Logs (18-24 ft)
Repeat Section of Natural Gamma Logs (42-58 ft)
Moisture Repeat Section (12-17.5 ft)
Moisture Repeat Section (45-61.5 ft)

[5] Hanford Gamma Unit

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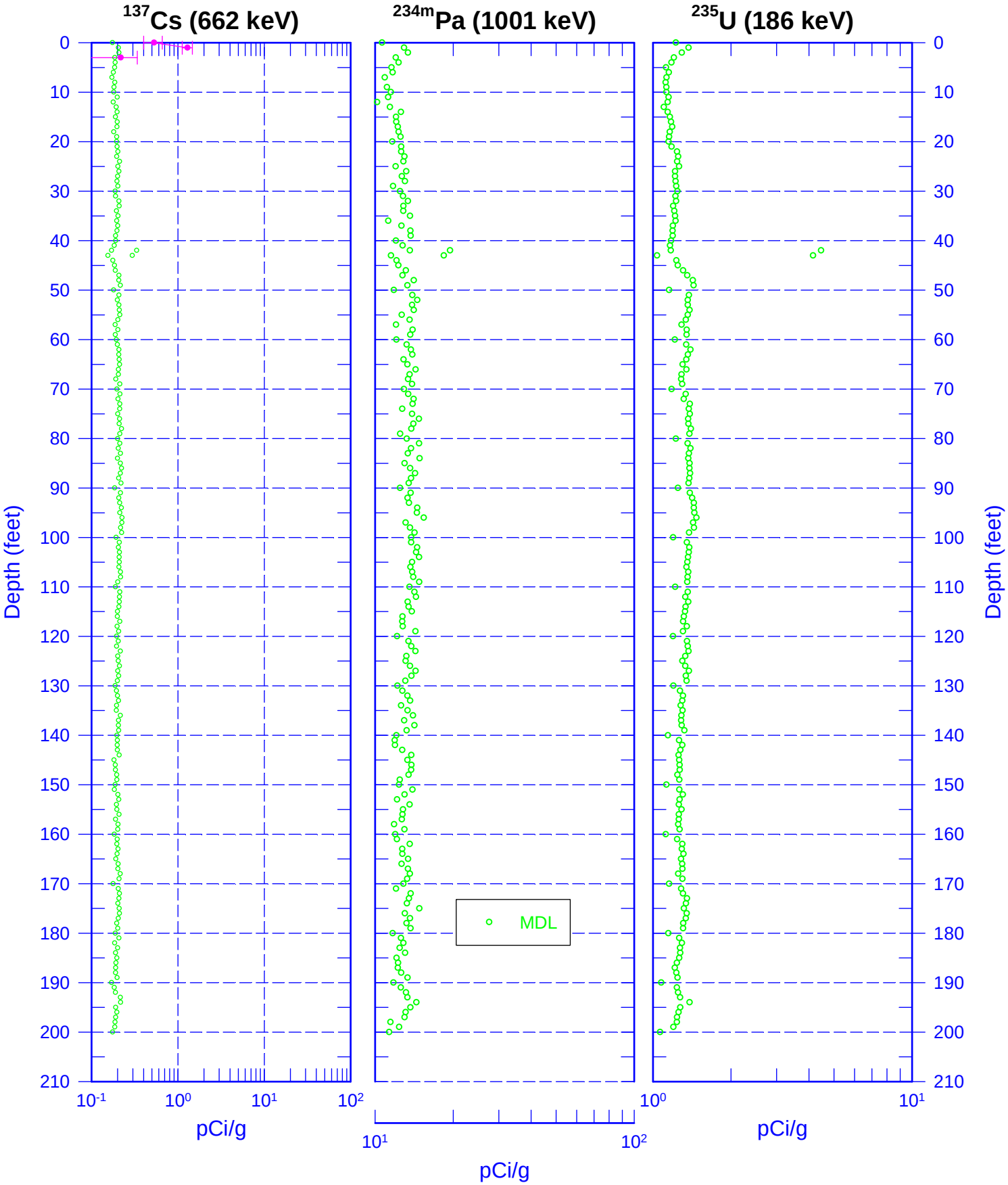
C9550
Manmade Radionuclides



Zero Reference - Ground Surface

SGW-60265, REV. 0

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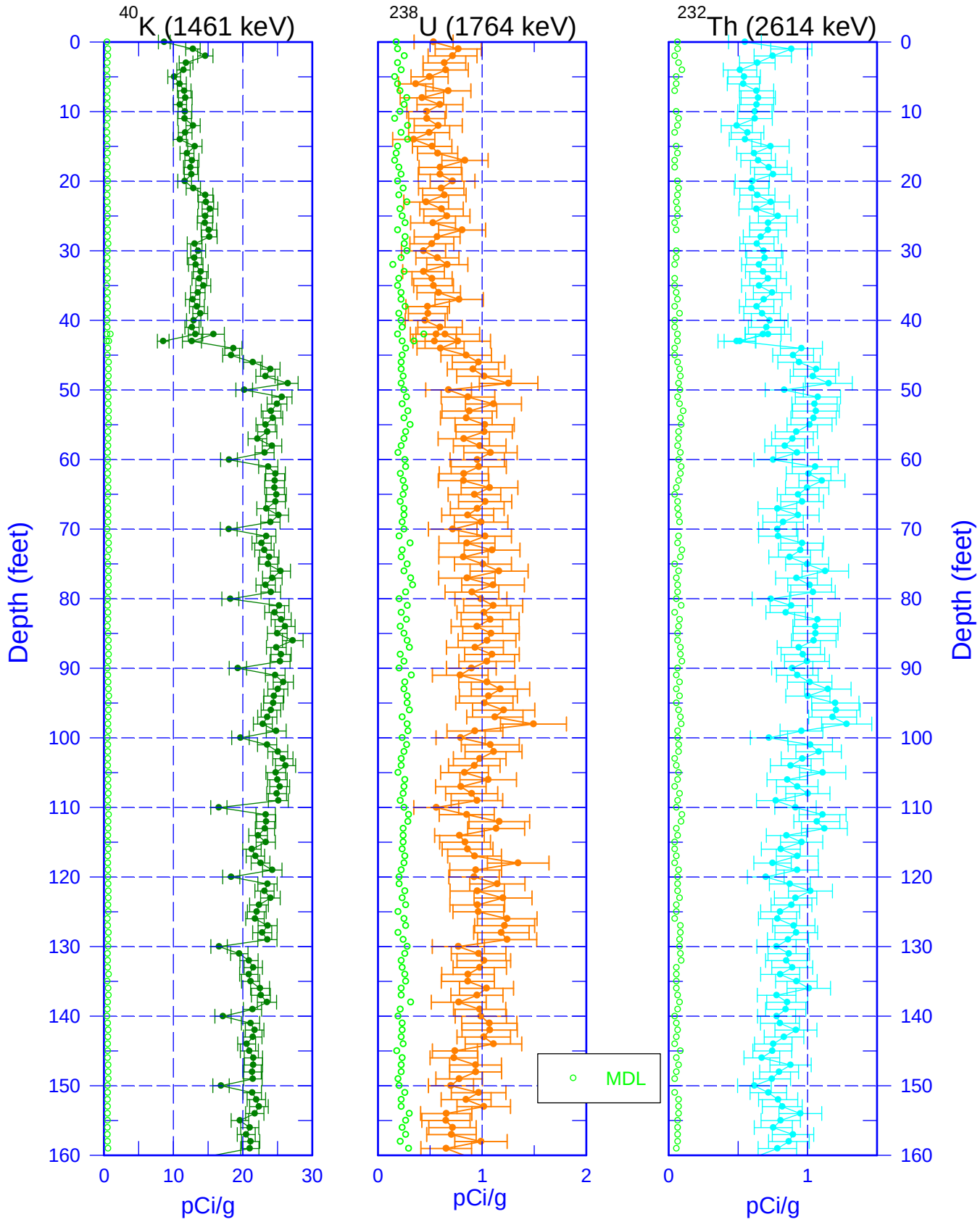
C9550
Natural Gamma Logs



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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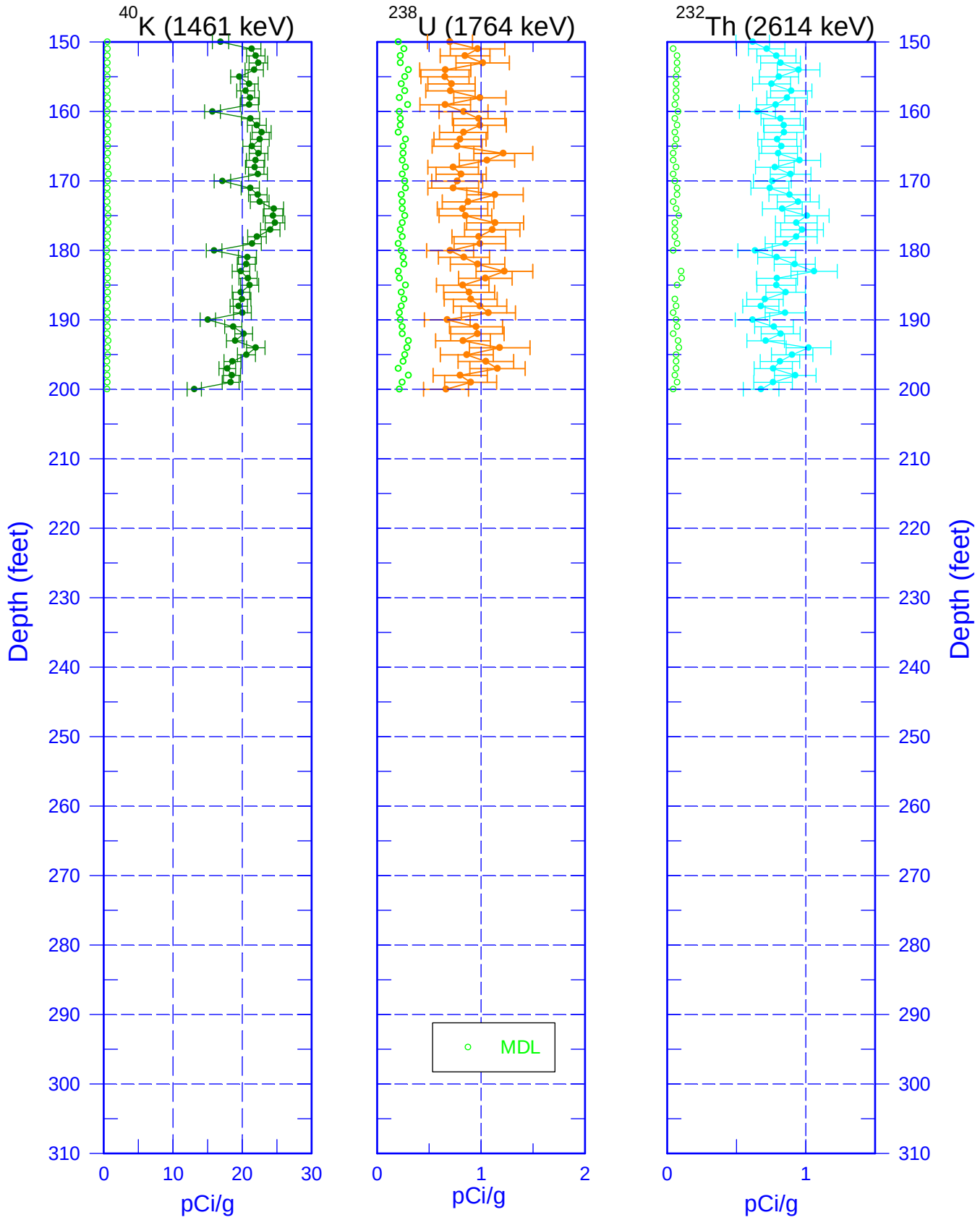
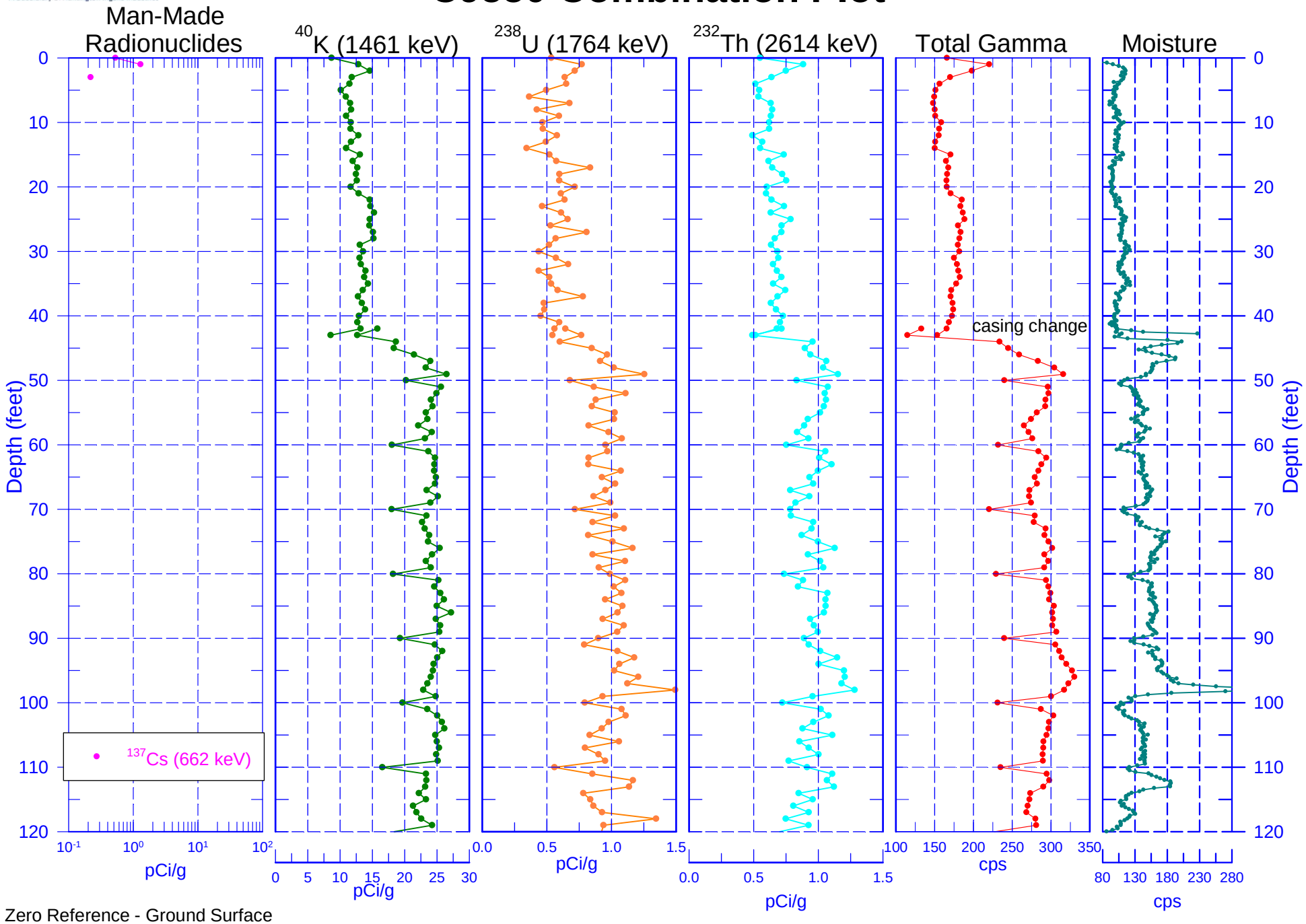
C9550
Natural Gamma Logs



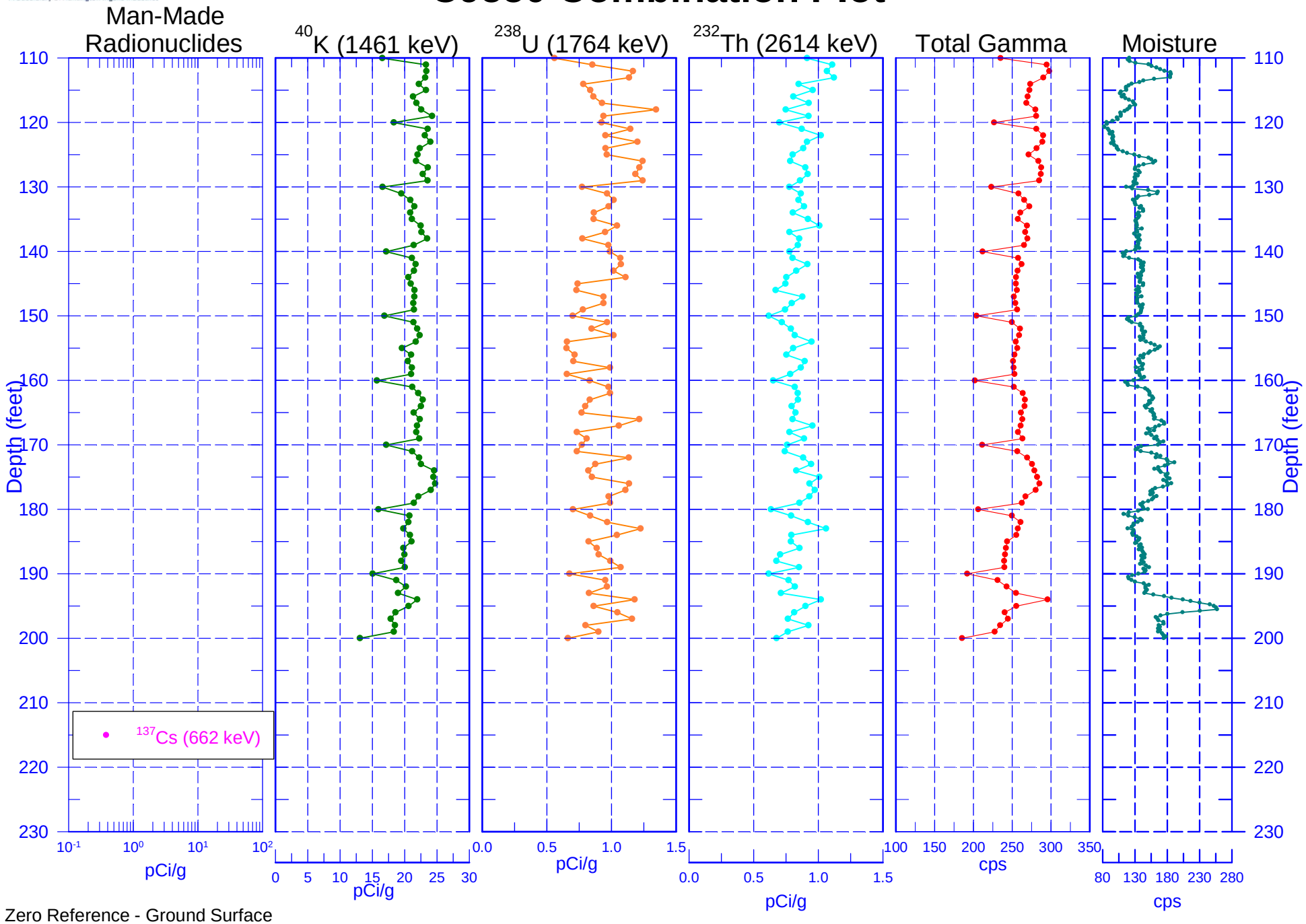
Zero Reference - Ground Surface

C9550 Combination Plot



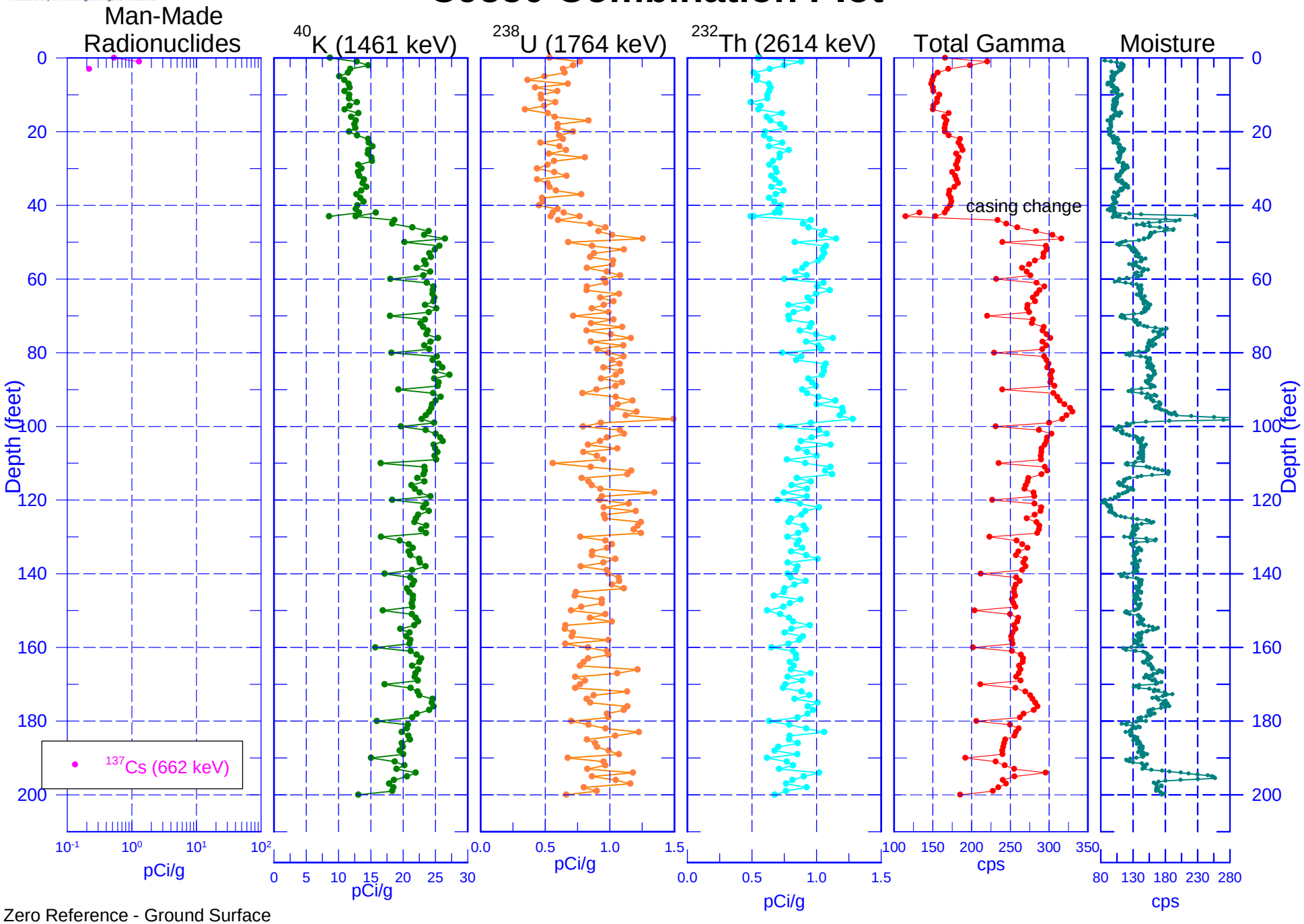
Zero Reference - Ground Surface

C9550 Combination Plot



Zero Reference - Ground Surface

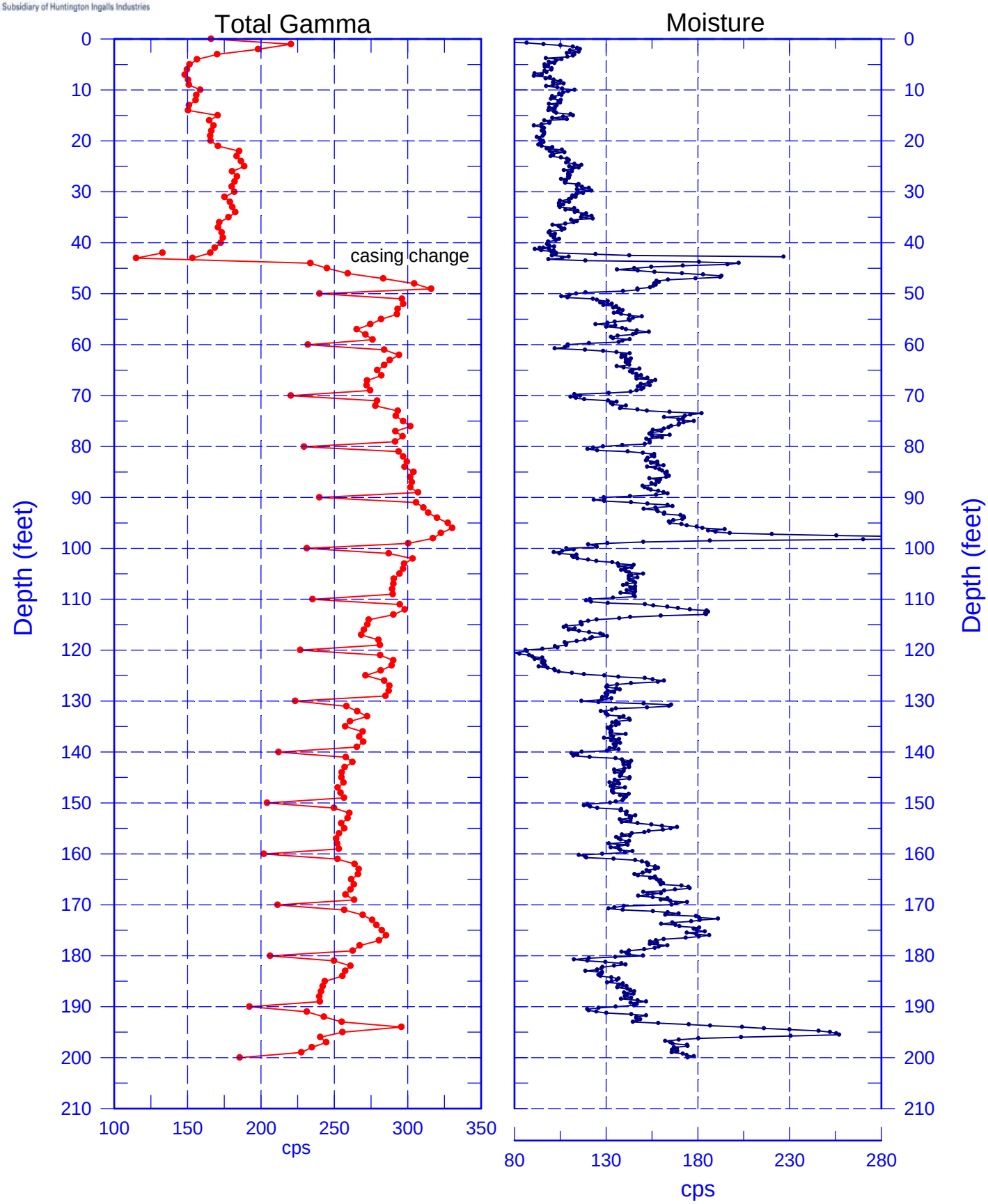
C9550 Combination Plot



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

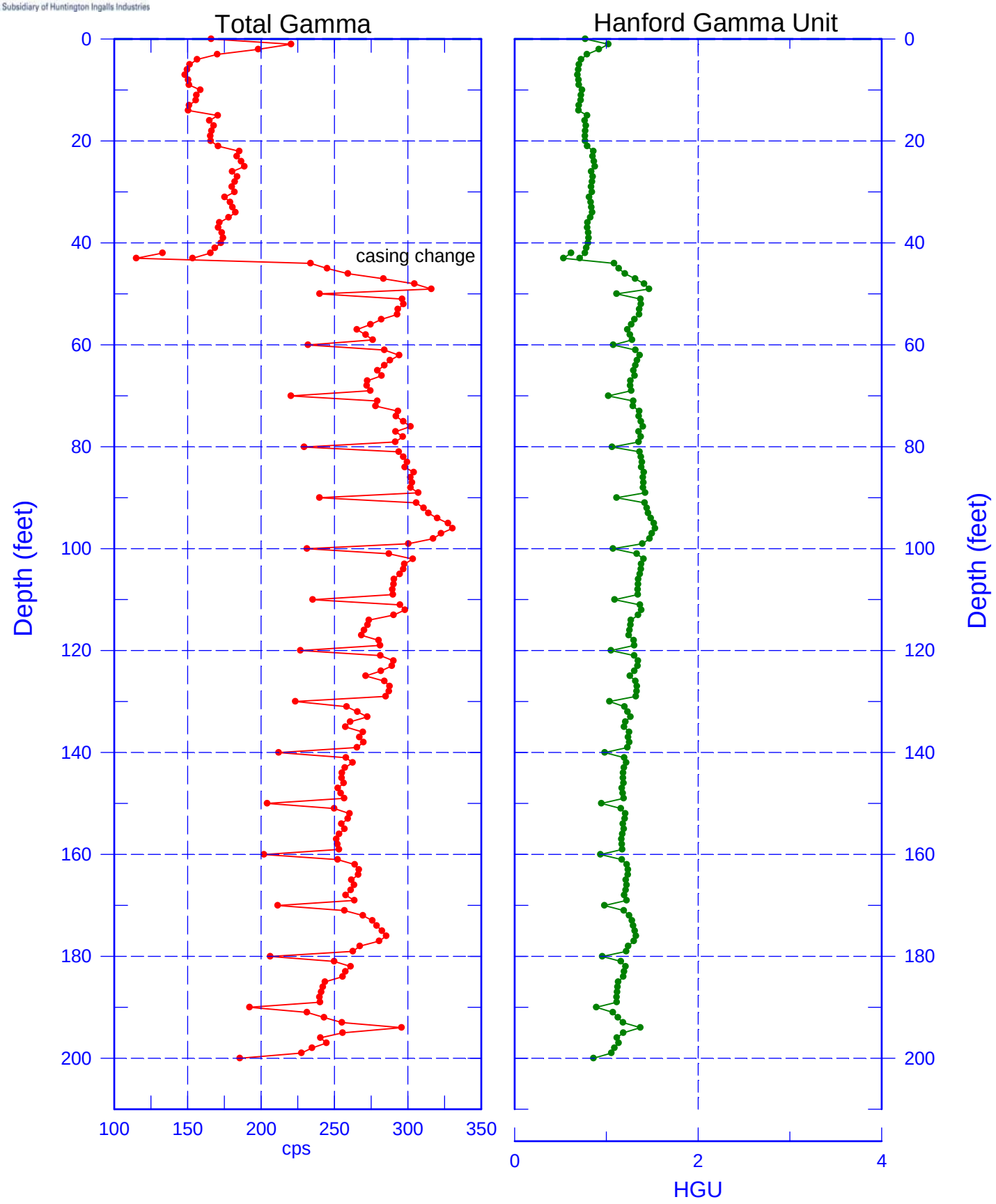
C9550
Total Gamma & Moisture



Zero Reference - Ground Surface

C9550

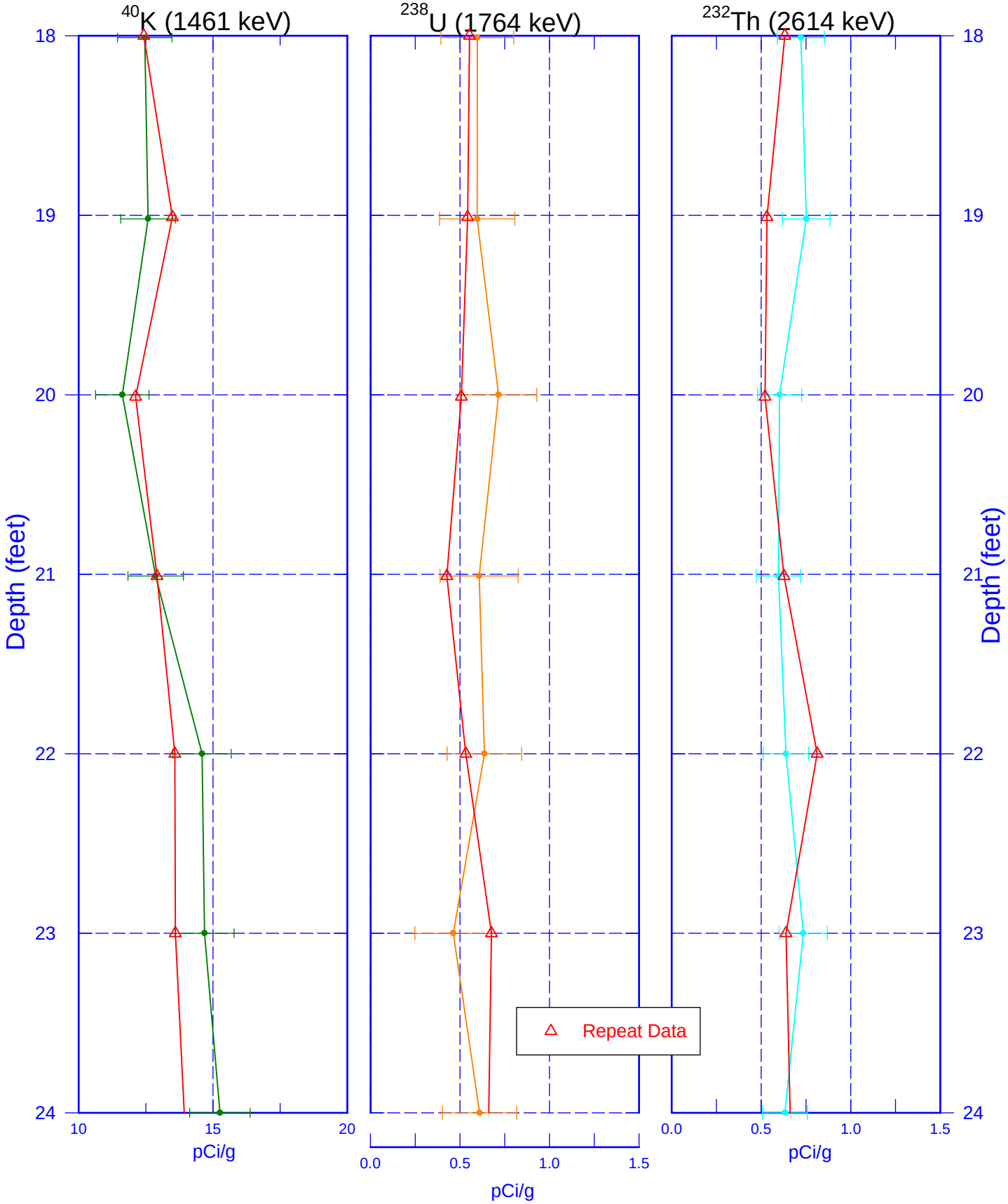
Total Gamma & Hanford Gamma Unit



Zero Reference - Ground Surface

C9550

Repeat Section of Natural Gamma Logs

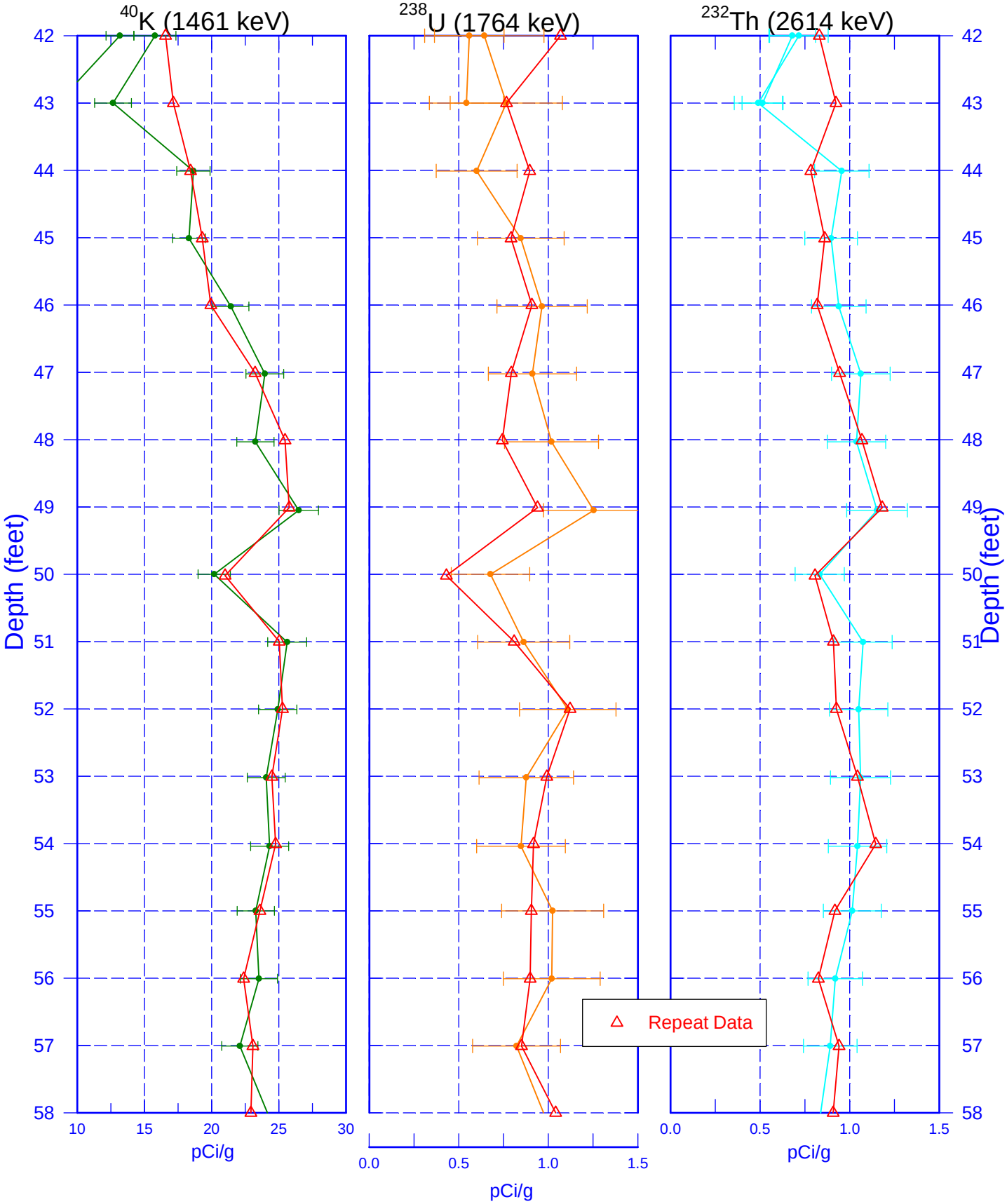


Zero Reference - Ground Surface

SGW-60265, REV. 0

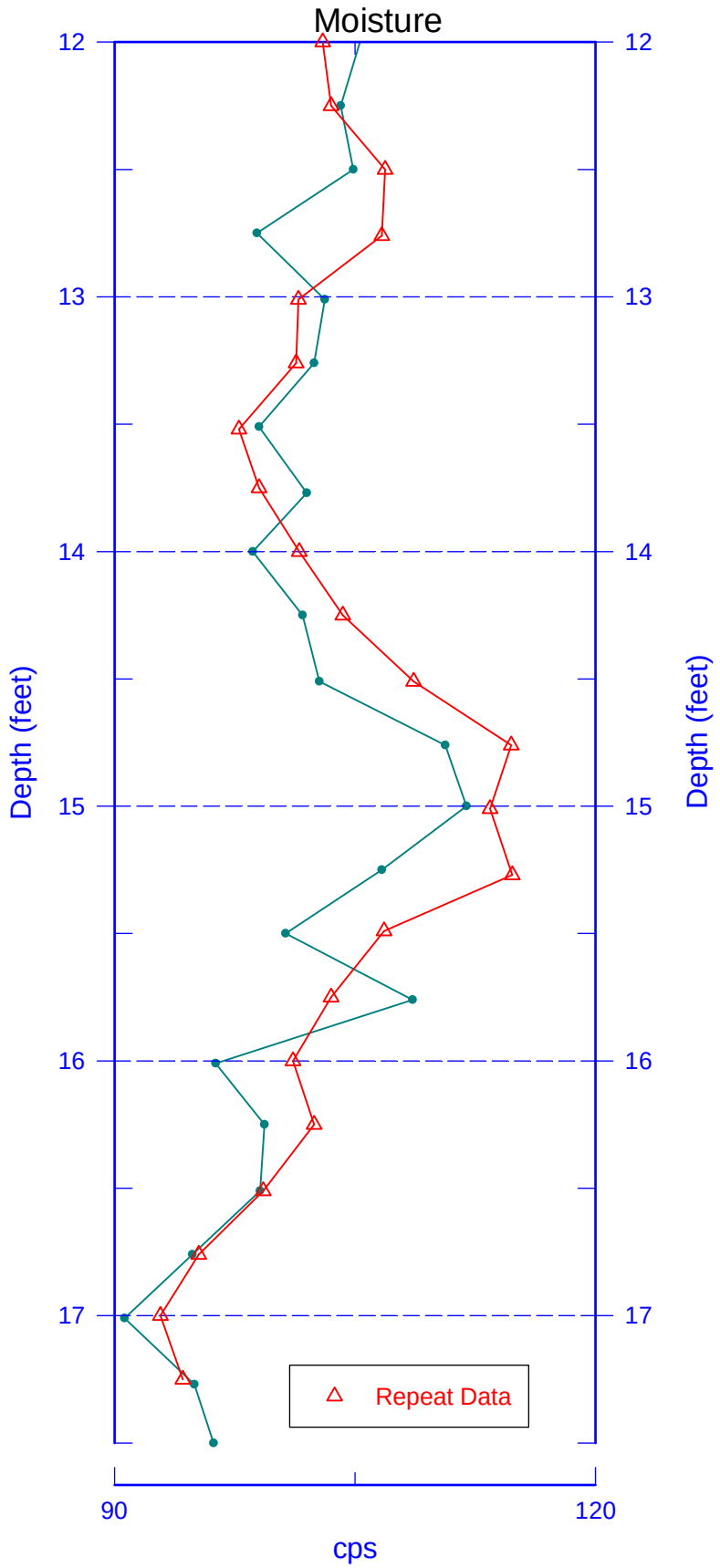
C9550

Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

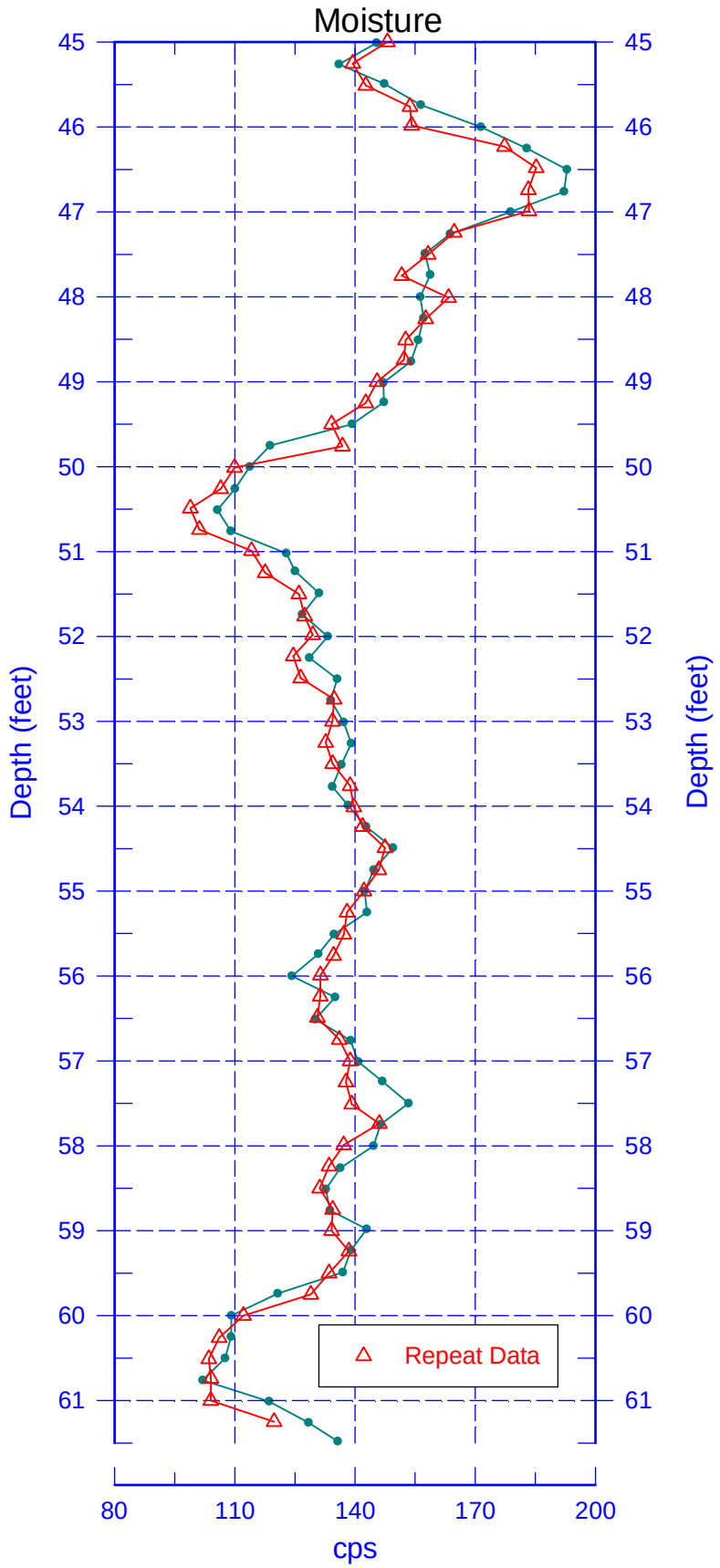
C9550
Moisture Repeat Section



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

C9550
Moisture Repeat Section



Zero Reference - Ground Surface

Appendix A

HGLP-LDR-892

Stoller Newport News Nuclear

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C9550
Log Data Report

Borehole Information

Borehole	-	Well ID	C9550	Client	CHPRC
Log Date	Engineer		Depth Reference		Site
1/21/2016	Felt,McClellan,Meisner		Ground Surface		BY Cribs (200-DV-1)

Log Run Information

Logging System	Borehole Deviation	Model	DG69-0901-4 #4654
Calibration Date	12/15/2015	Calibration Reference	HGLP-CC-135, Rev. 0
		Logging Procedure	SGRP-PRO-OP-53034

Log File	C9550_DV-1.raw	Report File	C9550_DV-1.rpt
Sight Line	012	Magnetic Declination	-15.15

Measured Depth (feet)	Course Inclin. From Vert (°)	Course Direction (deg)	Closure Direction (deg)	TrueVert. Depth (feet)	Rectangular Coordinates		Dogleg Severity °/100 ft	Closure Distance (feet)
					+N/-S	+E/-W		
0	0.59	350.9	0	0	0	0	0	0
20	0.42	38.9	10.71	20	0.16	0.03	2.2	0.16
40	0.51	46	26.82	40	0.28	0.14	0.5	0.31
60	0.51	57	35.7	60	0.39	0.28	0.5	0.48
80	0.53	57.2	41.53	80	0.49	0.43	0.1	0.65
100	0.52	50.1	44.18	100	0.6	0.58	0.3	0.83
120	0.52	58.9	46.01	120	0.7	0.73	0.4	1.01
140	0.47	61.4	48.06	139.99	0.79	0.88	0.2	1.18
160	0.52	53.6	49.24	159.99	0.88	1.02	0.4	1.35
180	0.56	53.7	49.78	179.99	0.99	1.17	0.2	1.54
198.5	0.57	65.7	50.82	198.49	1.08	1.33	0.6	1.71

Analysis Notes

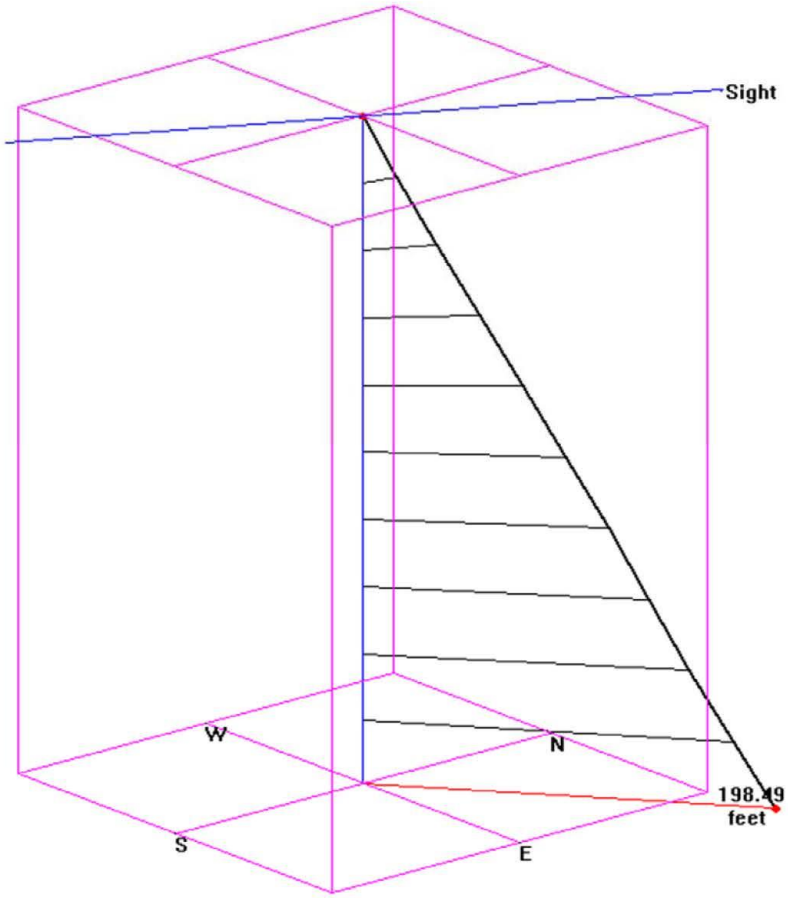
Analyst	K. Felt	Date	1/21/2016

Plots are for illustrative purposes. Sight line is initial orientation of tool. Borehole trajectory determined by minimum curvature method. Refer to table for true vertical depth and N/S and E/W deviation in feet.

List of Log Plots

Borehole Deviation

C9550
Borehole Deviation



C9549
Log Data Report

Borehole Information

Log Date	2016-02-02	Filename	C9549_HG-NM_2016-02-02	Site	216-B-45 (DV-1)
Coordinates (WA St Plane)		DTW[1] (ft)	None	DTW Date	01/28/16

North (m)	East (m)	Drill Date	TOC[2] Elevation	Total Depth (ft)
N/A	N/A	01/28/16	N/A	200.5

Casing Information

Casing Type	Drill Type	Stickup (ft)	Diameter (in.) Outer	Diameter (in.) Inside	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	Becker Push	0.65	8 5/8	7 3/8	5/8	0.65	45.38
Threaded Steel	Sonic Core	0	6	5	1/2	0	200.5

Borehole Notes

C9549 was drilled as an alternate for C9548, which was drilled as an alternate for C8707, which met with refusal. The C9548 casing diameter was too small for the SGLS. Log Data Report HGLP-LDR-851 was issued to provide the logging results for C9548. This Log Data Report includes SGLS, HRLS, and NMLS logging results for C9549.

The onsite geologist provided the total depth and casing depth. The logging engineer measured casing stick-up and casing diameter (rounded to the nearest 1/16-in.). No water was in this borehole. The maximum logging depth achieved was 200 ft.

Zero reference is ground surface.

A borehole deviation survey was conducted after logging was complete and is included as Appendix A (HGLP-LDR-891).

Logging Equipment Information

Logging System	Gamma 5T	Type	60% HPGe SGLS[3]
Effective Calibration Date	03/19/15	Serial No.	54-TP13441B
Calibration Reference	HGLP-CC-115, Rev. 0	Logging Procedure	SGRP-PRO-OP-53023, Rev. 0

Logging System	Gamma 5P	Type	NMLS[4]
Effective Calibration Date	04/15/15	Serial No.	H34055445
Calibration Reference	HGLP-CC-116, Rev. 0	Logging Procedure	SGRP-PRO-OP-53024, Rev. 0

Logging System	Gamma 5C	Type	planar HPGe HRLS[5]
Effective Calibration Date	07/30/15	Serial No.	39A314
Calibration Reference	HGLP-CC-123, Rev. 0	Logging Procedure	SGRP-PRO-OP-53023, Rev. 0

[1] depth to water inside casing
[2] top of casing
[3] Spectral Gamma Logging System
[4] Neutron Moisture Logging System
[5] High Rate Logging System

Logging System	Gamma 5T	**Type**	60% HPGe SGLS
Effective Calibration Date	01/13/16	**Serial No.**	54-TP13441B
Calibration Reference	HGLP-CC-134, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53023, Rev. 0

SGLS Log Run Information

Log Run	**1**	**2**	**3**	**4 Repeat**	**5**
HEIS Number	1013048	1013049	1013050	1013051	1013052
Date	10/14/15	10/14/15	10/14/15	10/14/15	10/14/15
Logging Engineer	Felt	Felt	Felt	Felt	Felt
Start Depth (ft)	0.0	11.0	15.0	33.0	37.0
Finish Depth (ft)	11.0	15.0	43.0	39.0	37.0
Count Time (sec)	200	20	200	200	500
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9549FTB2015 1014AV00CAB 1	C9549FTB2015 1014AV00CAB 1	C9549FTB2015 1014AV00CAB 1	C9549FTB2015 1014AV00CAB 1	C9549FTB2015 1014AV00CAB 1
Start File	AD000000	BD001100	CD001500	DD003300	ED003700
Finish File	AD001100	BD001501	CD004300	DD003900	ED003700
Post-Verification	GV00CAA1	GV00CAA1	GV00CAA1	GV00CAA1	GV00CAA1
Depth Return Error (in.)	N/A	N/A	N/A	N/A	N/A
Comments	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made

SGLS Log Run Information

Log Run	**6**	**7**	**12**	**13**	**14 Repeat**
HEIS Number	1013053	1013054	1013055	1013056	1013057
Date	10/14/15	10/14/15	02/01/16	02/01/16	02/01/16
Logging Engineer	Felt	Felt	Spatz	Spatz	Spatz
Start Depth (ft)	29.0	22.0	42.0	198.0	42.0
Finish Depth (ft)	29.0	22.0	197.0	199.0	58.0
Count Time (sec)	500	500	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9549FTB2015 1014AV00CAB 1	C9549FTB2015 1014AV00CAB 1	C9549FTB2016 0201AV00CAB 1	C9549FTB2016 0201AV00CAB 1	C9549FTB2016 0201AV00CAB 1
Start File	FD002900	GD002200	AD004200	BD019800	CD004200
Finish File	FD002900	GD002200	AD019700	BD019900	CD005800
Post-Verification	GV00CAA1	GV00CAA1	CV00CAA1	CV00CAA1	CV00CAA1
Depth Return Error (in.)	N/A	3.0 high	N/A	N/A	3.0 high

Log Run	6	7	12	13	14 Repeat
Comments	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made

HRLS Log Run Information

Log Run	10	11			
HEIS Number	1013058	1013059			
Date	10/19/15	10/19/15			
Logging Engineer	Felt	Felt			
Start Depth (ft)	10.0	11.0			
Finish Depth (ft)	15.0	12.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
Log Speed (ft/min)	N/A	N/A			
Pre-Verification	C9549FTB2015 1019AV00CAB 1	C9549FTB2015 1019AV00CAB 1			
Start File	AD001000	BD001100			
Finish File	AD001500	BD001200			
Post-Verification	BV00CAA1	BV00CAA1			
Depth Return Error (in.)	N/A	1.0 high			
Comments	No fine gain adjustments made	No fine gain adjustments made			

NMLS Log Run Information

Log Run	8	9 Repeat	15	16	17 Repeat
HEIS Number	1013060	1013061	1013062	1013063	1013064
Date	10/15/15	10/15/15	02/01/16	02/02/16	02/02/16
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	0.0	33.0	42.0	147.0	115.0
Finish Depth (ft)	43.0	38.0	148.0	200.0	131.0
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
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9549FPB20151 015AV00CAB1	C9549FPB20151 015AV00CAB1	C9549FPB20160 201BV00CAB1	C9549FPB20160 202BV00CAB1	C9549FPB20160 202BV00CAB1
Start File	CD000000	DD003300	AD004200	BD014700	CD011500
Finish File	CD004300	DD003800	AD014800	BD020000	CD013100
Post-Verification	DV00CAA1	DV00CAA1	AV00CAA1	CV00CAA1	CV00CAA1
Depth Return Error (in.)	N/A	0.0	2.0 high	N/A	N/A
Comments	None	None	None	None	6.0 high

Logging Operation Notes

A centralizer was not installed on the sondes. Sondes and logging cable were sleeved in plastic material for the logging conducted from ground surface to 43 ft to prevent potential contamination of equipment.

Pre- and post-survey verification measurements met the acceptance criteria for the established systems.

Analysis Notes

Analyst	P.D. Henwood	**Date**	02/17/16
Reference(s)	SGRP-PRO-OP-53040, Rev. 0; SGRP-PRO-OP-53051, Rev. 0		

A casing correction for a 5/8-in. thick casing was applied to 45 ft and for a 1/2-in. thick casing for the remainder of the borehole.

No correction for water was necessary throughout the borehole.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL templates identified as FTB20150319_CC115 and FTB20160113_CC134 for the SGLS and 20150730_FC_123 for the HRLS, using an efficiency function and corrections for casing and dead time as determined by annual calibrations.

NMLS data are reported in counts per second as there is no calibration for casing sizes used in this borehole.

HGU[6] is an empirical unit of gamma activity proposed as a means to standardize gamma log response across multiple logging systems with different response characteristics. The HGU is defined in terms of measurements in the Hanford Borehole Calibration Facility, and the magnitude is selected such that 1 HGU is approximately equivalent to typical Hanford background activity, based on data from background samples as reported in *Hanford Site Background Part 2, Soil Background for Radionuclides* (DOE/RL-96-12).

Results and Interpretations

Cs-137 was detected from ground surface to 72 ft, from 81 to 92 ft and from 119 to 124 ft. A high activity zone from 10 to 15 ft required the HRLS to measure concentrations. The maximum concentration was measured at approximately 37,000 pCi/g at a12-ft depth.

No other manmade radionuclides were detected in the borehole. MDLs are plotted for manmade uranium which is indicated by the Pa-234m gamma ray at 1001 keV for U-238 and the U-235 gamma ray at 186 keV.

The neutron moisture log primarily responds to moisture present in the surrounding formation. In general, an increase in count rate reflects an increase in moisture content. Moisture content may increase in sediments of relatively high silt or clay content. A relatively high count rate that appears to approach saturation is indicated at approximately 125 ft. The source of this moisture is not known.

The Manmade, KUT, and moisture repeat plots indicate that the respective systems were working properly. Repeat data for the moisture from depths of 115 to 131 ft suggest a depth discrepancy of approximately 0.5 ft which is consistent with the depth return error reported at the end of the day's logging.

Casing joints are indicated at ten ft intervals where the radionuclide concentrations, total gamma, and moisture exhibit relatively lower values.

[6] Hanford Gamma Unit

List of Log Plots

Depth Reference is ground surface.

Manmade Radionuclides (0-210 ft)
Natural Gamma Logs (0-160 ft)
Natural Gamma Logs (150-310 ft)
Combination Plot (0-120 ft)
Combination Plot (110-230 ft)
Combination Plot (0-210 ft)
Total Gamma & Moisture (0-210 ft)
Total Gamma & Hanford Gamma Unit (0-210 ft)
Repeat of Manmade Radionuclides (33-39 ft)
Repeat of Manmade Radionuclides (42-58 ft)
Repeat Section of Natural Gamma Logs (33-39 ft)
Repeat Section of Natural Gamma Logs (42-58 ft)
Moisture Repeat Section (33-38 ft)
Moisture Repeat Section (115-131 ft)

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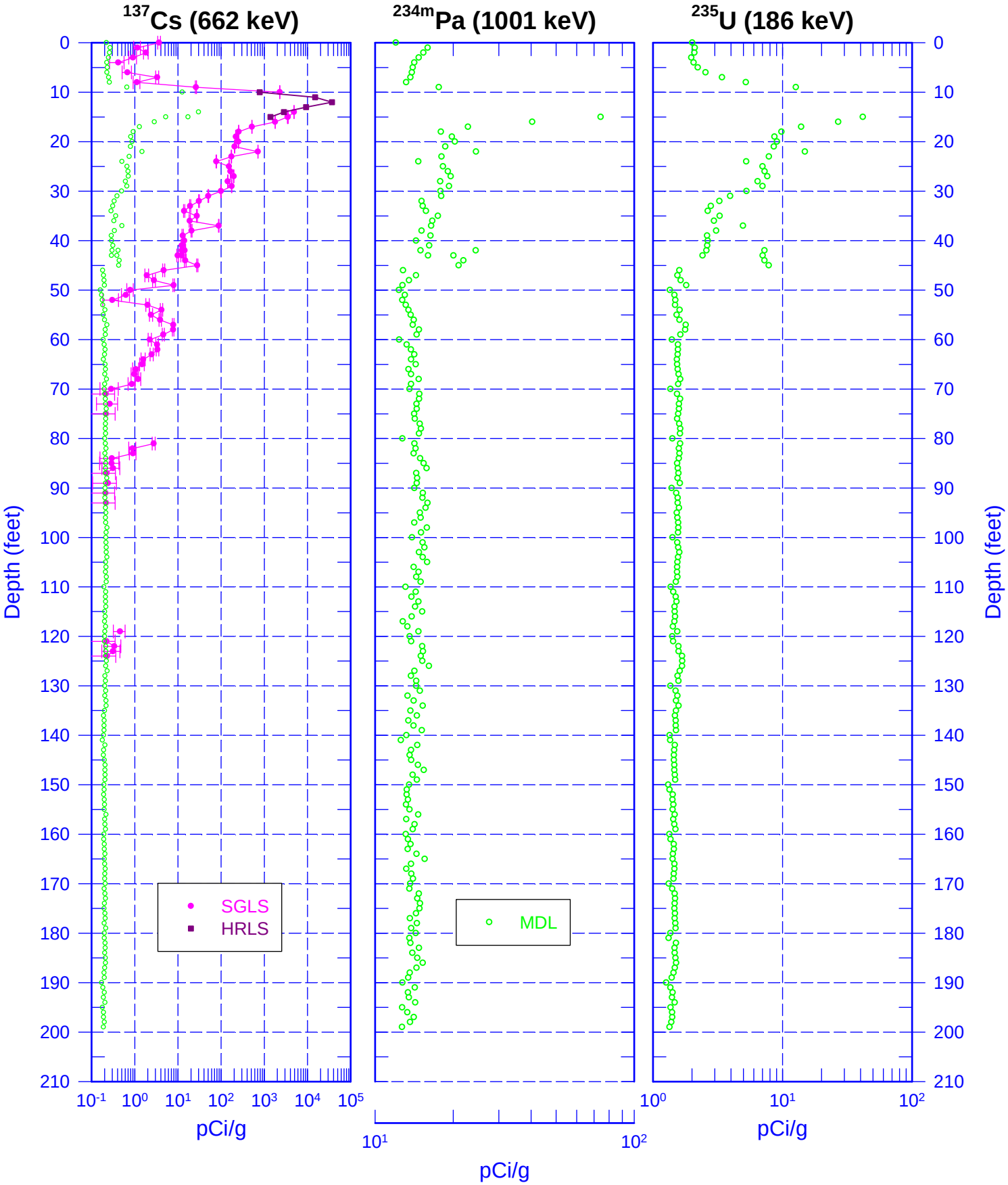
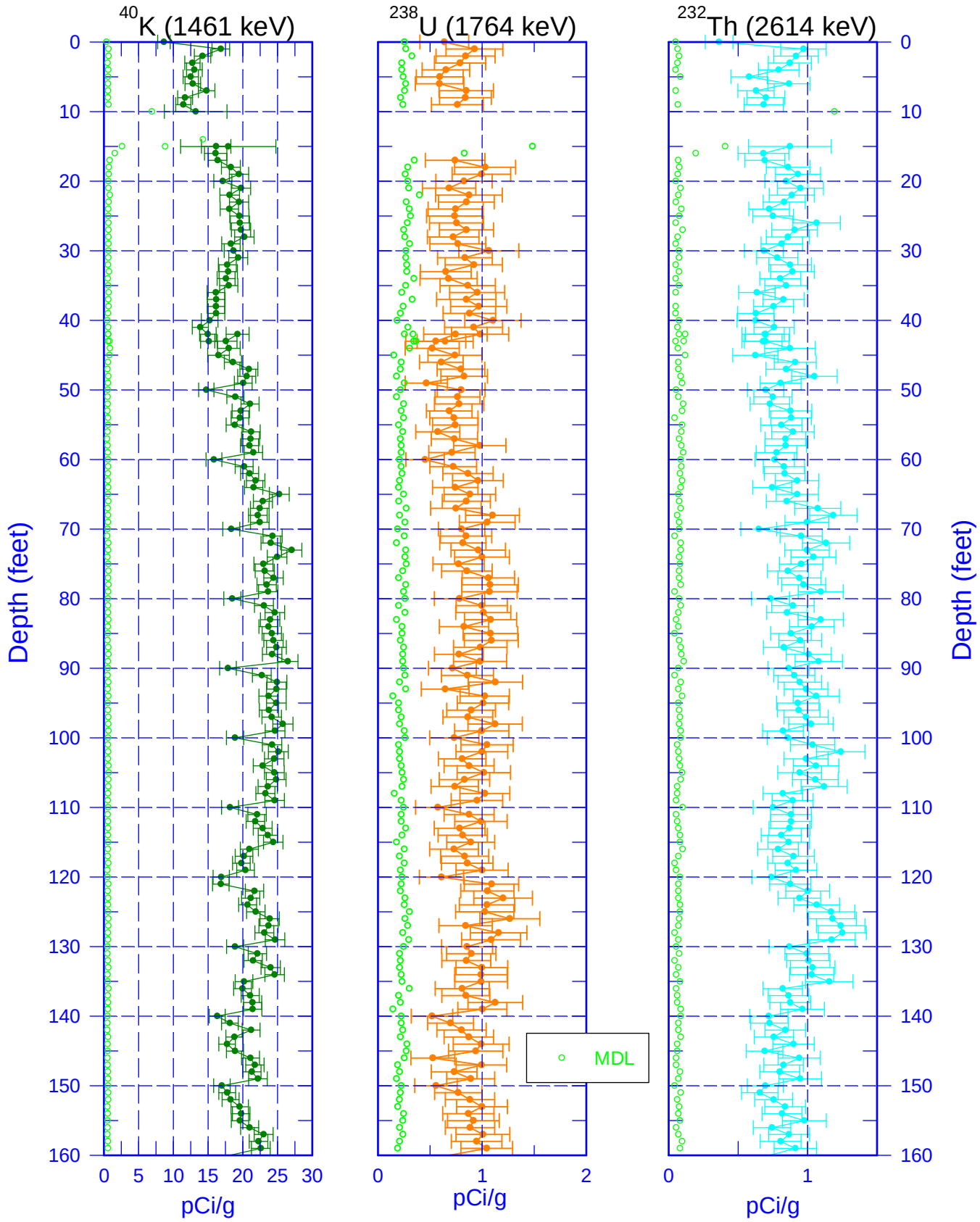
C9549
Manmade Radionuclides



Zero Reference - Ground Surface

SGW-60265, REV. 0

C9549
Natural Gamma Logs



Zero Reference - Ground Surface

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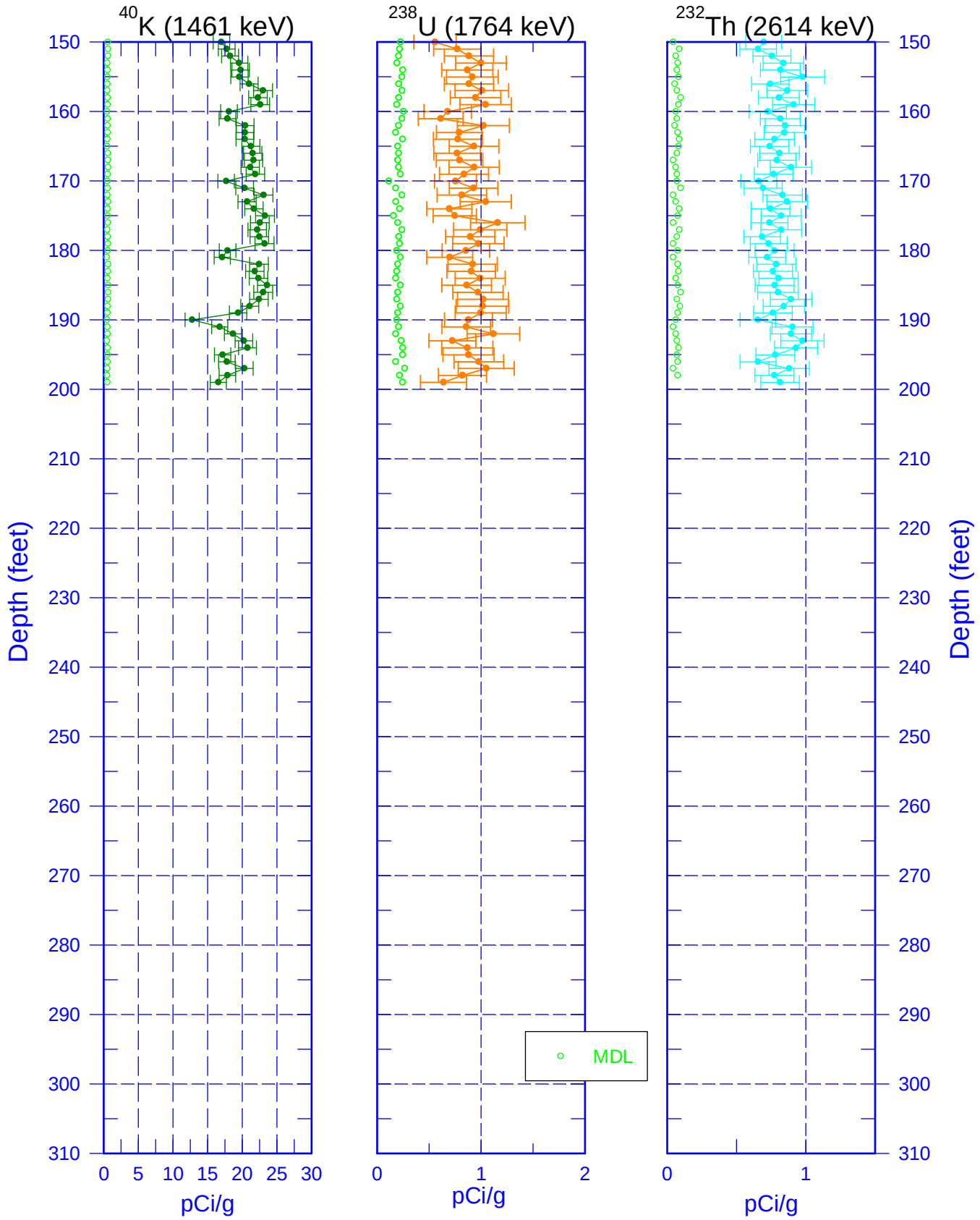
C9549
Natural Gamma Logs



Zero Reference - Ground Surface

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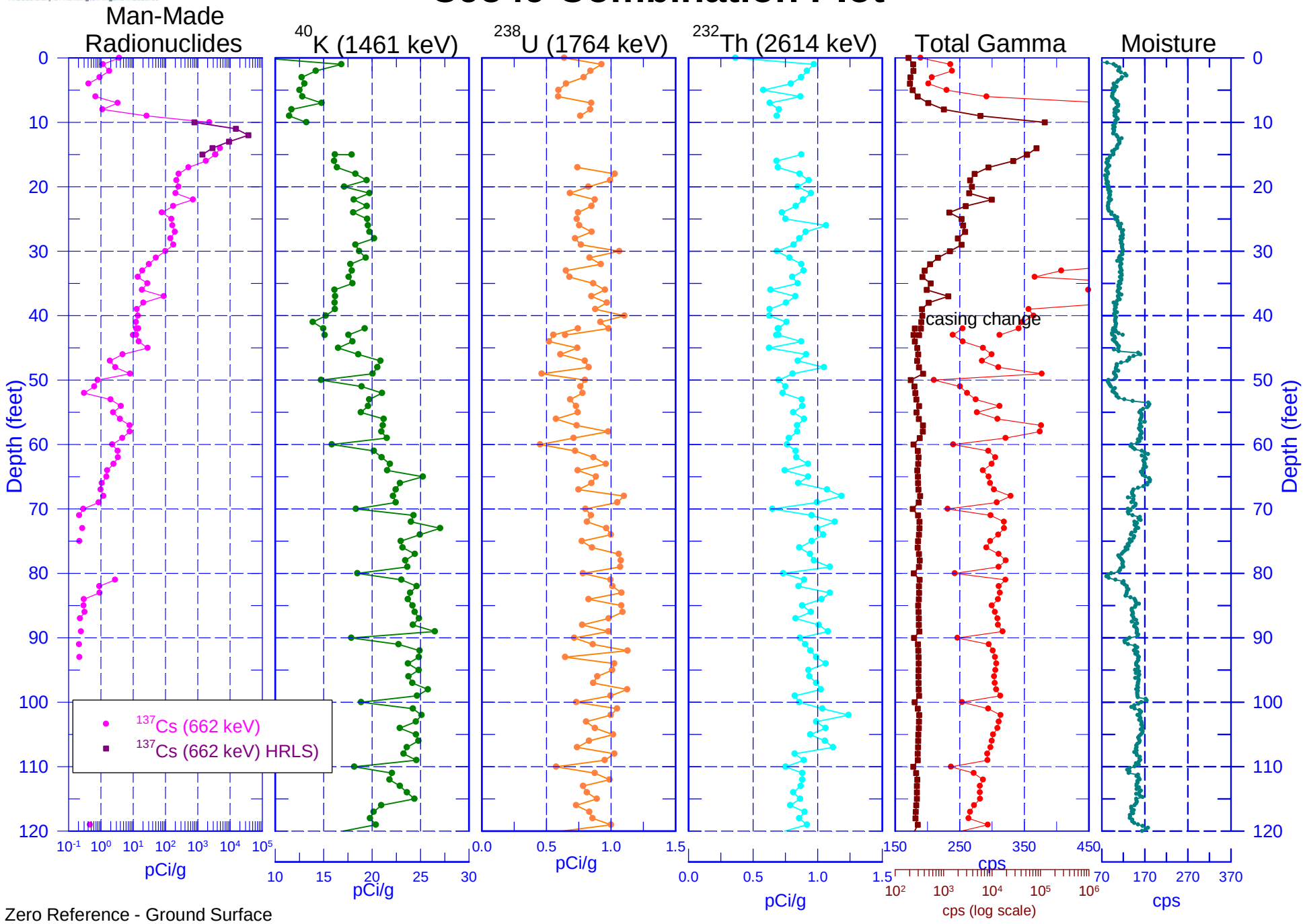
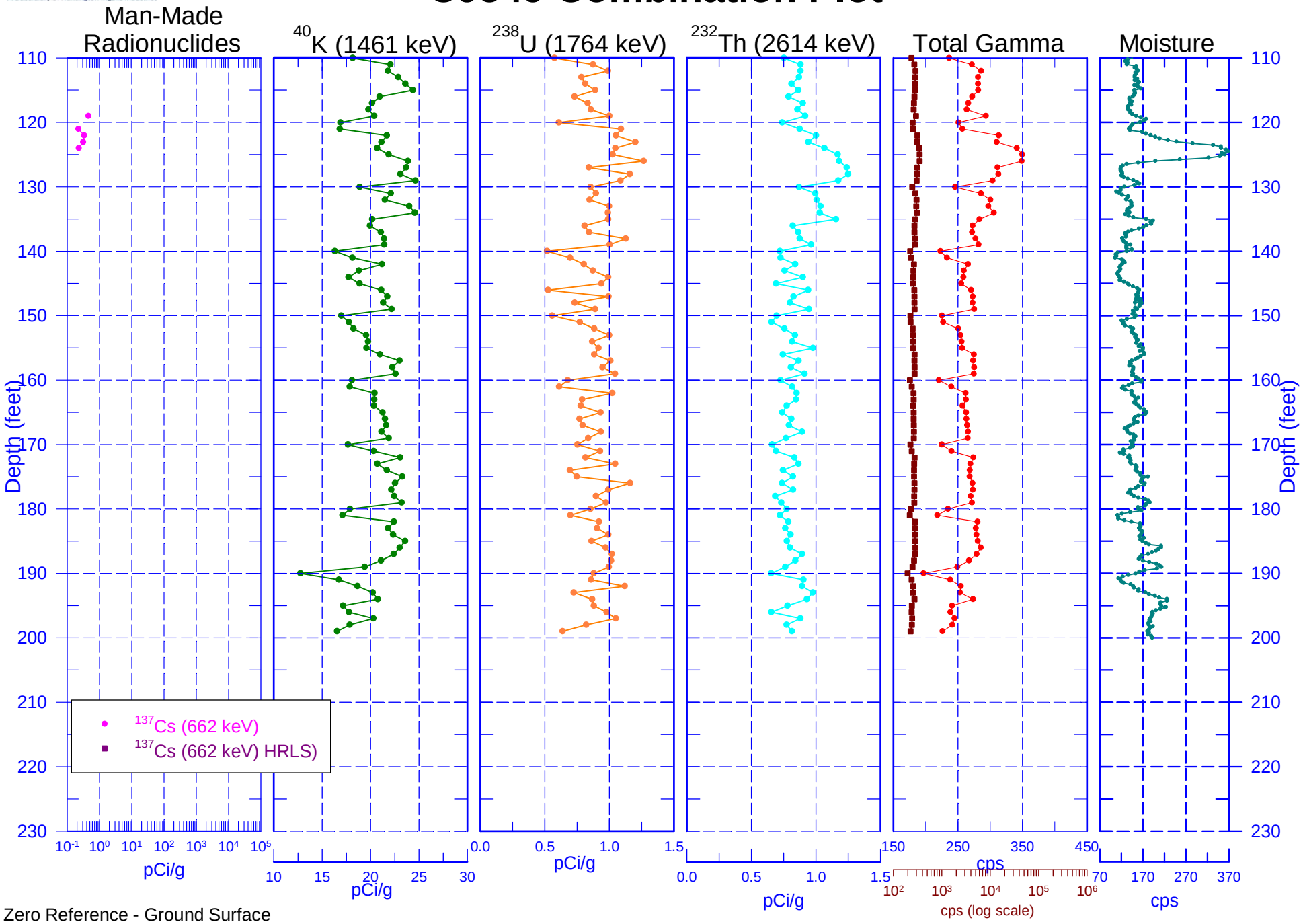
C9549 Combination Plot



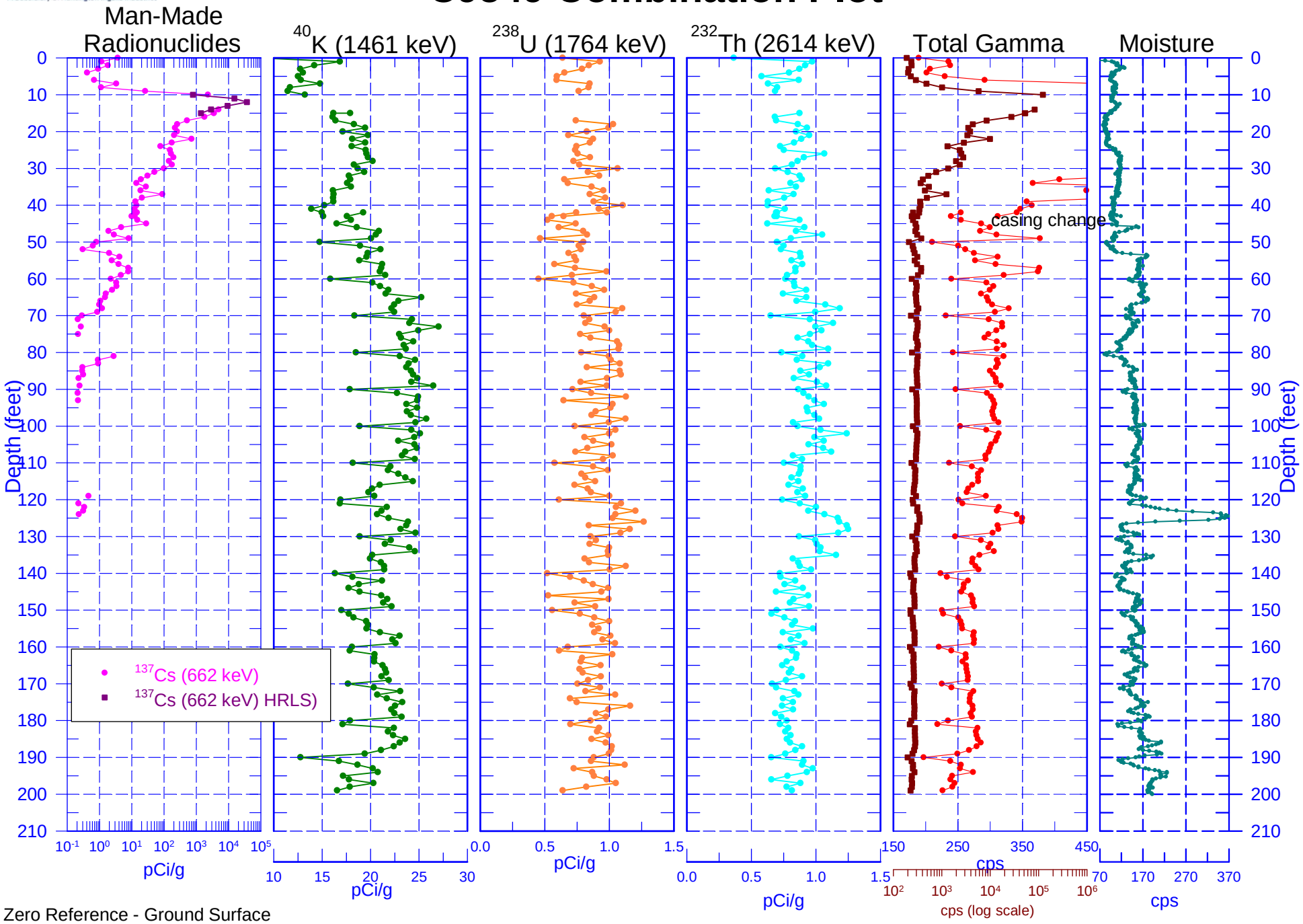
Zero Reference - Ground Surface

C9549 Combination Plot



Zero Reference - Ground Surface

C9549 Combination Plot



Zero Reference - Ground Surface

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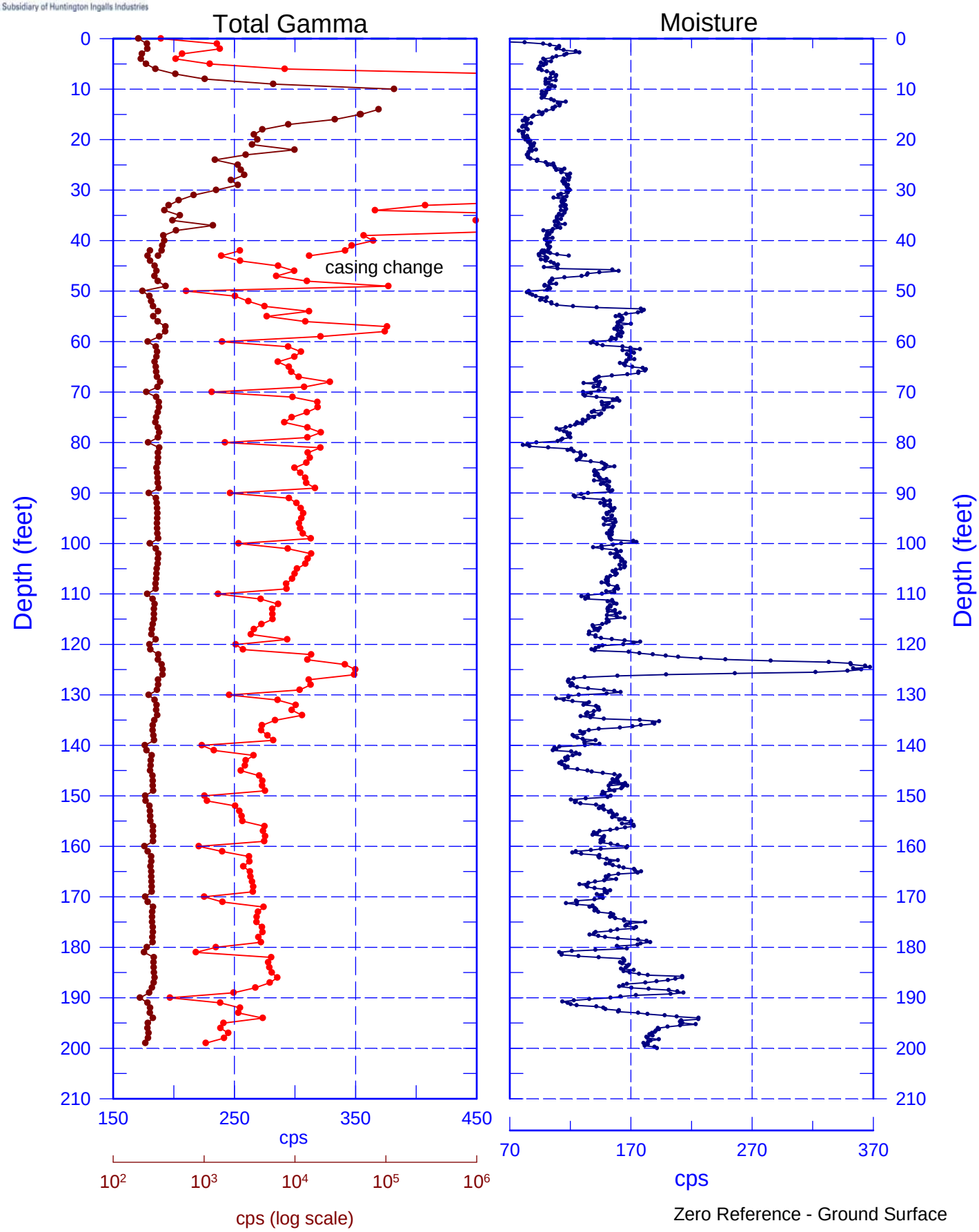
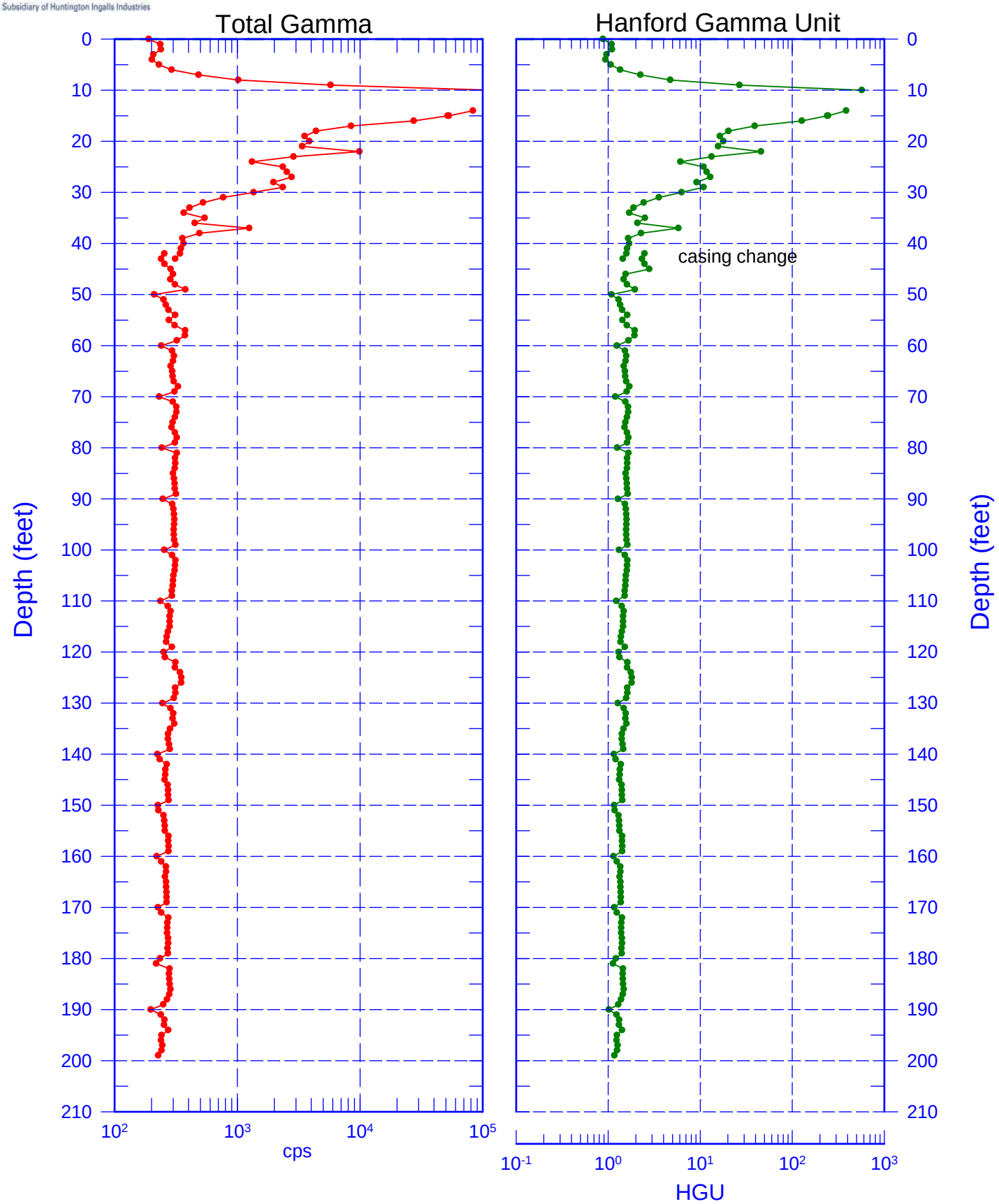
C9549
Total Gamma & Moisture

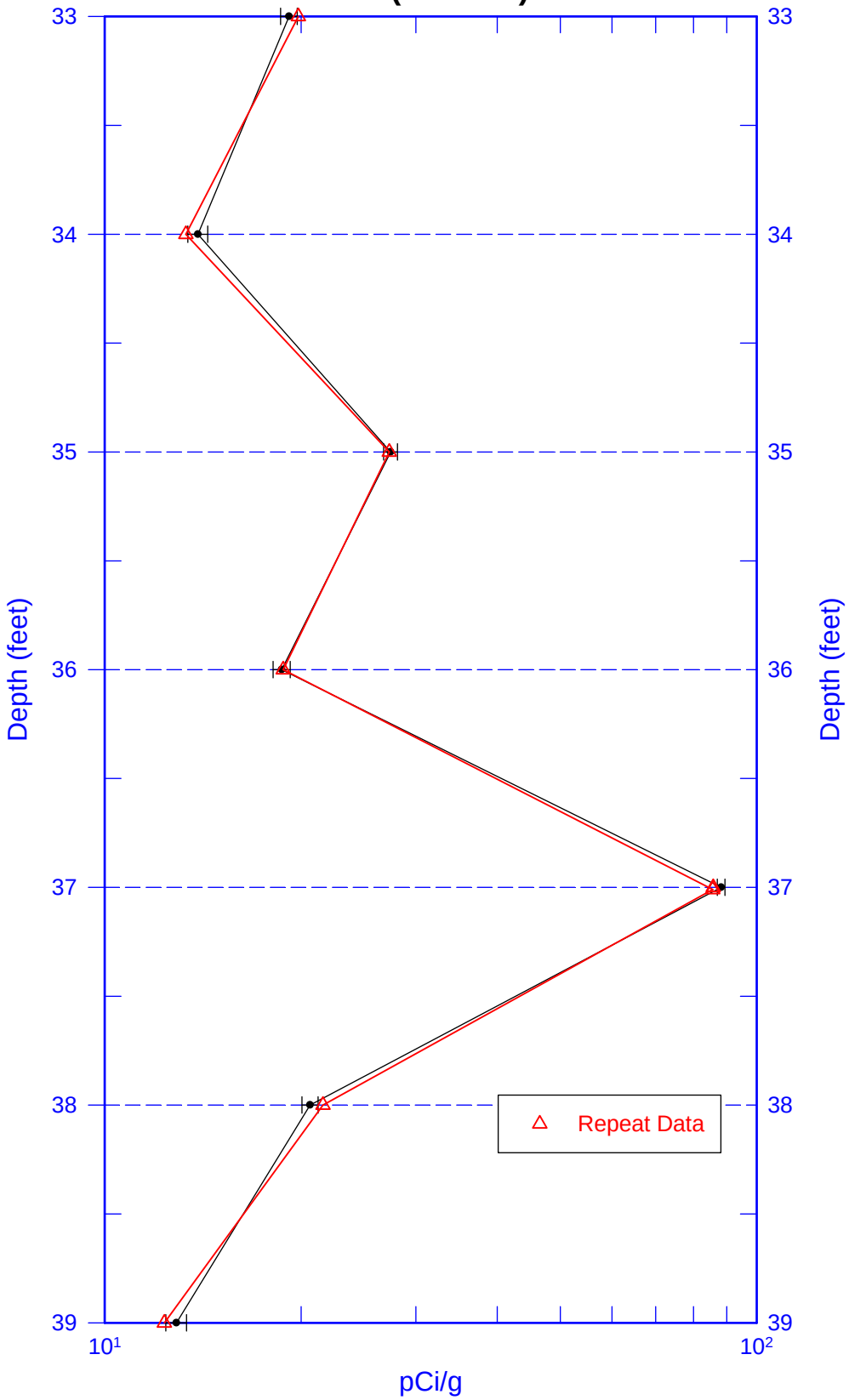


C9549
Total Gamma & Hanford Gamma Unit



Zero Reference - Ground Surface

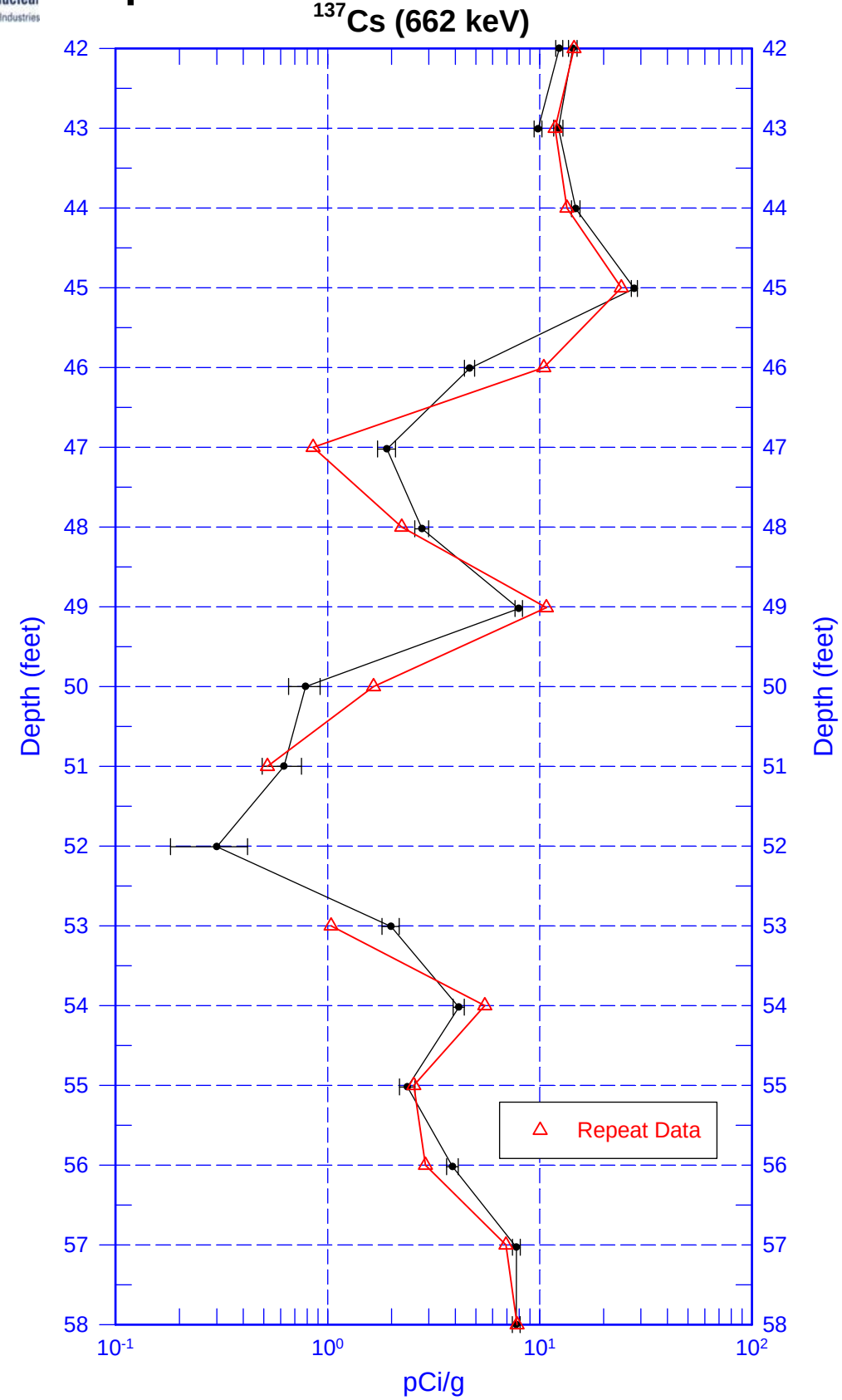
C9549
Repeat of Manmade Radionuclides
^{137}Cs (662 keV)



Zero Reference - Ground Surface

C9549

Repeat of Manmade Radionuclides



Zero Reference - Ground Surface

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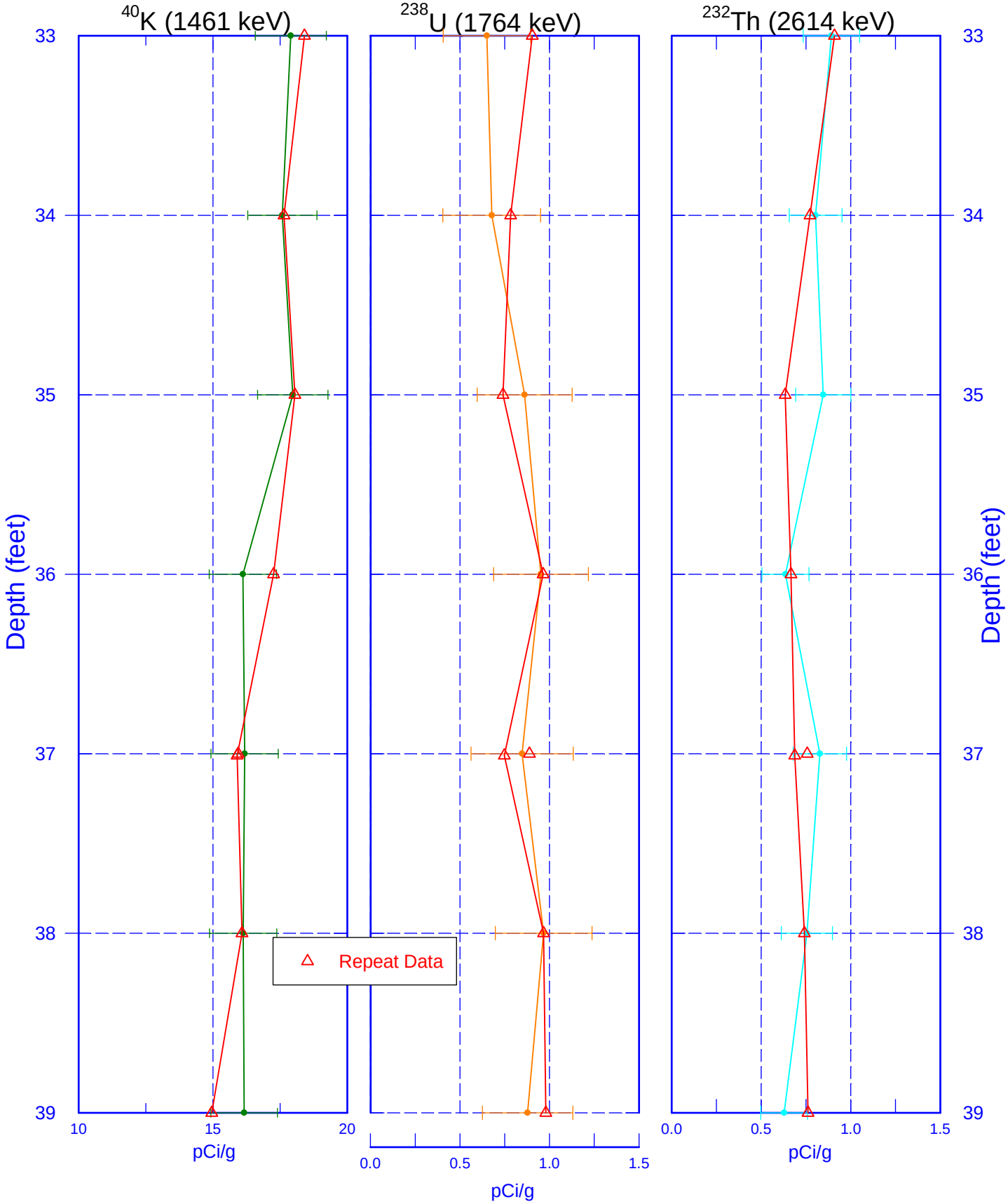
C9549

Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

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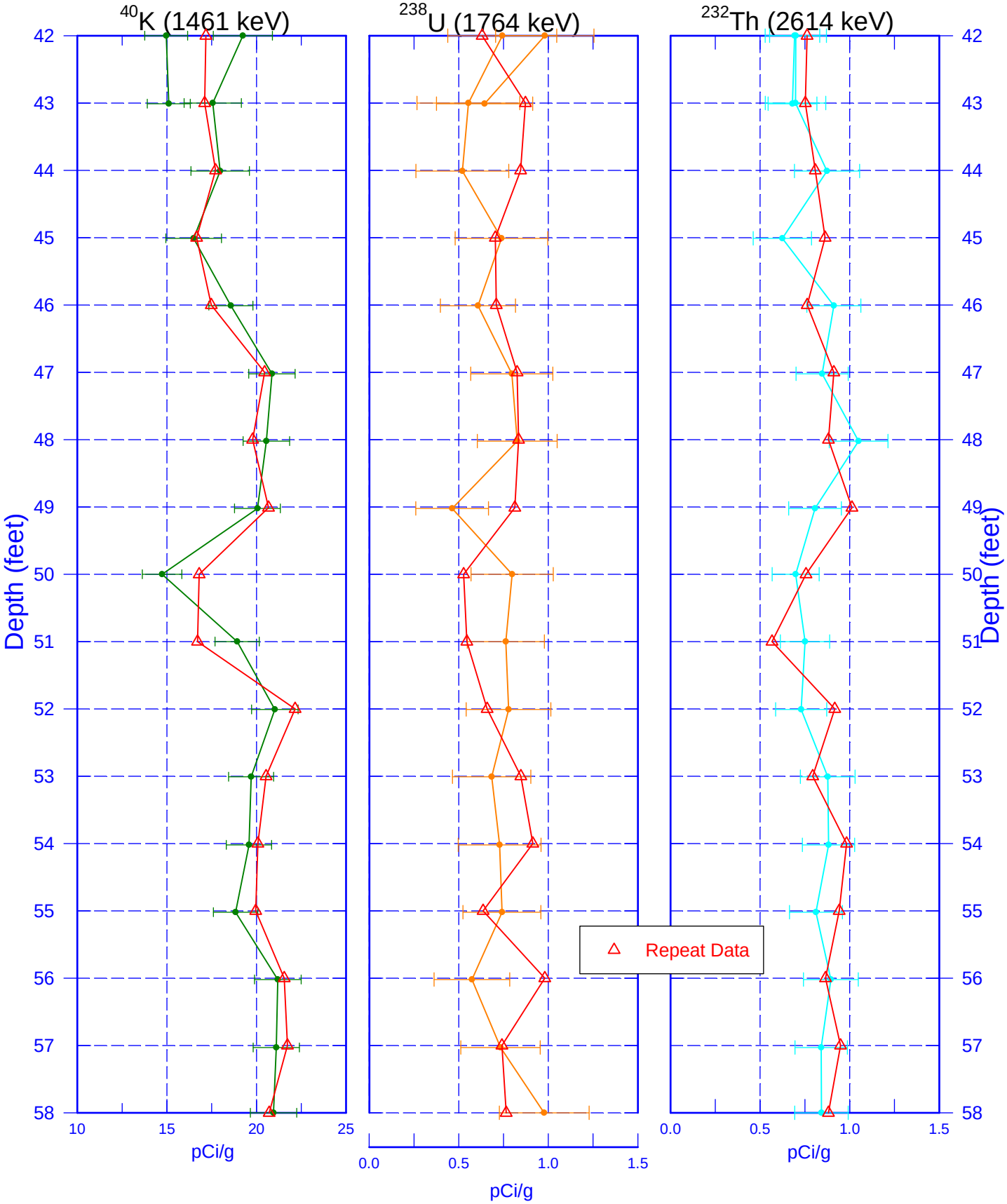
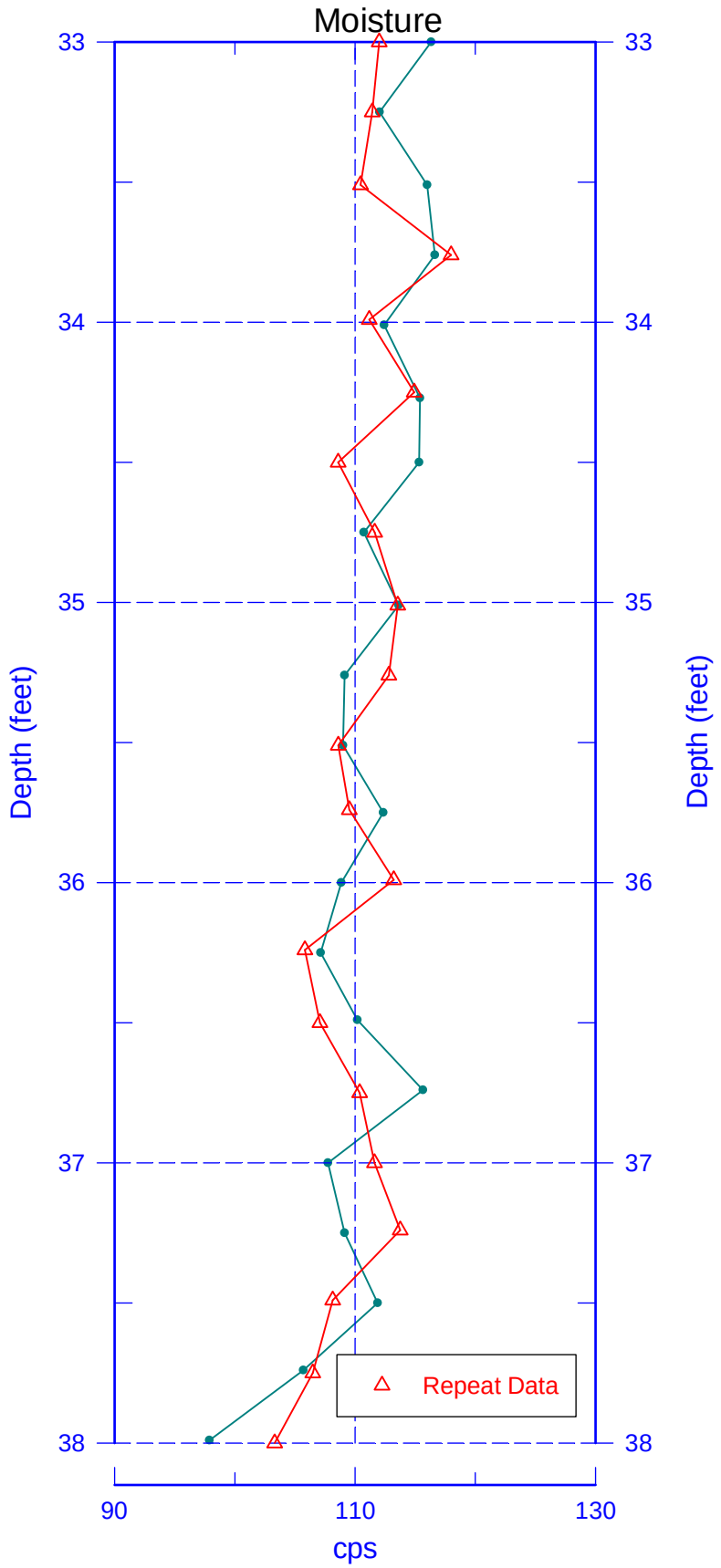
C9549

Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

C9549
Moisture Repeat Section



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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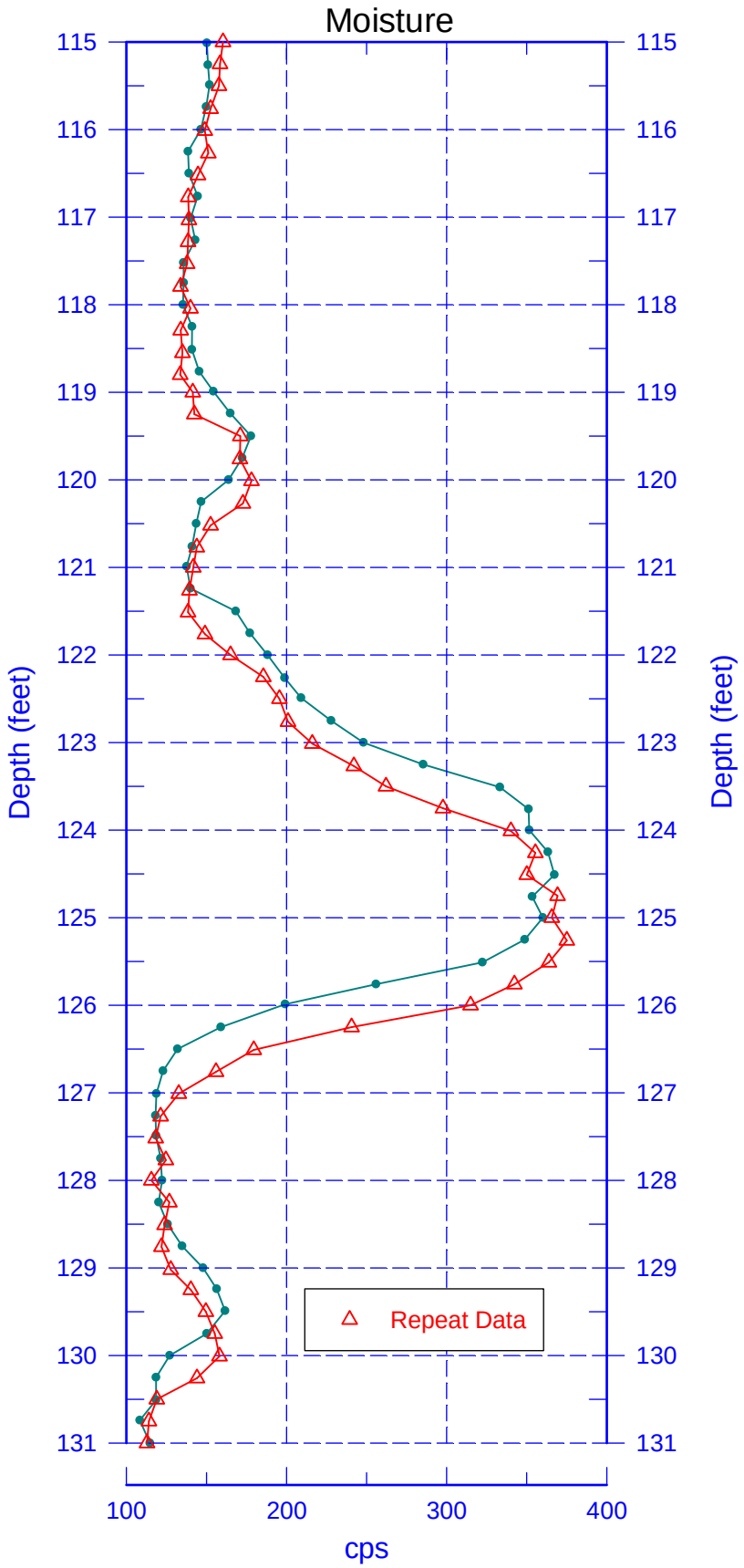
C9549
Moisture Repeat Section



Zero Reference - Ground Surface

Appendix A

HGLP-LDR-891

Stoller Newport News Nuclear

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C9549
Log Data Report

Borehole Information

Borehole	-	Well ID	C9549	Client	CHPRC
Log Date	Engineer		Depth Reference		Site
1/28/2016	Felt, Spatz		Ground Surface		BY Cribs (200-DV-1)

Log Run Information

Logging System	Borehole Deviation	Model	DG69-0901-4 #4654
Calibration Date	12/15/2015	Calibration Reference	HGLP-CC-135, Rev. 0
		Logging Procedure	SGRP-PRO-OP-53034

Log File	C9549_DV-1.raw	Report File	C9549_DV-1.rpt
Sight Line	004	Magnetic Declination	-15.15

Measured Depth (feet)	Course Inclin. From Vert (°)	Course Direction (deg)	Closure Direction (deg)	TrueVert. Depth (feet)	Rectangular Coordinates		Dogleg Severity °/100 ft	Closure Distance (feet)
					+N/-S	+E/-W		
0	0.19	222.8	0	0	0	0	0	0
20	0.67	79.7	92.27	20	0	0.09	4.2	0.09
40	0.94	78.9	82.44	40	0.05	0.37	1.3	0.37
60	0.92	85.7	82.36	60	0.09	0.69	0.6	0.69
80	0.87	88.6	83.84	79.99	0.11	1	0.3	1
100	0.91	83.4	84.33	99.99	0.13	1.31	0.5	1.32
120	0.91	87.6	84.56	119.99	0.15	1.62	0.3	1.63
140	1	90.7	85.35	139.98	0.16	1.96	0.5	1.96
160	0.94	90.4	86.12	159.98	0.16	2.3	0.3	2.3
180	0.89	90	86.62	179.98	0.15	2.62	0.3	2.62
198.27	0.87	91.9	87.03	198.25	0.15	2.9	0.2	2.9

Analysis Notes

Analyst	K. Felt	Date	2/15/2016

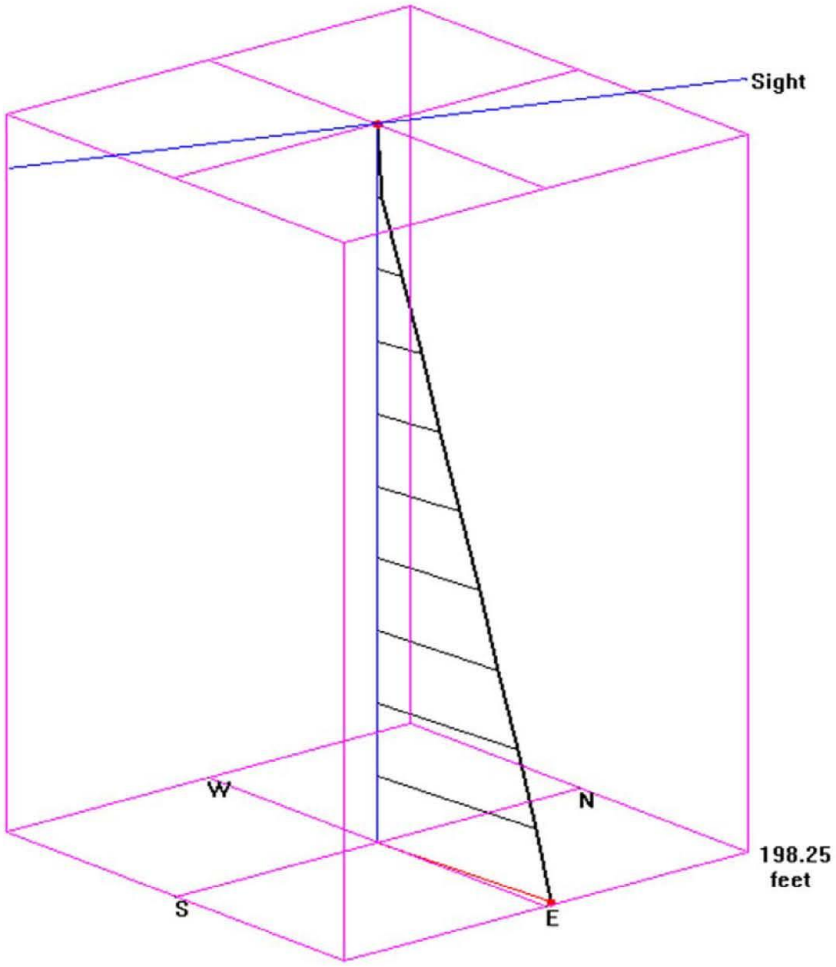
Plots are for illustrative purposes. Sight line is initial orientation of tool. Borehole trajectory determined by minimum curvature method. Refer to table for true vertical depth and N/S and E/W deviation in feet.

List of Log Plots

Borehole Deviation

C9549

Borehole Deviation



C9552
Log Data Report

Borehole Information

Log Date	2016-02-19	Filename	C9552_HG-NM_2016-02-19	Site	216-B-45 (DV-1)
Coordinates (WA St Plane)		DTW[1] (ft)	None	DTW Date	02/16/16

North (m)	East (m)	Drill Date	TOC[2] Elevation	Total Depth (ft)
N/A	N/A	02/16/16	N/A	202

Casing Information

Casing Type	Drill Type	Stickup (ft)	Diameter (in.) Outer	Diameter (in.) Inside	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	Becker Push	0.8	8 5/8	7 3/8	5/8	0.8	45.3
Threaded Steel	Sonic Core	-1.5	6	5	1/2	-1.5	202

Borehole Notes

C9552 was drilled as a replacement for C8709 and C9551, which met with refusal and were decommissioned without geophysical logging.

The onsite geologist provided the total depth and casing depth. The logging engineer measured casing stick-up and casing diameter (rounded to the nearest 1/16-in.). No water was in this borehole. The maximum logging depth achieved was 201 ft.

Zero reference is ground surface.

A borehole deviation survey was conducted after logging was complete and is included as Appendix A (HGLP-LDR-893).

Logging Equipment Information

Logging System	Gamma 5T	Type	60% HPGe SGLS[3]
Effective Calibration Date	03/19/15	Serial No.	54-TP13441B
Calibration Reference	HGLP-CC-115, Rev. 0	Logging Procedure	SGRP-PRO-OP-53023, Rev. 0

Logging System	Gamma 5P	Type	NMLS[4]
Effective Calibration Date	04/15/15	Serial No.	H34055445
Calibration Reference	HGLP-CC-116, Rev. 0	Logging Procedure	SGRP-PRO-OP-53024, Rev. 0

Logging System	Gamma 5T	Type	60% HPGe SGLS
Effective Calibration Date	01/13/16	Serial No.	54-TP13441B
Calibration Reference	HGLP-CC-134, Rev. 0	Logging Procedure	SGRP-PRO-OP-53023, Rev. 0

[1] depth to water inside casing
[2] top of casing
[3] Spectral Gamma Logging System
[4] Neutron Moisture Logging System

SGLS Log Run Information

Log Run	1	2 Repeat	3	4	5 Repeat
HEIS Number	1013084	1013085	1013086	1013087	1013088
Date	10/27/15	10/27/15	02/18/16	02/19/16	02/19/16
Logging Engineer	Felt	Felt	Felt	Felt	Felt
Start Depth (ft)	0.0	31.0	42.0	156.0	80.0
Finish Depth (ft)	43.0	36.0	157.0	201.0	96.0
Count Time (sec)	100	100	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9552FTB2015 1027AV00CAB 1	C9552FTB2015 1027AV00CAB 1	C9552FTB2016 0218AV00CAB 1	C9552FTB2016 0218AV00CAB 1	C9552FTB2016 0218AV00CAB 1
Start File	AD000000	BD003100	AD004200	BD015600	CD008000
Finish File	AD004300	BD003600	AD015700	BD020100	CD009600
Post-Verification	BV00CAA1	BV00CAA1	AVV00CAA	CVV00CAA	CVV00CAA
Depth Return Error (in.)	N/A	0.0	HIGH 2.0	N/A	HIGH 3.0
Comments	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made

NMLS Log Run Information

Log Run	8	9 Repeat	15	16 Repeat	
HEIS Number	1013089	1013090	1013091	1013092	
Date	10/27/15	10/27/15	02/19/16	02/19/16	
Logging Engineer	Felt	Felt	Felt	Felt	
Start Depth (ft)	0.0	31.0	42.0	180.0	
Finish Depth (ft)	43.0	36.25	201.0	196.0	
Count Time (sec)	15	15	15	15	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	0.25	0.25	0.25	0.25	
Log Speed (ft/min)	N/A	N/A	N/A	N/A	
Pre-Verification	C9552FPB20151 027AV00CAB1	C9552FPB20151 027AV00CAB1	C9552FPB20160 219AV00CAB1	C9552FPB20160 219AV00CAB1	
Start File	AD000000	BD003100	AD004200	BD018000	
Finish File	AD004300	BD003625	AD020100	BD019600	
Post-Verification	BV00CAA1	BV00CAA1	BV00CAA1	BV00CAA1	
Depth Return Error (in.)	N/A	HIGH 0.5	N/A	HIGH 2.0	
Comments	None	None	None	None	

Logging Operation Notes

A centralizer was installed on both sondes during logging of the first casing string, but not during logging of the second casing string. Both sondes and the logging cable were sleeved in plastic material for the logging of the first casing string to prevent potential contamination of equipment. Only the sonde was sleeved during logging of the second casing string.

Pre- and post-survey verification measurements met the acceptance criteria for the established systems.

Analysis Notes

Analyst	A.D. Pope	**Date**	02/24/15
Reference(s)	SGRP-PRO-OP-53040, Rev. 0; SGRP-PRO-OP-53051, Rev. 0		

A casing correction for a 5/8-in. thick casing was applied to 45.3 ft and for a 1/2-in. thick casing for the remainder of the borehole.

No correction for water was necessary throughout the borehole.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL templates identified as FTB20150319_CC115 and FTB20160113_CC134 for the SGLS, using an efficiency function and corrections for casing and dead time as determined during annual response checks.

NMLS data are reported in counts per second.

HGU[5] is an empirical unit of gamma activity proposed as a means to standardize gamma log response across multiple logging systems with different response characteristics. The HGU is defined in terms of measurements in the Hanford Borehole Model Facility, and the magnitude is selected such that 1 HGU is approximately equivalent to typical Hanford background activity, based on data from background samples as reported in *Hanford Site Background Part 2, Soil Background for Radionuclides* (DOE/RL-96-12).

Results and Interpretations

Cs-137 was detected from ground surface to about 3 ft. Cs-137 was also observed from 23 and 113 ft, continuously from 42 to 97 ft and intermittently to sporadically elsewhere in the interval. The maximum concentration was measured at approximately 1.6 pCi/g at 68 ft.

Co-60 was detected continuously from 25 to 36 ft, and almost continuously from 85 to 200 ft. Two isolated detections also occur from 42 to 43 ft. Concentrations range from just above the MDL (about 0.1 pCi/g) to about 0.5 pCi/g, with the maximum occurring at 112 ft.

No other manmade radionuclides were detected in the borehole. MDLs are plotted for manmade uranium which is indicated by the Pa-234m gamma ray at 1001 keV for U-238 and the U-235 gamma ray at 186 keV.

The neutron moisture log primarily responds to moisture present in the surrounding formation. In general, an increase in count rate reflects an increase in moisture content. Moisture content may increase in sediments of relatively high silt or clay content. Below the casing change at around 44 ft, there appear to be thick intervals (>10 feet) of relatively higher and lower average soil moisture content occasionally punctuated with thinner horizons (< 5 feet) of higher moisture content.

The Manmade, KUT, and moisture repeat plots indicate that the respective systems were working properly.

Casing joints in the second casing string are indicated at ten ft intervals where the radionuclide concentrations, total gamma, and moisture exhibit relatively lower values.

[5] Hanford Gamma Unit

List of Log Plots

Depth Reference is ground surface.

Manmade Radionuclides (Cs-137/Co-60) (0-210 ft)
Manmade Radionuclides (U-238/U-235) (0-210 ft)
Natural Gamma Logs (0-210 ft)
Combination Plot (0-120 ft)
Combination Plot (110-230 ft)
Combination Plot (0-210 ft)
Total Gamma & Moisture (0-210 ft)
Total Gamma & Hanford Gamma Unit (0-210 ft)
Repeat of Manmade Radionuclides (31-36 ft)
Repeat of Manmade Radionuclides (80-96 ft)
Repeat Section of Natural Gamma Logs (31-36 ft)
Repeat Section of Natural Gamma Logs (80-96 ft)
Moisture Repeat Section (30-37 ft)
Moisture Repeat Section (180-196 ft)

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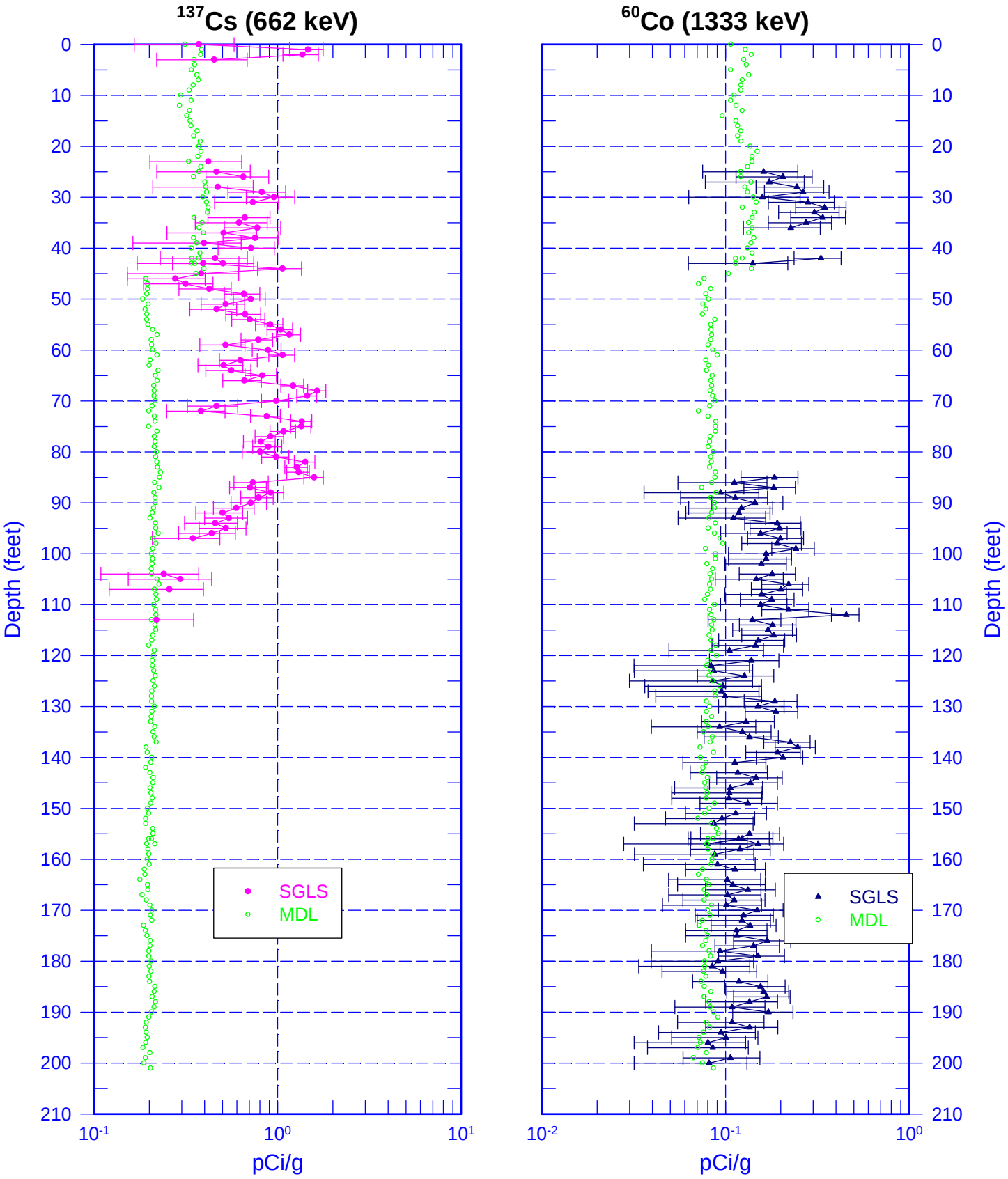
C9552
Manmade Radionuclides



Zero Reference - Ground Surface

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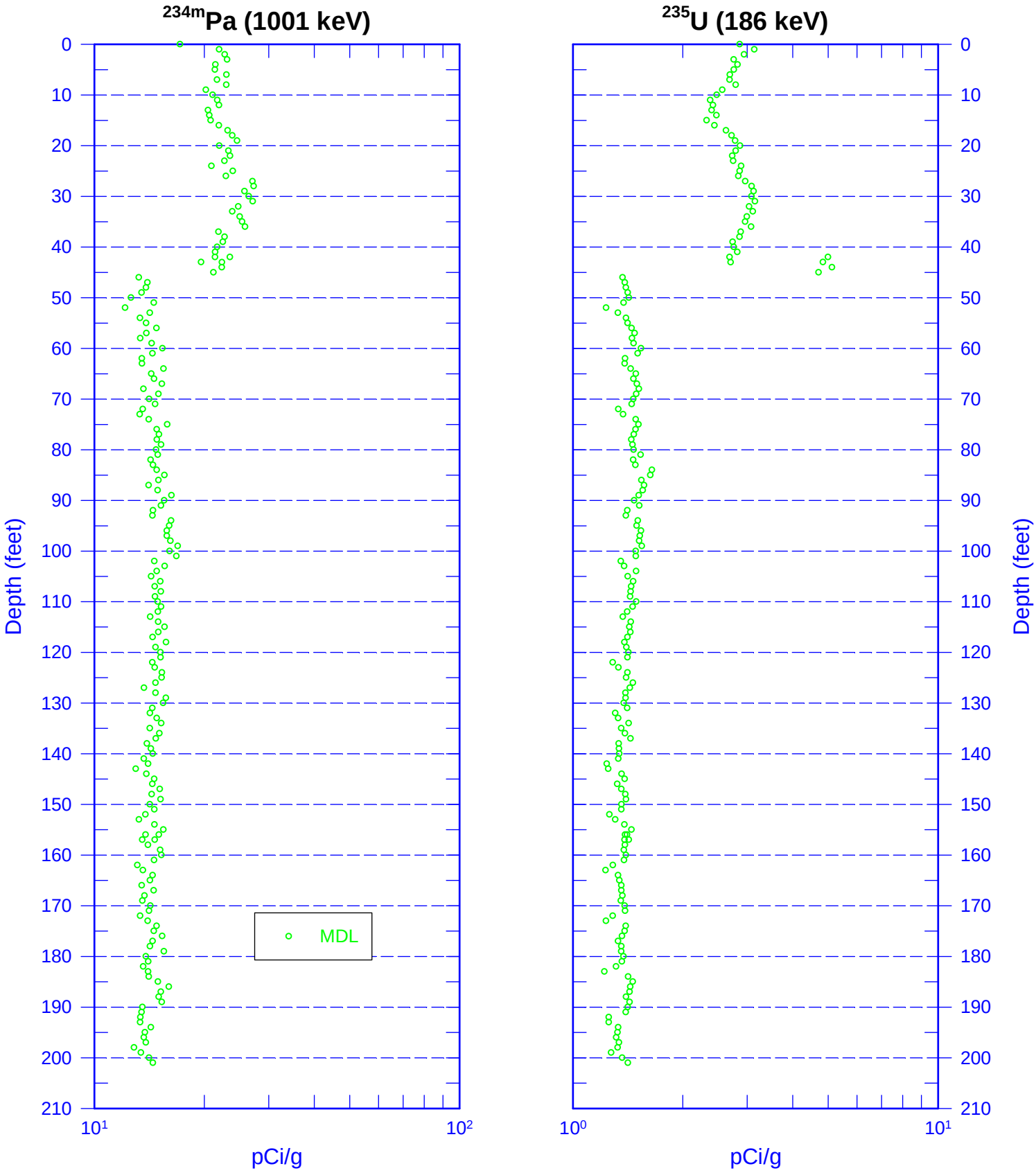
C9552
Manmade Radionuclides



Zero Reference - Ground Surface

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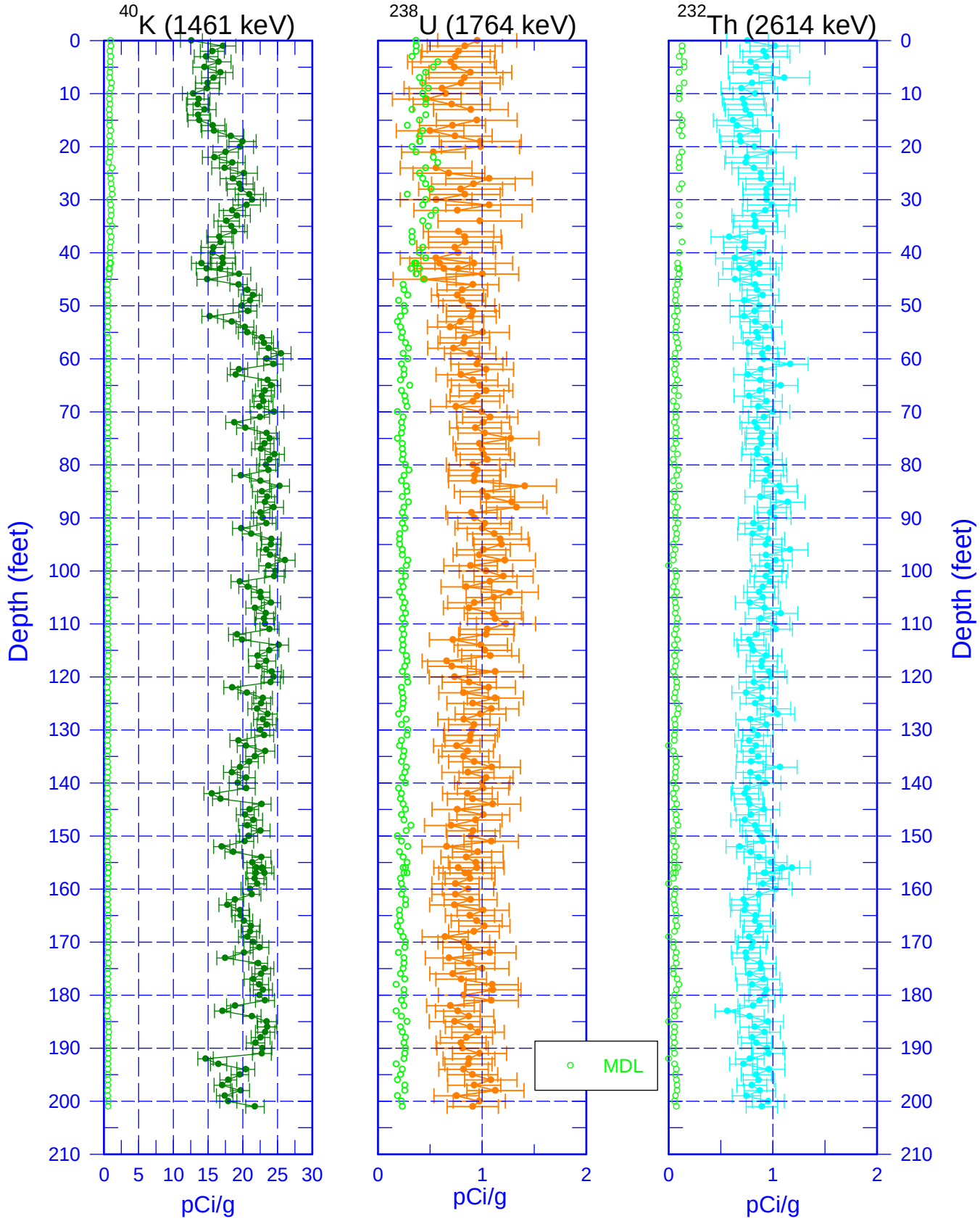
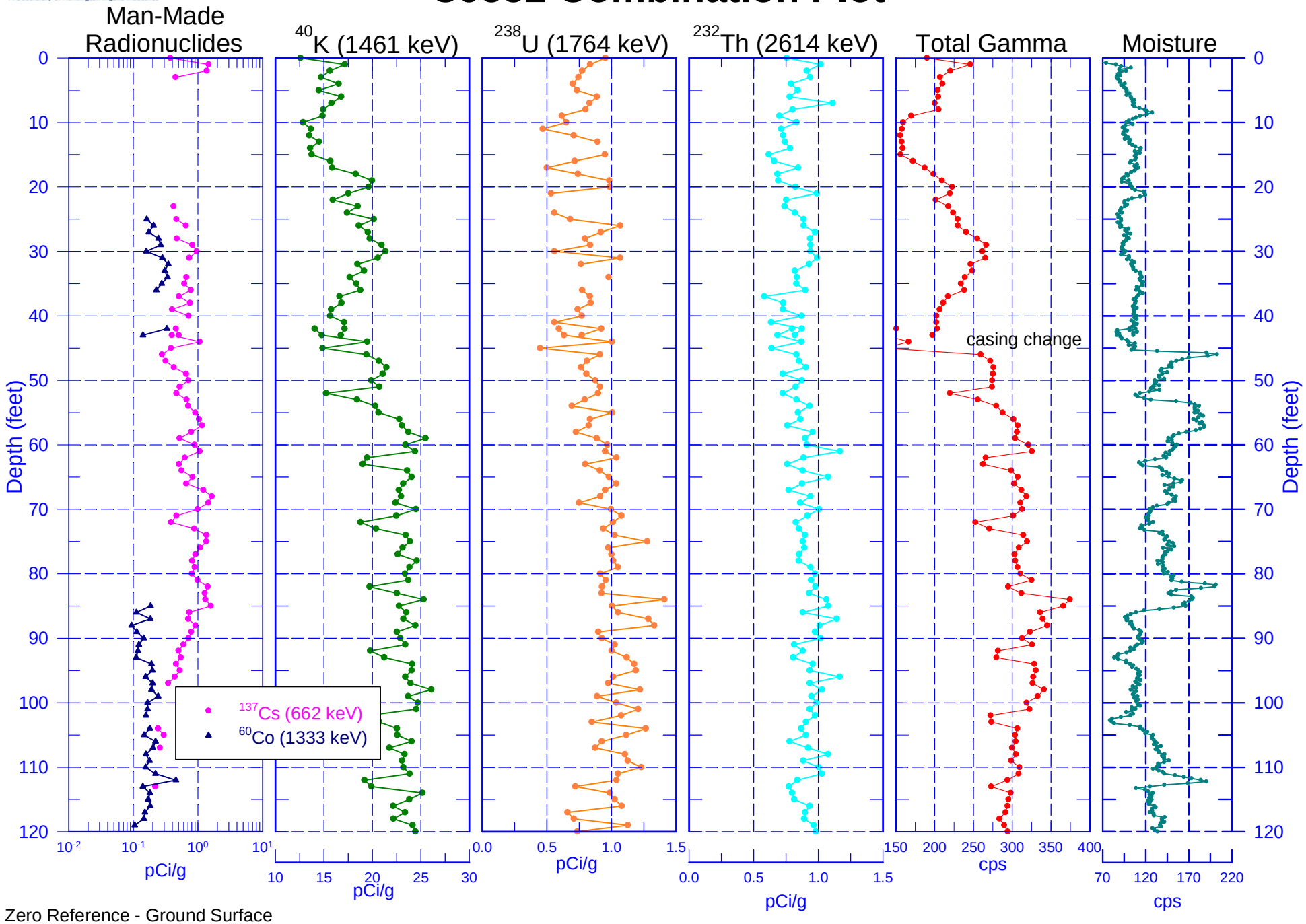
C9552
Natural Gamma Logs



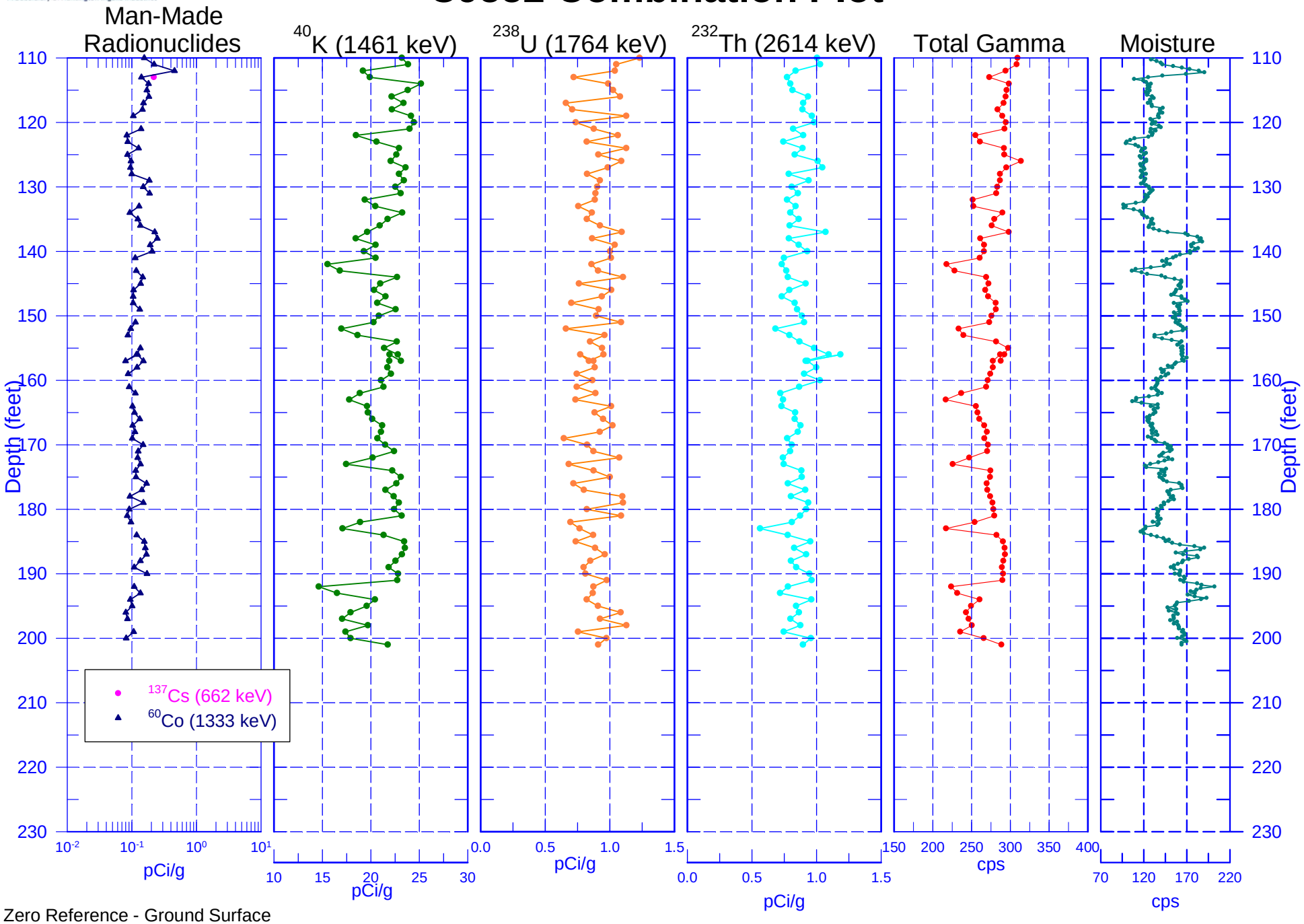
Zero Reference - Ground Surface

C9552 Combination Plot



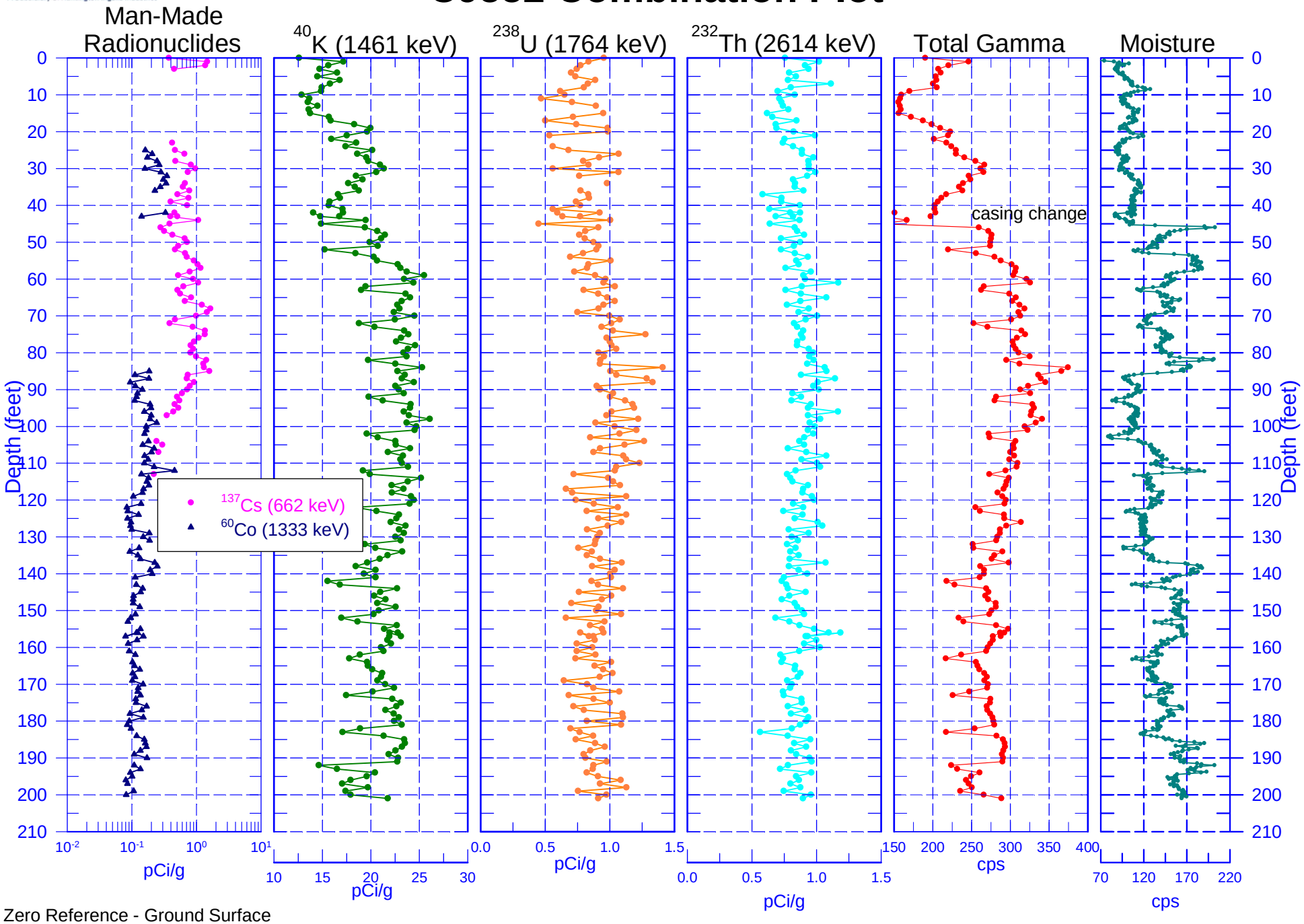
Zero Reference - Ground Surface

C9552 Combination Plot



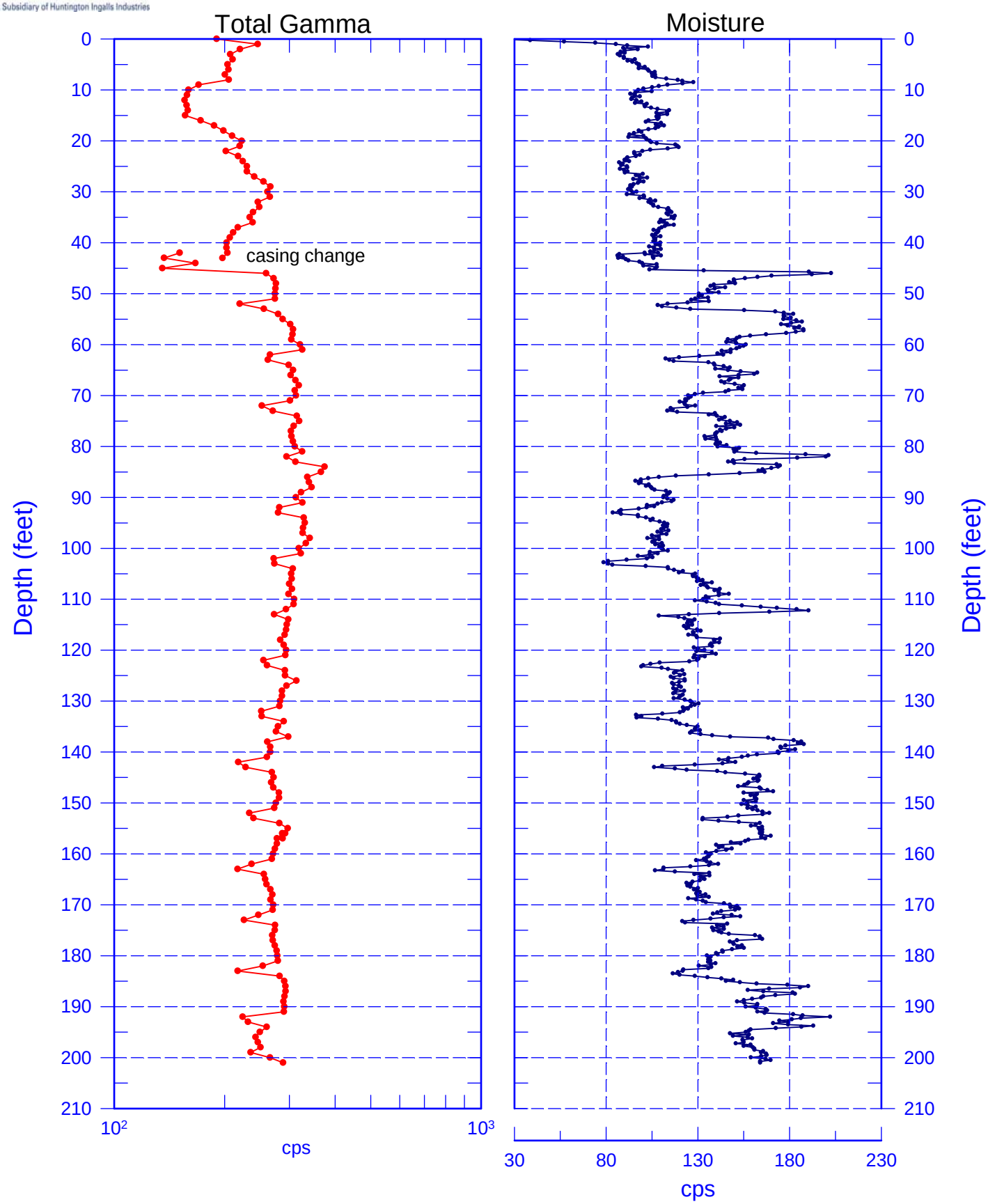
Zero Reference - Ground Surface

C9552 Combination Plot



Zero Reference - Ground Surface

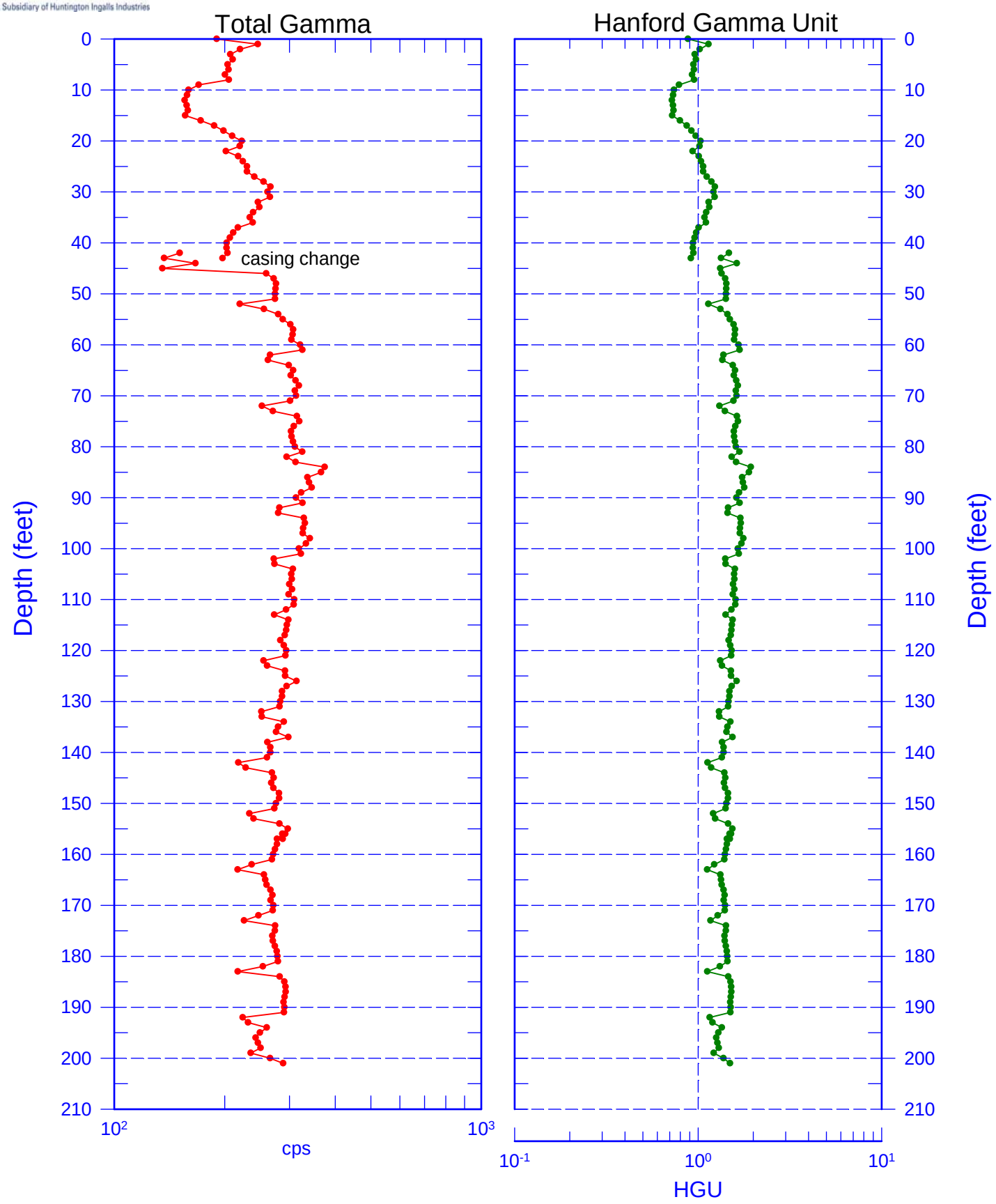
C9552
Total Gamma & Moisture



Zero Reference - Ground Surface

C9552

Total Gamma & Hanford Gamma Unit



Zero Reference - Ground Surface

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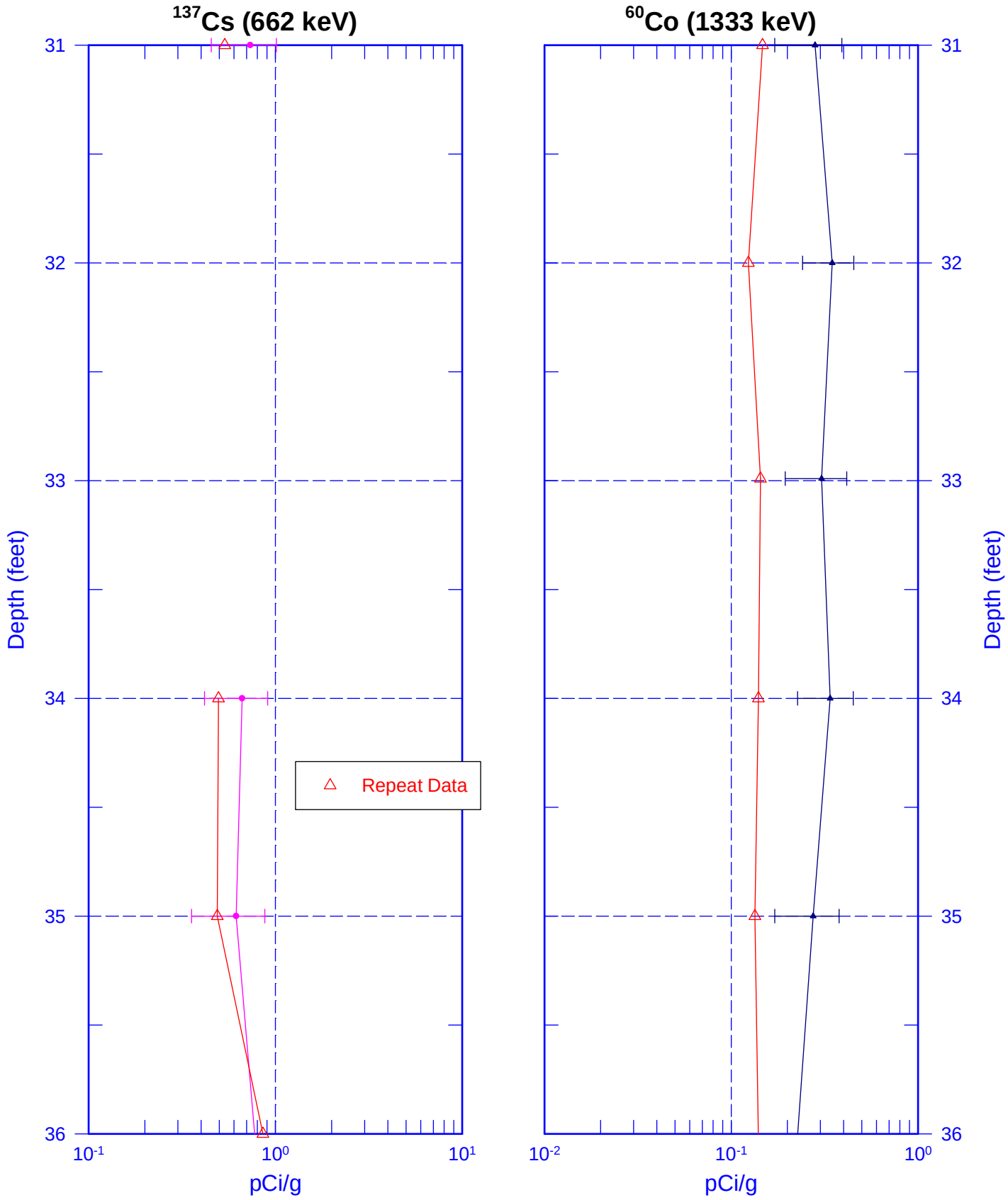
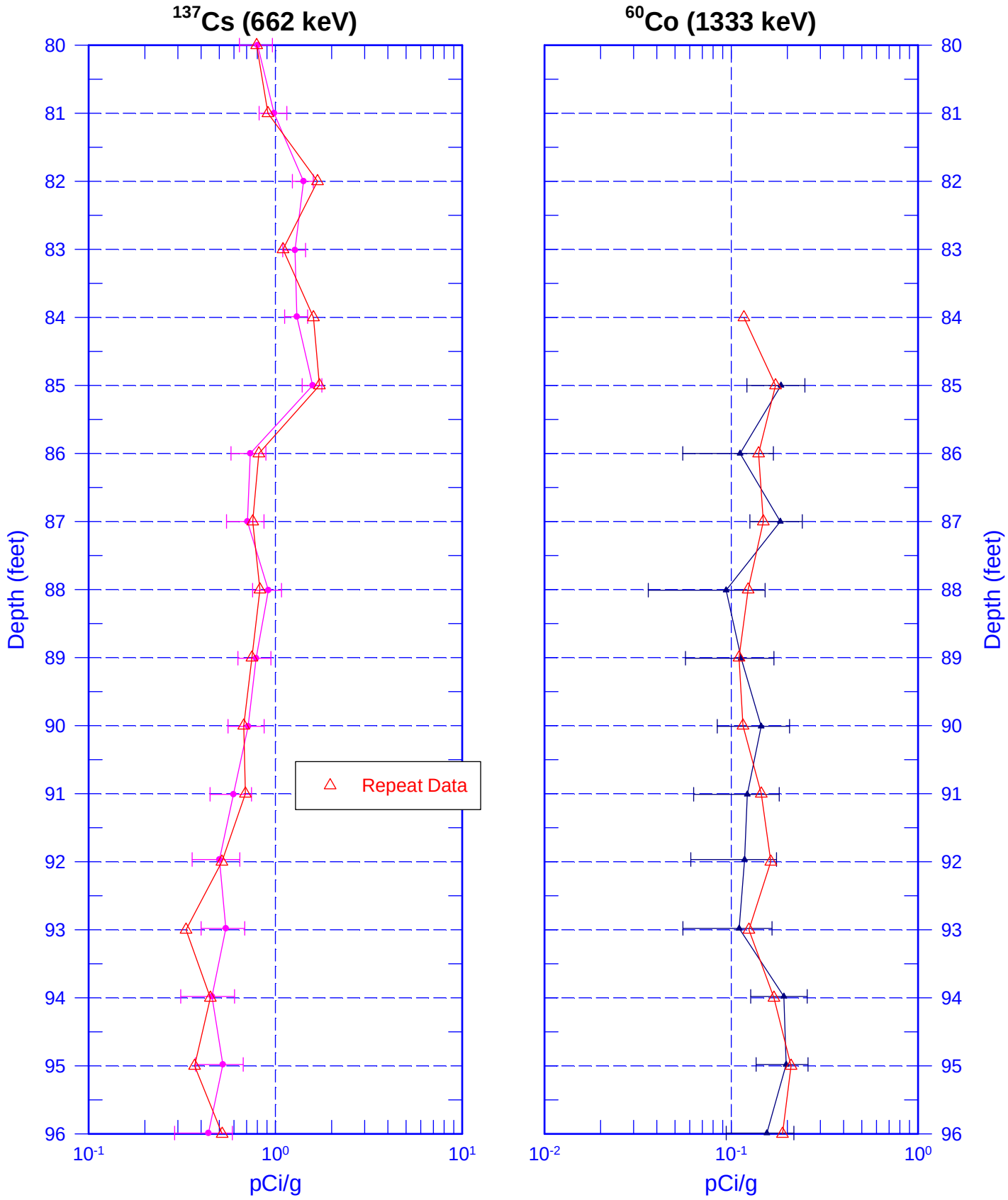
C9552
Repeat of Manmade Radionuclides



Zero Reference - Ground Surface

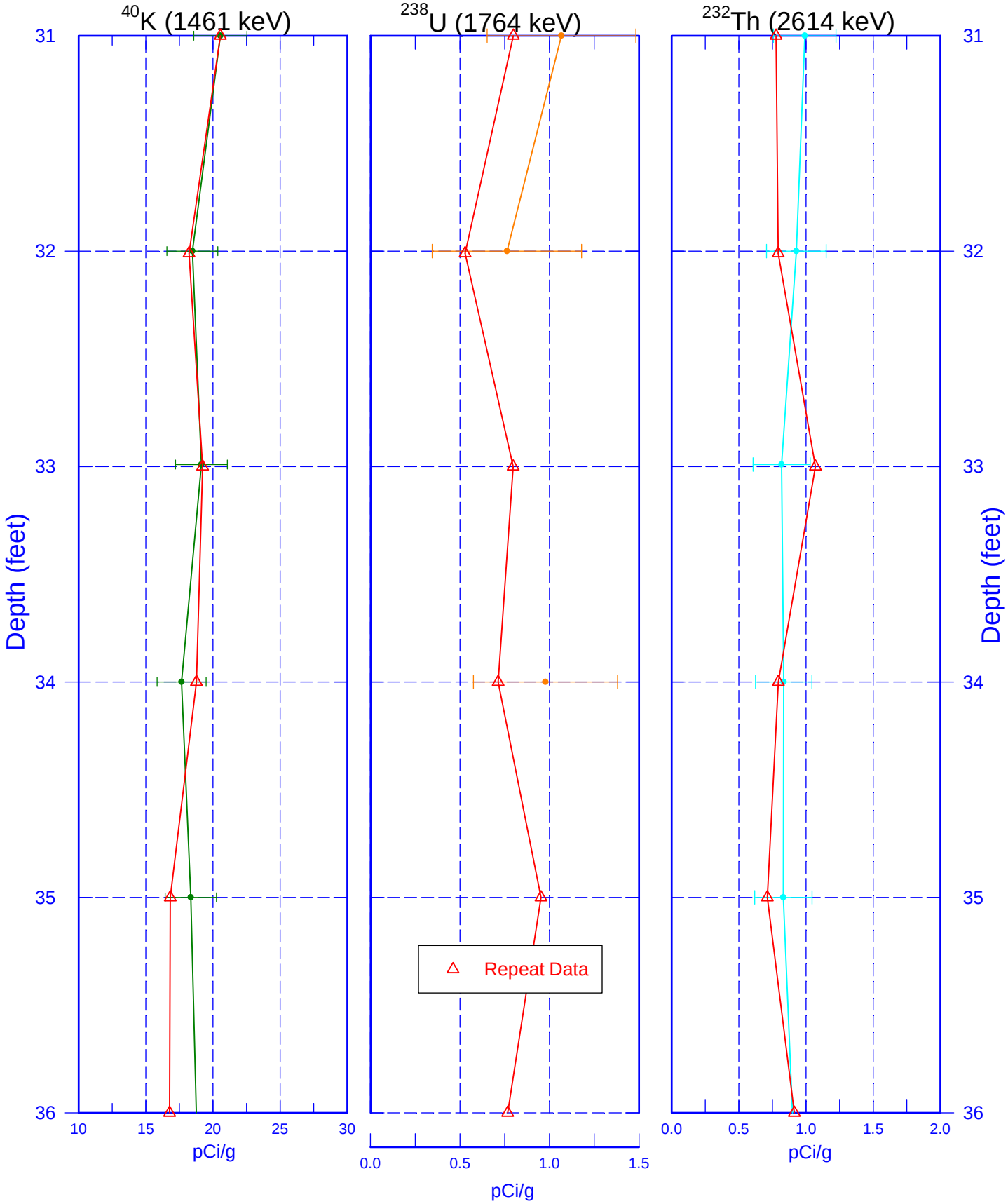
C9552
Repeat of Manmade Radionuclides



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

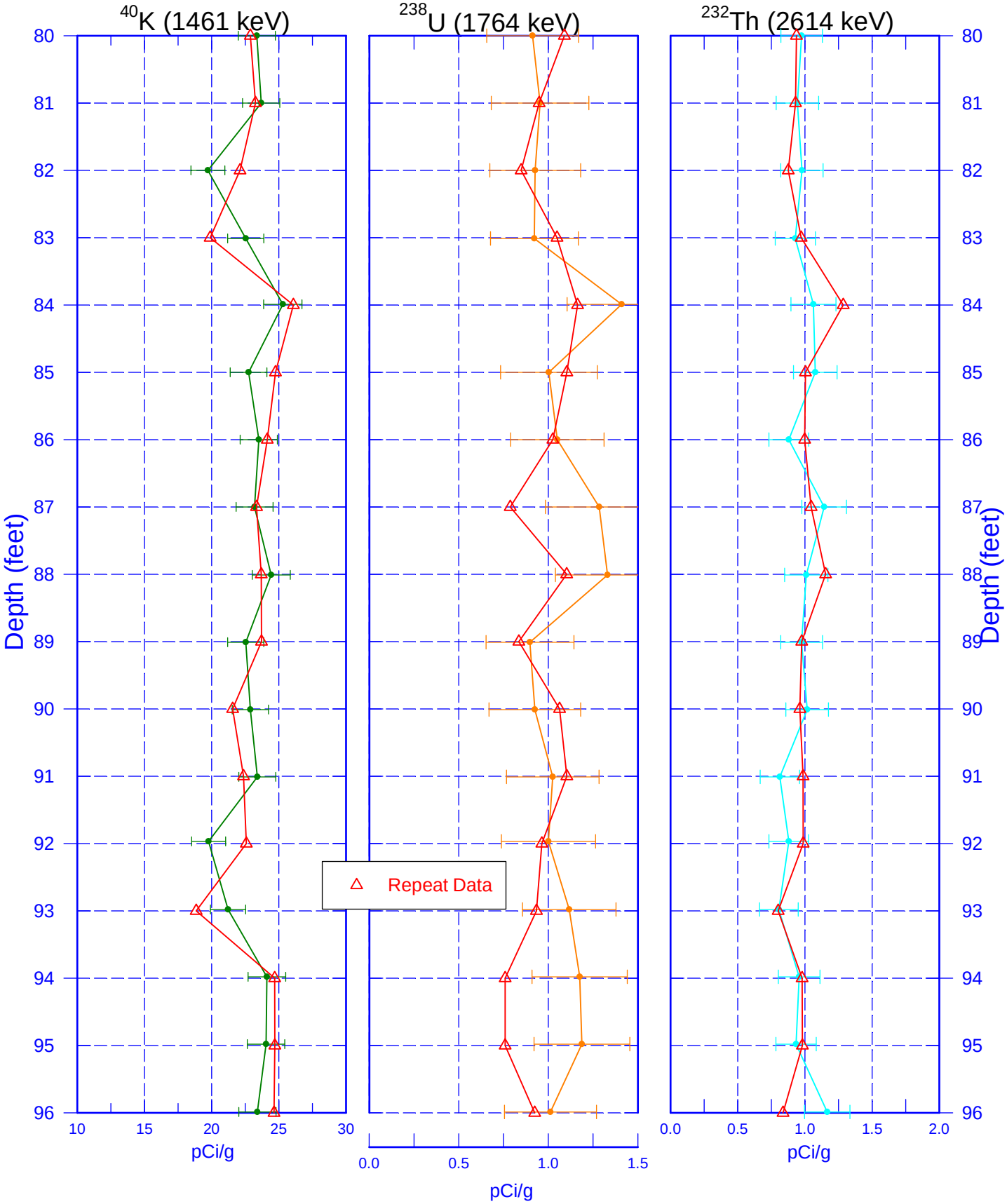
C9552
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

C9552
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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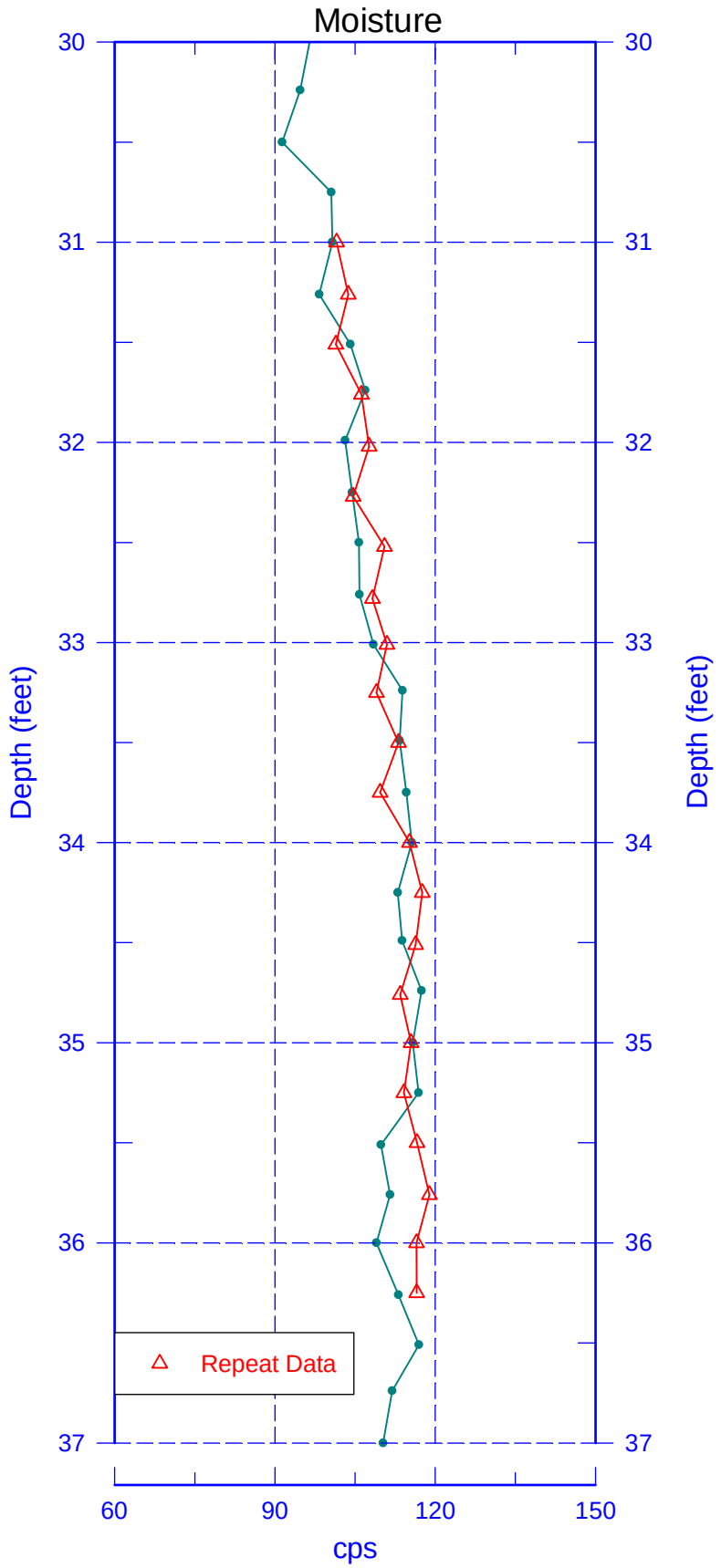
C9552
Moisture Repeat Section



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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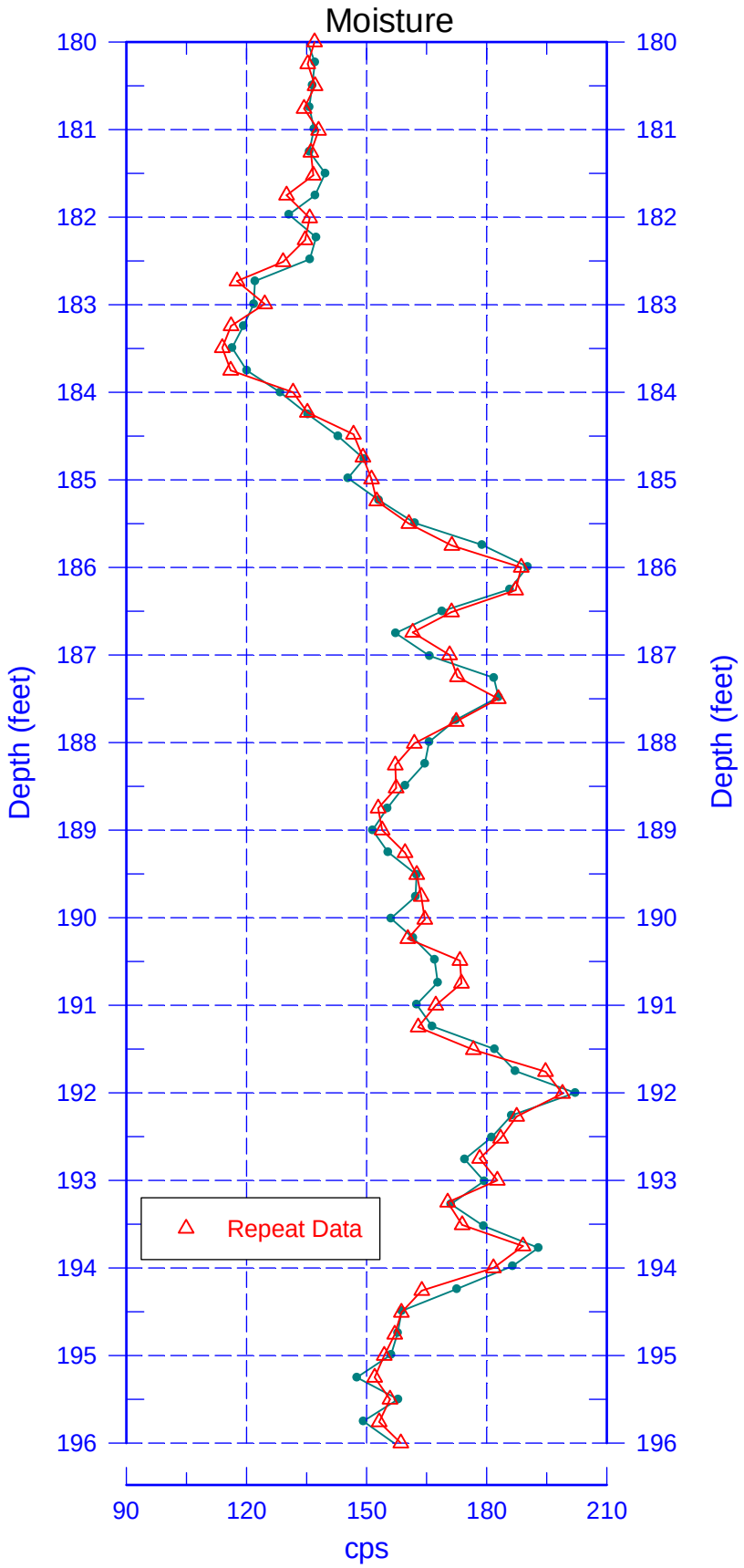
C9552
Moisture Repeat Section



Zero Reference - Ground Surface

Appendix A

HGLP-LDR-893

Stoller Newport News Nuclear

Stoller Newport News Nuclear

C9552
Log Data Report

Borehole Information:

Borehole:	-	Well ID:	C9552	Client:	CHPRC
Log Date	Engineer		Depth Reference		Site
2/17/2016	Felt, Meisner		Ground Surface		BY Cribs (200-DV-1)

Log Run Information:

Logging System:	Borehole Deviation	Model:	DG69-0901-4 #4654
Calibration Date:	12/15/2015	Calibration Reference:	HGLP-CC-135, Rev. 0
		Logging Procedure:	SGRP-PRO-OP-53034

Log File:	C9552.raw	Report File:	C9552.rpt
Sight Line:	027	Magnetic Declination:	-15.15

Measured Depth (feet)	Course Inclin. From Vert (°)	Course Direction (deg)	Closure Direction (deg)	TrueVert. Depth (feet)	Rectangular Coordinates		Dogleg Severity °/100 ft	Closure Distance (feet)
					+N/-S	+E/-W		
0	0.21	228.7	0	0	0	0	0	0
20	0.57	206.5	212.53	20	-0.11	-0.07	1.9	0.14
40	0.87	204.6	207.89	40	-0.34	-0.18	1.5	0.39
60	1.15	195.3	203.78	59.99	-0.67	-0.3	1.7	0.73
80	1.27	193.3	200.29	79.99	-1.08	-0.4	0.6	1.15
100	1.21	195.2	198.63	99.99	-1.5	-0.51	0.4	1.59
120	1.27	191.6	197.5	119.98	-1.93	-0.61	0.5	2.02
140	1.26	192.7	196.55	139.98	-2.36	-0.7	0.1	2.46
160	1.2	192.8	195.99	159.97	-2.77	-0.8	0.3	2.89
180	1.22	187.8	195.27	179.97	-3.19	-0.87	0.5	3.31
200	1.07	191.7	194.66	199.96	-3.58	-0.94	0.8	3.7

Analysis Notes:

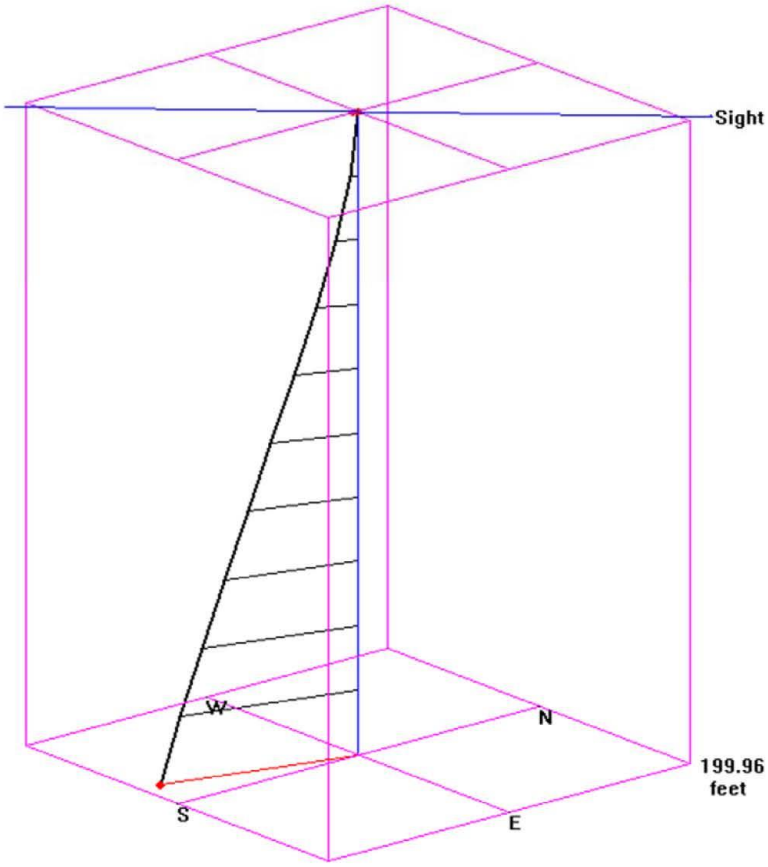
Analyst:	K. Felt	Date:	2/24/2016

Plots are for illustrative purposes. Sight line is initial orientation of tool. Borehole trajectory determined by minimum curvature method. Refer to table for true vertical depth and N/S and E/W deviation in feet.

List of Log Plots:

Borehole Deviation

C9552
Borehole Deviation



Stoller Newport News Nuclear

C8706
Log Data Report

Borehole Information

Log Date	2016-03-01	Filename	C8706_HG-NM_2016-03-01	Site	216-B-46 (200- DV-1)
Coordinates (WA St Plane)		DTW[1] (ft)	None	DTW Date	02/29/16

North (m)	East (m)	Drill Date	TOC[2] Elevation	Total Depth (ft)
N/A	N/A	02/29/16	N/A	202

Casing Information

Casing Type	Drill Type	Stickup (ft)	Diameter (in.) Outer	Diameter (in.) Inside	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	Becker Push	0.8	8 5/8	7 5/8	1/2	0.8	45.3
Threaded Steel	Sonic	-3.7	6	5	1/2	-3.7	202

Borehole Notes

The onsite geologist provided the total depth and casing depth. A Becker hammer push method was used to 45.3 ft. Subsequent drilling was conducted using a sonic method. The logging engineer measured casing stick-up and casing diameters. The second casing begins approximately 3.7 ft below ground surface. No water existed inside the casing. The maximum logging depth achieved was 202ft. Zero reference is ground surface.

A borehole deviation survey was conducted after logging was complete and is included as Appendix A (HGLP-LDR-898).

Logging Equipment Information

Logging System	Gamma 5T	Type	60% HPGe SGLS[3]
Effective Calibration Date	03/19/15	Serial No.	54-TP13441B
Calibration Reference	HGLP-CC-115, Rev. 0	Logging Procedure	SGRP-PRO-OP-53023, Rev. 0

Logging System	Gamma 5P	Type	NMLS[4]
Effective Calibration Date	04/15/15	Serial No.	H34055445
Calibration Reference	HGLP-CC-116, Rev. 0	Logging Procedure	SGRP-PRO-OP-53024, Rev. 0

Logging System	Gamma 5C	Type	Planar HPGe (HRLS)[5]
Effective Calibration Date	07/30/15	Serial No.	39A314
Calibration Reference	HGLP-CC-123, Rev. 0	Logging Procedure	SGRP-PRO-OP-53050, Rev. 0

Logging System	Gamma 1L	Type	60% HPGe SGLS
Effective Calibration Date	10/29/15	Serial No.	47-TP-32211A
Calibration Reference	HGLP-CC-130, Rev. 0	Logging Procedure	SGRP-PRO-OP-53010, Rev. 0

[1] depth to water inside casing
[2] top of casing
[3] Spectral Gamma Logging System
[4] Neutron Moisture Logging System
[5] High Rate Logging System

Logging System	Gamma 5P	**Type**	PNLS[6]
Effective Calibration Date	04/15/15	**Serial No.**	H34055445
Calibration Reference	HGLP-CC-116, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53024, Rev. 0

SGLS Log Run Information

Log Run	**1**	**2 Repeat**	**14**	**15 Repeat**	
HEIS Number	1015861	1015862	1015863	1015864	
Date	10/28/15	10/28/15	03/01/16	03/01/16	
Logging Engineer	Meisner/ McClellan	Meisner/ McClellan	Spatz	Spatz	
Start Depth (ft)	0.0	36.0	43.0	74.0	
Finish Depth (ft)	44.0	41.0	202.0	90.0	
Count Time (sec)	100	100	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	
Log Speed (ft/min)	N/A	N/A	N/A	N/A	
Pre-Verification	FTB…V00CAB	FTB…V00CAB	AL297CAB	AL297CAB	
Start File	FTB..AD000000	FTB..BD003600	AL297000	AL297160	
Finish File	FTB..AD004400	FTB..BD004101	AL297159	AL297176	
Post-Verification	FTB…V00CAA	FTB…V00CAA	AL297CAA	AL297CAA	
Depth Return Error (in.)	N/A	5.0 high	N/A	0	
Comments	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	

HRLS Log Run Information

Log Run	**3**	**4**	**5 Repeat**	**10**	**11 Repeat**
HEIS Number	1015865	1015866	1015867	1018161	1018162
Date	10/29/15	10/29/15	10/29/15	11/09/15	11/09/15
Logging Engineer	Felt/McClellan	Felt/McClellan	Felt/McClellan	Meisner/Spatz	Meisner/Spatz
Start Depth (ft)	9.0	26.0	12.0	12.0	13.0
Finish Depth (ft)	22.0	29.0	14.0	15.0	13.0
Count Time (sec)	300	300	300	300	300
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	Y	Y
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C8706FCB2015 1029AV00CAB 1	C8706FCB2015 1029AV00CAB 1	C8706FCB2015 1029AV00CAB 1	FCB…AV00CA B1	FCB…AV00CA B1
Start File	AD000900	BD002600	CD001200	AD001200	BD001300
Finish File	AD002200	BD002900	CD001400	AD001500	BD001300
Post-Verification	CV00CAA1	CV00CAA1	CV00CAA1	FCB…BV00CA A1	FCB…BV00CA A1
Depth Return Error (in.)	N/A	N/A	0.0	N/A	1.5 high

[6] Passive Neutron Logging System

Log Run	3	4	5 Repeat	10	11 Repeat
Comments	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made

NMLS Log Run Information

Log Run	6	7 Repeat	12	13 Repeat	
HEIS Number	1018143	1018144	1018165	1018166	
Date	10/29/15	10/29/15	02/29/16	02/29/16	
Logging Engineer	Felt/McClellan	Felt/McClellan	Felt/Meisner	Felt/Meisner	
Start Depth (ft)	0.0	40.0	43.0	74.0	
Finish Depth (ft)	44.0	44.0	202.0	90.0	
Count Time (sec)	15	15	15	15	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	0.25	0.25	0.25	0.25	
Log Speed (ft/min)	N/A	N/A	N/A	N/A	
Pre-Verification	C8706FPB20151 029AV00CAB1	C8706FPB20151 029AV00CAB1	C8706FPB20160 229AV00CAB1	C8706FPB20160 229AV00CAB1	
Start File	AD000000	BD004000	AD004300	BD007400	
Finish File	AD004400	BD004400	AD020200	BD009001	
Post-Verification	BV00CAA1	BV00CAA1	BV00CAA1	BV00CAA1	
Depth Return Error (in.)	N/A	0.5 high	N/A	2.5 high	
Comments	None	None	None	None	

PNLS Log Run Information

Log Run	8	9 Repeat			
HEIS Number	1018163	1018164			
Date	11/09/15	11/09/15			
Logging Engineer	Spatz/McClellan	Spatz/McClellan			
Start Depth (ft)	9.0	13.0			
Finish Depth (ft)	30.0	16.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
Log Speed (ft/min)	N/A	N/A			
Pre-Verification	C8706FPB20151 109AV00CAB1	C8706FPB20151 109AV00CAB1			
Start File	AD000900	BD001300			
Finish File	AD003001	AD001601			
Post-Verification	BV00CAA1	BV00CAA1			
Depth Return Error (in.)	N/A	N/A			
Comments	No source	No source			

Logging Operation Notes

A centralizer was not installed on the sondes. As a precaution, the sonde and cable were covered in plastic sleeving to prevent potential contamination of equipment. During logging of the second casing, plastic sleeving covered the sonde.

Pre- and post-survey verification measurements met the acceptance criteria for the established systems.

Analysis Notes

Analyst	P.D. Henwood	**Date**	03/28/16
Reference(s)	SGRP-PRO-OP-53040, Rev. 0; SGRP-PRO-OP-53051, Rev. 0; SGRP-PRO-OP-53052, Rev. 0		

A casing correction for a 1/2-in. thick casing was applied throughout the borehole. A Becker hammer push was used to 45.3 ft. Below 45.3 ft, a sonic drilling method was used. Both gamma and moisture measurements reflect reduced count rates at casing joints that occur at 10 ft intervals in the sonic drill casing.

No water correction was necessary as water was not encountered.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations from the SGLS were calculated in EXCEL templates identified as 1L20151029 and 5T20160113, using an efficiency function and corrections for casing and dead time as determined by annual calibrations. The template for the HRLS was 5C20150730.

NMLS data are reported in counts per second as there is no calibration for casing sizes used in this borehole.

HGU[7] is an empirical unit of gamma activity proposed as a means to standardize gamma log response across multiple logging systems with different response characteristics. The HGU is defined in terms of measurements in the Hanford Borehole Calibration Facility, and the magnitude is selected such that 1 HGU is approximately equivalent to typical Hanford background activity, based on data from background samples as reported in *Hanford Site Background: Part 2, Soil Background for Radionuclides* (DOE/RL-96-12).

Results and Interpretations

Cs-137, Co-60, and processed uranium (Pa-234m [U-238] and U-235) were detected in this borehole. Cs-137 was at the ground surface, from 8 to 64 ft, and at intermittent depth locations from 66 to 82 ft. A relatively high rate interval exists from 10 to 29 ft. A maximum concentration of 1.6 million pCi/g was measured at 13 ft in depth.

Co-60 was detected intermittently from 56 to 111 ft. The maximum concentration was measured at 0.1 pCi/g at 110 ft.

Pa234m (U-238) was detected intermittently from 80 to 86 ft with a maximum concentration of 29.5 pCi/g measured at 80 ft. U-235 was also detected at 80 ft at 2.2 pCi/g. The processed uranium appears to be associated with relatively high moisture measured near this depth.

The neutron moisture log primarily responds to moisture present in the surrounding formation. In general, an increase in count rate reflects an increase in moisture content. Moisture content may increase in sediments of relatively high silt or clay content. A relatively high moisture content is indicated at approximately 79 ft.

Passive neutron logging was conducted from 9 to 31 ft. This method employs the NMLS without the AmBe source to measure neutrons that may be emitted by TRU waste. It is known the NMLS is affected by very high gamma activity that can indicate neutron activity. This can cause the moisture count rate to be artificially high. The passive neutron measurements indicate no neutron activity in the high gamma activity zone. This suggests the neutron moisture log is responding entirely to moisture content.

The manmade, KUT, and moisture repeat plots indicate that the respective systems were working properly.

[7] Hanford Gamma Unit

List of Log Plots

Depth Reference is ground surface.

Manmade Radionuclides (0-210 ft)
Natural Gamma Logs (0-160 ft)
Natural Gamma Logs (150-310 ft)
Combination Plot (0-120 ft)
Combination Plot (110-230 ft)
Combination Plot (0-210 ft)
Total Gamma & Moisture (0-210 ft)
Total Gamma & Hanford Gamma Unit (0-210 ft)
Passive Neutron & Moisture (9-31 ft)
Repeat Section of Manmade Radionuclides (36-41 ft)
Repeat Section of Manmade Radionuclides (74-90 ft)
Repeat Section of Natural Gamma Logs (36-41 ft)
Repeat Section of Natural Gamma Logs (74-90 ft)
Moisture Repeat Section (40-44 ft)
Moisture Repeat Section (74-90 ft)

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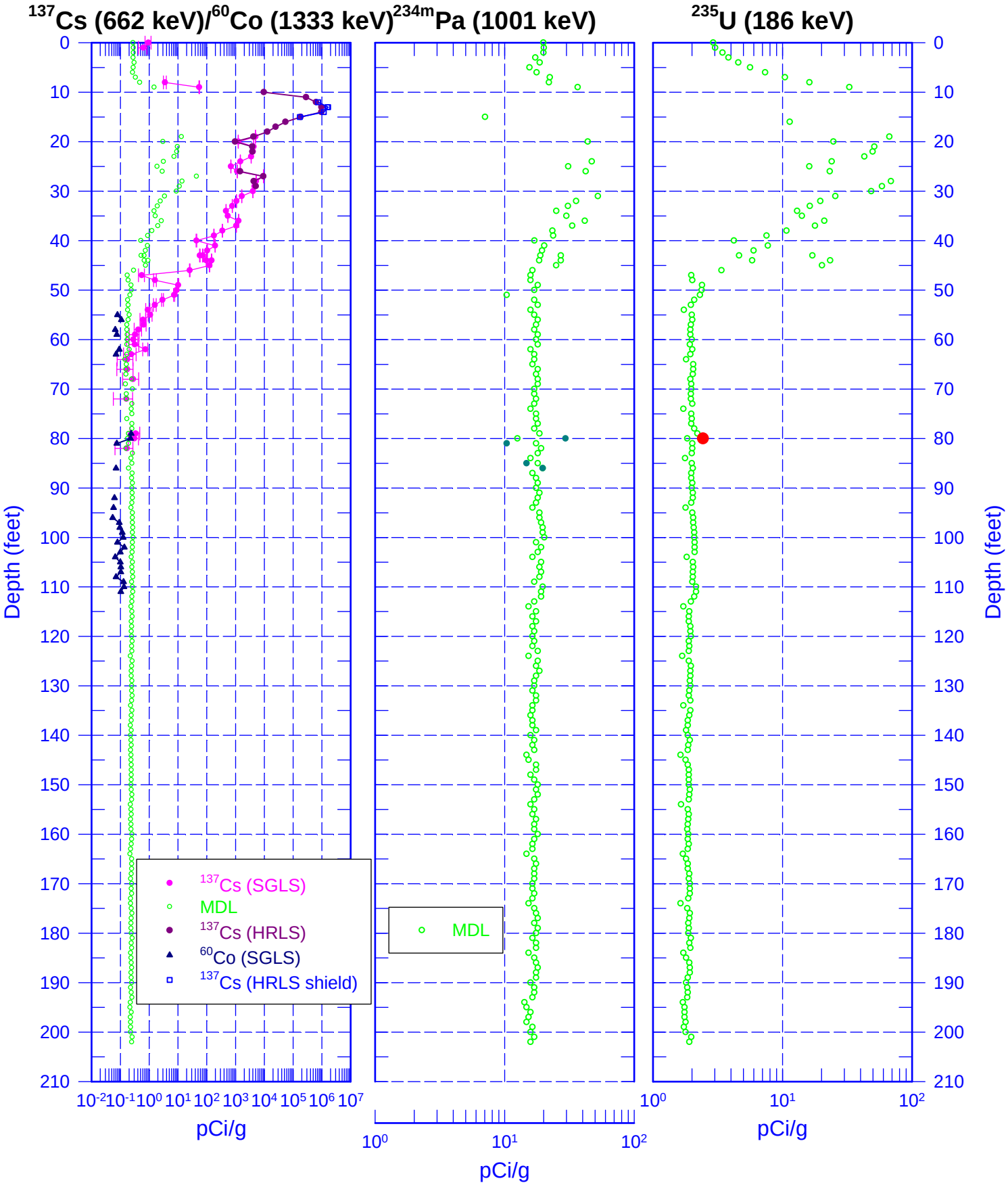
C8706
Manmade Radionuclides



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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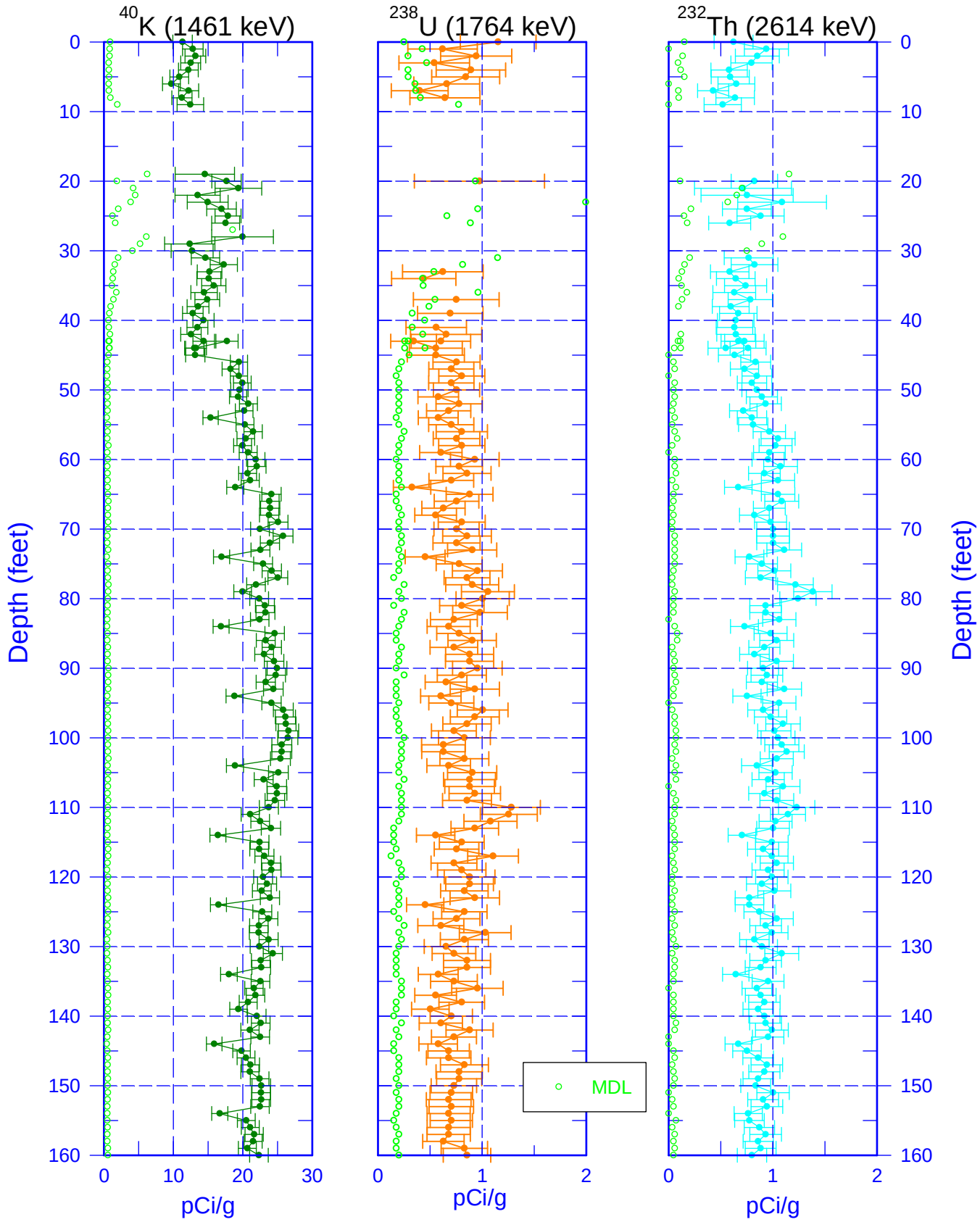
C8706
Natural Gamma Logs



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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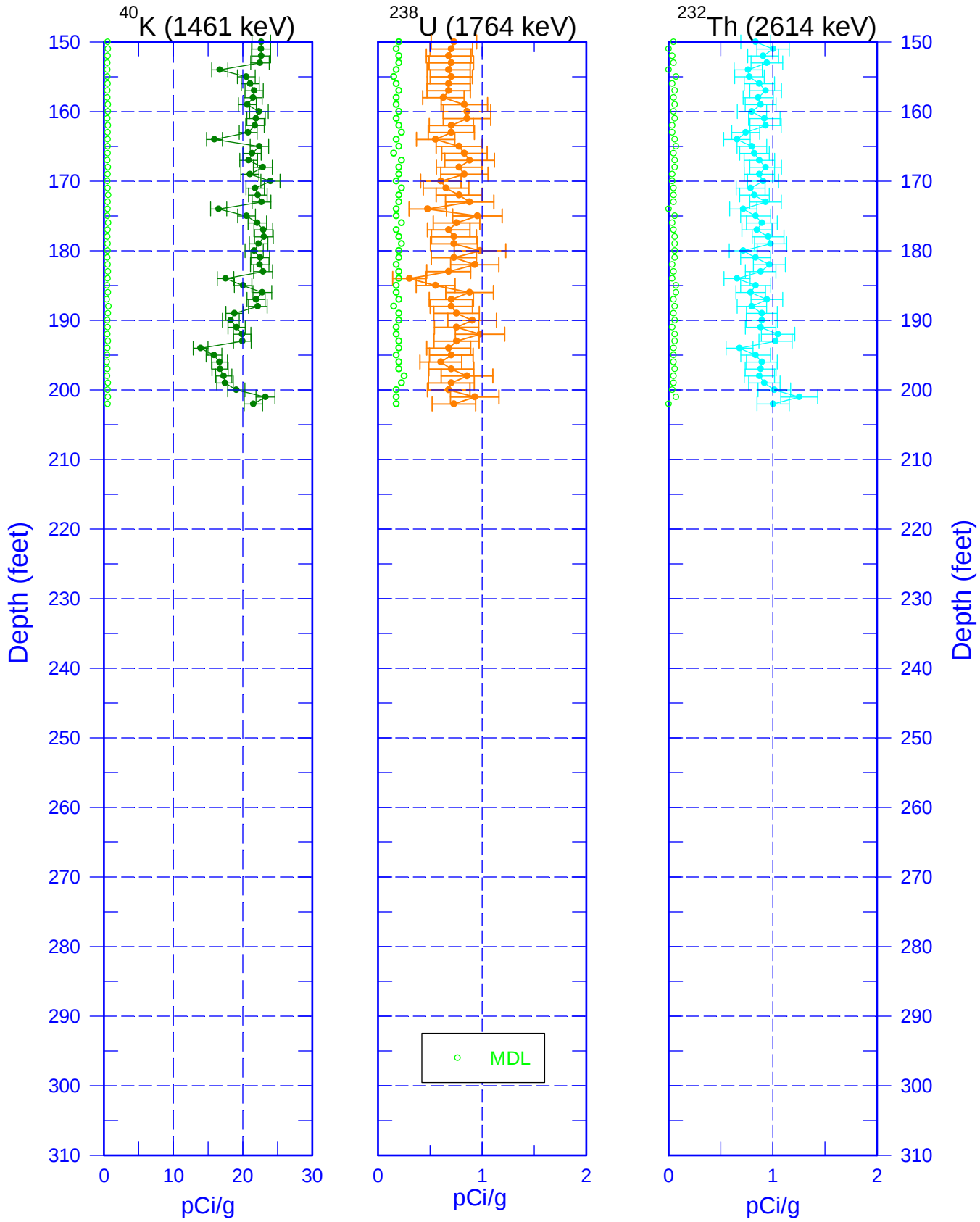
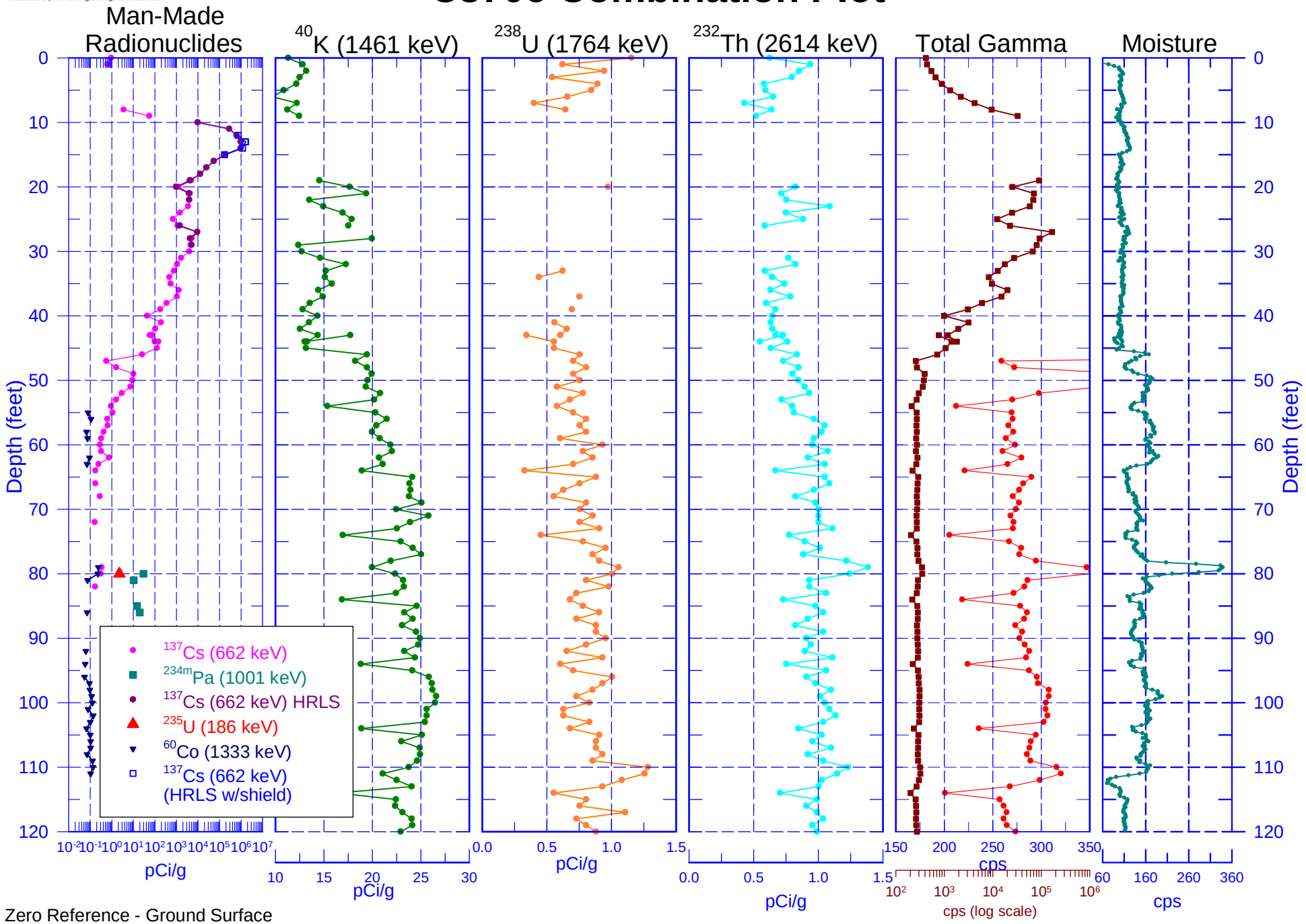
C8706
Natural Gamma Logs



Zero Reference - Ground Surface

C8706 Combination Plot



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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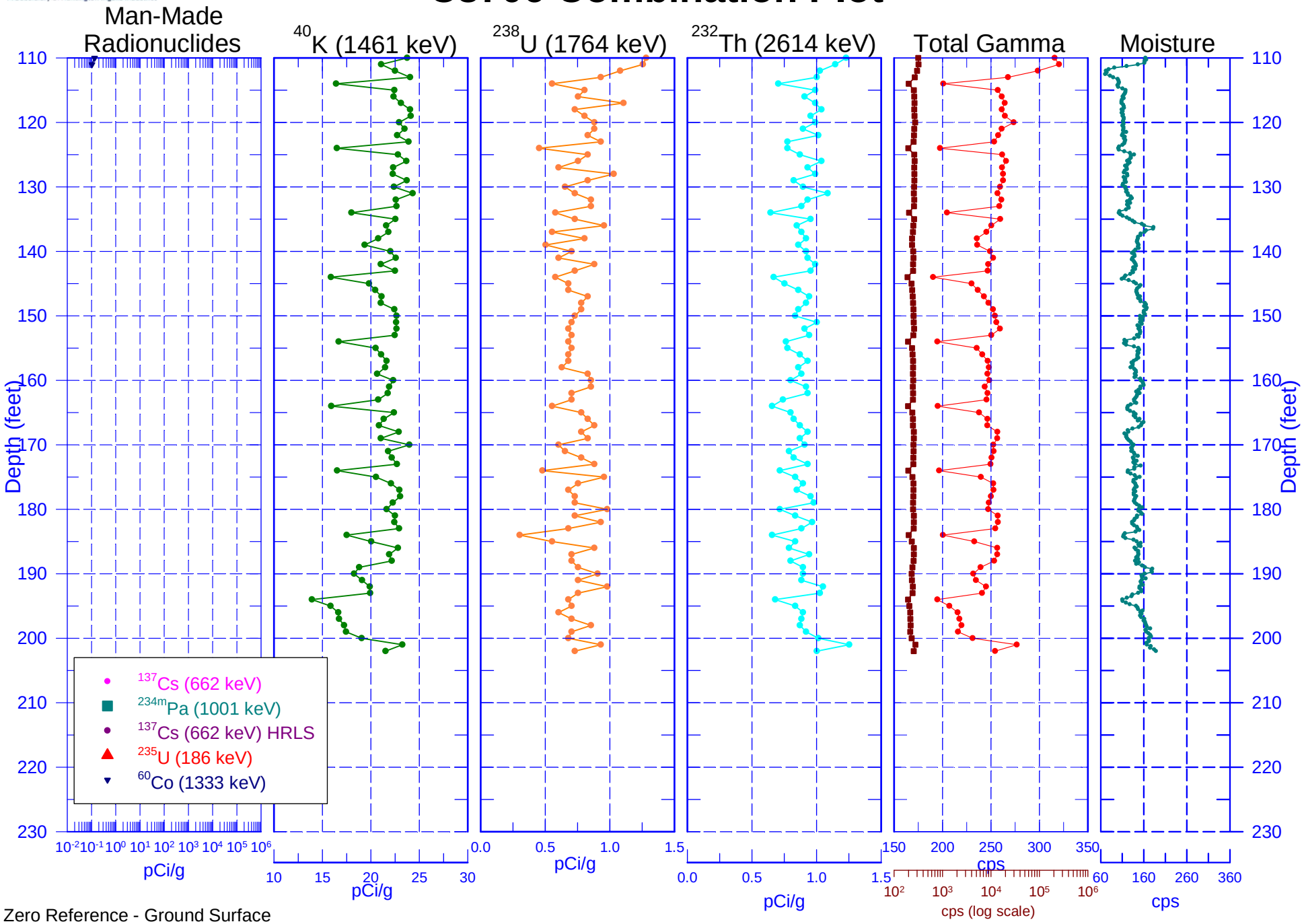
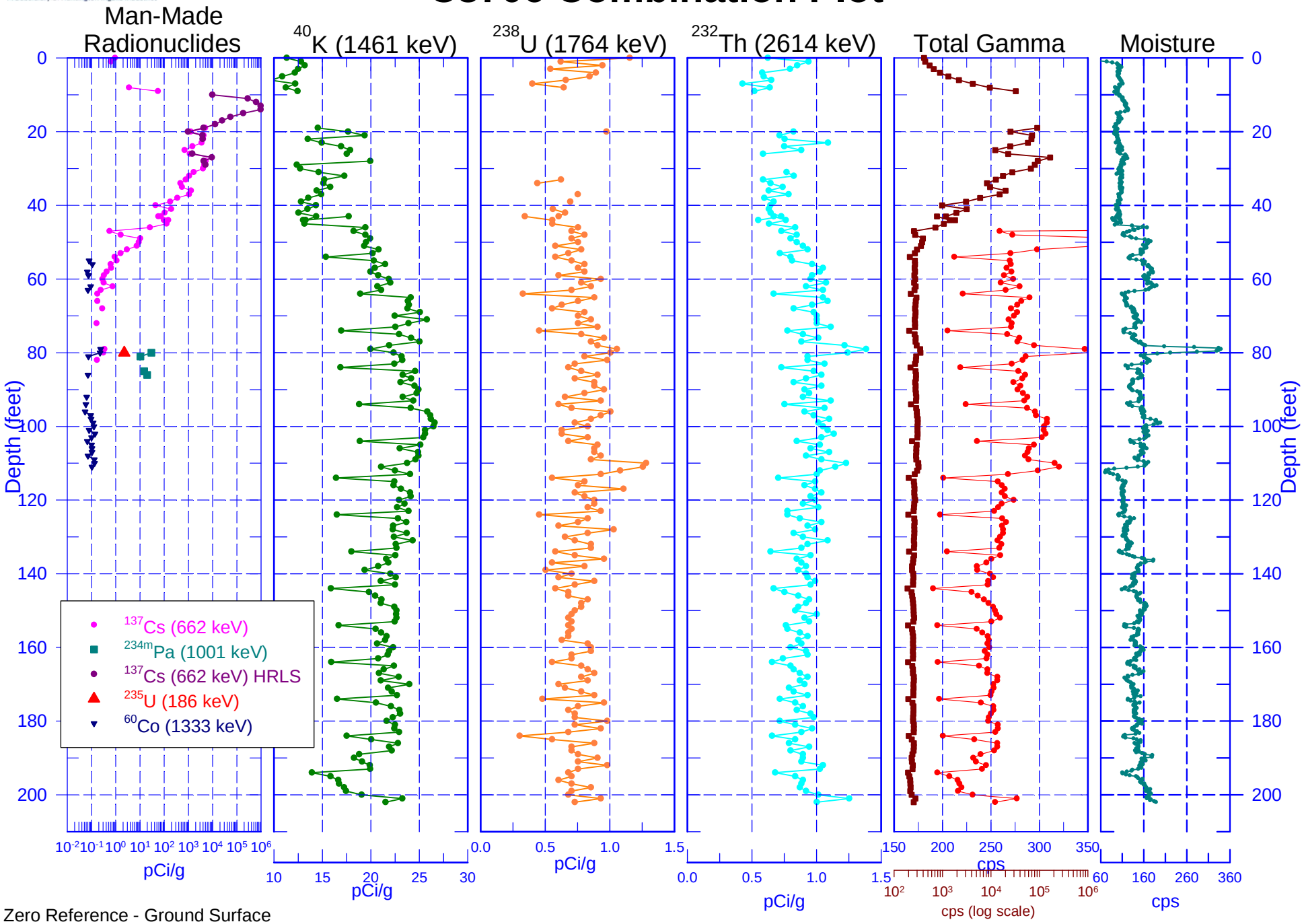
C8706 Combination Plot



Zero Reference - Ground Surface

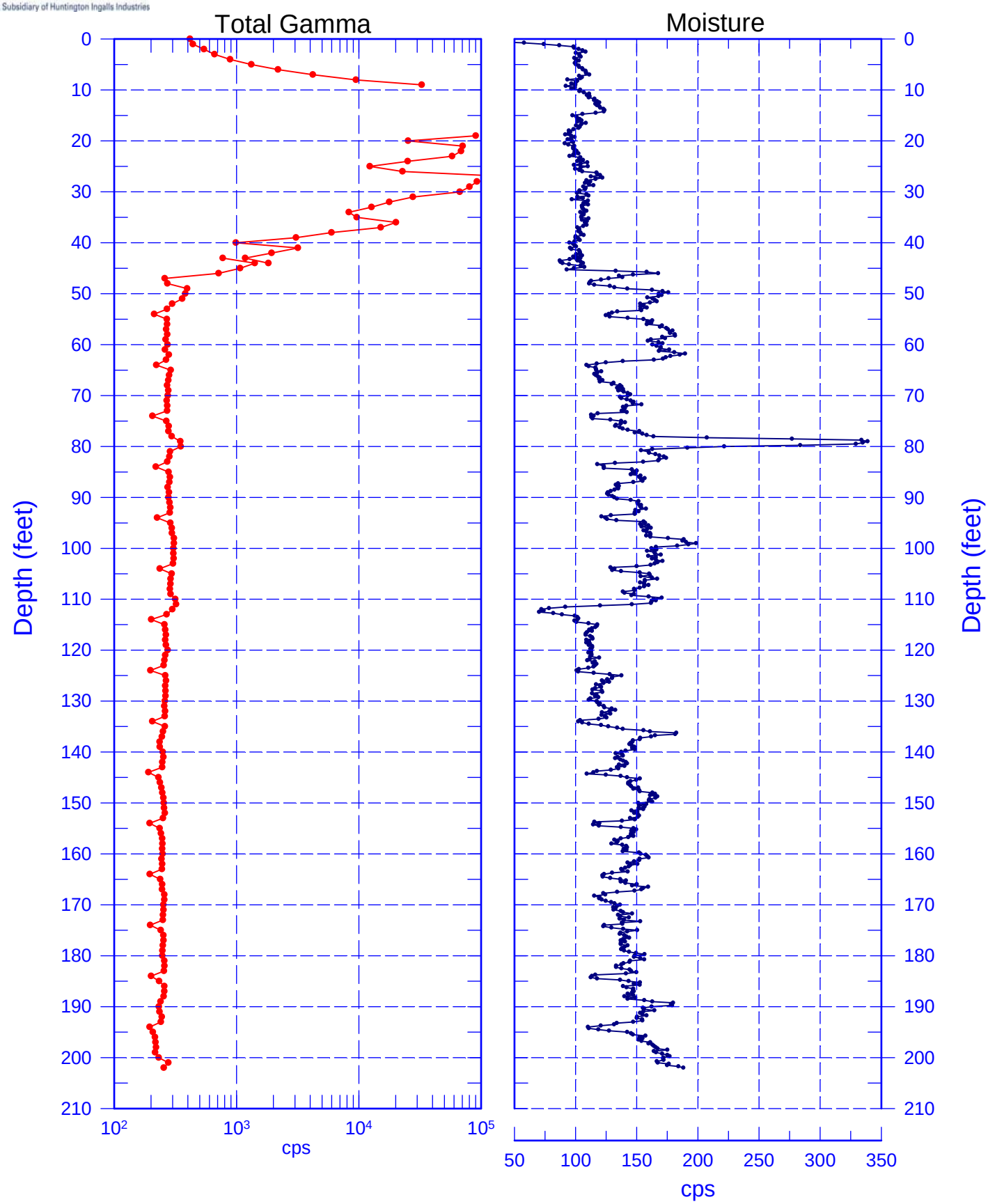
C8706 Combination Plot



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

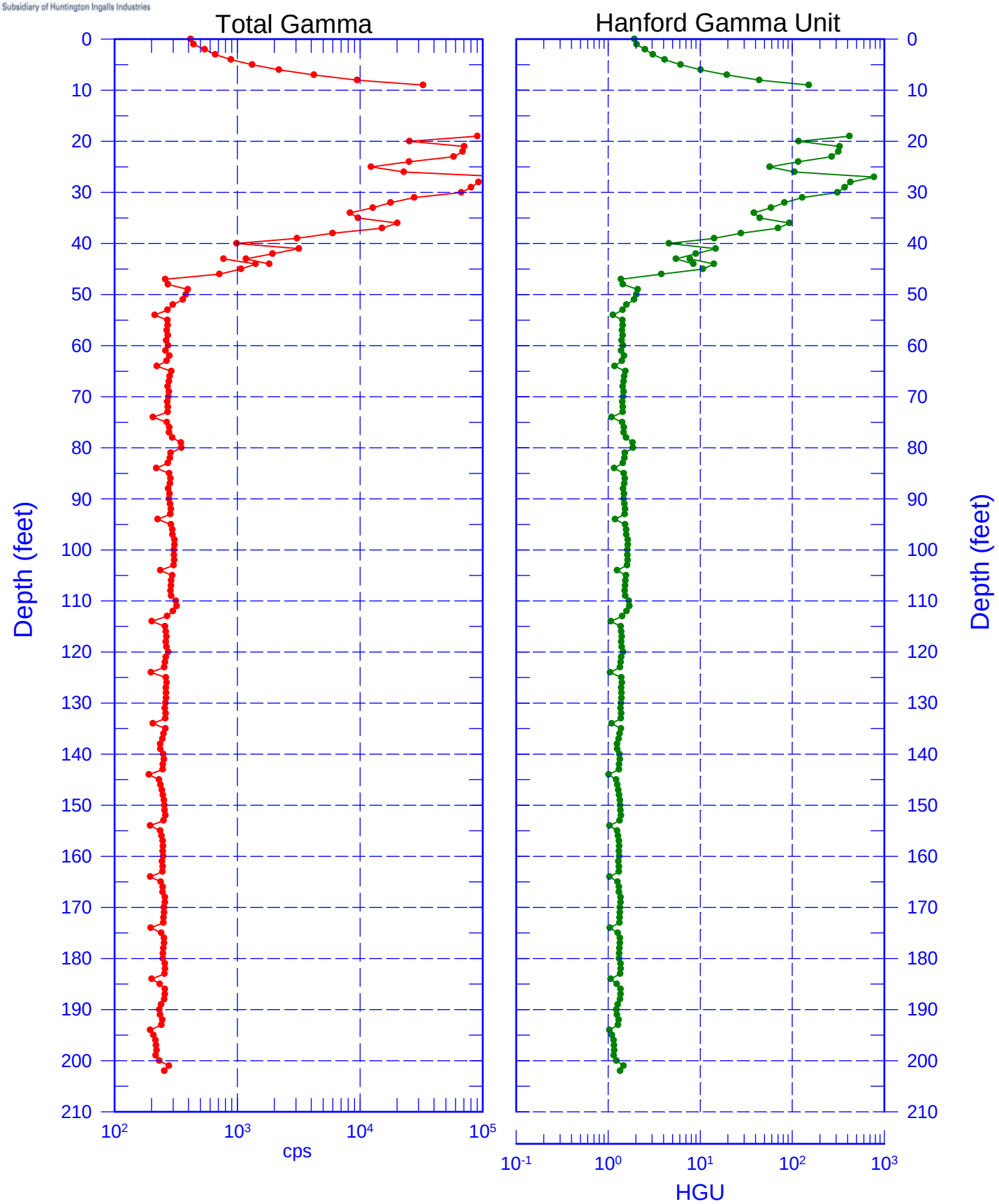
C8706
Total Gamma & Moisture



Zero Reference - Ground Surface

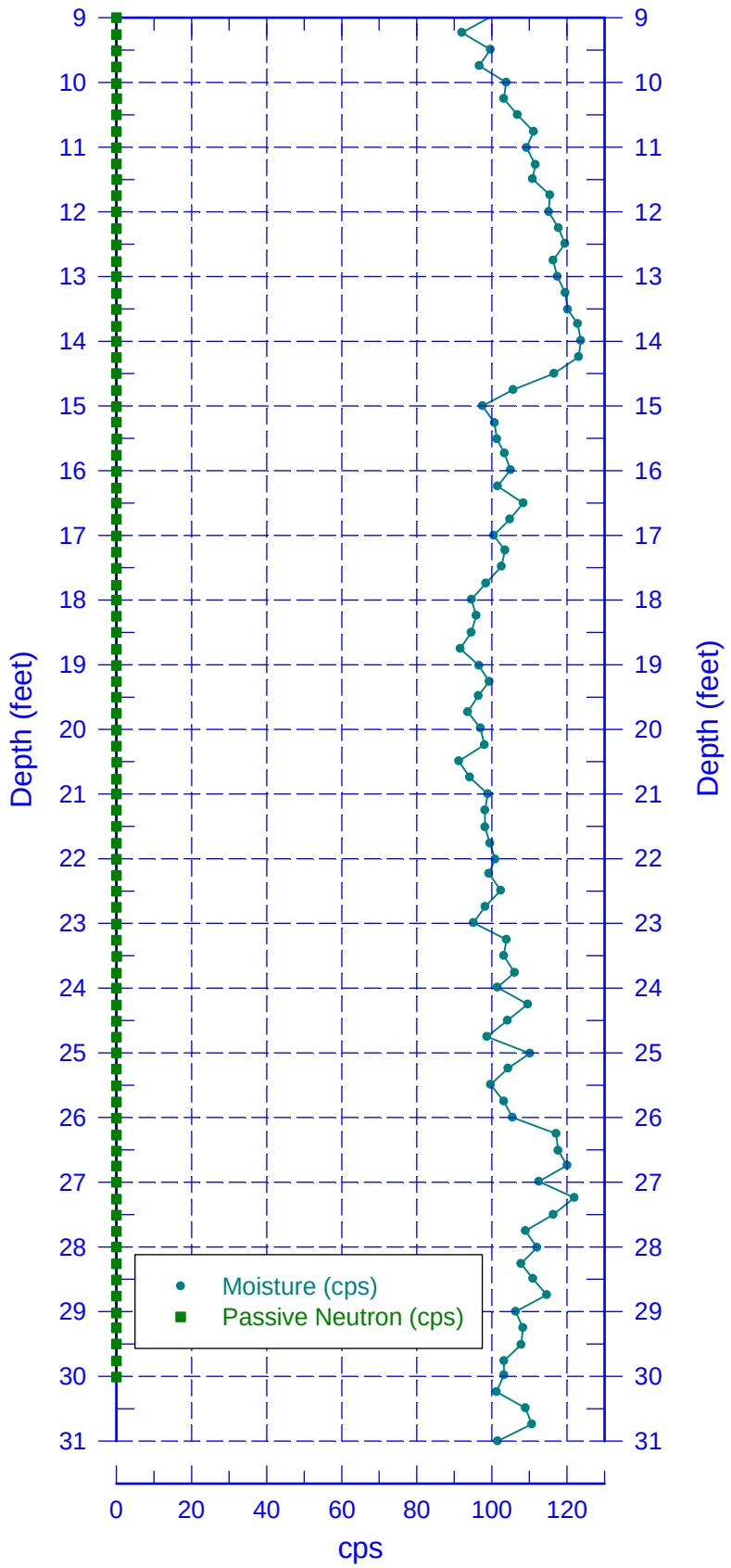
C8706

Total Gamma & Hanford Gamma Unit



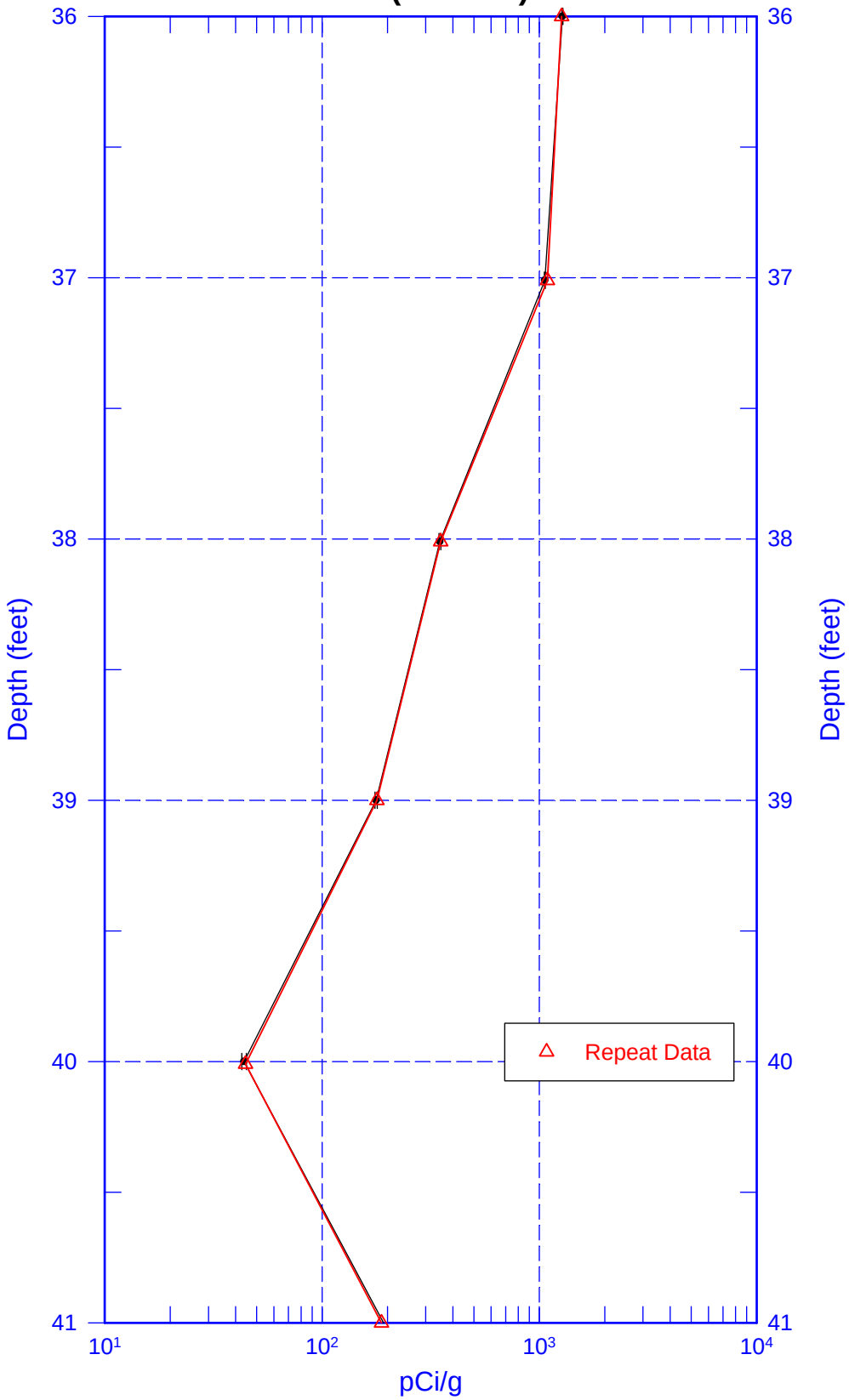
Zero Reference - Ground Surface

C8706
Passive Neutron & Moisture



Zero Reference - Ground Surface

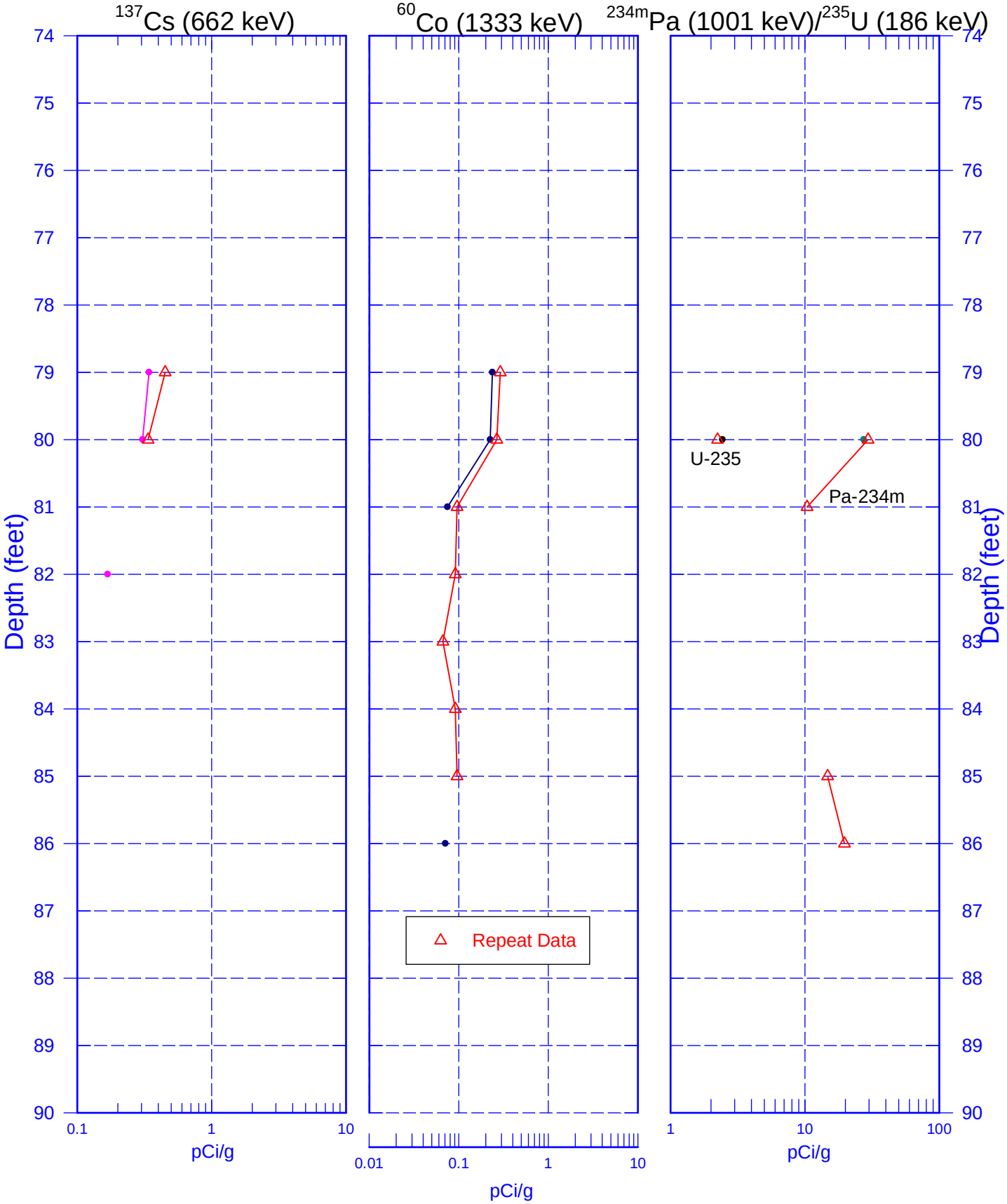
C8706
Repeat Section of Manmade Radionuclides
^{137}Cs (662 keV)



Zero Reference - Ground Surface

C8706

Repeat Section of Manmade Radionuclides



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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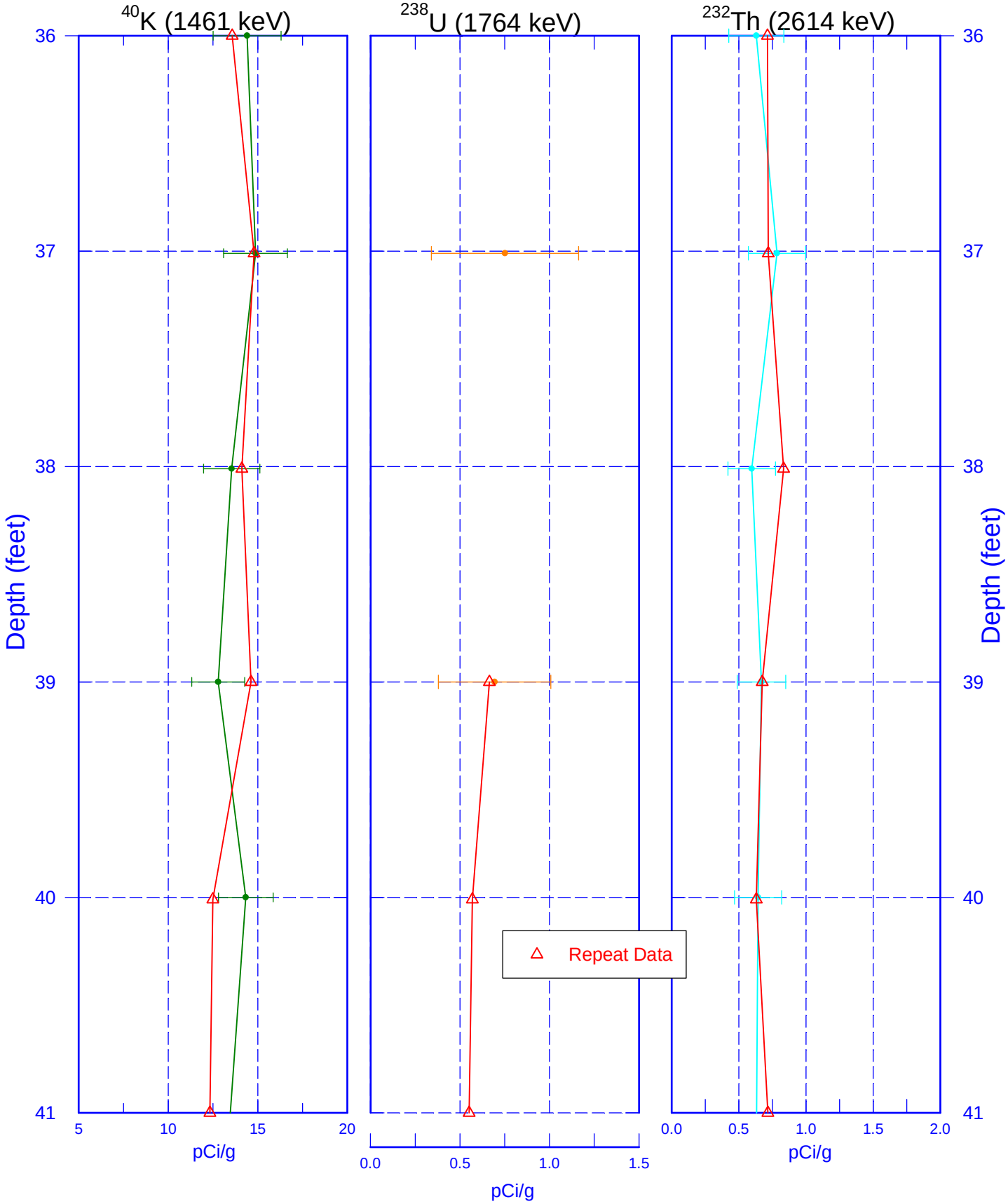
C8706
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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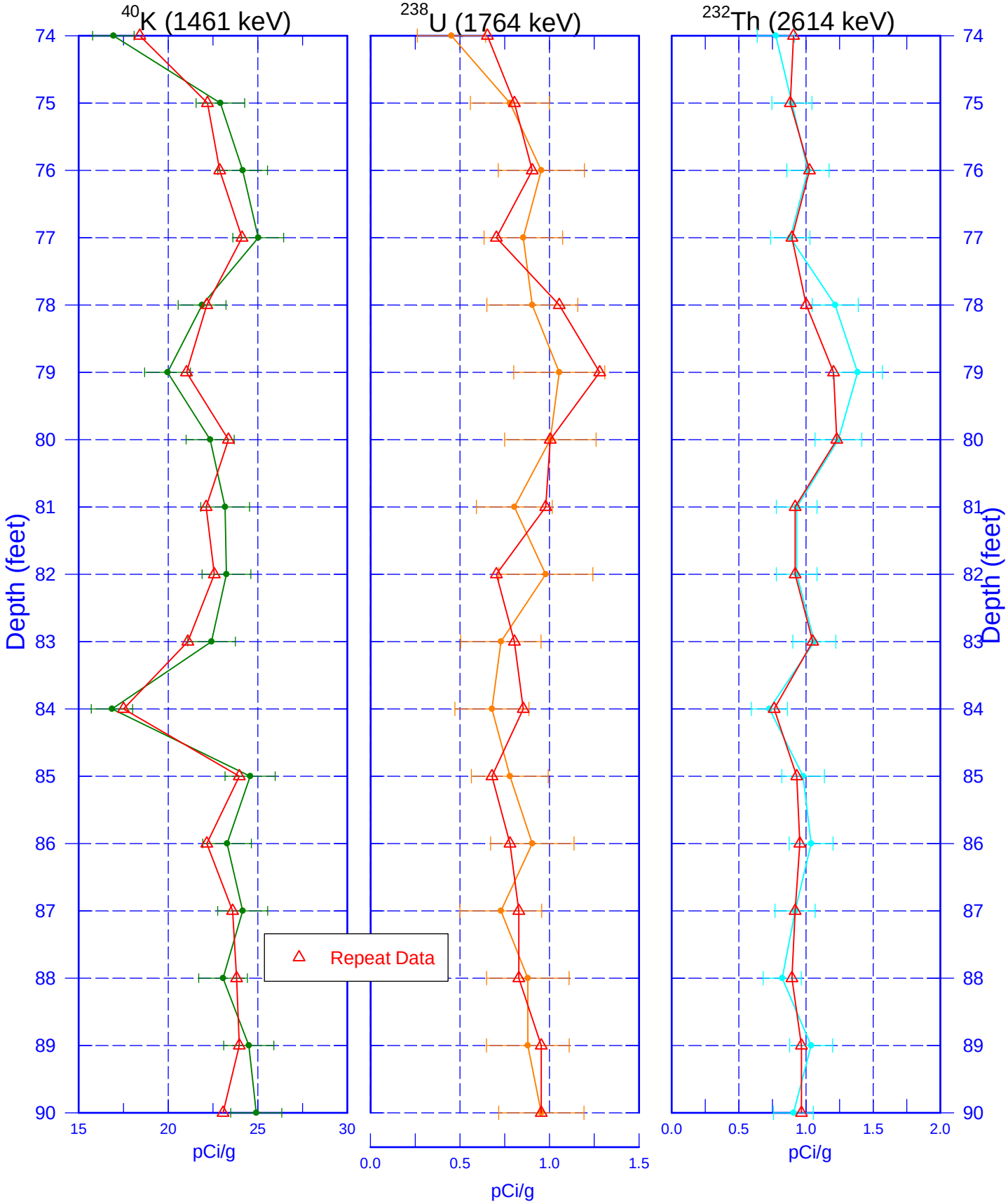
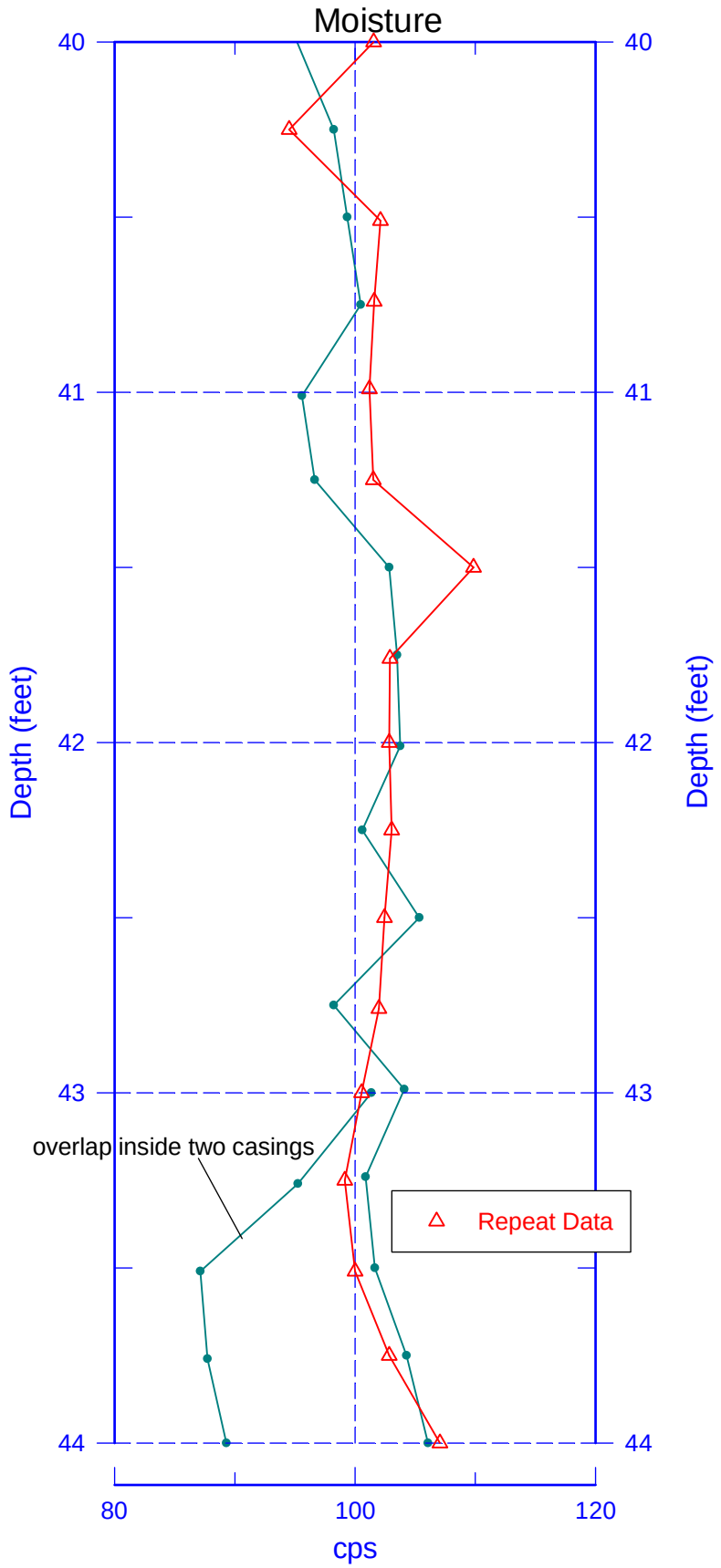
C8706
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

C8706
Moisture Repeat Section



Zero Reference - Ground Surface

Stoller Newport News Nuclear
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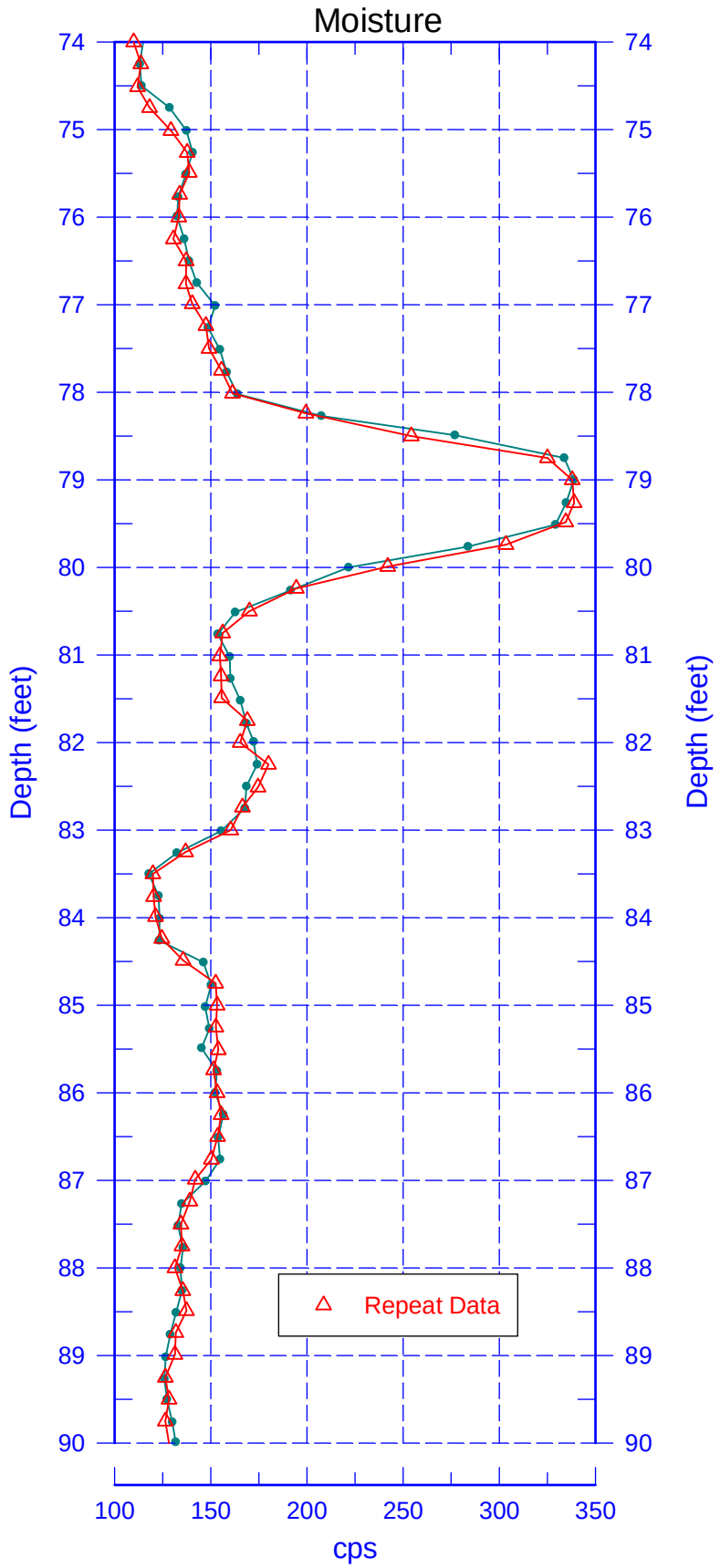
C8706
Moisture Repeat Section



Zero Reference - Ground Surface

Appendix A

HGLP-LDR-898

Stoller Newport News Nuclear

Stoller Newport News Nuclear

C8706

Log Data Report

Borehole Information:

Borehole:	-	Well ID:	C8706	Client:	CHPRC
Log Date	Engineer		Depth Reference		Site
2/29/2016	Felt, Meisner, McCllellan		Ground Surface		BY Cribs (200-DV-1)

Log Run Information:

Logging System:	Borehole Deviation	Model:	DG69-0901-4 #4654
Calibration Date:	12/15/2016	Calibration Reference:	HGLP-CC-135, Rev. 0
		Logging Procedure:	SGRP-PRO-OP-53034

Log File:	C8706.raw	Report File:	C8706.rpt
Sight Line:	165	Magnetic Declination:	-15.15

Measured Depth (feet)	Course Inclin. From Vert (°)	Course Direction (deg)	Closure Direction (deg)	TrueVert. Depth (feet)	Rectangular Coordinates		Dogleg Severity °/100 ft	Closure Distance (feet)
					+N/-S	+E/-W		
0	0.3	32.6	0	0	0	0	0	0
20	0.54	4.9	14.85	20	0.14	0.04	1.5	0.14
40	0.55	8.2	10.13	40	0.33	0.06	0.2	0.33
60	0.71	16.4	11.2	60	0.54	0.11	0.9	0.55
80	0.59	18.7	13.02	80	0.76	0.17	0.6	0.78
100	0.74	14.3	13.77	99.99	0.98	0.24	0.8	1.01
120	0.73	11.2	13.56	119.99	1.23	0.3	0.2	1.26
140	0.76	15	13.48	139.99	1.48	0.36	0.3	1.52
160	0.78	17.6	13.91	159.99	1.74	0.43	0.2	1.79
180	0.84	16.2	14.31	179.99	2.01	0.51	0.3	2.07
200	0.74	6	13.97	199.99	2.28	0.57	0.9	2.35

Analysis Notes:

Analyst:	K. Felt	Date:	3/7/2016

Plots are for illustrative purposes. Sight line is initial orientation of tool. Borehole trajectory determined by minimum curvature method. Refer to table for true vertical depth and N/S and E/W deviation in feet.

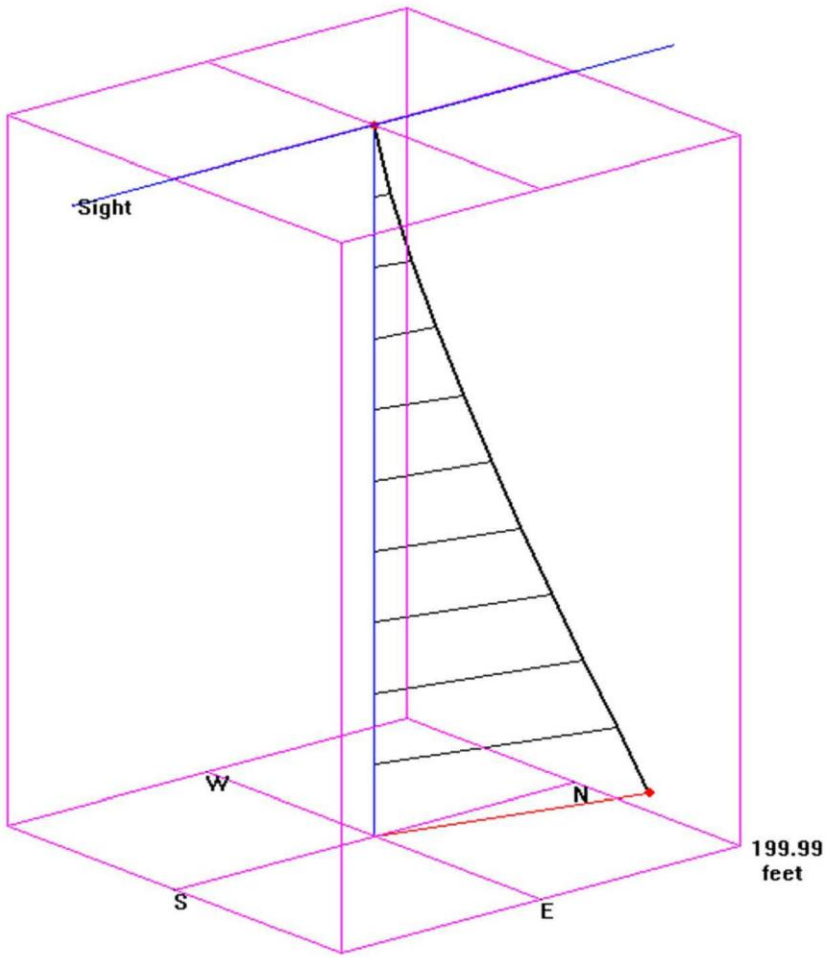
List of Log Plots:

Borehole Deviation

Stoller Newport News Nuclear

Stoller Newport News Nuclear

C8706
Borehole Deviation



Appendix C

Borehole Core Log Reports and Photographs

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Appendix C contains the core log reports and photographs for the characterization boreholes (C9550, C9549, C9552, and C8706) drilled in the BY Cribs. These reports and photographs were compiled by geologists at the RJ Lee soil laboratory.

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BOREHOLE LOG

Page 1 of 9

Date: 4·5·16

Well ID: C9550 | Well Name: NA | Location: BY Cribs N.W. ~~of Corner~~ Corner (TC) 11-21-16

Project: 200-DY-1 | 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
0-40' 40	DPT	DPT	No Recovery 0-40'	0-43.7 - DPT no Returns	0-43.7 Direct Push.
					No Recovery.
					Compact/Overdriven. soil.
42.5					
				(TC) 11-21-16 (TC) 11-21-16	43.7-200: Sonic w/ 5' core
				43.7-44.4 ~~silty~~ sandy Gravel ~~#3~~ G (30% G, 60% S, 10-5%)	5'x4" lexan liners.
				pr. srtd. v.fn.-v.c. sub-ang. S. of 25% mafic/75% felsic w/	43.7-48.7: Core 1: B340T1
				95% ~~mafic~~ sub.ang. v.fn.-c. pbl. of 95% mafic/5% Qtz. flds.	Driven 12·17·15 (0900)
45				2.5Y 3/3 H.olv.brn. slight plastic silt (5%) moist. graded contact. below. pot. slough.	
				44.4-46.0: Sand. (S.) (100%) pr. srtd. m.-v.c. sub-ang.	
				S. of 75% mafic/25% Qtz flds. 2.5Y 4/1 drk. gry. moist.	
		#1		46.0-47.9: Sand S. (100%) pr.→w. srtd downward. 50/50 mafic/felsic. overall. 2.5Y 3/3 H.olv.brn.	
				•Int bed.: 46.0-47.8 pr. srtd. fn.-m. S. (46.0-46.8)	(no rxn w/ HCl.)
47.5				•47.8-48.2': ~~mod. srtd. fn.-c.S.~~ AZ 3.30.16. (47.4-47.9: w. srtd. crs. S.)	-48-48.7' overdriven -
				47.9-52.9': Sand. S. (100% S) mod. srtd.-well srtd.	47.9-52.9' Core 2: B340T3
				ang. 90% Gr-v.c. S. 10% m.S. of 50%/50% felsic, mafic	Driven 1·11·16
				trc. fn. mica. no visible grading. massive.	Aliquote: ~~B34T~~ B34T20, B34T21
				trc. (sprs. fn.-m. rndd. pbl. of bslt.) slight moist. 2.5Y 3/3	(3·18·16) from (~~50.0-52~~) 47.9-51.9 AZ 3.30.16
50	B34T20 B34T21			lt. olv. brn. no rxn w/ HCl. sprs. hemmatite alt. of grains.	
				10YR 5/4 yellowish brn.	47.9-48.7: pot. slough.
				•51.9': 1" thick zone: modal fine grain. Sand. 80% C.-v.C. S.	
				20% v.fn.-fn. Qtz. dom. Sand.	
52.5					
				53.0-57.5': Sand. (98% S, <2% M)	53.0-58.0: Core 3: B340T5
				70% crs.-fn. Qtz. felds. S. / 30% v. Crs. sub-ang.	Driven 1·11·16.
				Mafic. S. trc. fn. sub-rndd. pbl. of bslt.	
				unconsolidated. slightly moist. 2.5Y 3/3 H.olv.brn.	
55.0				•53.6': 0.2' thick int. bed.: slightly more fn. matl.	
				of 90% m-fn. S. of 95% felsic/5% mafic. comp.	
		#3		no rxn w/ HCl. (trc. mica.) weak hem. alt. of	
				sprs. grains.	
				•57.2': 0.2' thick bed of m-fn. matl. of 100% S,	
57.5				60% m.-crs. sub-ang. S. / 40% v.fn.-S. of 99%	
				Qtz. flds. / 1% mafic. wk. rxn w/ HCl. Colo.: 2.5Y 6/3	58.0-63.0: Core 4
				lt. ylwsh. brn.	Next. Page.
				57.5-58: ~~#4~~ S. (90% S, 10% M. trc. pbl.)	
~~60.0~~ TC 11-22-16		#4		(TC) 11-21-16 90% crs. ang. crs.-v.fn. S. of 80% Qtz. felds. / 20% mafic.	

Reported By: A. Lantzen		Reviewed By: T. Clark	
Title: Geo. Tech.		Title: Geologist	
Signature: A. [illegible]	Date: 4·5·16	Signature: [illegible]	Date: 11/21/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 9

Date: 4.5.16

Well ID: C9550 | Well Name: NA | Location: BY Crib NW Corner

Project: 200 DV-1 | 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
60.0		100% #4		57.5-58: ~~m~~ S. (90% S, 10% m, trc. g.) pr. srtd.	Sonic w/ 5' core
				80% m-crs. ang. S. / 20% fn.-v.fn. Qtz. S. (TC 11-21-16)	58.0-63.0: Core 4: B340T7
				compact. w/ < 3% v.fn.-m. w.rndd. pbl. of bslt.	Driven 1.11.16
				color 2.5Y 6/3 lt. ylwsh brn. mod. rxn. w/ HCl.	overdriven 62-63' w/ sluff.
				slight. moist. non plastic v. porous.	
62.5				sharp contact w/ above.	
				58.0-63.0: Sand. S. (100% S) w. srtd.	63.2-68.2: Core 5: B340T9
		100% #5		sub.ang. m.-crs. S. of 50% felsic / 50% mafic.	Driven 1.12.16
				no vis. structure. trc. fn. mica. v.wk. rxn w/ HCl	Aliquot: 67.6-66.6': 3.24.16
				~~2.5Y 5/3~~ lt. olv. brn. slight moist. 2.5Y 5/3 lt. olv. brn. (AK 5-23-16)	HEIS# B34T23, B34T22
65.0				•62-63': Sed. compacted by being overdriven.	
				mod. rxn w/ HCl. crushed Qtz.	
				63.2-68.2': Sand S. (100%) mod. srtd. m-c. sub-ang.	- 1-2' downward coarsening beds.
	B34T23 B34T22			S. of 60% Qtz flds. / 40% mafic. largest grains are mafic.	
				trace sub.rndd. m. pbl. of bslt. 2mm thick beds of	
67.5				v.crs. ang. S. (64.7-65.0'). trc. med. mica.	
				• 67.5-~~68~~ 67.8': ~~Sandy silt~~ SM (silty Sand m S) (AK 5-24-16)	68.0-73.0 Core 6 B340V1
				(25% m, 75% S) sub rnd. v.f.-m. S. bed. w/ non- (AK 5-24-16)	Driven 1.12.16
				plastic silt. moist 2.5Y 5/3 lt. olv. brn. st. rxn HCl.	
				faint Fe+ stain patchy. above fn. grain bed.	
70.0		100% #6		•68-68.2': 2" thick bed ~~slightly silty Sand (m)~~ S (90% S, 10% m) (TC 11-21-16)	
				v.f.-c. sub ang. S. w/ non plastic M. 2.5Y 4/2 dark grysh. brn. (TC 11-21-16)	
				sharp. contact below. pot. slough. moist wk. rxn HCl.	
				68.2-73.0': Sand S. (100%) mod. srtd. 2.5Y 5/3 lt. olv. brn. moist.	
				•68.2-70.2': mod. srtd. m.-c. subang. S. of 50/50 maf./fels.	
72.5				•70.2-73.0': down coarsen m-c. subang. S. 50/50 maf:fels.	72.2-73.0': overdriven.
				2-3mm Fe staining.	73.1-78.1 Core 7 B340V3
				73.0-78.1': Sand S. (100%) mod.-w. srtd.	Driven 1.12.16
				f.-m. ang. S. of 70% Qtz. flds / 30% mafics. 2.5Y 5/3	
				lt. olv. brn. moist no rxn HCl. trc. med. mica.	
75.0				•@ 75.0': faint 2-5mm bedding of f. S. colored	
				10YR 4/3 brn. no rxn HCl. moist. Qtz. flds.	
		#7		•@ 76.0': faint 1" bed of f. S. colored 10YR 4/3 brn.	of Qtz. flds.
					~~77.1-78.1'~~ ~~77.1-78.1'~~ overdriven (AK 5-30-16)
77.5				78.1-83.1: Sand (S) (100%) w. srtd. v.f.-f. S.	
				sub.rndd. massive bedding / no vis. structure. moist. 2.5Y 5/3	78.1-83.1: Core 8 B340V5
				lt. olv. brn. no rxn HCl. 10% mafic / 90% felsic.	¼-½" rind on core walls.
~~80~~ TC 11-22-16		#8			82.1-83.1: overdriven.

Reported By: A. Lontau | Reviewed By: T. Clark

Title: Geo Tech. | Title: Geologist

Signature: A. Lontau | Date: 4.5.16 | Signature: [signature] | Date: 11/21/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 9

Date: 4.5.16

Well ID: C9550 | Well Name: NA | Location: By Crib NW. Corner

Project: 200-DV-1 | 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
80.0		100% #8		78.1-83.1: Sand (S) (100%) w. srtd. v.f.-f. S. of 10% mafic/90% Qtz.flds. no vis. bed. mois 2.5Y5/3 lt. olv. brn. no rxn HCl. trc. mica.	Sonic w/ 5' core 78.1-83.1 Core 8 B340V5 Driven 1.12.16
82.5				83.1-88.0: Sand S (100%) w. srtd. f.-m. S. of 20% mafic/80% Qtz flds trc. mica. sprs. fn. layers (2.4mm thick) of v.f-f.S. throughout. moist 2.5Y5/3 lt. olv. brn. 5-10mm thick laminar bedding.	82.1-83.1': overdriven 83.2-88.2 Core 9 B340V7 Driven 1.13.16
85.0		100% #9		e84.5: faint 1/4" thick bed of fn. w.srtd. S. color 2.5Y5/4 lt. olv. brn. no rxn HCl.	
				e84.2': 3mm thick silty sand layer w/ light & dark filimentous beds.	
87.5					87.7-88.2': overdriven.
87.7 TC 11-21-16				88.0-89.8': Sand. S. (100%) sub-ang. fn.-m. S. of 45% Qtz flds./65% mafic. low compaction. no rxn w/ HCl slight moist 2.5Y5/3 lt. olv. brn. sprs. mica. -sharp contact. bedding.	88.0-93.0: Core 10: B340V9 Drilled 1.13.16
90.0		97% 99% #10		89.8-93.0': Sand (S) (100%) ang-sub-ang. vf.-f. S. of 45% Qtz.flds./65% mafic. no rxn w/ HCl, slight moist. 2.5Y5/3 lt.olv. brn. v.fn. grading to fn. S. bed contains 2-3mm thick v.fn. bedding of fn. to v.fn. S. sprs. mica.	
92.5					93.3-98.3: Core 11: B340W1
		100% #11		93.3-98.1: Sand. S (100%) sub-ang. v.fn.-m. S. 90% Qtz. flds./10% mafic. (v.w. srtd.) 4-8mm thick layers w/ v.fn. 1mm thick layers of v.fn. Qtz.flds. 2% fn. mica + biotite. slight moist 2.5Y5/3 lt.olv.brn. no rxn w/ HCl.	Drilled 1.13.16
95.0					
97.5				98.1-103.1: Sand. S (100%) Next pg.	98.1-103.1 Core 12: B340W3 Drilled 1.13.16
100.0	TC 11-22-16	100% #12			

Reported By: A. Lantau		Reviewed By: T. Clark	
Title: Geo. Tech.		Title: Geologist	
Signature: A. Lantau	Date: 4.5.16	Signature: [signature]	Date: 11/21/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 9
Date: 4·5·16

Well ID: C9550 | Well Name: NA | Location: BY Cribs NW. Corner
Project: DV-1 | 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
100				98.1-103.1: Sand S. (100% S) mod.-pr.srtd. downhole.	Sonic w/ 5' core
				m.-v.c. S. downcoarsening of 60% Qtzflds./40% Mafic.	98.1-103.1': Core 12: B340W3
	B34T24 B34T25			5% subrndd. v.f.-f.pbl. of bslt at base of bed. dry 2.5Y	Drilled 1·13·16
				5/2 grysh brn. no rxn HCl	Aliquot 100.8-101.8': 3·24·16
		100% #12		~~103.1~~ 100.8-103.1': Sand (100% S) mod.srtd. m.-c. subang.	B34T24, B34T25
102.5				S. 60% felsic/40% Mafic. dry. 2.5Y 5/3 lt.olv. brn. no rxn HCl.	
				TC 11-22-16	
				103.2-107.7: Sand S. (95 ~~100~~% S) m.-v.c. ang. S. of	103.2-108.2' Core 13: B340W5
				70% Qtz flds./30% mafic abnt beds (1.5cm thick) of v.c.S.	Drilled 1·13·16
				w/ 5% sub.ang. v.f.-f.pbl. of 90% mafic comp. beds are	
105				1-1.5' apart slight moist 2.5Y 5/3 lt.olv.brn. no rxn HCl.	
				-graded contact	
		100% #13		• 107.7-108.2: Sand cont. ~~gradual~~ gradually increasing occurance	
				TC 11-22-16	
				of silt interbeds (1-3mm thic) spaced 1-2cm	Detail photo @ 107.7-108.2
				apart. 2.5Y 5/2 grysh brn. w/ filaments of 2.5Y 7/3	
107.5				pale brn. strong rxn w/ HCl. -may be relict of overdrive.-	
					109.2-113.2' Core 14: B340W7
				108.2-110.7: Sand S. (100% S) mod.srtd. m-v.c sub-ang.	Drilled 1·13·16
				S. of 70% Qtz flds./30% mafic. moist. 2.5Y 5/2 lt.grysh.brn.	110.2-111.2 Aliquot: 3·25·16
				sprs. 1cm thick layers containing v.crs. sub.ang. S. +	B34T26, B340W7
110				trc. v.f.c. pbl. no rxn HCl.	
	B34T26 B340W7			110.7'-113.2': Sand S. (100% S.) v.w.srtd. v.f.-m.S. of 90% Qtz.	110.7': (72 cpm By, 0 α @ contact)
				10% mafic. moist 2.5Y 5/3 lt.olv. brn. massive-no visible structure.	(Lab Lum 3 w/ 50cm² probe @ 14% Tcm)
		#14		@ sharp contact (110.7'): 3mm thic silt layer color 10YR 5/3	1,15 cpm By, 0 α
				brn. mod. plastic.	
112.5				@ 110.9': filiment of black carbon.	
					113.0-118.0 Core 15: B340W9
				113.0-118.0': Gravelly Sand (gS) (80% S, 20% G) pr.srtd.	Drilled 1-13-16
				ang. m.-v.c. S of 50/50% mafic, felsic w/ subang-	
				sub.rndd. v.f.-c.pbl. of 90% mafic/10% felsic comp.	
115				sprs. lrg. biotite, muscovite. no bedding visible.	
		100% #15		2.5Y 5/2 grysh brn. no rxn HCl.	
117.5					
				118.0-123: Sand S. (100% S) ang. m.-v.c. S. mod.	118.0-123.0, Core 16: B340X1
				srtd. of 50/50% mafic/felsic comp. no visible structure.	Drilled ~~1-13~~ 1·13·16
		#16		2.5Y 5/2 grysh brn. moist. no rxn w/ HCl. sprs. Fe⁺	
TXO TC	11-22-16			staining. 2-4mm. patches.	

Reported By: A. Lantau | Reviewed By: T. Clark
Title: Geo. Tech | Title: Geologist
Signature: A. [signature] | Date: 4·5·16 | Signature: [signature] | Date: 11/22/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 9
Date: 4·5·16

Well ID: C9550 | Well Name: NA | Location: BY Cribs NW. Corner
Project: 200-DV-1 | 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		98% #16		118.0-123.0: Sand S. (100% S.) ang. m.-v.c. S. mod. srtd.	Sonic w/ 5' core
				of 50/50% mafic/felsic comp. no visible structure	118.0 - 123.0': Core 16: B340X1
				2.5Y 5/2 grysh brn. moist. no rxn w/HCl sprs. Fe+	Drilled 1·13·16
				staining. 2-4 mm patches.	
122.5				123.1-125.1': Gravelly Sand g,S (90%S,10%G) mod. srtd.	123.1-128.1' Core ~~18~~ 17 : B340X3
		100% #17		ang. m. S. v.c. S. of bimodal size & comp.: m.-c. Qtz/	Drilled 1·14·16
				& v.c. Mafics S. w/ sub. rndd. v.f.-m. pbl. of	
				98% Mafic/2% Qtz. slight moist. no rxn HCl. 2.5Y 5/2	(Downward Coarsening)
125.0				grysh brn. sharp contact below. weathered contact.	
				• 125.5-126.0: Silt (M) interbeds. 1.5"-2" thick	← no activity.
				interbeds of silt. non plastic. high delateney.	
				stratified w/ crs. sand. moist 2.5Y 5/4 lt. olv. brn.	
				mod. rxn HCl. 1cm weathered horizon above & below.	
127.5				possible organic carbon at base of horizon.	
		100% #18		126-128.1': Sand (S.) 100% mod. srtd. m.-v.c. S. ang.	
				of 75% Qtz flds./25% mafic. no structure. moist. 2.5Y 5/2	128.0-133.0: Core 18 : B340X5
				grysh brn. no rxn w/ HCl.	Drilled 1·14·16
				128.0-130.3': Sand S. (100% S) mod. srtd. m-v.c. ang. S. of	
130.0	B34T28 B34T29			70% Qtz flds. / 30% Mafic. 2.5Y 5/2 grysh brn. no rxn HCl.	Aliquot 3·24·16
				• 130.3-130.9': silty Sand mS. (75%S/25%M) pr. srtd.	130.5-129.5': ~~B34OT~~ B34T29, B34T28
				v.f. S. w/ nonplastic M. <5% v.c. ang. S. of bslt.	
				• (Coarsens down.) to v.f. S. → m.S. f. lamina (1-2mm)	
				dark silt present throughout.	
132.5				130.9-133.0': S-gravelly Sand. (85%S, 15%g) mod. srtd.	
				C.-v.c. ang. S. of 60% mafic, 40% Qtz flds. w/ sub-rndd.	
				v.f.-c. pbl. of 90% bslt, 10% felsics. Downward coarsening.	133.2-138.2': Core 19: B340X7
				133.2-136.1: ~~Sand S.~~ (gravelly ~~Sand~~ Sand (gS) (85%S 15%g)	Drilled 1·14·16
				gravells & rudely stratified in 1/2"-3" beds. TC 11-22-16	
135.0		100% #19		bimodal Sand: m.-c. ang. S. of 25% mafic/75% felsic &	
				v.c. sub rndd S. of 75% bslt./25% Qtz	
				Gravel: mod. srtd. beds v.f.-f. sub-ang G. of 95% bslt/5%	felsic.
				interspersed f.-c. pbl. of w. rndd. felsic (non basalt). ~5%	
				black & 2.5Y 5/3 lt. olv. ~~brn~~ brn. no rxn HCl Dry.	
137.5				136.1-138.2: Sand S. (98%S, 2%g) mod. srtd. m.-crs. S.	
				of 50% mafic/50% felsic. down coarsening from m → crs. S.	137.2-138.2': overdrive
				• @ 136.5': c.-v.c. ang S. bed. 50/50 mafic felsic.	138-143.0': Core 20 : B340X9
					Drilled 1·14·16
~~140~~ TC	11-22-16	100% #20			Next pg.

Reported By: A. Fontana | Reviewed By: T. Clark
Title: Geo. Tech | Title: Geologist
Signature: A. Fontana | Date: 4·5·16 | Signature: [illegible] | Date: 11/22/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 9
Date: 4·5·16

Well ID: C9550 | Well Name: N1 | Location: By Cribs NW. Corner
Project: 200-DV-1 | 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
140		100% #20		138.2'-143.0': gravelly Sand (gS) (85%S, 15%g)	Sonic w/ 5' core.
				mod srtd. bimodal m.-c. ang. S. of 70% Qtz flds./30% mafic	138.0-143.0': Core 20: B340X9
				+ v.c. subang. bslt. S. w/ w.srtd. v.f. pbl. of bslt.	Drilled 1·14·16
				tre. c.pbl. of bslt. Dry 2.5Y 5/3 lt.olv.brn. w/ black	
				pebbles. no bedding. no rxn HCl.	
142.5					
				143.0- gravelly Sand gS (85%S, 15%g) mod.srtd.	142-143': overdriven
				overall w/ pr.srtd. beds. 1.5'-2' thick beds of gS: m-v.c. ang.	143-148': Core 21: B340Y1
				S. of 50/50% mafic:felsic comp. w/ v.f.-f.pbl. subang. dry	Drilled 1·14·16
				2.5Y 5/3 lt.olv. brn. no rxn HCl. sprs. med. mica.	
145		100% #21		•144.5': Coarse grain. pr.srtd. int.bed. mafic dom. of	
				crs.-v.c.S., v.f.-m.pbl.	
				•146.5': 3" thick int. bed. crs. grain m.S.-c.pbl. of	
				60% mafic/40% qtz. flds. Sharp Top contact.	
				pot. top of bed.	
147.5					147-148': overdriven + heated.
				148.0-153.0': gravelly sand gS (80%S, 20%g) 1.5-2' beds	
				mod-pr. srtd. down coarsening: ang. m.-c. S. of 60% mafic	148.0-153.0: Core 22: B340Y3
				40% qtz. flds. w/ v.f.-c.pbl. sub-rndd of 50% mafic/50% felsic.	Drilled 1·18·16
				Moist 2.5Y 5/3 lt.olv. brn. no rxn HCl.	
150		100% #22		•148.6': 2" thick more coarse base of bed. max pebble. 15mm.	
				•148.6-149.6': Down coarsening bed. max pbl.: m.pb. 20mm.	
				•149.6-151.7': pr.srtd. down crs. bed. max: 32mm C.pbl.	
				•151.7-153': Down crs. bed. max: f.pbl. 32mm. pr.srtd.	
152.5					152.5-153': overdrilled.
					Drilled 1·18·16
		Slough.		153.3-158.3': Gravelly Sand gS (90%S, 10%g) pr.srtd.	153.3-158.3': Core 23: B340Y5
	B34T30 B34T31			crs.-v.crs.S. of 50% mafic/50% felsic w/ sprs. v.f.-c.pbl. of	154-155.0 Aliquot: 3·25·16
				90% Mafic, 10% Qtz, int. Volcanics. sprs. 4mm clay clots.	B34T30, B34T31
155		100% #23		overall 2.5Y 5/3 lt.olv.brn.	@154': 34cpm By, 0α Contact. (Luciline 3, 50cm² probe, 14% eff. Tc-99)
				•155.1-155.6': Sand interbed (100%S) w. srtd, crs.	~~1.2 to 4pm~~ 800cpm By, 0α KL 4·5·16
				ang. Qtz. sand w/ tre. v.f pbl. of bslt. 2.5Y 5/3 lt.olv.brn.	
					overdriven + heated 157.3-158.3
157.5		Compact.			
		100% #24			158.0-163.0': Core 24: B340Y7
160	11-22-16				

Reported By: A. Santos | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: A. Santos | Date: 4·5·16 | Signature: [illegible] | Date: 11/22/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 7 of 9

Date: 4·5·16

Well ID: C9550 | Well Name: NA | Location: BY Cribs NW Corner

Project: 200-BV-1 | 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
160.0		100% #24		158-163.0': gravelly Sand (gS) (85%S, 15%g) 1' thick	Sonic w/ 5' core
				graded bedding downward coarsening mod. srtd. m.-C.S	158-163.0': Core 24: B34Y47
				grading to m.Sw/fn.pbl. at base of beds.	
				Sand: m.-v.c. ang. of 60% mafic/40% felsic Qtz.	
				Gravel: base of beds. contain v.f.-f.pbl. of 95% bslt./5% Qtz	
162.5				<5% m.-fn.pbl. sub-rndd. of 80% mafic/20% felsic (int. volc.>meta.)	
				2.5Y 5/3 lt.olv.brn. dry.	161.7-163.0' overdriven & heated.
				•159.0': faint 3mm thick fn.S. of 80% Qtz/20% mafic.	
				163.1'-167.6: Gravelly Sand gS (85%S, 15%g) 0.5-1' well	163.1-168.1': Core 25 B34Y49
				graded beds of mod.srt. m.-v.c. ang S. w/ 15% pbl.(fn.)pbl.	Drilled 1·18·16
165.0				grading to pr.srtd. m.S.-v.f. pbl. of bslt.	
		100% #25		Sand: 20% mafic/80% felsic. Gravel: 80% bslt, 20% meta.felsic.	(overall dry 2.5Y 5/3 lt.olv.brn)
				interspersed.(sprs.) m.-v.c. w.rndd pbls of Meta. max 50mm.	(no rxn HCl.)
				•165.6': 4" thick bed sandy Gravel sG (75%g, 25%S)	
				c.-v.c. ang S. of 30% maf, 70% Qtz. w/ v.f.-v.c. rndd pbl. of	167.2-168.1': overdriven.
167.5				80% bslt./20% felsic meta.	
				167.6-167.8: pr.srtd. coarse grain bed. Sandy Gravel sG (75%g, 25%S, <2%m) fn.-m.S. of	
				20% mafic; 80% felsic Qtz. w/ pr.srtd. v.f.-v.c. w.rndd. pbl.	max: 50mm. of 80% bslt. > and/20%
				felsic meta. matrix: 2.5Y 5/3 lt.olv.brn./clasts: black. on top of bed. are clay alt. rocks. (st. weathering)	
				mod.rxn w/ HCl.	
170.0				168.0-173.0': gravelly Sand gS. (85%, 15%) same as above	168.0-173.0 Core 26: B34101
		100% #26		(163-167) above. 0.5-1.5' w.graded beds. trc. 3mm mica.	Drilled: 1·18·16
				•171.0': 0.4' thick coarse bed. of med.-c. ang S. (70% bslt, 30%	felsic meta.) w/ fn.-c.pbl. of (80% mafic/20%
				felsi.) max. 30mm. trc. carbon chips.	(no Rxn HCl)
				•172.1: 0.1' thick bed fn.-m.pbl. (90% mafic/10% felsi) w/ trc.-5%	clots of silt (2-3mm) 2.5Y 5/3 olv.yellow.
172.5				173.2 (coarse bed may be base of ↓ coarsening beds.)	172.2-173.0: overdriven.
				173.2-~~177.4~~ 178.2: gravelly Sand gS. (15%g, 85%S, trc.M) pr.srtd.	
				fn.-crs. AK 4-4-16 ang. S. w/ 5% v.crs. sub-ang S. of 15% mafic, 85%	173.2-178.2: Core 27: B34103
				Qtz.flds. w/ w.rndd. m.pbl.-sm.cbl. of 30% mafic/70% felsic.	Drilled 1·18·16
				w/ trc. lrg mica. & trc. 2-4mm clots of mod.plastic.	Aliquot: 3·29·16 (175.5-176.5')
175.0				10YR 5/6 yllwsh.brn. (overal color: 2.5Y 5/3 lt.olv.brn.)	B34T32, B34T33
				prob. 1-3' thick downward coarsening beds. 2-4" thick	
	B34T32 B34T33 (3·29·16)	100% #27		base of beds contains up to 20% m.-c.pbl. of 70% bslt. no rxn HCl.	T·P6: slough.
				sprs. sm.cbl. 70mm. ~~trace~~ AK 3·29·16	bottom 8" overdriven.
				•177.4-178.2 pr.srtd. v.fn.-v.c. S. bed. of same comp. as above.	1/4" rhind.
177.5				w/ up to 5%m. contains. 2-5mm. clots of mod.plastic m.	
				178.0	
		10% #28		183-178.7: Next pg.	178.0-183.0: Core 28: B34105
				AK 4·5·16	Drilled · 1·19·16
~~180.0~~ TC 11-22-16					

Reported By: A. Lantau | Reviewed By: T. Clark

Title: Geo. Tech. | Title: Geologist

Signature: A. Lantau | Date: 4·5·16 | Signature: [signature] | Date: 11/22/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 8 of 9
Date: 4·5·16

Well ID: C9550 | Well Name: NA | Location: B-Cribs NW Corner
Project: 200-DV-1 | 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
180.0		#28	#28	178.0-178.6: ~~Sandy silt~~/silty Sand (50%m/50%s) (TC 11-22-16) non-plastic. v.low. dilatancy 2.5Y 4/3 olv.brn. moist w/ v.f.-m.S. 4mm bedding. pot. slough.	Sonic w/ 5' core 178.0-180.3': Core 28 : B34105 Drilled 1·19·16
				grades to gravelly Sand. from 178.5-178.8.	–
				•178.6'-178.8': 2" thick bed of v.c.pbl. oil stains on clasts. matrix. black from pulverized bslt. clast.	181.7-183.0': overdriven. end of core tube compacted into core.
182.5				178.8-180.0': gravelly ~~Sand~~ gS (90%s, 10%g) (TC 11-22-16) v.pr.srtd.	2" chips of liner in core.
183.0				bed. pot. ↓fining i v.f.-v.c. sub.ang. S. of 70% felsic/30% mafic w/ v.f.-v.c. pbl. v.w.rndd. of 80% bslt./20% felsic meta & int. vole. grad. grading to m.pbl. (down. fining).	Temp registered 147.9
				180-183: gravelly Sand (gS) (90%s, 10%g) pr.srtd. m.-v.crs. sub.ang. S. of 40% felsic/60% mafic w/ sprs. v.w.rndd. m.pbl. of 40% felsic, 60% bslt. 2.5Y 5/3 lt.olv.brn. moist. (bslt. > int. vole. > felsic meta.)	
			Move Down	@ 180.7': pot. rip up clast of palagonite w/ vesicular ~~bslt~~ t. bslt. v. weathered. to saprolite. mottled multi color olive green, pale yellow, bright white.	
182.5				Sandy Gravel (SG) (TC) 11-22-16	
183.0		Pulv.		183.1'-195.3': ~~gravelly Sand (gS)~~ (SG) (70%s, 30%g). (TC) 11-22-16 mod ~~v.~~ stratified. ↓coarsening beds. 4-10" thick grading (100%) m.S. to m.S w/ c.pbl. of 90% bslt./10% felsic meta.	183.1-188.1': core 29 : B34107 Drilled 4·19·16
				•4" beds grade from 100% m.S. to 70% m-v.c.S./30% v.f.-f.pbl. of 95% bslt./5% felsic. (Sand: 90% Qtz. flds/10% mafic.)	183.1-183.6: pulverized from above overdrill
185.0		100% #29		•sprs. w/ srtd. m.-c.pbl. of 80% bslt, 20% felsic meta. throughout. 2.5Y 5/3 lt.olv.brn moist. no rxn HCl.	
				185.3'-188.1': gravelly Sand gS. (80%s/20%g). mod. srtd. bimodal: v.f.-c. sub.ang. S. of 90% Qtz. flds. w/ a.c. sub.ang. mafic S. gravel: v.f. pbl. of 90% bslt./10% Qtz. 2.5Y 5/3 lt.olv.brn. moist. no rxn w/ HCl. massive - no vis. bedding.	*187.1-188.1': overdrilled - pulverized
187.5		Pulv. *			
					188.1-193.1': Core 30 : B34109
				188.1-193.1': gravelly Sand gS (90%s, 10%g) massive. no vis. bedding. v.f.-v.c. sub.ang. S. of 60%-50% felsic, 50-40% mafic. mod. srtd.-pr.srtd. w/ sprs. v.fn.-m. pbl. of 90% bslt./10% felsic meta. (sub-rndd.) (TC 11-22-16)	Drilled 1·19·16 181.1-181.3': pulverized from above overdrive.
190.0		100% #30		no vis. bedding. massive? moist 2.5Y 5/3 lt.olv. brn. no rxn HCl.	
					192.5-193.1': over driven.
192.5					
					193.2-198.2': Core 31 : B34111
				193.2-198.2': Next pg.	~~193.2-194.3'~~: Drilled Next pg.
~~195.0~~ TC 11-22-16		#31			

Reported By: A. Lantau | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: A. Lantau | Date: 4·5·16 | Signature: [signature] | Date: 4/22/16

A-6003-642 (03/03)

9 (TC) 11-22-16

BOREHOLE LOG

Page ~~8~~ 9 of 9

Date: 4·5·16

Well ID: C9550 | Well Name: N A. | Location: B4 Cribs NW. Corner

Project: 200-DV-1 | 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
195.0	B34T34 B34T35 (3·29·16)	100% #31		193.2-194.3': Sand (100%) v.w. srtd. v.f.-m. S of 95% felsic 5% mafic, 2.5Y 5/3 lt. olivbrn no rxn HCl. (pot. slough.)	Sonic w/ 5' core
				194.3-195.3': ~~silty~~ (TC 11-22-16) sandy gravel ~~m~~ SG (70%g, 20%S, 10%M) (TC 11-22-16) v.pr.srtd. v.f.-v.c. S. of 70% felsic/30% mafic w/ w. mndd.	193.2-198.2: Core 31: B34111 Drilled 1·19·16 Aliquot: 194.0-196.0 (3.29.16)
				v.f.-v.c. pbl. of 80% bslt, 20% felsic meta. w/ mod. plastic clayey silt. 2.5Y 5/2 grysh brn. no rxn HCl.	B34T34, B34T35
197.5				195.3-198.2': ~~slightly silty~~ (TC 11-22-16) sandy gravel ~~m~~ SG (60-70%g, 40-30%S, (TC 11-22-16) ≤5%m) mod. srtd. ↓ coarsening v.f.-v.c. ang. S of 80% Qtz 20% mafic w/ ↑ crs. v.f.-v.c. pbl. of 60% felsic meta/40% bslt. overall coarsen crsn. from v.f. silty S. to C. Sandy Gravel. moist 10YR 5/4 ylwsh brn. no rxn HCl. slight imbrication.	over driven 197.6-198.2'
197.5		Move Down		gravelly silty sand (gmS) (TC 11-22-16)	198.0-200.0' Core 32: B34113
		50% #32		198.0-200.0': ~~gravelly sandy silt. gsM~~ (50%m, 40%S, 20%g). uncompact, soft, non-plastic-low plastic silt. colored 10YR 4/2 dark grayish brown, 2mm thick beds of v.f. sand colored. 10YR 4/4 dark ylwsh brown. Contains v.f.-c. sub-ang. S. of 80% Qtz, flds/20% mafic + Gravel: ang. v.f.-m. pbl. of bslt. shards of metal + scale from drill pipe in top 2" of core.	Drilled 1·19·16
200.0	TD	slough	T.D.		

not used (TC) 11-22-16

Reported By: A. Lentow | Reviewed By: T. Clark

Title: Geo. Tech. | Title: Geologist

Signature: [signature] Date: 4·5·16 | Signature: [signature] Date: 11/22/16

A-6003-642 (03/03)

Core 1: 43.7-48.7

Core 2: 47.9-52.9

Core 3: 53.0-58.0

Core 4: 58.0-63.0

Core 5: 63.2-68.2

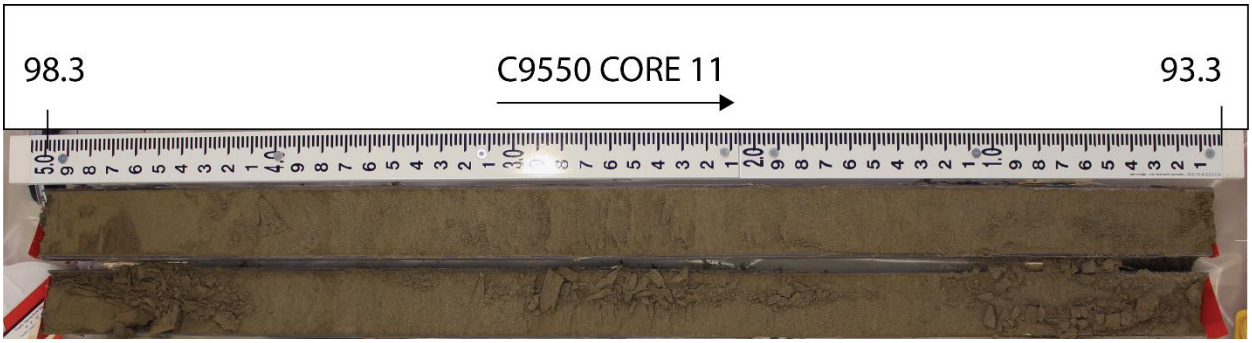
Core 6: 68.0-73.0

Core 7: 73.1-78.1

Core 8: 78.1-83.1

Core 9: 83.2-88.2

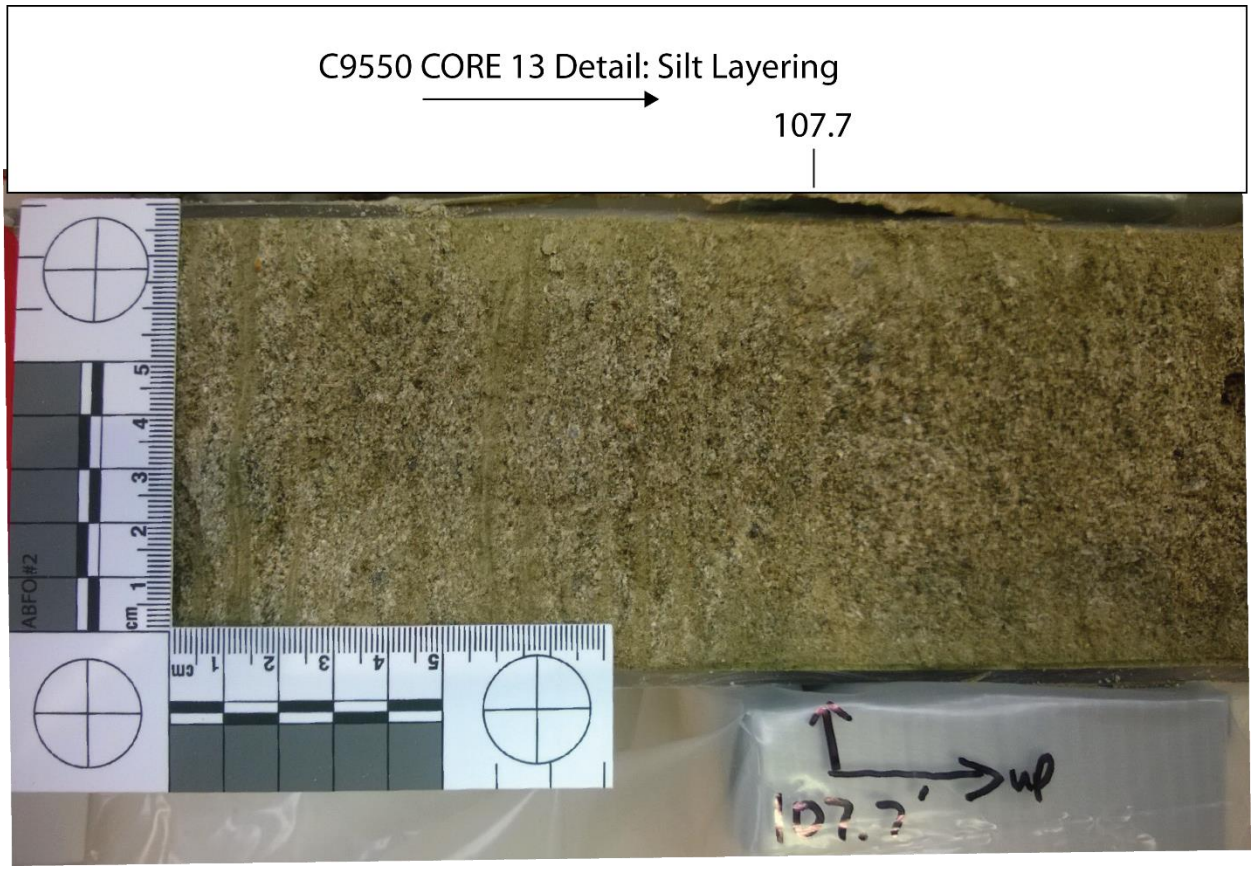
Core 10: 88.0-89.3



Core 11: 93.3-98.3

Core 12: 98.1-103.1

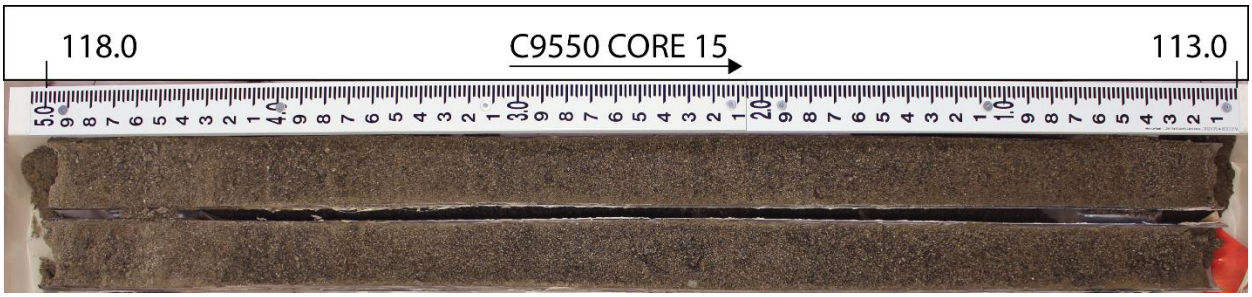
Core 13: 103.2-108.2



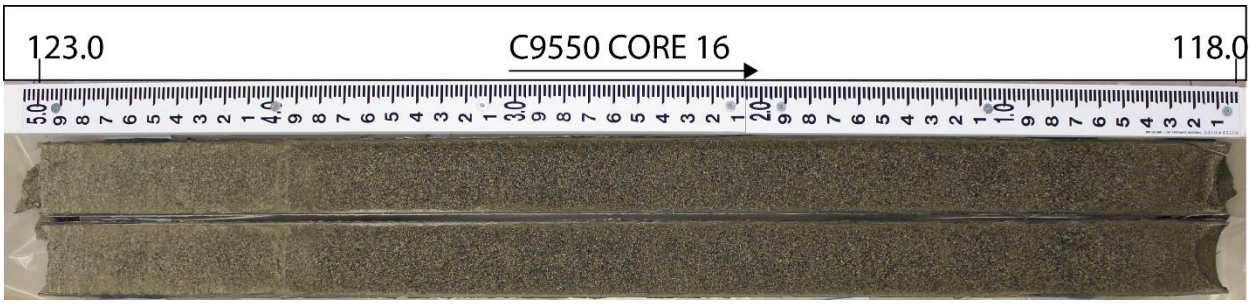
Core 13: 107.7 ft. detail

Core 14: 108.2-113.2

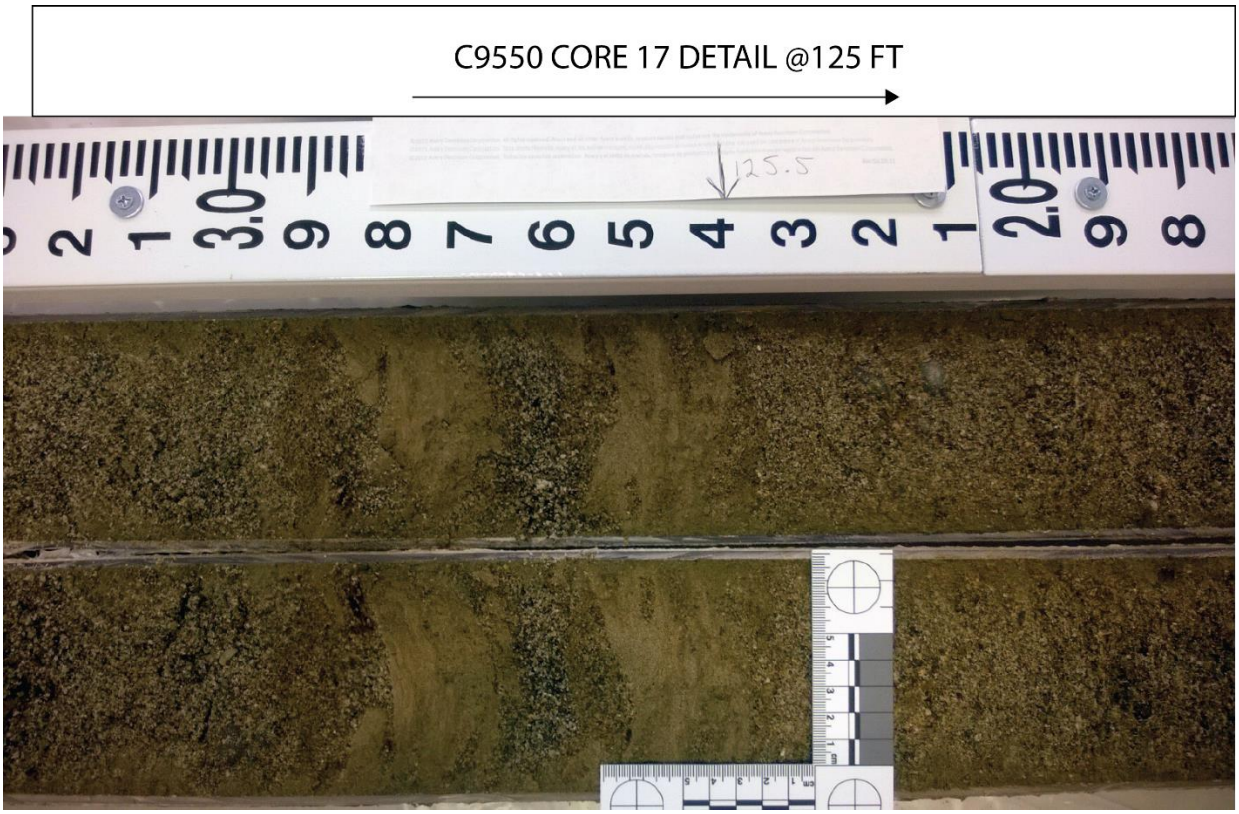
Core 14: 110-111 Sample Detail



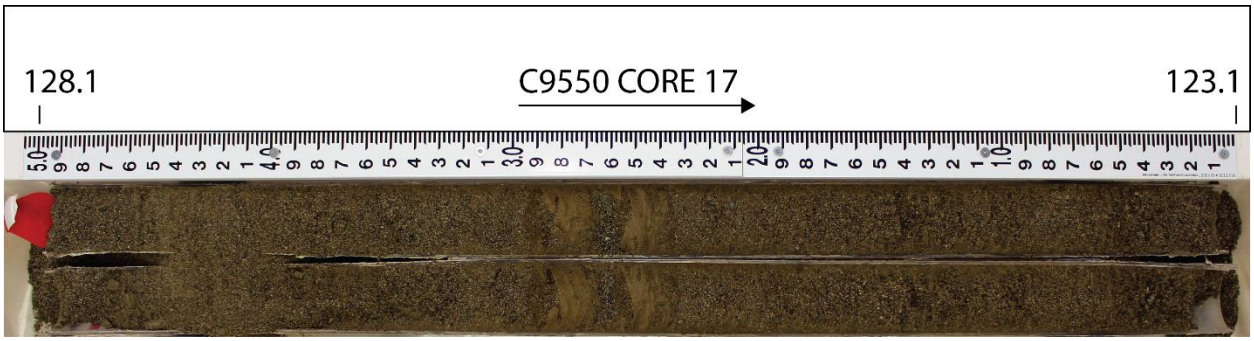
Core 15: 113.0-118.0



Core 16: 118.0-123.0

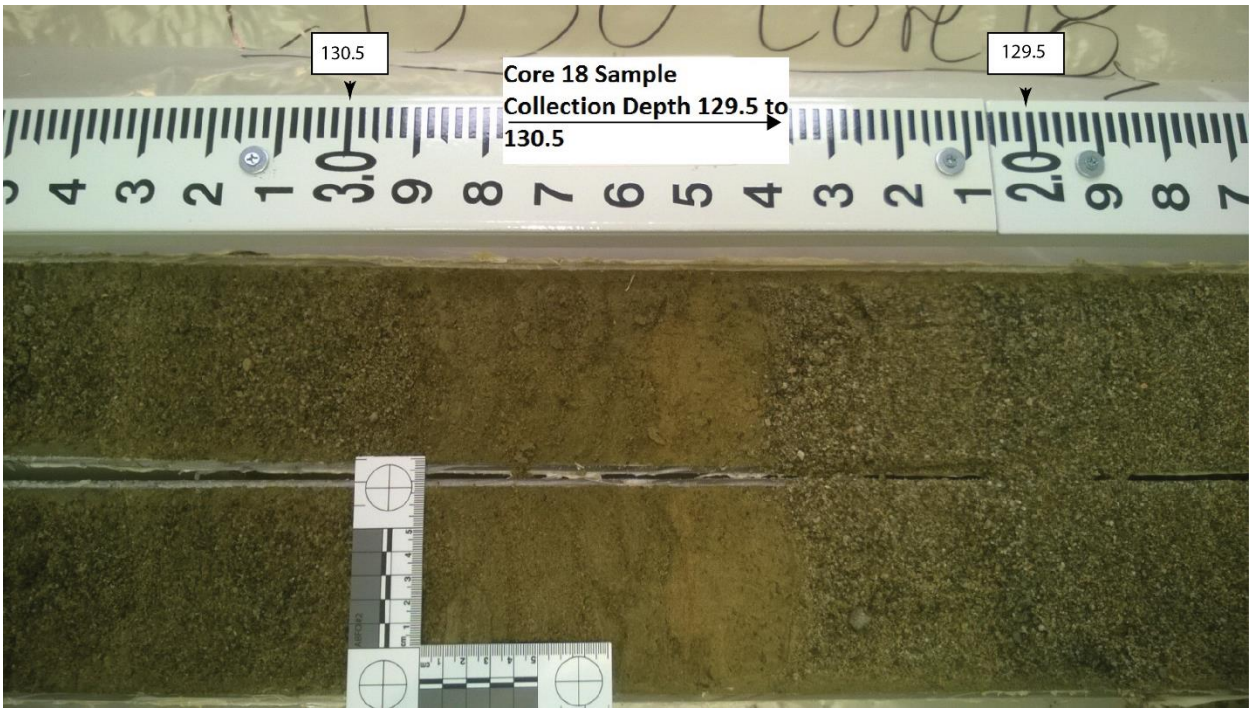


Core 17: 105.5 ft. Detail



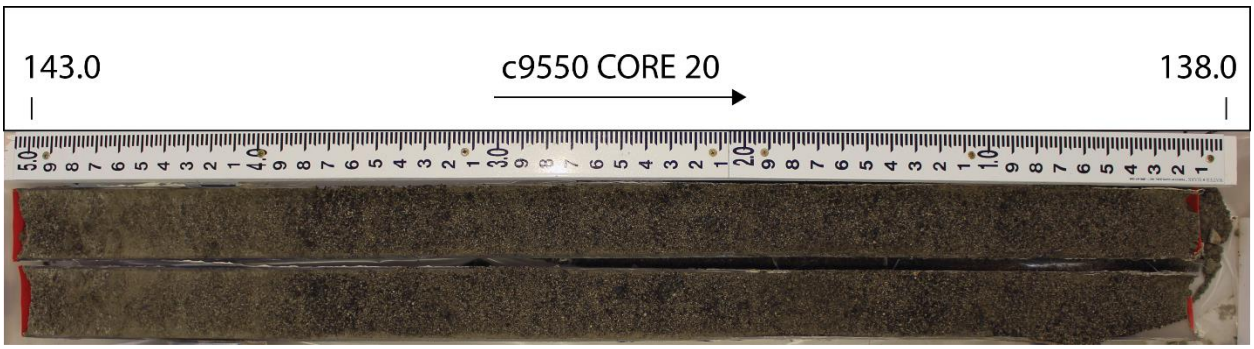
Core 17: 123.1-128

Core 18: 128.0-133.0

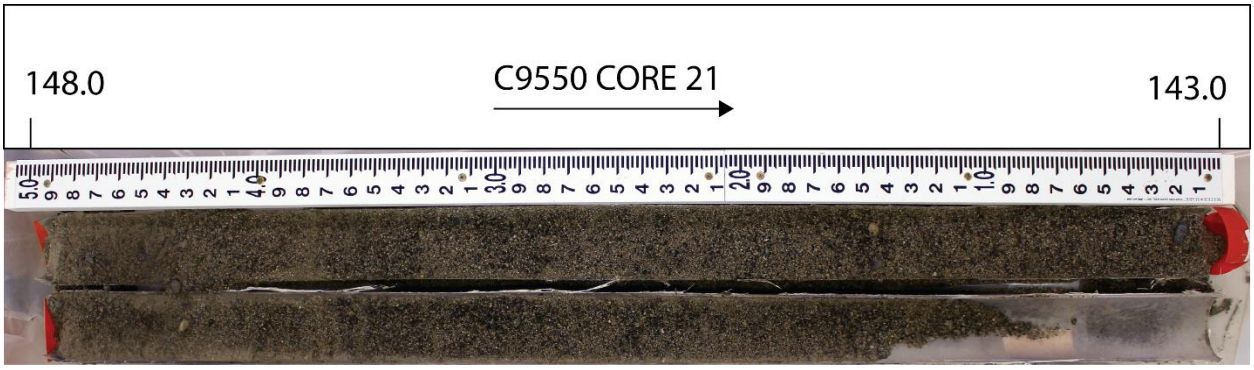


Core 18: 129.5-130.5 Detail

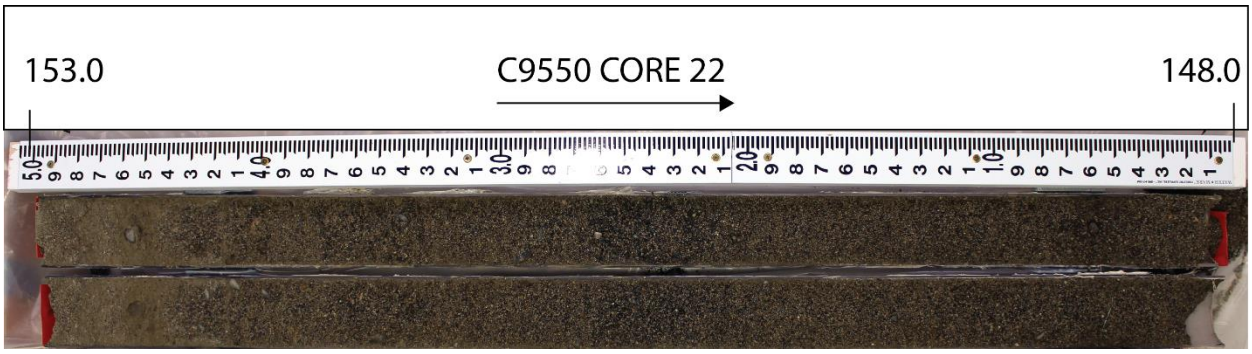
Core 19: 133.2-138.2



Core 20: 138.0-143.0



Core 21: 143.0-148.0



Core 22: 148.0-153.0

Core 23: 153.3-158.3

Core 24: 158.0-163.0

Core 25: 163.1-168.1

Core 26: 168.0-173.0

Core 27: 173.2-178.2

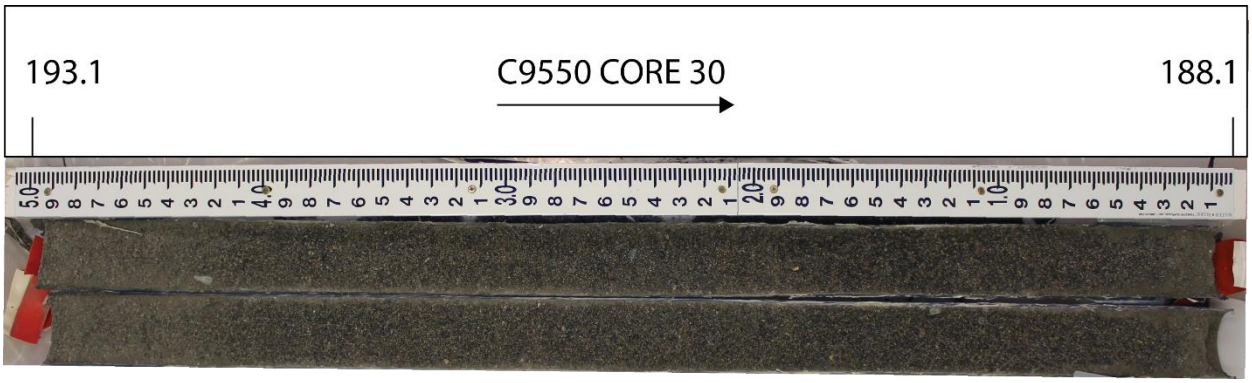
Core 28: 178.0-183.0

Core 28: 179.0 Detail

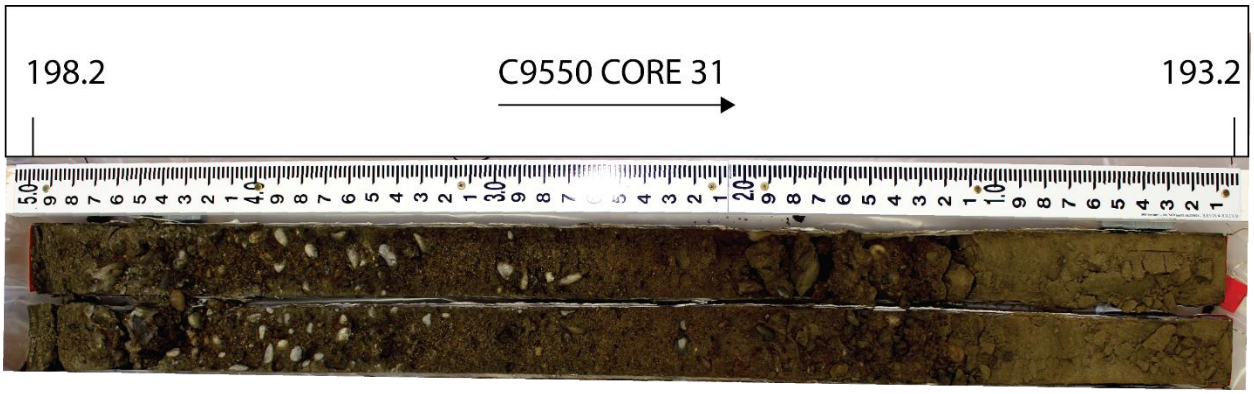
Core 28: 180.7 Detail

Core 28: 183.1 Detail

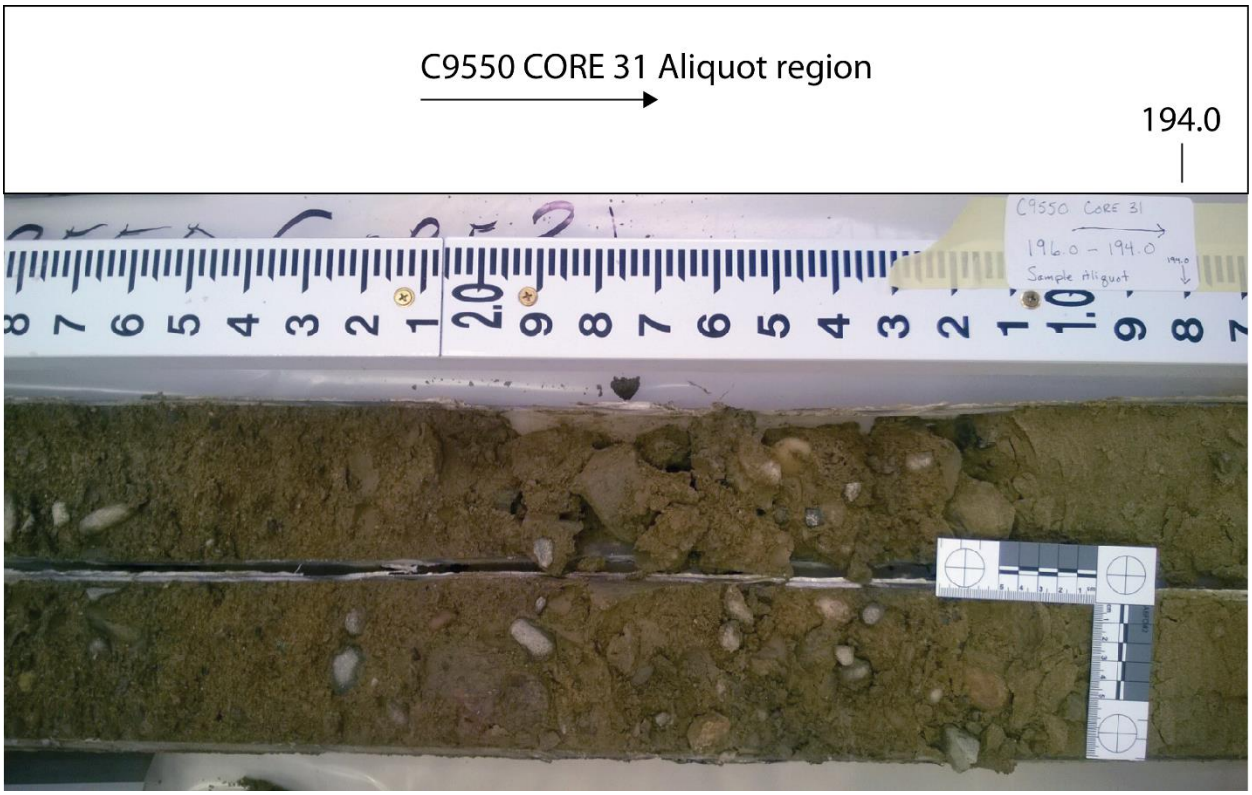
Core 29: 183.1-188.1



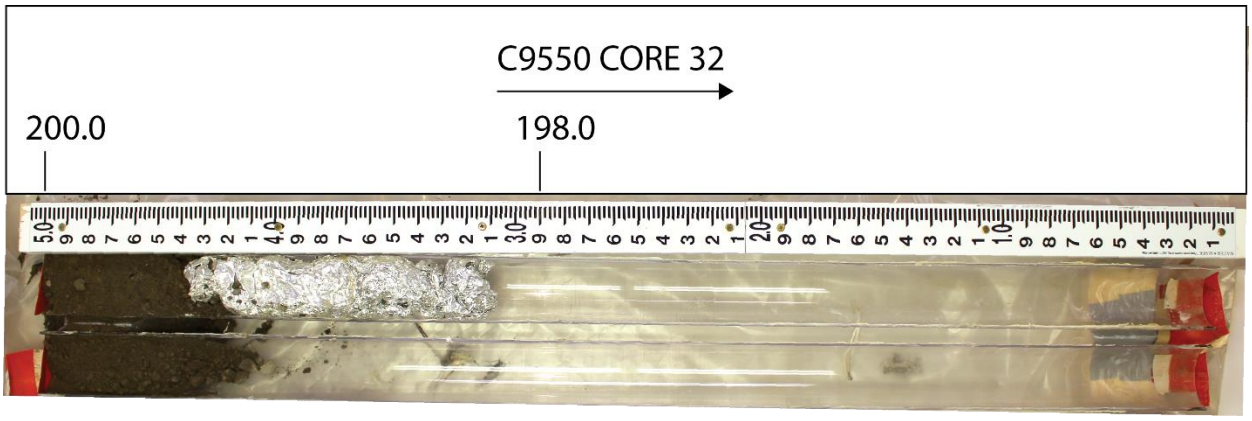
Core 30: 188.1-193.1



Core 31: 193.2-198.2



Core 31: 194-196 Aliquot Detail



Core 32: 198.0-200.0

BOREHOLE LOG

Page 1 of 9

Date: 4·25·16

Well ID: C9549 | Well Name: NA | Location: BY cribs: NE corner.

Project: 200-DV-1 | 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				0-45: DPT	0-45.38': DPT
					no recovery
				7.2-9.7': split spoon 75% recovery	pulverized-overdriven.
				HEIS# B33122, B33123	
				see geo. field log. (10·6·2015)	45.6-TD. Sonic w/5' core.
45				45.6'-46.2': slightly silty sand (m)SG (15%m, 85%S, trc.g) v.f.-v.c. sub.rndd. Sand of 50/50% mafic/felsic w/ trc.g. of f. sub-rndd. bslt. pbl. moist soft. 2.5Y 4/2 dark grysh brn.	45.6-50.6': Core 1: B34115 Drilled 1·20·16
					C 45.9': 2400 dpm/foot βγ, 0α (open in containment box.)
42.5				46.2-48.0': gravelly Sand (gS) (90%S, 10%g, 0%m) v.pr.srtd. f.-v.c. sub-ang. S. of 50-60% Qtz.flds./50-40% mafic. w/ spcs. v.f.-v.c. sub-ang. pbl. of 50/50% bslt/meta., 2.5Y 5/3 lt.olv.brn.	
		100% #1		48.0-48.8': gravelly Sand (gS) (95%S, 5%g, 0%m) Mod.pr.srtd. v.f.-v.c. sub-ang. S. of 90% bslt./10% Qtz.flds. w/ spcs. v.f.-c. pbl of bslt. > int. volc.	
50.0				48.8-50.6': gravelly Sand (gS) (80%S, 20%g, trc.m) v.pr.srtd. v.f.-v.c. sub-ang. S. of 50/50% mafic/felsic w/ f.-v.c. sub-rndd.-w.rndd. pbl. of 70% bslt/30% meta. 2.5Y 5/3 lt.olv.brn.	
				50.7'-51.7': silty sandy gravel (mSG) (40%g, 45%S, 15%m) v.pr.srtd. v.f. S.-v.c. ang.-sub-ang. S. of 50/50% mafic/felsic w/ w.rndd.-ang. v.f. pbl.-sm. cbl. of 50% bslt./50% meta. 2.5Y 4/2 olive brown. moist. no rxn HCl.	50.7-55.7: Core 2: B34117 Drilled 1·20·16 (open in Containment unit.)
52.5		100% #2		51.7-55.7': Sandy Gravel (SG) (70%S, 30%G, trc.m) v.pr.srtd. massive bed. f.-ang. S.-v.c. sub-ang. S. of 50/50% mafic/felsic w/ v.f.-w.rndd pbl. of bslt. & w.rndd. c. pbl.-sm. cbl. of 50%/50% bslt/Metamorphics > int. volcanics. 2.5Y 5/2 grayish brown. no rxn HCl. moist.	
55.0		Slough		55.6-60.6: Gravelly Sand (gS) (90%S, 10%g) v.pr.srtd. m.-v.c. sub-ang. S. of 50% Mafic/50% felsic. w/ 50/50% mafic felsic sub.rndd. m.-v.c. pbl. throughout. massive bed. no vis. structure. 2.5Y 5/3 lt.olv.brn. no rxn HCl. max clast: 64mm	55.6-60.6': Core 3: B34119
57.5		#3			
60.0		slough		60.6-61.4': gravelly Sand (gS) (70%S, 30%g) trc.m v.pr.srtd. v.f.-v.c. sub-ang. S. of 60% felsic/40% mafic w/ sub-rndd. f.-v.c. pbl. of bslt. (max 60mm.) trace m. 2.5Y 4/2 dark grysh brn. moist mod. rxn HCl.	60-60.6': overdriven. 60.6-65.6: Core 4: B34121 Drilled 1·21·16
61.0		#4			
At 45.6 ~~65.0~~ ~~62.8~~					

Reported By: A. Lanton | Reviewed By: T. Clark

Title: Geo. Tech. | Title: Geologist

Signature: A. Lanton | Date: 4·25·16 | Signature: [illegible] | Date: 5/31/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 9
Date: 4·25·16

Well ID: C9549 | Well Name: NA | Location: BY cribs. NE. corner.
Project: 200-DV-1 | 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
62.0					
62.5		100% #4		61.4-61.6': gravelly silty sand (gmS) (60% S, 30% m, 10% g)	Tonic w/ 5' core
63.0				Coarsen ↓ from mS → gmS. sharp contact below.	60.6-65.6': Core 4: B34121
64.0				v.f.-c. sub-ang. S. of 70% mafic/30% felsic. w/ w. rndd v.f.-f.	
				pbl. of 50/50% mafic/felsic. non plastic high delatency 2.5Y 4/3	
				drk grysh brn. fn. mica. moist. st. rxn HCl.	
65.0	1# 4.6			61.6-65.6': gravelly sand (gS) (80% S, 20% g, trc. m) 2-3' thick	beds of ↓ coarsening gS. mod-pr.
				stratified. v.f. S.-v.c. pebbley S. w/ trc. c. pbl. throughout.	
				Sand. v.f.-v.c. ang. S. 50/50% mof./felsic. w/ v.f.-f. sub-rndd.	pbl. of 50/50 mof.:felsic
				2.5Y 4/3 olv. brn. wk rxn HCl. moist.	
				@63.6: 2" thick ~~sandy~~ silty sand bed. mS. (70% S, 30% m, trc. g) sharp lower contact.	
				graded upper contac. w. stratified 10-30mm bedding. Colored	2.5Y 5/2 grysh brn./2.5Y 4/2 drk grysh.
		move down		brn. coarsening ↓ w/ v.f.-m. ang. mafic/felsic (50/50%) S.	
				moist st. rxn HCl.	lightly overdriven.
65.0					
				65.7'-70.7': Sand (S) (100%) v.w.srtd.-mod.	65.7-70.7': Core 5: B34123
				srtd. massive bed. c.-v.c. sub-ang. S w/	Drilled: 1·21·16
				trc. v.f. sub rndd. pbl. 50%/50% mafic/felsic.	
67.5		100% #5		moist. 2.5Y 4/3 olv. brn. no rxn HCl.	
				very uniform - no structure.	
70.0					end of tube damaged & melted.
				70.6-75.6': Sand (S) (100%) v.w.-mod. srtd.	70-70.6' overdriven. over heated.
				massive bedding. 2-4' thick. faint contacts. no vis.	
				grading. mod.-v.c. S. of 60% mafic/40% felsic.	70.6-75.6': Core 6: B34125
72.5				@71.9': 5m thick f.-m. S. of 80% felsic/20% mafic.	Drilled 1·21·16
				10YR 4/6 drk yksh brn.	
		#6		@74.2': 5" thick m. to f. S. base of 2' bed.	
				pot. downward fining.	
75.0					75.6-80.6': Core 7: B34127
				75.6-78.4': Sand (S) (100%) v.w.srtd. m. sub-ang. S	Drilled 1·21·16
		#7		of 50%/50% mafic:felsic 2.5Y 4/3 olv. brn. moist. no rxn HCl.	

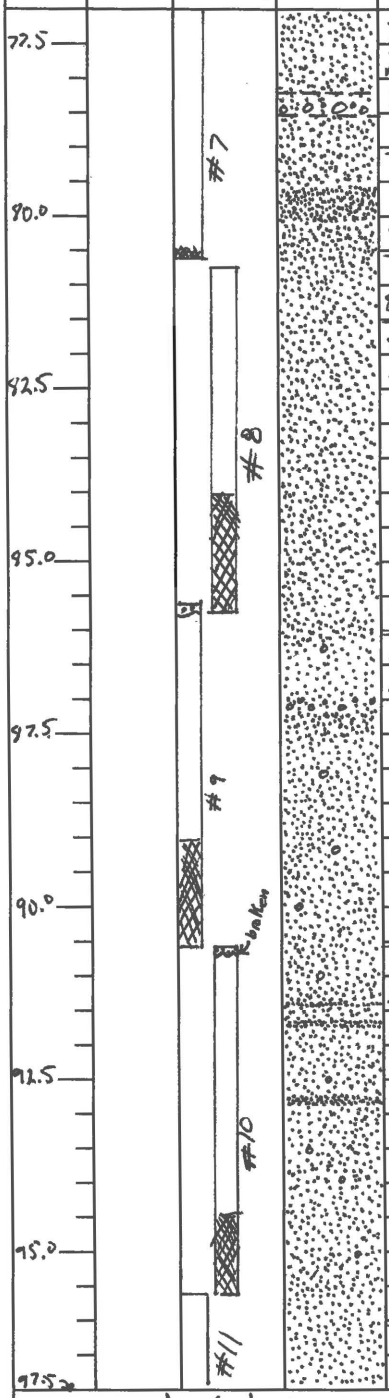
Reported By: A. Lanton | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: A. Lanton | Date: 4·25·16 | Signature: [illegible] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 9
Date: 4·25·16

Well ID: C9549 | Well Name: NA | Location: BY cribs: NE. corner
Project: 200-DV-1 | 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
77.5				78.4-79.5': gravelly Sand (gS.) (85%S, 15%g) mod. srtd.	Sonic w/ 5' core
				m.-v.c. ang. S. of 50/50% mafic/felsic w/ vf.-f. pbl. ang. of	75.6-80.6' Core 7 B34127
				bslt. (coarsest @ 78.8' max 8mm.) 2.5Y 5/3 lt. olv. brn.	
				79.5-80.0': Sand (S) (100%) fine grained. intbd.	
		#7		v.f.-c. ang. S. of 60% felsic Qtz felds/40% mafic. 2.5Y 6/1	gray. faint 2-5mm patchy Fe.
				staining. no rxn HCl.	
80.0				80.0-80.6': Sand (S) (100%) w. srtd. m.-c. ang. S. of	
				50/50% mafic/felsic. comp. 2.5Y 4/2 lt. brownish gray.	
				80.7-85.7 Sand (S) (100%) mod.-w. srtd. no vis.	80.7-85.7: Core 8: B34129
				structure-massive. m.-c. ang. S. of 60% mafic/40% felsic.	
82.5				tre. fn.-m. sub-rndd. pbl. of bslt. throughout.	
				2.5Y 4/3 olv. brn. moist.	
		#8			
					84-85.7: overdriven-pulverized.
85.0					
				85.6-90.6': Sand (S) (100% S. tre. g) mod. srtd.	85.6-90.6': Core 9: B34131
				m.-v.c. sub ang. S. of 60% mafic/40% felsic w/ tre.	Drilled 1·21·16
				sprs. v.f.-f. sub-rndd. pbl. of bslt. throughout.	
87.5				faint 2-4' downward coarsening. from M. S. to	
				v.c. S. w/ pbl.? 2.5Y 4/3 olv. brn. no rxn HCl	
		#9			89-90.6': overdriven-pulverized.
90.0				90.6-95.6': Sand (S) (100%) mod. srtd. crudely stratified.	
				w/ 4"-2' beds. faint coarsening. w/ sharp lower contacts	90.6-95.6: Core 10: B34133
				f.-v.c. sub-ang. S. of 60% mafic/40% felsic tre. sub-rndd.	Drilled 1·25·16
				fn. pbl. of bslt. throughout.	Top 2" of liner driven into core.
92.5				92.9': 1cm thick bed of fn.-m. S. of 90% felsic Qtz.	
				2.5Y 5/4 lt. olv. brn. moist. no rxn HCl	
		#10			
					94.9'-95.6: overdriven-pulverized
95.0				AZ 5-10-16 98.7	95.7-100.7: Core 11: B34135
				95.7-~~98.9~~: Sand (S) 100% w. Srtd. stratified beds	100 Drilled 1·25·16
				of f.-m S grading to m.v.c. S. of 60% mafic/40% felsic	
97.5		#11		2.5Y 5/2 grysh brn. no rxn HCl).	

Reported By: A. Lowe | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: A. Lowe | Date: 4·25·16 | Signature: [illegible] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 9

Date: 4·25·16

Well ID: C9549	Well Name: NA	Location: NE corner of BY cribs.
Project: 200-DV-1		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
97.5		100% #11		95.7'-100.1': Sand (S) (100%) fine grain intvl. well stratified v.f.-v.c. S. of 80% Qtz. felsic/20% mafic. 4" layers. @98.7 Top of bed. 2-3mm thick layer of v.f. S. of 99% Qtz. flds. 2.5Y 6/4 lt. yllwsh. brn. trc. mica. @100': 2" thick bed of v.f.-m. S. of 80% felsic/20% mafic S. mod rxn HCl 2.5Y 6/4 lt. yllwsh brn.	Sonic w/ 5' core. 95.7-100.7': Core 11: B34135 Drilled 1·25·16
100				100.1-100.7': Sand (S) (100%) w. srtd. massive down coarsening S. from v.c. S. to m. S. of 50/50% mafic/felsic.	← not over driven
102.5		100% #12		100.8-105.8': Sand S (98% S, <2% g) pr. srtd. v.f.-v.c. S. of 80% felsic/20% mafic w/ sprs. v.f. ang. pbl. of bslt. massive no vis. bedding. no rxn HCl. moist. 2.5Y 5/3 lt. olv. brn.	100.8-105.8': Core 12: B34137 Drilled 1·25·16
105.0				105.7'-110.7': Sand (S) (99% S, trc. g) mod. w. srtd. med.-v.crs. sub-ang. S.: 90% qtz flds./10% felsic. trc. fn. pbl. of bslt. 2.5Y 5/3 lt. olv. brn. moist. no rxn HCl.	← not over driven. 105.7'-110.7': Core 13: B34139 Drilled: 1·25·16
107.5		100% #13			
110.0				110.6-115.6': Sand (S) (98-95% S, 2-5% g, 0% m) massive-no visible bedding. pr. srtd. m.-v.c. sub-ang. S. of 85% Qtz. flds./15% mafic. coarsest fractions more mafic. w/ v.f.-f. w. rndd. pbl. of 95% bslt./5% meta.-int. Volc.	← Not over driven. 110.6-115.6': Core 14: B34141 K 5-10-16 Aliquot 112.6-113.6': ~~Aliquot~~ 4·21·16
112.5	B352W7 B352W8 4·21·16	100% #14			
115.0				115.8'-119.6': Next pg.	115.8-120.8': Core 15: B34143 Drilled: 1·25·16
		100% #15			

Reported By: A. Lantau		Reviewed By: T. Clark	
Title: Geo. Tech.		Title: Geologist	
Signature: A. Lantau	Date: 4·25·16	Signature: T. Clark	Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 9 (AZ 4-25-16)
Date: 4·25·16

Well ID: C9549 | Well Name: NA | Location: BY cribs NE corner
Project: 200-DV-1 | 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
117.5				115.8-119.6': Gravelly Sand (gS) (90%S, 10%g, 0%m) v.pr.srtd. m.-c. ang. S of 40% mafic/60% felsic (Qtz.) w/ v.f.-c. w.rndd pbl. of 70% felsic meta.-int. Volc/30% bslt. crude & coarsening. 2.5Y 5/3 lt. olv.brn. no rxn HCl.	Sonic w/ 5' core
					115.8-120.8': Core 15: ~~B34146~~ B34143 (AZ 3-30-16) Drilled 1.25.16
	115.8-120.8' Core 15 (AZ 3-30-16)	100% #15		119.6-120.8': Sand (S) (100%S) v.w.srtd. v.f.-f. Sand of 80% felsic/20% mafic.	
120.0				2.5Y 6/3 lt. ylwsh. brn. moist wk. rxn HCl. massive. Top 2" of unit contains v.f. S. w/ fn. lamina Colored 2.5Y 5/3 lt. olv. brn. not plastic.	Sharp contact w/ above unit.
				120.8-123.4': Sand (S) (100%) v.w.srtd. v.f. Sand of felsic comp. 2.5Y 6/3 lt. ylwsh. brn. w/ filimentuous layers colored 2.5Y 3/2 v.drk. grysh brn. throughout. no rxn w/HCl moist (2-4 mm lamina) present.	120.7-125.7': Core 16: B34145
122.5				123.4-124.0': Silt. (M) (100%) low. plastic. v.high delatency. med. density. mod. firm. 2.5Y 4/3 olive brown. mod.-strong rxn w/ HCl. sharp contacts. moist	123.4-124.0': Aliquot 4·21·16 B352W9, B352X0
	B352W9 B352X0 4·21·16	100% #16		124.0-125.7': Sandy silt. (sM) (60% m, 40% S, 0% g) mod. w. srtd. ~~w. stratified~~ c. ang. S. of 80% Qtz. flds./20% mafic. stratified ~~gradationally~~ w/ silt. v.low. plastic. soft. v.high. delatency. ~~2.5Y~~ 10.5YR 4/4 drk ylwsh. brn. moist. wk. rxn HCl about. mica present.	
125.0				125.8-130.8': Sand (S) (100% S) mod. w. srtd. subang.-ang. S. of 80% Qtz. flds./20% mafic. trc. mica.	125.8-130.8': Core 17: B34147
127.5	B352X1 B352X2 4·21·16	#17		~~2.5Y 6/3~~ 2.5Y 6/3 lt. ylw. brn. (TC 5-11-16 slightly) (contact observed by slough) @ 135.5 127.5-128.0': Silty sand (mS) (85% S, 15% m, 0% g) v.f. S. of-c. S. of 80% Qtz. flds. /20% mafic crudely stratified. & mixed matrix w/ w/ firm. non plastic silt. 2.5Y 6/3 lt. ylwsh. brn. moist mod. rxn w/ HCl. -st. rxn w/ HCl	127.2-128.3': Aliquot 4·21·16 B352X1, B352X2
					mod. impacted from drilling along edges. (rhind).
130.0				130.8-135.4': Sand (S) (100%) v.w.srtd. m.-v.c. subang. S. of 60% felsic/40% mafic massive bedding. 2.5Y 6/3 lt. ylwsh brn. moist no rxn HCl	130.8-135.8: Core 18: B34149 Drilled 1.25.16
132.5	130.8-135.8' Core 18: B34149	100% #18		135.4-135.8': Silty gravelly Sand (mgS) (65% S, 20% g, 15% m) (Slightly TC 5-11-16) v.pr.srtd. v.f.-v.c. subang. S. of 60% felsic, 40% mafic w/ w.-sub.-rndd. v.f.-c. pbl. of 95% bslt./5% felsic meta. w/ w. stratified 5-10mm beds overall 2.5Y 3/2 v.drk grysh brn. moist sprs. 3-5% c. pbl. max 20mm throughout.	
135.0		#19		@135.5': 3mm silt layer (100% m) non plastic high delatency 2.5Y 3/2 v.drk brn. non plastic.	135.7-140.7' Core 19: Next pg.

Reported By: A. Lantau | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: A. Lantau | Date: 4·25·16 | Signature: [signature] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 9
Date: 4.25.16

Well ID: C9549 | Well Name: N A | Location: BY Cribs. NE. Corner
Project: 200-DV-1 | 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
132.5		#19		135.7-140.7': gravelly Sand (gS)(90%S, 10%g, 0%m) AZ 8-10-16 AZ 5-10-16	Sonic w/5' core
				mod. w. stratified, 0.5-2' coarsening beds. of	135.7-140.7': Core 19: B34151
				f.-m. S. grading to v.pr.srtd. m.-v.c. ang. S. of 50/50	Drilled 1.26.16
				mafic/felsic. w/ sprs. sub-rndd. m-c. pbl. of 50/50 mafic/felsic comp. coarsest pbl. at base	
				of beds. 2.5Y 5/3 lt. olv. brn. moist. no rxn HCl	
140.0				@ 135.5': 2" thick bed of pr.srtd. c. S w/ abnt. v.f. pbl.	of 80% bslt./20% felsic meta.
				@ 137.8': 2" thick base of bed of c. S. AZ 5-10-16	
				@ 140.6-140.3': pr.srtd. intvl. of w. rndd f. S-m. pbl. (70% f. S, 30% c. S + m. pbl. of 70% felsic S/	
				/30% mafic coarse S. + mafic pbl.	
				140.6'-142.5': Sand (S)(95%S, 5%g, 0%m) mod. srtd.	140.6-145.6': Core 20: B34153
142.5		#20 100%		mod. w. stratified m-c. S. to v.c. pebbly Sand. of 60% Qtz.	Drilled 1.26.16
				flds./40% mafic. Beds 6" thick. 5mm blebby Fe+ staining.	moist. AZ 5-10-15
				142.5-145.6': Sandy Gravel (sG)(60-50%G, 40-50%S) [pot. fining beds. 2.5Y 5/3 lt. olv. brn. no rxn HCl]	
				mod. w. srtd., w. stratified in 6" beds.-2" beds. of fn. pbl.-mpbl.	+ w. srtd. f. pbl. of 90% bslt./10% Qtz.
				sand: pr.srtd. m.-v.c. ang. S. of 70% Qtz flds., 30% mafic.	
145.0				sprs. c.-v.c. w. rndd. pbl. of 50% bslt/50% felsic meta. throughout.	moist. 2.5Y 5/2 grysh. brn. no rxn HCl
					145.8-150.8': Core 21: B34155
		#21 98%		145.8-150.8': Gravelly Sand (gS)(85%S, 15%g, 0%m)	Drilled 1.26.16
				mod. w. srtd.-pr.srtd. m.-v.c. Sand & c.-v.c. Sand w/	
				v.f.-f. sub-rndd. pbl. sorted into 2" to 6" beds.	
147.5				Sand: 60% Qtz. flds./40% mafic. /Gravel: 95% bslt. /5% felsic. meta.	
				2.5Y 5/2 lt. olv. brn. no rxn HCl moist. ~~w/o~~ (with)	
				sprs. w. rndd. m.-c. pbl. of bslt. throughout.	
150.0				150.7'-153.2': Gravelly Sand (gS)(95%S, 5%g)	150.7-153.2': Core 22: B34157
				mod. srtd. m.-c. subang. S. of 60% Qtz. flds./40% mafic.	Drilled 1.27.16
				w/ sub.rndd. f.-v.f. pbl. of bslt. similar to above intvl. AZ 4-20-16	overdriven slough - pulverized in
		#22		2.5Y 5/3 lt. olv. brn. Dry. no rxn HCl.	top of tube & bottom.
152.5				Top + Bottom contain 6" of pulverized sed.	
				153.2-155.7': Sand (S) (100%S). Pot. slough.	153.2-155.7': Core 23: B34159
		#23 25%	AZ 4-20-16 No Recovery	m.-v.c. S. of 85% bslt/15% Qtz. felds. trc. fn. pbl.	Drilled 1.27.16
				of bslt. throughout. 2.5Y 4/2 drk grysh brn. moist	25% recovery.
155.0				wk. rxn HCl.	
				155.7-160.6': Next Pg.	155.6-160.6': Core 24: B34161
					Drilled 1.27.16
	Aliquot B352x3 B352x4				156.6-157.6': Aliquot

Reported By: A. Lantow | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: A. Lanto | Date: 4.25.16 | Signature: [illegible] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 7 of 9

Date: 4·25·16

Well ID: C9549 | Well Name: N.A. | Location: NE corner of B Yards

Project: 200-DV-1 | 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
157.5	B35ZX3 B35ZX4	100% #24		155.6-160.6': Sand (S) (98%S, 2%g, 0%m) mod. w. srtd. c.-v.c. ang. S. of 85% Qtz. flds./15% mafic w/ faint crude. Stratified 2-3' beds. faint ↓ coarsening. @ 159.8': mod. srtd. pebbly sand sub-unit. f.-c. ang. S. similar to above. w/ v.f.-f. sub-rnd. p. pbl. of 80% bslt/20% meta. overall 2.5Y 6/2 lt. brownish gray. mod. dry. wk rxn HCl.	Sonic w/ 5' core 155.6-160.6': Core 24 B34161
160.0				160.6'-165.6': gravelly Sand (gS) (90%S, 10%g, 0%m) mod.-pr. srtd. m.-v.c. ang. S. of 75% Qtz. flds./25% mafic w/ v.f.-f. pbl. of 95% bslt./5% felsic. (sub-rnd.) w/ trc. sprs. w. rnd. c. pbl. of 90% bslt/10% felsic meta > int. vol. faint 2"-5" thick weakly stratified beds throughout. no v.s. grading. trc. crs. mica. 2.5Y 5/3 lt. olv. brn. no rxn HCl.	160.6-165.6': Core 25: B34163 Drilled 1·27·16
162.5		100% #25			
165.0				165.6'-170.6': Gravelly Sand (gS) (90%S, 10%g, 0%m) mod.-pr. srtd. c.-v.c. ang. S. of 70% Qtz. flds./30% mafic w/ sprs. w. rnd. v.f.-f. pbl. of bslt. - trc. w. rnd. c. pbl. of 50% meta./50% bslt. 2.5Y 5/3 lt. olv. brn. moist. no rxn. HCl.	165.6-170.6': Core 26: B34165 Drilled 1·27·16
167.5		100% 95% #26			not overdriven
170.0				170.7-175.7': Gravelly Sand (gS) (95%S, 5%G, 0%m) v. similar to above. mod. srtd. c.-v.c. ang. S. of 75% Qtz. flds./25% mafic w/ sub ang. f.-v.f. pbl. of 90% bslt, 10% felsic. Crudely stratified w/ faint mod. w. srtd. beds 1"-6" thick of c. S. 2.5Y 5/3 lt. olv. brn. moist. no rxn HCl @ 171.5': 6" w. srtd. bed of m.-c. S. (75% mafic/25% felsic)	170.7-175.7': Core 27: B34167 Drilled 1·27·16
172.5		100% #27			
175.0		#28		175.8-180.8': Next pg.	175.8-180.8': Core 28: B34169 Drilled 1·27·16

Reported By: A. Lantau | Reviewed By: T. Clark

Title: Geo. Tech. | Title: Geologist

Signature: A. Lantau | Date: 4·25·16 | Signature: [illegible] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 8 of 9

Date: 4·25·16

Well ID: C9549 | Well Name: NA | Location: NE. corner of BY cribs

Project: 200-DV-1 | 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
177.5				175.8-180.8': Gravelly Sand (gS) (90%S, 10%G, 0%m) AK 5-10-16	Sonic w/5' core.
				mod.-pr. srtd. crudely stratified m.-v.c. S. of 85-90% AK 5-10-16	175.8-180.8: Core 28 : B34169
				Qtz. flds. /15-10% mafic. w/ v.f.-f. sub-rndd.-ang.	Drilled 1·27·16
		100% #28		pbl. of 90% bslt. /10% felsic. meta. > int. volc.	
				trc. w. rndd. m. pbl. of felsic. comp. throughout. trc. f. pbl. of carbonate (w. rndd.) present.	
180.0				throughout. 2.5Y 5/3 lt. olv. brn. no rxn HCl. moist	
				@ 180.0: 2-5mm clots of pabogonite clay colored black, yellow brn. + white.	
				2.5Y 6/6 olive yellow, pot. rip up clast.	
				180.6'-185.6': Gravelly Sand (gS) (85%S, 15%g, 0%m)	180.6-185.6': Core 29 : B34171
				poorly stratified. pot. ↓ coarsening. beds 2' thick grading	Drilled 1·27·16
182.5				from m.-c. ang. S. w/ sprs. v.f. bslt. pbls. -grading to	
		100% #29		v. pr. srtd. m.-v.c. ang. S. of 50% mafic/50% felsic comp. w/	
				up to 15% v.f.-v.c. pbl. of bslt. (10% meta. /90% bslt.)	
				max pbl. 60mm. avg. clast: 4mm,-6mm. of 90% bslt.	
				2.5Y 6/2 lt. brownish gray. moist	
185.0				overall coarsest grannuls of bslt. + Sand fraction of	
				Qtz flds. no rxn HCl. trc. clay clots 2-5mm. lt. yl. brn. colored.	
				185.8'-187.5': Gravelly Sand (gS) (85%S, 15%G 0-3%m)	185.8-180.8: Core 30 : B34173
				m.-c. ang. S. of 80% Qtz flds/20% mafic. w/ v.f.-v.c. pbl. (sub-ang.)	Drilled 1·27·16
	Aliquot. B352X5 B352X6 (4·25·16)			of 70% meta. /30% bslt. slight ↓ coarsening. similar to above. 2.5Y 4/2 lt. brownish gray. slight brown + tan coating.	
187.5				of silt. on largest clasts. 2.5Y 6/6 olive yellow. + 7.5YR 4/6 strong. brown. w/k. rxn HCl. sharp contact below.	
	186.8-187.8'			187.5-188.1': Sandy Gravel (sG) (40%S, 60%G, trc. m) AK 4-25-16	Aliquot: 186.8-187.8'
				v.f. felsic S. w/ 10% c.-v.c. ang. mafic S. matrx. w/ f.-v.c. pbl. of 60% meta. /40% bslt. (sub-w. rndd.)	
		100% #30		no rxn HCl. moist 10YR 5/3 brn. no clay. non plastic.	
				188.1-190.8': TC 5/11/16 Sandy Gravel (mSG) (75%G, 15-20%S, 5-10%m)	v. pr. srtd. v.f.-v.c. ang. S. of 60% Qtz. flds.
190.0				40% mafic w/ w. rndd.-subrndd v.f.-v.c. pbl. of 75% meta > int. volc. /	25% bslt. 2.5Y 5/4 lt. olv. brn. matrx.
				moist no rxn HCl.	
				190.7'-195.4': Sandy Gravel (sG) (75%G, 20%S, <5%m)	190.7-195.7: Core 31 : ~~B34175~~ B34175 AK 4-25-16
				v. pr. srtd. m.-v.c. ang. S. of 70% Qtz flds. /30% bslt.	Drilled 1·28·16
		Slough		w/ v.w. rndd. (discoidal + equant) f. pbl.-sm. cbl. of	
192.5				80% Meta. > int. volc. /20% bslt. pr.-mod. weathered	
				matrx color ~~2.5Y~~ 10YR 5/3 brown-10YR 4/3 drk yl wsh. brn. no rxn HCl.	
				Sandy 5-10-16	
		80% #31		195.4'-195.7': Silty Gravel (mSG) (60%G, 20%S, 15-5%m)	
				v. pr. srtd. v.f.-v.c. ang. S. of 80% felsic/20% mafic w/ w. rndd.	
195.0				f. pbl.-sm. cbl. of 80% meta > int. volc. /20% bslt. silt. is	
				10YR 4/3 drk yl wsh brn. mod.-non plastic. non-clayey. high	
				dilatancy. no rxn w/ HCl. moist	195.7-200.7': Core 32: ~~B34174~~ B34195 AK 4-25-16
		#32		195.7-200.7': Next Pg.	

Reported By: A. Lantau | Reviewed By: T. Clark

Title: Geo. Tech. | Title: Geologist

Signature: A. Lantau | Date: 4·25·16 | Signature: [illegible] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 9 of 9
Date: 4·25·16

Well ID: C9549 | Well Name: NA. | Location: NE. corner of BY cribs.

Project: 200-DV-1 | Reference Measuring Point: Ground Surface

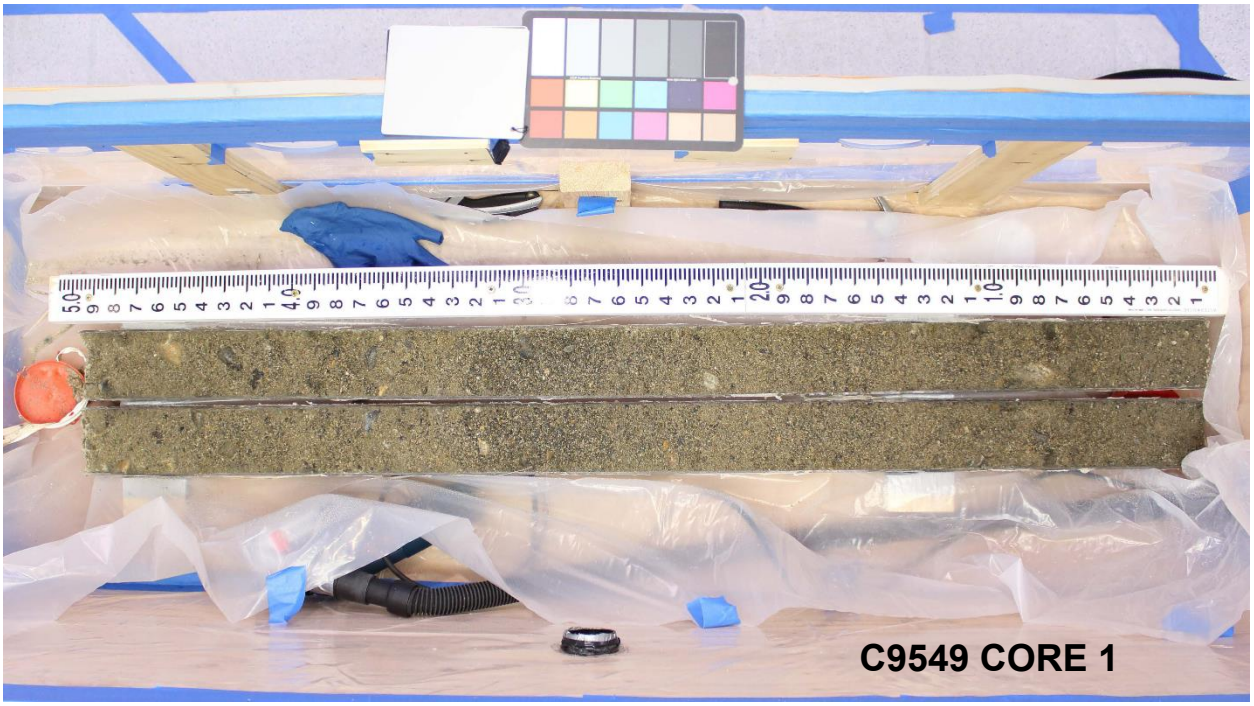
Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
197.5	B352X7 B352X8 (4-25-16)	100% #32		195.7'-200.7': Sandy Gravel (SG) (75-80%G, 25-20%S, tr.M) mod.-v.pr.srtd. c.-v.c. ang. S. w/ 5-10% f.-m. S. of 80% Qtz.flds./20% mafic. w/ 75% felsic meta./20% bslt. v.w.-sub.rndd. felsic. + sub-rndd-ang. bslt. lith.: (Meta. > Qtzite > int. Volc. lapili tuff > Granitoid. > bslt.) matrix: obscured by pulverization adjacent to lrg. clasts. clasts of fn. pbl.-lrg. cbl. max clast: 130mm. + 10YR 3/3 drk. yellowish brown moist no rxn w/ HCl. -wk. rxn. w/ HCl. under clasts. wk. imbrication. crude stratified. w/ ↓ coarsening over intvl. from m. pbl.-lrg. cbl. avg. sized.	Sonic w/ 5' core 195.7-200.7': Core 32 : B34H95 (: Aliquot 4·25·16 197.7-199.2') collect Aliquot between zones of pulverization. ~~TD@200.7' bgs.~~ AL 5·19·16 TD@200.7' bgs.
200.0		T.D.	Not used. AL 5·10·16		
202.5				Not used. AL 5·10·16	Not used. AL 5·10·16

Reported By: A. Lanton | Reviewed By: T. Clark

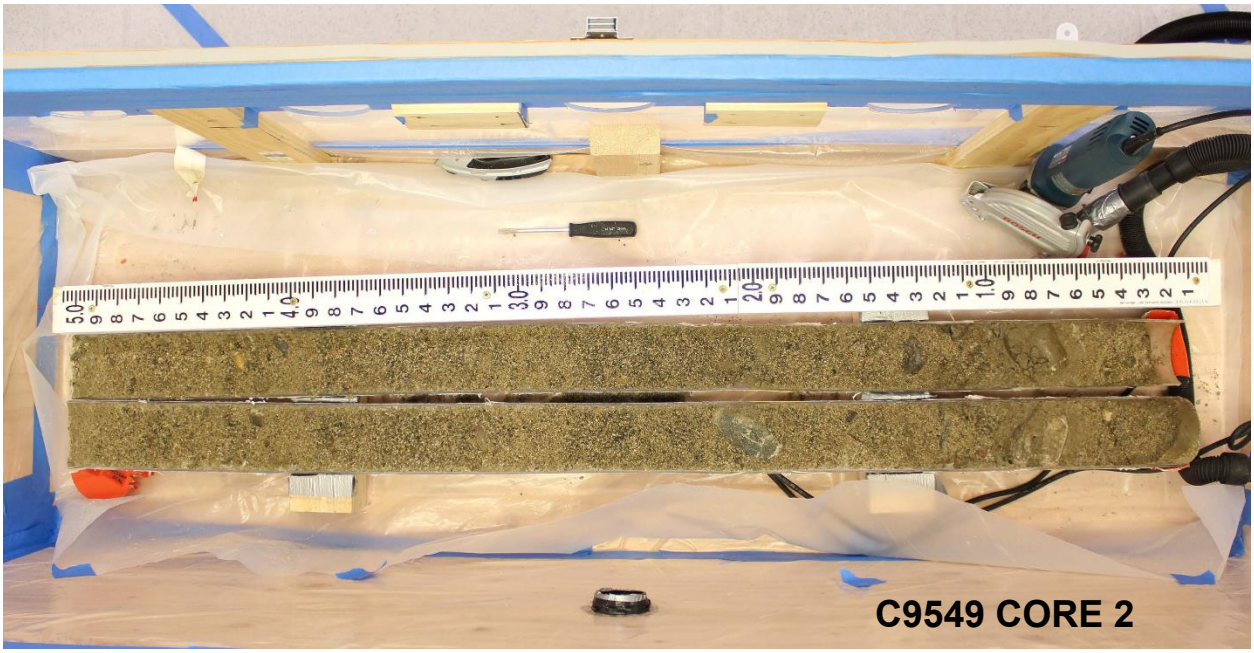
Title: Geo. Tech. | Title: Geologist

Signature: Aaron Lanton | Date: 4·25·16 | Signature: [illegible] | Date: 5/11/16

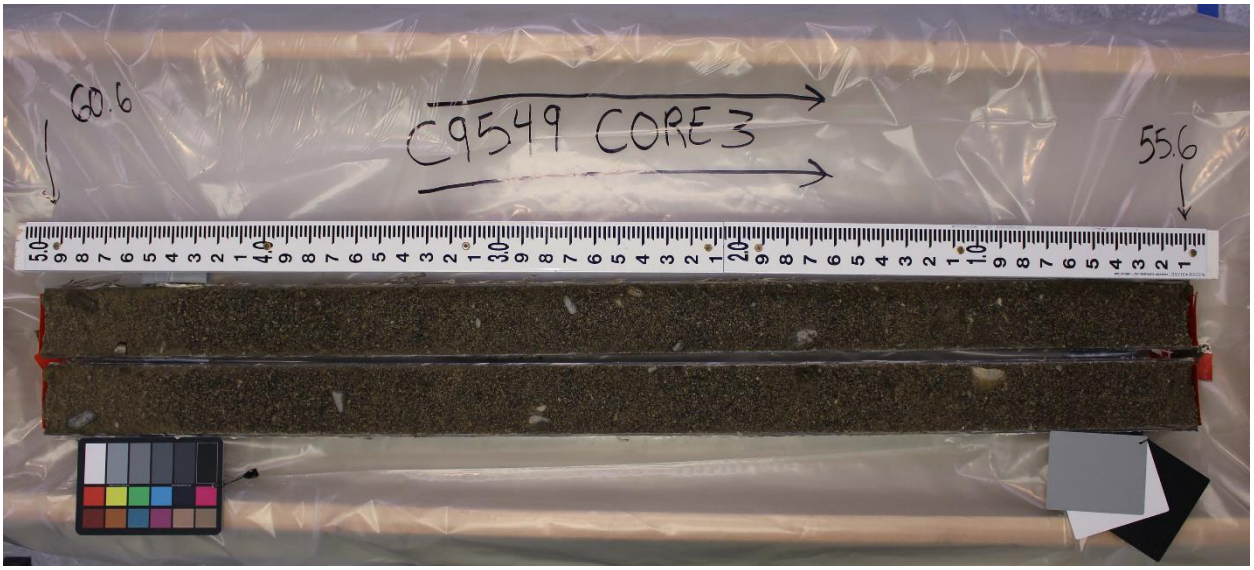
A-6003-642 (03/03)



Core 1: 45.6-50.6



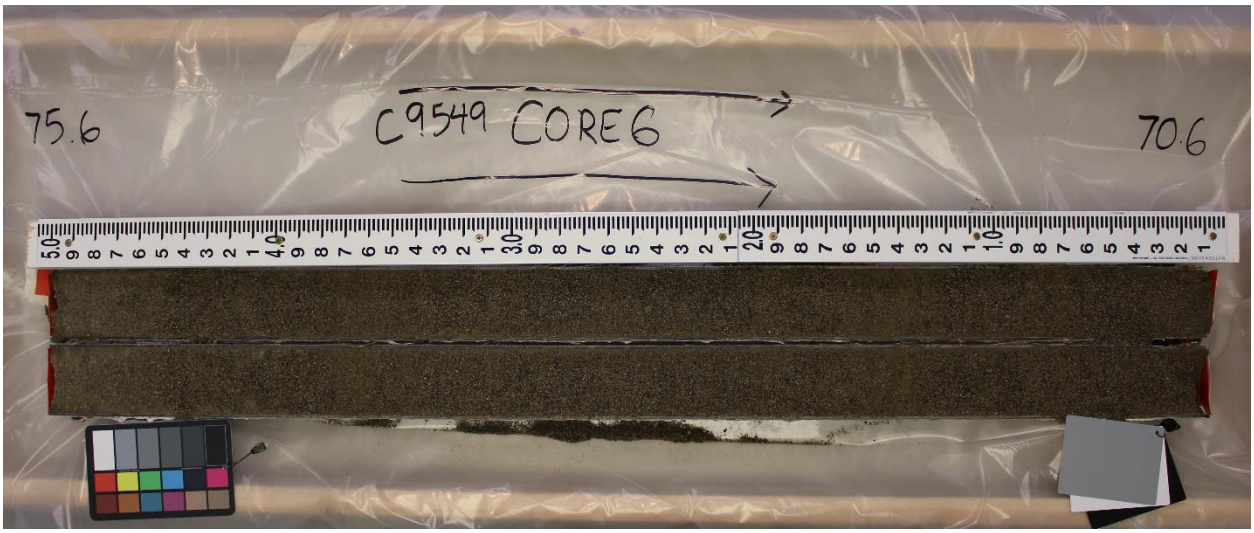
Core 2: 50.7-55.7



Core 3: 55.6-60.6

Core 4: 60.6-65.6

Core 5: 65.6-70.6

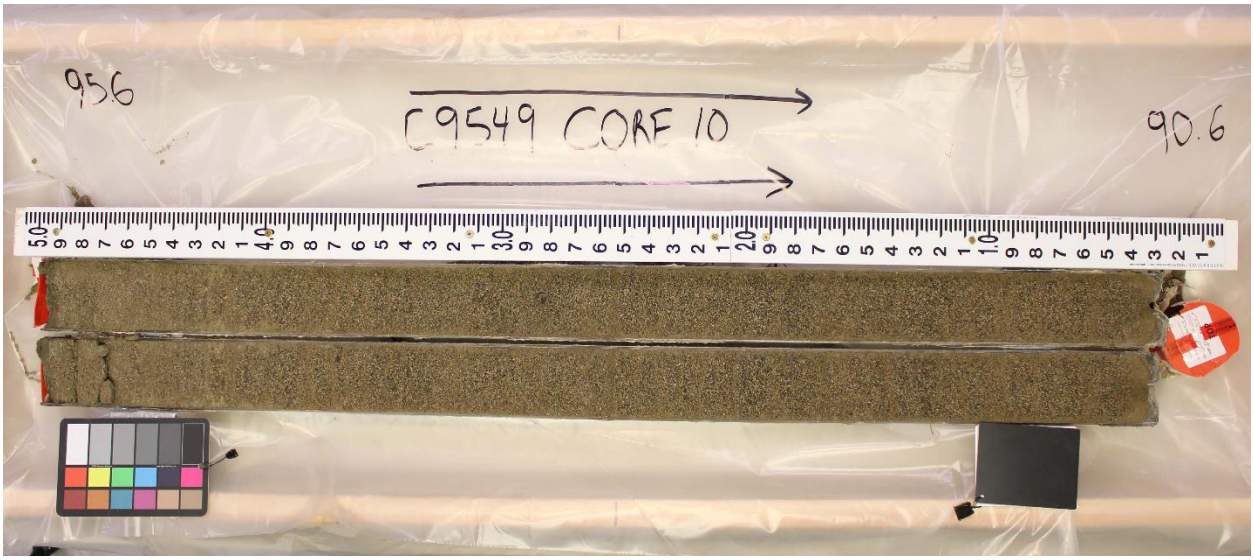


Core 6: 70.6-75.6

Core 7: 75.6-80.6

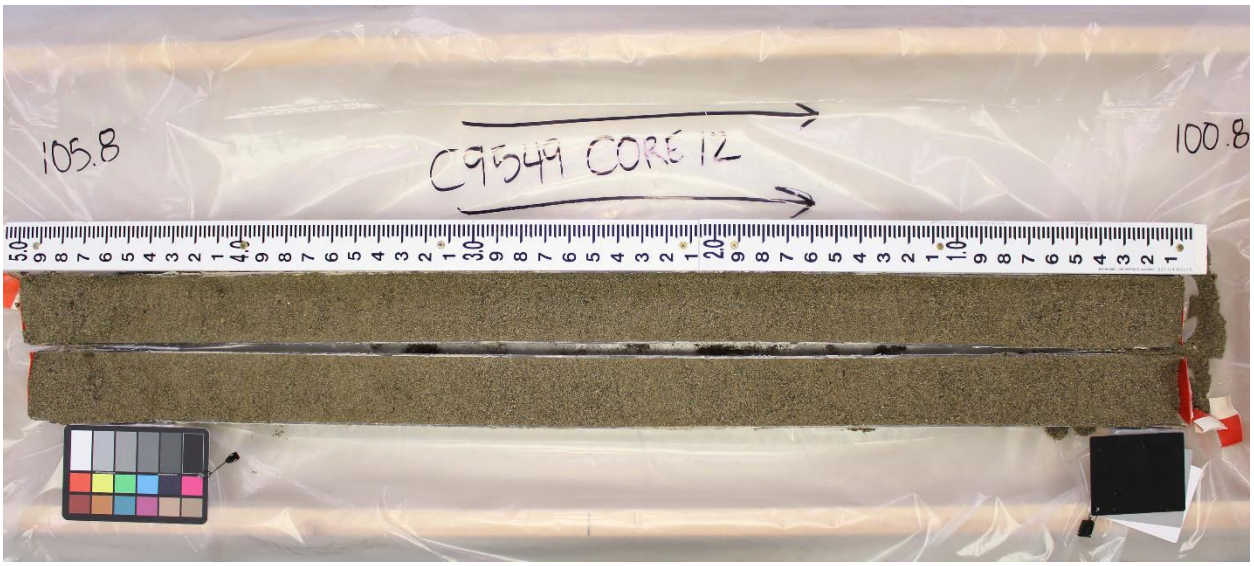
Core 8: 80.7-85.7

Core 9: 85.6-90.6



Core 10: 90.6-95.6

Core 11: 95.7-100.7



Core 12: 100.8-105.8

Core 13: 105.7-110.7

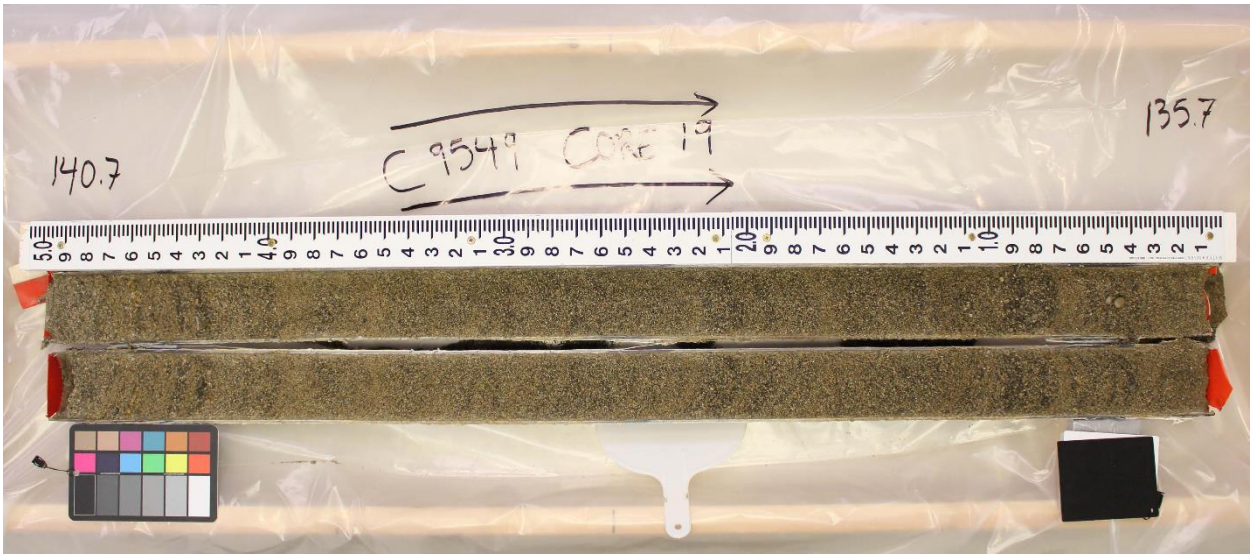
Core 14: 110.6-115.6

Core 15: 115.8-120.8

Core 16: 120.7-125.7

Core 17: 125.8-130.8

Core 18: 130.8-135.8

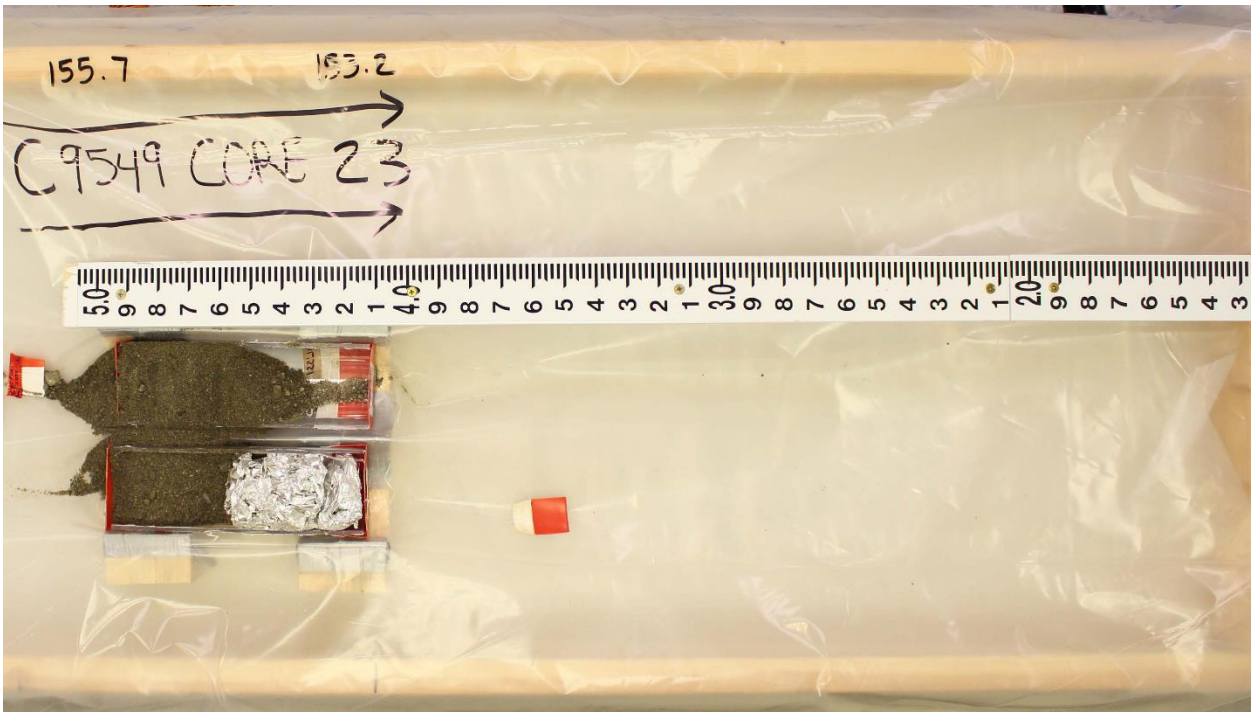


Core 19: 135.7-140.7

Core 20: 140.6-145.6

Core 21: 145.8-150.8

Core 22: 150.7-153.4

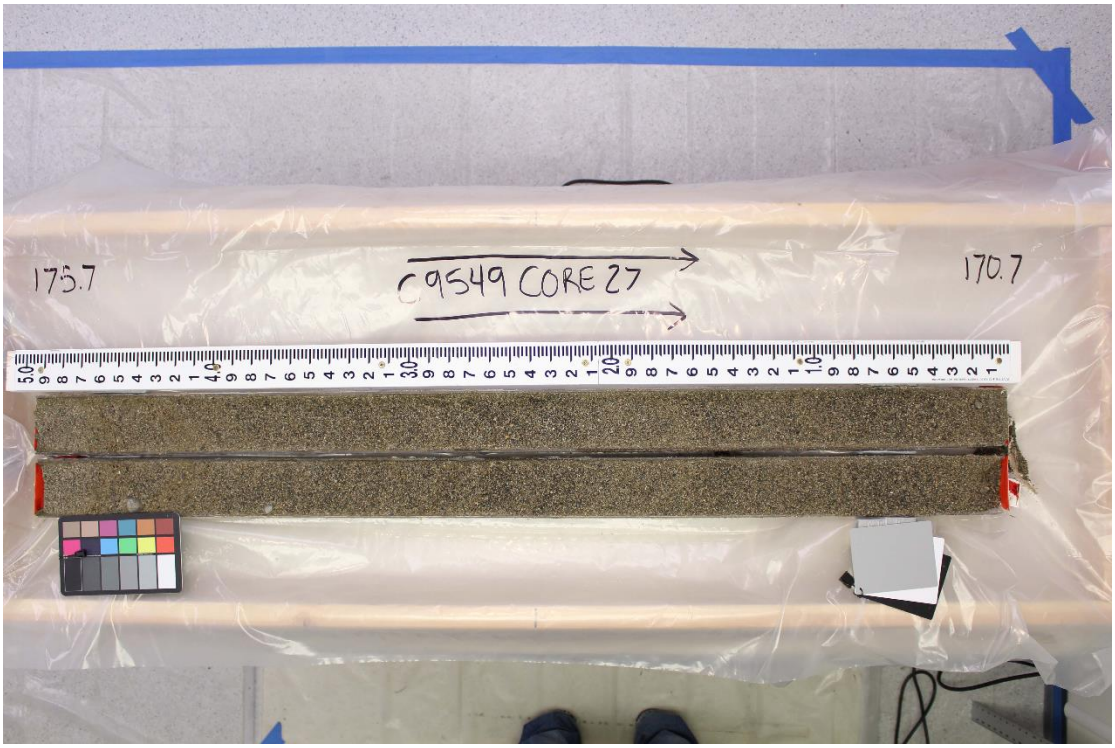


Core 23: 153.2-155.7

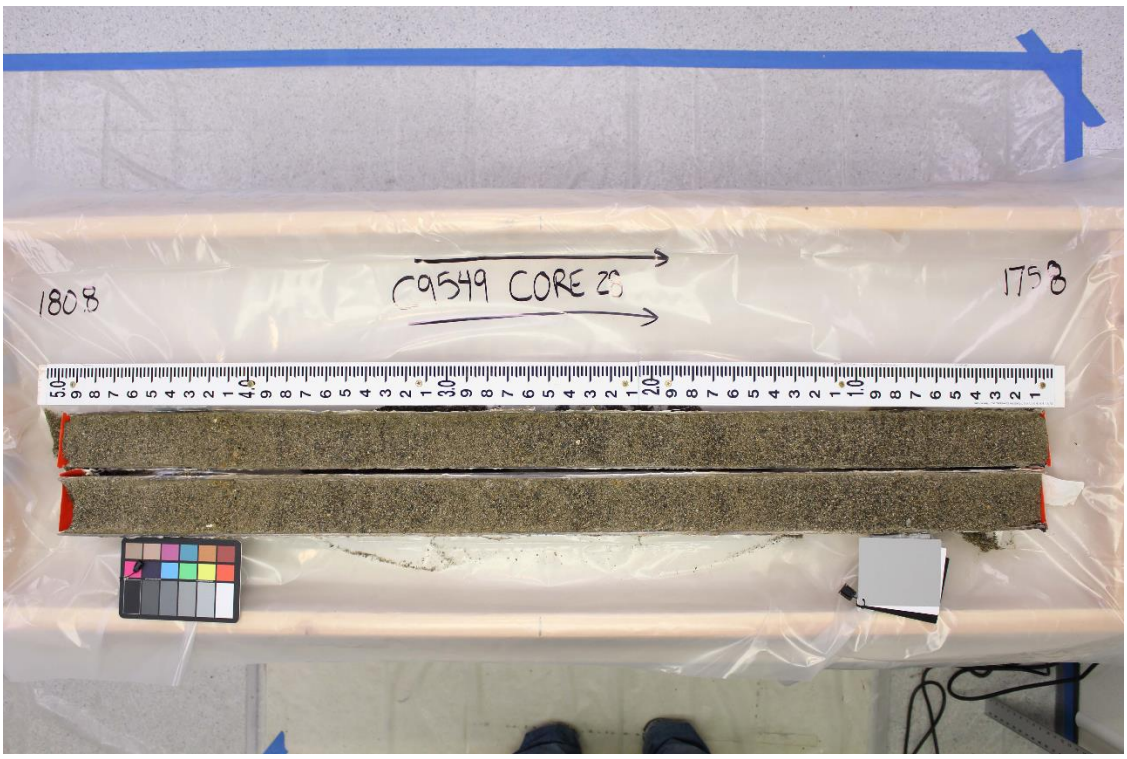
Core 24: 155.6-160.8

Core 25: 160.6-165.6

Core 26: 165.8-170.8

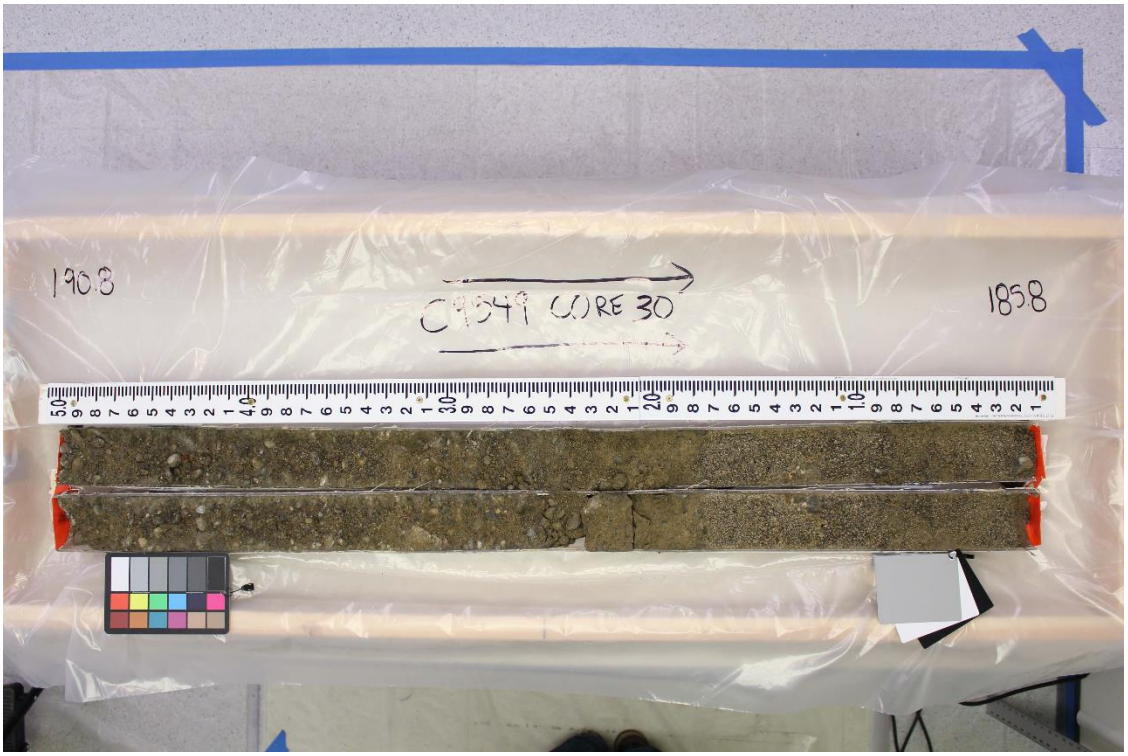


Core 27: 170.7-175.7



Core 28: 175.8-180.8

Core 29: 180.6-185.6



Core 30: 185.8-190.8

Core 31: 190.7-195.7

Core 32: 195.7-200.7

BOREHOLE LOG

Page 1 of 8
Date: 5·10·16

Well ID: C9552 | Well Name: NA | Location: 216-B-45/6 Cribs.
Project: 200-DV-1 | 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					0-45.5': DPT
					▨: no Recovery
					▩: Over driven-Pulverized.
		No Core			
45.0					45.5- TD: Sonic w 5' core x 4" diameter.
				45.5'-47.0': ~~gravelly~~ Sand. (S)(95%S, 5%G, 0%m)	45.5-47.0': Core 1: B34177
			#1	pr. srtd. m.-v.c. ang. S. of 50/50% mafic:felsic. w/	Drilled 2·8·16
				v.f.-c. pbl. of 50/50% mafic:felsic composition v.w. rndd.	45.5-45.7': 2" of slough.
47.5				max: 20mm. 2.5Y 5/3 lt. olv. brn. moist no rxn HCl	45.7-46.0': Compacted & pulverized by DPT
				47.2'-49.7': ~~Gravelly~~ Sand (S)(95%S, 5%G, 0-10%m)	
			#2	pr. srtd. f.-v.c. ang. S. of 50/50% mafic:felsic comp. w/	
				trc. f. mica. w/ v.f.-m. pbl. of 50/50% felsic:mafic.	47.2-49.7': Core 2: B34179
				@47.7': 4" thick silty sand (mS) (80%S, 20%m)	Drilled 2·8·16
				soft. 2.5Y 4/4 olive brn. moist mod. rxn HCl.	
50				v.f.-c. ang. S. of 50/50% mafic:felsic	47.5-52.0': Core 3: B34181
	49.5-52.0': B34181			49.5'-52.0': gravelly Sand (gS) (85%S, 15%-20%g, trm)	
			#3	pr. srtd. m.-v.c. subang-ang. S. of 70% mafic/30% Qtz. flds.	
				w/ w. rndd. f.-c. pbl. of 50/50% mafic:felsic.	
52.5				2.5Y 4/4 olv. brn. moist. pot. ↓ coarsen in 2-4' beds.	52.2-57.2': Core 4: B34183
				from f. pbl.-c. pbl. max clast sizes. no rxn HCl	Drilled 2·8·16
				52.2-54.9': gravelly Sand (gS) (75-80%S, 25-20%g) 0%m	53.7-55.7': Aliquot 5·4·16
	5·4·16 B34146 B34147 B35530			p.r. to mod. srtd. mod. w. stratified. Sand & gravelly sand. in 4-6"	B34146, B34147, B35530
				beds. w/ graded contacts. m.-v.c. ang. S. of 70% Qtz. felds/30% mafic.	
55.0			#4	w/ beds of v.f.-m. sub-rndd. pbls of 90% bslt./10% meta > int. volc. 2.5Y 5/3 lt. olv. brn. no rxn HCl.	
	54.2-57.2': B34183			54.9-57.2': gravelly Sand (gS) (90%S, 10%g, trm) more fine grained interval. of v.f.-v.c. ang S.	
				w/ 2" beds of gravelly Sand containing f.-c. sub-rndd. pbl. of 90% bslt./10% meta > int. volc.	
				2.5Y 5/4 lt. olv. brn. no rxn HCl.	
				@55.7': 4mm thick bed of m. S. of 99% Qtz. fcls. 2.5Y 5/4 lt. olv. brn. no rxn HCl.	
57.5				57.2-57.6': ~~silty Gravelly silty Sand (gmS)~~ (gmS) (10%g, 60%S, 20%m)	Slightly silty Gravelly Sand
				pot. slough: v.f.-v.c. ang. S. w/ v.f.-f. sub-ang. pbl. of 80%	57.2-62.2': Core 5
				bslt./20% Qtz. flds. 2.5Y 4/1 olv. brn. mod-st. rxn HCl. moist.	Drilled 2·8·16
				57.6'-62.2': Sand (S) (99%S, 1%g, 0%m)	
				mod.-w. srtd. mod. w. stratified beds 1-1.5' thick of	
60.0				c. ang. S.; m. ang. S. & pebbly c.-v.c. ang. S. w/ v.f.-f. ang.	
				bslt. pbl. overall comp. 50/50% mafic:felsic. w/ spcs.	
	57.2-62.2': B34185		#5	w. rndd. m. pbl. of mix. lith. throughout. 2.5Y 5/3 lt. olv. brn.	no rxn HCl.
				@61.1': 4mm thick silty sand bed (mS) (50%m, 50%S)	of v.f.-m. ang. felsic sand.
				w/ non plastic silt. 10YR 5/6 yellowish brn. no rxn HCl.	

Reported By: A. Lantau | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: A. Lantau | Date: 4·26·16 | Signature: [illegible] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 8

Date: 5·10·16

Well ID: C9552 | Well Name: NA | Location: BY cribs

Project: 200-DV-1 | 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
62.5	62.1-67.1: Core 6: B34187	100% #6		62.1-67.1: Sand (S) (99% S, 1% g, 0% m) v.w.srtd. c.-v.c. ang. S. of 50/50% felsic:mafic comp. w/ trc. v.rndd. f.-m. pbl. of mixed lith. (50/50% mafic:felsic comp.) 2.5Y 5/3 lt.olv.brn. no rxn HCl. moist massive bedding-no v.s. structure. @ 65.7': 1" thick layer of f.-v.c. S. of 20% v.f.-f. Sand of Qtz.flds. + 80% c.ang. Sand of 50% mafic, 50% felsic. 10YR 5/4 yllwsh.brn. moist. no rxn HCl.	Sonic w/ 5' core. 62.1-67.1: Core 6: B34187 Drilled 2·8·16
65.0					
67.5	67.1-72.1: Core 7: B34189	100% #7	Compact from above	67.1-70.4': Sand (S) (100% S, trc. g) w.srtd. v.w. stratified in ½" to 1.5' beds. of m. Sand of 95% Qtz. felds/5% mafic. + c.-v.c. ang. S. of 70% bslt./30% Qtz. felds. 2.5Y 5/3 lt.olv.brn. no rxn HC. trc. f.n. pbl. of bslt. @ 67.5': Pot. slough? f.-m. S. of 60% Qtz. felds./40% mafic. 2.5Y 5/2 grysh brown. st. rxn HCl. v. firm. (1" thick)	67.1-72.1: Core 7: B34189 69.6-70.6': Drilled 2·8·16 69.6-70.6': Aliquot (5·5·16) B34189, B35531, B35532
70.0	5·5·16 B35531 B35532			70.4-72.1': Sand (S) (100% S) v.w.srtd. massive bed. c. ang. S. of 80% Qtz felds./20% mafic w/ sprs. f.n. w.rndd pbl. of Meta. > int. volc. > bslt. 2.5Y 5/3 lt.olv.brn. no rxn HCl.	
72.5	72.2-77.2: Core 8: B34191	100% #8		72.2-77.2': Sand (S) (100% S, 0% g, 0% m) w.srtd. w.strat. w/ m.-c. S. + v.c. subang. S. of 70% Qtz. felds, 30% mafic. w. stratified w/ 1" to 1' thick beds. w/ faint coarsening. @ 72.6': 2" thick bed of silty sand (m S) (70% S, 30% m, 0% g) 70% v.f.-c. sub-ang. qtz. flds. Sand w/ ~30% mafics in coarser fraction. mod. firm. non-plastic. 2.5Y 5/3 lt.olv.brn. st. rxn w/ HCl -75.3-76.1': w.srtd. bed. of Sand m. S. w/ 2mm thick layer at its base of f.-m. S. colored 10YR 5/4 yllwsh brn. v.wk. rxn HCl.	72.2-77.2': Core 8: B34191 Drilled 2·8·16
75.0					
77.5	77.2-82.2: B34193	100% #9		77.2-82.2': Sand (S) (100% S) w.srtd. m.-v.c. sub-ang. S. of 50% felsic/50% mafic comp. massive bed. 4 to 5' thick. (75.3' to 80.2') 2.5Y 5/3 lt.olv.brn. no rxn HCl. moist. -80.2-82.2': Top of more fine grained bed. (of: 20% f.-m. S. + 80% m.-c. S. of 50/50% mafic:felsic 2.5Y 6/3 lt.yllwsh.brn. no rxn HCl. @ 80.9': 2mm thick layer of f. Sand of Qtz. flds. colored 10YR 5/6 yllwsh brn. slight yllwsh brown Fe^+ staining (pervasive) on 2" above f. sand layer.	77.2-82.2': Core 9 B34193 Drilled 2·9·16
81.0					
82.5					

Reported By: A. Lontau | Reviewed By: T. Clark

Title: Geo. Tech. | Title: Geologist

Signature: [signature] | Date: 4·27·16 | Signature: [signature] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 8
Date: 5·10·16

Well ID: C9552 | Well Name: NA | Location: BY Cribs
Project: 200-DV-1 | 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
82.5	#4 →			82.2'-85.2': Sand (S) (100% S.) v.w.srtd. w.stratified w/	Sonic w/ 5' core
				1.5' beds of w.srtd. m. S. of 85% Qtz. flds., 15% mafic	82.2-87.2': Core 10 : B34195
				colored 2.5Y 5/3 lt.olv.brn. & interspersed 2-5mm beds of f.-m.	Drilled 2·8·16
	5·5·16 B35597 B35598 B35599			S. of 95% Qtz flds. / 5% mafic, 2.5Y 5/4 lt.olv.brn. no rxn HCl.	B35.7-86.2': Aliquot (5·5·16)
				85.2-87.2': Sand (S.) (100% S. tr. g.) mod. srtd.	B35597, B35598.
85.0				m.-v.c. sub-ang. S. of 70% bslt. / 30% Qtz. flds. trc. pbl. of	B35599
				bslt. Sharp contact above. 2.5Y 5/2 grysh brn. - 5mm patchy Fe+ stains. -	
				@85.2': 1" thick bed. silty Sand (m S) (90% S. 10% M) v.f. S. of Qtz. flds. firm. nonplastic w/ silt	
				2.5Y 5/4 lt.olv.brn. wk. rxn. - Inclined beds	m. 2.5Y 5/4 lt.olv.brn. wk. rxn HCl.
				@85.55': 4mm thick silty Sand of v.f. S. w/ mod. plastic	87.1-92.1': Core 11 : B34197
87.5				87.1-92.1': gravelly Sand (gS) (90% S, 10% g, 0% M)	Drilled 2·9·16
				mod.-pr. srtd. w. stratified m.-v.c. S. of 50/50% mafic felsic.	
				w/ v.f. sub-rndd. pbl. of bslt. (~10% felsics / 90% bslt.)	
				2.5Y 6/1 gray - 2.5Y 5/3 lt.olv.brn. moist no rxn HCl. (6"-2.5' bedding. & coarsening.)	
				@12.7-12 5mm splotchy stains Fe+ 2.5Y 5/6 lt.olv.brn.	
90.0				@ 89.7-91.1': 6" bed of more coarse matl. contains v.f.-c. pbl.	
				of bslt. in sand matrix. pot. base of bed.	
				sharp contact below.	Tol end full of overpacked
					slough. - bedding curved down
					hole.
92.5				92.2-97.2': Sand (S) (100% S) mod.-w.srtd.	92.2-97.2': Core 12 optional-1
				mod.-pr. stratified S. beds 1"-2ft. thick 1"-2ft. thick	Drilled 2·9·16 B34K31
				w. faint. & coarsening from w.srtd. c. S. to mod. w.	
				srtd. m.-v.c. ang. S. of 70% Qtz. flds. / 30% mafic.	
				2.5Y 6/1 lt. brownish gray. moist. no rxn HCl.	
95.0				trc. crs. mica.	
97.5				97.5-112.2': no core provided.	
100.0			No Core		
102.5					

Reported By: A. Lanton | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: [signature] | Date: 4·28·16 | Signature: [signature] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 8
Date: 5·10·16

Well ID: C9552 (TC) 5-11-16 | Well Name: N.A | Location: BY Cribs

Project: 200-DV-1 (TC) 5-11-16 | 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
102.5					
105.0					
107.5					
110.0					
				112.2'-117.2': Sand (S) (99% S, trc. g, 0% m)	112.2-117.2': Core 15: B341B5
112.5	Sloughy → Compressed →			pr. srtd. pr. consolidated. dry. m.-v.c. sub.ang. S of 60% Qtz. flds/40% mafic. w/ trc. w.rnd. m.pbl. of bslt. 2.5Y 6/2 lt. brownish gray. v.wk. rxn HCl. @ 116.0': 6" zone of ½" to 1" thick inclined bedding of more mafic matl. ½ beds of 80% mafic/20% Qtz.; 1" beds of 60% Qtz. 40% mafic. grain size all the same. (m-v.c. Sand.) - no Fe+ staining.	Drilled 2-9-16 113.2-116.2 Aliquot + DUP B355V8, B355V9 B355K (B35KB1, B35KB2: DUP)
115.0	5-9-16 B3 B355V8, B355V9 (B35KB1, B35KB2) DUP	112.2-117.2: B341B5	#15		
117.5	Compressed →			slightly (TC) 5-11-16 117.2'-118.2': silty sand + Sand (mS + S) beds. mS: (20%m, 80%S): S: (5-10%m, 95-90%S) ½"-3" thick beds of mS. of v.f.-c. sub-ang. S. of 70% Qtz. 30% mafic. w/ non-plastic M. 2.5Y 5/3 lt. olv. brn. st. rxn HCl. w/ 2"-3" beds of S. of v.f.-v.c. sub-ang. S. of 25% mafic/ 75% felsic. 2.5Y 6/2 lt. brownish gray.	117.1-122.1: Core 16: B34B7 Drilled 2-10-16 117.5-121.6': Aliquot → (B355W0, B355W1, B355W2)
120	B355O, B355T, B355Z	5-9-16 117.2-122.1: B34B7	#16	118.2-122.1': Sand. (S) (100%) pr. srtd. m.-v.c. sub-ang. S. of 70% Qtz./30% mafic 2.5Y 5/3 lt. olv. brn. no rxn HCl @ 118.2-118.5': Coarse grained bed @ contact of m.-v.c. ang. S. of 20% Qtz. fell/80% mafic (c.-v.c. grains of 100% bslt.) wk. rxn HCl.	(massive bed) (faint ½" patchy Fe+ stains)
122.5					

Reported By: A. Lantau | Reviewed By: T. Clark

Title: Geo. Tech. | Title: Geologist

Signature: A. Lantau | Date: 4-28-16 | Signature: [illegible] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 8
Date: 5·10·16

Well ID: C9552
Well Name: N1A (TC) 5-11-16
Location: By Cribs
Project: 200-DV-1
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
122.5	#16	overdriver slough from above.		122.5-126.8': Sand (S) (99% S, 1% Gravel) mod. srtd.	1 Sonic w/ 5' core
	122.5-127.5: B341B9	#17		c.-v.c. ang. S. of 65% Qtz. flds/45% mafics. w/	122.5-127.5: Core 17: B341B9
				trc. c. pbl. of bslt. throughout. - no grading.-	Drilled 2-10-16
				2.5Y 6/2 lt. grysh. brn. sprs. Fe+ splotchy staining.	
				i trc. white mica. v. wk. rxn HCl.	
125.0				126.8-127.5': Sand (S) (100% S) w. srtd. w. stratified	
				m. S. grading to c. S. of 60% Qtz flds. -40% mafic.	(2.5Y 6/2 lt. grysh. brn.) moist.
				@126.9': 4mm thick layer of mafics + garnet. 2.5Y 3/1 v. drk. gry.	
127.5					
				127.5-142.3': no core provided. AL. 5·10·16	
130.5					
132.5					
135.0			no core	AL. 5·10·16	
137.5					
140.0					
142.5					

Reported By: A. Lontan
Title: Geo. Tech.
Signature: Aaron Lontan
Date: 4-28-16

Reviewed By: T. Clark
Title: Geologist
Signature: [illegible]
Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 8
Date: 5·10·16

Well ID: C9552 | Well Name: NA | Location: By Cribs
Project: 200-ZP-1 | 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
142.5				142.3-142.8: Slightly silty gravelly sand. Gravelly silty sand. (gmS)(10%g, 20%m, 70%S)	Sonic w/5' core.
				pr.srtd. v.f. ang. S. of Qtz.flds. of L.-v.c. subang. S. of	142.3-147.3: Core 21: B341C7
				65%Qtz flds/35% mafic. w/ sub-rndd. f.-c. pbl. of bslt.	Drilled 2·11·16
				w/silt. of non-plastic. v. high dilatancy. moist 2.5Y 4/2 drk. grysh. brn. st. rxn w/HCl.	
				pot. slough.- graded contact below.	
145.0				142.8'-147.3': Sand (S.) (95%S 5%g, 0%m)	
				v.pr.srtd. f.-v.c. ang. S. of 65% Qtz flds/35% mafic	
				w/ v.f.-c. pbl. of bslt. > int. volc. throughout.	
				5mm patchy Fe+ staining throughout.	
				2.5Y 5/3 lt. olv. brn. v.wk. rxn HCl.	
				(2-6" zones containing additional) f. Sand.	147.3-152.3': Core 22: B341C9
147.5				147.3-152.3': Sand (S) (98%S, 2%g, 0%m)	Drilled 2·11·16
				w. srtd. w. stratified Sand (½" to 2.5' beds)	
				of m.-v.c. ang. S. of 70% Qtz flds/30% mafic	
				v.c. S of 50% Qtz. flds/50% mafic. Coarse grained beds	
150.0				contain 2% v.w. rndd. f.-v.f. pbl. of int. volc. > bslt. > meta.	
				Colors: Coarse grained intervals: 2.5Y 6/2 lt. brownish gray moist	
				fn. grained intvls.: 2.5Y 5/3 lt. olv. brn. moist	
				no rxn HCl. - v.wk. rxn HCl.	
				sprs. 5mm patchy Fe+ stains.	
152.5	Slough from surface			152.3-152.2: Sand (S) (99%S, 1%g, 0%m)	152.2-152.2: Core 23: B341D1
				v.w. stratified. ½" to 6" beds. of w.srtd. c. subang. S. of	Drilled 2·11·16
	5·9·16			85% Qtz. flds/15% mafic, 2.5Y 5/4 lt. olv. brn. moist no rxn HCl)	153.7-155.7': Aliquot (5·9·16)
	B35SW3 B35SW4			& pr.srtd. m.-v.c. subang. S. of 65% Qtz, 45% mafic.	B35SW3, B35SW4
				2.5Y 5/2 lt. olv. brn. no rxn HCl.	
155.0				beds slightly inclined.	
				152.2 - Sand. (S) (99%S, 1%g, 0%m)	152.2-162.2': Core 24: B341D3
157.5				mod. srtd. mod. w. stratified. S. of m.-v.c. ang.	Drilled 2·11·16
				S. of 70% Qtz. flds/30% mafic w/ 1/2"-2" beds of	
				m.-v.c. S. of 80% Qtz. flds/20% mafic.	
				sprs. v.w. srtd. f.-m. pbl. of 90% bslt/10% meta.	
				Coars beds: 2.5Y 6/2 lt. brownis. grey moist	
160.0				fn. beds.: 2.5Y 5/3 lt. olv. brn. moist.	
				no rxn - v.wk. rxn HCl.	
				sprs. 5mm patchy Fe+ stains.	
162.5					

Reported By: A. Zantua | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: A. Zantua | Date: 5·10·16 | Signature: [illegible] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 7 of 8
Date: 5·2·16

Well ID: C9552 | Well Name: NA | Location: B4 Cribs

Project: 200-DV-1 | 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
162.5	162.2-167.2: B341D5	#25		162.2'-167.2': Gravelly Sand (gS) (75-80% S, 25-20% g)	Sonic w/ 5' core.
				pr. srtd. m.-v.c. ang.-sub-ang. S. of 60% Qtz. flds.	162.2-167.5: Core 25: B341D5
				40% bslt. w/ v.f.-f. pbl. of bslt.	Drilled 2·16·16
				@163.4': 1" bed of mod. w. srtd. f. pbl. of	
				bslt. sub-rndd. w/ <10% Sand. — broken clast of chert. colored red. in bed.	
165.0				@ 134.7': 1" bed of 70% f. pbl. of bslt. + 10%	
				m.-v.c. ang. S. of 70% bslt. / 10% Qtz. flds.	
				overall 2.5Y 6/2 lt. grysh. brn. moist no rxn HCl.	
				trace w. rndd. m. pbl. of bslt. throughout.	
				faint 5mm patchy Fe+ staining.	
167.5	167.3-172.3: B341D7	#26		167.3-169.3': gravelly Sand (gS) (90% S, 10% g, 0% m)	167.3-172.3': Core 26: B341D7
				similar to above. pr. srtd. m.-v.c. ang.-subang. S. of	Drilled 2·16·16
				60% Qtz. flds. / 40% mafic. w/ trc. f.-m. pbl. of 50% bslt / 50% mafic.	
				2.5Y 6/2 lt. brownish. gry. no rxn HCl.	
170.0				169.3'-172.3': gravelly Sand (gS) (95% S, ~5% g, 0% m)	
				mod. srtd.-pr. srtd. more fine grained intvl. of Bimodal	
				Bimodal: f.-m ang. S. of 90% Qtz. flds. / 10% mafic + v.c. ang.	
				S. of 80% mafic, 20% Qtz. flds. w/ 5% fn. pbl. of bslt. +	
				sprs. w. rndd. m.-c. pbl. of 70% Meta. / 30% bslt.	
				2.5Y 5/3 lt. olv. brn. moist. no rxn HCl	172.3-177.3: Core 27: B341D7
172.5				172.3'-177.3': gravelly Sand (gS) (90% S, 10% g, 0% m)	Drilled 2·16·16
				v. pr. srtd. massive bed of m.-v.c. ang. S. of	173.3-176.3': Aliquot (5·10·16)
	5·10·16			70-80% Qtz. flds. / 30-20% mafic. w/ v.f. sub-ang. pbl.	B35F0, B35F1, B35F2
				of bslt. contains trc. sub-rndd. m. pbl. of 50% bslt /	
				50% meta. > int. vole. throughout. 2.5Y 5/3 lt. olv. brn.	
175.0	B35F0, B35F1, B35F2			no rxn HCl. moist	
	173.3-177.3: B341D7	#27		@173.0-173.4': faint coarsening bed from m-c. S. of	
				80% Qtz. flds. / 20% mafic. to 70% c.-v.c. sub-ang. S. of	
				70% Qtz. flds. / 30% mafic.	
				@176': 6" zone of faint 50% inclined bedding (steep)	177.1-182.1: Core 28: B341F1
177.5				177.1-182.1: gravelly Sand (gS) (90% S, 10% G, 0% m)	Drilled 2·16·16
				mod.-w. srtd. m.-v.c. sub-ang. S. of 80% Qtz. flds. / 20%	
				mafic. w/ m.-c. sub-rndd. pbl. of 50% bslt. / 50% meta. > int. vole.	
				@ 178.8': w. srtd. f.-c. ang. S. of 90% Qtz. flds. / 10% mafic. (more fine grained bed ~2" thick)	
				overall 2.5Y 5/3 lt. olv. brn. no rxn HCl.	
180.0	177.1-182.1: B341F1	#28		1-2mm Fe+ staining.	
				mod. consolidated.	
182.5					

Reported By: A. Lantau | Reviewed By: T. Clark

Title: Geo. Tech. | Title: Geologist

Signature: A. Lantau | Date: 5·2·16 | Signature: [illegible] | Date: 5/11/16

A-6003-642 (03/03)

BOREHOLE LOG

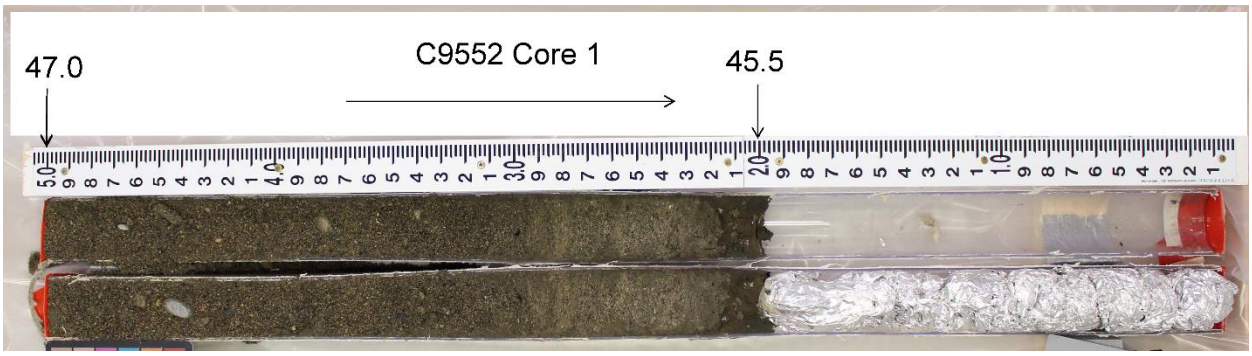
Page 8 of 8
Date: 5·10·16

Well ID: C9552 | Well Name: NA | Location: BY Cribs.
Project: 200-DV-1 | Reference Measuring Point: Ground Surface

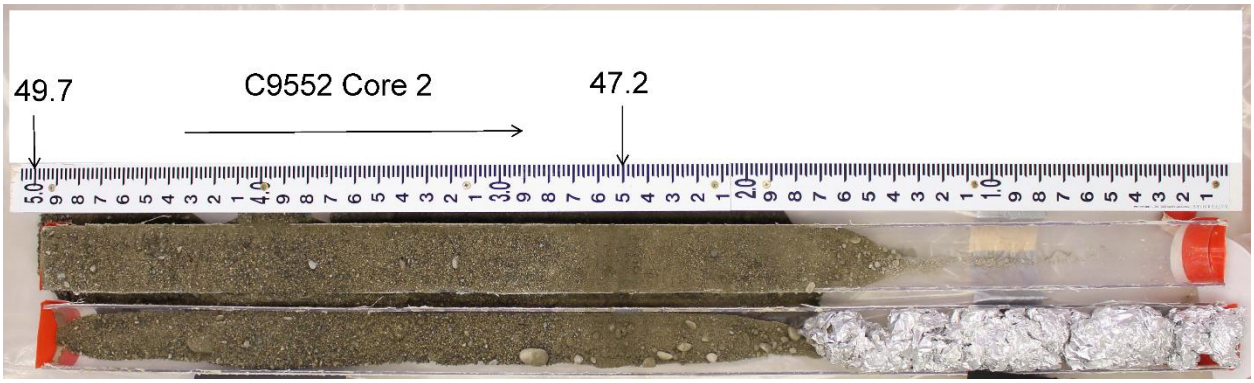
Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
182.5	5·10·16 B35JF3 B35JF4	182.2-187.2: B34 & B35 #29 option #2	no core	182.2-187.2: gravelly Sand (gS) (90% S, 10% g, 0% m) gr. sftd. massive bed. of m.-v.c. sub-ang. S. of 75% Qtz. flds./25% mafic. w/ v.f.-f. w. rndd. pbl. of bslt. sprs. sub-ang. m. pbl. of bslt. throughout. 2.5Y 6/3 H. yllwsh brn. no rxn HCl -lrg. (4mm) mica ~1%	Sonic w/ 5' core. 182.2-187.2: Core 29 optional 2
185.0				@ 186.6': 2" thick decomposed gravelly silty Sand. (60% S, 40% m, 10% g). Pot. rip up clast of palagonite or in-situ chemical altd. to clay. multi color. consists of v.f.-c. S. of 75% Qtz flds, 25% Mafic w/ v.f.-m. pbl. of Qtz > Meta. > Qtzite. > int. volc. > bslt. weathered or altered to silty clay colored. 2.5Y 8/1 white, 2.5Y 8/1 gray, 5Y 5/4 olive, 2.5Y 3/1 v. drk. gray & 10YR 5/6 yellowish brown. mod. firm. low-non plastic. v.st. rxn HCl.	184.6-186.6: Aliquot 5·10·16 B35JF3, B34JF4
187.5					
190.0				187.2-202.0': No Core Provided.	
192.5					
195.0					
197.5					
200					
202.0					TD: 202.0'

Reported By: A. Lantau | Reviewed By: T. Clark
Title: Geo. Tech. | Title: Geologist
Signature: A. Lantau | Date: 5·10·16 | Signature: [illegible] | Date: 5/11/16

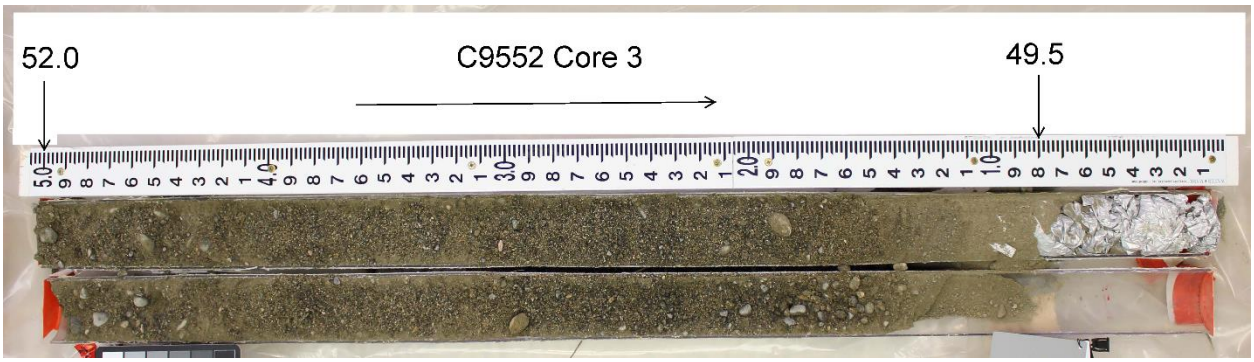
A-6003-642 (03/03)



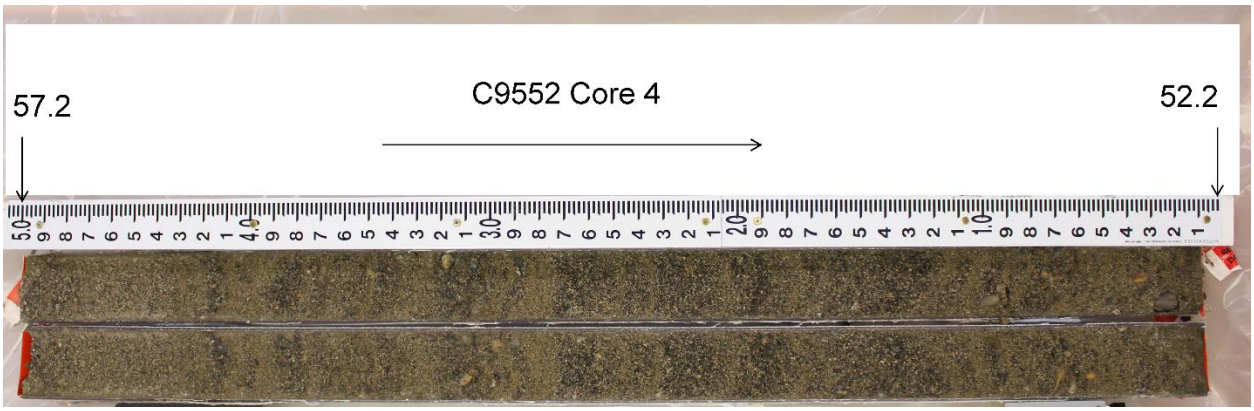
Core 1: 45.5-47.0



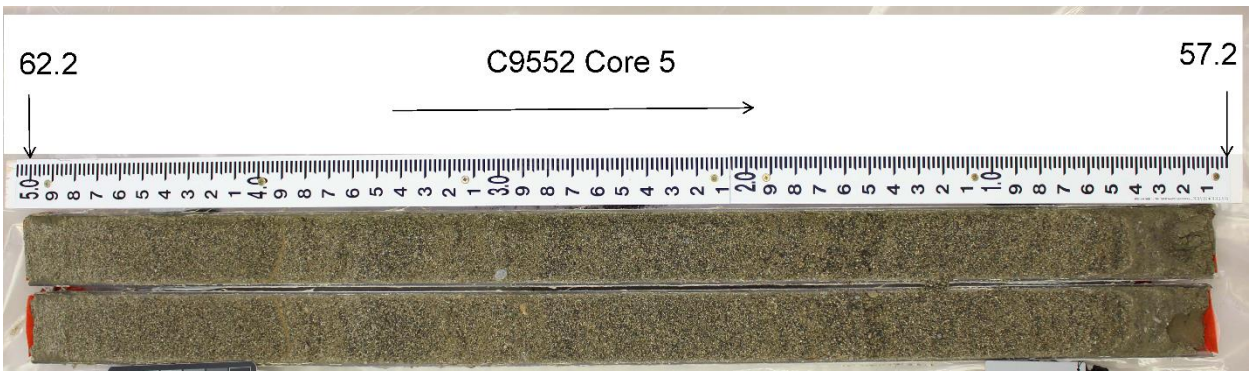
Core 2: 47.2-49.7



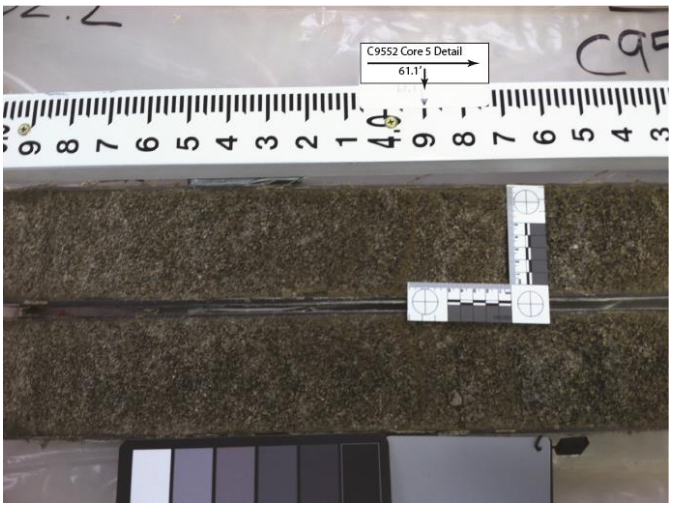
Core 3: 49.5-52.0



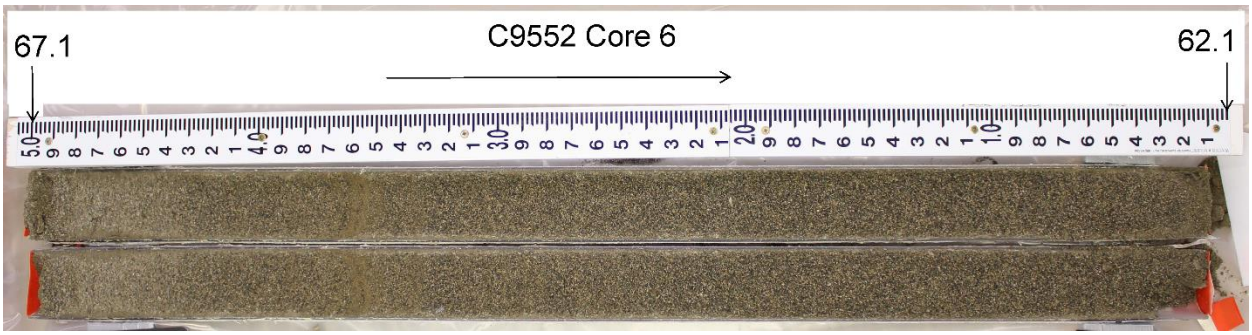
Core 4: 52.2-57.2



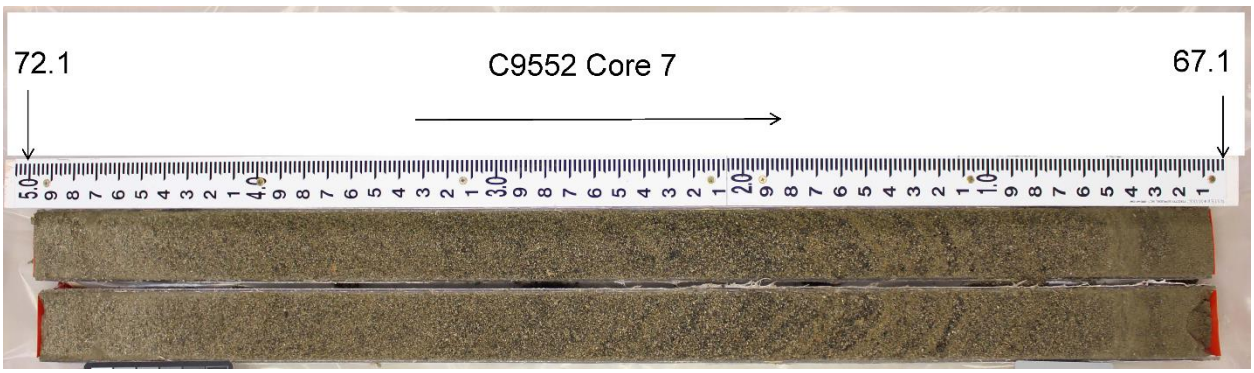
Core 5: 57.2-62.2



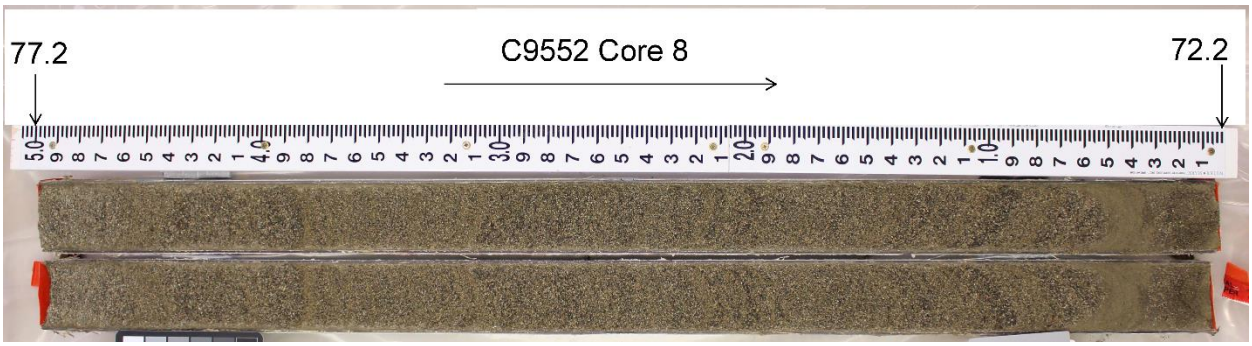
Core 5: 61.1 Detail



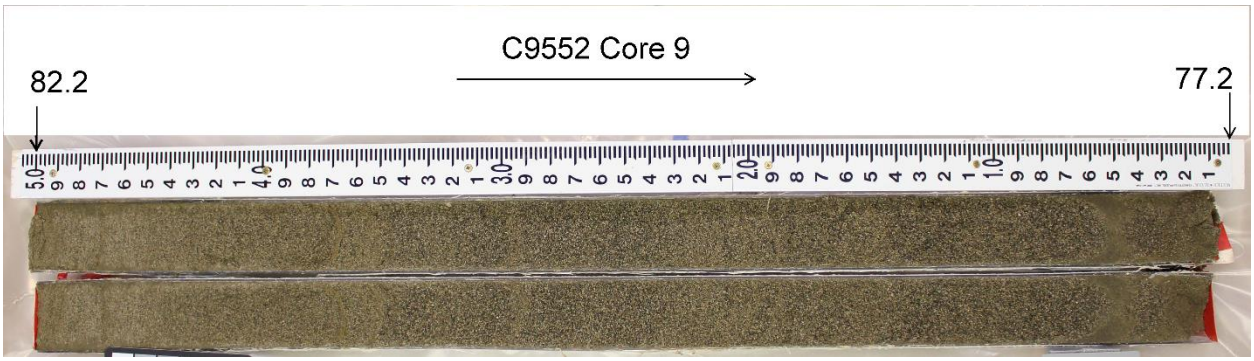
Core 6: 62.1-6701



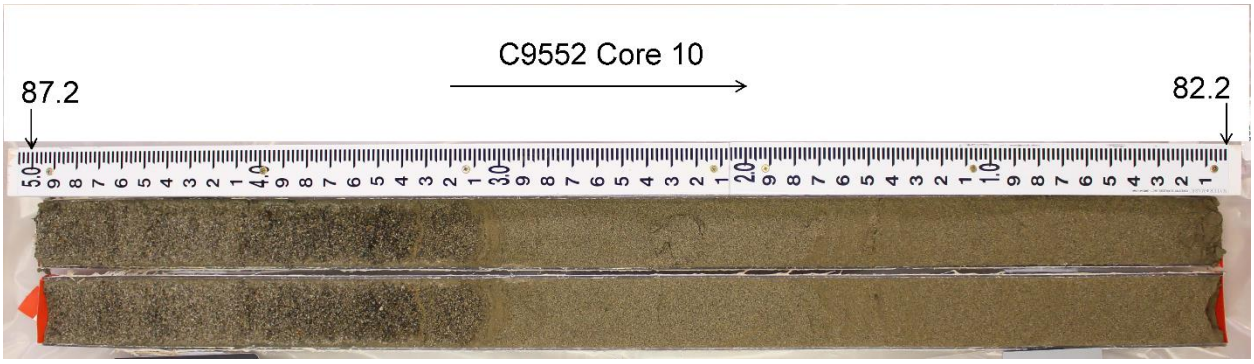
Core 7: 67.1-72.1



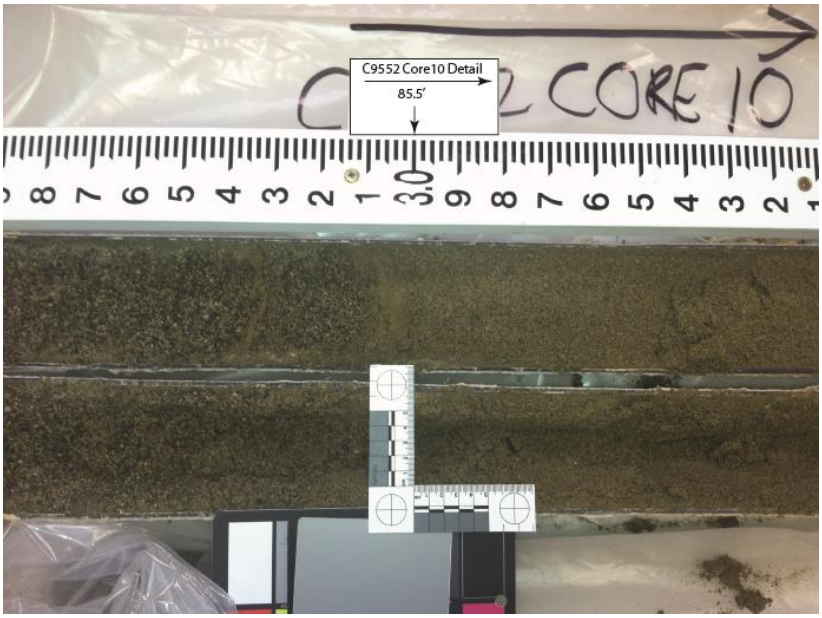
Core 8: 72.2-77.2



Core 9: 77.2-82.2



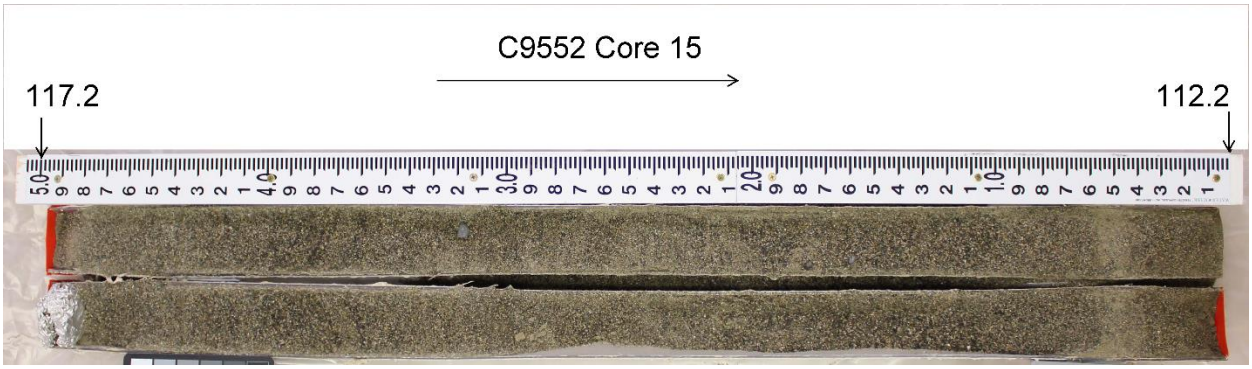
Core 10: 82.2-87.2

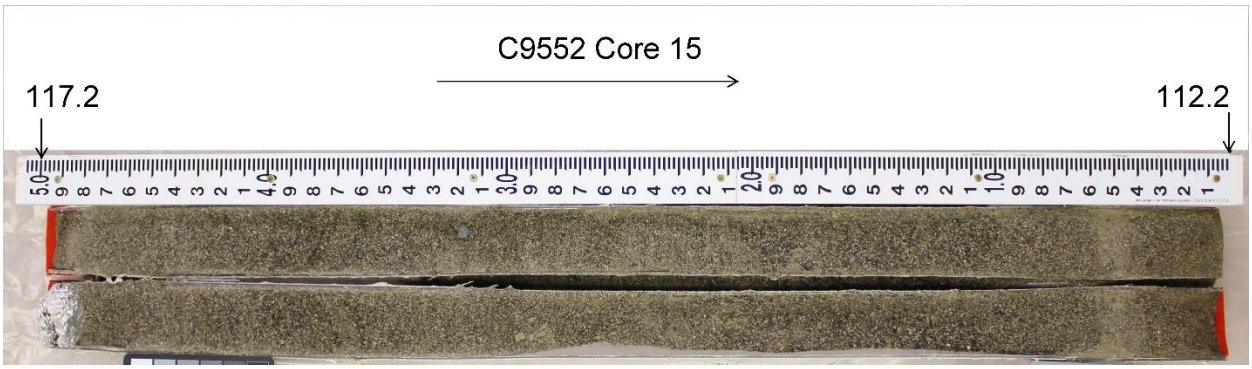


Core 10: 85.5 Detail

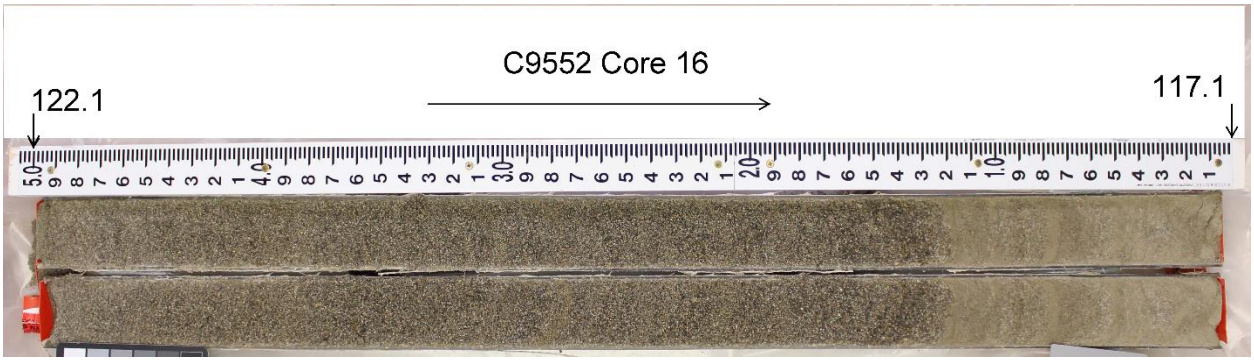
Core 11: 87.1-92.1

Core 12: Opt1 92.2-97.2

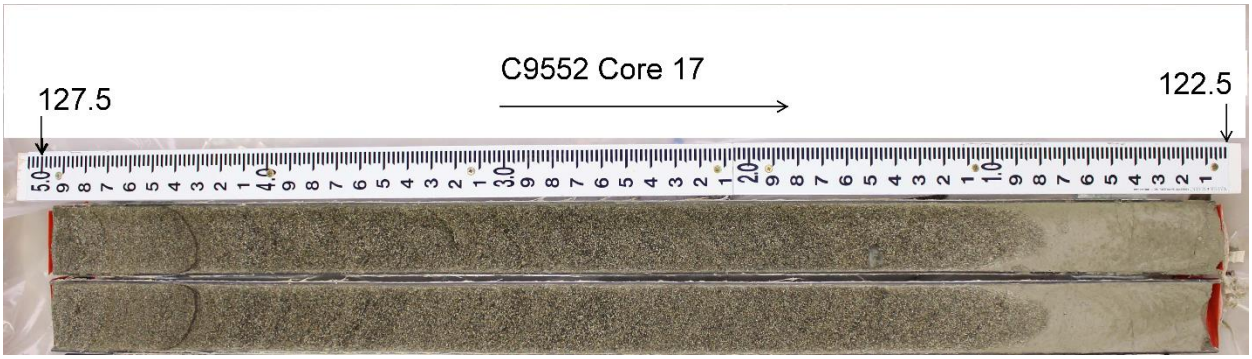




Core 15: 112.2-117.2

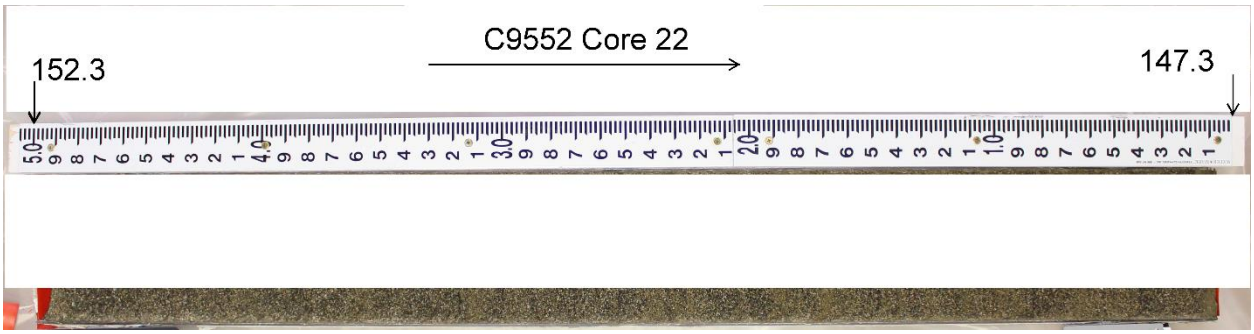


Core 16: 117.1-122.1

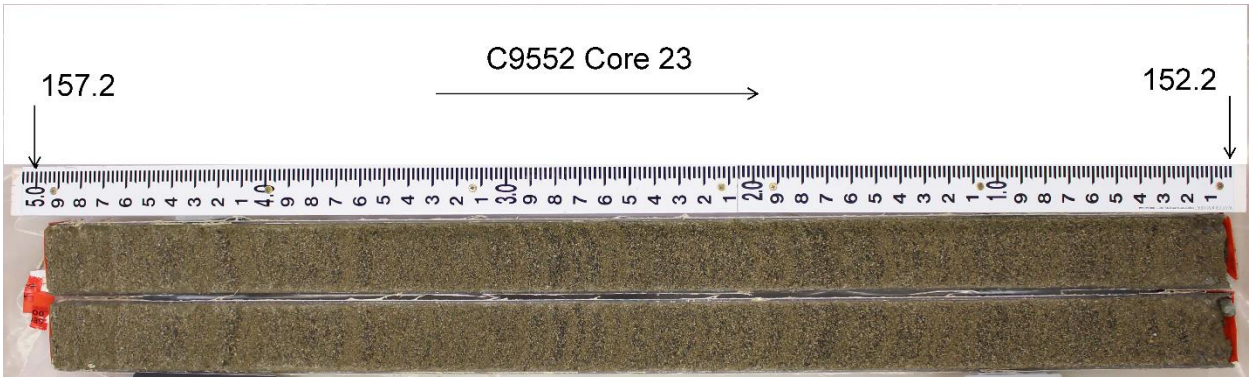


Core 17: 122.5-127.5

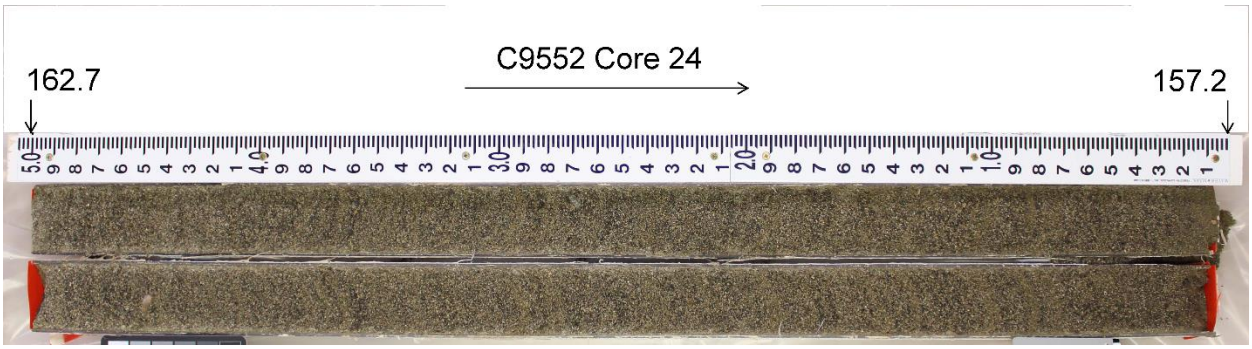
Core 21: 142.3-147.3



Core 22: 147.3-152.3

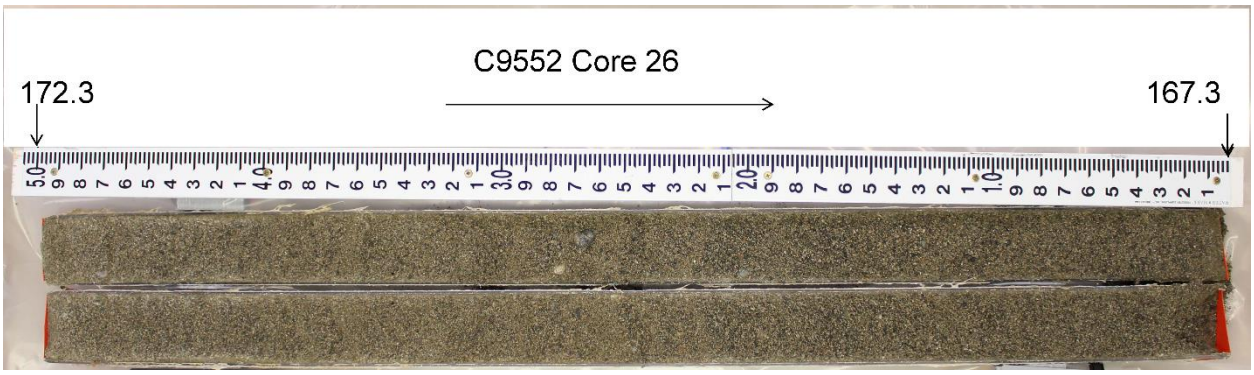


Core 23: 152.2-157.2



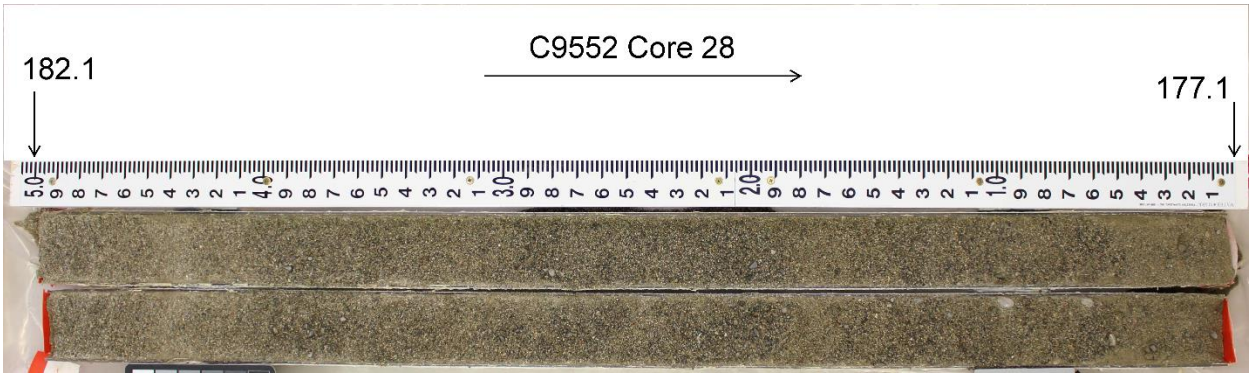
Core 24: 157.2-162.7

Core 25: 162.2-167.2

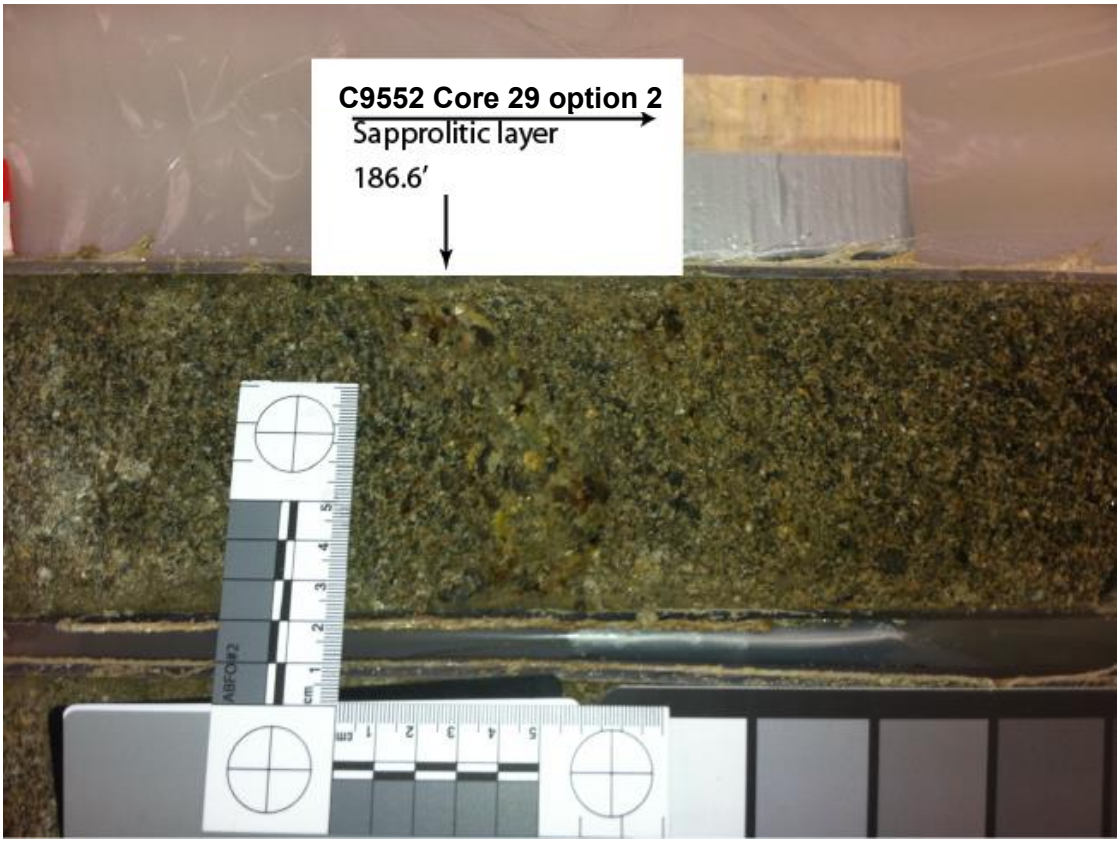


Core 26: 167.3-172.3

Core 27: 172.3-177.3



Core 28: 177.1-182.1



Core 29: Opt 186.6

Core 29: Opt 2 182.2-187.2

BOREHOLE LOG

Page 1 of 14
Date: 5/11/16

Well ID: C8706 | Well Name: NA | Location: BY cribs 216-B-46 crib
Project: 200-DV-1 | 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
					0-45.3': DPT
0					
2	B33B16 B33B17	S.Sp. Split spoon			2-4.5': Split spoon (S.Sp.)
4		S.Sp.			3.9-6.4: S.Sp.
6		S.Sp.			5.9-8.4: S.Sp.
8		S.Sp.			
10					▨: no recovery
					▩: pulverized from overdrive
20				not used/no core (TC) 6-7-16	
30					
40	Change Scale				
42.5					
45.0	END TPT			45.5-47.0: Gravelly Silty Sand (25% G, 45% S, 30% M)	
		40% rec. #1		Gravel: 75% Mafic, 25% Felsic, vf pebbles - sm cobbles, SR Sand: 70% Qtz/feldspar Felsic, 30% Mafic; SA-SR, M-VC; moist, mod-p sorted	45.5-TD: Sonic w/ 4" x 5' core
					45.5-47.0: Core 1: B324N7
					Drilled 2/17/16
47.5				2.5Y 4/1 Dark gray; non plastic	47.0-49.5: Core 2: B324N8.
				- coarse K feldspar sand grains present ~~from~~ @ 46.5'	Alignot: ~~#~~ screw JK 6.2.16
		140% #2		- wk rxn w/ HCl from 46.0-46.4	
49.5 Core 49.5					~~Prob. done greater than 2.5'~~ (TC) 6-6-16

Reported By: A. Lantow / Jen Russell | Reviewed By: Tessa Clark
Title: Geo Tech. / Geologist | Title: Geologist
Signature: A. Lantow / JenRussell | Date: 5/11/16 | Signature: [signature] | Date: 6/7/16

6.2.16

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 14
Date: 6/2/16

Well ID: C8706 | Well Name: NA | Location: 216-B-46 Crib

Project: 200-DV-1 | 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
45.5		#1			
47.5					
		move down AZ 5.25.16			
47.5		140% #2		47.0-47.3': gravelly Sand (gS) (85%S, 15%g, 0%m) pr. srtd. c.-v.c. sub-rnd. S. of 50%felsic, 50%mafic w/ f. pbl. of bslt. (sub.ang.). 2.5Y 5/2 grysh brn. moist no rxn HCl. pot. ↓ Coarsening.	47.0-49.5': Core 2: B324N8 Aliquot: AZ 5.25.16 Drilled: 2.22.16
50.0				47.3-47.5': slightly silty gravelly sand (mgS) (15%m, 10%g, 75%S) v.f.-v.c. sub.ang. S. of 50%mafic/50%bslt. f. w/ v.f.-c. pbl. of 50%mafic/50%felsic. w/ nonplastic m. 2.5Y 4/1 drk. gray. v.wk. rxn HCl. sharp contact below. ↓ Coarsening.	
				47.5-49.5': gravelly Sand (gS) (80-75%S, 20-25%g 0%m): mod.-pr. srtd. ↓ Coarsening. m.-v.c. ang. S of 50/50%mafic/felsic w/ v.f.-v.c. pbl. (ang.-sub-rnd.) of 95%bslt./5%meta 2.5Y 4/3 lt. olv. brn. non compact. moist. no rxn HCl.	

Reported By: A. Lantow / Jen Russell | Reviewed By: Tessa Clark

Title: Geo. Tech. / Geologist | Title: Geologist

Signature: A. Lantow / Jen Russell | Date: 5.25.16 | Signature: [signature] | Date: 6/6/16

6.2.16

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 14
Date: 5-12-16

Well ID: C8706 | Well Name: NA | Location: 216-B-41 B

Project: 200-DV-1 | 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
50.0	49.5-52.0'	50% #3		49.5-51.0: Gravelly Sand (gS) (80% S, 20% g, 0% m) pr. srtd. massive bed. f.-v.c. sub-rndd. S. of 50% mafic/50% felsic w. sub-rndd. v.f.-c. pbl. of 50/50% mafic:felsic. comp. 2.5Y 5/3 lt. olv. brn. moist. mod. rxn HCl. 51.0-51.5': slightly silty gravelly Sand (gS) (10% g, 80% S, 10% m) coarse grained matl. same as above w/ added silt.	Sonic w/ 4"x5' core 49.5-52.0': Core 3: B324N9 Drilled 2-22-16 470 cpm/100cm² above bkgrnd. By, Ox
52.5		move down		pr. srtd. v.f.-v.c. sub ang. S. of 50/50% mafic/felsic w/ v.f.-c. sub. rndd. pbl. of 50/50% mafic/felsic. 2.5Y 5/3 lt. olv. brn. moist. no rxn HCl. 51.5-52.0': Same as (49.5-51.0')	
52.5				52.2'-52.6': gravelly Sand (gS) (80% S, 20% g, ~0-5% m) pr. srtd. fining m.v.c. S. of 65% Qtz. flds./35% mafic. w/ w. rndd. m.-v.c. pbl. of 80% meta./20% bslt. 2.5Y 5/3 lt. olv. brn. no rxn HCl.	52.2-57.2': Core 4: B324P0
53				52.6-53.4': gravelly Sand (gS) (20% G, 80% S, 0% m) coarsening m.-v.c. ang. S. of 70% Qtz. flds/30% mafic. w/ v.f.-m. pbl. of bslt. + coarsening from v.f. pbl. to m. pbl. (coarsest pbl.s. of 70% meta./30% bslt.) @ 52.8': bed. of w. srtd. m. ang. S. of 98% Qtz. flds. 2% mafic. 2.5Y 6/4 lt. yloish. brn. no rxn HCl	
53.5		100% #4		53.4-54.4': gravelly Sand (gS) (80% S, 20% g, 0% m) mod. srtd. coarsening (c.r.s.) from m. S. w/ v.f. pbl. to v.c. S. w/ v.c. pbl. (Sand of 60%-50% felsic Qtz./40-50% mafic. trc. sub. rndd pbl. of bslt. throughout. 2.5Y 5/2 grysh brn. trc. m. mica.	
54				54.0-55.0': Sand (S). (95% S, trc. g., 0% m) v. w. srtd. bed. of c.-v.c. S. of 70% Qtz. flds./30% mafic. w. trc. v.f. ang. pbl. of bslt. 2.5Y 5/3 lt. olv. brn. grading to bed below. (coarsening downward?)	
54.5				55.0-55.9': gravelly Sand (gS) (80% S, 20% G) v. pr. srtd. m.-v.c. ang. S. of 50% felsic/50% mafic w/ pbl.s. of (90% v.f. pbl. + 10% c. pbl. of bslt. > meta. throughout. 2.5Y 5/3 lt. olv. brn. moist. no rxn HCl.	
55.0				55.9-56.7': gravelly Sand (gS) (80-90% S, 10% g) fining mod. srtd. m.-v.c. S. of 50% felsic/50% mafic grading to f.-c. S. of 60% Qtz./40% mafic. 2.5Y 5/3 lt. olv. brn. wk. rxn HCl. w/ v.f. pbl. in top of unit.	
57.5		move down		56.7-57.2': sandy Gravel (sG) (70% g, 30% S, 0% m) pr. srtd. no fabric. f.-v.c. ang. S. of 80% Qtz. flds./20% mafic. w/ f.-m. pbl. (w. rndd.) of 80% bslt./20% meta > int. volc. 2.5Y 5/3 lt. olv. brn. no rxn HCl.	-discoidal gravel. no imbrication.

Reported By: A. Lantau | Reviewed By: T. Clark

Title: Geo. Tech. | Title: Geologist

Signature: A. Lantau | Date: 5-12-16 | Signature: [signature] | Date: 6/6/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 14

Date: 5-16-16

Well ID: C8706	Well Name: NA	Location: 216-B-46 crib	
Project: 200-DV-1		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
57.5	572-622': B3247P1	100% #5		57.2'-58.0': ~~gravelly Silty Sand (gmS)~~ slightly silty gravelly sand (10%G, 70%S, 20%m) pr.srtd. v.f.-c. S. of 40%Qtz.flds. 40%mafic. w/ v.w.rndd. m.-c.pbl. of 50%mafic/50%felsic. non plastic, v.high dilatancy, 2.5Y 5/2 grayish brn. st.rxn HCl	Sonic w/ 4"x5' core 57.2-62.2': Core 5: B3247P1 Drilled: 2.22.16 @57.2': 1275 cpm/100cm² By/OA
60.0				58.0'-58.8': gravelly Sand (gS) (80%S, 20%G, 0%m) m.-c. ang. S. of 70%Qtz.flds./30%mafic. w/ v.w.rndd. discoidal m.-c.pbl. of 80%meta./20%bslt. 2.5Y 5/1 lt.olv.brn. no rxn HCl.	
				58.8-60.0': gravelly Sand (gS) (90%S, 10%G, 0%m) more coarse, bed. mod.srtd. c.-v.c sub-ang. S. of 40%Qtz flds./60%Mafic. w/ w.rndd. f.-v.f. pbl. of bslt. no felsic gravel. 2.5Y 4/2 dk.grayish brn. no rxn HCl.	
62.5		over driven		~~60.0-60.8~~:	
				60.0-61.2': Sand. (S.) (95%S, 5%G, 0%m) Coarsening. mod.w.stratified. f.-m. S. of 60-80%Qtz. flds. 40-20%bslt. grading to f.-c. S. of 75%Qtz.flds/30% mafic. 2.5Y 5/3 lt.olv.brn. (50/50%mafic/felsic)	
65.0			move down to 5.16.16	@61.0': 2" thick bed of m.-c. ang. S. w/ 20% G. of v.w. rndd. C. pbl. of 100%meta.	
				@61.2': at contact 1/4" graded-faint bed of v.f.-c. S. of 75%Qtz. flds/25%mafic color 2.5Y 5/6 lt.olv.brn. no rxn HCl.	
				61.2'-62.2': gravelly Sand (gS) (75%S, 25%G, 0%m) more Coarse, pr.srtd.-mod.srtd. c.-vC. sub-ang. S. of 50%mafic/50%felsic. w/ v.w.srtd. w. rndd. f. pbl. of 90%bslt./20% int. volv. > meta. 2.5Y 5/1 grayish brn. no rxn HCl. spors. v.c. pbl. of v.w.rndd. lapilli tuff.	
62.5	B35N89 B35N90	100% #6		62.2-67.2': Sand. (S) (100%S, tr. m.) mod. to w.srtd. w. stratified. beds ~~1/6 to 5/6~~ 1" to 3" thick. of m.-c. sub-ang. S. of 50%mafic/50%felsic. 2.5Y 6/1 lt. brownish gray. no rxn HCl. moist.	62.2-67.2': Core #6: B3247P2 Drilled 2.22.16 62.9-64.9': Aliquot: B35N89, B35N90 (5.25.16)
65.0	622-672': B3247P2			@62.6-62.3': bed of Sand. darker. grading from fn. sand to v.c. sub-ang. S. of 50-60%mafic/50-40%qtz. flds. w/ f. S. bed ~2-3mm thick on top + bottom colored 10YR 5/4 yellowish brn. moist no rxn HCl.	
				@64.6': 4mm layer of 10YR 5/4 yellowish brown colored med. Sand. faint Fe+ staining-pervasive in layer.	
67.5			move down 5.25.16		
70.0					

Reported By: A. Lantau		Reviewed By: T. Clark	
Title: Geo. Tech.		Title: Geologist	
Signature: A. Lantau	Date: 5.16.16	Signature:	Date: 6/7/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of 14
Date: 5·16·16

Well ID: C 8706	Well Name: NA.	Location: 216-B-46 crib	
Project: 200-DV-1		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
67.5				67.3-72.3': Sand (S) (100% S.) mod. w. stratified. mod. w. srtd. m.-c. ang. S. of 60% felsic Qtz. flds/ 40% mafic. 2.5Y 5/3 lt. olv. brn. no rxn HCl. moist.	Sonic w/ 4"x5' core. 67.3-72.3': Core 7: B324P3 Drilled: 2·22·16
70.0	67.3-72.3: B324P3	100% #7		@67.7-68.2': slightly silty Sand (m)S) (20% m, 80% S) v.f.-c. S. of 60% felsic, 40% mafic. w/ matrix of non plastic v. high dilatancy silt. 2.5Y 5/3 lt. olv. brn. st. rxn HCl.	↓ Coarsening. (silt content decreasing w/ depth)
				@68.6': 1" bed of w. srtd. v.c. slub. rnd. S. of 80% mafic/20% Qtz. flds.	
				@69.4': ½ thick bed of v.w. srtd. S. of 99% Qtz. flds./trc. mafics.	
72.5				@71.1': ½" bed of v.c. ang. S. of bslt. slightly inclined. ~40% inclination.	
				@72.0': faint sprs. 3mm Fe staining. patchy. no rxn HCl.	
	72.1-77.1: B324P4	100% #8		72.1-77.1': Sand (S) (99% S, trc. g, 0% m) w. srtd. mod. w. stratified. 6" to 2.5' beds of c. Sand & m.-c. S. downward coarsening to v.c. sub-ang. Sand.	72.1-77.1': Core 8: B324P4 Drilled 2·22·16
75.0				72.1-72.7': m.-c. ang. S. of 80% Qtz. flds/20% mafic. moist 2.5Y 5/4 lt. olv. brn. no rxn HCl. moist.	
				72.7-74.8': m.-v.c. sub-ang. S. of 50% mafic/50% felsic. w/ trc. sprs. v.f. pbl. of bslt.	
				@73.5': ½" thick v.f.-c. S. of 80% Qtz. flds/20% mafic. 2.5Y 5/4 lt. olv. brn. no rxn HCl. trc. f. mica.	
77.5				74.8'-76.0': massive mod. srtd. c.-v.c. ang. S. bed of 50%/50% mafic: felsic. 2.5Y 6/3 lt. brnsh gray. no rxn HCl. trc. crs. mica.	
	move down AZ 5-25-16			76.0-77.0': mod. srtd. m.-c. ang. S. of 70% Qtz./30% mafic.	
				@76.0': contact.-2mm. bed of v.f.-c. S. of 80% Qtz. flds. 2.5Y 6/4 lt. yllwsh brn. no rxn HCl	
77.5				77.0-78.3' slight incline bed. ~20%	
				78.3'-80.4': Sand (S) (100% S) v. srtd. m. S. of 50% mafic 50% felsic. same as above.	77.0-82.0': Core 9: B324P5 79.3-82.4': Aliquot 5·25·16 B35N91, B35N92
				78.3-79.4': silty Sand (m S) (40% m, 60% S) ↓ Coarsening. v.f. ang. S. of 50% mafic/50% felsic w/ wet. low dilatancy silt. 2.5Y 6/4 yellowish brown. no rxn HCl (grading from v.f. S. to v.c. S.). ½" flame structure 2mm wide by 2" tall flowing from base of bed upwards into more coarse unit. flame structure colored 10YR 5/2 grayish brown. no rxn. HCl.	@78.5 peak reading of 4,414 dpm/100cm² βα.
80.0	B35N91	100% #9			
	B35N92	77.0-82.0: B324P5			
82.5				79.4-80.4': Silt (m) (95% m, trc. s. trc. g). low.-mod. dilatancy. wet. silt. colored 10YR 5/3 brown. no rxn HCl. w/ v.f.-c. ang. S. 50/50% mafic/felsic. w/ sprs. trc. ang. f. pbl. of bslt.	
	move down AZ 5-25-16			— Next pg. 6 →	

Reported By: A. Santos.		Reviewed By: Tessa Clark	
Title: Geo. Tech.		Title: Geologist	
Signature: A. Santos	Date: 5·16·16	Signature:	Date: 6/7/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 14
Date: 5.25.16

Well ID: C8706 | Well Name: NA- | Location: 216-B-46 Crib.

Project: 200-DV-1 OU | 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
84.5				79.4-80.4': Silt (M) (95% m, trace S., trace g) wet. low-mod. dilatancy silt. colored 10YR 5/3 brown. w/ v.f. grading downwards to v.c. sub-ang. S. of 50%/50% mafic/felsic w/ trc. sprs. f. pbl. of bslt sand & grave content gradually increase w/ depth from 0% to ~5%. @ base (80.4): 3mm f. lamina of m. colored. 10YR 4/2 dk grayish brown. @ 79.6': ½" thick bed of silty sand (75% S, 25% m.) v.f.-v.f. sub-ang. S. of 50/50% mafic:felsic. colored 10YR 5/3 brown. no rxn HCl. wet. 80.4-82.0': Sand (S) (100% S) w. srtd. w. stratified v.f. S., v.c. S. & m. S. stratified into 2" to 1' thick beds. v.f.-m.S beds of 50%/50% mafic/felsic & c.-v.c. Sand beds of 80% bslt/20% Qtz. Flds. moist. no rx HCl. 2.5Y 5/4 H. olv. brn.	Continue Previous. 77.0-82.0: Core 9: Continued.
82.5					

move down AK 5.25.16

move down AK 5.25.16

AK 5.25.16

AK 5.25.16

Reported By: A. Lantau		Reviewed By: Tessa Clark	
Title: Geo. Tech.		Title: Geologist	
Signature: Aaron Lantau	Date: 5.25.16	Signature: [illegible]	Date: 6/7/16

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 5·16·16

Well ID: C 8706	Well Name: NA	Location: 316-13 4b crib
Project: 200-DV-1		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
82.5	82.2-87.2: B324P6	100% #10		82.2'-87.5: Sand (100%S) (S) (mod.w.srtd.-w.srtd. m.-C. ang. S. of 75%-70% Qtz flds./25-30%mafic. massive. no structure. 2.5Y 5/3 lt.olv.brn. no rxn HCl. moist. @ 82.6': ½ thick bed of slightly silty Sand ((m)S.) (15%m, 85%S) v.f.-c. S. of 60%Qtz./40%mafic. non plastic. 2.5Y 4/2 drk grysh brn. moist st. rxn HCl. 4mm sprs. Fe+ staining.	Sonic w/4"X5' core 82.2-87.2': Core 10: B324P6 Drilled 2·23·16
87.5	87.3-92.3: B324P7	100% #11		87.3'-92.3': Sand (S) (100%S). mod.-w.srtd. mod.w. stratified. 2"-6" beds. of m.-v.c.S. of 75%Qtz.flds./15%mafic 2.5Y 6/2 lt. ~~grysh~~ brownish gray TC 6-7-16 ~~brn.~~ no rxn HCl. pot. ~~&~~ coarsen. & f.-m. S. of ~~80~~ 85% Qtz.flds/15%mafic 2.5Y 5/4 lt.olv.brn. moist no rxn HCl. @ 88.1': 2" thick bed of m. S. of 85-90% Qtz.flds. 15-10%mafic. 2.5Y 5/4 lt.olv.brn. no rxn HCl.	87.3-92.3': Core 11: B324P7 Drilled: 2·23·16 TC 6-7-16
92.5	92.2-97.2: B324P8	100% #12		92.3-97.5: Sand (S) (100%S) mod.srtd. m.-C. sub.ang. S. of 60%Qtz.flds./40%mafic w/ sprs. trc. sub-rndd. v.f. pbl. of 50%/50%mafic/felsic. abnt. 2-4mm beds. ~2-10" intervals. apart. of f.-m. ang. Sand of 85%Qtz.flds/15%mafic. 2.5Y 5/4 lt.olv.brn. no rxn HCl. moist.	92.2-97.2': Core 12: B324P8 Drilled 2·23·16
97.5	97.1-102.1: B324P9	100% #13		97.1'-99.2': Sand (S) (100%S) v.f.-v.c. ang. Sand ~~of~~ of 85%Qtz.flds./15%mafic. 2.5Y 7/2 lt.gry. 2-5mm beds of f.-Sand. occurring increasing abundancy towards base of unit. 2.5Y 5/4 lt.olv.brn. of 90%Qtz./10%mafic. abnt. 3mm clots of silt. 2.5Y 5/4 lt.olv.brn. no rxn HCl.	97.1-102.1': Core 13: B324P9 Drilled 2·23·16
100.0				99.2-102.1': Sand (S) (100%S) mod. srtd. massive. f.-v.c. S. of 85%Qtz. flds./15%mafic. sprs. f. mica. faint sprs. 2-3mm Fe+ staining. overall 2.5Y 6/2 lt. brnish. gray. no rxn HCl.	
102.0					

Reported By: A. Lantau		Reviewed By: Tessa Clark	
Title: Geo. Tech.		Title: Geologist	
Signature: A. Lantau	Date: 5·16·16	Signature: [illegible]	Date: 6/7/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 8 of 14
Date: 5.16.16

Well ID: C8706 | Well Name: NA | Location: 216-B-46 crib
Project: 200-DV-1 | 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
102.5				102.1-107.2 Sand (S) (100%)	Sonic w/4"x5' core
				mod. srtd. ~~v.f.~~ m.-c. ang. S. of 85% Qtz. flds/~~15%~~	102.1-107.1: Core 14: B324R0
				mafic. ~~2.5Y 4/4 lt. olv. brn.~~ no rxn HCl. moist. abnt.	Drilled 2.23.16
				f. mica. 2.5Y 6/3 lt. ylwsh. brn.	No sigs of overdrive.
				102.1-104.1': faint 3-5mm. beds of v.f.-m. S.	
105.0	102.1-107.1: B324R0	100% #14		of 99% Qtz. flds/trc. mafic. 2.5Y 5/4	
				lt. olv. brn. moist no rxn HCl.	
				107.2-109.5: Sand (S) (100% S.)	107.2-112.2': Core 15: B324R1
107.5				massive bed. v.w. srtd. m.-v.c. Sand of 85% Qtz./	Drilled 2.23.16
				15% mafic. 2.5Y 6/2 lt. ylwsh. brn. no rxn HCl.	108.2-110.2': Aliquot: B.25.16
				109.5-111.5': Sand (S) (100%) v.w. srtd. v.w. strat.	~~B324N94~~, ~~B324N93~~
	B324N93 B324N94 2.25.16			v.f.-m. S. of 85% Qtz. flds/15% mafic. 2.5Y 7/2 light gray.	(B35N94, B35N93)
				no rxn HCl. v.f. lamina & filiments of m.-c. v.f. Sand.	5mm. patchy Fe+ staining.
110.0	B324R1	100% #15		@ 110.9': 2" thick ↓ coarsening bed. from v.f. S. to c. pbl.	of 50% mafic/felsic. comp.
				~110.9-111.5': massive bed of v.w. srtd. v.f. S. 2.5Y 7/2 lt. gray. no rxn HCl.	
				111.5-112.2': ~~Silty~~ Sand (S) (90% S, 10% G, 0% m)	0% S (90% S, 10% m)
	102.2-112.2: B324R1			w. srtd. w. stratified. v.f. S. grading to c. S. w/ m matrix.	→ @ 110.9' 1157 dpm/100cm² By OA
				Coarsening ↓ m. → c. S. 2.5Y 5/3 lt. olv. brn. no rxn HCl.	slight inclined bedding 1-2" thick.
112.5				112.1-117.1: Sand (S) (90% S, 10% G, 0% m)	112.1-117.1: Core 16: B324R2
				mod. srtd. mod. w. stratified. 6" to 2' beds. downward	Drilled 2.23.16
				coarsening. from m.-c. ang. S. of 70% Qtz. flds/30% mafic	
				to v.c. S. w/ v.f. pbl. of 30% Qtz. flds./70% bslt.	Top pulverized from above drive
				2.5Y 7/2 lt. gray. dry. no rxn HCl.	
115.0	112.1-117.1: B324R2	100% #16		sprs. w.rndd. c. pbl. @ 116.2'-117.1	
				faint. trace. 2-4mm Fe staining in splotches.	
117.5				117.2-122.2': Sand (S) (99% S, trc. g, 0% m)	117.2-122.2': Core 17: B324R3
				mod.-~~pr.~~ srtd. pr. stratified. ↓ coarsening 2.5' beds	
				of m.-c. ang. S of 70% Qtz./30% mafic grading to	
				c.-v.c. sub-ang. S. of 70% Qtz./30% mafic w/ trc.	
	112.2-122.2: B324R3	100% #17		w.rndd. f. pbl. of bslt. no rxn HCl. dry. 2.5Y 7/2 lt. gray.	
120.0				v. unconsolidated.	
				@ 120.0': Top of 2.5' bed. grading from f.-c. S. grading	
				to v.c. S.	

Reported By: A. Lantow | Reviewed By: Tessa Clark
Title: Geo. Tech | Title: Geologist
Signature: A. Lantow | Date: 5.16.16 | Signature: [illegible] | Date: 6/7/16

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 5-17-16

Well ID: C8706	Well Name: NA	Location: 216-B-4b crib
Project: 200-DV-1		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
122.5		#17		122.5-~~127.5~~ 124.9: Sand (S) (98%S, 2%G, trc. m)	Sonic w/ 4"x5' core.
				Pr. srtd. w. stratified. c.-v.c. ang. S. of 70% Qtz. flds. (TZ 5-17-16)	122.5-127.5: Core 18: B324R4
				30% mafic w/ ↓ coarsening 1.5-2' beds. coarsen from	Drilled 2-23-16
				m.-c. S. to c.-v.c. S. w/ trc. v.f. pbl. of bslt.	
				2.5Y 7/2 H. gray. dry. no rxn HCl. vs unconsolidated.	Top pulverized from above
125.0				sprs. mica. sprs. 4mm. Fe+ staining - splotchy.	drive.
				124.9'-127.5': Sand (S) (99% S. trc. m)	
				v.w. stratified. mod.-vw. srtd. beds. of 2"-6" thick	
				beds of m.-v.c. ang. S. of 80% Qtz. flds. & 2-5mm	
				thick beds of f.-m. S. of 90% Qtz. flds / 10% mafic	
127.5				2.5Y 5/3 H. olv. brn. ~~sprs. 5mm beds of Sand w/~~ AZ 5-17-16	
				sprs. clay chips or saprolitic chips 2-4mm. of Tan, black, olive	
				green & red brown. throughout coarse grained beds.	
				Unit coarsend downward from bedded f. to c. Sands	
				to 1' massive ↓ coarsening bed of Sand from f.-c. S. to	
				c. S. (v.w. srtd.)	
		Move down AZ 5-17-16		- @ 127.0', 1/2' thick bed of saprolitic w/ f. pbl.	
				of Tan Qtz > brn. Qtz. > green gray into volc. > red. (AZ 5-17-16)	Top + bottom over driven
				brn. mafics. (2-4mm in size)	pulverized.
127.5				127.0-132.0': Sand (S) (100% S, 0% g, 0% m)	127.0-132.0': Core 19: B324R5
				mod. srtd. massive bed. med.-c. S. of 60% Qtz. flds.	Drilled 2-24-16
				40% mafic w/ sprs. v.c. sub-ang. S. of 60% Qtz / 40% mafic.	Top pulverized from above drive.
				2.5Y 5/3 H. olv. brn. dry. no rxn HCl	Top + bottom over driven.
130.0				131.0' ~~@ 130.0'~~: faint 1" bed of m. S. of 80% Qtz. flds / 20%	pulverized.
				mafic. 2.5Y 4/3 H. olv. brn. no rxn HCl. (AZ 5-17-16) TC 6-7-16	
132.5				132.4-136.2': Sand (S) (100% S) mod.-w. srtd. beds.	132.4-137.4': Core 20: B324R6
				2'-6" thick ↓ ~~of coarsening of~~ (AZ 5-26-16) downward coarsening of	Drilled 2-24-16
				m.-v.c. subang. S. of 50-80% Qtz. flds. / 50-20% mafic.	
				2.5Y 6/2 H. brownish gray. moist no rxn HCl. sprs. f. mica.	135.4-136.9': Aliquot 5-26-16
					B35N95, B35N96
135.0				136.2-137.4': gravelly Sand (g S) ~~trc (m)~~ TC 6-7-16 mod. srtd. poorly	
				stratified into v.f.-m. S. & m.-v.c. sub-ang. S. of	(80% S, 20% g, trc. m)
				75% Qtz. flds. / 25% mafic. no rxn. HCl. 2.5Y 5/4 H. olv. brn.	
				w/ v.f.-f. pbl. of bslt.	
137.0					

Reported By: A. Lantau		Reviewed By: Tessa Clark	
Title: Geo. Tech.		Title: Geologist	
Signature: Aaron Lantau	Date: 5-17-16	Signature: [illegible]	Date: 6/7/16

A-6003-642 (03/03)

BOREHOLE LOG

Page 10 of 14

Date: 5.17.16

Well ID: C8706	Well Name: NA.	Location: 216-B-46 crib
Project: 200-DV-1		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
137.5		C-24 10		136.2-137.4': gravelly Sand (gS) (80% S, 20% g, trace) mod. srtd. pr. stratified. downward coarsening beds 2"-½" thic of v.f.-m.S. & m.-v.c. sub ang. S. of 75% Qtz. flds/25% mafic. w. sub-rndd. v.f.-f. pbl. of bslt. throughout. 2.5Y 5/4 lt. olv. brn. moist no rxn HCl.	Sonic w/ 4"x5' core
137.5				137.2-138.9': Gravelly Sand (gS) (80% S, 20% G, 0% m) v.pr. srtd. m.-v.c. sub-ang. S. of 50% felsic/50% mafic w/ sub-rndd. v.f.-f. pbl. of bslt. & sprs. w. rndd. m. pbl. of bslt. weakly stratified. w/ faint beds of c. & v.c. S. 2.5Y 5/3 lt. olv. brn. no rxn HCl moist. no Fe+ staining.	137.2-142.2': Core 21: B324R7 Drilled 2.24.16
140	137.2-142.2: B324R7	100% #21		138.9'-142.2': Sand (S) (100% S) pr. srtd. massive bed of m.-v.c. sub-ang. S. of 50% Qtz. flds/ 50% mafic. 2.5Y 4/3 lt. olv. brn. no rxn HCl. TC 6-7-16	Pot. ↓ fining. sharp contact ↓
142.5				142.3'-147.3': gravelly Sand (gS) (80% S, 20% g, 0% m) mod. w. srtd. v.w. stratified m.-c. ang. S. of 50%-60% Qtz. flds. w/ 50-40% mafic. 2.5Y 5/3 lt. olv. brn. w/ 1-2" beds of pebbly Sand of v.c. S. of 70% Qtz. flds. /30% mafic w/ v.f. sub-rndd. pbl. of bslt. moist no rxn HCl. v. gradual ↓ coarsening. from m.-v.c. S. overall. sprs. w. rndd m. pbl. of bslt. > int. volc. faint 20-50% inclined bedding. sprs. mica & pyrite.	142.3-147.3': Core 22: B324R8 Drilled 2.24.16
145.0	142.3-147.3: B324R8	100% #22			
147.5				147.1'-148.2': Gravelly Sand (gS) (80% S, 20% g, 0% m) ↓ coarsening. pr. srtd. bed of m.-v.c. ang. S. of 60% Qtz. flds. /40% mafic. w/ v.w. rndd. c. pbl. of 90% meta/10% bslt. 2.5Y 5/3 lt. olv. brn. moist no rxn HCl	147.1-152.1': Core 23: B324R9 Drilled 2.24.16
150.0	147.1-152.1: B324R9	100% #23		148.2'-152.1': Sand (S) (100% S, 0% g, 0% m) mod. srtd. mod. stratified. m. S. of 90% Qtz. flds. /10% mafic. w/ 2-3" beds of c.-v.c. ang. S. of 70% Qtz. flds 30% mafic. 2.5Y 6/2 lt. brownish gray. no rxn HCl. TC 6-7-16	← (½"-1" beds)
152.5		#24		148.2'-155.2': Sand (S) (100% S) mod. srtd. m.-v.c. sub ang. S. of 50% mafic/50% felsic on 2.5Y 6/2 lt. brownish gray. moist. no rxn HCl. faint. ½" inclined beds of 70% mafic/30% felsic c. ang. Sand.	152.1-157.1': Core 24: B324T0 Drilled 2.24.16
155.5					not overdriven.

Reported By: A. Zontow		Reviewed By: Tessa Clark	
Title: Geo. Tech.		Title: Geologist	
Signature: Aaron Zontow	Date: 5.17.16	Signature: [illegible]	Date: 6/7/16

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 5·17·16

Well ID: C8706	Well Name: NA	Location: 216-B-46 crib
Project: 200-DV-1		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
155.0	152.1-157.1: B324T0	100% #27		155.2-157.1': gravelly Sand (gS) (80% S, ~~to~~ 20% g) 0%m TC 6-7-16	Sonic w/4" x 5' core
155.2 TC 6-7-16				↓fining. sub-rndd. fn. pbl. of bslt. grading to	152.1-157.1: Core 24: B324T0
				pr. srtd. m.-v.c. S. of 70% Qtz. flds/30% mafic.	Drilled 2·24·16
				2.5Y 5/2 grysh brn. moist no rxn HCl.	not over driven.
157.0				157.0-162.0 gravelly Sand (gS) (90% S, 10% g 0%m)	157.0-162.0: Core 25: B324T1
				pr. srtd. pr.-mod. stratified 3'-2" beds. of m.-c.S.	Drilled 2·24·16
				& m.-v.C. S. w/ f.-c. w.rndd. pbl. of 50% bslt/50%	158.5-160.5' Aliquot 5·25·16
	B35N97 B35N98 5-26-16			meta. 2.5Y 5/3 lt. olv. brn. no rxn HCl. abnt. mica.	
160.0				Sand of 75% Qtz/25% mafic. sprs. 10mm Fe+ staining	
				w/ abnt. ~20% Fe+ oxidation or weathering of mafic grains of sand.	
				wk. carbonate rinds developing under larger clasts.	
162.5				162.1-167.1' gravelly Sand (gS) (90% S, 10% g. 0%m)	162.1-167.1: Core 26: B324T2
				v. pr. srtd. m.-vc. subang. S. of 60-70% Qtz. flds/40-30%	Drilled 2·24·16
				felsic w/ v.w.rndd. c. pbl. of bslt. slightly weathered clasts.	
				abnt. weathered crs. grained mafics. Fe+ staining.	
				1-3mm. filiments of carbon throughout.	
165.0				2.5Y 5/2 ~~grayish brown olive gray~~ moist no rxn HCl TC 6-7-16 olive gray TC 6/7/16	
167.5				167.1' - 172.1': Sand (S) (98% S, tr. g.) 0%m	167.1-172.1: Core 27: B324T3
				pr. srtd. m.-v.c. S. of 70-75% Qtz. flds/25-30% mafic. w/	Drilled 2·25·16
				sprs. m.-c. pbl. of bslt. AZ 5·17·16 ~~massive~~ 6"-2' bedding	
				of above material + 6" beds of c. ang. S. of 50% mafic	
				50% felsic. comp. overall 2.5Y 5/2 TC 6-7-16 lt. olv. gray. moist	
170.0				no rxn HCl.	
				sprs. 4mm Fe+ staining.	
172.5				172.1-177.3: Sand (S) (98% S, 2% G)	172.1-177.3: Core 28:
				Gravel: vf pebbles - small cobbles; 40% Mafic	Drilled 2·25·16
				40% felsic; SR Sand: m-vc, SA, 70% Qtz	
				Felsic, 30% Mafic; 2.5Y 5/3 Light olive brn;	
				dry, no rxn w/ HCL, mod. sorted. - 4mm iron staining	

Reported By: A. Foster / Jen Russell	Reviewed By: Tessa Clark
Title: Geo Tech. / Geologist	Title: Geologist
Signature: Aaron Foster / Jen Russell Date: 5·17·16	Signature: [illegible] Date: 6/7/16

6·2·16

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 5-18-16

Well ID: C8706	Well Name: NA	Location: 216-B-46 crib
Project: 200-DV-1		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
	172.3-177.3	100% rec. #28		172.1-177.3: Sand(S)(98%S, 2%G) Gravel: vf peb - sm cob; 60% Mafic, 40% Felsic, SR; Sand: m-vc, SA, 70% Qtz felsic, 30% Mafic; 2.5Y 5/3 lt. olive brn; dry, no rxn w/HCl, mod sort.	Sonic w/ 4" x 5' core
				- ~1mm iron staining throughout	core 28
				- f-c grained from 172.9-173.0	Drilled 2.25.16
175.0					
177.5	177.3-182.3: B324T5	100% #29		177.3-182.3: gravelly Sand (gS) (90%S, 10%g, 0%m) mod-pr. srtd. well stratified. beds 2" to 6" thick of c.-v.c. ang. S. of 80% Qtz. felds./20% mafic. w/ v.f. ang. pbl. of bslt.; trc. w. rndd. m. pbl. of bslt. throughout. inclined beds ~50% grading. 2.5Y 6/3 lt. brnish gry. no rxn HCl.	177.3-182.3: Core 29: B324T5 Drilled 2.25.16
180.0				179.0: 1" thick bed of Sand (w/ trc. g.) (95%S, trc. g) 90% Qtz. flds./10% mafic. m.-c. ang. S. w/ f. pbl. of bslt. 2.5Y 6/3 lt. ylwsh. brn. no rxn HCl. ~50% inclined.	
				179.1: 1" thick sandy gravel bed. ~50% inclined of c.-v.c. ang. S. of 80% Qtz. flds., 20% mafic, + 90% bslt., 10% meta. 2.5Y 3/1 v. dark gray. no rxn HCl. (75%g, 25%S, 0%m) w/ v.f.-f. ang.-subang. pbl. of	
182.5				~~177.3-182.3: Gravelly Sand (gS) (90%S, 10%g, 0%m) mod. srtd. c. v.c. ang. S. of 85% Qtz. flds, 15% mafic w/ spts. v.w. rndd. sm. cbl. of meta. 2.5Y 6/3 lt. ylwsh. brn. no rxn HCl.~~	
				182.3-187.3: Gravelly Sand (gS) (85%S, 15%g, 0%M) mod-poorly sorted Sand: 80% Qtz felsic, 20% mafic m-vc, sang-ang. Gravel: 50% felsic, 50% Mafic, vf peb - vc peb, SR-SA; 2.5Y 5/1 gray; dry; no rxn w/HCl	183.3-185.3: Core 30 B324T6 Driller 2.25.16
185.0		100% rec.		- f-c sand 183.3'-183.4' / 184.3'-184.8': vc peb - sm cobbles	
				185.6-185.9': coarse - vc pebbles, dec. sand content	

Reported By: A. Lanton / Jen Russell — Reviewed By: Tessa Clark

Title: Geo. Tech. / Geologist — Title: Geologist

Signature: Aaron Lanton / Jen Russell — Date: 5-18-16 / 6-2-16 — Signature: [signature] — Date: 6/7/16

A-6003-642 (03/03)

BOREHOLE LOG

Date: 5-18-16

Well ID: C8706	Well Name: NA	Location: 216-B-46 crib
Project: 200-DV-1		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
182.5				182.3-187.3: Gravelly Sand/gS (85%S, 15%G, 0%M) Mod-poorly sorted; Sand: 80% felsic, 20% Mafic, m-vc, SA-A; Gravel: 50% felsic, 50% Mafic, vfpeb-vc.peb; SR-SA; 2.5Y5/1 Gray; dry; no rxn w/HCL	Sonic w/4"x5' core.
		move down AK 5-18-16			
187.0				187.3'-189.0': Sand (S) (100%S) mod.srtd. massive bedding. c.-v.c. ang. S. of 85-90% Qtz. flds/15-10% mafic. trc. f.pbl. of bslt. 2.5Y 6/3 H.ylwsh.brn, moist. no rxn HCl.	187.3-192.3': Core 31: B324T7
189.0				189.0'-?: Sandy Gravel (sG) (70%G, 25%S, 5-10%m) v.pr.srtd. f.pbl.-sm.cbl. (max 130mm) of 80% bslt./20% meta. >int.volc. w/ v.f.-v.c. subang. S. of 60% Qtz.flds./40% mafic. w/ low plastic silt colored 5Y4/2 olive gray. v.high dilatency.	
190.0		5-4/5 #31 no recovery	no AK 5-18-16		
192.5		32 #(optional) 1		192.3'-194.8': gravelly Sand (gS) (75-80%S, 25-20%G, 0%m) v.pr.srtd. f.-v.c. ang. S. of 60% Qtz.flds./40% mafic w/ c.pbl.-v.c.pbl. (max 64mm) of 60% meta./40% bslt. (v.w.rndd.) 2.5Y 5/2 grysh brn. wk. rxn HCl. moist. wk. weathered. slight imbrication. clasts v.w.rndd. discoidal.	192.3-197.3: Core option 1 B324T8 Drilled 2-25-16
195.0				↓ Coarsening. 194.8-196.3': Sandy Gravel (sG) (60-75%G, 40-25%S, trc. m) v.pr.srtd. ↓ coarsening. m.-v.c. sub-ang.-ang. S. of 60% Qtz.flds, 40% mafic w/ m.pbl.-sm.cbl. v.w.rndd. of 60% bslt. >And.>int.volc./40% meta.>felsic volc.>felsic granit. discoidal to equant, no imbrication. 2.5Y 4/2 drk grysh brn. wk. rxn HCl.	
197.5				sprs. Carbonate rinds on clasts. v. wk. Fe weathering. 196.3-197.3': Sandy Gravel (sG) (75%G, 20%S, 5%m) mod.-pr.srtd. w.rndd. v.f.-v.c.pb. of 90% int. volc. lapilli tuff./10% meta. almost clast supported. w/ v.f.-v.c. ang. S. of 50% mafic/50% felsic. slightly plastic. 5Y 5/2 olive gray. wk. rxn HCl. silt content increasing down hole.	
200.0		100% rec.		197.3-201.3: Sandy Gravel (sG) (75%G, 20%S, 5%m) PG, R-SR, 50% Mafic, 50% felsic, vf pebbles - 10cm cobbles; Sand: m-vc, SA, 70% felsic, 30% Mafic; dry, no rxn w/HCL, 10YR 5/6 yellowish brn.	Gravel: 198.3-201.3': Core (Optional) 2 B324T9

Reported By: A. Lantau / Jen Russell	Reviewed By: Tessa Clark
Title: Geo. Tech. Geologist	Title: Geologist
Signature: A. Lantau / Jen Russell Date: 5-18-16	Signature: Date: 6/7/16

6-2-16

BOREHOLE LOG

Page 14 of 14
Date: 6·1·16

Well ID: C8706 | Well Name: NA | Location: 216-B-46 crib

Project: 200-DV-1 | 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
202.5		100% rec.		197.3-202.3: Sandy Gravel (SG): (75% G, 20% S, 5% M)	Sonic w/ 4"x5' core
				Gravel: 50% Felsic, 50% Mafic, vf peb-10cm cobbles; R-SR	
				Sand: m-vc, SA, 70% Qtz feldspar, 30% Mafics;	
				dry, non w/ HCL, 10YR 5/4 yellowish brn,	198.3'-201.3': Optional
				Poorly sorted	Core 2 B324T9
				- Gravel size increasing w/depth	

NOT USED
UR 6/2/16

Reported By: Jen Russell | Reviewed By: Tessa Clark

Title: Geologist | Title: Geologist

Signature: Jenny Russell | Date: 6/2/16 | Signature: [illegible] | Date: 6/7/16

A-6003-642 (03/03)

Core 1: 45.5-47.0

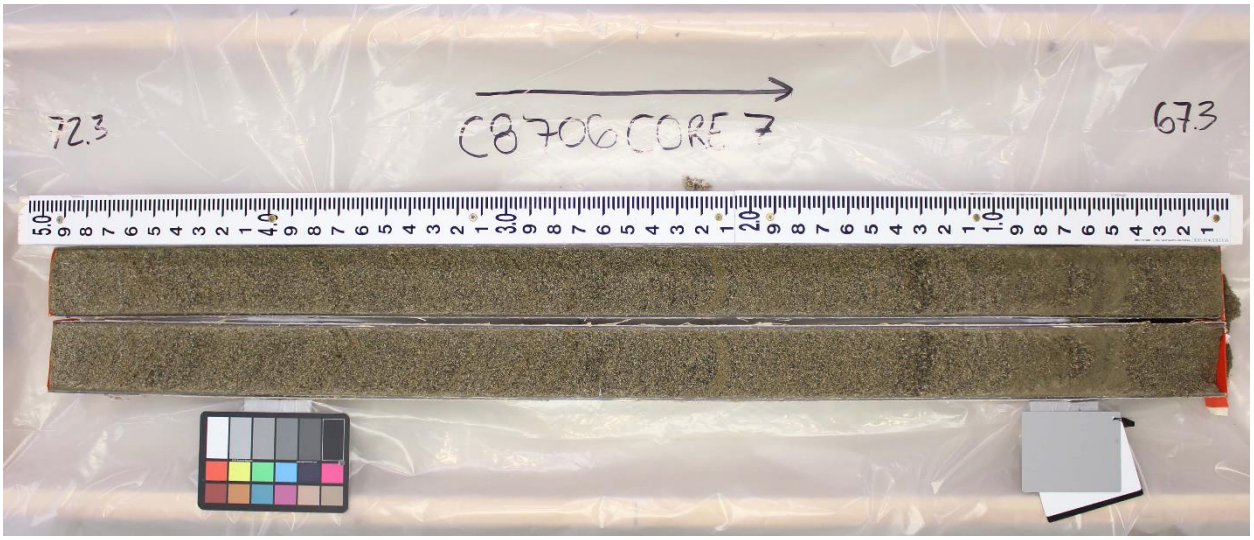
Core 2: 47.0-49.5

Core 3: 49.5-52.0

Core 4: 52.2-57.2

Core 5: 57.2-62.2

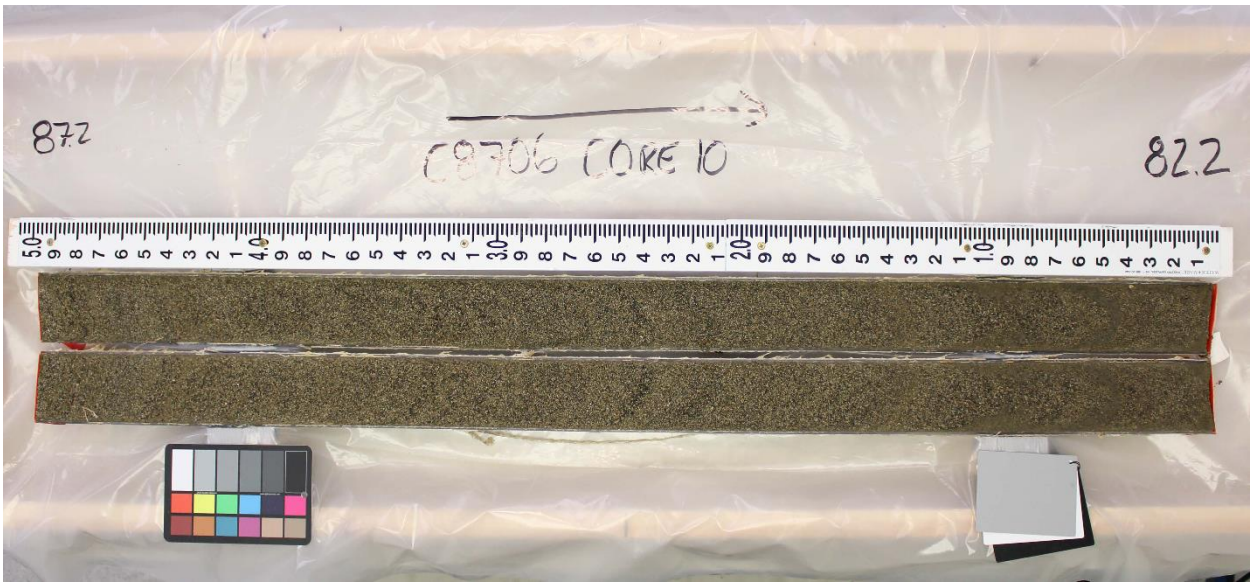
Core 6: 62.2-67.2



Core 7: 67.3-72.3

Core 8: 72.1-77.1

Core 9: 77.0-82.0



Core 10: 82.2-87.2

Core 11: 87.3-92.2

Core 12: 92.2-97.2

Core 13: 97.1-102.1

Core 14: 102.1-107.1

Core 15: 107.2-112.2

Core 16: 112.1-117.1

Core 17: 117.2-122.1

Core 18: 122.5-127.5

Core 19: 127.0-132.0

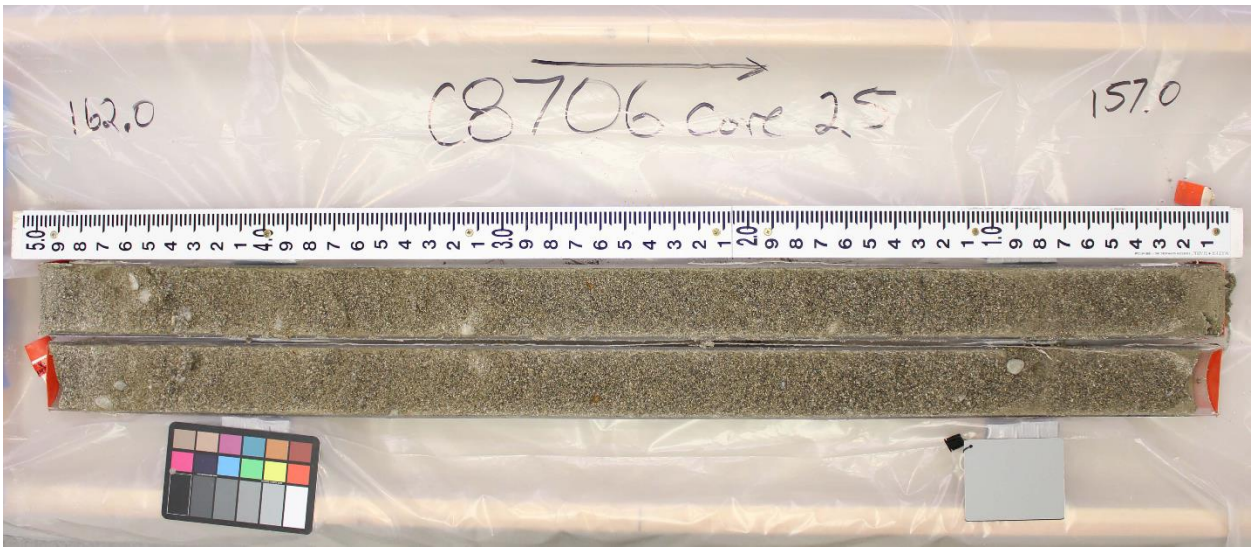
Core 20: 132.4-137.4

Core 21: 137.0-142.2

Core 22: 142.3-147.3

Core 23: 147.1-152.1

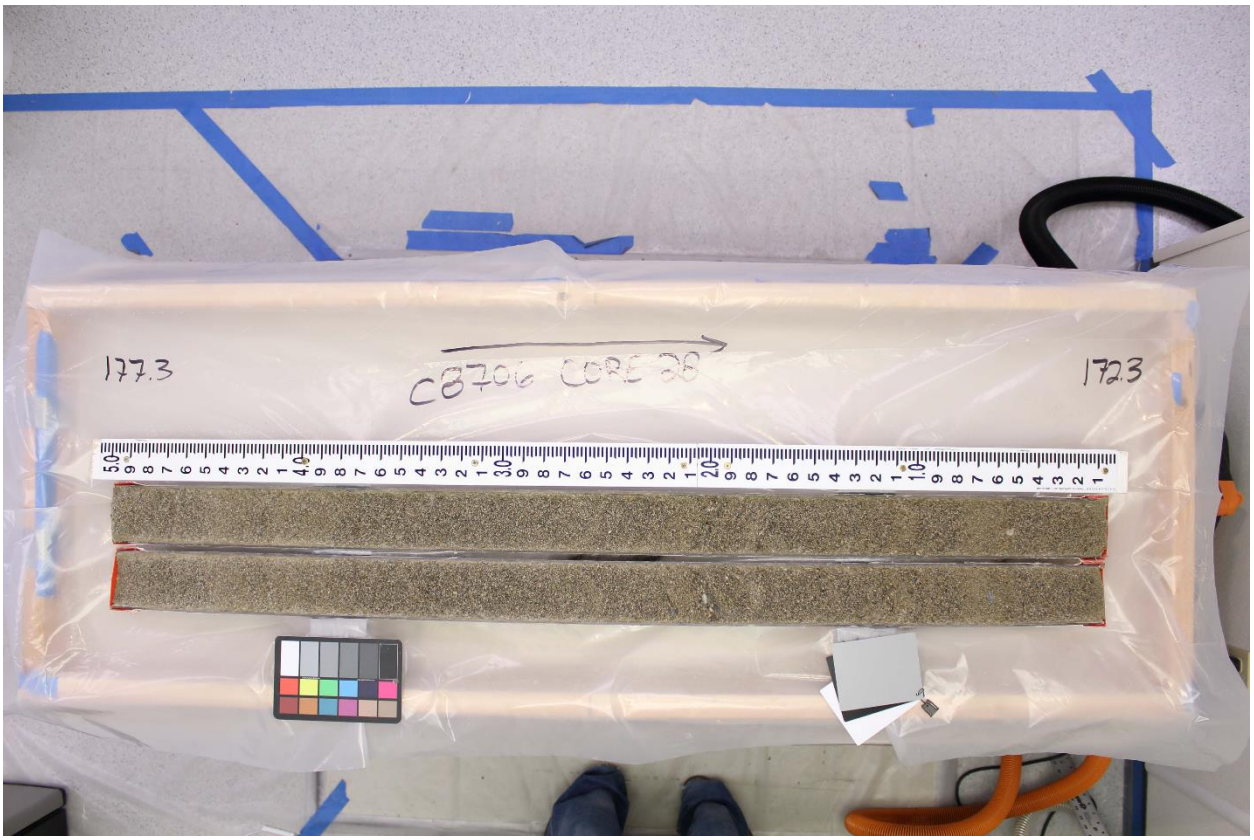
Core 24: 152.1-157.1



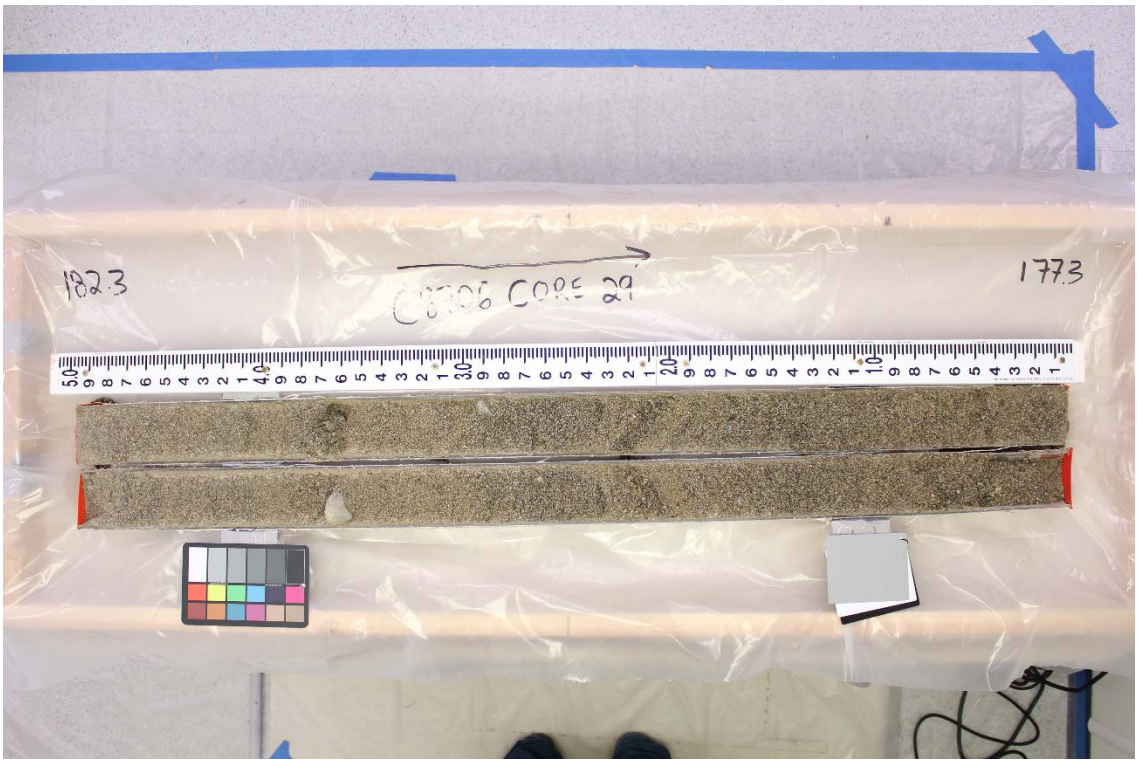
Core 25: 157.0-162.0

Core 26: 162.1-167.1

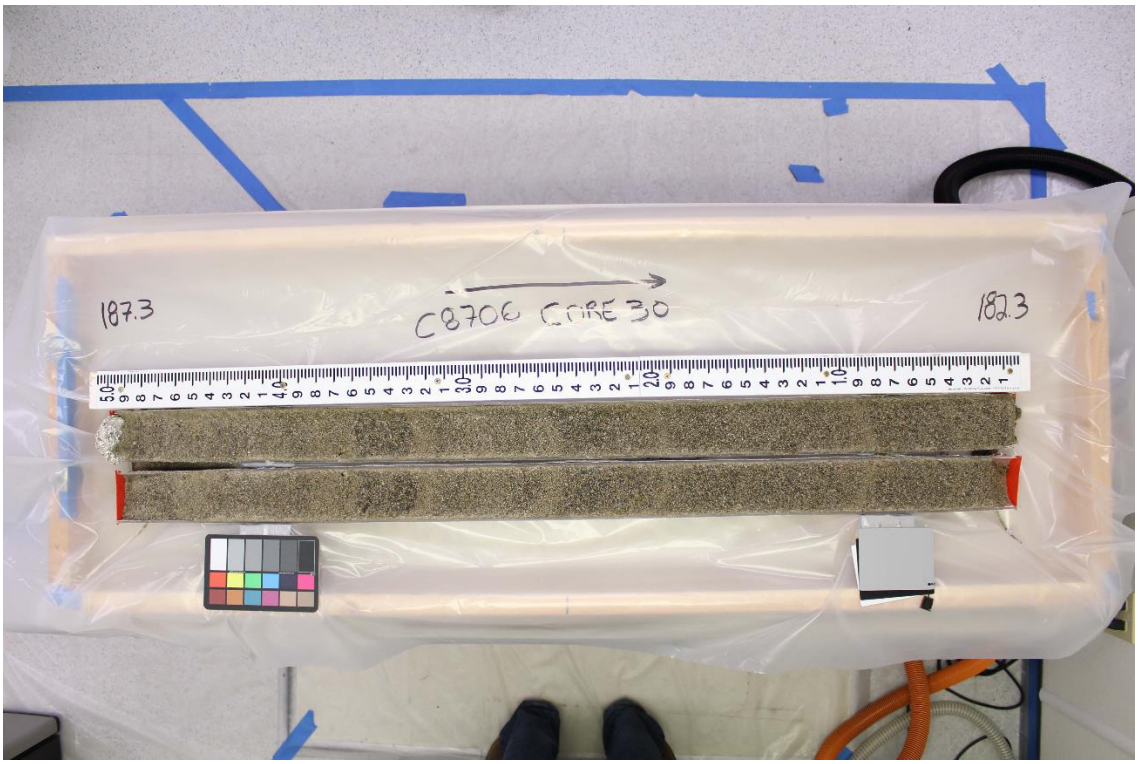
Core 27: 167.1-172.1



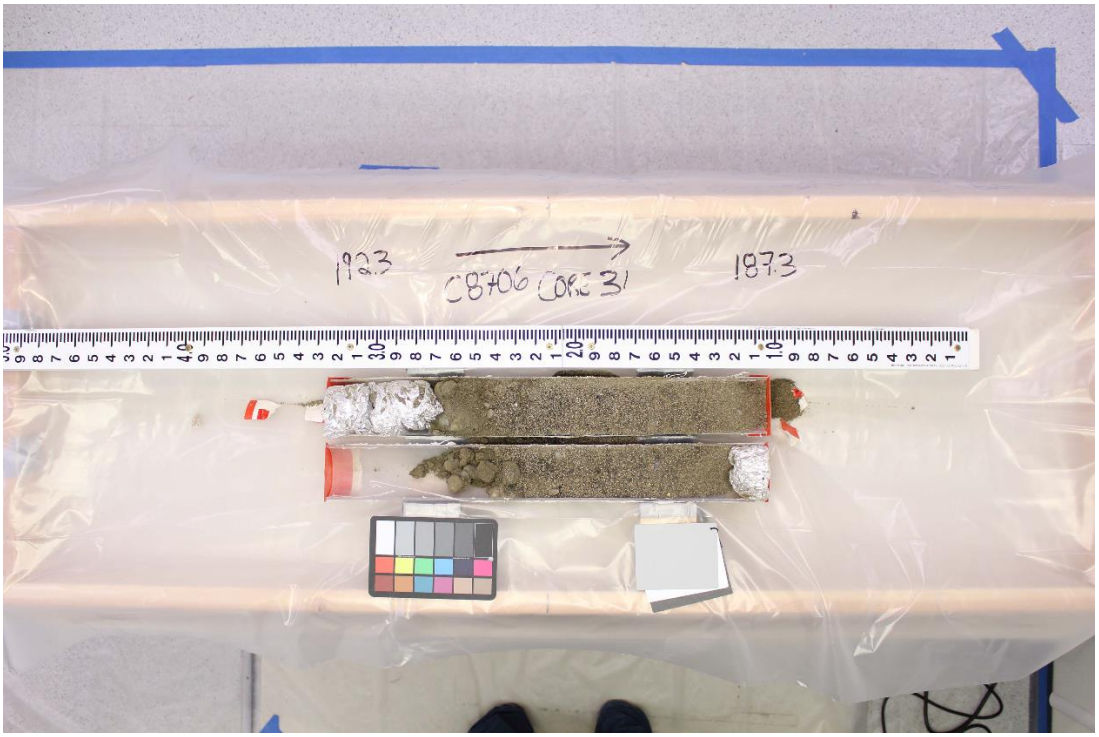
Core 28: 172.3-177.3



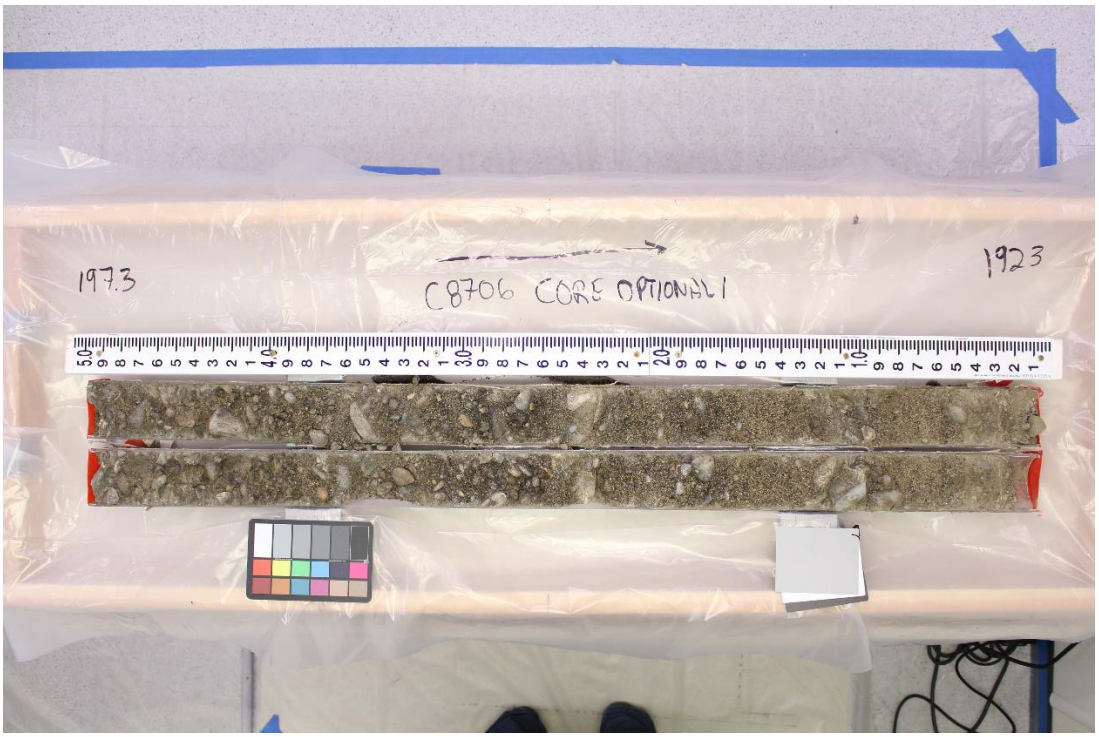
Core 29: 177.3-182.3



Core 30: 182.3-187.3



Core 31: 187.3-192.3



Core 32-Optional 1: 192.3-197.3

Core-Optional 2: 197.3-202.3