1239268

Attachment 7

BHI-01607
Rev. 0

[00760544]

Borehole Summary Report for Boreholes C3103 and C3104, and Drive Casings C3340, C3341, C3342, C3343, and C3344, in the 216-B-38 Trench and 216-B-7A Crib, 200-TW-2 Tank Waste Group Operable Unit

RECEIVED
JUL 07 2016
EDMC

Prepared for the U.S. Department of Energy, Richland Operations Office
Office of Environmental Restoration

Submitted by: Bechtel Hanford, Inc.

213

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy. Available in paper copy and microfiche.

Available for a processing fee to U.S. Department of Energy and its contractors from:
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
(865) 576-8401
fax: (865) 576-5728
email: reports@adonis.osti.gov
online ordering: http://www.doe.gov/bridge

Available for sale to the public, in paper, from:
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(800) 553-6847
fax: (703) 605.6900
email: orders@ntis.fedworld.gov
online ordering: http://www.ntis.gov/ordering.htm

Printed in the United States of America

DISCLM-5.CHP (11/99)

BHI-01607
Rev. 0
OU: 200-TW-2
TSD: N/A
ERA: N/A

APPROVAL PAGE

Title: Borehole Summary Report for Boreholes C3103 and C3104, and Drive Casings C3340, C3341, C3342, C3343, and C3344, in the 216-B-38 Trench and 216-B-7A Crib, 200-TW-2 Tank Waste Group Operable Unit

Approval: L. R. Curry, Groundwater/Vadose Zone Integration Project Engineer

L. R. Curry 4/30/02
Signature Date

B. H. Ford, Groundwater/Vadose Zone Integration Project, 200 Area Assessment Task Lead

4/30/02
Signature Date

L. M. Dittmer, Groundwater/Vadose Zone Integration Project Environmental Lead

Lorna M. Dittmer 4/30/02
Signature Date

BHI-DIS Dmc 4/30/2002

The approval signatures on this page indicate that this document has been authorized for information release to the public through appropriate channels. No other forms or signatures are required to document this information release.

BHI-01607
Rev. 0

Borehole Summary Report for Boreholes C3103 and C3104, and Drive Casings C3340, C3341, C3342, C3343, and C3344, in the 216-B-38 Trench and 216-B-7A Crib, 200-TW-2 Tank Waste Group Operable Unit

Authors

M. E. Todd
C. Trice
CH2MHILL Hanford, Inc.

Date Published

April 2002

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

1.1 BACKGROUND 1-2

2.0 FIELD ACTIVITIES AND SAMPLING 2-1

2.1 DRIVE CASING INSTALLATIONS AND DECOMMISSIONING 2-1

2.2 BOREHOLE DRILLING AND DECOMMISSIONING 2-2

2.2.1 216-B-38 Trench 2-2
2.2.2 216-B-7A Crib 2-2

2.3 SAMPLING AND ANALYSIS 2-3

2.3.1 Field Screening and Measurements 2-4
2.3.2 Borehole Soil Sampling and Analysis 2-4
2.3.3 Air Monitoring/Sampling 2-5
2.3.4 Integration Sampling 2-5

2.4 BOREHOLE GEOLOGICAL LOGGING 2-5

2.5 DRIVE CASING GEOPHYSICAL LOGGING 2-5

2.6 BOREHOLE GEOPHYSICAL LOGGING 2-5

2.7 OTHER ACTIVITIES 2-6

3.0 RESULTS 3-1

3.1 GEOLOGY 3-1

3.1.1 216-B-38 Trench 3-1
3.1.2 216-B-7A Crib 3-1

3.2 FIELD SCREENING RESULTS 3-2

3.3 GEOPHYSICAL LOGGING RESULTS 3-2

3.3.1 216-B-38 Drive Casings 3-2
3.3.2 216-B-38 Borehole 3-3
3.3.3 216-B-7A Borehole 3-4

3.4 BULK DENSITY RESULTS 3-4

3.5 CONCLUSIONS 3-4

4.0 REFERENCES 4-5

APPENDICES

A. BOREHOLE GEOLOGIC LOGS ..... A-i

B. BOREHOLE GEOPHYSICAL LOGGING REPORTS ..... B-i

C. SURFACE GEOPHYSICAL SURVEY REPORT – GROUND PENETRATING RADAR ..... C-i

FIGURES

1-1. Location Map of the 216-B-38 Trench and the 216-B-7A Crib 1-4
2-1. Typical As-Built Drawing of the 216-B-38 Trench Drive Casings (C3340 to C3344) 2-7
2-2. Location of 216-B-38 Trench Drive Casings and Borehole 2-8
2-3. As-Built Drawing of the 216-B-38 Trench Borehole (C3104) 2-9
2-4. Location Map of the 216-B-7A Crib Borehole (C3103) 2-10
2-5. As-Built Drawing of the 216-B-7A Crib Borehole (C3103) 2-11
3-1. 216-B-38 Crib Stratigraphy, Sample Locations, Radiological Field Screening Data, and Geophysical Logging Results 3-5
3-2. 216-B-7A Crib Stratigraphy, Sample Locations, Radiological Field Screening Data, and Geophysical Logging Results 3-5

TABLES

2-1. Summary of Drilling Activities 2-12
2-2. Summary of Investigation-Derived Waste Generated During the 200-TW-2 Remedial Investigation 2-12
2-3. Soil Samples at Borehole C3104 (216-B-38 Trench) 2-15
2-4. Soil Samples at Borehole C3103 (216-B-7A Crib) 2-16
2-5. Summary of Integration Samples 2-17
3-1. Field-Screening Data 3-5

ACRONYMS

bgs	below ground surface
ERC	Environmental Restoration Contractor
HEPA	high-efficiency particulate air (filter)
OD	outside diameter
OU	operable unit
RI/FS	remedial investigation/feasibility study
SST	single-shell tank

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerels	0.027	picocuries

1.0 INTRODUCTION

This report summarizes the characterization activities performed to collect soil samples, to better define stratigraphy, to assess physical properties, and to assess the nature and vertical extent of contamination at the 216-B-38 Trench and the 216-B-7A Crib as part of the remedial investigation (RI) for the 200-TW-2 Tank Waste Group Operable Unit (OU). Characterization was performed in accordance with the *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan* (DOE-RL 2001). The work plan provides the details for characterizing the vertical extent of chemical and radiological contamination as well as physical conditions beneath the waste sites. Data collection activities and results presented in this report will be used as supporting information to the RI report.

The locations of the 216-B-38 Trench and the 216-B-7A Crib are shown in Figure 1-1. Other documents prepared to support field activities include the following:

- *Preliminary Hazard Classification for Sampling and Characterization Activities to be Conducted at the 216-B-7A Crib, the 216-T-26 Crib, and the 216-B-38 Trench* (BHI 2001e)
- *216-B-7A Crib, 216-T-26 Crib, and 216-B-38 Trench Criticality Evaluation*, 0200X-CE-N0002 (BHI 2001b)
- *216-B-7A Crib Criticality Evaluation*, 0200X-CE-N0002 (BHI 2001c)
- *Site Specific Health and Safety Plan; 200-TW-1 & TW-2 Site Characterization*, 0200X-SSHS-G0003 (BHI 2001i)
- *Radiological Work Permit*, GW-136 (BHI 2001f)
- *Radiological Work Permit*, GW-138 (BHI 2001g)
- *Environmental Program ALARACT Demonstration for Drilling* (WDOH 2001)
- *200-TW-2 Tank Waste Group Operable Unit Facility Investigation/Corrective Measures Study Waste Control Plan* (BHI 2001a)
- *Remedial Investigation Data Quality Objectives Summary Report for the 200-TW-1 Scavenged Waste Group and 200-TW-2 Tank Waste Group Operable Units* (BHI 2000).
- *Data Quality Objectives Summary Report for 200-TW-1 and 200-TW-2 Waste Designation* (BHI 2001d)
- *Results of the Geophysical Investigations at the 216-T-26 Crib, 216-B-7A Crib, and the 216-B-38 Trench and Associated Burial Ground* (BHI 2001h).

To promote efficient use of resources during the remedial investigation, the Environmental Restoration Contractor (ERC) 200 Area Remedial Action Project teamed with other ERC projects and other Hanford Site contractors to obtain samples in support of several activities. Integration was achieved by identifying vadose zone and groundwater needs in a common work document and conducting the field investigation as a coordinated effort between the core projects of the Groundwater/Vadose Zone Integration Project. The details of the integration effort are specified in Appendix A of the 200-TW-1 and 200-TW-2 RI/ FS work plan (DOE-RL 2001), and are summarized in this document.

1.1 BACKGROUND

The 200-TW-2 waste sites received tank waste from first- and second-cycle decontamination processes associated with the bismuth-phosphate process at the B and T Plants. These tank wastes contained inorganic anions and cations as well as low levels of radionuclides (DOE-RL 2001).

The 216-B-38 Trench is an inactive waste site located north of B Plant and west of the 241-BX Tank Farm. The trench, active only in July 1954, received 1,430,000 L (380,000 gal) of high-salt, neutral/basic first-cycle supernatant waste from the 221-B Building via tanks 241-B-110, 241-B-111, and 241-B-112 (Maxfield 1979). The 216-B-38 Trench is 77 m (250 ft) long, 3 m (10 ft) wide, and 3 m (10 ft) deep (Maxfield 1979) and was deactivated by removing the above-ground piping when specific retention was reached (Maxfield 1979). Compounds in the liquid disposed to this site include fluoride, nitrate, nitrite, phosphate, sodium aluminate, sodium hydroxide, sodium silicate, and sulfate-based compounds from the bismuth/phosphate campaign. Radionuclides contained in the waste stream at the time of discharge included 510 Ci of cesium-137, 1,900 Ci of strontium-90, 560 Ci of ruthenium-106, 1.2 g of plutonium, and 42 kg of uranium (Maxfield 1979). In October 1982, the trench was surface stabilized with 0.6 m (2 ft) of clean topsoil and treated with an herbicide.

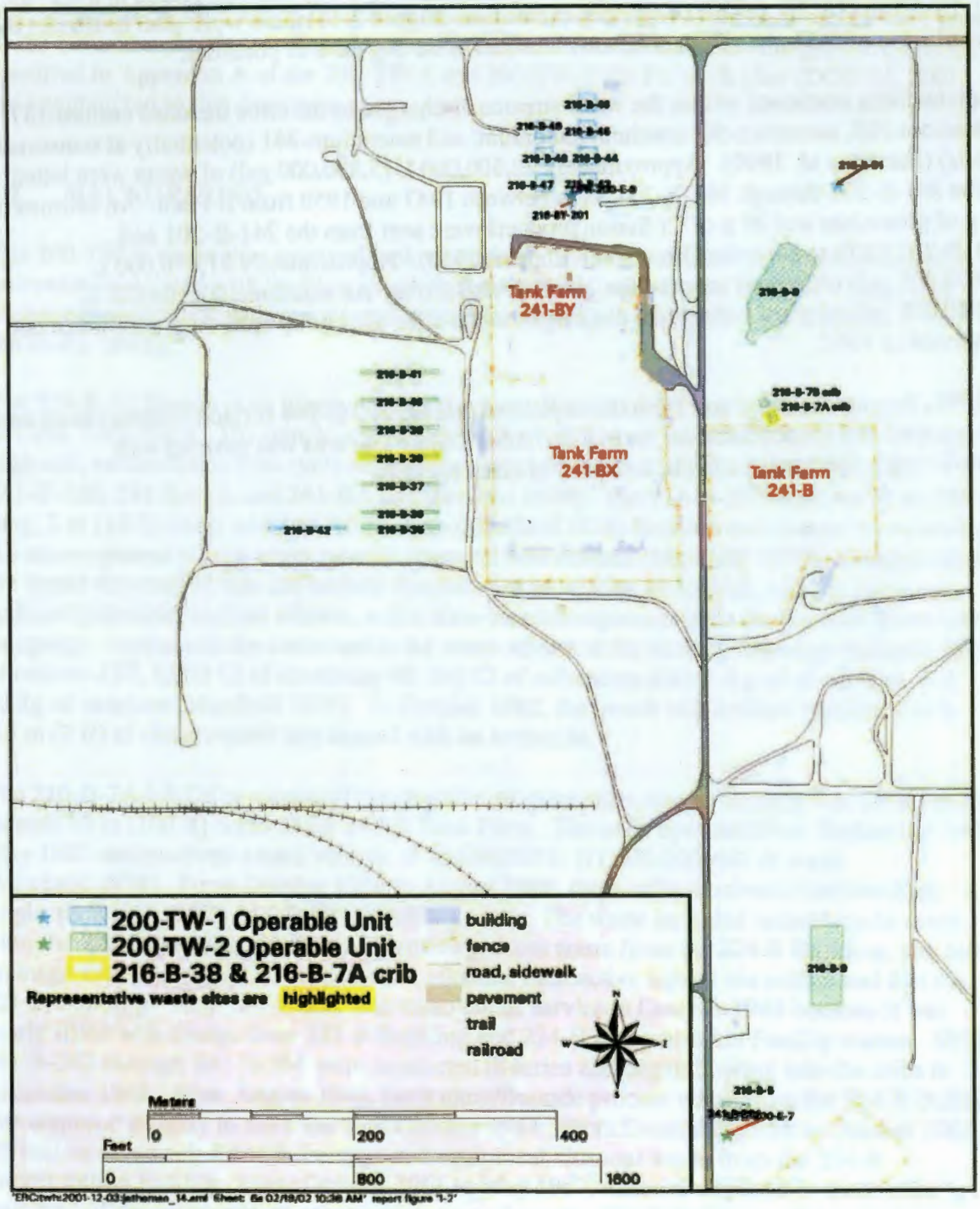
The 216-B-7A&B Cribs consist of two inactive wooden cribs, approximately 6 m (20 ft) apart, located 30 m (100 ft) north of the 241-B Tank Farm. The cribs operated from September 1946 to May 1967 and received a total volume of 43,600,000 L (11,500,000 gal) of waste (Maxfield 1979). From October 1946 to August 1948, these cribs received overflow from single-shell tank (SST) 241-B-201 (a settling tank). The waste included second-cycle waste from the 221-B Building, lanthanum/fluoride process waste from the 224-B Building, and cell drainage and other liquid waste (low salt, alkaline, radioactive liquid) via cells 5 and 6 in the 221-B Building. Tank 241-B-201 was taken out of service in October 1948 because it was nearly filled with sludge from 221-B Building and 224-B Concentration Facility wastes. SSTs 241-B-202 through 241-B-204 were connected in series and began flowing into the cribs in December 1948. After August 1948, lanthanum/fluoride process waste from the 224-B Building was disposed directly to the cribs until October 1961. From December 1954 to October 1961, the unit received cell 5 and 6 drainage and equipment cleanout waste from the 224-B Concentration Facility. From October 1961 to May 1967, material disposed in these cribs consisted of decontamination construction waste from the 221-B Building. The cribs became inactive in 1967 (Brown and Ruppert 1950, WHC 1991).

The 216-B-7A&B Cribs are in line with an 8-cm (3-in.) steel inlet pipe that supplied waste to both cribs simultaneously. Each crib is a 4- by 4- by 1.2-m (12- by 12- by 4-ft) hollow (i.e., not gravel-filled) wooden structure made of 15- by 15-cm (6- by 6-in.) timbers, placed in a 4.2- by 4.2- by 4.2-m (14- by 14- by 14-ft) deep excavation. Figure 2-16 of the work plan illustrates the construction of the cribs. Both cribs are classified as having cave-in potential.

Radionuclides contained within the waste streams discharged to the cribs included cesium-137, ruthenium-106, strontium-90, uranium, plutonium, and americium-241 (potentially at transuranic levels) (Brown et al. 1990). Approximately 22,300,000 L (5,890,000 gal) of waste were jetted to the 241-B-201 through 241-B-204 SSTs between 1947 and 1950 from B Plant. An estimated 10 g of plutonium and 20 g of Ci fission products were sent from the 241-B-201 and 241-B-202 SSTs to the cribs (Brown and Ruppert 1950). Approximately 21,470,000 L (5,670,000 gal) ultimately reached the 216-B-7A&B Cribs. An additional 22,100,000 L (5,800,000 gal) of wastewater were discharged to the cribs after 1950 until they were taken out of service in 1967.

In 1992, the contaminated soil from the unplanned release 200-E-144 surface contamination area was scraped and consolidated on the 216-B-7A&B Cribs. The area was covered with approximately 0.45 to 0.61 m (18 to 24 in.) of clean backfill.

Figure 1-1. Location Map of the 216-B-38 Trench and the 216-B-7A Crib.



2.0 FIELD ACTIVITIES AND SAMPLING

This section describes characterization activities performed as part of the 200-TW-2 RI as defined in the 200-TW-1 and 200-TW-2 RI/FS work plan (DOE-RL 2001). The primary objective of the field effort was to characterize the nature and vertical extent of contamination in the vadose zone underlying the 216-B-7A Crib and the 216-B-38 Trench. Drilling, surface and borehole geophysical surveys, and sampling and analysis of soil samples were conducted during the RI. Five drive casing holes were installed at the 216-B-38 Trench and logged. Two vadose boreholes were drilled (one at each waste site); sampled for nonradiological, radiological, and physical property analyses during the field investigation; and geophysically logged. Field activities commenced June 29, 2001, with the installation of drive casings for geophysical logging at the 216-B-38 Trench. All field activities described in this report were completed by October 2, 2001. Field activities (e.g., drilling, sampling, decontamination) were performed in accordance with BHI-EE-01, *Environmental Investigations Procedures*, unless otherwise stated.

2.1 DRIVE CASING INSTALLATIONS AND DECOMMISSIONING

Five drive casing holes (C3340 through C3344) were installed in the 216-B-38 Trench and logged with a spectral gamma tool to identify the area of highest radiological contamination. The casing were also logged with a neutron-neutron tool to identify areas of high moisture. This information was used to optimize the placement of the borehole in the area of highest contamination. Operations commenced June 29, 2001 with the installation of the drive casings, and were completed August 31, 2001 after the final drive casing was decommissioned. Drive casing installation and decommissioning activities were performed in accordance with *Washington Administrative Code* 173-160.

The five drive casing holes were installed using a diesel hammer drill rig. The 6.625-in. (16.8-cm) outside-diameter (OD) casing was driven to total depth of 60 ft (18.3 m) at each location. The casing was equipped with a specially-constructed drive tip fabricated for this project. The tip was disconnected prior to pulling the casing from the drive casing hole. No drill cuttings were generated. This method allowed the installation of a hole for logging purposes without worker exposure and waste management issues associated with normal drilling where drill cuttings are brought to the surface. Drive casing geophysical logging is described in Section 2.5. No water was added to any of the holes to facilitate the driving of the casing.

The drive casing holes were backfilled with bentonite and cement after total depth was reached. As casing was removed from each borehole, granular bentonite pellets were placed from approximately 3 to 60 ft (0.91 to 18.3 m) below ground surface (bgs). A cement seal was placed from a depth of approximately 2 to 3 ft (0.61 to 0.91 m). A gravel drill pad extends from approximately 2 ft (0.61 m) to the surface. A cement cap with a brass marker showing the well name and decommissioning date marks the location of each of these drive casing holes. A typical as-built drawing of the drive casing holes is shown in Figure 2-1. Drilling information is summarized in Table 2-1.

2.2 BOREHOLE DRILLING AND DECOMMISSIONING

2.2.1 216-B-38 Trench

One vadose borehole (C3104) was drilled through the 216-B-38 Trench to a total depth of 263.5 ft (80.3 m) bgs (Figure 2-2). Operations commenced on July 31, 2001 with the initiation of drilling and were completed on September 12, 2001 after the boring was decommissioned. Drilling operations were conducted at night to minimize heat-associated stress to workers. Soil sampling and borehole geophysical logging associated with drilling are described in Sections 2.3 and 2.6, respectively.

Borehole C3104 was drilled using the cable tool method. Drive barrel and split-spoon sampling were used to advance the borehole to total depth. No water was added to the borehole during drilling activities. Temporary threaded carbon steel casings were used to assist in the drilling process. The casings were used to minimize downhole cross contamination, to keep the hole open, and to ream the borehole to a larger size. Temporary telescoping casings were set at depths of 58 ft (17.7 m), 111 ft (33.8 m), and 259.6 ft (79.1 m) bgs. The temporary casings were removed from the borehole during decommissioning. The outside diameter of the three casing strings and size of the borehole were 11.75 in. (29.8 cm), 8.625 in. (21.9 cm), and 6.625 in. (16.8 cm), respectively. Casing was not used in the borehole from 259.6 to 263.5 ft (79.1 to 80.3 m) bgs. In this zone, the size of the borehole (5 in. [11.2 cm]) corresponds to the size of the split-spoon sampler.

Borehole C3104 was decommissioned on September 12, 2001. As the temporary casing was removed, the borehole was filled with the following materials:

- Sand - 262.1 to 252.9 ft (79.9 to 77.1 m) bgs
- Cement - 252.9 to 236.5 ft (77.1 to 72.1 m) bgs
- Bentonite - 236.5 to 2.5 ft (72.1 to 0.76 m) bgs
- Cement - 2.5 to 2.0 ft (0.76 to 0.61 m) bgs.

A cement cap with a brass marker showing the well name and decommissioning date mark the location of this borehole. Drilling information is summarized in Table 2-1. Investigation-derived waste generated during the drilling activities is summarized in Table 2-2. An as-built of the borehole is shown in Figure 2-3.

2.2.2 216-B-7A Crib

One vadose borehole (C3103) was drilled through the 216-B-7A Crib to a total depth of 222.5 ft (67.8 m) bgs (Figure 2-4). The drilling of borehole C3103 commenced on August 21, 2001 with the initiation of drilling, and was completed on October 2, 2001 after the borehole was decommissioned. Drilling operations were conducted at night from August 21, 2001 through September 10, 2001, to minimize heat-associated stress to workers. Day shift drilling commenced on September 11, 2001, when the weather was cooler and the drilling had progressed past the zone of high contamination.

Borehole C3103 was drilled with both cable tool and diesel hammer drill rigs. The borehole was drilled to an initial depth of 56.5 ft (17.2 m) with a cable tool rig. The 6.625-in. (16.8-cm) OD casing, split-spoon samplers, and a drive barrel were used to advance the borehole to this depth. This portion of the borehole was backfilled to the surface with silica sand after reaching a depth of 56.5 ft (17.2 m) and the 6.625-in. (16.8-cm) casing was removed. The cable tool rig was moved off the borehole and replaced with a diesel hammer drill rig.

The diesel hammer (i.e., pile driver) was used to drive an outer string of 11.75-in. (29.8-cm) OD casing and an inner string of 4.5-in. (11.4-cm) OD casing with a drive point. This method was used to limit the quantity of highly contaminated soils removed from the borehole (located immediately below the crib) while allowing casing downsizing in accordance with state regulations. The crew attempted to drive the casing strings back to the initial depth of 56.5 ft (17.2 m). Attempts to reach the targeted depth were unsuccessful. The total depth reached with the drive point was 32 ft (9.7 m). At this depth, the 4.5-in. (11.4-cm) OD inner casing string and drive point were removed from the borehole.

The cable tool drill rig was then moved back on site and used to advance the borehole to a total depth of 222.5 ft (67.8 m). The drive barrel and split-spoon samplers were used to advance the borehole to total depth. No water was added to the borehole during drilling activities. Temporary threaded carbon steel casings were used to assist the drilling process. The temporary telescoping casings were set at depths of 50.7 ft (15.4 m), 130.5 ft (39.8 m), and 218.0 ft (66.5 m) bgs with the cable tool rig. The temporary casings were removed during the decommissioning of the borehole. The OD of the three casing strings and size of the borehole were 11.75 in. (29.8 cm), 8.625 in. (21.9 cm), and 6.625 in. (16.8 cm), respectively. Casing was not used in the borehole from 218 to 222.5 ft (66.5 to 67.8 m) bgs. In this zone, the size of the borehole (5 in. [11.2 cm]) corresponds to the size of the split-spoon sampler.

Borehole C3103 was decommissioned on October 2, 2001. As the temporary casing was removed, the borehole was filled with the following materials:

- Bentonite - 222.5 to 3.3 ft (76.8 to 1.0 m) bgs
- Cement - 3.3 to 2.0 ft (1.0 to 0.7 m) bgs.

A cement cap with a brass marker showing the well name and decommissioning date mark the location of this borehole. Drilling information is summarized in Table 2-1. Investigation-derived waste generated during the drilling activities is summarized in Table 2-2. An as-built drawing of the borehole is shown in Figure 2-5.

2.3 SAMPLING AND ANALYSIS

Samples were collected in accordance with the work plan and applicable procedures. Sampling activities are documented in logbooks EL-1518 and 1518-1. Samples from the upper zones of the borehole, where contamination levels were expected to be high, were collected inside a

glovebag that was placed inside a contamination-control structure. The glovebag was fitted with a high-efficiency particulate air (HEPA) vacuum unit.

2.3.1 Field Screening and Measurements

Soil samples were screened in the field prior to sample collection for indications of contamination, to assist in selecting sample points, to support worker health and safety, and for shipping documentation. Samples were screened for alpha and beta-gamma activity. Radiological screening was performed by a radiation control technician using an E-600 ratemeter with a SHP380-A/B scintillation probe and a dose meter. Radiological activity greater than two times background was used as an indication of contamination. Background was determined by measuring the activity at ground surface adjacent to the borehole. Mercury was also monitored at the wellhead, in the breathing zone, and on the cuttings and samples to support worker health and safety.

Bulk density measurements were taken in the field according to BHI-EE-05, *Field Screening Procedures*, Procedure 3.9, "Determination of Field Bulk Density Using a Split-Spoon Sampler." Results are presented in Section 3.0.

2.3.2 Borehole Soil Sampling and Analysis

Soil samples were collected from the boreholes and submitted to offsite laboratories for chemical and radiological analysis and determination of physical properties. All soil samples were collected according to BHI-EE-01, Procedure 4.0, "Soil and Sediment Sampling." Split-spoon sampling was the primary sampling method used for borehole sample collection. A total of 18 samples were collected from the 216-B-38 boring and 22 samples from the 216-B-7A boring, including quality assurance/quality control samples and physical property samples. Lionville Laboratory (formerly RECRA) of Lionville, Pennsylvania, and Eberline Services (formerly TMA) of Richmond, California, were the primary chemical and radiological laboratories, respectively. Severn Trent Laboratory of Richland, Washington, and St. Louis, Missouri, was the split laboratory. Laboratory physical property analyses were performed by Maxim Technologies of St. Louis, Missouri. A total of 22 samples were collected from the 216-B-7A Borehole at 10 ft (3 m) intervals in support of the tank farm vadose zone project. These archive samples were primarily collected from the contents of the drive barrel. These samples were relinquished to the PNNL for archive. Five samples were also collected from this borehole in the zone of highest contamination to support the Science and Technology Project.

Sample numbers, depths, and analytes are listed in Tables 2-3 and 2-4. Samples were collected according to the sample schedule identified in Appendix A of the sampling and analysis plan (DOE-RL 2001) with the following exceptions:

- Slight adjustment in sample depth in the field to account for field conditions
- The physical property sample at 216-B-38 Trench in the Hanford formation/Plio-Pleistocene unit (?). Gravel was attempted at 261 to 263.5 ft (79.6 to 80.3 m) bgs but was not collected, due to insufficient recovery in the split-spoon sampler.

A surface sample was also collected from 0 to 6 in. (0 to 15 cm) at each borehole location and analyzed for chloro-herbicides to support waste designation.

2.3.3 Air Monitoring/Sampling

Air sampling was conducted in accordance with the *Environmental Program ALARACT Demonstration for Drilling* (WDOH 2001) to verify that contamination did not migrate from the waste site. Existing near-facility stations (N967, N973, and N976) in the 200 East Area were used during the characterization activities. The Washington State Department of Health was notified and agreed to this plan prior to the initiation of the drilling activities as required for high-risk drilling sites in the ALARACT (WDOH 2001). Data from these stations will be included as part of the annual near-field environmental monitoring report.

2.3.4 Integration Sampling

Additional soil samples were collected as specified in the work plan for the Science and Technology Project to support plutonium and other contaminant studies. These samples are listed in Table 2-5. In addition, samples were collected for CH2M Hill Hanford Group, Inc. to support tank farm vadose zone studies. These samples are also identified in Table 2-5.

2.4 BOREHOLE GEOLOGICAL LOGGING

Drill cuttings were logged by a geologist to describe the subsurface soils, identify changes in lithology, support sample collection locations, and provide detailed information for correlation with geophysical logging and analytical results. A detailed description is provided in Section 3.1. The geologic log is provided in Appendix A.

2.5 DRIVE CASING GEOPHYSICAL LOGGING

Borehole geophysical logging was performed in the five drive casing holes at the 216-B-38 Trench. The logging was performed in July 2001. Spectral gamma and neutron-neutron moisture surveys were run. On drive casing holes C3340, C3341, and C3342, the high-rate logging system was used in zones with high contaminant concentrations. A detailed report of logging operations is provided in Appendix B. The report includes a summary of the calibration requirements, processing of the data, and log results.

2.6 BOREHOLE GEOPHYSICAL LOGGING

Borehole geophysical logging (spectral gamma and neutron-neutron moisture) was performed in boreholes C3103 and C3104. The logging was optimized so that data were collected only through a single casing thickness. Logging was performed during August and September. A detailed report of logging operations is provided in Appendix B.

2.7 OTHER ACTIVITIES

Surface geophysical surveys were conducted at each site prior to excavation using ground-penetrating radar. The surveys were performed to verify the location of waste sites and identify potential underground hazards prior to excavating. Several sample locations were adjusted based on the findings of these surveys. The surface geophysical survey report is presented in Appendix C.

The borehole locations were surveyed according to BHI-EE-01, Procedure 1.6, "Survey Requirements and Techniques." Coordinates were recorded using the North American Vertical Datum of 1988 (NAVD 1988) and the Washington State Plane (South Zone) North American Datum of 1983 (NAD 1983) with the 1991 adjustment for horizontal coordinates. Survey data are presented in Table 2-1.

Figure 2-1. Typical As-Built Drawing of the 216-B-38 Trench Drive Casings (C3340 to C3344).

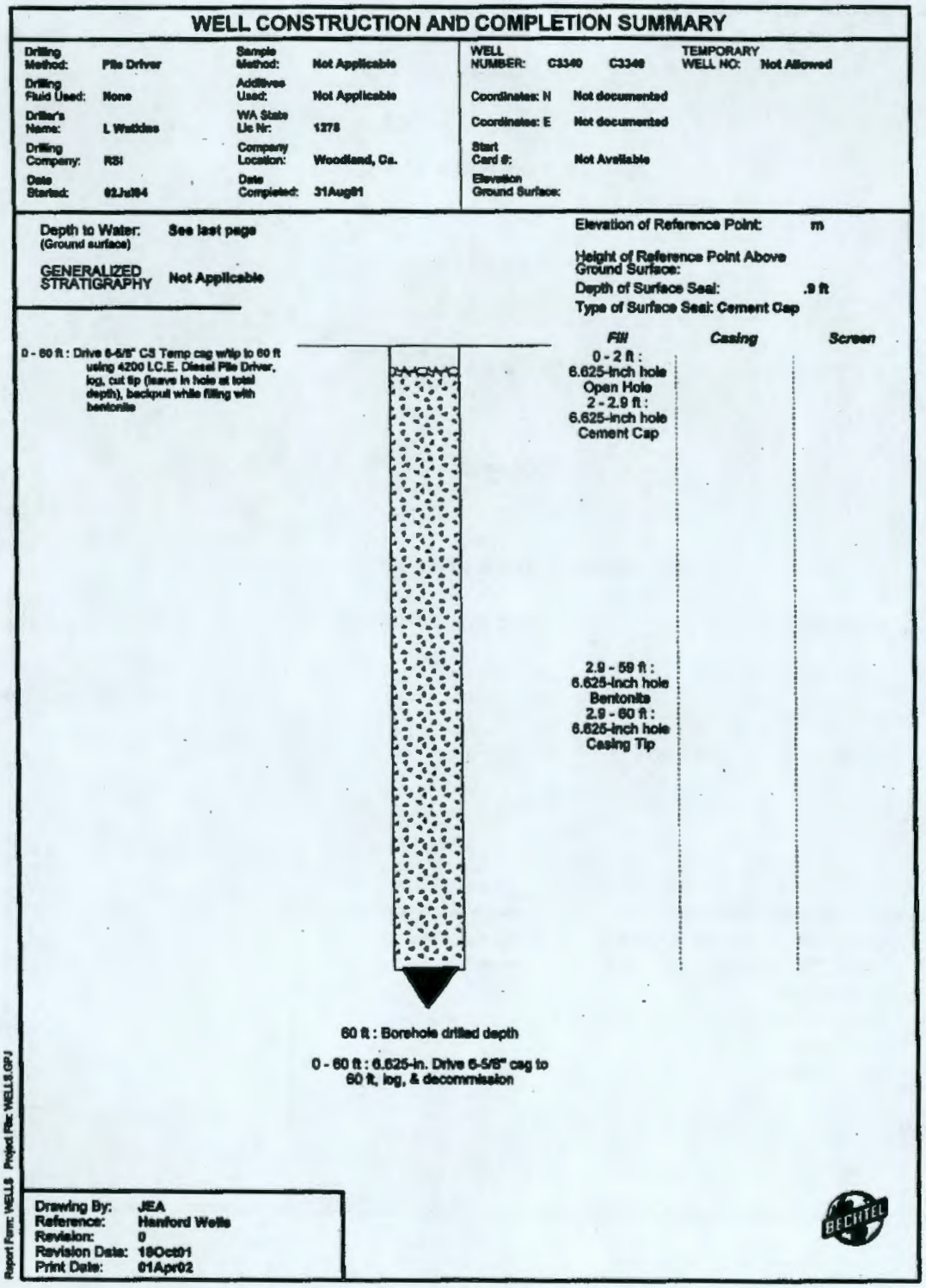


Figure 2-2. Location of 216-B-38 Trench Drive Casings and Borehole.

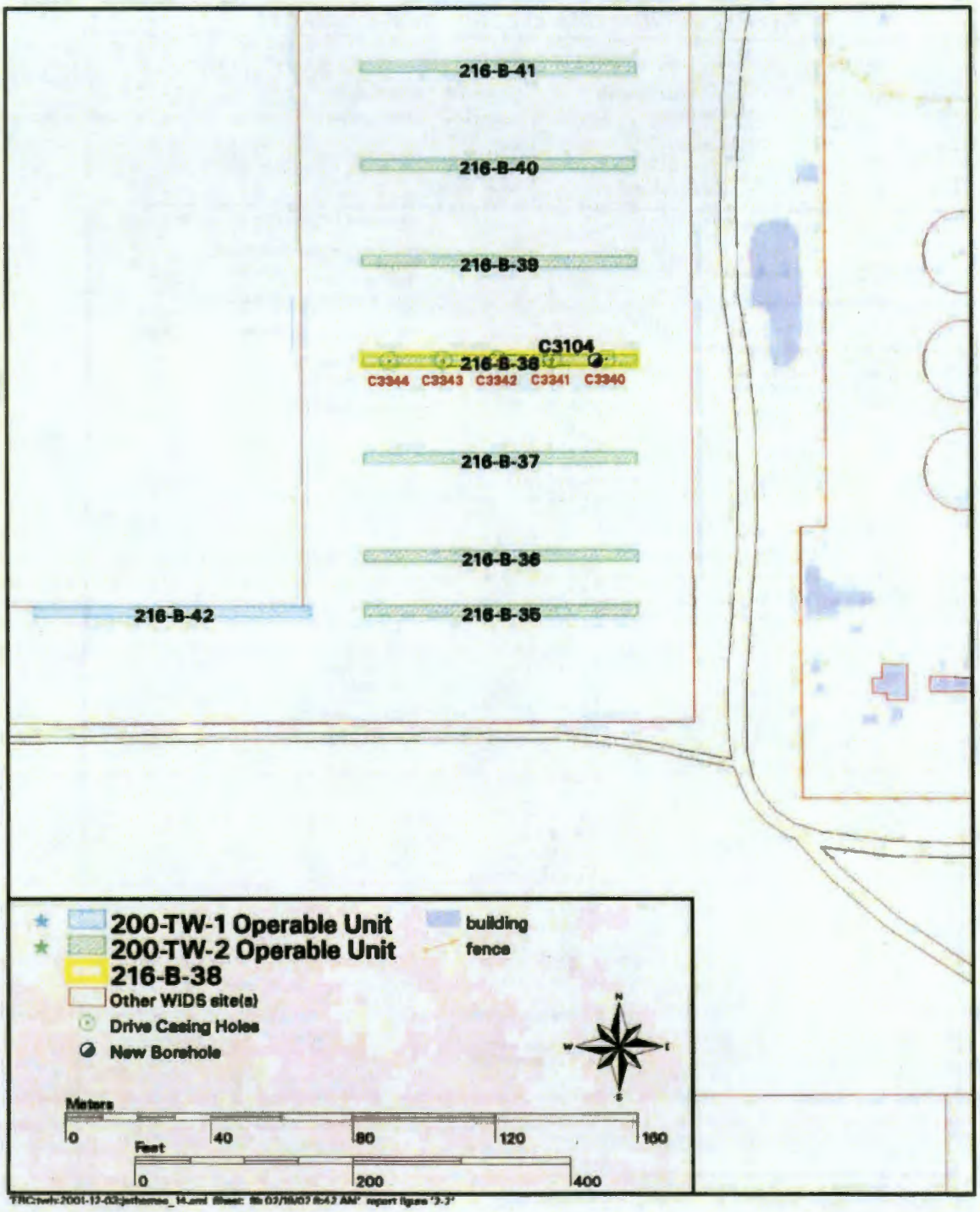


Figure 2-3. As-Built Drawing of the 216-B-38 Trench Borehole (C3104).

WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method:	Cable Tool	Sample Method:	Grab/Split Spoon	WELL NUMBER:	C3104 C3104	TEMPORARY WELL NO:	Not Allowed
Drilling Fluid Used:	None	Additives Used:	None Documented	Coordinates: N	Not documented		
Driller's Name:	Morris Wrangler	WA State Lic Nr:	1909	Coordinates: E	Not documented		
Drilling Company:	RSI	Company Location:	Woodland, Ca.	Start Card #:	Not Documented		
Date Started:	31Jul01	Date Completed:	12Sep01	Elevation Ground Surface:			

Depth to Water: 283 ft 10Aug01
(Ground surface)

GENERALIZED STRATIGRAPHY Geologist's Log

Elevation of Reference Point: m

Height of Reference Point Above Ground Surface:

Depth of Surface Seal: .5 ft

Type of Surface Seal: No Pad

0 - 1 ft : Crushed Basalt Gravel
1 - 2.5 ft : Silty Sand
2.5 - 15 ft : Gravelly Silty Sand
15 - 21.5 ft : Sandy Gravel - Silty Sandy Gravel
21.5 - 30.5 ft : Sandy Gravel
30.5 - 110.5 ft : Sand

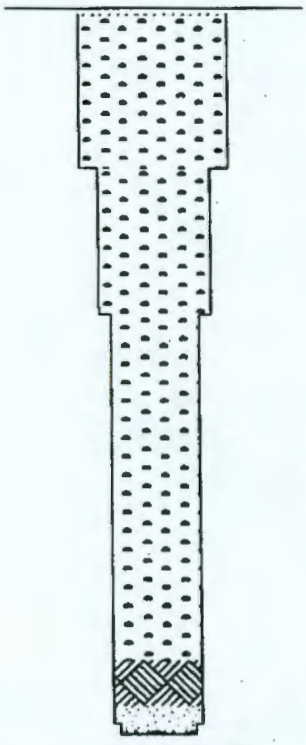
110.5 - 117 ft : Silty Sand
117 - 140 ft : Slightly Silty Sand

140 - 195 ft : Sand

195 - 217.5 ft : Slightly Silty Sand

217.5 - 218.5 ft : Silty Sand
218.5 - 229 ft : Silty Sandy Gravel
229 - 250 ft : Sandy Gravel

250 - 263.5 ft : Silty Sandy Gravel



Fill	Casing	Screen
2 - 2.5 ft : 12-inch hole Cement		
2.5 - 58 ft : 12-inch hole Bentonite		
58 - 111 ft : 9-inch hole Bentonite		
111 - 236.5 ft : 7-inch hole Bentonite		
236.5 - 252.9 ft : 7-inch hole Cement		
252.9 - 259.6 ft : 7-inch hole Silica Sand (size not documented)		
259.6 - 262.1 ft : 6-inch hole Silica Sand (size not documented)		
262.1 - 263.5 ft : 6-inch hole Slough		

263.5 ft : Borehole drilled depth

0 - 58 ft : 12-in. Cable tool 11-3/4" CS Temp csg
58 - 111 ft : 9-in. Cable Tool 8-5/8" CS Temp csg
111 - 259.6 ft : 7-in. Cable Tool 6-5/8" CS Temp csg
259.6 - 263.5 ft : 6-in. Open hole

Drawing By: JEA
Reference: Hanford Wells
Revision: 0
Revision Date: 30Oct01
Print Date: 01Apr02

Report Form: WELL8 Project File: WELL8.GPJ

Figure 2-4. Location Map of the 216-B-7A Crib Borehole (C3103).

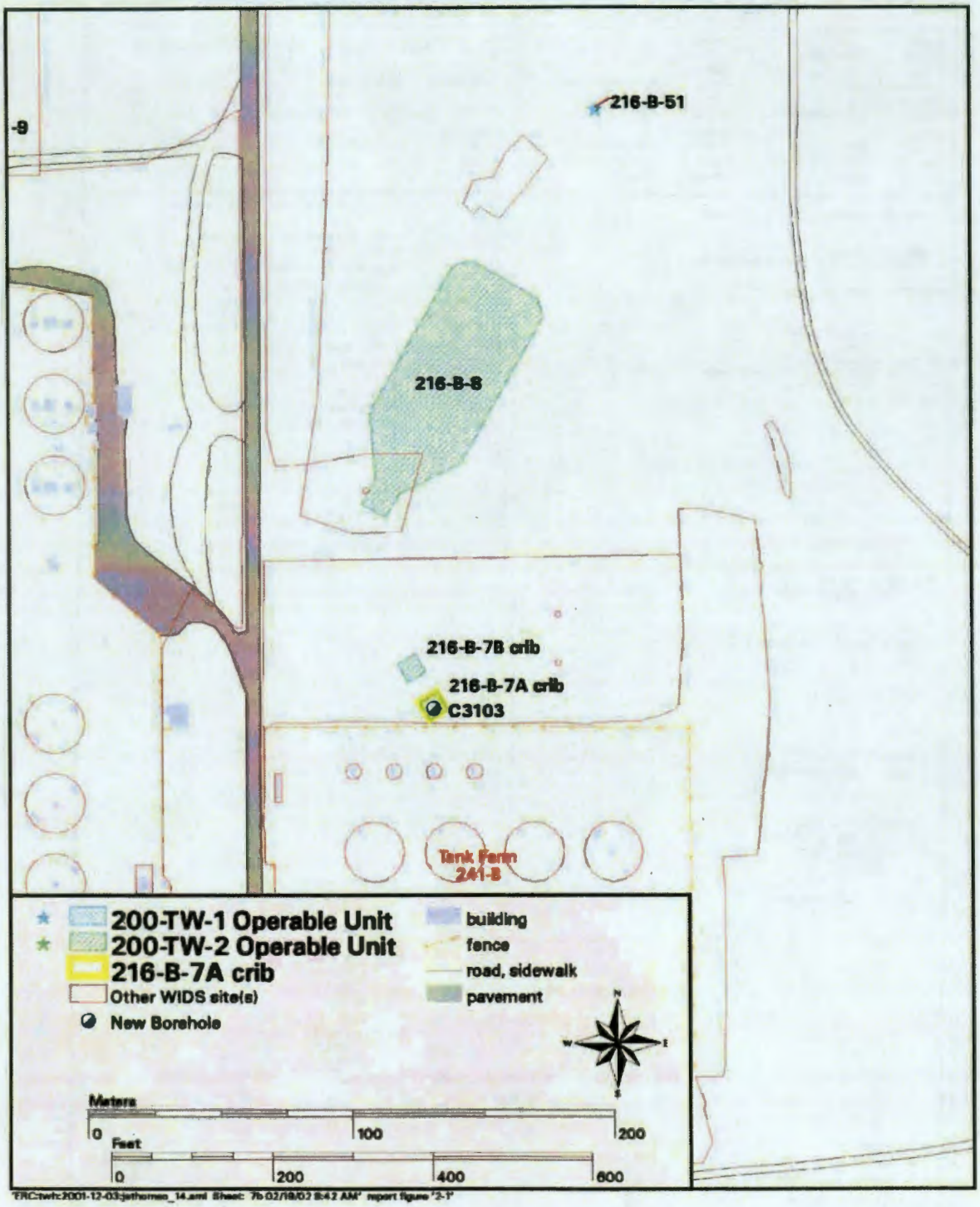


Figure 2-5. As-Built Drawing of the 216-B-7A Crib Borehole (C3103).

WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method:	Cable Tool	Sample Method:	Grab/Split Spoon	WELL NUMBER:	C3103	C3103	TEMPORARY WELL NO: Not Allowed
Drilling Fluid Used:	None	Additives Used:	None	Coordinates: N	Not documented		
Driller's Name:	Morris Wraspir	WA State Lic Nr:	1909	Coordinates: E	Not documented		
Drilling Company:	RSI	Company Location:	Woodland, Ca.	Start Card #:	Not Documented		
Date Started:	21Aug91	Date Completed:	02Oct91	Elevation Ground Surface:			

Depth to Water: See last page
(Ground surface)

GENERALIZED STRATIGRAPHY Geologist's Log

Elevation of Reference Point: m

Height of Reference Point Above Ground Surface:

Depth of Surface Seal: 1.3 ft

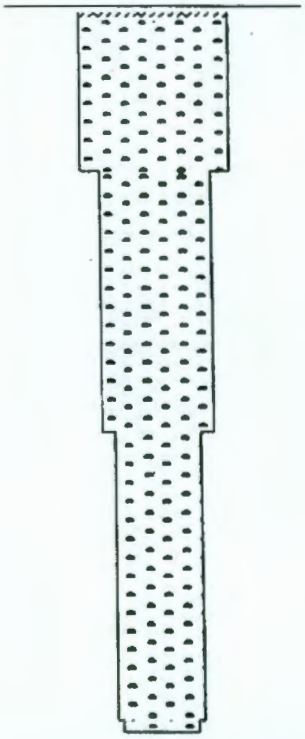
Type of Surface Seal: No pad

0 - 2.5 ft : Gravel
2.5 - 35 ft : Silty Sandy Gravel

35 - 40 ft : Gravelly Silty Sand
40 - 168.5 ft : Sand

168.5 - 169 ft : Silty Sand
169 - 180 ft : Slightly silty Sand (Silty Sand Stringer @ 172.5)
180 - 219 ft : Sand

219 - 222.5 ft : Silt



Fill	*Casing*	*Screen*
2 - 3.3 ft : 12-inch hole Cement		
3.3 - 50.7 ft : 12-inch hole Bentonite		
50.7 - 130.5 ft : 9-inch hole Bentonite		
130.5 - 219 ft : 7-inch hole Bentonite		
219 - 222.5 ft : 6-inch hole Bentonite		

222.5 ft : Borehole drilled depth

0 - 50.7 ft : 12-in. Cable Tool 11-3/4" CS Temp cag to 50.7 ft
50.7 - 130.5 ft : 9-in. Cable Tool 8-5/8" CS Temp cag to 130.5 ft
130.5 - 219 ft : 7-in. Cable Tool 6-5/8" CS Temp cag to 219 ft
219 - 222.5 ft : 6-in. Cable Tool - Open hole

Drawing By: JEA
Reference: Hanford Wells
Revision: 0
Revision Date: 30Oct01
Print Date: 01Apr02

Report Form: WELL8 Project File: WELL8.GPJ

Table 2-1. Summary of Drilling Activities.

Borehole Name/Well Number	216-B-38	216-B-7A Crib
Drilling start date	6/29/01	8/21/01
Drilling end date	9/12/01	9/23/99
Total depth of borehole	18.3 m (60 ft) – drive casing boreholes 80.3 m (263.5 ft) – cable tool boring	67.8 m (222.5 ft)
Static water level, bgs (date)	80.1 m (236 ft) on 8/10/01	NA
Washington Coordinate System of 1983, south zone (1991)	N: 137347.64 m (450615.62 ft) E: 573471.18 m (1881467.13 ft)	N: 137385.58 m (450651.51 ft) E: 573802.55 m (1882554.30 ft)
Elevation of brass cap (NAVD88)	201.990 m (662.70 ft)	198.974 m (652.81 ft)
Decommission/well completion date	9/13/01	10/01/01
Number of investigation-derived waste drums generated	37	46

NA = not applicable

Table 2-2. Summary of Investigation-Derived Waste Generated During the 200-TW-2 Remedial Investigation. (4 Pages)

Drum Number	Package Date	Source ID	Depth Interval, ft bgs	Waste Description
200E-01-0013	07/12/01	216/B-38 Trench	NA	Soils, aggregate, ethylene glycol
200E-01-0014	08/02/01	C3104	NA	Soils and MSW (plastic, cloth)
200E-01-0015	08/03/01	C3104	21 - 26	Soils and MSW (plastic, cloth)
200E-01-0016	08/03/01	C3104	26 - 31.5	Soils and MSW (plastic, cloth)
200E-01-0018	08/02/01	C3104	NA	Soils and MSW (plastic, cloth)
200E-01-0019	08/02/01	C3104	17 - 21	Soils and MSW (plastic, cloth)'
200E-01-0020	08/03/01	C3104	31.5 - 36	Soils and MSW (plastic, cloth)
200E-01-0021	08/03/01	C3104	36 - 40	Soils and MSW (plastic, cloth)
200E-01-0022	08/05/01	C3104	28 - 32	Soils and MSW (plastic, cloth)
200E-01-0055	08/06/01	C3104	32 - 36	Soils and MSW (plastic, cloth)
200E-01-0056	08/06/01	C3104	45 - 51.5	Soils and MSW (plastic, cloth)
200E-01-0057	08/06/01	C3104	57 - 67	Soils and MSW (plastic, cloth)
200E-01-0058	08/07/01	C3104	NA	MSW (plastic, paper, cloth, rubber)
200E-01-0059	08/07/01	C3104	67 – 79	Soils
200E-01-0060	08/07/01	C3104	79 – 89	Soils

Table 2-2. Summary of Investigation-Derived Waste Generated During the 200-TW-2 Remedial Investigation. (4 Pages)

Drum Number	Package Date	Source ID	Depth Interval, ft bgs	Waste Description
200E-01-0061	08/07/01	C3104	89 - 98	Soils
200E-01-0062	08/07/01	C3104	98 - 106	Soils
200E-01-0063	08/07/01	C3104	106 – 118	Soils and MSW (cloth)
200E-01-0064	08/07/01	C3104	118 - 139	Soils
200E-01-0065	08/08/01	C3104	4139 - 159	Soils
200E-01-0066	08/08/01	C3104	159 - 176	Soils
200E-01-0067	08/09/01	C3104	176 - 198	Soils
200E-01-0068	08/09/01	C3104	198 - 217	Soils
200E-01-0069	08/07/01	C3104	217 - 240	Soils
200E-01-0070	08/09/01	C3104	NA	MSW (cloth, metal, rubber, paper)
200E-01-0071	08/10/01	C3104	240 - 263.5	Soils
200E-01-0073	08/16/01	C3341	NA	MSW (paper, plastic, rubber, cloth)
200E-01-0077	08/08/01	C3104	NA	MSW (plastic, HEPA filter)
200E-01-0100	09/04/01	C3104	NA	MSW (plastic, cloth)
200E-01-0101	08/30/01	C3104	NA	MSW (plastic, cloth)
200E-01-0106	09/18/01	C3104	NA	Carbon steel core barrel/pallet
200E-01-0109	09/18/01	C3104	NA	Carbon steel well casing 4 in. x 5 ft = 9 pieces/ pallet
200E-01-0110	09/18/01	C3104	NA	Carbon steel well casing 4 in. x 5 ft = 9 pieces/ pallet
200E-01-0111	09/18/01	C3104	NA	Carbon steel well casing 4 in. x 5 ft = 9 pieces/ pallet
200E-01-0112	09/18/01	C3104	NA	Carbon steel well casing 4 in. x 5 ft = 9 pieces/ pallet
200E-01-0113	09/18/01	C3104	NA	Carbon steel well casing 4 in. x 5 ft = 9 pieces/ pallet
200W-01-0124	NA	C3104	NA	Purge water
200E-01-0078	08/23/01	C3103	18.5 - 25	Soil and MSW
200E-01-0079	08/23/01	C3103	25 - 35	Soil and MSW (plastic, paper, foil)
200E-01-0080	08/27/01	C3103	35 - 48	Soil and MSW (paper, cloth)
200E-01-0081	08/27/01	C3103	48 - 56	Soil and MSW (paper, cloth)
200E-01-0082	08/27/01	C3103	NA	MSW (plastic, paper, cloth, rubber)
200E-01-0083	08/27/01	C3103	NA	Stainless steel metal split spoons and MSW (paper, rubber, cloth)
200E-01-0084	09/06/01	C3103	NA	MSW from glovebag and HEPA filter (plastic, rubber, cloth)
200E-01-0085	09/06/01	C3103	NA	MSW (paper, plastic, rubber, cloth)

Table 2-2. Summary of Investigation-Derived Waste Generated During the 200-TW-2 Remedial Investigation. (4 Pages)

Drum Number	Package Date	Source ID	Depth Interval, ft bgs	Waste Description
200E-01-0086	09/06/01	C3103	NA	MSW (plastic from enclosure)
200E-01-0087	09/06/01	C3103	NA	Plastic stained w/oil and aggregate soil
200E-01-0088	08/21/01	C3103	NA	Container 200E-01-0107 with soil and HEPA debris
200E-01-0089	08/27/01	C3103	NA	MSW (plastic, cloth, paper)
200E-01-0102	08/15/01	C3103	NA	Bulk/pallet - steel drill rig cable
200E-01-0103	08/21/01	C3103	0 – 18.5	Soil and MSW
200E-01-0108	09/06/01	C3103	NA	Bulk/pallet - metal well casing 5 ft x 6 in. = 11 pieces
200E-01-0090	09/10/01	C3103	NA	MSW (plastic, cloth, paper, HEPA filter)
200E-01-0091	09/13/01	C3103	NA	MSW (paper, plastic, rubber, cloth)
200E-01-0092	09/13/01	C3103	NA	HEPA filter and MSW (paper, plastic, cloth, metal)
200E-01-0093	09/17/01	C3103	NA	MSW (plastic and cloth stained with hydraulic fluid)
200E-01-0094	09/19/01	C3103	31 - 36	Soil and MSW (plastic, metal)
200E-01-0095	09/20/01	C3103	39 - 44	Soil and MSW (plastic)
200E-01-0096	09/19/01	C3103	136 - 39	Soil and MSW (plastic)
200E-01-0097	09/20/01	C3103	44 - 46	Soil and MSW (plastic)
200E-01-0098	09/20/01	C3103	46 - 51	Soil and MSW (plastic)
200E-01-0099	09/20/01	C3103	151 - 54	Soil and MSW (plastic)
200E-01-0114	09/18/01	C3103	NA	Carbon steel (madrell, jar and drill stem) 4 in. x 16 ft
200E-01-0115	09/19/01	C3103	NA	Metal well casing and boring probe 4 in. x 5.5 ft = 6 pieces
200E-01-0116	09/20/01	C3103	NA	MSW (plastic, cloth, paper, rubber)
200E-01-0117	09/20/01	C3103	NA	MSW (plastic, cloth, paper)
200E-01-0118	09/21/01	C3103	66 - 80	Soils
200E-01-0119	09/21/01	C3103	53 - 66	Soils
200E-01-0120	09/21/01	C3103	80 - 93	Soils
200E-01-0121	09/21/01	C3103	93.5 - 104.5	Soils
200E-01-0122	09/20/01	C3103	104.5 - 114	Soils
200E-01-0123	09/24/01	C3103	114 - 127	Soils
200E-01-0124	09/24/01	C3103	127 - 137.5	Soils
200E-01-0125	09/25/01	C3103	4162 - 182	Soils
200E-01-0126	09/25/01	C3103	182 - 202	Soils

Table 2-2. Summary of Investigation-Derived Waste Generated During the 200-TW-2 Remedial Investigation. (4 Pages)

Drum Number	Package Date	Source ID	Depth Interval, ft bgs	Waste Description
200E-01-0127	09/25/01	C3103	137 - 162	Soils
200E-01-0128	09/26/01	C3103	202 - 222.5	Soils and MSW
200E-01-0129	09/27/01	C3103	NA	Metal/HEPA vacuum
200E-01-0130	10/02/01	C3103	NA	MSW (cloth, rubber, plastic)
200E-01-0133	10/03/01	C3103	NA	MSW (cloth, rubber, plastic)
200E-01-0139	10/10/01	C3103	NA	Bulk/pallet – carbon steel well casing 12 in. x 5 ft = 4 pieces
200E-01-0140	10/10/01	C3103	NA	Bulk/pallet – carbon steel well casing 12 in. x 5 ft = 6 pieces
200E-01-0141	10/10/01	C3103	NA	Carbon steel well casing 8 in. x 5 ft = 2 pieces

MSW = miscellaneous solid waste
NA = not applicable

Table 2-3. Soil Samples at Borehole C3104 (216-B-38 Trench). (2 Pages)

Sample Interval		HEIS Number	Date Sampled	Analytes
Top (ft bgs)	Bottom (ft bgs)			
Physical Property Samples				
3.0	5.5	B12CB7	08/01/01	Moisture content, particle size
97.5	100.0	B12CB8	08/07/01	Moisture content, particle size
Soil Samples				
0	0.5	B12684	07/18/01	Chloro-herbicides
3.0	5.5	B12C67	08/01/01	Metals, anions, radionuclides
9.5	12.0	B12C68	08/02/01	Metals, anions, radionuclides
13.0	15.5	B12C63	08/02/01	Radionuclides
13.0	15.5	B12C63-A	08/02/01	Metals, anions
18.0	20.5	B12C64	08/02/01	Radionuclides
18.0	20.5	B12C64-A	08/02/01	Metals, anions
22.5	25.0	B12DB8	08/03/01	Radionuclides
22.5	25.0	B12DB8-A	08/03/01	Metals, anions
29.0	31.5	B12DB9	08/03/01	Radionuclides
29.0	31.5	B12DB9-A	08/03/01	Metals, anions
37.5	40.0	B12C88	08/05/01	Radionuclides
37.5	40.0	B12C88-A	08/05/01	Metals, anions
52.0	54.5	B12C69	08/06/01	Metals, anions, radionuclides

Table 2-3. Soil Samples at Borehole C3104 (216-B-38 Trench). (2 Pages)

Sample Interval		HEIS Number	Date Sampled	Analytes
Top (ft bgs)	Bottom (ft bgs)			
97.5	100.0	B12C71	08/07/01	Metals, anions, radionuclides
147.5	150.0	B12C72	08/08/01	Metals, anions, radionuclides
197.5	200.0	B12C73	08/09/01	Metals, anions, radionuclides
261.0	263.5	B12C74	08/10/01	Metals, anions, radionuclides
Duplicate Samples				
52.0	54.5	B12C70	08/05/01	Metals, anions, radionuclides
37.5	40.0	B12DC0	08/05/01	Radionuclides
37.5	40.0	B12DC0-A	08/05/01	Metals, anions
Equipment Blank				
3.0	5.5	B12BW6	07/18/01	Metals, anions, VOA, semi-VOAs, gross alpha, gross beta, radionuclides; tied to B12C67

HEIS = Hanford Environmental Information System
VOA = volatile organic analyte

Table 2-4. Soil Samples at Borehole C3103 (216-B-7A Crib). (2 Pages)

Sample Interval		HEIS Number	Date Sampled	Comments
Top (ft bgs)	Bottom (ft bgs)			
Physical Properties Samples				
2.5	5.0	B12BR7	08/22/01	Moisture content, particle size
97.5	100	B12BR8	09/21/01	Moisture content, particle size
219	221.5	B12BR9	09/26/01	Moisture content, particle size
Soil Samples				
0	0.5	B12683	06/19/01	Chloro-herbicide
2.5	5.0	B12MH5	08/22/01	Metals, anions, radionuclides
5.5	8.0	B12MH6	08/22/01	Metals, anions, radionuclides
10.0	12.5	B12MH7	08/22/01	Metals, anions, radionuclides
12.5	15.0	B12MH4	08/23/01	Metals, anions, radionuclides
18.5	21.0	B12C89	08/23/01	Metals, anions, radionuclides
18.5	21.0	B12C89-A	08/23/01	Metals, anions, radionuclides
22.5	25.0	B12DC1	08/24/01	Metals, anions, radionuclides
22.5	25.0	B12DC1-A	08/24/01	Metals, anions, radionuclides
25.0	27.5	B12ML4	08/26/01	Radionuclides
25.0	27.5	B12ML4-A	08/26/01	Metals, anions
30.0	32.5	B12ML5	08/27/01	Radionuclides

Table 2-4. Soil Samples at Borehole C3103 (216-B-7A Crib). (2 Pages)

Sample Interval		HEIS Number	Date Sampled	Comments
Top (ft bgs)	Bottom (ft bgs)			
30.0	32.5	B12ML5-A	08/27/01	Metals, anions
35.0	37.5	B12ML6	08/27/01	Radionuclides
35.0	37.5	B12ML6-A	08/27/01	Metals, anions
48.0	50.5	B12ML7	08/28/01	Metals, anions, radionuclides
72.5	75.0	B12MH8	09/21/01	Metals, anions, radionuclides
97.5	100	B12MJ0	09/21/01	Metals, anions, radionuclides
147.5	150	B12MJ1	09/25/01	Metals, anions, semi-VOA, VOA, radionuclides
219	221.5	B12MJ2	09/26/01	Metals, anions, semi-VOA, VOA, radionuclides
Duplicate Sample				
72.5	75.0	B12MH9	09/21/01	Metals, anions, semi-VOA, VOA, radionuclides; replicate of B12MH5
Split Sample				
48.0	50.5	B12C91 (Sample)	08/28/01	Metals, anions, radionuclides
Equipment Blank				
264.0	265.5	B12DB4	08/10/01	Metals, anions, VOA, semi-VOA, radionuclides, gross alpha, gross beta; tied to B12MH5

Table 2-5. Summary of Integration Samples. (2 Pages)

Sample Number	Interval (ft)	Date
7A-22.0[a]	22	08/24/01
7A-25.0	25	08/26/01
7A-30.0	30	08/27/01
7A-35.0	35	08/27/01
7A-48	48	08/28/01
B10024[b]	60	09/21/01
B10025	70	09/21/01
B10026	80	09/21/01
B10027	90	09/21/01
B10028	100	09/21/01
B10031	110	09/21/01
B10032	120	09/24/01
B10033	130	09/24/01
B10034	140	09/25/01
B10035	150	09/25/01

Table 2-5. Summary of PNNL Samples. (2 Pages)

Sample Number	Interval (ft)	Date
B10036	160	09/25/01
B10037	168	09/25/01
B10038	170	09/25/01
B10039	172.5	09/25/01
B10040	180	09/25/01
B10041	190	09/25/01
B10042	200	09/26/01
B10043	210	09/26/01
B10044	218	09/26/01
B10045	221.5	09/26/01
B10046	219	09/26/01
B10047	221.5	09/26/01

[a] Samples collected for the Science and Technology Project.
[b] Samples collected for the Tank Farm Vadose Zone Project.
PNNL = Pacific Northwest National Laboratory

3.0 RESULTS

This section describes the geology encountered during the drilling activities and presents the results of field screening and geophysical logging activities.

3.1 GEOLOGY

3.1.1 216-B-38 Trench

Borehole cuttings were logged by a geologist. Soils described as backfill material form the uppermost soil horizon at the trench. Backfill was identified from 0 to 15 ft (0 to 4.6 m) bgs and consisted mainly of crushed basalt gravel, sand, and silty sandy gravel. The trench bottom was estimated to be at 15 ft (4.6 m) bgs. Soils typical of Hanford sand- and gravel-dominated sequences lie beneath the backfill. The following stratigraphy was identified in the borehole:

- Hanford formation gravel-dominated sequence from 15 to 30.5 ft (4.6 to 9.3 m) bgs
- Hanford formation sand-dominated sequence from 30.5 to 218.5 ft (9.3 to 66.6 m) bgs
- Hanford formation/Plio-Pleistocene unit (?) from 218.5 ft (66.6 m) bgs to the bottom of the borehole (263.5 ft [80.3 m] bgs).

The water table was encountered at 263 ft (80.2 m) bgs. Figure 3-1 shows the stratigraphy for the C3104 borehole.

3.1.2 216-B-7A Crib

Borehole cuttings were logged by a geologist. Soils described as backfill material form the uppermost soil horizon at the crib. Backfill was identified from 0 to 23 ft (0 to 7 m) bgs and consisted mainly of crushed basalt gravel, sand, and silty sandy gravel. The wooden crib structure was encountered at 21 ft (6.4 m) bgs and the crib bottom is estimated to be at 23 ft (7 m) bgs. Soils typical of Hanford sand- and gravel-dominated sequences lie beneath the backfill. The following stratigraphy was identified in the borehole:

- Hanford formation gravel-dominated sequence from 23 to 35 ft (7 to 10.7 m) bgs
- Hanford formation sand-dominated sequence ranged from 35 to 218 ft (10.7 to 66.5 m) bgs
- Hanford formation/Plio-Pleistocene unit (?) silt from 218 ft (66.5 m) to the bottom of the borehole (222.5 ft [67.8 m] bgs).

The water table was not encountered in this borehole; however, drilling was suspended when nearly saturated soils were encountered at approximately 219 ft (66.8 m) bgs. Figure 3-2 shows the stratigraphy for the C3103 borehole.

3.2 FIELD SCREENING RESULTS

The radiological field screening results from the drill cuttings are presented in Figures 3-1 and 3-2. Results of alpha and beta-gamma screening of the split-spoon samplers and the mercury screening are presented in Table 3-1. Mercury was detected at the 216-B-38 borehole at the top of the drill casing in the 3 to 5.5 ft (0.9 to 1.7 m) interval. Work was stopped so the health and safety implications could be assessed. Work was resumed with respirators until mercury readings were below the action level.

The radiological field screening at the 216-B-38 borehole showed elevated beta-gamma counts at samples B12C63, B12C64, B12DB8, and B12DB9 (14.5 to 25 ft [4.4 to 7.6 m] bgs). The readings were significantly elevated through this zone with dose readings as high as 6 mrem/hr of beta and 8 mrem/hr of gamma radiation. Radiological field screening is consistent with the geophysical logging results at these depths. The remainder of the field screening basically showed background levels.

The radiological field screening at the 216-B-7A borehole showed elevated beta-gamma counts at samples B12C89, B12DC1, B12ML4, B12ML5, and B12ML6 (18 to 37.5 ft [5.5 to 11.4 m] bgs). The readings were significantly elevated through this zone with dose readings as high as 1,500 mrem/hr beta and 20 mrem/hr gamma. Elevated alpha contamination was identified in samples B12ML4, B12ML5, and B12ML6 (22.5 to 37.5 ft [6.6 to 11.4 m] bgs). Readings as high as 100 mrem/hr were detected in this zone.

3.3 GEOPHYSICAL LOGGING RESULTS

3.3.1 216-B-38 Drive Casings

Cesium-137 was the only man-made radionuclide detected in the five drive casings. In drive casing C3340, cesium-137 was detected from 15 to 32 ft (4.6 to 9.8 m) bgs with the maximum of 180,000 pCi/g occurring at 23.5 ft (7.2 m) bgs.

In drive casing C3341, the highest concentrations of cesium-137 occurred between 12.5 and 28 ft (3.8 and 8.5 m) bgs with a maximum concentration of 56,186 pCi/g at 17 ft (5.2 m) bgs. A second interval of cesium-137 contamination was encountered from 29.5 to 33 ft (9.0 to 10.0 m) bgs with a maximum concentration of 6,356 pCi/g at 31.5 ft (9.6 m). Minor cesium-137 contamination was noted from 4 to 5.5 ft (1.2 to 1.7 m) with a maximum concentration of 2.57 pCi/g. Cobalt-60 was detected from 33 to 57 ft (10.0 to 17.4 m) with a maximum concentration of 0.16 pCi/g at 53 ft (16 m). The neutron moisture increased slightly between 15 and 35 ft (4.6 and 10.7 m) bgs. This corresponds to the area of high cesium-137, but also may be a result of interference with the tool from the high gamma.

In drive casing C3342, the highest concentrations of cesium-137 occurred between 13 and 33.5 ft (4.0 and 10.2 m) with a maximum concentration of 195,000 pCi/g at 16.5 ft (5.0 m) bgs. From 17.5 to 28.5 ft (5.3 to 8.7 m) bgs, the concentrations decreased to the 20,000 to 100,000 pCi/g

range. From 33.5 ft (10.2 m) to the total depth of 59.5 ft (18.1 m), the concentrations decreased from over 2,000 pCi/g to about 15 pCi/g. Cobalt-60 was detected from 34 to 42 ft (10.4 to 12.8 m) bgs with a maximum concentration of 0.29 pCi/g. The neutron moisture increased slightly in the zone of high cesium-137.

In 3343, only minor cesium-137 concentrations were detected from 4.5 to 5.5 ft (1.4 to 1.7 m) bgs with a maximum of 1.2 pCi/g. Moisture increased slightly from 22 to 29 ft (6.7 to 8.8 m) bgs and below 35 ft (10.7 m) bgs. These increases correspond to an increase in concentration of naturally occurring radionuclides and may indicate a stratigraphic change with higher fines content.

In 3344, only minor cesium-137 concentrations were detected from 4.5 to 5.0 ft (1.4 to 1.5 m) bgs with a maximum of 0.8 pCi/g. Moisture increased slightly from 38 to 39 ft (11.6 to 11.9 m) bgs. This increase corresponds to an increase in concentration of naturally occurring radionuclides and may indicate a stratigraphic change with higher fines content.

3.3.2 216-B-38 Borehole

The man-made radionuclides cesium-137 and cobalt-60 were detected in borehole C3104. The high-gamma activity between 13 and 45 ft (4.0 and 13.7 m) bgs is attributed to cesium-137 activities greater than 1,000 pCi/g. High-rate logging indicates that cesium-137 reaches activities of about 100,000 pCi/g between 18 and 35 ft (5.5 and 10.7 m) bgs. In addition, cobalt-60 was observed in the intervals from 44 ft (13.4 m) through 71.5 ft (21.8 m) and at 115 ft (35.1 m) bgs at about 0.1 pCi/g. Cobalt-60 may also be present higher in the borehole but was not detected due to saturation from the high levels of cesium-137 activity. Deeper in the borehole, cesium-137 activity was observed at 217.5 ft (66.3 m) with a measured activity of about 0.2 pCi/g.

Other then the zones containing man-made radionuclides, the changes in gross gamma counts depend primarily upon changes in potassium-40 activities. There is an increase in potassium-40 from about 14 pCi/g above 12 ft (3.7 m) to about 19 pCi/g below 43 ft (13.1 m) bgs. This increase in apparent potassium-40 activity occurred within the interval of high dead time, which was due to high cesium-137 activity. The increase in gross gamma counts from 130 to 145 cps at a log depth of 217 through 220 ft (66.2 through 67.1 m) bgs corresponds to an increase in gross neutron counts per second. Cesium-137 was detected within this zone at 217.5 ft (66.3 m) with an activity of 0.2 pCi/g. Below 220 ft (67.1 m), gross gamma counts average about 25 cps less than that measured above 215 ft (65.5 m) bgs.

Elevated neutron counts at 115 ft and 219 ft (35.1 and 66.8 m) bgs corresponded with intervals of man-made radionuclides. At 115 ft (35.1 m), cobalt-60 was detected at 0.1 pCi/g; cesium-137 was not detected at this depth. Cesium-137 was detected at 217.5 ft (66.3 m) at approximately 0.5 pCi/g. The natural radionuclides do not show any apparent changes in these intervals. The elevated neutron count rate at 109 through 111 ft (33.2 through 33.8 m) bgs is probably related to the bottom of the second casing string.

3.3.3 216-B-7A Borehole

The man-made radionuclides detected in borehole C3103 were cesium-137 and europium-154. Cesium-137 was detected continuously from near the ground surface to about 56 ft (17.1 m) in depth with the highest concentration of about 300,000 pCi/g measured at about 23 ft (7.0 m) bgs. Europium-154 was detected between 16 and 18 ft (4.9 and 5.5 m) and probably exists at some depth intervals within the high-rate zone between 18 and 27 ft (5.5 and 8.2 m) bgs. No other man-made radionuclides were detected in this borehole, including plutonium-239, for which longer counting times were employed to enhance the possibility of detection.

The potassium/uranium/thorium logs do not delineate any definitive lithologic units. Changes in the potassium-40 concentrations from about 12 pCi/g at about 18 ft (5.5 m) to about 17 pCi/g near 37 ft (11.3 m) suggest a lithologic change occurs in the high-rate interval. A thin bed with relatively high thorium-232 concentrations occurs at about 107 ft (32.6 m) and may be useful to correlate in nearby boreholes.

Relatively higher moisture content appears to exist in the interval from 18 to 37 ft (5.5 to 11.3 m) bgs. The highest moisture content occurs at 20 ft (6.1 m) in depth, just above the depth where the highest cesium-137 concentrations were measured. An interval between about 80 and 100 ft (24.4 and 30.5 m) indicates slightly higher moisture that corresponds with finer grained soil as indicated by slightly higher concentrations of potassium-40 and thorium-232. The remainder of the borehole exhibits consistent moisture content in the soils. The moisture content is increasing near the bottom of the borehole, and the final data point at 218 ft (66.5 m) indicates the detector is in close proximity to groundwater but has not fully entered the saturated interval.

3.4 BULK DENSITY RESULTS

Bulk density measurements were computed from data collected in the field. Samples of a known volume were weighed and moisture was compensated for in the calculation. Table 3-1 provides the bulk densities associated with the physical property samples.

3.5 CONCLUSIONS

This report summarizes the drilling, sampling, and geophysical logging activities for the 200-TW-2 OU at the 216-B-38 Trench and the 216-B-7A Crib. An RI report will be prepared for this OU that will summarize and evaluate the laboratory and other results from the RI. The RI will include evaluations of risk and fate and transport of contaminants. The RI is to be submitted to the U.S. Environmental Protection Agency by September 30, 2002, under *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1998) Milestone M-15-42b.

Figure 3-1. 216-B-38 Crib Stratigraphy, Sample Locations, Radiological Field Screening Data, and Geophysical Logging Results.

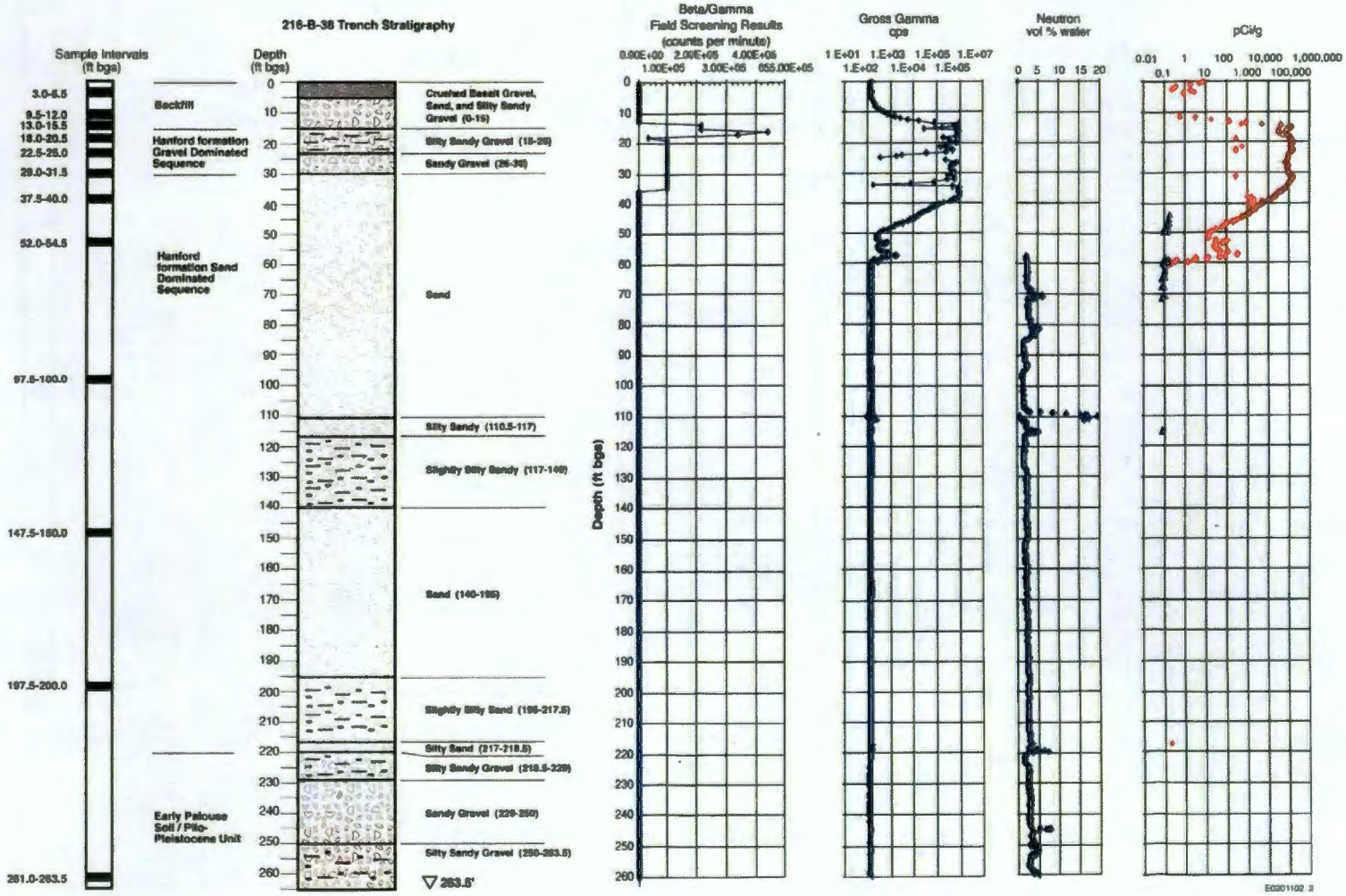


Figure 3-2. 216-B-7A Crib Stratigraphy, Sample Locations, Radiological Field Screening Data, and Geophysical Logging Results.

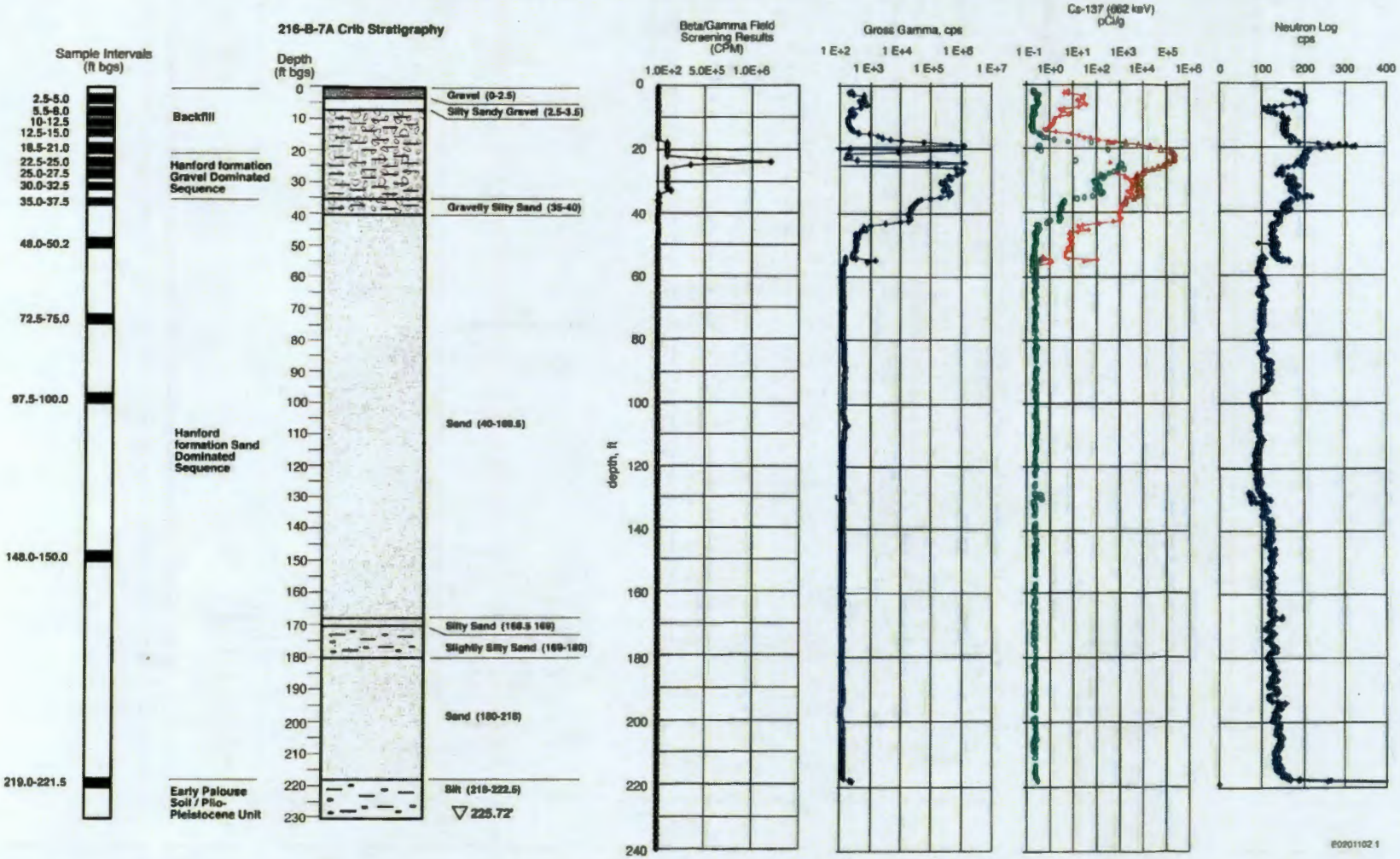


Table 3-1. Field-Screening Data. (2 Pages)

Sample Number	Depth (ft bgs)	Alpha Field Screening	Beta-Gamma Field Screening	Mercury Field Screening	Bulk Density	Formation
C3103						
B12MH5	2.5 - 5.0	BG	BG	ND	2.01 g/cc	Backfill
B12MH6	5.5 - 8.0	BG	BG	ND	NA	Backfill
B12MH7	10.0 - 12.5	BG	BG	ND	NA	Backfill
B12MH4	12.5 - 15.0	BG	BG	ND	NA	Backfill
B12C89	18.5 - 21.0	BG	3 mrem/hr beta <0.5 mrem gamma	ND	NA	Backfill
B12DC1	22.5 - 25.0	BG	1.5 mrem/hr beta <0.5 mrem gamma	ND	2.06 g/cc	Backfill/ Hanford formation – gravel-dominated sequence
B12ML4	25.0 - 27.5	100 mrem	1500 mrem/hr beta 20 mrem/hr gamma	ND	1.88 g/cc	Hanford formation – gravel-dominated sequence
B12ML5	30.0 - 32.5	100 mrem	100 mrem/hr beta 20 mrem/hr gamma	ND	NA	Hanford formation – gravel-dominated sequence
B12ML6	35.0 - 37.5	20 mrem	1 mrem/hr beta <0.5 mrem/hr gamma	ND	NA	Hanford formation – sand-dominated sequence
B12ML7	48.0 - 50.5	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12C91	48.0 - 50.5	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12MH8	72.5 - 75.0	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12MH9	72.5 - 75.0	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12MJ0	97.5 - 100.0	BG	BG	ND	1.61 g/cc	Hanford formation – sand-dominated sequence
B12MJ1	147.5 - 150.0	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12MJ2	219.0 - 221.5	BG	BG	ND	1.56 g/cc	Early Palouse soil/ Plio-Pleistocene unit
C3104						
B12C67	3.0 - 5.5	BG	BG	0.598 ppm	1.40 g/cc	Backfill
B12C68	9.5 - 12.0	BG	BG	ND	NA	Backfill
B12C63	14.5 - 15.5	BG	5 mrem/hr	ND	NA	Backfill
B12C64	18.0 - 20.5	BG	6 mrem/hr beta 8 mrem/hr gamma	ND	1.98 g/cc	Hanford formation – gravel-dominated sequence
B12DB8	22.5 - 25.0	BG	5 mrem/hr	ND	NA	Hanford formation – gravel-dominated sequence
B12DB9	14.5 - 15.5	BG	3 mrem/hr	ND	NA	Backfill

Table 3-1. Field-Screening Data. (2 Pages)

Sample Number	Depth (ft bgs)	Alpha Field Screening	Beta-Gamma Field Screening	Mercury Field Screening	Bulk Density	Formation
B12DC0	37.5 - 40.0	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12C88	37.5 - 40.0	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12C69	52.0 - 54.5	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12C70	52.0 - 54.5	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12C71	97.5 - 100.0	BG	BG	ND	1.69 g/cc	Hanford formation – sand-dominated sequence
B12C72	147.5 - 150.0	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12C73	197.5 - 200.0	BG	BG	ND	NA	Hanford formation – sand-dominated sequence
B12C74	261.0 - 263.5	BG	BG	ND	1.91 g/cc	Early Palouse soil/ Plio-Pleistocene unit

BG = background
NA = not applicable – bulk density measure not taken at this sample location
ND = not detected

4.0 REFERENCES

BHI, 2000, *Remedial Investigation Data Quality Objectives Summary Report for the 200-TW-1 Scavenged Waste Group and 200-TW-2 Tank Waste Group Operable Units,* BHI-01356, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001a, *200-TW-2 Tank Waste Group Operable Unit Facility Investigation/Corrective Measures Study Waste Control Plan*, WCP-2001-0002, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001b, *216-B-7A Crib, 216-T-26 Crib, and 216-B-38 Trench Criticality Evaluation,* 0200X-CE-N0002, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001c, *216-B-7A Crib Criticality Evaluation*, 0200X-CE-N0002, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001d, *Data Quality Objectives Summary Report for 200-TW-1 and 200-TW-2 Waste Designation,* BHI-01492, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001e, *Preliminary Hazard Classification for Sampling and Characterization Activities to be Conducted at the 216-B-7A Crib, the 216-T-26 Crib, and the 216-B-38 Trench,* BHI-01507, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001f, *Radiological Work Permit*, GW-136, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001g, *Radiological Work Permit*, GW-138, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001h, *Results of the Geophysical Investigations at the 216-T-26 Crib, 216-B-7A Crib, and the 216-B-38 Trench and Associated Burial Ground*, CCN 085931, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001i, *Site Specific Health and Safety Plan; 200-TW-1 & TW-2 Site Characterization,* 0200X-SSHS-G0003, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-01, *Environmental Investigations Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-05, *Field Screening Procedures*, Bechtel Hanford, Inc., Richland, Washington.

Brown, R. E. and H. G. Ruppert, 1950, *The Underground Disposal of Liquid Wastes at the Hanford Works, Washington*, HW-17088, General Electric Hanford Company, Richland, Washington.

Brown, M. J., R. L. P'Pool, and S. P. Thomas, 1990, *Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1989: 200/600 Area*, WHC-EP-0141-2, Westinghouse Hanford Company, Richland, Washington.

DOE-RL, 2001, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan*, DOE/RL-2000-38, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1998, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Maxfield, H. L., 1979, *200 Areas Waste Sites Handbook*, RHO-CD-673, 3 vols., Rockwell Hanford Operations, Richland, Washington.

WDOH, 2001, *Environmental Program ALARACT Demonstration for Drilling*, Washington Department of Health, Olympia, Washington.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, as amended.

WHC, 1991, *Tank Waste Discharge Directly to Soil at the Hanford Site*, WHC-MR-0227, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

BOREHOLE GEOLOGIC LOGS

Appendix A – Borehole Geologic Logs

WELL SUMMARY SHEET

Page 1 of 1
Date: 8-10-01

Well ID: C3104	Well Name: ~~NA~~ C3104
Location: 200 East 216-B-38	Project: 200-TW-2
Prepared By: Kevin Singleton — Date: 8-10-01	Reviewed By: D.C. Ulsoe — Date: 10/19/01
Signature:	Signature:

CONSTRUCTION DATA

Description

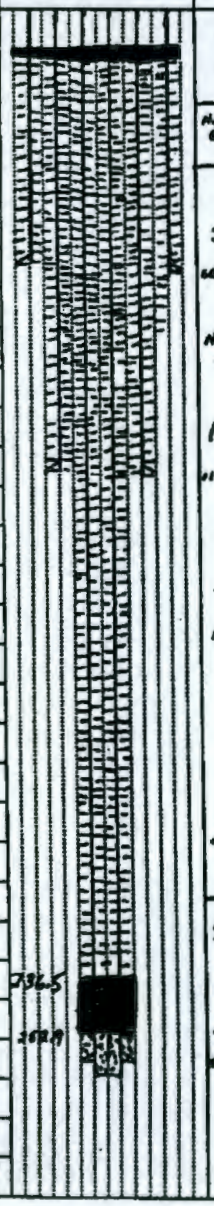
0.87"ID, 0.98 OD" casing to ~~236.5~~ 580
0.63"ID, 0.72 OD" casing to 111
0.47"ID, 0.55 OD" casing to 2586
All casing is temporary

cement 20'-25'
Bentonite 25'-236.5
Cement 236.5'-252.9'
SAND 252.9'-262.1'

Bentonite
Cement
SAND

All depths in feet below ground.
All temporary casing removed.

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0'-1' Crushed Basalt Gravel
Back Fill		1'-25' Silty SAND
Hanford Gravel		25'-15' Gravelly Silty SAND
		15'-26.5' Sandy Gravel - Silty Sandy Gravel
		26.5'-30.5' Sandy Gravel
50		30.5'-110.5' SAND
110.5		110.5'-117' Silty SAND
		117'-140' Slightly Silty SAND
Hanford SAND		140'-195' SAND
		195'-212.5' Slightly Silty SAND
100		212.5'-218.5' Silty SAND
111		218.5'-229' Silty Sandy Gravel
		229'-250' Sandy Gravel
		250'-263.5' Silty Sandy Gravel
150		Back Fill 0'-15'
		Hanford Gravel 15'-30.5'
		Hanford SAND 30.5'-218.5'
		Hanford/RPU 218.5'
		Formally known Hanford Gravel
200		
Hanford RPU		Total depth 263.5'
250		
189.6 263.5		▽ Water Table 268' 8/10/01

BHI-EE-189 (12/97)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 7-31-01
Finish Date: 9-12-01
Page 1 of 1

Well ID: C3104	Well Name: C3104	Approximate Location: 200 East 216-B-38	
Project: 200-TW-2		Other Companies: CH1	
Drilling Company: R.S.I		Geologist(s): Kevin Singleton, L.D. Walker	
Driller: Morris Wraspir	License #: 1909		

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter 11 3/4" From 0 to 60.5
11 3/4" O.D. Thread	0 - 58.0	–	Cable Tool: ✓	Diameter 9" From 60.5 to 112
8 5/8" O.D. Thread	0 - 111'	9"	Air Rotary:	Diameter 7" From 112 to 263.5
6 5/8" O.D. Thread	0 - 259.6	7"	A.R. w/Sonic:	Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
	____ - ____			Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design				Diameter ____ From ____ to ____

Drilling Fluid: None Used

Total Drilled Depth: 263.5'	Hole Dia @ TD: 7"	Total Amt. Of Water Added During Drilling: None Used	
Well Straightness Test Results: NA		Static Water Level: 263'	Date: ~~26~~ 8-10-01

10-11-01 GEOPHYSICAL LOGGING 8-10-01

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	0 - ~~58~~ 60.5	8-6-01	NA	____ - ____	
Spectral Gamma/Neutron Moisture	~~58~~ 60.5 - 112'	8-7-01		____ - ____	
Spectral Gamma/Neutron Moisture	112 - 263.5	8-10-01		____ - ____	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
	____ - ____				____ - ____		
	____ - ____				____ - ____		
	____ - ____			NA	____ - ____		
	____ - ____				____ - ____		
	____ - ____				____ - ____		

OTHER ACTIVITIES

Aquifer Test: NA	Date:	Well Decommission:	Yes: ✓	No:	Date: 9-12-01
Description: NA		Description: Sand 257.9'-262.1', Cement 236.5'-257.9' Bentonite 2.5-236.5', Cement 2.0'-2.5'			

WELL SURVEY DATA (if applicable)

	Protective Casing Elevation: NA
Washington State Plane Coordinates: NA	Brass Survey Marker Elevation: NA

COMMENTS/REMARKS

Reported By: Kevin Singleton Title: Geologist Signature: [signature] Date: 10-12-01

Original to: Document & Information Services, H0-09/HWIS
Distribution by DIS: Environmental Technologies Well Coordinator, H0-02

BHI-EE-181 (07/27/2001)

BOREHOLE LOG

Page 1 of 9
Date: 8-1-01

Well ID: ~~AH~~ C3104 | Well Name: C3104 | Location: 200 East 216-B-38
Project: 200-TW-2 | 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	DB	0-1'		0'-1' Crushed basalt vcp (Gravel)	
				1'-2.5' Silty Sand, 10YR5/4, light olive brown, dry, No RX	Bottom Trench @ -15'
				mod sorted, 70% Sand, 30% Silt, Sand	
	55 3-5.5	RCY 95%		mainly vfs-fs, 30-40% ms & others sub round	
5				to ang 70% Qtz, 30% mafic MPS 1mm	
	DB			2.5'-15' Gravelly Silty Sand, 10YR4/3	
				to 10YR5/4, light olive brown to olive brown, moist	
				weak RX to acid, poorly sorted, 70% Sand, 10-20%	
10	55 8.5-12	RCY 66%		Gravel, 10% Silt, mainly vfs to ms, lithics	
				ang to subrd, mainly mp to vcp, Round, 60-70	
				% Qtz, 30-40% other, MPS 1.36 Gravel	
				size & % increasing with depth.	
	13-15.5	100%		15'-21.5' Sandy Gravel to Silty Sandy	
15	5MR	Blows 105		Gravel	
	DB			10YR3/2, moist, very dark grayish brown	
				40-55 Gravel, 35-40% Sand 5-10% Silt	
	55 18-20.5	100%		No to weak RX, mainly mp to vcp, Round,	
				ms-vcs. MPS MPS 55mm, 70% Basalt	
20				30% others	
				21.5'-30.5' Sandy Gravel, 10YR4/2 dark grayish	
				brown, moist, poorly sorted	
	55 22.5' 25'	100% RCY 283 blows count		No RX, 65% Sand, 27% Gravel, 3% Silt	Gravel % increases
				mainly ms-cs, Round to ang, & mp-cp, 80%	to 60% Sand
25				Basalt, 20% other. MPS. 60mm	~37% @ 29.5'
				30.5'-45' Sand, 10YR4/2, dark grayish brown	Sandy Gravel
				moist, well to mod sorted, No RX, 90% Sand	
				7% Gravel 3% Silt, mainly ms-vcs, Round-ang	
	55			vcp-bp-Round 80% Basalt, 20% other MPS 20mm	

Reported By: Kevin Singleton | Reviewed By: DC Ukeles
Title: Geologist | Title: Geologist
Signature: [signature] Date: 8-6-01 | Signature: DC Ukeles Date: 10/19/01

BHI-EE-183 (12/97)

Appendix A – Borehole Geologic Logs

BOREHOLE LOG

Page 2 of 9
Date: 8-3-01

Well ID: C3104 | Well Name: C3104 | Location: 200 East 216-B-38

Project: 200-TW-2 216-B-38 | Reference Measuring Point: Ground

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
30	SS 29-31.5	100% RCY		30.5'-45.0' SAND, 10YR4/2 moist (see page 1)	
	OB			45.0'-77 SAND, 10YR4/2, moist, dark grayish brown, well to mod sorted	
35				No RK, 95% SAND, 5% other; mainly msto vcs; Rsub-Rsub-ANG, 70-80% Qtzsalt; 20% other MPS 4mm, unconsolidated	
	SS 35.5-40.0	100% RCY			
40					
45					
50					
	SS 52-54.5 55	100% RCY			
55					

Reported By: Kevin Singleton | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: [signature] Date: 8-6-01 | Signature: [signature] Date: 10/19/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 3 of 9
Date: 8-6-4

Well ID: C3104 | Well Name: ~~AA~~ C3104 | Location: 200 East 216-B-38
Project: 200-TW-2 O.U. | Reference Measuring Point: Ground

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	DB	NA		45'-77' SAND, 10YR4/2, dark grayish brown, (see page 2)	
65				@72' Silty SAND Stringer 6" mainly vfs-ms No RX 20-30% silt	
70				77-87' SAND, 10YR4/2, dark grayish brown, well sorted, NO RX moist, very consolidated, 95% SAND 5% others, mainly ms; 70-80% Basalt Otz & Feld 20-30% other Basalt, MPS 7mm	look like Ringold SAND
75					
80				87'-89 SAND, 10YR4/2 dark grayish brown moist, well sorted, No RX, 95% SAND, 4% Silt, 1% other, mainly coarse sand 50% Basalt, 50% other MPS 3mm	
85				89-110.5 SAND, 10YR4/2, dark grayish brown moist, well sorted, RX No, 97% SAND, 3% other, mainly coarse & med sand 50% mafic/50% Felsic & Otz. MPS 8mm	

Reported By: Kevin Singleton | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: [signature] | Date: 8-8-01 | Signature: [signature] | Date: 10/19/01

BHI-EE-183 (12/97)

Appendix A – Borehole Geologic Logs

BOREHOLE LOG

Page 4 of 9
Date: 8-7-01

Well ID: C3104 | Well Name: ~~RCW 1-MA~~ C3104 (9/19/01) | Location: 200 East 216-B-38
Project: 200-TW-2 O.U. | Reference Measuring Point: Ground

Depth (FL)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
90	DB			89-110.5 Sand, 10YR4/2 dark grayish brown moist, No RX, well sorted, mostly CS m.S, 50% Basalt/mafic/50% Felsic, Qtz MPS 4mm	
95				@ 95' mainly m.S	
	92.5-100	125 Blows 100% RCV		@ 97.5 mainly m.S	Split spoon
100	DB				
105					
110				110.5-113.5 Silty Sand, 10YR7/2, light gray dry, Strong RX, poorly sorted, 60% Sand 40% Silt, mainly ms-cs, Silt is non plastic (calcite $CaCO_3$) 30-40% Basalt, 60% Qtz some Felsic MPS 2mm, Friable, weakly consolidated	
115				113.5-117 Silty Sand, 10YR5/3, brown moist, No RX, 80% Sand, 20% Silt mainly vfs-fs, 30% Basalt, 70% other MPS 2mm	

Reported By: Kevin Singleton | Reviewed By: D C Weekes
Title: Geologist | Title: Geologist
Signature: [signature] | Date: 8-7-01 | Signature: [signature] | Date: 10/19/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 5 of 9
Date: 8-8-01

Well ID: C3104 | Well Name: ~~AAA~~ C3104 | Location: 200 East 216-B-38
Project: 200-TW-2 O.U. | Reference Measuring Point: Ground

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	~~BB~~ DB	NA		117-130 Slightly Silty Sand	
				10YR4/2, dark grayish brown, moist, weak RX	
				85% Sand, 15% Silt, mainly ms-cs	
				50% Basalt, 40-50% Qtz & Feld, weakly	
125				cemented, MPS 2mm well sorted	
				130-140 Slightly Silty Sand	
				10YR4/2, dark grayish brown, moist No-weak	
130				RX, 85% Sand, 15% Silt mainly ms-cs	
				70% Qtz & Feld, 30% Basalt MPS 2mm	
				140-159 Sand, 10YR4/2, dark grayish brown	
				moist, well sorted No to weak	
135 ~~140~~				RX, mainly ms, 40-30% Basalt 60% other	
				MPS<3mm	
140					
145					
	1425 -150	103 blows 75%			

Reported By: R. Singleton | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: [signature] | Date: 8-9-01 | Signature: [signature] | Date: 10/9/01

BHI-EE-183 (12/97)

Appendix A – Borehole Geologic Logs

BOREHOLE LOG

8-08-01

Page 6 of 9
Date: 8-08-01

Well ID: C3104
Well Name: ~~C3104~~ C3104 TA
Location: 200 East 216-B-38
Project: 200-TW2
Reference Measuring Point: Ground

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
150	PB	NA		140-159 SAND, 10YR4/2, dark grayish brown. (See page 5)	
				159-162 SAND, 10YR4/2, dark grayish brown, moist, poorly sorted	
155				No RX, mainly VCS-MS, 95% SAND 5% Silt MPS 4mm 70% Basalt, 30% other	
				162-187 SAND, 10YR 5/2, grayish brown moist mod-poorly sorted, Weak RX weakly cemented, 90% SAND 10% Silt & others, mainly MS-CS, 70% Basalt, 30% others MPS ~3mm, weakly cemented	
160				~65' Mod to strong RX to acid ~~weakly~~ weakly cemented	8-08-01
165				~70 Weak to mod RX to acid	
170					
175					

Reported By: Kevin Singleton
Title: Geologist
Signature: [signature] Date: 8-9-01

Reviewed By: DC Weekes
Title: Geologist
Signature: DC Weekes Date: 10/19/01

BHI-EE-183 (12/97)

Appendix A – Borehole Geologic Logs

BOREHOLE LOG

Page 7 of 7
Date: 8-9-01

Well ID: C3104 | Well Name: C3104 | Location: 200 East 26-B-38
Project: 200-TW-2 | Reference Measuring Point: Ground

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	DB	NA		162'-187' SAND, 10YR5/2 grayish brown moist, mod-poorly sorted	
				Weak RX to acid, weakly cemented, 90%	
				SAND, 10% silt & others, main ms-cs,	
				70% Basalt, 30% others MPS 3mm	
185					
				187-145' SAND, 10YR6/1, dry, poorly sorted	
				weak RX, weakly cemented, 90%	
				SAND, mainly ms to vcs, basalt subrounded to	
				subANG, Qtz & Feld ANG, 10% others, 70%	
190				Basalt, 30% other MPS 3mm	
				195'-211' Slightly Silty SAND, 10YR6/1 GRAY	
				dry, poorly sorted, weak RX, weak cemented	
195				80% SAND, mainly ms to vcs, ~20% Silt	
				60-70% Basalt, 30-40% others MPS 3mm	
	SS 97.5-200	65% Rec 191 Blows			
200		NA			
205					

Reported By: Kevin Singleton | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: [signature] Date: 8-09-01 | Signature: DC Weekes Date: 10/9/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 8 of 9
Date: 8-08-01

Well ID: C3104 | Well Name: 10/19/01 C3104 | Location: 200 East 216-B-38
Project: 200-TW-2 | Reference Measuring Point: Ground

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
210	OB	NA		195-211 Slightly Silty Sand	
				10YR6/1, gray, dry, poorly sorted, weak RX to acid, weakly cemented, weakly cemented	
				80% Sand, mainly ms-vcs, ~20% Silt	
215				60-70% Basalt, 30-40% other MPS <3mm	
				211'-217.5' Slightly Silty Sand	
				10YR6/2 light brownish gray, poorly sorted, weak to mod RX, weakly cemented 85% Sand	
220				mainly ms-cs, ~15% Silt 60-70% mafic	
				30% others MPS 3mm <2% Gravel	
				217.5'-218.5 Silty Sand, 10YR6/3	
225				pale brown, dry, med sorted, weak RX, 70% vfs-fs	
				30% Silt, 60% Basalt 30-40% other MPS 2mm	
				218.5'-229 Silty Sandy Gravel,	RF/PPF(?) 218.5'
230				10YR5/2, grayish brown, dry, very poorly sorted	Few Also slightly altered
				weak RX to acid, white brown staining, 65% Gravel	
				30% Sand, 5% Silt, mainly vfp-cp Round,	
				mainly ms-vcs, 90% Basalt, 10% other MPS 30mm	
235				~1 moist zone of 4" silty vcs c. ~20'	
				229-235 Sandy Gravel, 10YR5/2, grayish brown	
				dry, poorly sort, weak to mod RX,	
				75% Gravel (mainly vfp-fp) 23% Sand (mainly ms-vcs)	
				90% Basalt, 10% other MPS 20mm	

Reported By: Kevin Singleton | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: [signature] Date: 8-10-01 | Signature: DC Weekes Date: 10/19/01

BHI-EE-183 (12/97)

Appendix A – Borehole Geologic Logs

BOREHOLE LOG

Page 9 of 9
Date: 8-10-01

Well ID: C3104 | Well Name: C3104 | Location: 200 East 216-B-38
Project: 200-TW-2 | Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240	DB			235-250' Sandy Gravel, 10YR5/2, grayish brown, dry, poorly sorted, weak to mod RX, 75% Gravel, 23% Sand & 2% Silt mainly vf-mp, Round; f-ms-vcs, 90% Basalt 10% others MPS. 25mm Small clast sometimes altered	
245					
				@ 250' Clast size max = 40mm with some silty altered zones	
250				250'- Silty Sandy Gravel, 10YR5/3 dark brown, moist-dry poorly sorted, weak RX, 75% Gravel, 20% Sand 5% Silt; mainly vfa-cr, Round, f-ms-vcs 85% Basalt, 15% others, MPS 90mm	
255				Small cobbles @ 255	
260					▽ ~263'
	S3 61-63.5	75% RCV			END HOLE 263.5
265					

Reported By: Kevin Singleton | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: [signature] | Date: 8-10-01 | Signature: DC Weekes | Date: 10/19/01

BHI-EE-183 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT NO. 1

Page 1 of 2

DRILLING PLAN Use additional pages if req'd.

Date: 7-31-01

Purpose: Characterization by soil sampling
Location: 200-East C3104 / 216-B-38
Well Name: C3104
Well ID: C3104
Drlg. Co.: RST
Rig No.: HO-22 5309
Rig Make/Mod.: Wellmaster 1250

Casing String No. (1) 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size 0.87 ID	Auger NA	Air NA Water/Mud NA	Make NA
Grade	Rotary NA	Reverse Direct	Model NA
Lbs. Per Ft. NA	Tubex NA	Vol: cfm NA	Choke NA
Material Carbon Steel	Cable Tool ✓	gpm NA	Casing Hammer
Type:	Sonic NA	Pressure NA psi	Make NA
Welded Thd. ✓	A.R. w/Sonic	Drill Pipe O.D. NA	Model NA
Planned/Actual	Other:	Tool Joint Size NA	Bit Size
Set At: 60.5 / 60		Additives NA	Type NA
Shoe OD/ID 0.87 ID / 0.80 OD			Nozzles NA
Reference Measuring Point:			
GROUND LEVEL			

Drlg. Co. RST
Rig No.: HO-5309 HO-22
Rig Make/Mod.: Wellmaster 1250

Casing String No. (1) 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size 0.63 ID	Auger NA	Air NA Water/Mud NA	Make NA
Grade NA	Rotary NA	Reverse Direct	Model NA
Lbs. Per Ft. NA	Tubex NA	Vol: cfm NA	Choke NA
Material Carbon Steel	Cable Tool ✓	gpm NA	Casing Hammer
Type:	Sonic NA	Pressure NA psi	Make NA
Welded Thd.	A.R. w/Sonic NA	Drill Pipe O.D. NA	Model NA
Planned/Actual	Other:	Tool Joint Size NA	Bit Size
Set At: 100 / 111		Additives NA	Type NA
Shoe OD/ID 0.63 ID / 0.72 OD			Nozzles NA
Reference Measuring Point:			
GROUND LEVEL			

Comments/Remarks: All measurements are in tenths of a foot.

Estimated Depth to Water: ~265.57 Ft

Reported By: Kevin Simpkins
Name/Title: Geologist
Signature: [signature] Date: 8-1-01

Reviewed By: D C Weekes
Name/Title: Geologist
Signature: [signature] Date: 10/19/01

BHI-EE-017 (12/97)

FIELD ACTIVITY REPORT- DAILY DRILLING
Continuation Page

Page 2 of 2
Date: 7-31-01

Well Name: B 10-1-01 ~~TH~~ C3104
Well ID: C3104
Location: 200 East
Continuation of Report No.: 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
2130		Crew on site @ 2130hrs by Ed RaFuse. RaFuse review several safety topics; Safety attitude, job readiness, insect bits, major minor injuries, house keeping, managing time, reduce chances of injury, others, POD @ 2130 to 2200hrs. Move equipment, move drill rig, drill collect samples. Preparing to drill @ 2200hrs. Dug thru gravel drill pad @ 0045hrs with shovel to ~6' Set First joint of casing 0.38 Head + 0.82 Shoe + 4.00 = Total ~~9.8'~~ 5.20'
	0125	of 9.8" O.D. casing. Ready drill @ ~ 0125hrs. Short pre job safety
	0145	meeting @ 0125hrs in office trailer. Meeting over @ 0145hrs
		Lunch. Drilling @ 0230hrs. Core barrel to 2' @ 0245hrs.
		HPT noted 650cpm on soil; also background is ~300cpm;
		however 3000 cpm of non-smearable contamination is in the
		top of the drive barrel. The elevated levels of contamination
		may be from the Fixed contamination or radon. HPT accounted
		soil @ ~0305hrs; <300cpm. Concern was raised regarding
		using the drive barrel with fixed contamination. Issue
	0350	addressed per Mary Todd, CHL. Drilling continues. @ 0350hrs
		Hg vapors exceed action levels of 0.1. Reading of .58 and
		0.234 for 1 minute. Work stopped by TA Tech. Crew
		leaves zone. Crew may need to work in respirator on next
		shift. Crew off site @ 0500hrs. Will regroup on next
	0500	sh. ft.
		Note collected chemical sample from 3-5.5' @ 0245hrs.

Reported By: Kevin Singleton
Title: Geologist
Date: 8-1-01
Signature:

Reviewed By: DC Weekes
Title: Geologist
Date: 10/19/01
Signature:

BHI-EE-018 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-1 / 8-2-01

Well Name: 10-11-01 ~~HH~~ C3104		Well ID: C3104	
Location: 200 East		Report No.: 2	
Start	**Finish**	**Total**	
Time 2130	Time 0700	Time 9	
Hole/Depth/Csg 6 / 15.2	Hole/Depth/Csg 20.5 / 19	Hole/Depth/Csg 14.5 / 13.8	
Reference Measuring Point: GROUND SURFACE	Casing String No. (1) 2 3 4 _ See Report No. 1		

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew on site @ 2130hrs. Plan of the day and meeting conducted by Russ Fabre. Russ complimented the crew on emergency evacuation procedure regarding detection of Hg vapor above the action level on last shift. Russ requested that each crew member provide a narrative regarding body location prior to the detection. All narratives were submitted to Russ. Many visitors on site; see plan of the day sign in sheet 8-1-01. Safety topics; report injuries, lessons learned; exhaust fans equipment. The RWP was reviewed by Ryder (HPT). A secondary meeting was held with Sheldon to discuss details of the time line of the Hg vapor detection on 8-1-01 AM. RWP reviewed again @ 2231hrs. by HPT. Ed Rafere review emergency evacuation procedure. Added 5.01' of casing; Total string is 10.26. Drilling @ 0040hrs. Collecting spoon from 9.5-12 @ 0110hrs. Adding 5.00' of casing @ 0130hrs. Total string is 15.21'. Note: Team entered zone in Anti-Cs with respirators with Hg carts. All masks were removed / taken off @ 0145hrs.
	2145	Collecting spoon 13-15.5' - Blow counts 105; SMr on bottom of tube. Lunch @ 0230hrs. @ 0310hrs short safety meeting. Waiting on paperwork forward needed for pinky ring. Drill @ 0330hrs. Adding 5.10' @ 0503hrs; total string is 20.21'. 0605hrs; 18-20.5'. Limits of
	0625	RWP exceeded @ 0625hrs; max 27mR/hrs; @ end of shift; should be no greater than 10mR/hr. Sample indicate zero flow / negative pressure in glove bag @ 0635hrs. Crew stopped work; screen samples & HPT in zone; offsite 0700hrs
	~0700	

Reported By: Kevin Singleton		Reviewed By: D C Weekes	
Title: Geologist	Date: 8-2-01	Title: Geologist	Date: 10/19/01
Signature: [signature]		Signature: [signature]	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-26-8-01

Well Name: C3104 ~~NA~~ 10-11-01	Well ID: C3104
Location: 200 East 216-B-38	Report No.: 3

Start	Finish	Total
Time 2130	Time 0710	Time 9hrs 10min
Hole/Depth/Csg 20.5 / 19	Hole/Depth/Csg 36 / 36.8	Hole/Depth/Csg 15.5 / 17.8

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 3 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew on site @ 2130hrs. Plan of the day @ ~ 2132hrs by Ed Rafuse. Topics - operation of HEPA VAC; Mercury vapor monitoring; management review of work @ C3104 - good effort; evacuation plan. Todd review the RWP. Waiting on IH Tech; he is having problems calibrating equipment. IH Tech on site @ 2224hrs. Dressing and preparing to drill @ 2225hrs. Samples and HPT in zone @ ~ 2300hrs to assure small/clean at glass bag. Drilling @ ~ 2315hrs Total string is 20.21'.
	2315	
	2330	@ 2330hrs wind out of the west 5-8mph; Temp ~ 72°F. Adding 5.02
	0023	@ 0023hrs, total casing string is 25.23'. Hole @ 22.5' @ 0047hrs
	0048	Preparing to spoon. Spoon at of hole ~ 0104hrs 22.5-25.0' 100%
		REC. Adding 5.02' of casing; Total string 30.25 @ 0210hrs. Crew
		preparing to leave zone @ ~0215hrs. Lunch 0230hrs. Preparing
		to drill moving drums, equipment & hot soil samples. Drilling @
		~0345hrs. @ 0445hrs. Preparing to drive spoon 28-31.5.
8-3-01		Adding 5.02' of casing @ 0540hrs. Total string 35.27'. Adding
		5.00' of casing total string is 40.27'. Hanford SAND & great drilling
	0450	Depth is 36" @ 0650hrs. Contact between H1 & H2 is 30.5'.
	0700hrs	Crew leaving zone @ ~0700hrs.
		NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 8-3-01	Title: Geologist	Date: 10/19/01
Signature:		Signature:	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-5 & 6-01

Well Name: AA C3104 ✓ 10-11-01	Well ID: C3104
Location: 200 East 216-B-38	Report No.: 4

Start	Finish	Total
Time 2130	Time 0530	Time 6.5
Hole/Depth/Csg 36 / 136.8	Hole/Depth/Csg 60.5 / 58	Hole/Depth/Csg 24.5 / 21.2

Reference Measuring Point: GROUND SURFACE

Casing String No. (1) 2 3 4 _
See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew onsite @ 2130hrs. Plan of the day @ 2131 hrs. by
		Ed RaFuse. Safety topic - A SAFE WORK PLACE; employees
		are valuable resources. Preparing tool kit, moving equipment,
		dress in Anti-Cs @ 2200hrs. IH Tech has equipment problem
		Drilling delayed ~ 30min. Drilling @ ~ 2240hrs. Driving SS @
	1100	1100hrs. Wind out of West 1-5mph @ 2302 hrs; Temp ~ 70°F.
		Total casing string is 48.27'. Wind 0-1 mph From north @
	2355	2320hrs. Adding 4.33' of casing @ 2355hrs. Total string is 44.60'
	0030	Drilled to 45' @ 0030hrs. Contaminate level are declining
	0035	therefore; HPT may decontpost the CA. Crew surveying out @ 0035
		HPTs down posting site. Lunch @ 0245hrs. Site down posted
		and drilling continues @ 0330hrs. Adding 4.67' of casing @ 0400hrs.
		Total string is 49.27'. Driving SS @ 52.0' @ 0415hrs. Adding
		two points of casing @ 0445hrs; 4.37' + 4.63' = total string
	0515	of 58.27'. First casing string set @ 58.00' @ 0515; RoD
		@ 60.5'. The hole will be geophysically logged with the
		spectral gamma tool later today. The logging truck is expected
	0521	out @ 0700hrs
		NA

Reported By: Kevin Simpleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 8-5-01	Title: Geologist	Date: 10/9/01
Signature: [signature]		Signature: DC Weekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-6 & 7-01

Well Name: ~~NA~~ C3104 8-10-01	Well ID: C3104
Location: 200 East 216-B-38	Report No.: 5

Start	Finish	Total
Time 2130	Time 0800	Time 10
Hole/Depth/Csg 60.5 / 0	Hole/Depth/Csg 112 / 111	Hole/Depth/Csg 51.5 / 111

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 (2) 3 4 _
See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew onsite @ 2130hrs. Plan of the day @ 2136hrs by Ed RoFuso
		Geophysical logging of the 1st string (casing) was completed during the day
		shift - set @ 58'. Ed assumed job responsibilities for site workers
		Run casing - string #2, H&S Monitoring, change drive head, decon,
	2145	drill, sample. Preparing to drill @ 2145hrs. Down sized hole &
		casing - completed @ 2340hrs. 2nd string is 8" ID (0.65' ID
		0.72' O.D.). Total string is 1.08' Head + 1.00 Shoe + 10.02
		10.01 + 10.01 + 10.01 + 10.00 + 10.00 + 3.01 = 67.14'. Drilling
		commenced @ 2345hrs. Wind out of the north ~15-20 mph, Temp
		~70°F. Adding 5.00' of 8" ID casing @ 0001hrs. Total string is
		72.14. Adding 5.00' @ 0025hrs, Total string is 77.14. Adding
	0047	5.00' @ 0047hrs, total string is 82.14, hole @ 78. Adding
		5.00', total string is 87.14 @ 0120hrs. Adding 5.0' of 8" casing
		0155, Total string is 92.14', hole @ 90' @ 0225hrs. Lunch -
		Drilling @ 0315hrs. @ 0330hrs adding 5.0' of 8" ID,
		Total string is 97.14'. Collecting split-spoon sample (92.5-100)
		@ 0400hrs. Adding 5.0' of casing @ 0415hrs, Total string is 102.14
		Adding 5.0' of casing @ 0445hrs, Total string is 107.14. Setting
		casing with last 8" joint (5.0'), Total string is 112.14
		Hole @ 112.0 0555hrs - most of the crew is out of the zone.
		Geophysical logging is scheduled @ 1600hrs. Logging crew in
		zone @ 0630hrs (Steve Los). Singleton witness logging
		pre-check - for moisture tool until 0900hrs. OFF-SITE
	0900	@ 0900hrs.

Reported By: Kevin Singleton		Reviewed By: DC Ukeeles	
Title: Geologist	Date: 8-7-01	Title: Geologist	Date: 10/19/01
Signature: [signature]		Signature: DC Ukeeles	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-7&8-01

Well Name: ~~HA~~ C3104 10-4-01
Well ID: C3104
Location: 200 East 216-B-38
Report No.: 6

Start	Finish	Total
Time 2130	Time 0800	Time 10
Hole/Depth/Csg 112 / 0	Hole/Depth/Csg 177 / 175.5	Hole/Depth/Csg 65 / 175.5

Reference Measuring Point: GROUND SURFACE
Casing String No. 1 2 (3) 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew onsite @ 2130hrs. Plan of the day @ 2140hrs by Ed Rafuse; delay by HPTs; Job scope covered by Ed; other topics extention cord safety. Crew preparing to run/down size to 6" casing
		Downsizing @~2210hrs - Drilling commences @ 2320hrs. Total
		6" ID casing is 116.80'. Adding 5.00' of 6" casing @ 2355hrs; Total string
		is 121.80'. Adding 5.0' @ 0022hrs. - Total casing is 126.80. Adding
	0050	5.00' of 6" casing; Total casing is 131.80'. hole @ ~127' @ 0050hrs
		Adding pipe @ 0130hrs (5.00'); total string is 137.80'. Total casing is
		141.80 - Added 5.00' of pipe. Hole @ 138' - 0200hrs. Adding 5.00' of 6";
		total string is 146.80 @ 0225hrs; hole @ 143 - Lunch.
		Drilling continues @ 0310hrs. Collecting split spoon 147.5-150 @
	0300hrs	0330hrs. Adding 5' of 6" casing @ 0340hrs; string is 154.80. Adding
		5.0' @ 0405hrs; total string is 156.80. + 5' of casing @ 0430
		hrs. total string is 161.80'. + 5' of 0500hrs. total string is
		166.80. + 5' of casing; total string is 171.80. @ 0700hrs hole
		@ 176'; adding 5.00' of 6". Total string is 176.80.
	0720	Crew completed drill during shift @ 0720hrs. Moving equipment

NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 08-8-01	Title: Geologist	Date: 10/19/01
Signature: [signature]		Signature: DC Weekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-8 & 9-01

Well Name: C3104	Well ID: C3104
Location: 200 East 216-B-38	Report No.: 7

Start	Finish	Total
Time 2130	Time 0800	Time 10
Hole/Depth/Csg ~~175.5~~ 177 / 175.5	Hole/Depth/Csg 224 / 222.5	Hole/Depth/Csg 48 / 47

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 (3) 4 _
See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew onsite @ 2130. Plan of the day conducted by Ed
		RaFase. Job scope include; drilling, sampling, decon, measure
		water level in nearby wells. Safety topics; weather, heat
	2145.	stroke. Drilling commenced @ 2150 hrs. Drilling stopped @
		2152 hrs by K.M. Singleton as directed by Ed RaFase.
		Drilling stopped as IH Tech having equipment problems
	2255	(locking spanners). Ed provides the OK to proceed with drilling
		with AM-PM IH coverage. Drilling @ 2257 hrs. Adding 5.00'
		of 6" casing; Total string is 181.80. IH Tech onsite @ 0002 hrs
		Depth to 185' @ 0012 hrs; adding 5.00' of casing - total
		string is 186.80'. @ 0110 hrs adding 5.00' of casing; total
		string is 191.80. @ 0150 adding 5.00' of casing; total string
		is 196.80. - 0230 hrs Lunch - Drilling continues @ 0303 hrs
		Drill split spoon for chem. sample @ 0310 hrs. Adding
		5.00' @ 0330 hrs. Total string is 201.80. Adding more pipe (5.00')
		@ 0415 hrs total string is 206.80. Adding more pipe (5.00')
		@ 0500 hrs; total string is 211.80. Hole is @ 207'. Hole @
		215 @ 0605 hrs; adding 5.00' of 6" casing; Total string is 216.80'
	0650	@ 0650 hole to 217.5; adding 5.00' of casing; Total string
	0745	is 221.80'. Adding 5.00' of casing @ 0745 hrs; Total string
		is 226.80. Hole @ 224'
		NA

Reported By: Kevin Singleton		Reviewed By: DCWeekes	
Title: Geologist	Date: 8-9-01	Title: Geologist	Date: 10/19/01
Signature:		Signature:	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 2
Date: 8-9 & 10-01

Well Name: ~~AA~~ C3104	Well ID: C3104
Location: 200 East 216-B-38	Report No.: 8

Start	Finish	Total
Time 2130 hrs	Time 0700	Time 9
Hole/Depth/Csg 224 / 222.5	Hole/Depth/Csg 263.5 / 258.6	Hole/Depth/Csg 39.5 / 37.1

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 (3) 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew mtg @ 2130hrs. Ed Rafuse presented the plan of the day.
		Scope includes, drilling, sampling, monitoring, inventory sampling
		equipment. Ed reviewed changes to the H&S Plan. Preparing to
	2146	drill @ 2146hrs. Drilling @ 2200hrs. Borehole to 228' @ 2250hrs
		- adding 5.00' of 6" casing; total casing string is 231.80. Hole to
		34.5' @ 2330hrs. Adding 5.00' of 6" casing. Total string is 236.80
		Borehole to 240' @ 0034hrs; adding 5.0' of 6" casing; total string is 241.80
		Borehole to 244' @ 0145hrs.; adding 5.0' of 6" casing; Total string is
		246.80'. Lunch @ 0230hrs. Drilling continues @ 0305hrs.
	0310	Hole to 250' @ 0330hrs. Adding 5.0' of casing; Total casing
	0436	string is 251.80. Hole @ 255'; Adding 5.00' @ 0430hrs.
		Total string is 256.80. Hole to 260' @ 0530hrs. Adding
		5.00' of casing; Total string is 261.80. Driving split spoon
	0600	@ 0600hrs. From 261.0-263.5. End of shoe is wet.
		Drilling is done. Great job team. Water table @ 263'
		Note: Geology BACKFILL 0-15
		Hanford Gravel 15-30.5'
		Hanford Sand 30.5-218.5
		HF/PPU? 218.5
		water table 263' below ground surface.
		AA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 8-10-01	Title: Geologist	Date: 10/19/01
Signature: [signature]		Signature: DC Weekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
TUBULAR GOODS TALLY

Page 2 of 2
Date: 8-10-01

Well Name: NA C3104 ~~C3103~~ Well I.D.: C3104

String #1 TEMPORARY		String #2		String #3 ~~PERMANENT~~ Temporary						~~SCREEN/GAP~~ NA		
Jt.#	Length (ft.)	Jt.#	Length (ft.)	Jt.#	Length (ft.)	C	Jt.#	Length (ft.)	C	Jt.#	Length (ft.)	Jt.#
1	0.38 head	21	1.08 head	1	~~0.55~~ 1.00 head		21	5.00		1	5.00	
2	0.82 shoe	22	1.06 shoe	2	1.00 shoe		22	5.00		2	5.00	25.80
3	4.00	23	10.07	3	9.95		23	5.00		3	5.00	
4	5.01	24	10.01	4	9.94		24	5.00		4		
5	5.00	25	10.01	5	9.92		25	5.00		5		
6	5.00	26	10.01	6	10.00		26	5.00		6		
7	5.02	27	10.00	7	10.00		27	5.00	181.8	7		
8	5.02	28	10.00	8	9.95		28	5.00		8		
9	5.02	29	5.01	9	10.00		29	5.00		9		
10	5.00	30	5.00	10	10.00		30	5.00		10		
11	4.33	31	5.00	11	10.02		31	5.00		11		
12	4.67	32	5.00	12	10.00		32	5.00		12		
13	4.37	33	5.00	13	10.00		33	5.00	214.80	13		
14	4.63	34	5.00	14	5.02		34	5.00		14		
15		35	5.00	15	5.00		35	5.00		15		
16		36	5.00	16	5.00		36	5.00	246.8	16		
17		37	5.00	17	5.00		37	5.00		17		
18		38	5.00	18	5.00		38	5.06		18		
19		39		19	5.00		39	5.00		19		
20		40		20	5.00		40	5.00	276.80	20		
Tot	58.27	Tot	112.14	Tot	→		Tot	276.80		Tot	261	80

*Indicate those joints with centralizers with a C in the available box.
ALL casing length shall be measured to the nearest 0.01 ft.

Comments/Remarks:
None

Temporary: O.D./I.D. Permanent: O.D./I.D. NA Screen: O.D./I.D. NA

String #1 0.87' ID, 0.98' O.D
String #2 0.63' ID, 0.72' OD
String #3 ~~0.55 ID~~ 0.42 ID, 0.55 O.D 8-8-01
NA

Reported By: Kevin Singleton		Reviewed By: DC Akeks	
Title: Geologist	Date: 8-10-01	Title: Geologist	Date: 10/19/01
Signature:		Signature: DC Akeks	

BHI-EE-182 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8/13 → 8/14/01

Well Name: NA C3104 10-11-01	Well ID: C 3104
Location: 200 East / 216-B-38	Report No.: 9 10/9/01

Start	Finish	Total
Time 2130	Time 0800	Time 10 hrs
Hole/Depth/Csg NA —	Hole/Depth/Csg NA —	Hole/Depth/Csg NA —

Reference Measuring Point: GROUND SURFACE
Casing String No. 1 2 3 4
See Report No. 1 Borehole Abandonment

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130	2150	Plan of the Day held at the site trailer. Led by E. Refuse, BHI-STR
2150		Resume backpull of the 6" temporary casing, and backfilling with bentonite chips. See Well Completion Log sheets for details. Shift begins with 6" casing shoe 228 feet below ground surface.
2230 tom		Switch from bentonite chips (medium) to bentonite crumbles (Cetco granular bentonite crumbles #8)
	8-14 0125	All 6" temporary casing out of the ground. Bentonite crumbles up into the 8" temp. casing, which is set 111' bgs.
0200		Begin backpulling the 8" casing, backfilling with bentonite crumbles.
0230	0300	Lunch break.
	0500	All 8" temp. casing is out of the ground. The granular bentonite is at 57.9' bgs – the 12" casing is set at 58' bgs. Drill crew secures the drill site. The crew then works to set up the drill rig at the next TW-2 borehole (a different rig than is set up at C3104)
	0600	Walker leaving site. The crew will continue setting up to 0800.
		NA →

Reported By: L. D. Walker		Reviewed By: Kevin Singleton	
Title: Geologist	Date: 8-14-01	Title: Geologist	Date: 10-11-01
Signature:		Signature:	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 9/6 & 7/01

Well Name: C3104
Well ID: C3104
Location: 216-B-38 Trench
Report No.: # 10 dtd 10/9/01

Start	Finish	Total
Time 2130	Time 0340	Time ~7.0
Hole/Depth/Csg 57.8 / 57.77	Hole/Depth/Csg NA / NA	Hole/Depth/Csg ~~4.63 / 53.44~~ NA 10-4-01

Reference Measuring Point: GROUND SURFACE
Casing String No. (1) 2 3 4 _
See Report No. 1

Weather 50's, Wind 30's mph

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130	2200	POD. Work for Saturday Possible. Ed working details.
		Back Pull B-38 12" Casing tonight.
2200	2355	Prep for back pulling: Reposition drill rig, bentonite chips,
		pallets for Casing, steaving for casing, rags from 7A CA zone,
		Assemble knocker head
2355	0215	Begin back pulling & continue back pulling
0215	0255	Lunch
0310	0340	Continue Back Pulling
0340		Stop work due to chipped cloth on Spudding Arm.
		Causing dangerous work environment and not able to pull
		Casing.
		Summary
		1) Pull 4.63' of casing
		2) Back filled 11.5' with Bentonite Chips
		3) Work cut short by unsafe mechanical equipment
		& unable to continue to pull casing effectively.
		NA

Reported By: Greg Thomas		Reviewed By: Kevin Singleton	
Title: Geologist	Date: 9/7/01	Title: Geologist	Date: 10-4-01
Signature: Greg Thomas		Signature: [signature]	

FIELD ACTIVITY REPORT- DAILY DRILLING

~~Continuation Page~~ 9-10-01

Page 1 of 1

Date: 9-10-01

Well Name: C3104	Well ID: C3104
Location: 200 East 216-B-38	~~Continuation~~ Report No.: ~~12~~ 11

Time/Depth From	To	Description of Activities/Operations with Depth
2130		Crew onsite @ 2130hrs. Wind 0-3mph out of the west. Temperature ~ 65°F. The drive hammer was not successful in driving casing to depth. The rig @ C3103 is down - replacement part as need. Crew thus far planning to backpull 1st casing string @ 216-B-38. Because of contamination control concern, the drill string will be replace; portions of the rig with serviable contamination will also be decomed. Drillers off site @ 2150hrs. obtaining equipment casing cutter, new drilling stem, other. Will backpull @ B-38 if all goes well. Switching out cable tool rigs
	2200	C-B38 & B-31.
		Backpulling @ 216-B-38 @ 0715hrs. Casing @ 48.99';
	0800	Fill @ 39.5' @ end of shift.

NA

Reported By: Kevin Singleton		Reviewed By: DC Ubelaker	
Title: Geologist	Date: 9-10-01	Title: Geologist	Date: 10/9/01
Signature:		Signature:	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 3
Date: 9-12-01

Well Name: ~~NA~~ C3104 10-11-01	Well ID: C3104
Location: 200E 216-B-38 Trench	Report No.: ~~13~~ 12

Start	Finish	Total
Time 2130	Time 0200	Time 4.5
Hole/Depth/Csg 0 / 0	Hole/Depth/Csg 0 / 0	Hole/Depth/Csg 0 / 0

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 3 4 _
See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew on site @ 2130 hrs. POD conducted by Ed Rafuse.
		Reviewed heightened security measures on the Hanford Site.
		Access to the outer areas is only by the Yakima & Wye
		barricades. Will be backfilling @ 216-B-38.
		Crew will be working in a contamination (CA) area. HPT accessible
	2310	RWP for the scope of this activity. Crew dressed and in gear @ 2310 hrs.
		-Full with Cs-110 respirators. Backfilling @ 2312 hrs. Wind out of the
		west 0-3 mph, Temperature ~ 67°F. Hole is being abandoned with
		bentonite. Pipe to 14'-4½" is clean, contaminated pipe from 8.19'-
TB	0030 ~~+2.30 hr~~	24 is con. Pipe will be put in plastic sleeves. All pipe out
		of hole @ 0148. Cement from 2.5-20 below current
		ground surface - 2' of pad (gravel drill pad) will be
		removed later. A survey marker was added to the
	0155	step of the cement.
		NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-13-01	Title: Geologist	Date: 10/23/01
Signature:		Signature: DC Weekes	

BHI-EE-018 (12/97)

WELL COMPLETION LOG

Page 1 of 5 Date: 8-13-01

Well Name: ~~NA~~ C3104 10-1-01 | Well ID: C3104

Project: 200-TW-2 | Location: 200 East 216-B-38 | Drilling Contractor: RST

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Amt	Unit	Comments
2350	266.80	7.3	259.5	269.4	NA	NA	~~264.4~~ 262.1	2.6	SAND 20-40	1	1 Bag	Water Table c 263'
0000	266.8	7.3	259.5	263.0			255.7	11.1				263-252.9 Fill c SAND
-5 0006	266.8	8.0	~~257.8~~ 257.8	265.6			256.6	1.20	SAND	1	Bag	
0012	261.8			254.2								
-5 0020	261.8	9.0	252.8	261.9			252.9	0.1	cement	6	Bags	Change added 0 0440hrs
-5 0510 ~~0530~~	256.8	4.0	252.8	~235.5			231.5	21.3				Running Tremie
0557	241.8	5.4	236.4	–			–	–	crumble	1/2	Bag	
-5 0605	241.8	5.4	236.4	239.10			233.7	2.7	crumble	1/2	Bag	
0640	236.8	4.0	232.8	237.0			233	0.2	–	–	–	
0705	236.8	7.0	229.8	237.0			230	0.2	–	–	–	
0715	236.8	8.7	228.1	237.1 ~~236.8~~			228.5 ~~228.1~~	0.3 ~~0.6~~	–	–	–	
2155	236.8	8.7	228.1	233.9			225.2	2.9	Bentonite chips	1	50-lbs bag	Add bentonite
2200	236.8	9.5	227.3	236.1			226.6	0.7	NA			Pull casing
2210	231.8	5.2	226.6	221.9			216.7	9.9	Bent. chips	4	50-lb. bag	Remove 5.0' casing / Add bent
2225	226.8	5.5	221.3	230.0			224.5	-3.2	NA			Pull / remove 5.0'
2235	226.8	5.5	221.3	203.2			197.7	23.6	bent crumbles	10	50-lbs bag	Add bentonite
2240	221.8	5.6	216.2	208.9			203.3	12.9	NA			Pull / remove 5.0' casing
2248	216.8	5.2	211.6	210.2			205.0	6.6	NA			Pull / remove 5.0'
2310	216.8	5.2	211.6	190.8			185.6	26.0	bent. crumbles	5	50-lbs bag	Add bentonite

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: L.D. Walker | Reviewed By: Kevin Singleton

Title: Geologist | Date: 8-13-01 | Title: Geologist | Date: 10-1-01

Signature: L D Walker | Signature:

BHI-EE-179 (12/97)

WELL COMPLETION LOG

Page 2 of 5 Date: 8-13-01

Well Name: ~~NA~~ C3104 10-11-01 | Well ID: C3104

Project: 200 - TW - 2 | Location: 200 East ; 216-B-38 trench | Drilling Contractor: RSI

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Amt	Unit	Comments
2320	201.8	5.6	196.2	195.9	NA	NA	190.3	5.9	NA			Pull / remove 15.0' casing
2325	201.8	5.6	196.2	172.2			166.6	29.6	bent. crumbles	6	50-lbs bag	Add bentonite
2335	186.8	5.5	176.3	178.1			172.6	3.7	NA			Pull / remove 20.0'
2341	181.8	5.5	176.3	146.7			141.2	35.1	bent. crumb.	8	50-lb. bag	Add bentonite
2355	161.8	5.5	156.3	153.3			147.8	8.5	NA			Pull / remove 20.0'
8-14-01 0015	161.8	5.5	156.3	132.8			127.3	29.0	bent. crumb.	5	50-lbs bag	Add bentonite
0025	141.8	5.7	136.1	139.0			133.3	2.8	NA			Pull / remove 20.0'
0030	141.8	5.7	136.1	107.3			101.6	34.5	bent. crumbles	8	50-lbs bag	Add bentonite
0041	121.8	5.6	116.2	117.0			111.4	4.8	NA			Pull / remove 20.0'
0045	121.8	5.6	116.2	92.4			86.8	29.4	bent. crumb.	6	50-lbs bag	Add bentonite
0125	All 6" out of borehole.											Pull / remove all 6" casing
0200	112.1	1.1	111.0	99.7			98.6	12.4	NA			8" Casing
0202	112.1	1.1	111.0	94.5			93.4	17.6	bent. crumbles	2 1/2	50-lbs bag	Add bentonite
0214	102.1	2.6	99.5	99.0			96.4	3.1	NA			Pull / remove ~~5.0~~ 10.0' in casing
0310	102.1	2.6	99.5	77.3			74.7	24.8	bent. crumbles	10	50-lbs bag	Add bentonite
0330	92.1	4.2	87.9	85.5			81.3	6.6	NA			Pull / remove 10.0'
0336	92.1	4.2	87.9	63.7			59.5	28.4	bent. crumb.	10	50-lbs bag	Add bentonite
0345	82.1	3.0	79.1	66.7			63.7	15.4	NA			Pull / remove 10.0'
0355	77.1	3.3	73.8	68.0			64.7	9.1	NA			Pull / remove 5.0'

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: L. D. Walker | Reviewed By: Kevin Singleton

Title: Geologist | Date: 8-14-01 | Title: Geologist | Date: 10-11-01

Signature: [signature] | Signature: [signature]

BHI-EE-179 (12/97)

WELL COMPLETION LOG

Page 5 of 5 (ACH 10/19/01)

Date: 8-14-01

Well Name: ~~NA~~ C3104 ~~C~~ C3104 (10-11-01)

Well ID: C3104

Project: 200 - TW - 2

Location: 200 East / 216-B-38 trench

Drilling Contractor: RSI

1. Time	2. Total Casing	3. Stkup	4. Btm Cag	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Amt	Unit	Comments
0400	72.1	3.1	69.0	68.3	NA	NA	65.2	3.8	NA	—	—	Pull / remove 5.0' casing
0403	72.1	3.1	69.0	64.2			61.1	7.9	Bentonite Crumbles	2	50-lbs bag	Add bentonite
0405	67.1	3.2	63.9	65.1			61.9	2.0	NA	—	—	Pull / remove 5.0'
0410	67.1	3.2	63.9	60.7			57.5	6.4	bent. crumb.	2	50-lbs bag	Add bentonite
0415	62.1	3.9	58.2	62.9			59.0	-0.8	NA	—	—	Pull / remove 5.0'
0416	62.1	3.9	58.2	(NM)			—	—	bent. crumb	1	50-lbs bag	Add bentonite
0500	All 8" Casing out of ground											Remove all 8" casing
0501	58.3	0.3	58.0	58.2			57.9	0.1	NA	—	—	12" casing

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: L.D. Walker

Title: Geologist

Date: 10/19/01

Signature: DC Weekes for L.D. Walker

Reviewed By: DC Weekes

Title: Geologist

Date: 10/19/01

Signature: DC Weekes

BHI-EE-179 (12/97)

WELL COMPLETION LOG

Page 4 of 5 Date: 9/6-7/01

Well Name: C3104 | Well ID: C3104

Project: 200-TW-2- | Location: 200 E 216-B-38 | Drilling Contractor: RSI

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Amt	Unit	Comments
0019	63.27	5.5	57.77	63.3		63.3	57.8					
0028	63.27	6.5	57.77	50.0		50.0	44.5	13.27	bentonite chips	12	bags	
0130	53.64	.3	53.64	46.1		46.1	45.8	7.84				Removed 4.6' of casing & knocked head 5'
0340	53.64	4.0	49.64	50.3		50.3	46.3	3.34				
End of shift Friday AM the 7th September												
0720	53.64	4.0	49.64	42.7		42.7	38.7	10.9	bentonite chip	8	bags	
0745	49.19	0.2	48.99	39.7		39.7	39.5	9.2				
2340	44.12	0.2	43.92	40.4		40.4	40.2	3.72	bentonite chips	33	bags	9-7-01 2312 backfilling
0000	44.12	0.2	43.92	1.2		1.2	1.0	42.92		1	bag	
0002	44.12	0.6	43.52	1.2		1.2	0.6	42.92		3	bags	9-13-01 0002 AM
0015	44.12	2.0	42.12	0.4	pipe is bent.	0.4	0.4'	43.72	—	—	—	Fill 30.4' below top of casing
0030	39.12	.02	38.92	—	—	—	—	—	—	—	—	
0035	34.12	0.3	33.82	—	—	—	—	—	—	—	—	
0041	29.12	0.5	28.62	2.5		2.5	2.0'	26.62	—	—	—	
0054	24.12	0.3	23.82	—	—	—	—	—	—	—	—	
0100	19.12	0.3	18.82									
0110	14.12	0.3	13.82	6.3		6.3	6.0	7.82'				
0120	9.12	0.4	8.72	7.1		7.1	6.7	2.02	bentonite chip	4	bags	

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Greg Thomas | Reviewed By: Kevin Singleton

Title: Geologist | Date: 9/7/01 | Title: Geologist | Date: 10-11-01

Signature: Greg Thomas | Signature:

BHI-EE-179 (12/97)

WELL COMPLETION LOG

Page 5 of 7 Date: 9-12-01

Well Name: C3104 Well ID: C3104

Project: 200-TW-2 Location: 200 East 216-B-38 Drilling Contractor: RSI

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
0129	9.12	.04	8.72	2.9		2.9	2.5	6.62				
0131	4.12	0.3	3.8	–	–	–	–	–	bentonite chips	1	bag	
0140	4.12	0.3	3.8	4.0	–	4.0	3.7	0.1				
0145	0	0	0	–	–	–	-3.7	–	bentonite	1	bag	
0150	–	–	–	–	–	–	-2.5	–	cement	1	bag	
0155	–	–	–	–	–	–	2.0	–	–	–	–	Cement to 2' below ground surface, survey marker also add. 2' of gravel drill pad will be removed later in the year. The survey mark for C3104 will be at the surface

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Kevin Singleton Reviewed By: DC Weekes

Title: Geologist Date: 9-13-01 Title: Geologist Date: 10/19/01

Signature: Signature: DC Weekes

BHI-EE-179 (12/97)

Appendix A – Borehole Geologic Logs

WELL SUMMARY SHEET

Page 1 of 1
Date: 10-02-01

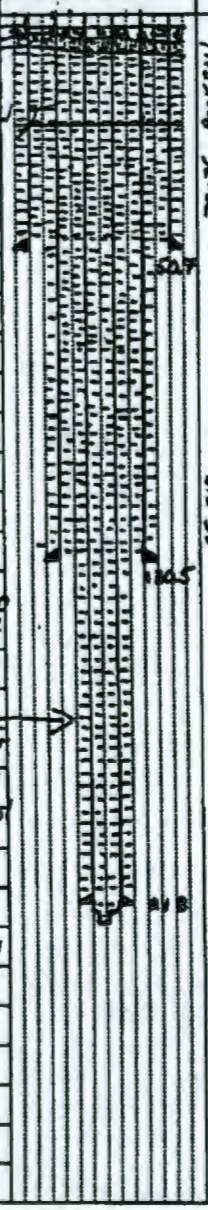
Well ID: C3103	Well Name: C3103
Location: 200 East -216-B-7A	Project: 200-TW-2
Prepared By: Kevin Singleton Date: 10-2-01	Reviewed By: DC Weekes Date: 10/11/01
Signature:	Signature: DC Weekes

CONSTRUCTION DATA

Description

12" ID, 10 3/4" OD to 50.7'
8" ID, 8 5/8 OD casing to 130.5
with shoe hole is 9".
6" ID, 6 5/8" OD casing to 218'
6 5/8" hole to 219'
4" hole 219-222.5'.
All casing was removed from hole.
0'-23' Backfill
23'-35 Hanford Formation Sand Gravel Dominated Sequence
35'-218' Hanford Formation Sand Dominated Sequence
218'-222.5' Hanford Formation Plio-Pleistocene Unit-Silt
Hole backfill with bentonite from 222.5'-3.3'
Cement from 3.3'-2.0'
Gravel 0'-2.0'
All depths in feet below ground surface.

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 50, 100, 150, 200, 250

Graphic Log

Lithologic Description

0-2.5 Gravel
2.5-35 Silty Sandy Gravel
35-40 Gravelly Silty Sand
40-168.5 Sand
128.5 Silty Sand Stringer
168.5-168.0 Silty Sand
168.0-180 Slightly Silty Sand
180-218 Sand
218-222.5 Silt
END OF HOLE = 222.5'

BHI-EE-189 (12/97)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 8-21-01
Finish Date: 10-2-01
Page 1 of 1

Well ID: C3103 | Well Name: C3103 | Approximate Location: 200 East 216-B-7A Crib
Project: 200-TW-2 | Other Companies: CHI
Drilling Company: R.S.I | Geologist(s): Kevin Singleton, Greg Thomas
Driller: Morris Wraspir | License #: 1909

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
* 6 5/8 OD Thread	0 - 56.5	7" OD
11 3/4" OD Thread	0 - 50.7'	
8 5/8 OD Thread	0 - 130.5'	9" OD
6 5/8 OD Thread	0 - 218'	7" OD
	-	

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

DRILLING METHOD

~~Auger~~	Cable tool
Cable Tool:	✓
~~Air Rotary:~~	Cable tool
~~AB Sonic:~~	Cable tool
Diesel hammer →	

HOLE DIAMETER (in) / INTERVAL (ft)

Diameter	From	to
7"	0	56.5
9"	56.5	137.5
7"	137.5	222.5
4"	218'	222.5
11 3/4	0	50.75

Drilling Fluid: None Used
Total Drilled Depth: 222.5 | Hole Dia @ TD: 7"
Total Amt. Of Water Added During Drilling: None Used
Well Straightness Test Results: NA | Static Water Level: NA | Date: NA

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma/Neutron Moisture	0 - 56.5	8-28-01	NA	-	
Spectral Gamma/Neutron Moisture	56.5 - 137.5	9-24-01	NA	-	
Spectral Gamma/Neutron Moisture	137.5 - 222.5	9-27-01	NA	-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval (Annular Seal/Filter Pack)	Volume	Mesh Size
	-				-		
	-				-		
	-			NA	-		
	-				-		
	-				-		

OTHER ACTIVITIES

Aquifer Test: NA | Date:
Well Decommission: Yes: ✓ No: | Date: 10-2-01
Description:
Description: 222.5'-3.3' Bentonite, 3.3'-2.0' Cement

WELL SURVEY DATA (if applicable)

Protective Casing Elevation: NA
Washington State Plane Coordinates:
Brass Survey Marker Elevation: NA

COMMENTS/REMARKS

* 6 5/8" Drilled to 56.5' and removed. Used diesel hammer as a core push to advance borehole to 50.7' with 11 3/4" casing. All casing was removed from borehole after reaching total depth.

Reported By: Kevin Singleton | Title: Geologist | Signature: [signature] | Date: 9-17-01

Original to: Document & Information Services, H0-09/HWIS
Distribution by DIS: Environmental Technologies Well Coordinator, H0-02

BHI-EE-161 (07/27/2001)

BOREHOLE LOG 0540402

Page 1 of 8
Date: 8-22-01

Well ID: C3103
Well Name: C3103 ~~NA~~ MCN 10/23/01
Location: 200 East 216-B-7A
Project: 200-TW-2
Reference Measuring Point: ground

Depth (FL)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0	DB			0-0.5 Crushed BASALT GRAVEL-CP-ANG	Soil adjacent to
				0.5-2.5 BASALT Boulder >600mm	boulder is SSG
	SS 2.5-5.0	100% RCY		2.5-7.0 SILTY SANDY GRAVEL 10YR5/3 brown, moist	
5	DB			strong RX, very poorly sorted, 50% GRAVEL	
	5.5-8.0 SS	100% RCY		40% SAND, 10% Silt, mainly mp-vcp, ms-cs-basalt	
				MPS, 55mm	
	DB			7.0-12.0 Slightly SILTY GRAVELLY SAND	
10	SS 10-12.5	109 Blows 50% RCY		10YR5/3, brown, moist, Strong RX, mod sorted	
				80% SAND, 10% GRAVEL, 10% Silt, mainly	
	SS 12.5-15.0	73 Blows 50% RCY		ms-cs; vep to Ep; 60-70% Basalt, 30-40% others	
				MPS 30mm.	
15	DB			12-21 SILTY SANDY GRAVEL, 10YR5/3 brown, very	
				poorly sorted, moist	
				strong RX, 60% SAND, 25% GRAVEL, 15% Silt	
	18.5-21.0 SS	50% RCY		FS-CS; mp-cp, round, mainly basalt (80%)	
20				Wood @ 21'	
					BACKFILL 0-23'
	DB	wet		21-25 SILTY SANDY GRAVEL, 10YR3/2	HANFORD GRAVEL @23'
	SS 22.5-25.0	100% RCY		very dark grayish	
				brown, VPS, wood from 21'-23', very moist, <	
25		wet		saturated; wood is wet, RX none @23; coarse-	
	25.0-27.5 SS	100% RCY		white-non carbonate in matrix, 50% SAND	DB-Drive barrel
				30-35% GRAVEL, 15-20% Silt, ms-vcs;	SS-Split spoon
				FP-MP, MPS 50mm	

Reported By: Kevin Singleton
Title: Geologist
Signature: [signature] Date: 8-24-01

Reviewed By: DC Weekes
Title: Geologist
Signature: [signature] Date: 10/23/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 2 of 8
Date: 8-26-01

Well ID: C3103 | Well Name: ~~C3103~~ C3103 | Location: 200-East 216-B-7A
Project: 200-TW-2 | Reference Measuring Point: Ground

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
30	DB			25-27.5 Silty Sandy Gravel, 10YR3/2, very dark grayish brown,	
	30.0 – 32.5 SS	50% RCY		vps, wet 25'-26'; sample make Fe in mL H_2O	
	DB			No RX, 50% Sand, 30-35% Gravel, 15-20%	
				Silt, mostly ms-vcs; Fp-mp. MPS 50mm, mainly	basalt?
35	35.0 – 37.5 SS	75% RCY		27.5-35 Silty Sandy Gravel, 10YR3/2, very	
	DB			dark grayish brown	
				vps, moist, 65% Sand, 25-30% Gravel	
				5-10% Silt, Weak RX, mainly ms-cs; Fp-mp	
40				MPS 40mm; Mainly Basalt	
				35-40 Gravelly Silty Sand, 10YR5/3	
				brown, moist, 75% Sand, 13% Gravel, 12%	
45				Silt, fs-ms; cp MPS 32mm	
				40-45 Sand, 10YR5/3, brown, moist	
				med. sorted, 90% Sand, 10% other	
	48.0 – 50.2 SS			mostly ms-cs, No RX, MPS 10mm	
50	DB			45-50 Sand, 10YR5/2, grayish brown	
				med to poorly sorted, No RX, dry	
				90% Sand, 10% others, mainly ms-vcs;	
				Fp, MPS 10mm	
55					

Reported By: Kevin Singleton | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: [signature] | Date: 8-27-01 | Signature: DC Weekes | Date: 10/23/01

BHI-EE-183 (12/97)

Appendix A – Borehole Geologic Logs

BOREHOLE LOG

Page 3 of 8
Date: 8-27-01

Well ID: C3103
Well Name: C3103
Location: 200E-216-B-7A
Project: 200-TW-2
Reference Measuring Point: ground

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	PNNL Grab			50-56.5 SAND, 10YR4/2, dark grayish brown, weak-strong RX, moist well-mod sorted, 90-95% SAND, 5-10% other 80-90% BASALT, 10-20% other, very loose, weakly cemented, ms-cs, MPS 6mm	
	DB				
65				56.5-87 SAND, 10YR4/2, dark grayish brown, weak-mod RX, dry-moist, mod sorted, 90-95% SAND, mostly vcs-ms, 5% other, MPS 7mm, weakly cemented, 60-70% mafic, 30-40% other	9-21-01 start
70	PNNL Grab				
	DB				
	SS 72.5-75.0	100% Rcy			
75	DB				
80	PNNL Grab				
	DB				
85					

Reported By: Kevin Singleton
Title: Geologist
Signature: [signature] Date: 9-22-01

Reviewed By: DC Ubekes
Title: Geologist
Signature: DC Ubekes Date: 10/23/01

BOREHOLE LOG

Page 4 of 8
Date: 9-21-01

Well ID: C3103
Well Name: ~~NA~~ RCN 10/23/01 C3103
Location: 200 E 216-B-7A
Project: 200-TW-2
Reference Measuring Point: Ground

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	PNNL			87-116' SAND, 10YR4/2 dark grayish brown, wet RX, moist, mod sorted, 95% SAND, cs-ms, 5% other, MPS 4mm	
		RCN 10-2-01		60% Basalt - 40% other, MPS 4mm	
85					
90	PNNL sample				
95				Fe/Mg staining in split spoon sample	
	97.5 - 100	100% RCY 85 blow count			
100					
105					

Reported By: Kevin Singleton
Title: Geologist
Signature: [signature]
Date: 9-21-01

Reviewed By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 10/23/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 5 of 8
Date: 9-25-01

Well ID: C3103 | Well Name: ~~AA~~ NEW C3103 10/23/01 | Location: 200 East 216-B-7A
Project: 200-TW-2 | Reference Measuring Point: Ground

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
110	PNNL Sample			87-116' SAND, 10YR 4/2 dark grayish brown, weak RX, moist, mod sorted, 95% SAND, cs-ms, 5% other, 60% Basalt, 40% other, MPS 4mm	
					End 9-21-01 @ 1111
115				116-150' SAND, 10YR 3/3, dark brown weak to no RX, moist, mod sorted 97% SAND, 3% other, SAND main cs-ms, some vcs, 70% Basalt, 30% other, MPS 4mm	
120	PNNL				
125					
130	PNNL			@ 130 SAND vcs to ms	
135					

Reported By: Kevin Singleton | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: [signature] Date: 9-25-01 | Signature: DC Weekes Date: 10/23/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 6 of 8
Date: 9-25-01

Well ID: C3103 | Well Name: C3103 | Location: 200 East
Project: 200-TW-2 | Reference Measuring Point: Ground

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	PNNL GRAB			116-150' SAND, 10YR4/2, darkgrayish brown	
145				Weakly cemented @ 145'	
				Cemented zone SAND, 10YR6/3, dry, moist, poorly	
				sorted, strong RX, 90% SAND, 10% other,	
				mainly ms-cs-fs, MPS 2mm, 40%-50% basalt	
	148-150			40-50% other.	
150				Weakly cemented @ 150	
				150-168.5 SAND, 10YR6/3 dry, moist, poorly sorted	
				weakly cemented, weak-strong RX,	
				90% SAND, most cs-fs, 10-5% Silt	
155				MPS 2mm, interstratified with ms vcs to ms.	
160	PNNL GRAB				
				168.5-169.0 SILTY SAND, 10YR5/3 brown,	
165				moist	
				poorly sorted, weakly cemented, strong RX to acid	
				75% SAND, mostly ms-vcs, 25% Silt, ← 25-35% Silt	
				Non plastic MPS 2mm	
1					

Reported By: Kevin Singleton | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: [signature] Date: 9-25-01 | Signature: DC Weekes Date: 10/23/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 7 of 8
Date: 9-25-01

Well ID: C3103 | Well Name: ~~NA~~ C3103 10/23/01 | Location: 200-East 216-B-7A
Project: 200-TW-2 | Reference Measuring Point: Ground

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
170	PNNL Grab			169-180 Lightly Silty Sandy Silt 9-25-01	
				10YR 4/3, brown, moist, poorly sorted, weak RX, 85% Sand cs-vfs, 15-10% Silt 60% mafic-40% other MPS 3mm, very weakly cemented.	
175				Silty Sand stringer @ 172.5	
180	PNNL Grab			180-190 Sand, 10YR 4/3, brown, moist, poorly sorted, very weak RX, 90% Sand vcs-vfs 10% Silt, 60% mafic-40% other MPS 4mm, weakly cemented	
185				190-198 Sand, 10YR 5/3 brown, moist poorly sorted weak RX, 90% Sand vcs-fs, <10% Silt, 60% mafic, 40% others, 7mm, weakly cemented.	
190	PNNL Grab			198-200 Sand, 10YR 4/3, moist, mod sorted weak to no RX, 95% Sand, vcs-ms 5% Silt, very few gravel 70% Basalt 30% other MPS 15mm - Gravel Obs & Felt	
195					END 9-25-01 @ 195 Slough in hole on 9-24-01 @ 194. Very moist in this zone due to heavy rain last night

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: DC Weekes for Kevin Singleton	Date: 10/23/01	Signature: DC Weekes	Date: 10/23/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 8 of 8
Date: 9-26-01

Well ID: C3103
Well Name: ~~NA~~ C3103 (10/4/01)
Location: 216-B-7A 200 East
Project: 200-TW-2
Reference Measuring Point: Ground

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	PNNL Grab			200- SAND, 10YR6/3, light brownish	
				218.0 SAND, 10YR6/3, light brownish gray, moist to nearly dry, well sorted, very weak to No RX 90-95% SAND VFS-MS mostly, 5-10% Silt, MPS 0.5mm (8 mm) very compacted; abs occas. Trace clays with strong RX - indicates this zone is partially weak cemented - 40% Basalt - 60% Qtz, Feldspars	
205					
210				@ 210 No to Weak RX; incemented	
215				@ 216 Strong RX to acid, Silt content increasing to 12%.	
				@ 216.5 - 18" 2 3mm silt stringers	
220	219	100% RCV		218.0 SILT 10YR6/2, light gray/pink brown	
	221.5 SS			222.5 SILT very well sorted strong RX Non-plastic, ~~moderately hydrated~~ dry, moist	END 9-26-01
	PNNL SS				Total depth 222.5'
225				219-219.5 Water saturated sediments	6" casing @ 218'
					SS = split spoon

Reported By: Kevin Singleton
Title: Geologist
Signature: [signature] Date: 9-26-01

Reviewed By: DC Weekes
Title: Geologist
Signature: DC Weekes Date: 10/1/01

BHI-EE-183 (12/97)

FIELD ACTIVITY REPORT NO. 1

Page 1 of 2

DRILLING PLAN — Use additional pages if req'd.

Date: 8-21-01

Purpose: Drill & sample beneath crib	Location: 200 East 216-B-7A
Well Name: ~~AHA~~ C3103	Well ID: C3103
Drlg. Co.: RSI	Rig No.: H0-22-5211 Rig Make/Mod.: Buc Cyrus

Casing String No. (1) 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size 5 5/8 ID 6 5/8 OD	Auger NA	Air NA Water/Mud NA	Make NA
Grade	Rotary NA	Reverse Direct	Model NA
Lbs. Per Ft. NA	Tubex NA	Vol: cfm NA	Choke NA
Material Carbon Steel	Cable Tool ✓	gpm NA	Casing Hammer
Type:	Sonic NA	Pressure NA psi	Make NA
Welded Thd.	A.R. w/Sonic NA	Drill Pipe O.D. NA	Model NA
Planned/Actual	Other:	Tool Joint Size NA	Bit Size
Set At: 60 / 56.5		Additives NA	Type NA
Shoe OD/ID —			Nozzles NA
Reference Measuring Point: GROUND LEVEL			

Drlg. Co. RST	Rig No.: H0-22-5211	Rig Make/Mod.: BucCyrus

Casing String No. 1 2 3 4	Drilling Method	Circulation	D.H. Hammer
Casing Size 11 3/4 8 5/8, 6 5/8	Auger NA	Air NA Water/Mud NA	Make XT 70T
Grade —	Rotary NA	Reverse Direct	Model Enviromental
Lbs. Per Ft. —	Tubex NA	Vol: cfm NA	Choke Hammer
Material Carbon Steel	Cable Tool ✓	gpm NA	Casing Hammer
Type:	Sonic NA	Pressure NA psi	Make NA
Welded Thd.	A.R. w/Sonic NA	Drill Pipe O.D. NA	Model NA
Planned/Actual	Other: NA	Tool Joint Size NA	Bit Size
Set At: — / 50.7, 180.5, 218.0		Additives NA	Type 11 3/4" OD
Shoe OD/ID 8 5/8" with 9" shoe			Nozzles Casing
Reference Measuring Point: GROUND LEVEL			Pushed 11 3/4" to 50.7'

Comments/Remarks:

Drilled to 56.5' with 6 5/8" casing. Then 6 5/8" casing removed, hole back fill with sand. Cone pushed 11 3/4, 10 3/4 ID casing (outer casing 4.5. OD casing (inner wall casing) to 50.75'. 8" ID, 8 5/8 OD casing to 180.5, 6" ID, 6 5/8" OD. to 218'.

Estimated Depth to Water ~252'

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Name/Title: Geologist		Name/Title: Geologist	
Signature:	Date: 8-22-01	Signature: DC Weekes	Date: 10/23/01

BHI-EE-017 (12/97)

FIELD ACTIVITY REPORT- DAILY DRILLING
Continuation Page

Page 2 of 2
Date: 8-21 & 22-01

Well Name: ~~AHA~~ NCN 10/23/01 C3103
Well ID: C3104 NCN 3
Location: 200 East - 216-B-7A
Continuation of Report No.: 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
2130		Crew on site @ 2130hrs. Plan of the day present by Ed RaFuse of BHI. May rain tonight; the trailer is the staging area; reviewed evacuation procedure; report all injuries. Reviewed role and responsibilities. Reviewed RWP, sample intervals, geology, other screening. Rad screening levels based on hazard class; 330,000cpm alpha, Trace [ ]s 2,700cpm alpha, Air 5.5 cpm alpha. Preparing to drill @ 2115hrs. Driller removing a larger boulder from the
	0230	well head until 0220hrs. Lunch @ 0230hrs. Hole hand dug to 2.5 @ 0400hrs. Drilling with split spoon @ 0401hrs. Team is dress in Full Anti Cs - working in CA. Spoon out @ 0407 hrs. 6.00' drive head + 1.00' shoe + 5.00' of 6" ID Casing = [7.00'] Driving spoon #2 @ 5.5'. Spoon out @ 0513hrs. Adding 5.00' of 6" I.D. casing @ 0550hrs. Total string is 12.0'. CO_2 alarm @ ~ 0530hrs; Also @ ~ 0600hrs. Crew evacuated upwind according to procedure. Russ Fabre stopped work under @ ~
	0603	0603hrs. Hole @ 8'; Casing @ 7'; Total String is 12.00'

NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 8-22-01	Title: Geologist	Date: 10/23/01
Signature: [signature]		Signature: DC Weekes	

BHI-EE-018 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-23-01

Well Name: ~~C3103~~ NOW C3103	Well ID: C3104 NOW C3103
Location: 200 East 216-B-7A	Report No.: 2

Start	Finish	Total
Time 2130	Time 0700	Time 9
Hole/Depth/Csg 8 / 7	Hole/Depth/Csg 22.31 / 20.3	Hole/Depth/Csg 14.31 / 13.3

Reference Measuring Point: GROUND SURFACE

Casing String No. (1) 2 3 4 __
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew on site @ 2130hrs. Plan of the day presented by Ed Ra Fuse. Rain is expected tonight. Temperature should be in the mid 60's. Ed reviewed the layout of the enclosure. Brief review of last shift's activities. Review today's roles and responsibilities. Sampling, drilling, and screening, RWP 138; PPE Full anti C's and PAPRs
	2320	Preparing to drill and dressing @ 2215 hrs. Drilling @ 2320hrs. Wind out of the east 10-20mph; Temp ~ 70°F. Waiting @ 2325hrs. - Moving drums & casing into sch. enclosure. Driving spoon 10-12.5 @ 2350hrs
	0040	Drilling spoon 12.5 to 15.0 @ 0040hrs. Adding 5.00 of 6" ID casing @ 0051hrs; Total string is [17.00]. Driving spoon @ 0120hrs 18.5-21.0. Drilling is very fast indicating loose/unconsolidated soils. Adding 5.0' casing @ 0140hrs; Total string is 22.00'. High contamination level detected @ ~ 0150 hrs. RPT directed crew to leave zone. Lunch @ 0230hrs. Crew drinking ~ 0330 hrs. Drilling continues @ 0430hrs. Activity stopped @ 0440 hrs. The crew needs an additional respirator in the zone. Drilling @ 0600 hrs. ~~Driving spoon 22.5-25.0~~ @ Crew cleaning equipment/samples from last day. END of shift @ 0700
		NA

Reported By: Kevin Singleton	Reviewed By: DC Akeles
Title: Geologist Date: 8-23-01	Title: Geologist Date: 10/23/01
Signature: [signature]	Signature: [signature]

BHI-EE-018 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-23 & 24-01

Well Name: C3103	Well ID: C3103
Location: 200 East -216-B-7A	Report No.: 3

Start	Finish	Total
Time 2130	Time ~0500	Time 8.00 hrs.
Hole/Depth/Csg 22.5 / 20.3	Hole/Depth/Csg 25 / 24	Hole/Depth/Csg 2.7 / 3.7

Reference Measuring Point: GROUND SURFACE

Casing String No. (1) 2 3 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew onsite @ 2130. Safety Topic by Russ Fabre - DOE type A accident @ drillsite - multiple failures caused the accident. Guard pros & cons of drilling @ night. POD by Ed Rafore @ 2200hrs - Weather - windy, temperature in 60's; Drill, sample - 1st sample @ 22.5. Pumped RDP GW-138. PPE - Anti Cs & respirator. Preparing to drill @ ~2222hrs. Drilling is delayed as HPT need to remove an instrument from the zone and perform a sound check @ 22.4'. Drilling @ 0140hrs. Spoon 22.5-25 out of hole @ 0155hrs. Adding 5.00' of 6" ID casing @ 0215hrs; total string is 27.7'. Cleaning line bay until ~0500hrs. Crew out of zone as battery low on HPT PAPC.
0215		
~0500		

NA

Reported By: Kevin Singleton		Reviewed By: DCWeekes	
Title: Geologist	Date: 8-24-01	Title: Geologist	Date: 10/23/01
Signature:		Signature: DCWeekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-26 & 27-01

Well Name: ~~NA~~ DCW C3103	Well ID: C3103
Location: 200 East 216-B-7A 10/22/01	Report No.: 4

Start	Finish	Total
Time 2130	Time ~0710 8-27-01	Time ~9.5 hrs
Hole/Depth/Csg 25' / 24'	Hole/Depth/Csg ~~47.0~~ 47.0 47'	Hole/Depth/Csg ~~23.0~~ 23.0 23'

Reference Measuring Point: GROUND SURFACE

Casing String No. (1) 2 3 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew onsite @ 2130hrs minus HPT. Ed commenced POD @ 2132hrs. Weather ~80°F; wind 0-4mph from the west. HPT on site @ 2145hrs. Topics - work safety - most dangerous area is around the drill rig - watch body position - watch out for other surv well being - RWP 138 reviewed. PPE Rotics - with PAPR. Also reviewed RAD screening numbers. Preparing to drill @ 2220hrs - wrapping ~~PAPR~~ PAPRs. Crew in zone and drilling @ 2310hrs - 25'-27.5'. Adding 5.0' of casing @ ~0030hrs total string is 32'. Drilling spoon 30-32.5 @ 0106hrs Adding 5.0' of casing @ 0200hrs. Total string is 37'. Most of the crew leaving zone @ 0210hrs for lunch. Samples still working. Lunch @ 0230hrs. Drilling continues @ ~0340hrs Collecting spoon @ 35' @ ~0430hrs. Adding 5.0' of casing; total string is 42.0'. Adding 5.0' of casing @ 0600hrs. Crew out of zone ~~AC~~ total @ 0700hrs.
	0700	

NA
Not used DCWeekes 10/11/01

Reported By: Kevin Singleton		Reviewed By: DCWeekes	
Title: Geologist	Date: 8-27-01	Title: Geologist	Date: 10/11/01
Signature: [signature]		Signature: DCWeekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 8-27 & 28-01

Well Name: ~~NA~~ C3103 (10/23/01)	Well ID: C3103
Location: 200 East 216-B-7A	Report No.: 5

Start	Finish	Total
Time 2130	Time 0800	Time 10
Hole/Depth/Csg 48 / 47	Hole/Depth/Csg 56.5 / 56.5	Hole/Depth/Csg 8.5 / 9.5

Reference Measuring Point: GROUND SURFACE

Casing String No. (1) 2 3 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
2130		Crew onsite @ 2130 hrs. Site visitors are Jeff Groven & Chuck Hedell (CHI). POD @ 2145 hrs. Wind out of west 5-10 mph; temperature ~ 70°F. Ed Refuse identified staging area, evacuation procedure, 1st aid procedure. Covered roles and responsibilities for all - driller, samplers, HPTs, IH. Reviewed GW-RWP-138. PPE includes Anti-Cs & respirators. Note: Recognition lunch was provided by BHI prior to the POD. Preparing to drill @ ~2230 hrs - moving equipment, drivers contaminated split spoons. Drilling upon 48-50.5' @ 0003 hrs. Adding 5.0' of casing @ 0020 hrs, total string is 52'. Drill
	0110	to 52' @ 0110 hrs. Adding 5.0' of casing @ 0125 hrs. Total string is 57'. To total depth / 6" casing to 56.5' @ 0200 hrs.
	0300	Most of the crew except driller out of zones. Will log hole during the day shift with the moisture and spectral gamma tool

NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 8-28-01	Title: Geologist	Date: 10/23/01
Signature:		Signature: DC Weekes	

BHI-EE-018 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 9/5 & 6/01

Well Name:	C3103	Well ID:	C3103
Location:	B-7A / 200 E	Report No.:	6

Start	Finish	Total
Time 2130	Time 0206	Time 4.5
Hole/Depth/Csg 56.5' / 56.5'	Hole/Depth/Csg 0 / 0	Hole/Depth/Csg NA / NA

Reference Measuring Point: GROUND SURFACE

Casing String No. (1) 2 3 4 _
See Report No. 1

Weather 5-35 MPH, Cloudy, 60's

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
		Pull 6" Casing
2130	2155	POD. Weather. Carpenter Removed wood. PAPR, in zone.
		Go with regs for contamination on casing. Drilling equipment
		wrenches, knocker head from B-3B site. Need new drive plate
2155	2220	Drillings to other site
2220	2345	Prep. Go over RWP. Dress
2345	0000	Prep / cut sleeving, remove equipment from bags, put in place 16 5 gallon
		buckets of 10/20 silica sand, pallet for casing in RBA zone.
		Note 5 gallon bucket = 1 50 lb bag
0001	0206	Pull casing - See page 2

Reported By: G Thomas		Reviewed By: K.M. Singleton	
Title: Geologist	Date: 9/6/01	Title: Geologist	Date: 10-11-01
Signature: Greg Thomas		Signature: [signature]	

BHI-EE-018 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 3
Date: 9/8/01

Well Name:	NA	Well ID:	C3103
Location:	B-216-7A / 200E	Report No.:	7

Start	Finish	Total
Time 0600	Time 1430	Time 10
Hole/Depth/Csg 0 / 0	Hole/Depth/Csg 3' / 3'	Hole/Depth/Csg 3' / 3

Reference Measuring Point: GROUND SURFACE

Casing String No. (1) (2) 3 4 _
See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0640	POD. Discuss HASP with Drillers (Kelly Olson, Mike Gomez, Darwin Tenney and Theresa Curry
		Area working in RBA and training requirements Read Worker
		I. Survey and tube blocking. Prep 1½. weather calm
		& clear. Darwin wants an appropriate seal to stop dust
		emmission. Discuss Geology Gravels with boulders to 25', sandy
		Gravel to 35' Sand to 56.5'. Mike will use visqueen around
		jacks. Discuss punch point. Plan to go to 56' bgs with
		12" Casing.
0700	0715	Ed Refuse off site to get rags
0715		Prep site. Remove visqueen from wood and from port hole of test
		and place in drum 200E-01-00089, position Rig & set blocks &
		jacks, transport casing
		measurements on 12" Casing
		Point .8' Casing 8 x 5.0', 1 x 5.1', Shoe .75'
		Point Assembly 2nd .75' Not measured
		(Decon report on 12" Casing) 531-5485 Darwin Call
		(Monday Morning from Darwin)
0845		Set point and point Assembly 1.0' + 1.0' + 4.8'
0908		Add 5.0' Casing. Total Casing plus Point 5.8'
0915		Add centralizer on inner casing. Took off centralizer
0923		Set point on Ground Surface
0931		Add drive head
0934		Add wet Rags around point

Reported By: Greg Thomas		Reviewed By: Kevin Singleton	
Title: Geologist	Date: 9/8/01	Title: Geologist	Date: 10-1-01
Signature: Greg Thomas		Signature: [signature]	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT- DAILY DRILLING
Continuation Page

Page 2 of 3
Date: 9/8/01

Well Name: ~~NA~~ NEW C3103 10/22/01
Well ID: C3103
Location: 216-B-7A / 200E
Continuation of Report No.: 7

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
0935	0950	Break & Drillers dress in Coveralls
0950		Connect drive head to diesel hammer
0958		Begin pushing casing
1001		Level Casing
1008	1042	Realign casing
1042		Continue pushing casing
1052	1102	Work on pump
1103	1104	Continue push (drove 3') 2 cups
1104	1107	hydraulic leak. Clean up. 2 cups leaked (All Contained)
1107	1150	Add 5.0' inner & outer casing [Total outer Casing 10.8']
1150	1155	Prime Diesel Hammer
1156	1156	Diesel Hammer started. 3 blows before leak.
1156		Fuel leak 1 minute free flow ~ 1 Gallon
		Fuel Filter Seam ruptured
		Mike (Driller) stops leak & works to repair
		Crew contains & absorbs leak. All contained on visqueen &
		absorbed within 12 minutes. Fluid on casing & drill rig
		Brace on hammer is cracked also.
1218		Darwin calls Rob Dobush to inform of Spill.
		Ed Rafuse calls Bruce Ford and leaves message regarding Spill
		Ed Rafuse Calls Chris Kemp Spill Coordinator No answer
		Ed Rafuse Calls Russ Fabre
1225	1320	Team discussion on plan for problem: Possible solutions
		1) Need to get RWP to pull pile and drill initial 10'
		for starter for the push with 13 3/8" casing. With that
		depth of initial hole driller feels confident that any
		boulders could be pushed out of path. Team believes
		boulders pushing casing off to side.
		Plan for the remainder of day is to Clean up & call it a day

Reported By: Greg Thomas
Title: Geologist
Date: 9/8/01
Signature: Greg Thomas

Reviewed By: Kevin Singleton
Title: Geologist
Date: 10-11-01
Signature:

BHI-EE-016 (12/97)

FIELD ACTIVITY REPORT- DAILY DRILLING
Continuation Page

Page 3 of 3
Date: 9-8-01

Well Name: ~~AA~~ C3103
Well ID: C3103
Location: 216-B-7A 200E
Continuation of Report No.: 7

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1320	1430	Clean up site. Sweep up absorbent & wash down rig with Simple green & straps. All waste (rags & absorbent) disposed into drum 200E-01-0089
		NA

Reported By: Greg Thomas
Title: Geologist
Date: 9-8-01
Signature: Greg Thomas

Reviewed By: Kevin Singleton
Title: Geologist
Date: 10-11-01
Signature:

BHI-EE-018 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 3
Date: 9/9 & 10/01

Well Name: NA	Well ID: C3103
Location: 216-B-7A / 200 E	Report No.: 8

Start	Finish	Total
Time 2130	Time	Time
Hole/Depth/Csg 3' / 3'	Hole/Depth/Csg 27' / 27'	Hole/Depth/Csg 24 / 24

Reference Measuring Point: GROUND SURFACE (RG 10-1-01)
Casing String No. 1 2 3 4 _
See Report No. 1 (RG 10-1-01)

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
		Site Personnel Ed Rafuse, Mark Hasey, Mo Wrasper, Dave Curry, Bill Mercer, Bryan Reader, Greg Thomas
2130	2210	POD. Pull B-38 casing & Try pushing casing at C3103
2215		Remove jaws from Rig Cable tool Rig at C3103. Survey 5600 cpm
		at the top end of the mandrel. Decision to cut cable ~ 20' above
		mandrel jaws. (2318). Change, new plan decon wire rope, mandrell,
		drill string and jaws.
	0180	Complete decon of Smearable contamination.
0130		Drum Containment plastic into 200E-01-0082.
0145	0655	Stand by
0655	0735	Prep Mike Gomez, Jerry Beck
0736	0745	Remove 5.0' outer 11 3/4" casing & Drive head. Also Remove
		5.0' inner casing.
0745	0855	Repair Rear Brace (Not work). Heat alignment Brace for Hammer
		with torch & pound into place. weld on Support Brace.
0855	0905	Add 5.0' inner, 5.0' outer & Drive head [Total Casing 10.8']
0905	0933	Set chains on top & bottom of casing to Align
0934		Soft hit & tighten chains
0937	0950	Prime hammer
0951		Drive hammer 4 Blows
0946		Mary Todd & Kevin Singleton Call. Talk to Ed Rafuse regarding
		work completed Saturday & Sunday. Ask about clean up of diesel
		leak
1003	1028	Drive casing & adjust cam along (finish 7 bag)
1028		Add 5.0' inner & Outer casing [Total Casing 15.8']
		RCT Coverage Bill Mercer until 11:30, 2nd RCT 12:30-3:30, 3rd RCT

Reported By: Greg Thomas		Reviewed By: Kevin Singleton	
Title: Geologist	Date: 9/10/01	Title: Geologist	Date: 10-1-01
Signature: Greg Thomas		Signature: [signature]	

BHI-EE-016 (12/97)

FIELD ACTIVITY REPORT- DAILY DRILLING Continuation Page	Page 2 of 3 Date: 9/10/01
Well Name: NA	Well ID: C3103
Location: 216-B-714/200E	Continuation of Report No.: 8

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
		4:15 until shut down. Drilling Crew can go into RBA
		without RCT if they desire (ie enter 12:00 prior to 12:30 shift RCT).
	1031	(This according to Bob Dunnam)
	1035	Mr Wrasplr & Dave Cuny off site
	1057	Bob Edrington on site
	1108	Drive Casing
	1115	Break for lunch – RCT surveys crew out of zone
	1140	Loud "Bang" noise comes from area of Rig. Driller
		come out of lunch trailer, invertigates to find
		that the out back passenger-side tire has blown.
		Rupture is on top on the outer top edge. This
		will not affect drilling, as Back end of rig is on
		jacks.
	1152	Driller + Helper back in zone starting up Rig.
	1154	Remove cap, start to add casing. 5' inner casing.
	1208	Adding outer casing. Total Casing 20.8'
	1223	Driving Casing (10 strokes)
	1225	Pulling cap to add more casing.
	1228	Adding 5' inner
	1232	Adding 5' outer casing. Total Casing 25.8'
	1240	Drive casing (70 strokes)
	1242	Pulling cap to add more casing
	1243	As helper prepares inner casing w/ centralizer, Driller
		and RSI personnel prepare to bring more casing into
		zone
	1259	Casing in zone; RCT surveys fork lift forks, Driller
		adding 5.0' inner casing w/ centralizer.
	1303	Add 5.0' outer casing (~31' of casing) Total Casing 30.8'
	1311	Drive Casing (375 strokes)

Reported By: Greg Thomas		Reviewed By: Kevin Singleton	
Title: Geologist	Date: 9/10/01	Title: Geologist	Date: 10-11-01
Signature: [signature]		Signature: [signature]	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
SHIFT CONTINUATION SHEET

Continuation of Report No.

Page 3 of 3

Continuation of Shift 9/10/01 (Date)	Well/Excavation No. C3103	Operable Unit No. 200-TW-2

Description of Operations/Remarks

1325 - While removing Cap, driller notice cracks Brings welder over to repair crack
1345 - It is also discovered that the adjustment nut is broken, ~~the~~ This means that the cone point has ~~mostly~~ most likely shifted up into the casing
1355 - RSI personnel takes adjustment nut into town for repair
1400 - Driller welding cracks in Drive cap. Russ Fabre on site.
1416 - Finished with welding cap. Driller goes to get jacks
1511 - RSI personnel returns w/ adjustment nut, not
1525 - Find out new game plan, adjustment nut can't be fixed so, driller is going to back pull casing and try to reset drive point. At that time he will phone the shop the dimensions needed and they will fabricate a solid piece to replace the adjustment nut. They will then send it out to us here and the driller will ~~drive~~ RST drive casing. RCT Support ENDS at 1575.
1540 - LC Swanson calls, I am to return to home base (signed) Russ Fabre will supervise operation

NA

Report By: Robert S. Edrington (Print) (Sign) Date: 9/10/01

Title: Geologist

A-6001-123.1 (03/93)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 9-11-01

Well Name: C3103
Well ID: C3103
Location: 200 East 216-B-7A
Report No.: 9

Start	Finish	Total
Time ~0815	Time 1045	Time 2.5hrs.
Hole/Depth/Csg NA / 27	Hole/Depth/Csg NA / 28.5	Hole/Depth/Csg NA / ~~28.5~~ 1.5'

Reference Measuring Point: GROUND SURFACE
Casing String No. (1) 2 3 4 __
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0815		Singleton onsite @ 0815hrs. Crew making repairs & trying to advance hole. Crew is attempting to drive casing with the XT 700 environmental hammer to ~56.5. The hole was drilled to ~56.5 with a cable tool rig & 6" ID casing. The hole was logged with spectral gamma tool & neutron moisture. After logging was completed the 6" casing was removed & the hole was back filled with sand. The hammer drill (pile driver) is being used to redrill the hole/push 10¾" casing back to ~56.5. This method of drill & push are needed to limited dose to worker and is needed to work within the planned hazard classification required. Rig appears to be operation @ 0915hrs. Drilling, welding @ 0916hrs. Driving casing @ ~1010hrs 225 blows drives casing ≤ 1". Hole To ~28.5'. Russ Fabre
	1045	evacuating site @ 1045hrs. due to national emergency.

NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-11-01	Title: Geologist	Date: 10/23/01
Signature: [signature]		Signature: DC Weekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 9-18-01

Well Name: ~~NA~~ C3103 (10/23/01)
Well ID: C3103
Location: 200 East - 216-B-7A
Report No.: 10

Start	Finish	Total
Time ~~0530~~ 0600 (Rig replaced)	Time 430PM	Time 1000
Hole/Depth/Csg NA / 32	Hole/Depth/Csg NA / 32	Hole/Depth/Csg NA / 320

Reference Measuring Point: GROUND SURFACE
Casing String No. (1) 2 3 4 _ (10-11-01)
See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
~~0530~~ 0600	(10-11-01)	Crew on site @ ~~0530~~ 0600hrs. POD presented by Ed RaFaep. Temperature ~ 59°F; Wind's calm. Shift is 6-4:30. Reviewed emergency procedures; staging area, 1st aid station fire department. Rig will be inspected @ 0700hrs - wrong/incorrect bns may be on rig - causing bushing to wear out. Well is currently @ a depth of ~32. Two casing strings are in the hole - planning to remove inner string and core probe; will drill with core barrel to 40' & set
	0630	casing. Waiting for rig inspection crew @ 0630hrs. Inspection team on site @ 0745hrs. Inspection complete @ 0830hrs. Moving equipment, making minor rig repairs, (ie. welding drive plate
	1400	until 1400hrs. Drill rig place new hole @ ~ 1400hrs. Prepare to drill & until about 430PM Singleton off site @ ~300PM.
		NA

Reported By: Kevin Singleton		Reviewed By: D C Weekes	
Title: Geologist	Date: 9-18-01	Title: Geologist	Date: 10/23/01
Signature: [signature]		Signature: [signature]	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 2
Date: 9-18-01

Well Name: ~~AA~~ new C3103		Well ID: C3103	19 10-11-01
Location: 200 East - 216-B-7A		Report No.: 11	

Start	Finish	Total
Time 0600	Time 1630	Time 10
Hole/Depth/Csg 32 / 320 / ~~30.5~~	Hole/Depth/Csg ~~30.5~~ 36.5 / 1" 36.5	Hole/Depth/Csg ~~[illegible]~~

Reference Measuring Point: 19 10-11-01
GROUND SURFACE

Casing String No. (1) 2 3 4 _
See Report No. 1 B 9-18-01

4.5' / 4.5 RO 10-11-01

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		Crew on site @ 0600hrs. Ed RoFar conducted the PQP.
		Temperature - 58°F; Wind 0 mph. Plan: Backpull inner
		wall casing, set 10 3/4" @ 70' (outer casing). Reduce casing size
		to 8", drill to 100'. POD completed @ 0630hrs. Driller
		gathering tools. When ready (driller) & when all tools are obtained
		the HPTs will review the RWP. HPT reviewing RWP GW-152
	0635	Rev 0 @ 0635hrs. Driller, helper and HPT in agreement on art C's &
	0815	PAPRs @ 0815hrs. Backpulling inner casing. Wind out of the
		west @ 0816hrs 6-8 mph. Removing 1st joint of casing @ 0829hrs.
		[5.00'] Removed Joint #2 @ 0840hrs [5.00'], note inner casing
		only is being removed. 2nd joint is contaminated. 3rd joint out @ 0850hrs
		[5.00'] 4th joint out @ 0855hrs [5.00'] - 15R open 86. 5th joint
		out @ 0912 hrs. [5.00'], Removing last joint including seal & drive
		point @ 0926hrs. Four centralizers also removed with 4" inner wall casing.
	0932	@ 0932hrs Lab @ 32'; casing @ 35.10' - 3.10' of overlap in casing.
		Crew leaving zone @ 0940hrs. Casing tally correction; Total string
		is 30.25 - stickup 0.6 = 30.15 (bottom of casing). Holes @ 32'
		1.85' is open hole. HPT having instrument problems. Surveying
		equipment may not be functioning properly. Surveying instruments are
		being replaced. Waiting for new instrumentation. Reviewing RWP GW
		188-Rev 3 @ 1215hrs. @ ~ Drilling putting on drive head/changing tools.
		New survey equipment also on site & operational. Wind out of the east
		@ 3-4 mph @ 1311hrs. - gust to 8 mph. Adding 5.00' + .58 drive head
	1341	Total string is 36.33. Driving casing @ 1341 hrs.

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-19-01	Title: Geologist	Date: 10/22/01
Signature: [signature]		Signature: DC Weekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT- DAILY DRILLING
Continuation Page

Page 2 of 2
Date: 9-18-01

Well Name: C3103
Well ID: C3103
Location: 200 East 216-B-9A
Continuation of Report No.: 11

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
1345		Total string is 36.3' @ 1345. @ 1400 hrs 1st drive barrel after completing core push out of hole. 0% soil recovered in drive barrel. ~~60,000 cpm~~ 8,000 cpm BG and 15 cpm γ on drive barrel (smearable). 12K cpm BG & 12 cpm γ on drive barrel @ ~32' (smearable). 100 mR on material in drive barrel (window open) 25 mR window close – material in drive barrel is 20-40 SAND. No reading provided from HPT in regards to alpha, beta, gamma – material to hot – a 20-40 SAND in drive barrel. @ 34.5' 1 cpm alpha, 20,000 cpm BG. @ 36' 0 cpm alpha, 20,000 cpm BG. Hole to 36.5'
	1430	
1550	1550	Casing to 36.5'. 12K beta gamma on soil/ 0 cpm alpha. Crew undressing @ 1600.

NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-18-01	Title: Geologist	Date: 10/23/01
Signature:		Signature: DC Weekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 9-20-01

Well Name: C3103
Well ID: C3103
Location: 200 East - 216-B-7A
Report No.: 12

Start	Finish	Total
Time 0600	Time 1430	Time 10
Hole/Depth/Csg 36.5 / 36.5	Hole/Depth/Csg 54 / 54 (50.75)	Hole/Depth/Csg 17.5 / 17.5

Reference Measuring Point: GROUND SURFACE
Casing String No. 1 2 3 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		Crew on site @ 0600hrs. Ed Rafuse conducting PDD @ 0605hrs. Temp; 55°F; Wind 0-1 mph. Topics- parking lot restrictions @ Federal building, housekeeping, moving wood around in the CA. Plan: drill to ~40' with 12" casing, downpost, telescope with 8" and drill to ~100'. RWP-GW-138, Rev 3 reviewed by
	0630	HPT. Dressing @ 0630hrs - Full anti Cs - no respirator. Drilling @ 0715hrs. Wind out of the east. Drum barrel #1 0cpm alpha, 30Kcpm BG. Adding 5.00' of 12" casing; Total string is 46.33' Immovable contamination detected around the borehole - on ground - the area is being covered in
		plastic @ 0815hrs. Redrill to 38.5' @ 0825hrs. Note: Drilling with
	0845	rig # HO-22-5211 (Cable tool). Hole to 40' @ 0845hrs - 0cpm alpha, 5Kcpm BG on soil. <0.5 mrad. Crew out of zone @ 0925hrs for water & other. Temperature ~70°F - wind 0-3 mph. Crew dressing @
	0940	0940hrs. Drilling continues @ 1000hrs. Adding 5.00' of casing @
	1040	1040hrs; total string is 46.33. Lunch @ 1130hrs - Drilling
	1230	continues @ 1230hrs - Tom in anti Cs - no respirator. Adding 5.00'
		of 12" @ 1320hrs; Total string is 51.33. Preparing to downpost
		& downpost; hole @ 54' casing @ 50.75. Removing drive
	1430	barrel @ 1410hrs. 1430hrs Singleton off site. Crew
		down posting.
		NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-20-01	Title: Geologist	Date: 10/23/01
Signature:		Signature:	

BHI-EE-01A (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 9-21-01

Well Name: C3103	Well ID: [redacted]
Location: 200 East 216-B7-A	Report No.: 13

Start	Finish	Total
Time 0600	Time 1630	Time 10
Hole/Depth/Csg 54.4 / 0	Hole/Depth/Csg 114 / 110	Hole/Depth/Csg 60 / 110

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 (2) 3 4 _
See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		Crew on site @ 0600hrs. POD inserted by Bob Jones @ 06 [illegible]
		Temp ~53°F, Wind - calm. Topics reviewed, 1st [illegible] decontamination
		Facilities, work safe (in a rush, body position, emergency
		numbers (376-3800), stay Focused. Plan: Reduce hole & casing size
		to 9" & 8" respectively, drill & sample soils. Crew preparing to
	0635	drill @ 0635hrs. @ 0750hrs crew telescoping 8" TD casing. Total
		casing string is 52.33 @ 0827hrs. - Moving equipment into RBA
		casing (additional), tables, chairs, drums. Drilling commences @ 0945hrs
	0940	Adding 5.00' of casing @ 0940hrs - Total string is 62.38. Hole
		to 62.5' @ 1020hrs. Adding 5.00' @ 1035hrs; total string is 67.38
		The hole is clean @ 70.5' @ 1055hrs. Adding 5.00' of 8" TD
		casing. total string is 72.38. Lunch @ 1100hrs. Drilling continues
	~1145	~1145hrs. Collecting split spoon 72.5-75 @ 1210hrs. Add 5.00'
		of 8" casing @ 1220hrs. Total string is 77.38. Hole to 80' @
	1235	1235hrs. Adding 5.00' of 8" @ 1245hrs. Total string is 82.38
		Adding 5.00' of casing @ 1305hrs - Total string is 87.38. Hole to 93.5'
	1350	@ 1350hrs. Adding 5.0' of 8" Total string is 92.38. Adding
	1410	5.00' of 8" @ 1410hrs - Total string is 97.38'. Collecting split
		spoon sample 97.5-100' @ 1430hrs. Adding 5.00' of 8"
	1445	casing @ 1445hrs Total string is 102.38. Hole to 103 @
		1505hrs. Adding 5.0' of 8" - Total string is 107.38 @ 1515.
		Adding 5.00' of 8" casing @ 1530hrs. Total string is 112.38'
		Hole @ 110'. Crew closing site down for weekend
		NA NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-21-01	Title: Geologist	Date: 10/23/01
Signature: [signature]		Signature: DC Weekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 2
Date: 9-24-01

Well Name: C3103	Well ID: C3103
Location: 200 East - 216-B-7A	Report No.: 14

Start	Finish	Total
Time 0600hrs	Time 1630	Time 10
Hole/Depth/Csg 114 / 110	Hole/Depth/Csg 137.5 / 130.5	Hole/Depth/Csg 23.5 / 30.5

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 (2) 3 4 __
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		Crew on site @ 0600 hrs, except HPT. POD @ 0630hrs by Ed RaFase. HPT on site @ 0640hrs. Temp. ~60°F - Wind - calm. Waiting on cross over sub to run additional 8" casing. Planning to downsize within the next 30' of @ possible perching horizon/Drill & sample - log borehole. Crew in zone @ 0745 preparing to drill. Using different drive head (-0.4'); total casing string is 111.98 + 5.00' = 117.08'.
	0810	Drilling @ 0810hrs. Collecting PNNL "20" sample @ 0840hrs (grab). Adding casing 5.00' @ 0845hrs. Total casing string is 122.08.
	0905	Hole to 126' @ 0905hrs. Adding 5.00' of casing @ 0925hrs. Total string (casing) is 127.08'. Hole to 130' @ 0954hrs. Hole
	1002	to 132' @ 1002hrs. Adding 5.00' of casing; total string is 132' (casing). Hole to 134' @ 1025hrs. Hole @ 136.5' @ 1031hrs.
	1037	End drilling & sampling activities @ 1037hrs. Formation Sand dominated sequence of the Hanford Formation. Preparing to geophysically log borehole with spectral gamma & moisture tool. Logger warming tools up @ 1030hrs.

NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-24-01	Title: Geologist	Date: 10/23/01
Signature:		Signature: DC Weekes	

BHI-EE-018 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
TUBULAR GOODS TALLY

Report #14

Page 2 of 2
Date: 9-24-01

Well Name: C3103
Well I.D.: C3103

TEMPORARY				Inner Wall PERMANENT: Temporary						SCREEN/CAP*		
Jt.#	Length (ft.)	Jt.#	Length (ft.)	Jt.#	Length (ft.)	C	Jt.#	Length (ft.)	C	Jt.#	Length (ft.)	Jt.#
1	5.0'+.75'	21		1	Point LD		21	6.16 head		1	5.00	112.08
2	5.0'	22		2	1st Ave 1.0		22	11.04		2	5.00	
3	5.0'	23		3	4.8	C	23	10.04		3	5.00	
4	5.0'	24		4	5.0		24	10.03		4		
5	5.0'	25		5	5.0	C	25	10.03		5		
6	5.0'	26	drive head	6	5.0		26	5.02		6		
7	5.0'+.58'	27	removed	7	5.0	C	27	5.02		7		
8	5.0'	28	removable	8	5.0		28	5.05		8		
9	5.0'	29	never installed	9			29	5.05	112.38	9		
10	5.0'	30		10			30	5.00		10		
11		31		11			31	5.00		11		
12		32		12	Inner casing		32	5.00		12		
13		33		13	removed		33	5.00	112.38	13		
14		34		14			34	5.00		14		
15		35		15			35	5.00		15		
16		36		16			36	5.00		16		
17		37		17			37	5.00	112.38	17		
18		38		18			38	5.00		18		
19		39		19			39	5.00	112.38	19		
20		40		20			40	-.40	change	20 head		
Tot	51.33	Tot		Tot	0		Tot	111.98		Tot		

*Indicate those joints with centralizers with a C in the available box.
ALL casing length shall be measured to the nearest 0.01 ft.

.58

Comments/Remarks:

Shoe .85'

Temporary: O.D./I.D.	Permanent: O.D./I.D.	Screen: O.D./I.D.
Inner wall 4.5" OD - inner wall removed from borehole on 9-19-01		
Outer Casing 18 3/4" / 10 3/4"		
8" ID 8 5/8" O.D casing 9" shoe		

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-24-01	Title: Geologist	Date: 10/23/01
Signature:		Signature: DC Weekes	

BHI-EE-182 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 2 Date: 9-25-01

Well Name: C3103	Well ID: C3103
Location: 200 East - 216-B-7A	Report No.: 15

Start	Finish	Total
Time 0600hrs	Time 1600hrs	Time 9
Hole/Depth/Csg 137.5 / 195	Hole/Depth/Csg 195 / 194	Hole/Depth/Csg 57.5 / 194

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 (3) 4 _

See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		Crew onsite @ 0600hrs. POD presented by Ed RaFuse.
		Safety topic: First Aid procedures. Plan: run 6", drill &
		sample. Preparing to drill @ 0610hrs. Running 6" casing @
	0850	~0700hrs. Drilling @ ~0850hrs. Total 6" casing string
		is 142.29'. Adding 5.0' of casing @ 0910hrs. Total string is 147.29'
		Collecting split spoon sample from 148-150 @ ~0945hrs.
	1000	Adding 5.00' of 6" @ 1000hrs. Total string (casing) is 152.29'
		Adding 5.00' of 6" @ 1025hrs. Total string is 157.29'
		Hole to 157' @ 1100hrs. Lunch. Drilling continues @ 1135hrs.
	1140	Adding 5.00' @ 1140hrs. Total string is 162.29' Wind out of
		the East ~10mph. Temp ~65°F @ 1150hrs. Adding 5.0' of casing
RG 9-25-01		@ 0785 @ Total string is ~~164~~ 167.29. Adding 5.0' of casing
RG 9-25-01		@ ~1230hrs. Total string is 172.29. Adding 5.00' of casing @
		1330hrs. total string is 177.29. To 182.5' @ 1348hrs.
		Adding 5.00' of 6" casing @ 1429hrs, total string is 182.29'
		plus 5.00' of casing @ 1455hrs, Total string is 187.29'
		Borehole to 190' @ 1517hrs. + 5.00' of casing: total string
	1545	is 192.29. @ 195' (Hole) @ 1545hrs HPT has to leave.
	1600	Adding 5.0' of 6" - Total string is 197.29'.
		Not used 10/23/01

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-25-01	Title: Geologist	Date: 10/23/01
Signature: RG		Signature: DC Weekes	

BHI-EE-018 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
TUBULAR GOODS TALLY

Report # 15

Page 1 of 2
Date: 9-25-01

Well Name: ~~AA~~ C3103 Well I.D.: C3104 3

TEMPORARY				PERMANENT*						SCREEN/CAP*		
Jt.#	Length (ft.)	Jt.#	Length (ft.)	Jt.#	Length (ft.)	C	Jt.#	Length (ft.)	C	Jt.#	Length (ft.)	Jt.#
1	1.00	21	5.00	1			21			1		
2	1.00	22	5.00	2			22			2		
3	10.02	23	5.00	3			23			3		
4	9.98	24	5.00	4			24			4		
5	10.02	25	5.00	5			25			5		
6	10.04	26	5.00	6			26			6		
7	10.04	27	5.00	7			27			7		
8	9.98	28	5.00	8			28			8		
9	9.96	29	5.00	9			29			9		
10	9.99	30	5.00	10			30			10		
11	10.02	31	5.00	11			31			11		
12	10.05	32	5.00	12			32			12		
13	10.02	33	5.00	13			33			13		
14	5.02	34	5.00	14			34			14		
15	5.03	35	5.00	15			35			15		
16	5.03	36		16			36			16		
17	5.02	37		17			37			17		
18	5.04	38		18			38			18		
19	5.03	39		19			39			19		
20	5.02	40		20			40			20		
Tot	147.29	Tot		Tot			Tot			Tot		

*Indicate those joints with centralizers with a C in the available box.
ALL casing length shall be measured to the nearest 0.01 ft.

Comments/Remarks:
NA

Temporary: O.D./I.D.	Permanent: O.D./I.D.	Screen: O.D./I.D.
6" ID 6 5/8" O.D.		

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-26-01	Title: Geologist	Date: 10-2-3/01
Signature:		Signature:	

BHI-EE-182 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 2 (1) 10/23/01
Date: 9-26-01

Well Name: ~~AH~~ NCW 10/23/01 C3103	Well ID: C3103
Location: 200-East-216-B-7A	Report No.: 16

Start	Finish	Total
Time 0600	Time 1600 hrs	Time 9.5
Hole/Depth/Csg 195 / 184	Hole/Depth/Csg 222.51 / 218.0	Hole/Depth/Csg 222.51

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 (3) 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		Crew onsite @ 0600 hrs. POD presented by Ed Rafuse. Plan
		Lubricate rig, drill & sample soil ~60' to total depth.
		Other topics - dosimeters, data to completion. Preparing to drill
	0630	@ 0630 hrs. Drilling @ 0710 hrs. Note heavy rain last night.
		1st core barrel out of hole moist. Appears the rains from last
		night enter the borehole. Adding 5.00' of 6" - Total string is
	0742	202.29 @ 0740 hrs. Fuel truck onsite @ 0742 hrs. Drilling is
		stopped for Fueling. Drilling @ 0800 hrs. Hole to 206' @ 0853 hrs;
		adding 5.0' of 6" casing total string is 207.29. IH Tech onsite
	0946	for AM check @ ~ 0905 hrs. Hole to 210' @ 0940 hrs. Adding
		5.0' of 6" @ 0944 hrs. Total string is 212.29. Adding 5.0'
		of 6" casing @ 1036 hrs; Total string is 217.29; hole @ 216
	1100	Lunch @ 1100 hrs. Drilling continues @ ~1145. Drill to 118' -
		Silt - driller having problem retrieving silt. Clutches smoking
		@ 1225 hrs. Break - to let clutch cool @ 1225 hrs. Cleaned
		out hole - Drive split spoon 219-221.5. Clutches burning after
		~7min of backpulling. Break to let clutches cool. Backpulling
		@ 1320 hrs. Spoon out of hole @ 1330. Top of sample very
		wet (saturated.) Pulling tools out of hole. Hole will sit
		~45min to determine if water will accumulate. No water.
		Driving second split spoon @ 1500 hrs. Hole @ total
		depth.
		NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-26-01	Title: Geologist	Date: 10/23/01
Signature:		Signature: DC Weekes	

BHI-EE-018 (12/97)

Appendix A – Borehole Geologic Logs

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1
Date: 9-27-01

Well Name: ~~NA~~ C3103 10/23/01
Well ID: ~~NA~~ C3103 10/23/01
Location: 200 East 216-B-7A
Report No.: 17

Start	Finish	Total
Time 0600	Time 0635	Time NA
Hole/Depth/Csg 222.5 / ~~222~~ 218.0	Hole/Depth/Csg NA / NA	Hole/Depth/Csg NA / NA

Reference Measuring Point: 9-27-01
GROUND SURFACE

Casing String No. 1 2 (3) 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		Crew onsite @ 0600hrs. Ed RaFuse presenting the POD.
		Plan: Tag water, collect water sample if possible, log borehole
		with radionuclide logging system & moisture tool; Safety
	0611	topics - body position, continue to work safely. POD ends @ 0611hrs.
	0620	Moving casing out of RBA @ 0620hrs. E-Tape in hole @
		0630hrs - result is negative - no water in the borehole. Bottom of
		hole is 220.83. Currently 1.7' of sluff in borehole. Logging
	0635	truck moving into work zone @ 0635hrs.

NA

Reported By: Kevin Singleton		Reviewed By: DCWeekes	
Title: Geologist	Date: 9-27-01	Title: Geologist	Date: 10/23/01
Signature:		Signature:	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT- DAILY DRILLING

~~Continuation Page~~

Page 1 of 3

Date: 9-28-01

Well Name: C3103	Well ID: C3103
Location: 200 East - 216-B-7A	Report No.: 18

Time/Depth From	To	Description of Activities/Operations with Depth
0600		Crew onsite @ 0600hrs. Geophysical logging still in progress
		POD @ 0625 by Ed RaFuse. Safety topic: tripping
		hazards, body position, new HPT onsite. Current temperature
		~53°F, Wind 0-1mph. PLAN: survey logging truck &
		equipment out of hole/zone, Check for water in hole, and sample
	0635	H_2O if possible, change drilling tools, and back pull 6" casing.
		Geophysical logging completed @ 0700hrs. Tagged bottom of
		well with E Tape @ ~0715 - No measurable water. Drilling
		split spoon to get/sample sluff in bottom of borehole - Driving
		spoon from 218-223'. @ 0740hrs. Preparing to backpull 6"
	0750	casing @ 0750hrs. The sluff/sample will be stored in the
		drum storage area. Note: 200E-01-~~028~~ 0128 See this drum
		for sluff sample. Drum#. Backpulling @ 0930hrs.
		Lunch @ 1110hrs. All 6" casing out of hole @ 1445hrs -
	1445	shoe is present. Bentonite crumbles placed from ~223' to
	1455	126.5. Driller moving 6" casing out of RBA @ 1453hrs.
		Additional equipment is needed to pull 8" casing. Drilling
		planning to go to 100N pipe yard.

NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Geologist	Date: 9-28-01	Title: Geologist	Date: 10/23/01
Signature:		Signature: DC Weekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT
DAILY DRILLING

Page 1 of 1 Date: 10-1-01

Well Name:	C3103	Well ID:	C3103
Location:	200 East 26-B-7A	Report No.:	19

Start	Finish	Total
Time 0600	Time 1630	Time 10hrs
Hole/Depth/Csg NA / NA	Hole/Depth/Csg NA / NA	Hole/Depth/Csg NA / NA

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 3 4 _
See Report No. 1

Time/Depth From	To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		Crew of site @ 0600hrs. POD presented by Jim Diebel.
		Major concern from RSI regarding "Backpulling" without
		respirators. Multiphase calls to Rad con. POD over @
		0645hrs. Plan: Backpull, 8" & 6" - Fill hole with bentonite.
		RAD Con will address rad concern. RAD Con "Greg" onsite
		@ 0815. All field screening data suggest that (collected to date)
	0830	respirators are not required based on derived air concentrations.
		Jim Diebel ask the team if any problems/concerns - none.
		Planning to backpull @ 0833hrs. Wind out of the east -
		2-5mph @ 0850hrs - Temp - 60°F. Backpulling procedure commencing
	0905	@ 0905hrs - 8" casing. 82'-77' joint of casing is hot - wiping casing
		- contamination was removed. Lunch @ 1100hrs - Moving pipe &
		equipment out of zone. Add crumbs @ 1210hrs. All pipe is being
		wiped as it comes out of hole. Bridge in hole @ 1225hrs.
	1600	All 8" casing out of hole @ 1600hrs - shoe intact.
		NA

Reported By: Kevin Singleton		Reviewed By: DC Weekes	
Title: Asbestos	Date: 10-1-01	Title: Geologist	Date: 10/23/01
Signature:		Signature: DC Weekes	

BHI-EE-018 (12/97)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 1 10/23/01

Date: 10-2-01

Well ID: C3103	Well Name: C3103
Location: 200 East - 216-B-7A	Report No.: 20

Start	Finish	Total
Time 0600	Time 1530	Time 9
Hole Depth/Csg NA / NA	Hole Depth/Csg NA / NA	Hole Depth/Csg NA / NA

Reference Measuring Point: GROUND SURFACE

Casing String No. 1 2 3 4 ____ Rod Size:

See Report No. 1

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600		Crew onsite @ ~ 0600hrs, exceptions - HPT & geologist.
		Geologist onsite @ 0610hrs - HPT onsite @ 0625hrs.
		Safety Topic - emergency contacts & numbers - 376-3800, First
		Aids. Plan: Backpull 12" casing/decomission with bentonite.
		POD ends @ 0752hrs. HPT leaving to pickup equipment.
	0945	Moving equipment - posting CA until 0945hrs. Reviewing
		PWP @ 0946hrs - Crew dressing in Anti-Cs. Backpulling
		12" @ 1020hrs. Lunch @ 1200hrs. 20' of 12" out of the hole.
		Backpulling @ 1300hrs. Backpulling complete @ 1530hrs
	1530	See ~~page 2~~ DAY 2. well completion log.

Not used
DCWeekes 10/23/01

Reported By: Kevin Singleton		Reviewed By: DCWeekes	
Title: Geologist	Date: 10-2-01	Title: Geologist	Date: 10/23/01
Signature: [signature]		Signature: DCWeekes	

Original to: Document and Information Services, H0-09/HWIS

BHI-EE-018 (07/27/2001)

WELL COMPLETION LOG

Page 1 of 1 Date: 9/6/01

Well Name: ~~AA~~ C3103 Well ID: C3103

Project: B-7A/200 E Location: 200 TW2 - Soil Sampling Drilling Contractor: RSI

1. Time	2. Total Casing	3. Stikup	4. Btm Cag	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Amt	Unit	Comments
0005	57.2	0.7	56.5	57.2		57.2	—	—	~~Silica 10/20~~	~~2~~	~~AT buckets~~	
0008	57.2	0.7	56.5	49.4		49.4	48.4	8.1	Silica 10/20	2	Buckets	1 bucket = 1 50lb bag
0026	52.2	.7	51.5	50.6		50.6	49.9	1.6				Remove 5' casing 5K Total
0030	52.2	.7	51.5	41.1		41.1	40.4	11.1		3	Buckets	
0039	47.2	1.0	46.2									Remove 5' casing
0045	42.2	1.0	41.2									Remove 5' casing
0056	37.2	1.5	35.7									Remove 5' casing
0102	32.2	2.0	30.2	44.5		43.5	41.5					Remove 5' casing
0112	32.2	2.0	30.2	7.0		7.0	5.0	25.2	Silica 10/20	11	buckets	
0120	27.2	2.5	24.7									Remove 5' casing
0128	22.2	2.0	20.2									Remove 5' casing
0135	17.2	2.5	14.7									Remove 5' casing
0139	17.2	2.5	14.7	+2.0		+2.0	+2.0	16.7	Silica 10/20	5	bags	
0144	12.2	2.5	9.7									Remove 5' casing
0150									Silica	2	bags	
0157	7.2	2.5	4.7									Remove 5' casing
0206	0											Remove 5' casing
												1' slough, 1' pulled back

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: G Thomas Reviewed By: Kevin Singleton

Title: Geologist Date: 9/6/01 Title: Geologist Date: 10-11-01

Signature: Greg Thomas Signature:

BHI-EE-179 (12/97)

WELL COMPLETION LOG

Page [illegible]
Date: 9-28-01

Well Name: C3103
Well ID: C3103
Project: 200-TW-2
Location: B-7A/200E
Drilling Contractor: RSI

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Amt	Unit	Comments
0935	222.28	5.0	217.28			220.5	215.5	1.78	Bentonite	2	Bag	
0941	222.28	7.0	215.2			222.3	215.3	0.1	Bentonite	1	Bag	
0945	222.28	8.0	214.28			219.6	211.6	2.68				
0948	222.28	9.0	213.28			221.3	212.3	0.98				
-5.00 0950	217.28	~~5.0~~	~~212.28~~						Bentonite	1	Bag	
0955	217.28	5.5	211.78			213.8	208.3	3.5				
-5.00 1001	217.28	9.0	208.28			217.4	208.4	-0.12	Bent	1	Bag	
1003	212.28	4	208.28			208.6	204.6	3.8	Bent.	2	Bags	
1012	212.28	7	205.28			204.4	197.4	7.88				
-6.00 1016	212.28	10	202.28			209	199	3.28	Bent	2	Bags	
-5.00 1020	202.28	5.0	202.28			195.8	190.8	12.2				
1030	202.28	5.7	196.6			197.8	192.1	4.5	Bent	2	Bag	
-5.00 1032	202.28	5.7	196.6			194.0	188.3	8.3				
1034	197.28	5.0	192.28			194.6	189.6	2.7	Bent	2	Bags	
1037	197.28	5.0	192.28			186.4	181.4	10.9				
-5.00 1046	192.28	5.0	187.28			181.4	176.4	10.9				
-5.00 1100	192.28	7.0	185.28			191.1	184.1	1.18				
1200	187.28	6.0	181.28			188.8	182.8	-1.5	Bent.	3	Bag	
-5.00 1205	187.28	6.0	181.28			177.8	171.8	8.4				

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 - Col. 3 = Col. 8; Col. 8 - Col. 5 = Col. 9

Reported By: Measure Kevin Singleton
Title: Geologist
Date: 9-28-01
Signature:

Reviewed By: DC Weekes
Title: Geologist
Date: 10/23/01
Signature: DCWeekes

BHI-EE-179 (12/97)

WELL COMPLETION LOG

Page 4 of 46
Date: 9-28-01

Well Name: ~~NA~~ AOU C3103
Well ID: C3103
Project: 200-TW-2
Location: 200-East 216-8-7A
Drilling Contractor: RSI

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Amt	Unit	Comments
1208	182.28	5.0	177.28			179.6	174.6	2.7	Bent	2	Bags	
1213	182.28	5.0	177.28			171.2	166.2	11.0				
1215	177.28	5.0	172.28			173.0	168.0	4.28	Bent	2	Bags	
1217	177.28	5.0	172.28			164.7	159.7	12.6				
1221	172.28	5.0	167.28			167.5	162.5	4.7	Bent	2	Bags	
1226	172.28	5.0	167.28			159.2	154.2	13.0				
1228	167.28	5.0	162.28			160.9	155.9	6.4	Bent	2	Bags	
1231	167.28	5.0	162.28			152.8	147.8	14.5				
1234	162.28	6.0	156.28			—	—	—	—	—	—	
1236	157.28	6.0	151.28			155.9	149.9	1.38	Bent	3	Bags	
1242	157.28	6.0	151.28			142.3	137.3	14.0				
1245	147.28	6.0	141.28			146.8	140.8	0.5'	Bent	4	Bags	
1251	147.28	6.0	141.28			130.4	124.4	16.8				
1255	142.28	6.0	136.28			132.5	126.5	9.7	Bent	1	Bag	
1257	142.28	6.0	136.28			128.2	122.2	14.0				all 6" is with the 8" casing
1300	137.28	6.0	131.28			—	—	—	—	—		@ 1445hrs. Removing
1302	132.28	5.0	127.28			133.5	-128.5	1.22	Bent	1	Bag	all 6" casing.
1445	132.28	5.0	127.28			131.2	126.2	~~1.2~~				St. All 6" casing with shoe
												at of hole @ 1440hrs

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 9 - Col. 8 = Col. 9

Reported By: Measure Kevin Singleton
Title: Geologist
Date: 9-28-01
Signature:

Reviewed By: DC Weekes
Title: Geologist
Date: 10/23/01
Signature: DC Weekes

BHI-EE-179 (12/97)

WELL COMPLETION LOG

Page 4 of 6 pages
Date: 10-1-01

Well Name: C3103
Well ID: C3103
Project: 200-TW-2
Location: 216-B-7A
Drilling Contractor: RSI

1.	2.	3.	4.	5.	6.	7.	8.	9.	Fill Material			
Time	Total Casing	Stkup	Btm Csg	Tape Reading	Correction	Cor Tape Reading	Fill Depth	Overlap	Type	Amt	Unit	Comments
0905	134.3	5.5	130.8			126.1	126.1	4.7	Bent	3	Bags	Adding 5.00' of casing
-6 0915	136.3	5.5	130.8			125.7	120.2	10.6				to pull with casing jacks
0920	131.3	5.6	125.7			125.1	119.5	6.2	Bent	2	Bags	
-6 0925	131.3	5.6	125.7			118.7	113.1	12.6				(-5) Denotes sleeved
-5 0928	133.3	4.3	122.0			–	–	–	–	–	–	because of contamination
0930	121.3	4.3	117.0			120.8	116.5	0.5	Bent	10	Bags	
-10 0935	121.3	4.3	117.0			99.8	95.5	21.5				
0945	111.3											Adding 0.7' head
-5 0946	+112.0	5.0	107.0			103.3	98.3	8.7				
0948	107.0	5.0	102.0			104.5	99.5	2.5	Bent	10	Bag	
-6 1015	107.0	5.0	102.0			83.1	78.1	23.9				
1026	92	5.0	88.7			89.6	84.6	2.4	Bent	10	Bags	TOC in hot/1st joint with
-16 1030	92	5.0	87.0			68.3	63.3	23.7				82' in hole.
1040	77	5.0	72.0			72.2	67.2	5.0	Bent	10	Bags	
-5 1210	77	5.0	72.0			50.9	45.9	26.1				
-5 1310	72	7.0	65.0			49.0	42.0	23.0				← Pipe hanging in hole when
-5 1341	67	2.0	65.0			44.2	42.2	22.8				measured
(-5) 1356	62	2.0	60.0			51.3	49.3	10.7				Bent = bentonite crumbles
1406	57	2.0	55.0			54.0	52.0	3.0	Bent	2	Bags	

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Kevin Singleton
Title: Geologist
Date: 10-1-01
Signature: [signature]

Reviewed By: DC Weekes
Title: Geologist
Date: 10/23/01
Signature: DC Weekes

BHI-EE-179 (12/97)

WELL COMPLETION LOG

Page ~~5~~ 6 of ~~5~~ final
Date: 10-1-01

Well Name: ~~NA~~ NEW C3103
Well ID: C3103
Project: 200-TW-2
Location: 216-B-7A
Drilling Contractor: RSI

1. Time	2. Total Casing	3. Stickup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
(-5) 1415	57	3.1	53.9			49.9	46.8	7.1				(-5) Denoted sleeved
.6 1425	52	2.5	49.5			50.1	48.1	1.4				
1510	47	3.0	44.0									
	-47		0									000 8" casing out of hole @ 1600hrs with shoe in place.
							NA					

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Kevin Singleton
Title: Geologist
Date: 10-1-01
Signature: [signature]

Reviewed By: DC Weekes
Title: Geologist
Date: 10/23/01
Signature: DC Weekes

BHI-EE-179 (12/97)

WELL COMPLETION LOG

Page ~~2~~ 6 of ~~2~~ 6 now
Date: ~~10-2-01~~ 10-2-01

Well Name: ~~AA~~ dry C3103
Well ID: C3103
Project: 200-TW-2
Location: 200 East 216-B-7A
Drilling Contractor: RST

1. Time	2. Total Casing	3. Stkup	4. Btm Csg	5. Tape Reading	6. Correction	7. Cor Tape Reading	8. Fill Depth	9. Overlap	Fill Material Type	Fill Material Amt	Fill Material Unit	Comments
1020	52.33	1.8	50.5		~~2~~ 10-2-01	~~49.4~~ 50.0	49.2	1.3				(-5) = casing sleeved.
1025	52.33	2.3	50.0			51.5	49.2	0.8				
1029	52.33	2.9	49.4			52.2	49.3	0.1	Bent	9	Bags	
(-5) 1033	52.33	2.9	49.4			42.6	39.7	9.7				changed head; -1'
1044	~~47.33~~ 46.33	1.5	44.8			42.0	40.5	4.3	Bent	7	Bags	
(-5) 1100	46.33	1.5	44.8			34.0	32.5	12.3				
1106	41.33	0.8	40.5			35.0	34.2	6.3	Bent	10	Bags	
(-5) 1116	41.33	0.8	40.5			25.0	24.2	16.3				
(-5) 1135	36.33	1.3	35.0			27.3	26.0	9.0				
(-5) 1140	31.33	2.0	29.3			28.4	26.4	2.9	Bent	23	Bags	
(-5) (-5) 1310	31.33	2.0	29.3			~~22~~ NA	50+	~~29.3+~~ 30.6				
1500	11.33	2.0	9.33			6.5	4.5	4.8	Bent	1	Bag	
-10 1510	11.33	3.0	8.33			5.5	2.5	5.8				
1530	0	0	0			4.0	4.0	NA	Bent	2	Bags	→ in well & annulus
						3.3	3.3		Cement	1	Bag	
						2.0	2.0					
												Bent = Bentonite crumbles

Note: Col. 2 - Col. 3 = Col. 4 - Col. 5 - weight and attachments = Col. 7; Col. 7 – Col. 3 = Col. 8; Col. 4 - Col. 8 = Col. 9

Reported By: Kevin Singleton
Title: Geologist
Date: 10-2-01
Signature: [signature]

Reviewed By: DC Weekes
Title: Geologist
Date: 10/23/01
Signature: [signature]

BHI-EE-179 (12/97)

APPENDIX B

BOREHOLE GEOPHYSICAL LOGGING REPORTS

C3340

Log Data Report

Borehole Information

Borehole: C3340			Site: 216-B-38		
Coordinates		GWL[1] (ft):	none	GWL Date:	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
N/A[3]	N/A	June 2001	N/A	60	push

Casing Information

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
steel threaded	0.5	6.625	5.625	0.5	0	60

Borehole Notes:

This is a temporary borehole pushed to a depth of approximately 60 ft. There is a gravel pad approximately 1 ft thick, and the top of casing sticks up approximately 0.5 ft above the gravel surface. The zero reference point for the log data is the ground surface.

Logging Equipment Information

Logging System:	Gamma 2B		Type:	SGLS (35%)
Calibration Date:	09/00	Calibration Reference:		GJO-2001-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Logging System:	RLS		Type:	NMLS (Moisture)
Calibration Date:	05/01	Calibration Reference:		GJO-2001-247-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Logging System:	Gamma 1C		Type:	HRLS
Calibration Date:	09/00	Calibration Reference:		GJO-2001-244-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Page 1

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	
Date	7/11/01	7/11/01	7/12/01	7/12/01	
Logging Engineer	Spatz/Musial	Spatz/Musial	Kos/Musial	Kos/Musial	
Start Depth	0	12.5	22.5	35.0	
Finish Depth	13.5	23.5	34.5	35.0	
Count Time (sec)	180	30	30	180	
Live/Real	L	R	R	L	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	0.5	0.5	0.5	0.5	
ft/min	n/a[4]	n/a	n/a	n/a	
Pre-Verification	B0017CAB	B0017CAB	B0019CAB	B0019CAB	
Start File	B0018000	B0018028	B0019000	B0019024	
Finish File	B0018027	B0018050	B0019023	B0019024	
Post-Verification	B0018CAA	B0018CAA	None	None	

High Rate Logging System (HRLS) Log Run Information:

Log Run	5				
Date	7/20/01				
Logging Engineer	A. Pearson				
Start Depth	13.5				
Finish Depth	36.0				
Count Time (sec)	300				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	0.5				
ft/min	n/a				
Pre-Verification	D0000CAB				
Start File	D0000000				
Finish File	D0000045				
Post-Verification	D0002CAA				

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	6	7 (repeat)			
Date	7/23/01	7/23/01			
Logging Engineer	Kos/Spatz	Kos/Spatz			
Start Depth	0.0	40.0			
Finish Depth	59.0	33.25			
Count Time (sec)	n/a	n/a			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	n/a	n/a			
ft/min	1.0	1.0			
Pre-Verification	C0042CAB	C0042CAB			
Start File	C0052000	C0052237			
Finish File	C0052236	C0052264			
Post-Verification	C0062CAA	C0062CAA			

Logging Operation Notes:

Log depths are relative to ground surface. The NMLS and HRLS data are relative to top of casing, which represents an offset of about 0.5 ft. Multiple SGLS log runs were made to adjust count times in response to high dead time intervals. In areas of excessive dead time, the count time was reduced to 30 seconds to provide a log record where spectra were not anticipated to contain reliable full energy peaks. No fine-gain adjustments were made. SGLS log run four was terminated early due to a water-pump failure in the logging truck, and no post-run verification spectrum was recorded. No SGLS logs were recorded below a depth of 35 ft.

Internal contamination (inside the casing) was reported by the HPT on July 11, 2001. A reading of approximately 12,000 dpm was reported. The radionuclide responsible for this contamination was not identified.

Analysis Notes:

Analyst:	McCain	Date:	07/27/01	Reference:	MAC-VZCP 1.7.9, Rev. 2

Pre-run and post-run verification spectra were evaluated and found to be within acceptance criteria. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for casing thickness and dead time. Because of high dead time and detector saturation, maximum gross count rates and ^{137}Cs concentrations are not considered reliable, and are probably significantly higher than reported values. Where dead time exceeds about 40 percent, pulse pileup and peak spreading effects may result in underestimation of peak count rates. The ^{214}Bi peak at 1764 keV was used to determine ^{238}U concentrations instead of the ^{214}Bi peak at 609 keV to avoid interference from the ^{137}Cs peak at 662 keV.

The high rate data were processed for the ^{137}Cs count rate at 662 keV using APTEC supervisor. Concentrations were calculated in EXCEL. A casing correction factor of 1.37 was applied to the high rate data to account for the increased attenuation in the 0.5-inch steel casing, relative to 0.28-inch casing.

The neutron moisture log was processed using the calibration relationship developed for a 6-inch diameter borehole with 0.28-inch thick casing. A correction factor of 1.20 was applied to account for the effects of the thicker casing, which is based on an equivalent casing correction for 8-inch diameter developed by Randall.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K and associated decay progeny of ^{232}Th and ^{238}U), man-made radionuclides, and moisture content. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and does not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. Intervals where SGLS dead time exceeds 40 percent are shaded.

Results and Interpretations:

^{137}Cs was detected. The greatest ^{137}Cs concentration occurs between 15 and 32 ft. High dead times and detector saturation occurs between 13 and 36 ft. The maximum measured ^{137}Cs concentration is about 180,000 pCi/g, at 23.5 ft.

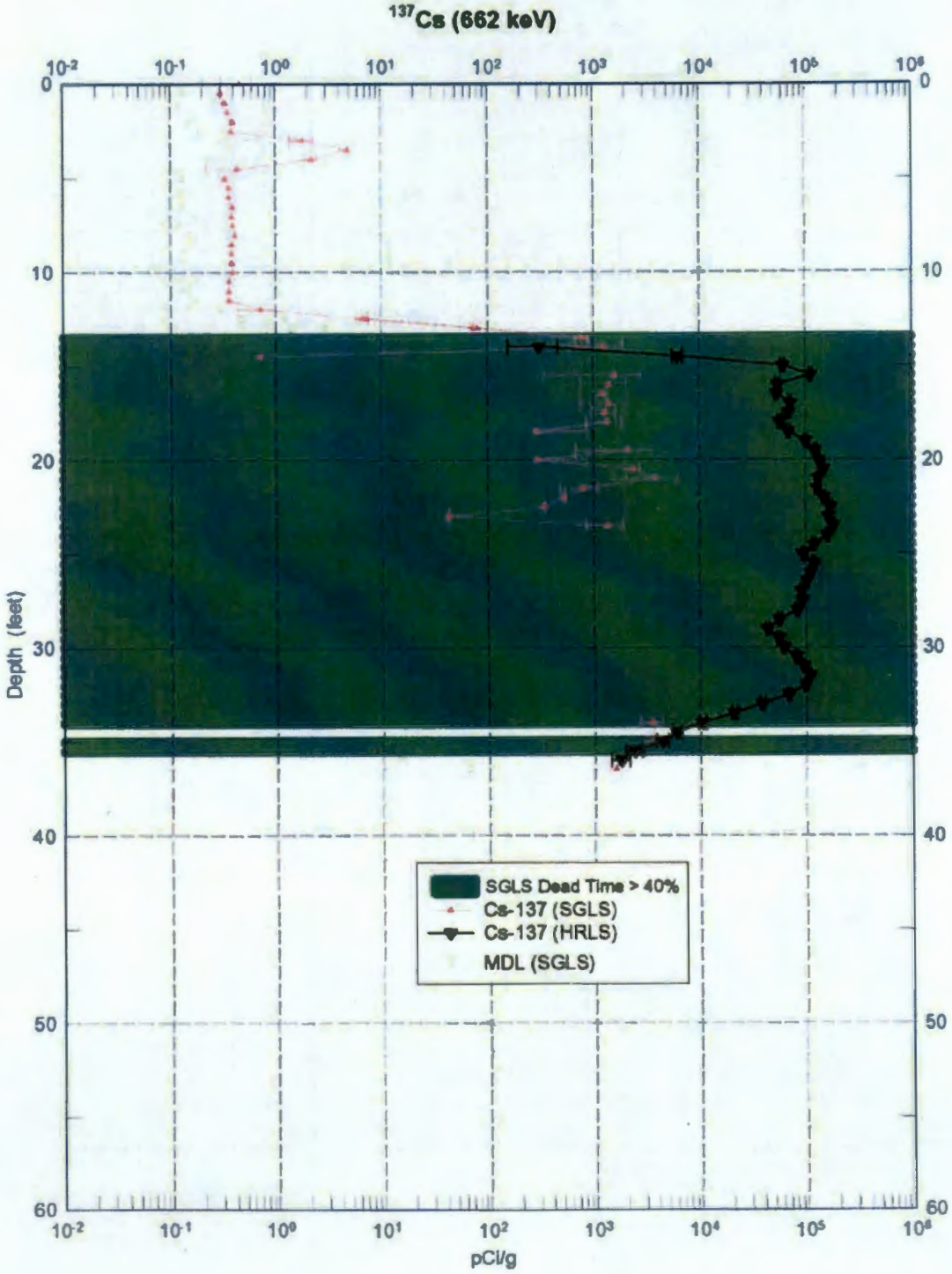
Detector saturation in the region of high ^{137}Cs effectively obscures the natural radionuclides.

---

[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not available
[4] n/a – not applicable

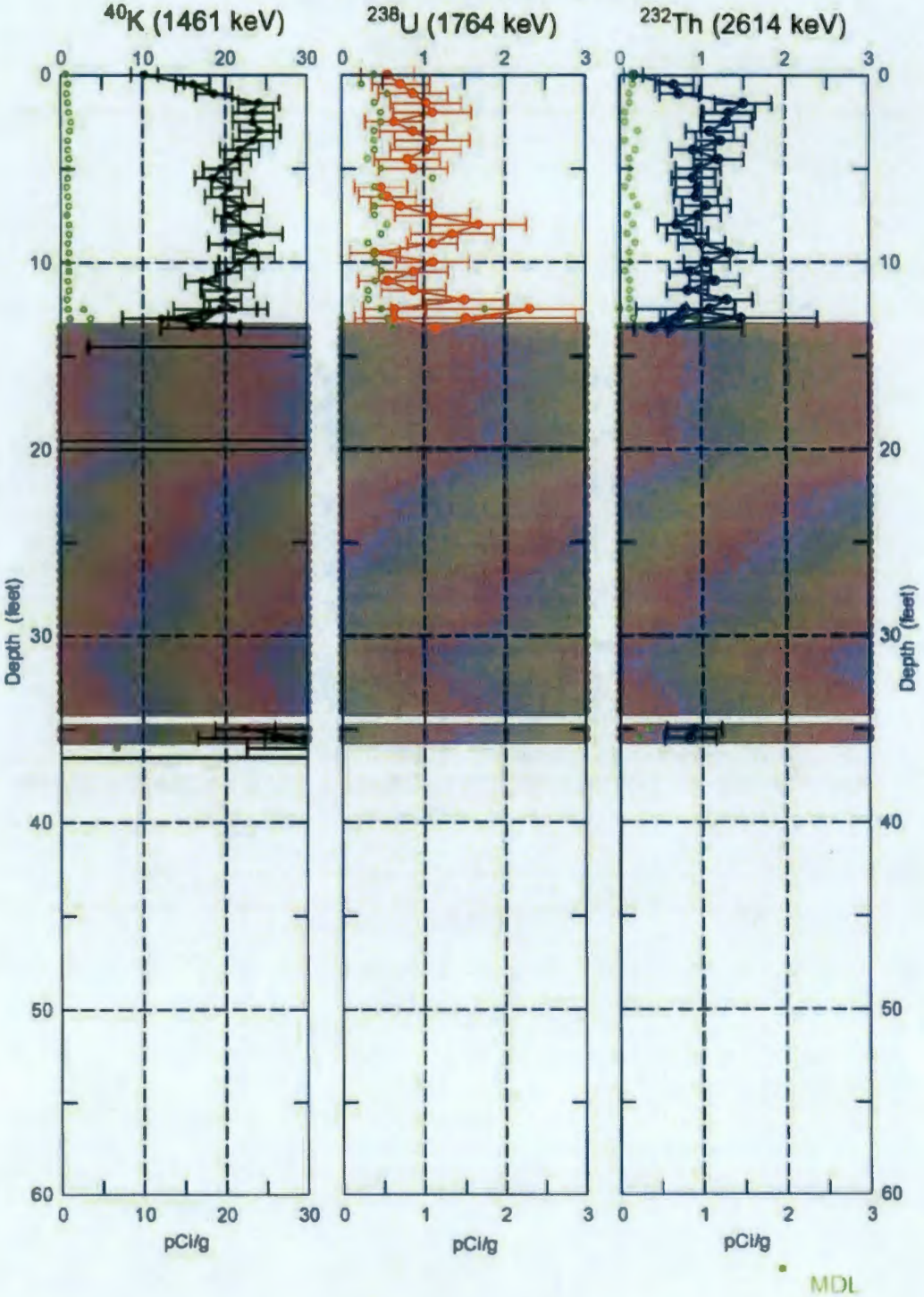
C3340

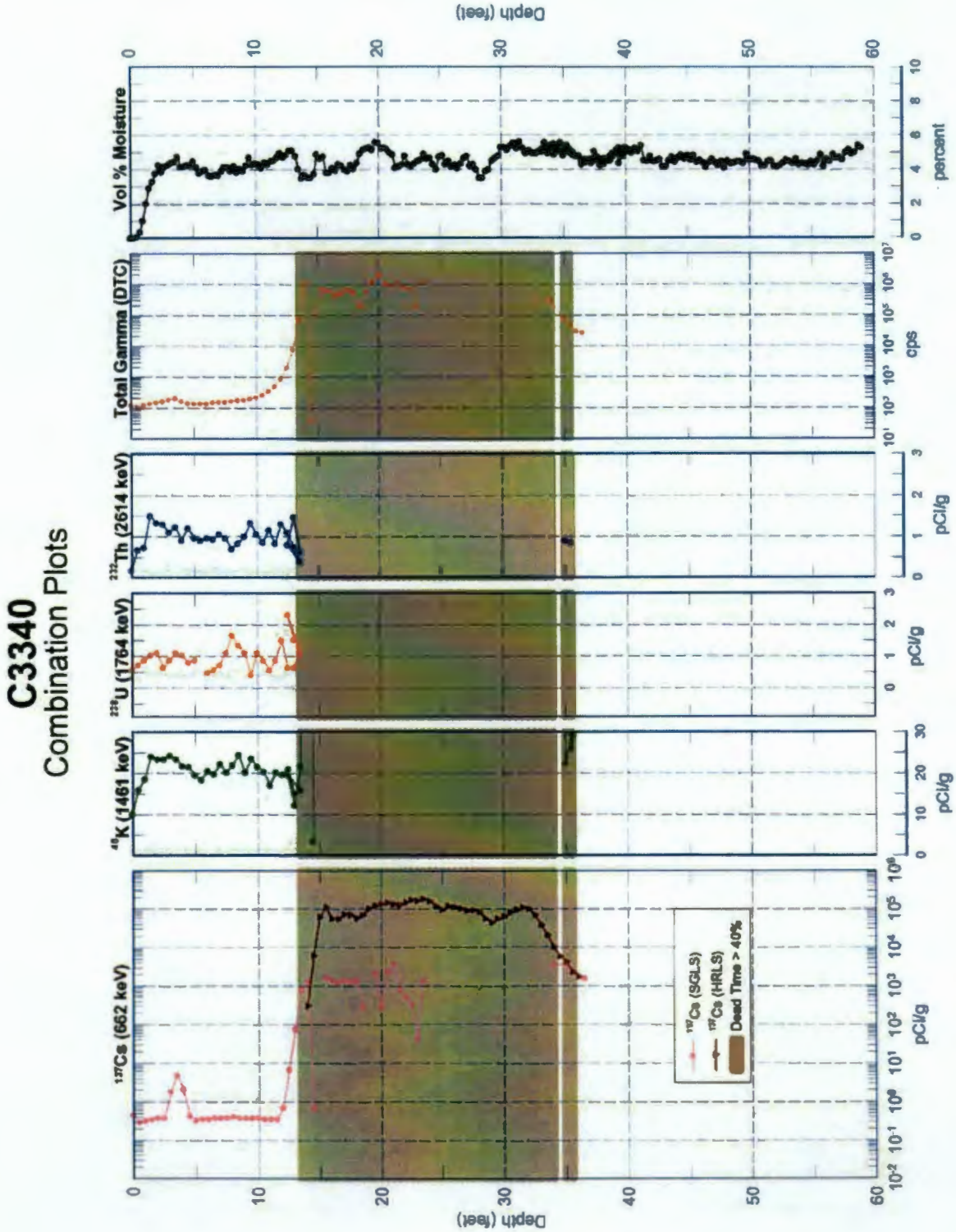
Man-Made Radionuclides



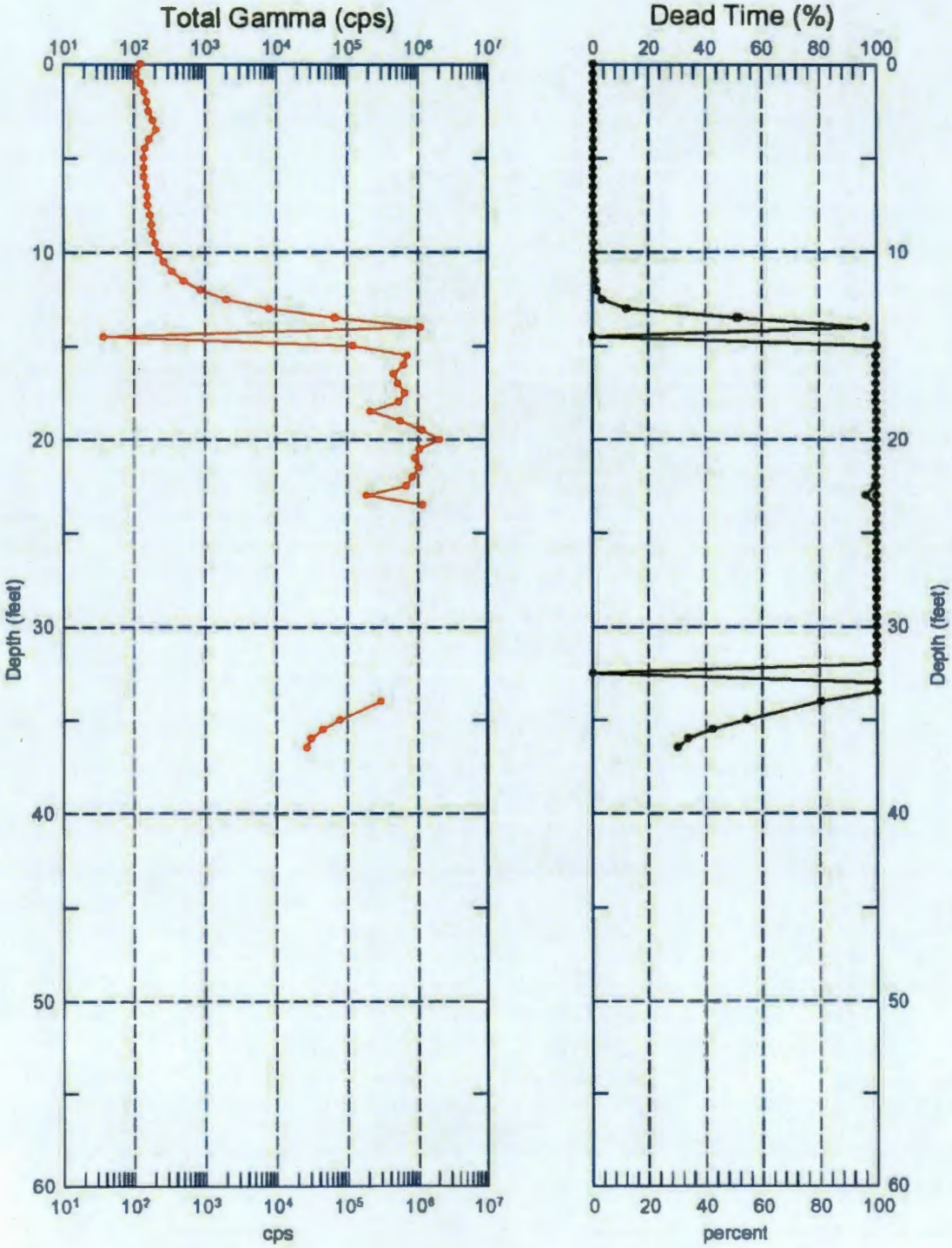
C3340

Natural Gamma (KUT) Logs




C3340
Combination Plots
Vol % Moisture
percent
Total Gamma (DTC)
cps
232Th (2614 keV)
pCi/g
238U (1764 keV)
pCi/g
40K (1461 keV)
pCi/g
137Cs (662 keV)
pCi/g
Depth (feet)
137Cs (SGLS)
137Cs (HRLS)
Dead Time > 40%

C3340
Total Gamma and Dead Time



C3341

Log Data Report

Borehole Information

Borehole: C3341			Site: 216-B-38		
Coordinates		GWL (ft)[1]:	N/A	GWL Date:	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
N/A[3]	N/A	June 2001	N/A	60	push

Casing Information

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
steel threaded	0.5	6.625	5.625	0.5	0	59.5

Borehole Notes:

This temporary borehole was pushed to a depth of approximately 60 ft. There is a gravel pad approximately 1 ft thick, and the top of casing sticks up approximately 0.5 ft above the gravel surface. The zero reference point for the log data is the ground surface.

Logging Equipment Information:

Logging System:	Gamma 2B		Type:	SGLS (35%)
Calibration Date:	09/00	Calibration Reference:		GJO-2001-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Logging System:	RLS1		Type:	NMLS (Moisture)
Calibration Date:	05/01	Calibration Reference:		GJO-2001-247-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Logging System:	Gamma 1C		Type:	HRLS
Calibration Date:	09/00	Calibration Reference:		GJO-2001-244-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Page 1

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	7/10/01	7/10/01	7/10/01	7/10/01	7/10/01
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth	59.5	33.0	30.5	20.0	19.0
Finish Depth	32.0	29.5	19.0	18.0	13.0
Count Time (sec)	180	180	180	180	30
Live/Real	L	R	L	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	n/a[4]	n/a	n/a	n/a	n/a
Pre-Verification	B0016CAB	B0016CAB	B0016CAB	B0016CAB	B0016CAB
Start File	B0016000	B0016056	B0016064	B0016088	B0016093
Finish File	B0016055	B0016063	B0016087	B0016092	B0016105
Post-Verification	B0016CAA	B0016CAA	B0016CAA	B0016CAA	B0016CAA

Log Run	6	7	8 (repeat)		
Date	7/10/01	7/11/01	7/11/01		
Logging Engineer	Spatz	Musial/Spatz	Musial/Spatz		
Start Depth	14.0	8.0	14.0		
Finish Depth	7.0	1.0	8.0		
Count Time (sec)	180	180	180		
Live/Real	L	L	L		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	0.5	0.5	0.5		
ft/min	n/a	n/a	n/a		
Pre-Verification	B0016CAB	B0017CAB	B0017CAB		
Start File	B0016106	B0017000	B0017015		
Finish File	B0016120	B0017014	B0017027		
Post-Verification	B0016CAA	B0017CAA	B0017CAA		

High Rate Logging System (HRLS) Log Run Information:

Log Run	9	10			
Date	7/20/01	7/20/01			
Logging Engineer	Pearson /Musial	Pearson /Musial			
Start Depth	13.5	29.0			
Finish Depth	24.0	34.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.5	0.5			
ft/min	n/a	n/a			
Pre-Verification	D0000CAB	D0000CAB			
Start File	D0001000	D0001022			
Finish File	D0001021	D0001032			
Post-Verification	D0002CAA	D0002CAA			

Neutron Moisture Logging System (NMLS) Log Run Information

Log Run	11	12 (repeat)			
Date	7/24/01	7/24/01			
Logging Engineer	Kos/Spatz	Kos/Spatz			
Start Depth	0.0	42.0			
Finish Depth	59.5	35.75			
Count Time (sec)	n/a	n/a			
Live/Real	n/a	n/a			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	1.0	1.0			
Pre-Verification	C0042CAB	C0042CAB			
Start File	C0062000	C0062239			
Finish File	C0062238	C0062264			
Post-Verification	C0062CAA	C0062CAA			

Logging Operation Notes:

Log depths are relative to ground surface. Multiple SGLS log runs were made to adjust count times in response to high dead time intervals. Measurement mode was switched from live time to real time in intervals with high count rates to expedite logging operations. In areas of excessive dead time, the count time was reduced to 30 seconds to provide a log record where spectra are not anticipated to contain reliable full energy peaks. No fine-gain adjustments were made. The post-run verification spectrum B0017CAA was collected over a 500-second count time instead of 1,000 seconds.

The HRLS data are relative to top of casing. To account for the 0.5-ft stickup, depths for the HRLS should be reduced by 0.5 ft.

Analysis Notes:

Analyst:	McCain	Date:	07/27/01	Reference:	MAC-VZCP 1.7.9, Rev. 2

Pre-run and post run verification spectra were evaluated and found to be within acceptance criteria. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for casing thickness and dead time. Water correction was not required. Because of high dead time and detector saturation, maximum gross count rates and ^{137}Cs concentrations are not considered reliable, and are probably significantly higher than reported values. Where dead time exceeds about 40 percent, pulse pileup and peak spreading effects may result in underestimation of peak count rates. The ^{214}Bi peak at 1764 keV was used to determine ^{238}U concentrations instead of the ^{214}Bi peak at 609 keV to avoid interference from the ^{137}Cs peak at 662 keV.

The high rate data were processed for ^{137}Cs count rate at 662-keV energy level using APTEC supervisor. Concentrations were calculated in EXCEL. A casing correction factor of 1.37 was applied to the high rate data to account for the increased attenuation in the 0.5-inch steel casing, relative to 0.28-inch casing, for which the system was calibrated. No shield corrections were required.

The neutron moisture log was processed using the calibration relationship developed for a 6-inch-diameter borehole with 0.28-inch-thick casing. A correction factor of 1.20 was applied to account for the effects of

the thicker casing, which is based on an equivalent casing correction for 8-inch diameter developed by Randall.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, and decay progeny of ^{232}Th and ^{238}U), man-made radionuclides, and moisture content. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. Intervals where SGLS dead time exceeds 40% are shaded. The total gamma log is plotted at both logarithmic and linear scales. The logarithmic scale shows the full range of variation, while the linear scale shows subtle variation in low count intervals.

A repeat log plot is also shown. The repeat plot indicates good agreement between successive log runs. This demonstrates good repeatability in both depth and radionuclide measurement.

Results and Interpretations:

^{137}Cs and ^{60}Co were detected. The highest ^{137}Cs concentrations occur between 12.5 and 28 ft. High dead times and detector saturation occurs between 14.5 and 19 ft. The maximum measured ^{137}Cs concentration is about 56,186 pCi/g at 17 ft. A second interval of ^{137}Cs occurs between 29.5 and 33 ft, with concentrations as high as 6356 pCi/g at 31.5 ft. Minor ^{137}Cs also occurs between 4.0 and 5.5 ft, with a maximum concentration of 2.57 pCi/g.

^{60}Co was detected intermittently between 33 and 57 ft, with a maximum concentration of 0.16 pCi/g at 33 ft.

^{40}K concentrations increase gradually from about 10 pCi/g at 19 ft to about 20 pCi/g at 33 ft. This increase may indicate a gradational change, with increasing fines in the material below 32.5 ft.

Moisture content appears to increase slightly between about 15 and 35 ft. This corresponds to the interval of high ^{137}Cs concentration, but it is not clear if the neutron log is responding to an increased moisture content or to interference from the high gamma flux in this interval.

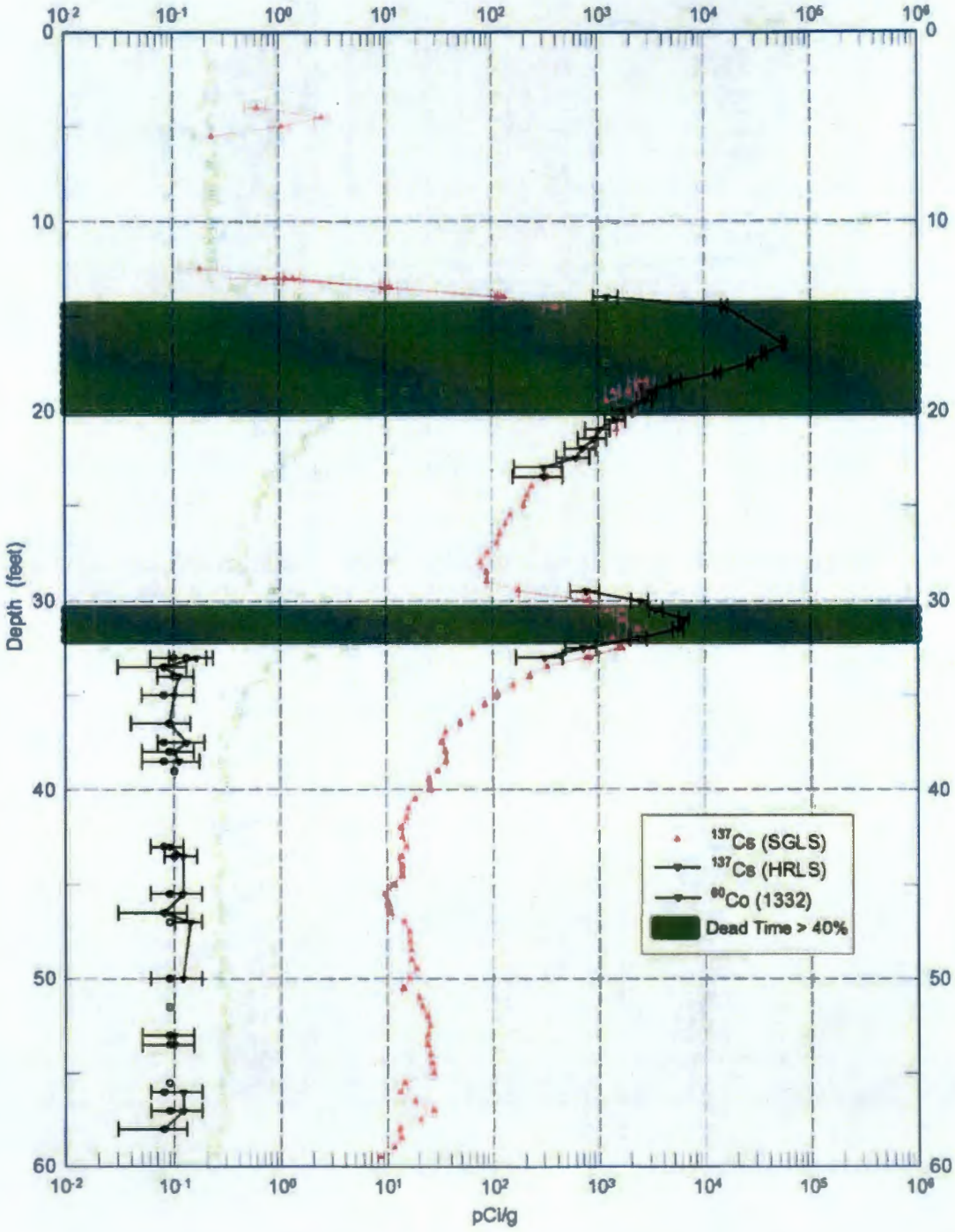
---

[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not available
[4] n/a – not applicable

C3341

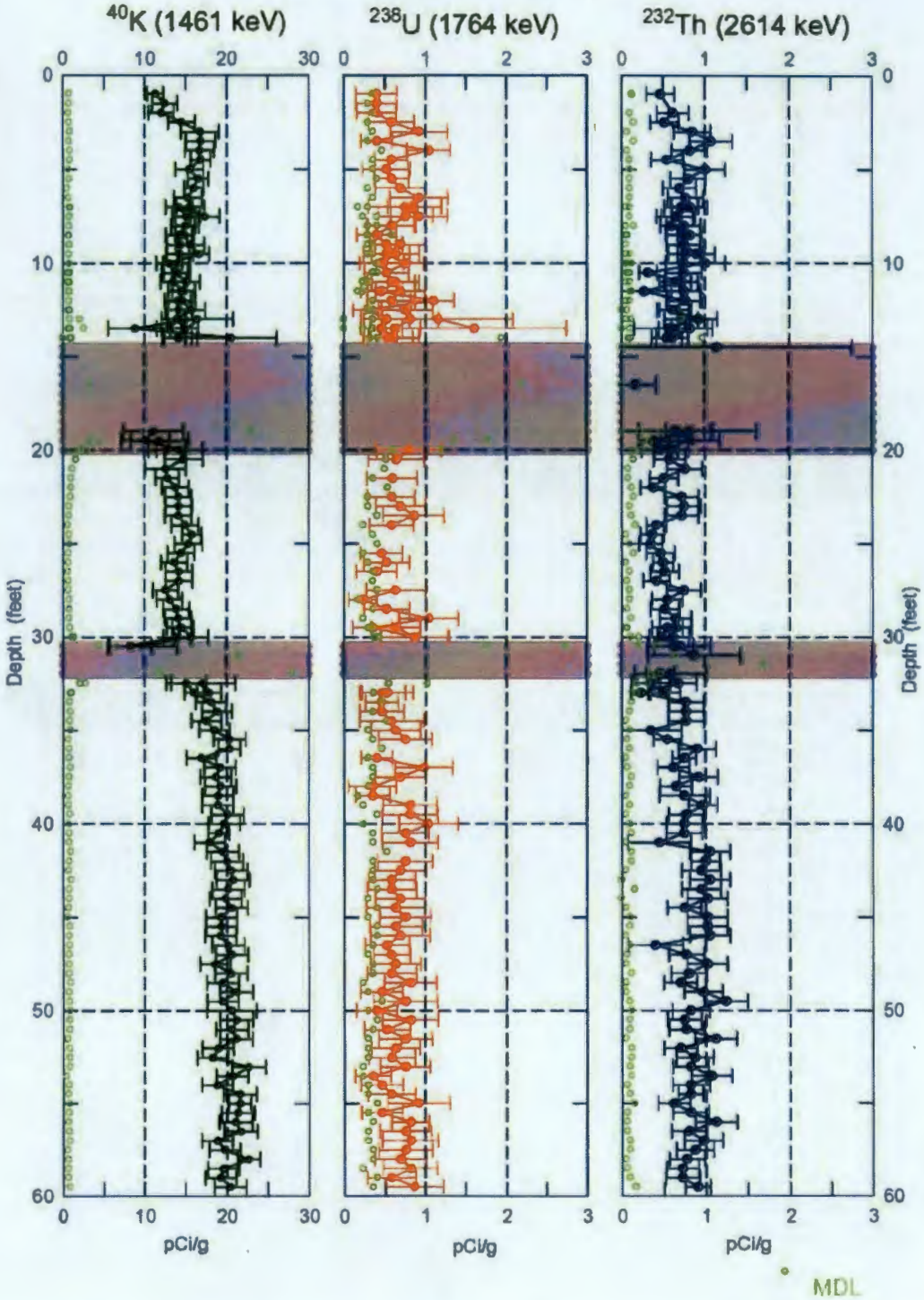
Man-Made Radionuclides

^{137}Cs (662 keV)

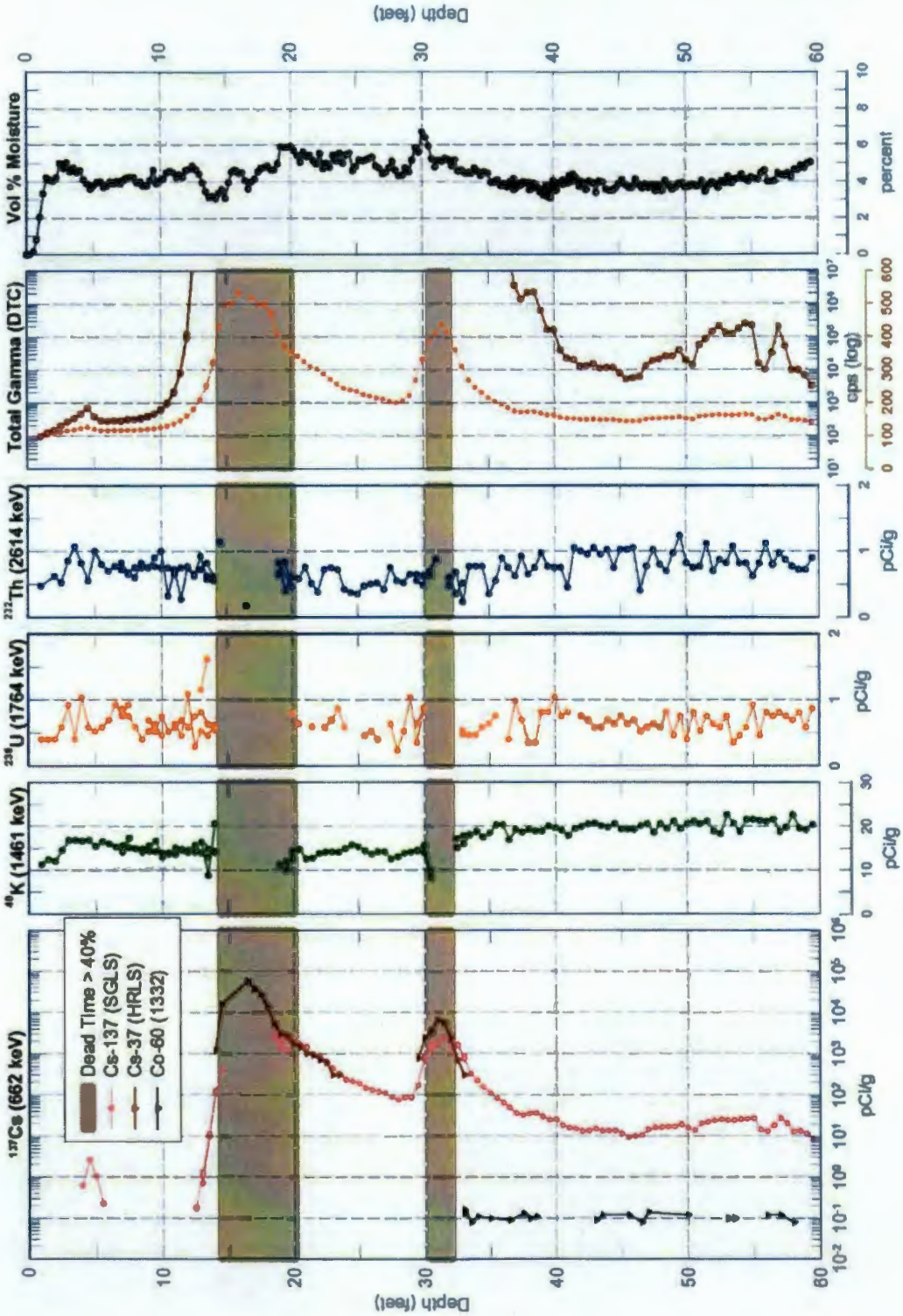


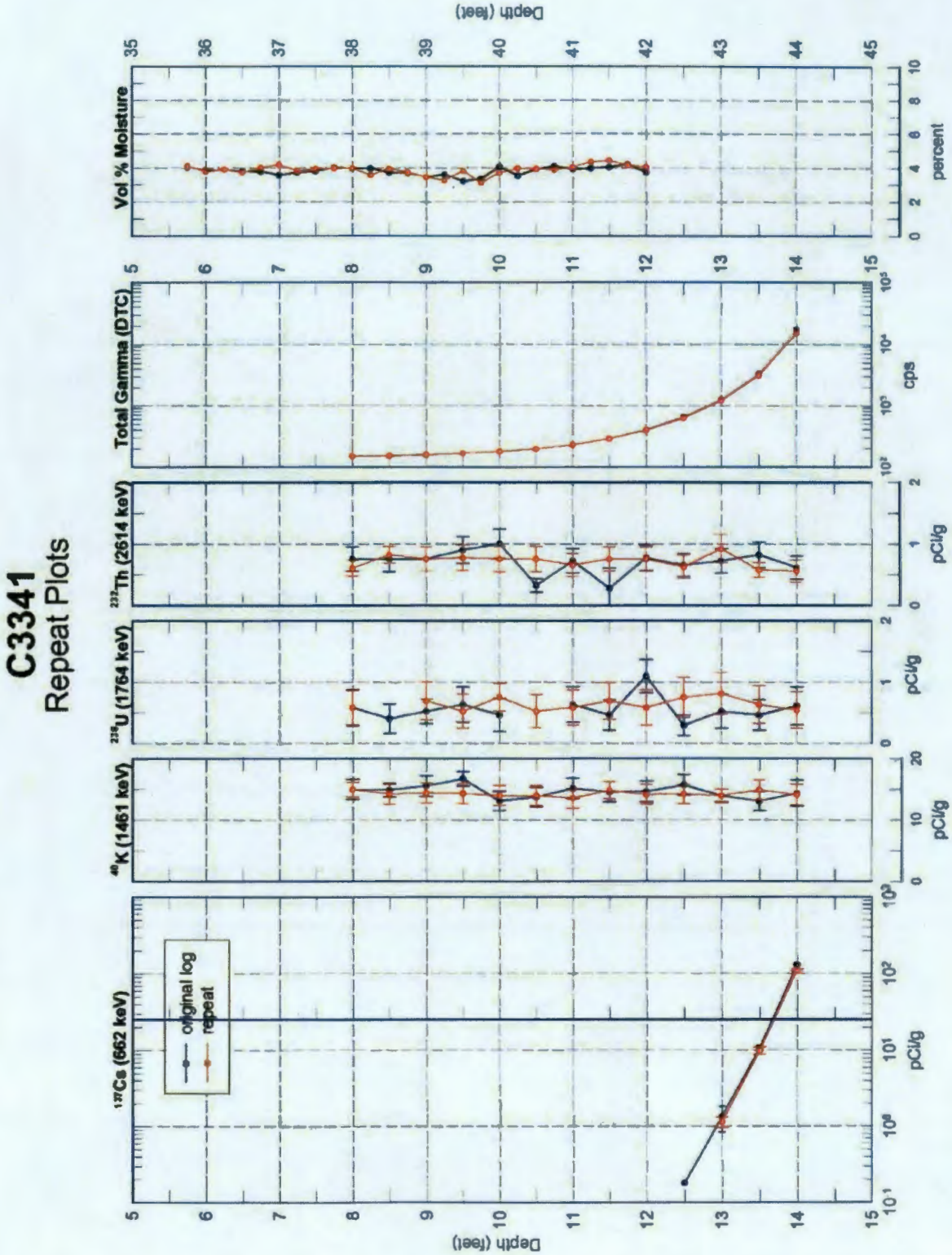
C3341

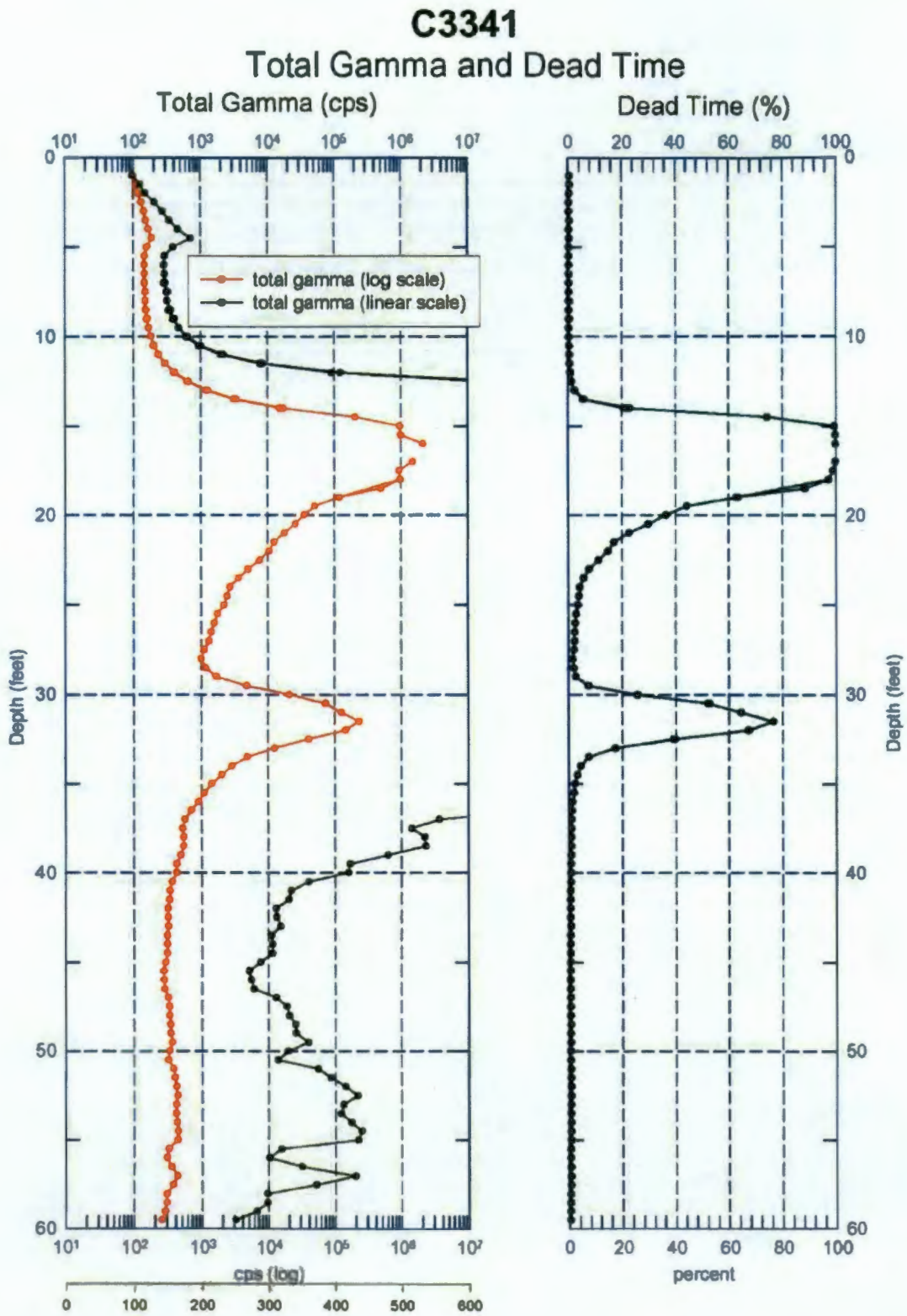
Natural Gamma (KUT) Logs



C3341 Combination Plots




C3341
Repeat Plots
Vol % Moisture
Total Gamma (DTC)
^{232}Th (2614 keV)
^{238}U (1764 keV)
^{40}K (1461 keV)
^{137}Cs (662 keV)
original log
repeat
Depth (feet)
percent
cps
pCi/g


C3341
Total Gamma and Dead Time
Total Gamma (cps)
Dead Time (%)
total gamma (log scale)
total gamma (linear scale)
Depth (feet)
cps (log)
percent

C3342

Log Data Report

Borehole Information

Borehole: C3342			Site: 216-B-38		
Coordinates		GWL[1] (ft):	N/A[2]	GWL Date:	
North	East	Drill Date	TOC[3] Elevation	Total Depth (ft)	Type
N/A	N/A	June 2001	N/A	60	push

Casing Information

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
steel threaded	0.5	6.625	5.625	0.5	0	59.5

Borehole Notes:

This is a temporary borehole pushed to a depth of approximately 60 ft. There is a gravel pad approximately 1 ft thick, and the top of casing sticks up approximately 0.5 ft above the gravel surface.

Logging Equipment Information:

Logging System:	Gamma 2B		Type:	SGLS (35%)
Calibration Date:	09/00	Calibration Reference:		GJO-2001-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Logging System:	NMLS		Type:	NMLS (Moisture)
Calibration Date:	05/01	Calibration Reference:		GJO-2001-247-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Logging System:	Gamma 1C		Type:	HRLS
Calibration Date:	09/00	Calibration Reference:		GJO-2001-244-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Page 1

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5 (repeat)
Date	7/09/01	7/09/01	7/09/01	7/09/01	7/09/01
Logging Engineer	Spatz/Musial	Spatz/Musial	Spatz/Musial	Spatz/Musial	Spatz/Musial
Start Depth	59.5	34.0	29.5	14.0	14.0
Finish Depth	33.0	28.5	13.0	1.0	8.0
Count Time (sec)	180	180	30	180	180
Live/Real	L	R	R	L	L
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	n/a[4]	n/a	n/a	n/a	n/a
Pre-Verification	B0015CAB	B0015CAB	B0015CAB	B0015CAB	B0015CAB
Start File	B0015000	B0015054	B0015066	B0015100	B0015127
Finish File	B0015053	B0015065	B0015099	B0015126	B0015139
Post-Verification	B0015CAA	B0015CAA	B0015CAA	B0015CAA	B0015CAA

High Rate Logging System (HRLS) Log Run Information:

Log Run	6				
Date	7/20/01				
Logging Engineer	Pearson				
Start Depth	13.5				
Finish Depth	35.0				
Count Time (sec)	300				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	0.5				
ft/min	n/a				
Pre-Verification	D0000CAB				
Start File	D0002000				
Finish File	D0002043				
Post-Verification	D0002CAA				

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	7				
Date	7/20/01				
Logging Engineer	Spatz/Musial				
Start Depth	0.0				
Finish Depth	59.5				
Count Time (sec)	n/a				
Live/Real	n/a				
Shield (Y/N)	N				
MSA Interval (ft)	0.25				
ft/min	1.0				
Pre-Verification	C0002CAB				
Start File	C0002000				
Finish File	C0062238				
Post-Verification					

Page 2

Logging Operation Notes:

The zero reference point for all log data is the top of casing. Depths have been adjusted to groundsurface, which is taken as the top of the gravel pad. Multiple SGLS log runs were made to adjust count times in response to high dead time intervals. Measurement mode was switched from live time to real time in intervals with high count rates to expedite logging operations. In areas of excessive dead time, the count time was reduced to 30 seconds to provide a log record where spectra were not anticipated to contain reliable full energy peaks. Fine-gain adjustments were made in run 1 after B0015031 (44.0 ft), and in run 4 after B0015103 (12.5 ft).

Analysis Notes:

Analyst:	McCain	Date:	07/27/01	Reference:	MAC-VZCP 1.7.9, Rev. 2

Pre-run and post-run verification spectra were evaluated and found to be within acceptance criteria. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for casing thickness and dead time. Water correction was not required. Where SGLS dead time exceeds about 40 percent, pulse pileup and peak spreading effects may result in underestimation of peak count rates. The ^{214}Bi peak at 1764 keV was used to determine ^{238}U concentrations instead of the ^{214}Bi peak at 609 keV to avoid interference from the ^{137}Cs peak at 662 keV.

The high rate data were processed for ^{137}Cs count rate at 662-keV energy level using APTEC supervisor. Concentrations were calculated in EXCEL. A casing correction factor of 1.37 was applied to the high rate data to account for the increased attenuation in the 0.5-inch steel casing, relative to 0.28-inch casing, for which the system was calibrated. No shield corrections were required.

The neutron moisture log was processed using the calibration relationship developed for a 6-inch-diameter borehole with 0.28-inch-thick casing. A correction factor of 1.20 was applied to account for the effects of the thicker casing, which is based on an equivalent casing correction for 8-inch-diameter casing developed by Randall.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, and associated decay progeny of ^{232}Th and ^{238}U), man-made radionuclides, and moisture content. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. Intervals where SGLS dead time exceeds 40 percent are shaded. The total gamma log is plotted at both logarithmic and linear scales. The logarithmic scale shows the full range of variation, while the linear scale shows subtle variation in low count intervals.

A repeat log plot is also shown. The repeat plot indicates good agreement between successive log runs. This demonstrates good repeatability in both depth and radionuclide measurement.

Results and Interpretations:

^{137}Cs and ^{60}Co were detected. The greatest ^{137}Cs concentration occurs between 13 and 33.5 ft. High dead times and detector saturation occur between 14.5 and 29 ft. The maximum measured ^{137}Cs concentration is about 195,000 pCi/g at 16.5 ft. Between 17.5 and 28.5 ft, the ^{137}Cs concentration falls between 20,000 and

100,000 pCi/g. From 33.5 ft to TD at 59.5 ft the ^{137}Cs concentration gradually decreases from more than 2,000 pCi/g to about 15 pCi/g.

^{60}Co was detected intermittently between 34 and 42 ft, with a maximum concentration of 0.29 pCi/g at 34 ft.

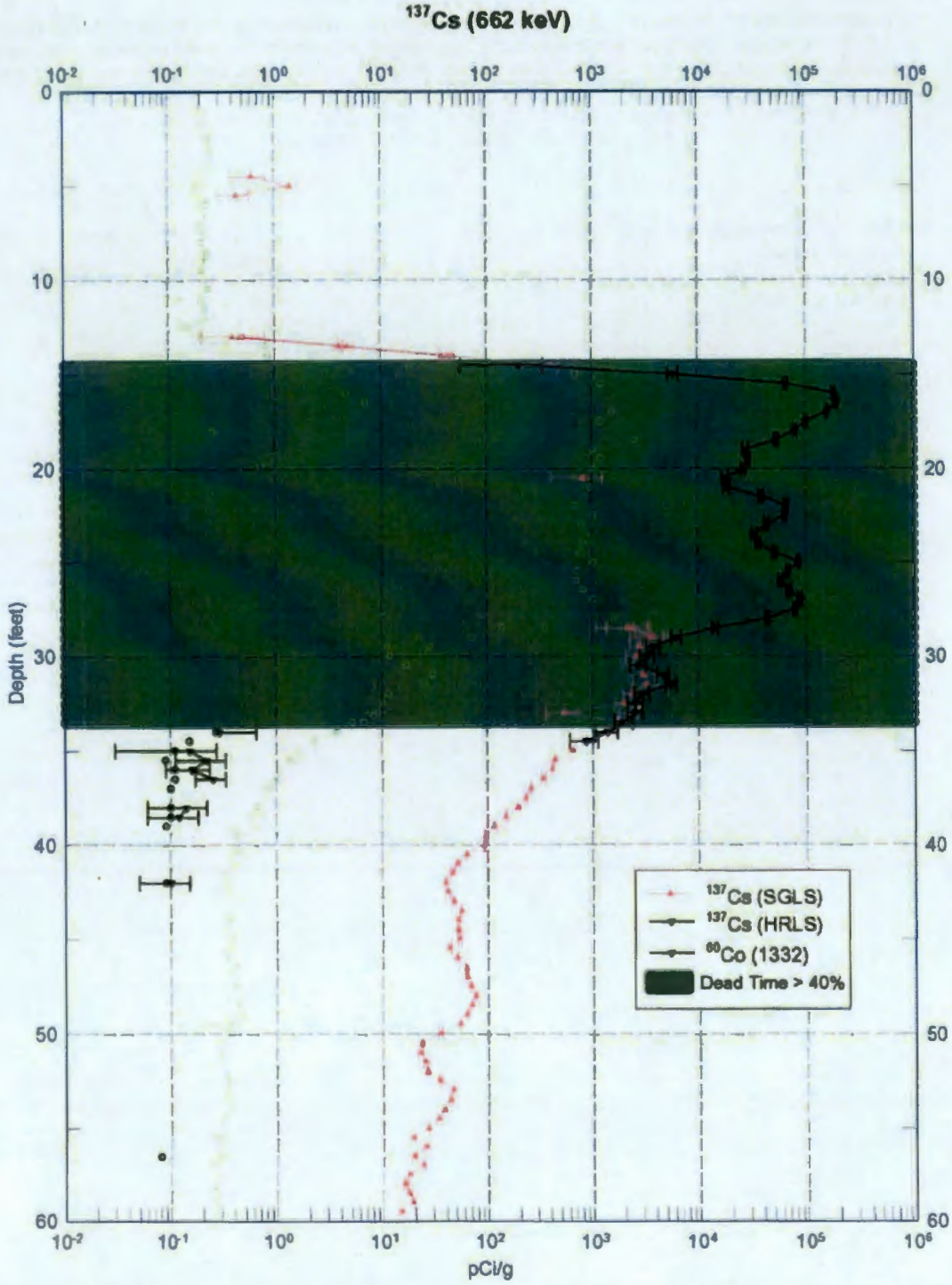
The neutron moisture log indicates a slightly higher moisture content corresponding with the interval of high ^{137}Cs, but it is not clear if this is related to higher moisture content, or to interference from the high gamma flux. There is a relatively thin interval from about 26.5 to 28.5 ft where the moisture content increases from about 5 percent to 8 percent. This zone occurs near the bottom of the interval of maximum contamination, and does not appear to be related to changes in gamma intensity. There is also a zone of elevated moisture content at about 1 to 5 ft with a maximum of 5.5 percent at 3 ft.

---

[1] GWL – groundwater level
[2] N/A – not available
[3] TOC – top of casing
[4] n/a – not applicable

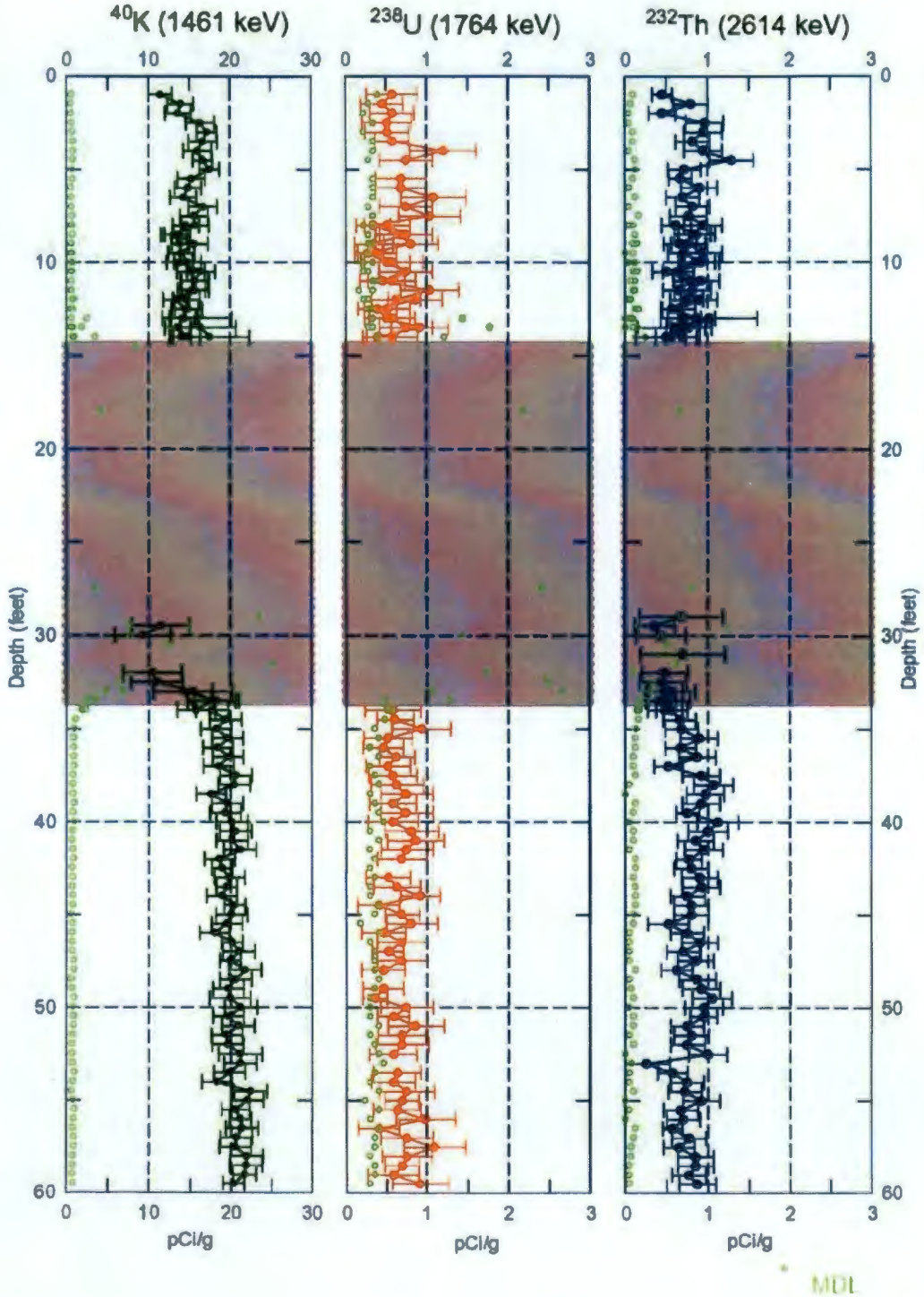
C3342

Man-Made Radionuclides

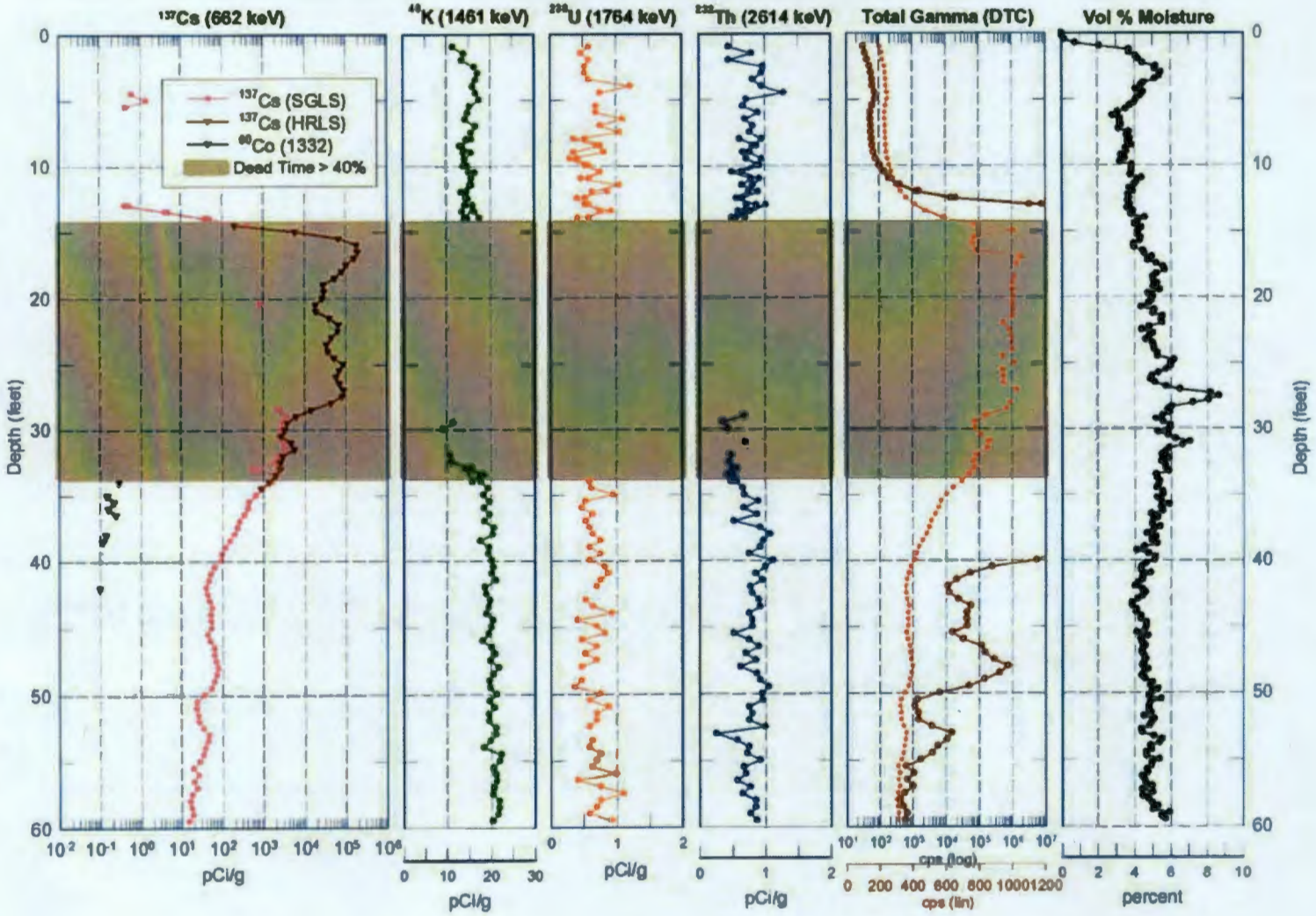


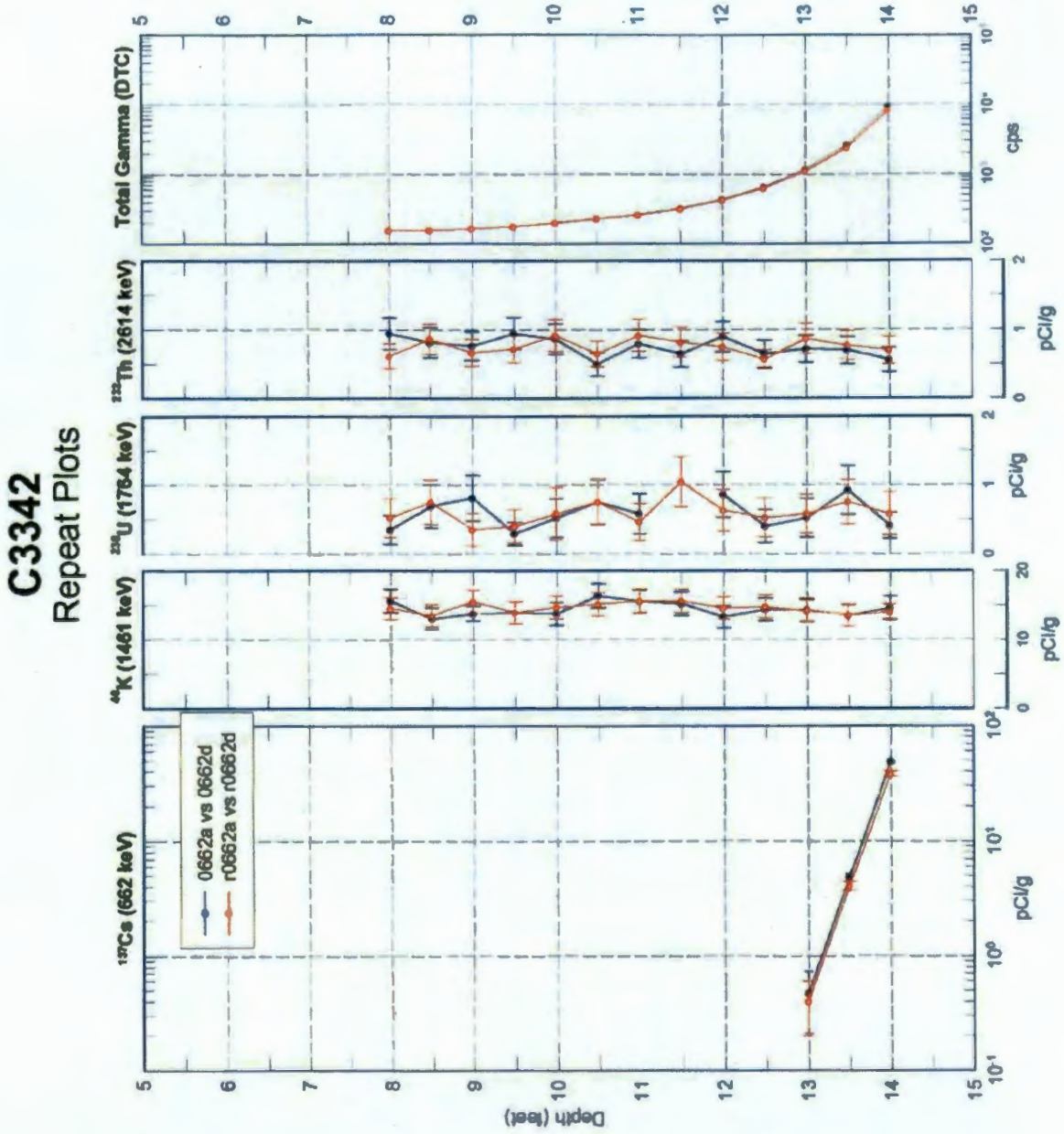
C3342

Natural Gamma (KUT) Logs

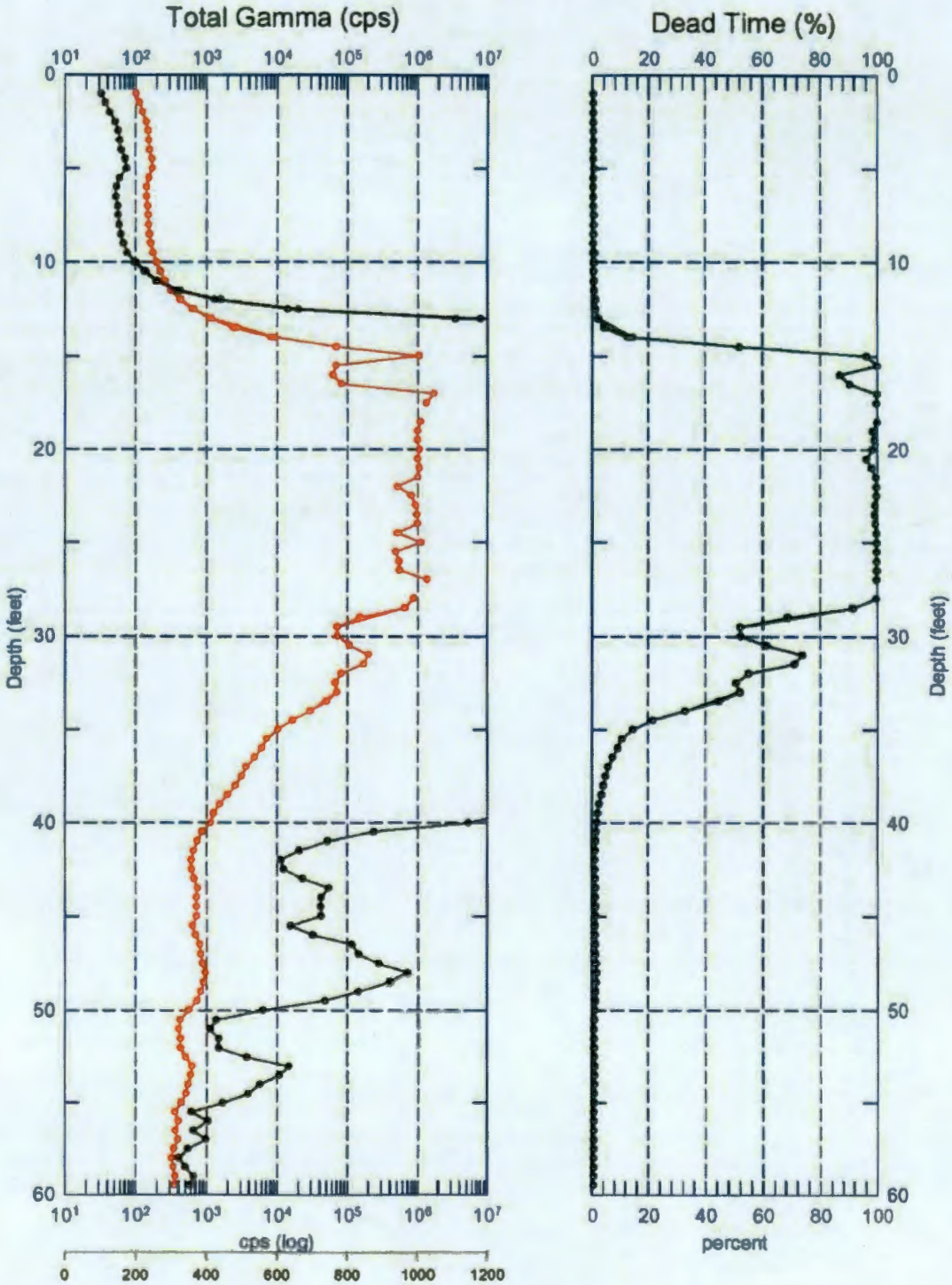


C3342
Combination Plots




C3342
Repeat Plots
Total Gamma (DTC)
cps
^{232}Th (2614 keV)
pCi/g
^{238}U (1764 keV)
pCi/g
^{40}K (1461 keV)
pCi/g
^{137}Cs (662 keV)
pCi/g
0662a vs 0662d
r0662a vs r0662d
Depth (feet)

C3342
Total Gamma and Dead Time



C3343

Log Data Report

Borehole Information:

Borehole: C3343			Site: 216-B-38		
Coordinates		GWL[1] (ft):	N/A[4]	GWL Date:	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
N/A	N/A	June 2001	N/A	60	push

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
steel threaded	0.5	6.625	5.625	0.5	0	59.5

Borehole Notes:

This is a temporary borehole pushed to a depth of approximately 60 ft. There is a gravel pad approximately 1 ft thick, and the top of casing sticks up approximately 0.5 ft above the gravel surface.

Logging Equipment Information:

Logging System:	Gamma 2B		Type:	SGLS (35%)
Calibration Date:	09/00	Calibration Reference:		GJO-2001-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Logging System:	NMLS		Type:	NMLS (Moisture)
Calibration Date:	05/01	Calibration Reference:		GJO-2001-247-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Page 1

Spectra Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 (repeat)			
Date	7/05/01	7/05/01			
Logging Engineer	Spatz	Spatz			
Start Depth	59.5	3.0			
Finish Depth	1	9.0			
Count Time (sec)	180	180			
Live/Real	L	L			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.5	0.5			
ft/min	n/a[4]	n/a			
Pre-Verification	B0014CAB	B0014CAB			
Start File	B0014000	B0014118			
Finish File	B0014117	B0014130			
Post-Verification	B0014CAA	B0014CAA			

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	7				
Date	7/20/01				
Logging Engineer	Spatz/Musial				
Start Depth	0.0				
Finish Depth	59.5				
Count Time (sec)	n/a				
Live/Real	n/a				
Shield (Y/N)	N				
MSA Interval (ft)	0.25				
ft/min	1.0				
Pre-Verification	C0002CAB				
Start File	C0003000				
Finish File	C0003238				
Post-Verification	C0003CAA				

Logging Operation Notes:

The zero reference point for all log data is the top of casing. Depths have been adjusted to groundsurface, which is taken as the top of the gravel pad. Fine-gain adjustments were made in run 1 after file B0014033 (43.0 ft).

Analysis Notes:

Analyst:	McCain	**Date:**	07/27/01	**Reference:**	MAC-VZCP 1.7.9, Rev. 2

The pre-run verification spectrum was found to be within acceptance criteria. The post-run verification spectrum was below the lower warning limit for all three peak intensities (609, 1461, and 2615 keV). FWHM values were within verification criteria. Comparison of the two spectra indicates the tool appears to be functioning properly. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for casing thickness. Water correction was not required. Dead time was less than 1 percent over the entire borehole, and no dead time corrections were required. The ^{214}Bi peak at 1764 keV

was used to determine ^{238}U concentrations instead of the ^{214}Bi peak at 609 keV. This was done for consistency with boreholes C3340, C3341, and C3342, where interference from the ^{137}Cs peak at 662 keV affected the ^{214}Bi peak at 609 keV.

The neutron moisture log was processed using the calibration relationship developed for a 6-inch-diameter borehole with 0.28-inch-thick casing. A correction factor of 1.20 was applied to account for the effects of the thicker casing, which is based on an equivalent casing correction for 8-inch diameter developed by Randall.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, and decay progeny of ^{232}Th and ^{238}U), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation.

A repeat log plot is also shown. The repeat plot indicates good agreement between successive log runs, demonstrating good repeatability in both depth and radionuclide measurement.

Results and Interpretations:

Only minor amounts of Cs-137 were detected by the SGLS between 4.5 and 5.5 ft. The maximum concentration of 1.2 pCi/g occurred at 5.5 ft.

Increases in gamma counts at 22 to 29 ft and below 35 ft are attributed to increases in natural radionuclides, primarily K-40. This may be an indication of a stratigraphic change associated with an increase in fines.

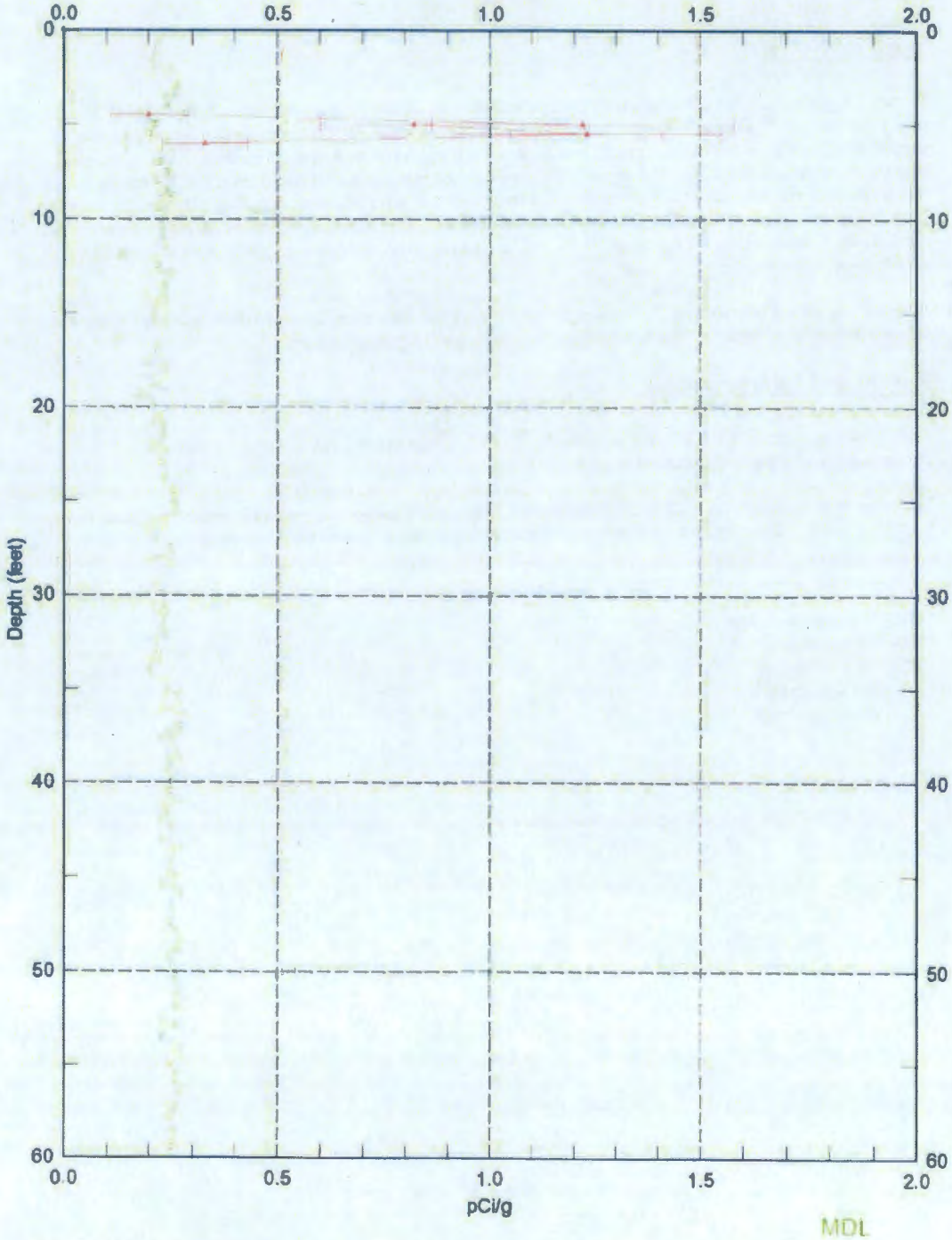
---

[1] GWL – groundwater level
[2] N/A – not available
[3] TOC – top of casing
[4] n/a – not applicable

C3343

Man-Made Radionuclides

^{137}Cs (662 keV)



was used to determine ^{238}U concentrations instead of the ^{214}Bi peak at 609 keV. This was done for consistency with boreholes C3340, C3341, and C3342, where interference from the ^{137}Cs peak at 662 keV affected the ^{214}Bi peak at 609 keV.

The neutron moisture log was processed using the calibration relationship developed for a 6-inch-diameter borehole with 0.28-inch-thick casing. A correction factor of 1.20 was applied to account for the effects of the thicker casing, which is based on an equivalent casing correction for 8-inch diameter developed by Randall.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, and decay progeny of ^{232}Th and ^{238}U), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation.

A repeat log plot is also shown. The repeat plot indicates good agreement between successive log runs, demonstrating good repeatability in both depth and radionuclide measurement.

Results and Interpretations:

Only minor amounts of Cs-137 were detected by the SGLS between 4.5 and 5.5 ft. The maximum concentration of 1.2 pCi/g occurred at 5.5 ft.

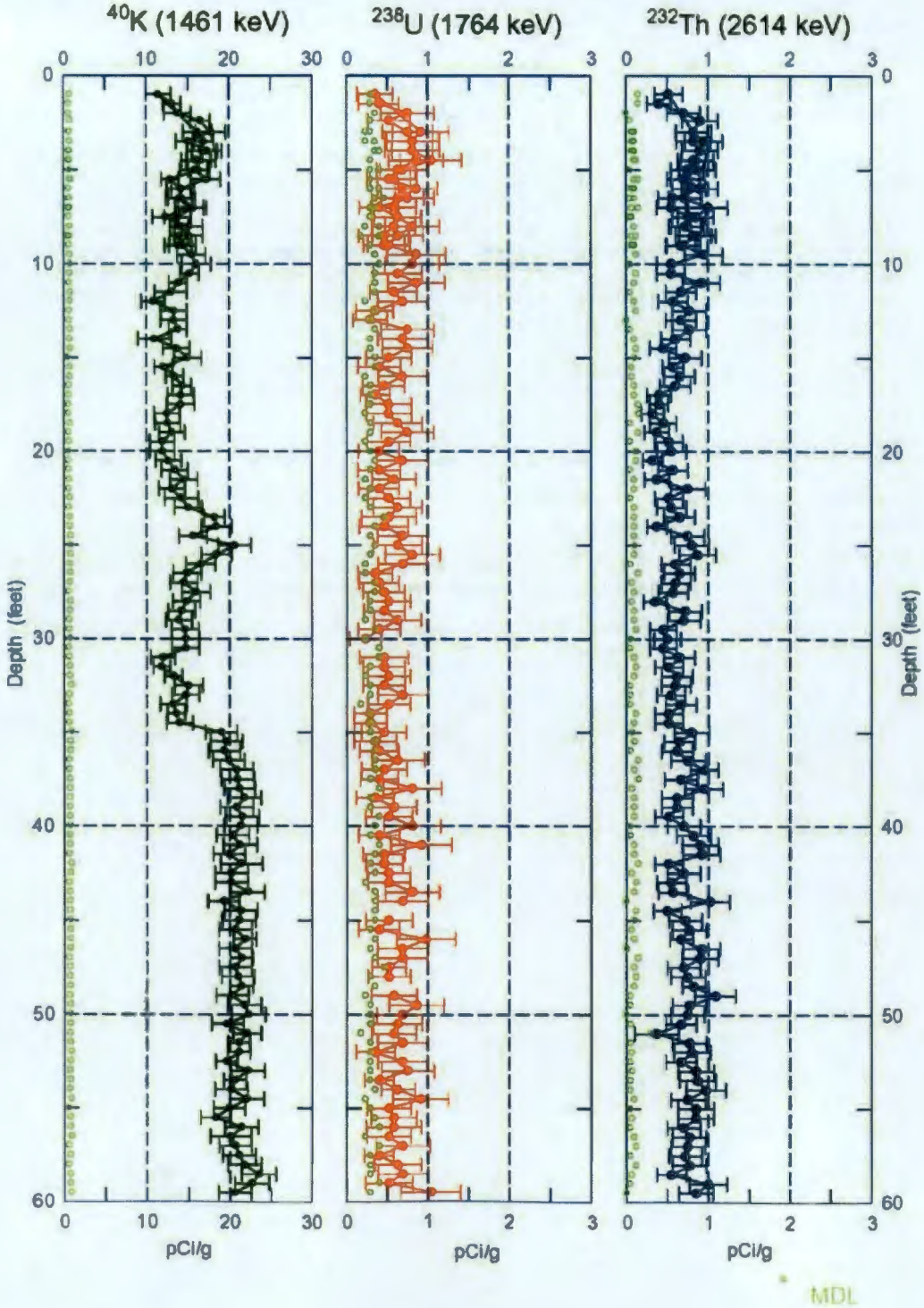
Increases in gamma counts at 22 to 29 ft and below 35 ft are attributed to increases in natural radionuclides, primarily K-40. This may be an indication of a stratigraphic change associated with an increase in fines.

---

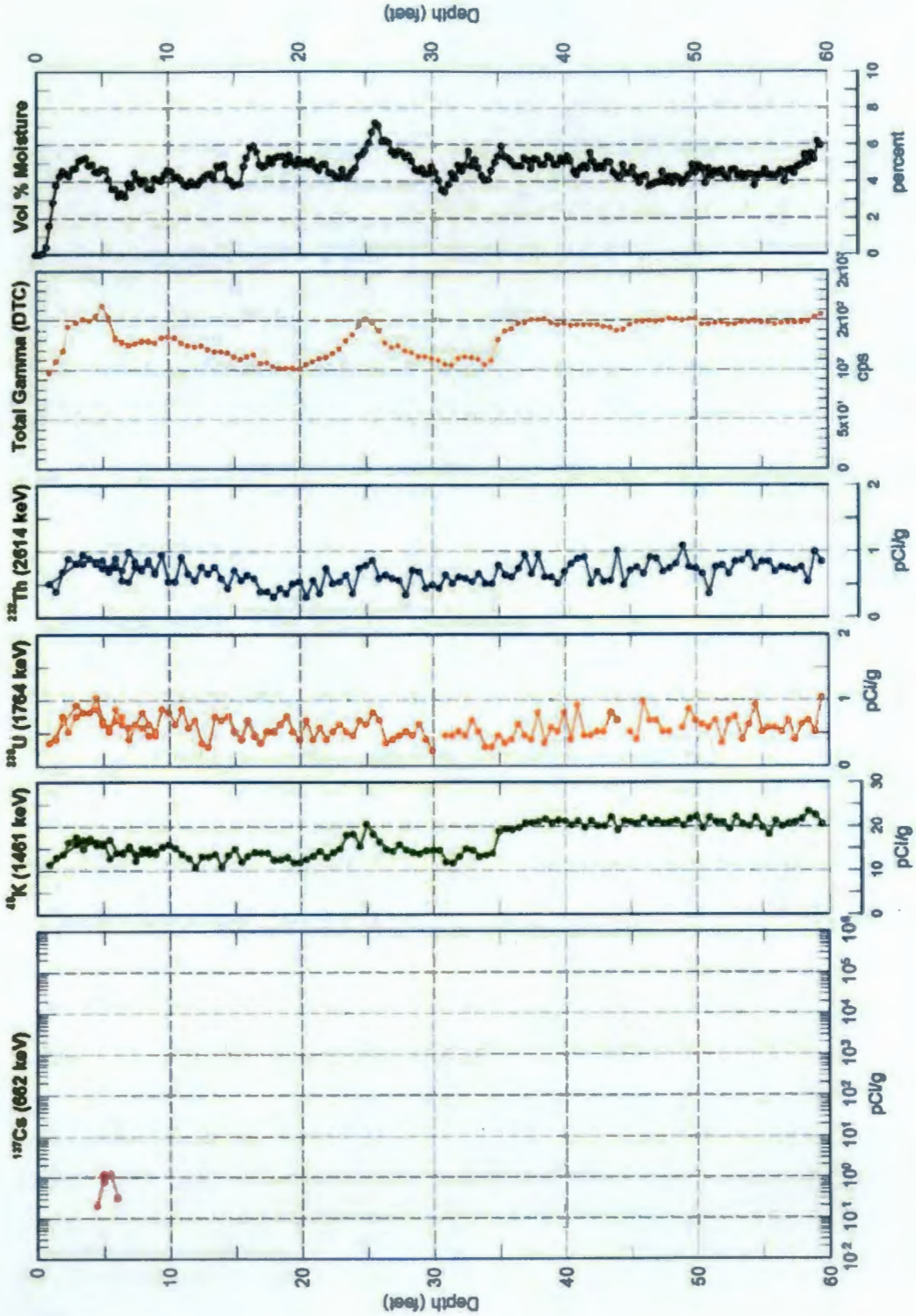
[1] GWL – groundwater level
[2] N/A – not available
[3] TOC – top of casing
[4] n/a – not applicable

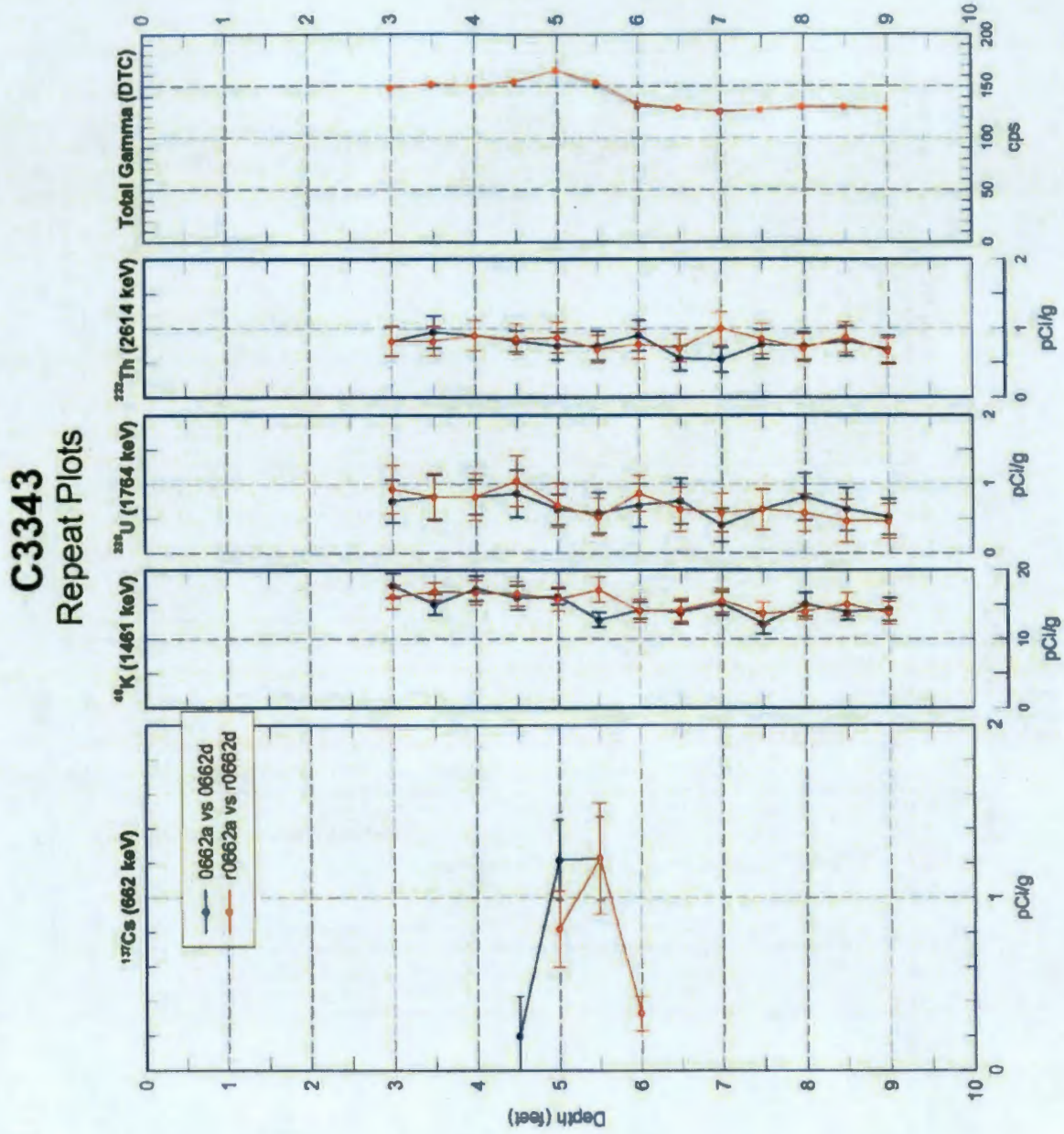
C3343

Natural Gamma (KUT) Logs

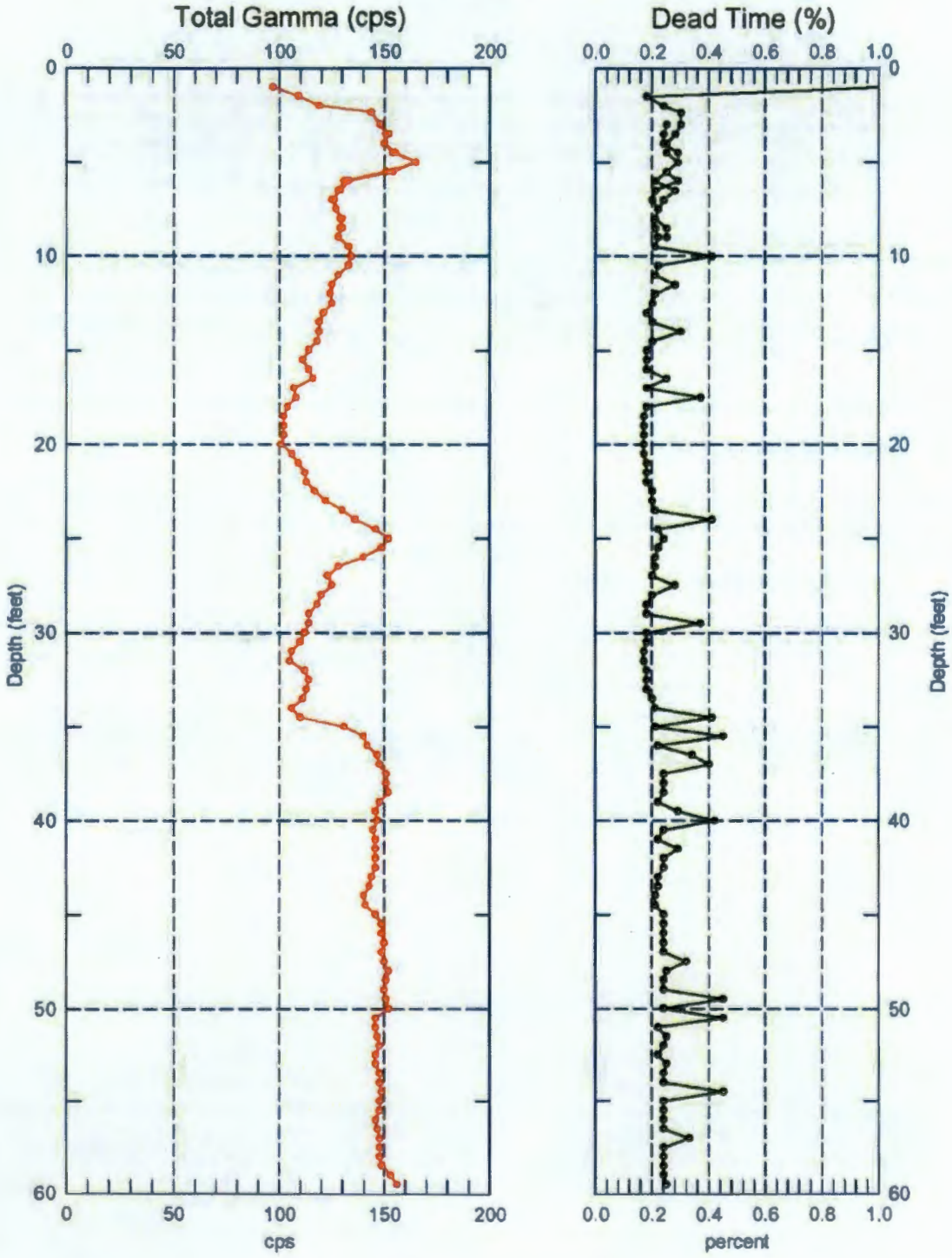


C3343 Combination Plots




C3343
Repeat Plots
Total Gamma (DTC)
cps
^{232}Th (2614 keV)
pCi/g
^{238}U (1764 keV)
pCi/g
^{40}K (1461 keV)
pCi/g
^{137}Cs (662 keV)
pCi/g
0662a vs 0662d
r0662a vs r0662d
Depth (feet)

C3343
Total Gamma and Dead Time



C3344

Log Data Report

Borehole Information

Borehole: C3344			Site: 216-B-38		
Coordinates		GWL[1] (ft):	N/A[2]	GWL Date:	
North	East	Drill Date	TOC[3] Elevation	Total Depth (ft)	Type
N/A	N/A	June 2001	N/A	60	push

Casing Information

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
steel threaded	0.5	6.625	5.625	0.5	0	59.5

Borehole Notes:

This is a temporary borehole pushed to a depth of approximately 60 ft. There is a gravel pad approximately 1 ft thick, and the top of casing sticks up approximately 0.5 ft above the gravel surface.

Logging Equipment Information

Logging System:	Gamma 2B		Type:	SGLS (35%)
Calibration Date:	09/00	Calibration Reference:		GJO-HAN-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Logging System:	RLS		Type:	NMLS (Moisture)
Calibration Date:	05/01	Calibration Reference:		GJO-HAN-247-TAR
		Logging Procedure:	MAC-HGLP 1.6.5	

Page 1

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 (repeat)			
Date	7/02/01	7/02/01			
Logging Engineer	Musial/Spatz	Musial/Spatz			
Start Depth	59.5	10.0			
Finish Depth	1	4.0			
Count Time (sec)	150	150			
Live/Real	L	L			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.5	0.5			
ft/min	n/a*	n/a			
Pre-Verification	B0012CAB	B0012CAB			
Start File	B0012000	B0012118			
Finish File	B0012117	B0012130			
Post-Verification	B0012CAA	B0012CAA			

Neutron Moisture Logging System (NMLS) Log Run Information

Log Run	3	4 (repeat)			
Date	7/23/01	7/23/01			
Logging Engineer	Kos/Spatz	Kos/Spatz			
Start Depth	0.0	36.0			
Finish Depth	59.5	29.5			
Count Time (sec)	n/a	n/a			
Live/Real	n/a	n/a			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	1.0	1.0			
Pre-Verification	C0042CAB	C0042CAB			
Start File	C0042000	C0042239			
Finish File	C0042238	C0042264			
Post-Verification	C0062CAA	C0062CAA			

Logging Operation Notes:

The zero reference point for all log data is the top of casing. Depths have been adjusted to groundsurface, which is taken as the top of the gravel pad. Fine-gain adjustments were made in run 1 after file B0012094 (12.5 ft).

Analysis Notes:

Analyst:	McCain	Date:	07/27/01	Reference:	MAC-VZCP 1.7.9, Rev. 2

The pre-run verification spectrum was found to be within acceptance criteria. The post-run verification spectrum was below the lower warning limit for all three peak intensities (609, 1461, and 2615 keV). FWHM values were within verification criteria. Comparison of the two spectra indicates the tool appears to be functioning properly. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for casing thickness. Water correction was not required. Dead time was less than 1 percent over the entire borehole, and no dead time corrections were required. The ^{214}Bi peak at 1764 keV

Page 2

was used to determine ^{238}U concentrations instead of the ^{214}Bi peak at 609 keV. This was done for consistency with boreholes C3340, C3341, and C3342, where interference from the ^{137}Cs peak at 662 keV affected the ^{214}Bi peak at 609 keV.

The neutron moisture log was processed using the calibration relationship developed for a 6-inch-diameter borehole with 0.28-inch-thick casing. A correction factor of 1.20 was applied to account for the effects of the thicker casing, which is based on an equivalent casing correction for 8-inch diameter developed by Randall.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, and decay progeny of ^{232}Th and ^{238}U), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable activity (MDA) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation.

A repeat log plot is also shown. The repeat plot indicates good agreement between successive log runs, demonstrating good repeatability in both depth and radionuclide measurement.

Results and Interpretations:

Only minor amounts of Cs-137 were detected by the SLGS between 4.5 and 5 ft. The maximum concentration of 0.8 pCi/g occurred at 4.5 ft.

Increases in gamma counts at 38 to 39 ft are attributed to increases in natural radionuclides. This may be an indication of a stratigraphic change associated with an increase in fines.

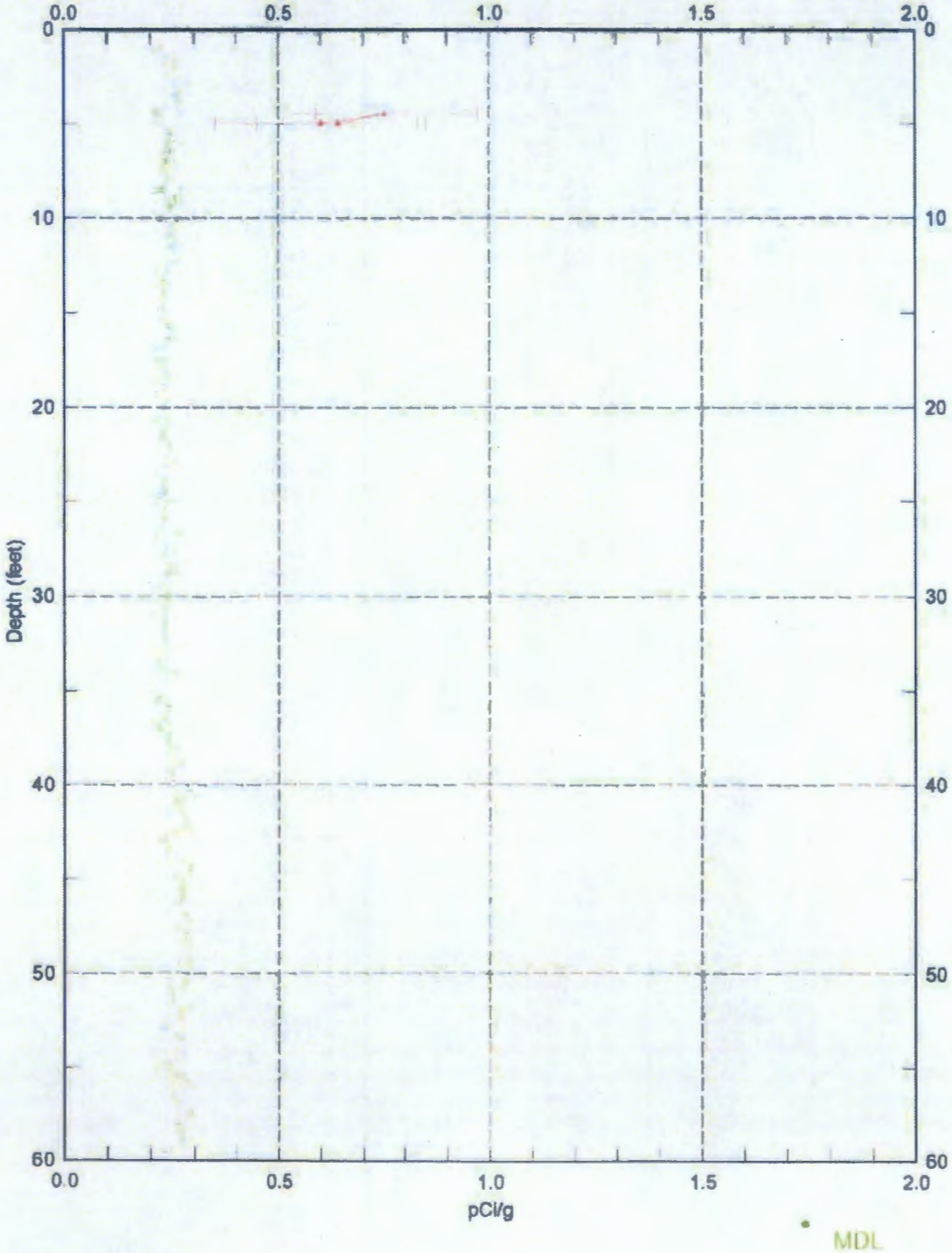
---

[1] GWL – groundwater level
[2] N/A – not available
[3] TOC – top of casing
[4] n/a – not applicable

C3344

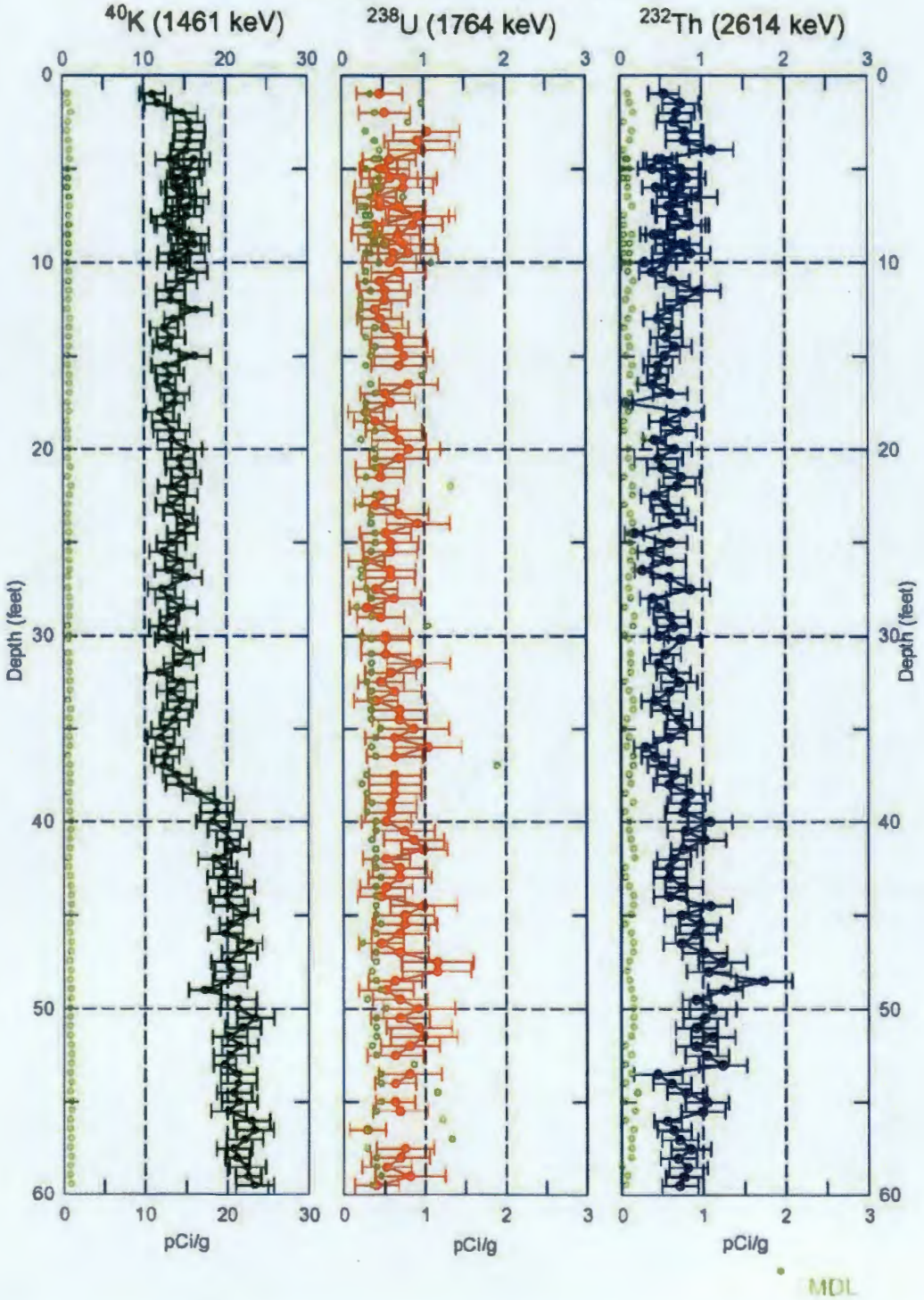
Man-Made Radionuclides

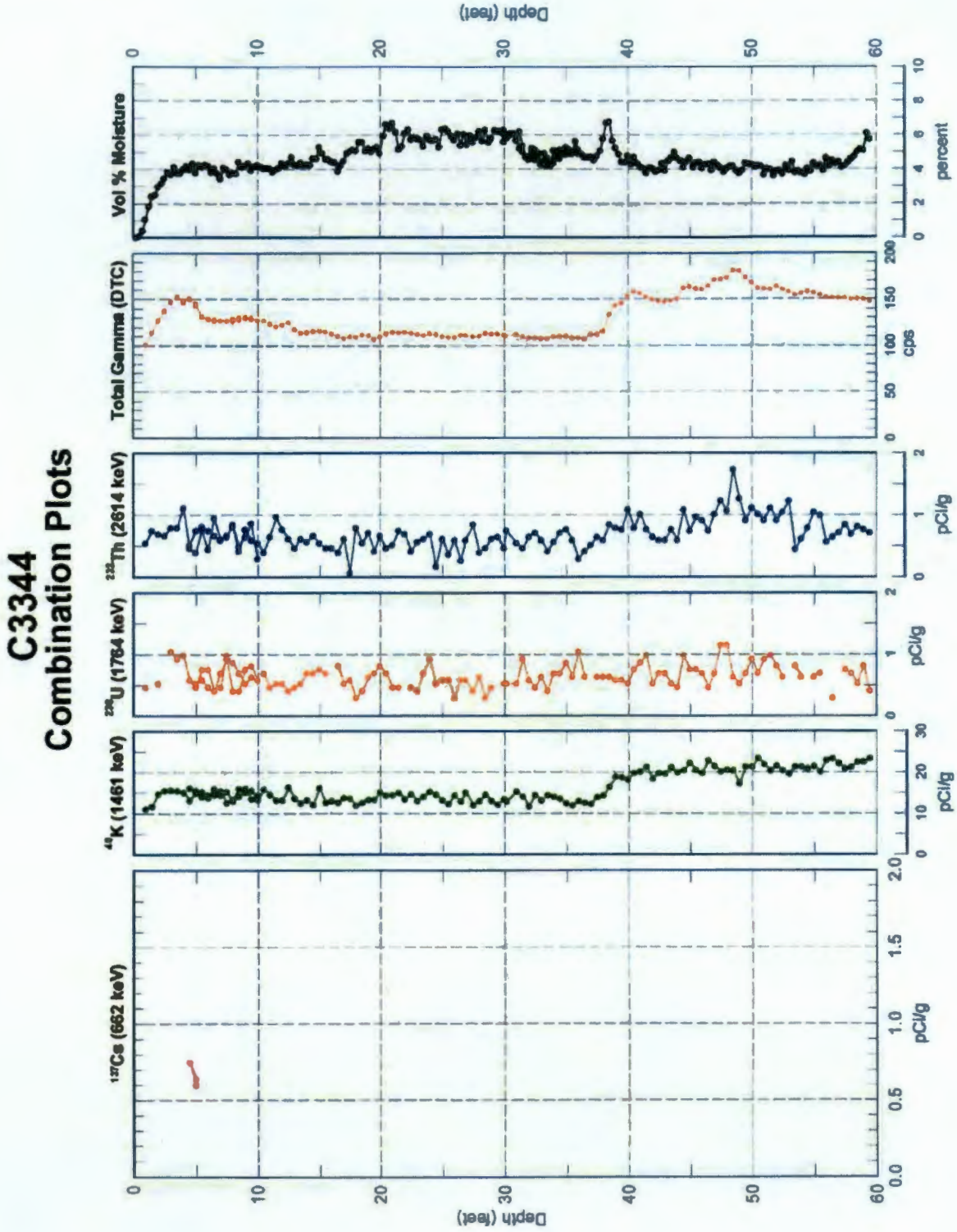
^{137}Cs (662 keV)

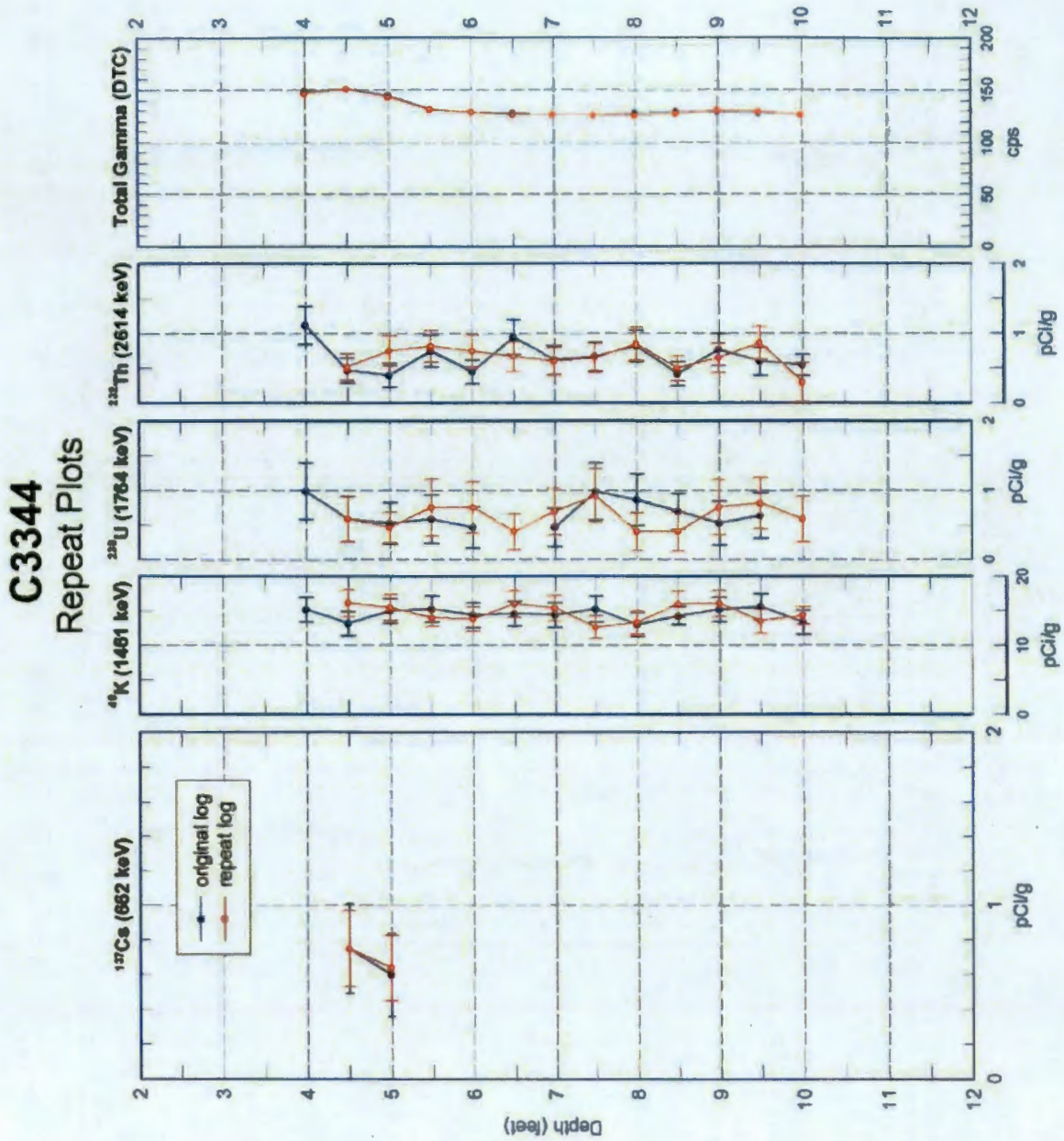


C3344

Natural Gamma (KUT) Logs

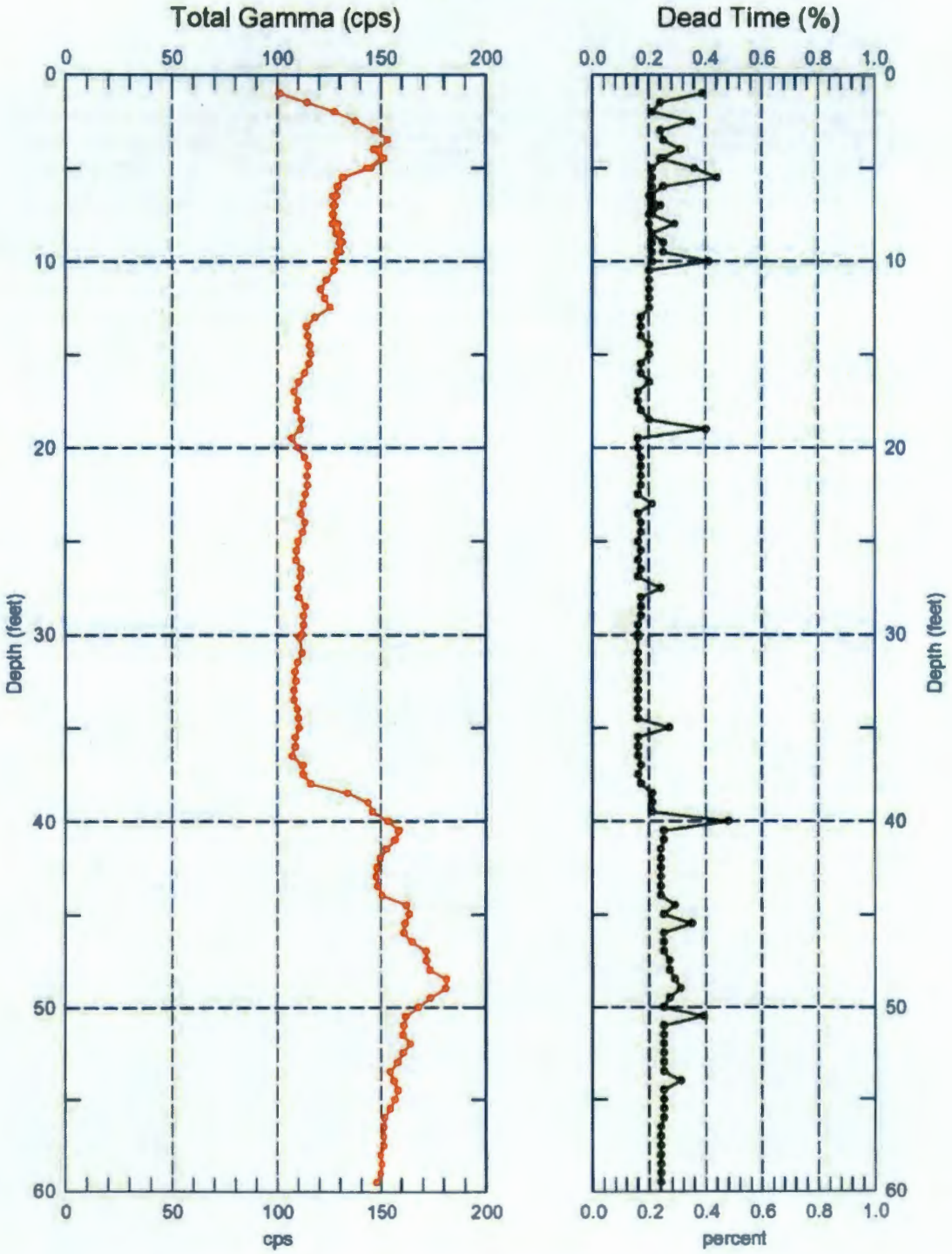



C3344
Combination Plots
Vol % Moisture
percent
Total Gamma (DTC)
cps
^{232}Th (2614 keV)
pCi/g
^{238}U (1784 keV)
pCi/g
^{40}K (1461 keV)
pCi/g
^{137}Cs (662 keV)
pCi/g
Depth (feet)


C3344
Repeat Plots
Total Gamma (DTC)
cps
^{232}Th (2614 keV)
pCi/g
^{238}U (1764 keV)
pCi/g
^{40}K (1461 keV)
pCi/g
^{137}Cs (662 keV)
pCi/g
original log
repeat log
Depth (feet)

C3344

Total Gamma and Dead Time



C3104

Log Data Report

Borehole Information:

Borehole: C3104			Site: 216-B-38 Trench		
Coordinates		GWL[1] (ft):	Not reached	GWL Date:	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
N/A[3]	n/a	8/01/01	n/a	259.6	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
CS threaded steel pipe	5 in.	10.75	9.25	0.75	0	58
CS threaded steel pipe	17 in.	8.375	7.825	0.5	0	111
CS threaded steel pipe	26.5	6.687	5.6785	0.5	0	259.6

Borehole Notes:

Ground surface is a gravel pad 1.5 to 2.0 ft thick.
This borehole is located 5.0 ft west of the "push" borehole C3340.

Logging Equipment Information:

Logging System:	Gamma 2B		Type: SGLS (35%)
Calibration Date:	9/00	Calibration Reference:	GJO-2001-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	RLS 1		Type: Moisture
Calibration Date:	5/01	Calibration Reference:	RLSM00.0
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	Gamma 1C		Type: HRLS
Calibration Date:	9/00	Calibration Reference:	GJO-2001-244-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Page 1

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4/Repeat	5
Date	8/06/01	8/06/01	8/06/01	8/06/01	8/07/01
Logging Engineer	Musial	Musial	Musial	Musial	Musial/Kos
Start Depth (ft)	0	18.5	42	53	58
Finish Depth (ft)	18	41.5	59.5	59	111.5
Count Time (sec)	200	30	200	200	200
Live/Real	R	R	R	R	R
Shield	N	N	N	N	N
MSA Interval (ft)	0.5	0.5	0.5	1.0	0.5
ft/min	n/a*	n/a	n/a	n/a	n/a
Pre-Verification	B00029CAB	B00029CAB	B00029CAB	B00029CAB	B00030CAB
Start File	B0029000	B0029037	B0029084	B0029120	B0030000
Finish File	B0029036	B0029083	B0029119	B0029132	B0030107
Post-Verification	B00029CAA	B00029CAA	B00029CAA	B00029CAA	B00030CAA

Log Run	6/Repeat	7	8	9	10/Repeat
Date	8/07/01	8/10/01	8/10/01	8/11/01	8/11/01
Logging Engineer	Musial	Musial	Pearson	Musial	Musial
Start Depth (ft)	106	110	173.0	219.5	115
Finish Depth (ft)	111.0	174	222.0	260	130
Count Time (sec)	200	200	200	100	100
Live/Real	R	R	R	R	R
Shield	N	N	N	N	N
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	n/a	n/a	n/a	n/a	n/a
Pre-Verification	B00030CAB	B00032CAB	B00032CAB	B00033CAB	B00033CAB
Start File	B0030108	B0032000	B0032129	B0033000	B0033082
Finish File	B0030118	B0032128	B0032227	B0033081	B0033112
Post-Verification	B00030CAA	B00032CAA	B00032CAA	B00033CAA	B00033CAA

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2/Repeat	3	4/Repeat	
Date	8/07/01	8/07/01	8/11/01	8/11/01	
Logging Engineer	Musial/Kos	Musial/Kos	Musial	Musial	
Start Depth (ft)	58.0	105	110	230	
Finish Depth (ft)	111.25	110	260	245	
Count Time (sec)	n/a	n/a	n/a	n/a	
Live/Real	n/a	n/a	n/a	n/a	
Shield	N	N	N	N	
MSA Interval (ft)	0.25	0.25	0.25	0.25	
ft/min	1.0	1.0	1.0	1.0	
Pre-Verification	C009CAB	C009CAB	C0010CAB	C0010CAB	
Start File	C009000	C009214	C0010000	C0010601	
Finish File	C009213	C009234	C0010600	C0010661	
Post-Verification	C009CAA	C009CAA	C0010CAA	C0010CAA	

Page 2

High Rate Logging System (HRLS) Log Run Information:

Log Run	1	2/Repeat			
Date	8/16/01	8/16/01			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	12.0	25.0			
Finish Depth (ft)	47.0	20.0			
Count Time (sec)	300	n/a			
Live/Real	R	n/a			
Shield	N	N			
MSA Interval (ft)	0.5	0.25			
ft/min	n/a	n/a			
Pre-Verification	D003CAB	D003CAB			
Start File	D003000	D003071			
Finish File	D003070	D003081			
Post-Verification	D003CAA	D003CAA			

Logging Operation Notes:

Spectral gamma data were collected in three surveys, one in each casing string as the borehole was advanced. The final SGLS survey was conducted on August 11, 2001.

SGLS log depths are relative to ground level. During logging run 3, a fine gain adjustment occurred at file B0029089 (45 ft). During logging run 4, a fine gain adjustment occurred at file B0029120 (53 ft). During logging run 8, fine gain adjustments occurred at files B0032111 (165.5 ft) and B0032125 (172.5 ft). SGLS surveys conducted on 8/11/01 (log runs 9 and 10) were erroneously conducted at an acquisition rate of 100 seconds real time.

Neutron moisture logs were run on 8/07/01 and 8/11/01 using the RLS 1 through one string of drill pipe. Log depths are relative to ground level. The neutron moisture tool was run centralized.

Two strings of casing were removed from the borehole prior to running the HRLS. High rate logging was not performed in this casing string when it was initially installed because the inside of this casing string has the potential for internal contamination. The HRLS tool was covered with a plastic bag, because this borehole has a potential for internal contamination. The outside temperature was extremely hot (>100 °F) during logging, which appears to have caused some minor gain drift during the pre-run verification and spectra collected early in the log run. Fine-gain amplifier adjustment after files: D003003 at 13 ft; D003008 at 16 ft; D003013 at 18.5 ft; D003048 at 36 ft.

Analysis Notes:

Analyst:	Sobczyk	Date:	08/22/01	Reference:	MAC-VZCP 1.79, Rev.2

Pre-run and post-run verification spectra for the SGLS were evaluated. All of the pre-survey verification spectra were within the control limits. The post-survey verification spectrum for logging run 1 (file B00030CAA) was the only post-survey verification spectrum that was outside of the control limits. The full width half maximu m (FWHM) for the 1461-keV peak and the 2614-keV peak were above the upper control limits for this post-run verification spectra. Examinations of spectra indicate that the detector appears to have functioned normally during the log run. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for a casing thickness of 0.75 inches from the surface to 58 ft and for a casing thickness of 0.50 inch from 58 to 260 ft. A correction for

water in the borehole was necessary. Dead time corrections were necessary in portions of the borehole above 47 ft. The hole was open at the end of each drill string at 58, 111, and 259.6 ft, and the change in drill strings is apparent in the logs as a slight increase at the end of the drill string and a decrease at the beginning of the log run while in double casing.

The first and second reruns of the SGLS show good repeatability. On the third rerun of the SGLS, data collected using a 100-second count time (rerun) compares well with data collected using a 200-second count time (original log run) except on the ^{40}K curve at 122.5, 124, 126.5, 127, and 129.5 ft. These discrepancies may be related to the shorter counting time used on the repeat log.

The High Rate Logging System (HRLS) was run in the interval from 12 to 47 ft. Data were collected in the interval of the SGLS high dead time (> 40%) and indicates that ^{137}Cs reaches activities of about 100,000 pCi/g between 18 and 35 ft. This high rate zone contains activities of ^{137}Cs that are beyond the operating range of the SGLS. At lower activities of ^{137}Cs, there is good agreement between the SGLS and HRLS in the interval between 42 and 47 ft.

Moisture calibration models at Hanford for 6-inch-diameter casing with 1/2-inch thickness have not been established; however, calibration models have been established for 8-inch-diameter casing with 0.322-inch thickness and 6-inch-diameter casing with 0.28 inch thickness. A casing thickness correction (relative to 8-inch) casing can be estimated. Thus, the neutron log was processed for the portion of the hole with 6-inch casing to estimate volumetric moisture content with the established 6-inch hole-size correction and the 0.50-inch casing thickness for 8-inch diameter casing. A casing correction factor of 1.2 was applied to account for casing thickness. Neutron data are also presented as gross counts. In general, an increase in neutron count is indicative of an increase in moisture content.

The first rerun of the neutron-moisture tool shows good repeatability. On the second rerun of the neutron-moisture tool, the rerun appears to read about 10 cps higher on the rerun than the original run.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{232}Th, ^{238}U, and associated decay progeny), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable activity (MDA) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and does not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. Total gamma is plotted at both linear and logarithmic scales. The linear scale shows subtle variation in low count rate intervals while the log scale shows the high count rate intervals. A combination plot is also included to facilitate correlation. A neutron moisture log of volume percent moisture is also shown on the combination plot.

Results and Interpretations:

The man-made radionuclides ^{137}Cs and ^{60}Co were detected in this borehole. The high gamma activity between 13 and 45 ft is attributed to ^{137}Cs activities greater than 1,000 pCi/g. High rate logging indicates that ^{137}Cs reaches activities of about 100,000 pCi/g between 18 and 35 ft. In addition, ^{60}Co was observed in the intervals from 44 ft through 71.5 ft and at 115 ft at about 0.1 pCi/g. ^{60}Co may also be present higher in the borehole but was not observed due to the high recorded dead time due to the high levels of ^{137}Cs activity. Deeper in the borehole, ^{137}Cs activity was observed at 217.5 ft with a measured ^{137}Cs activity of about 0.2 pCi/g.

Other then the zones containing man-made radionuclides, the changes in gross gamma counts depend primarily upon changes in ^{40}K activities. There is an increase in ^{40}K from about 14 pCi/g above 12 ft to about 19 pCi/g below 43 ft. This increase in apparent ^{40}K activity occurred within the interval of high dead time, which was due to high ^{137}Cs activity. The increase in gross gamma counts from 130 to 145 cps at a

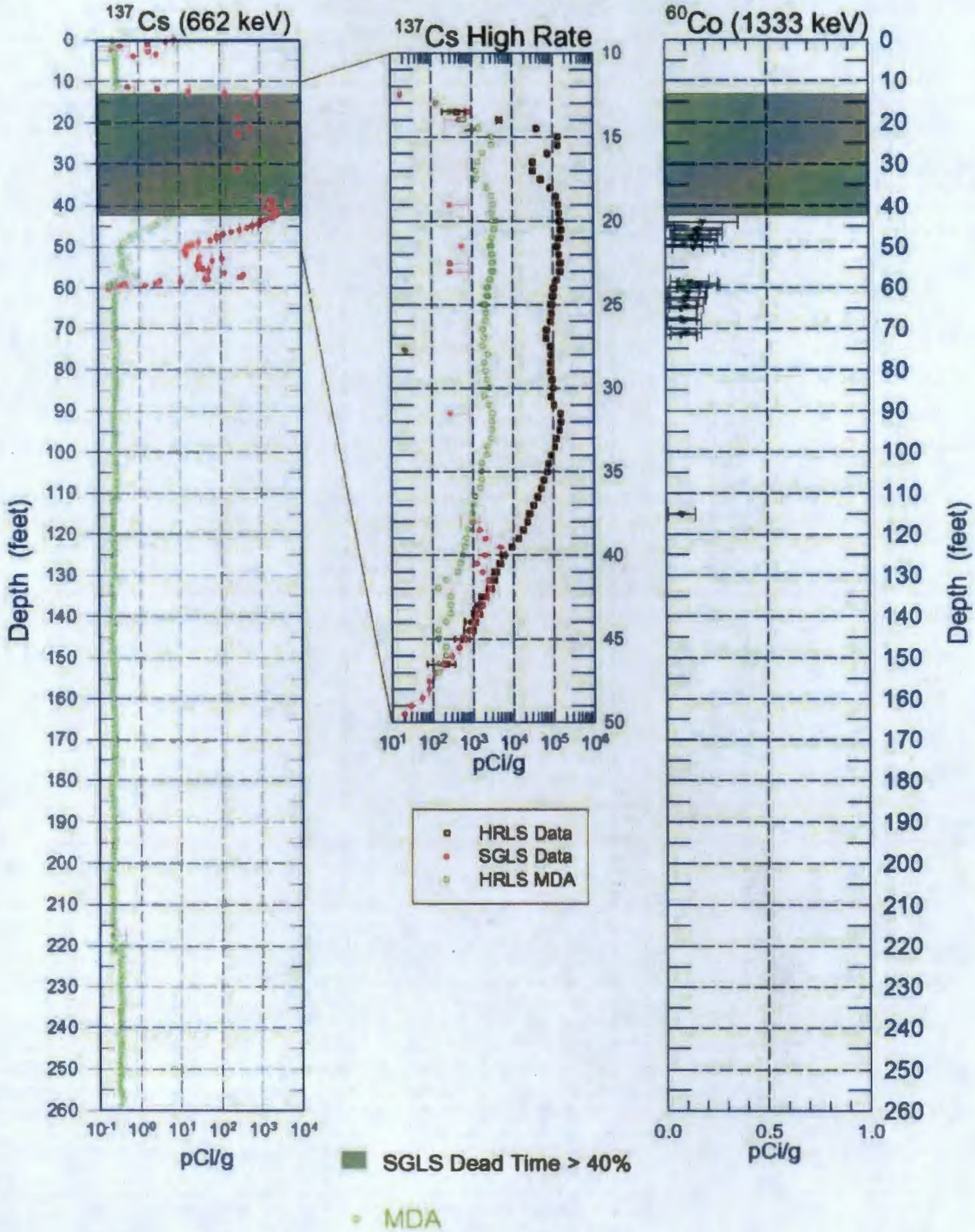
log depth of 217 through 220 ft corresponds to an increase in gross neutron counts per second. ^{137}Cs was detected within this zone at 217.5 ft with an activity of 0.2 pCi/g. Below 220 ft, gross gamma counts average about 25 cps less then that measured above 215 ft.

The elevated neutron counts per second that occur at about 115 ft and 219 ft correspond with intervals of man-made radionuclides. At 115 ft, ^{60}Co was detected at 0.1 pCi/g. ^{137}Cs was detected at 217.5 ft. The natural radionuclides do not show any apparent changes in these intervals. The elevated neutron count rate at 109 through 111 ft is probably related to the bottom of the second casing string.

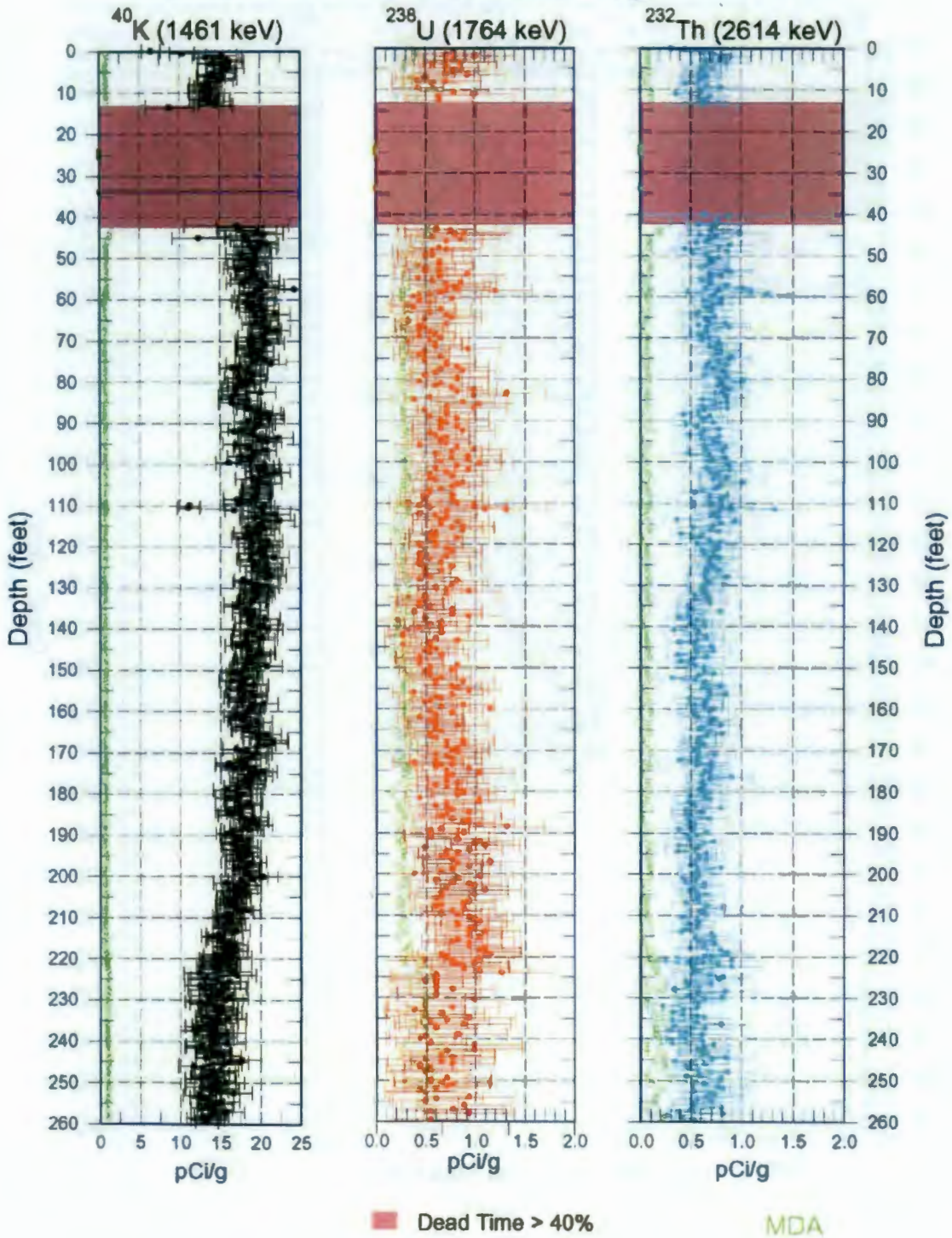
---

[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not available
[4] n/a – not applicable

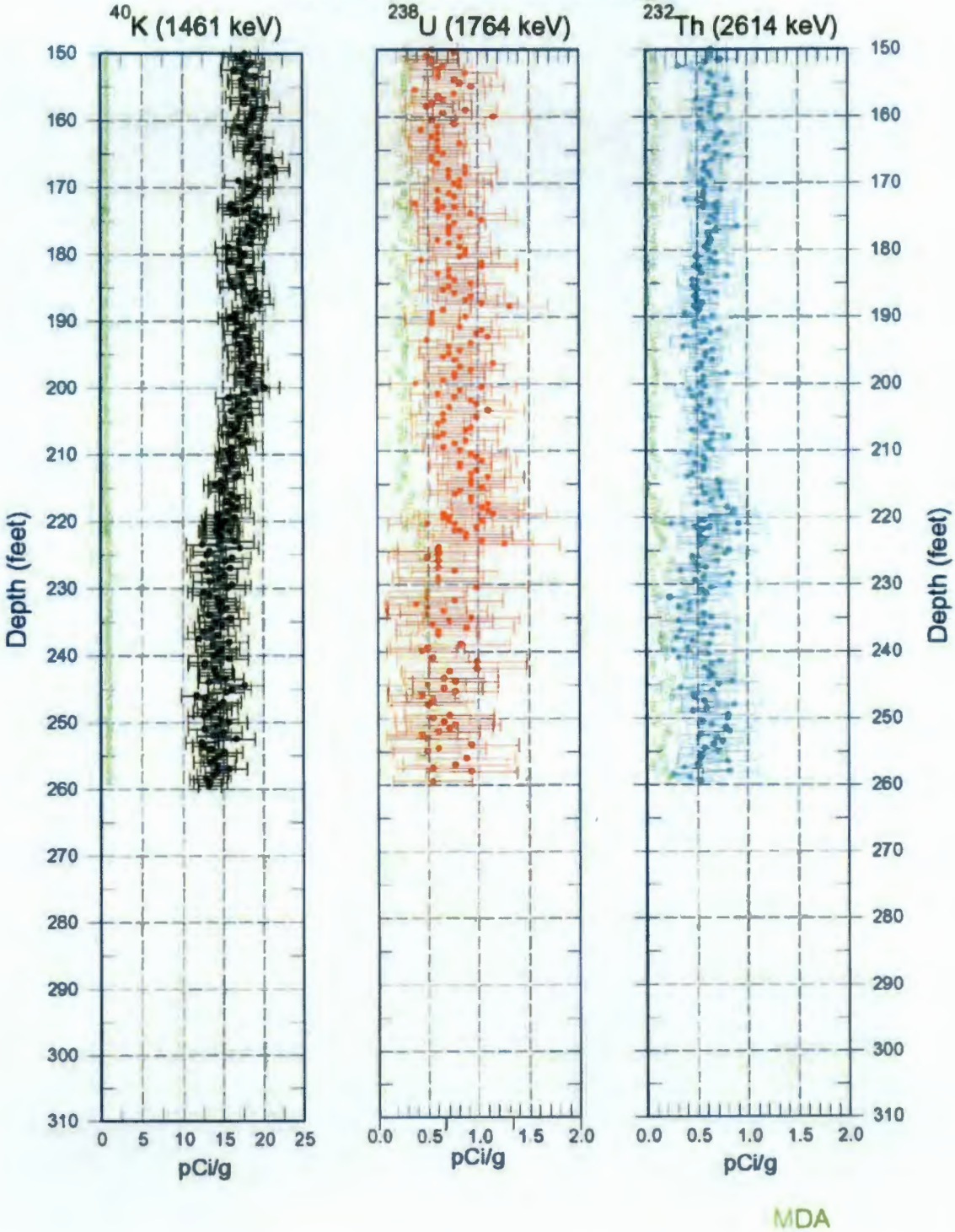
C3104
Man-Made Radionuclide Concentrations

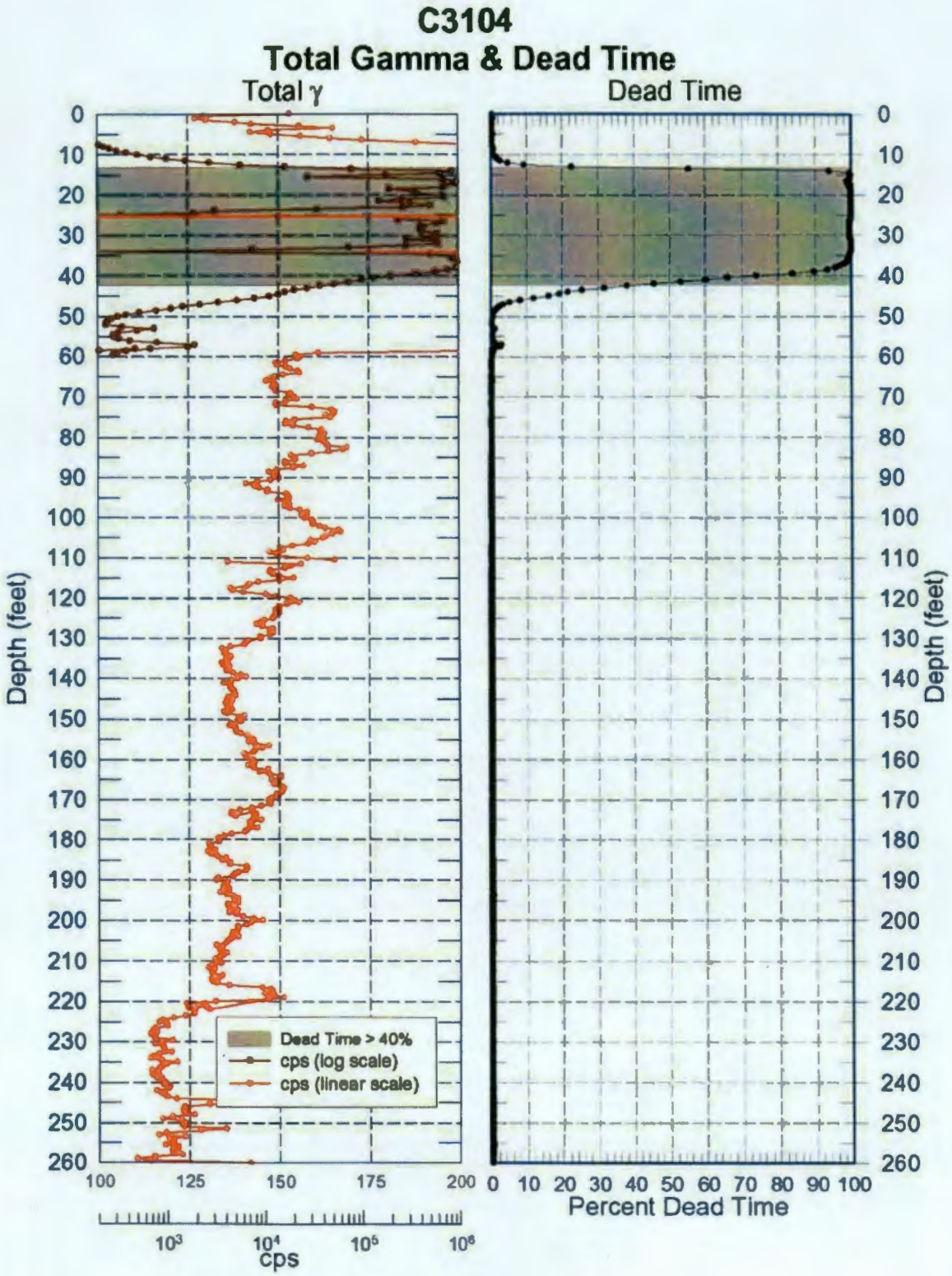


C3104
Natural Gamma Logs



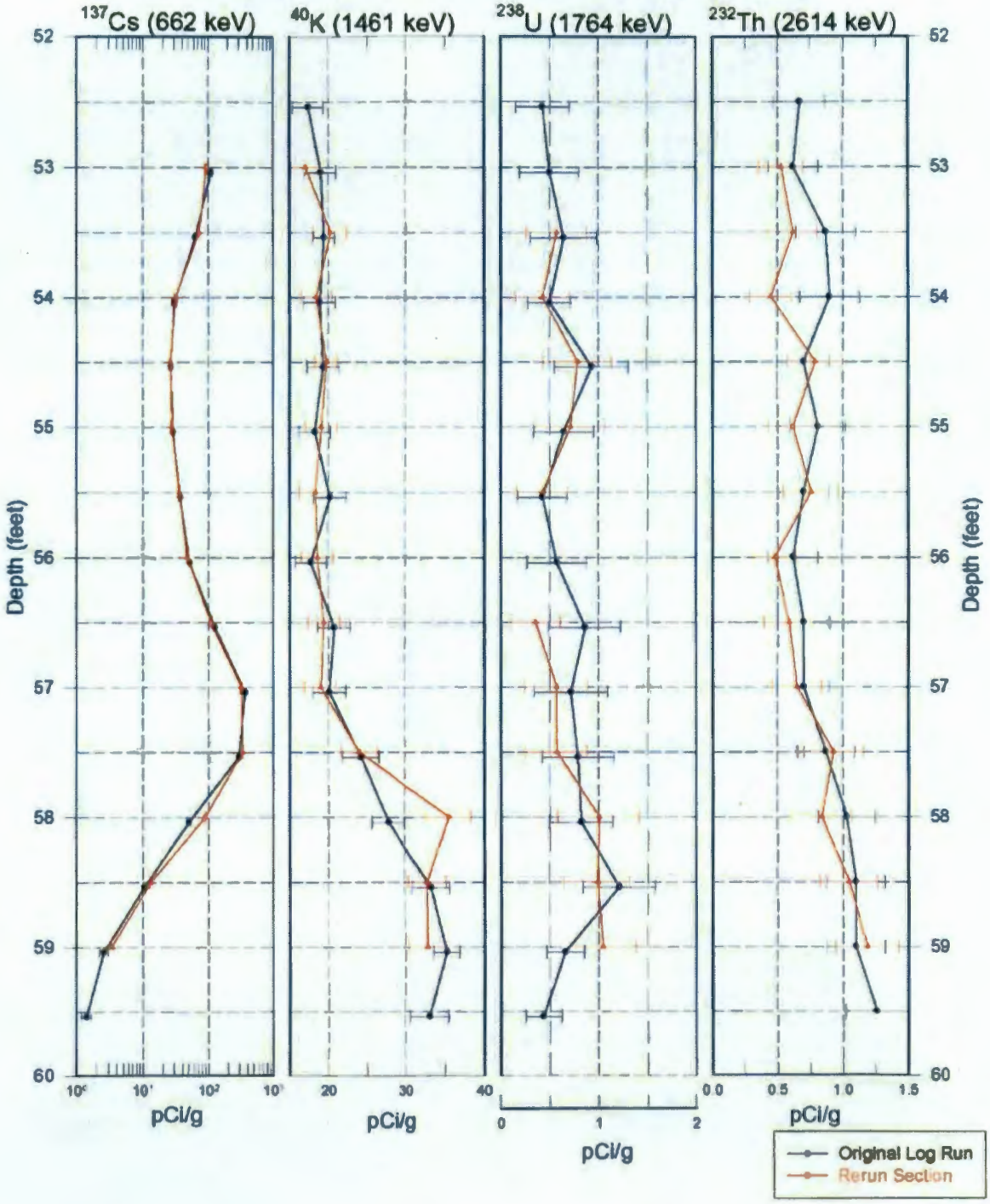
C3104
Natural Gamma Logs



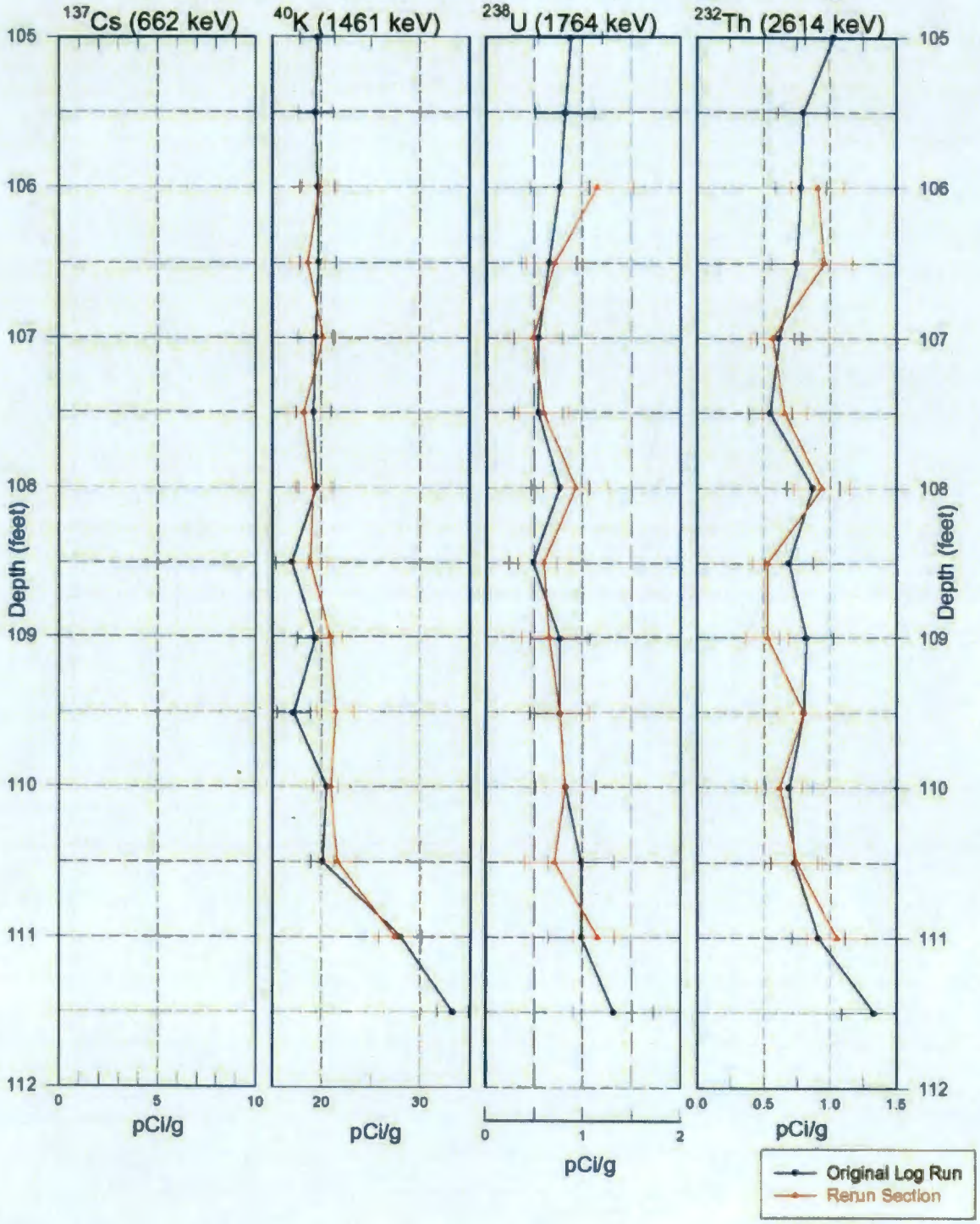

C3104
Total Gamma & Dead Time
Total γ
Dead Time
Depth (feet)
Dead Time > 40%
cps (log scale)
cps (linear scale)
100 125 150 175 200
10³ 10⁴ 10⁵ 10⁶
cps
0 10 20 30 40 50 60 70 80 90 100
Percent Dead Time

C3104

First Rerun Section of Spectral Gamma Logs

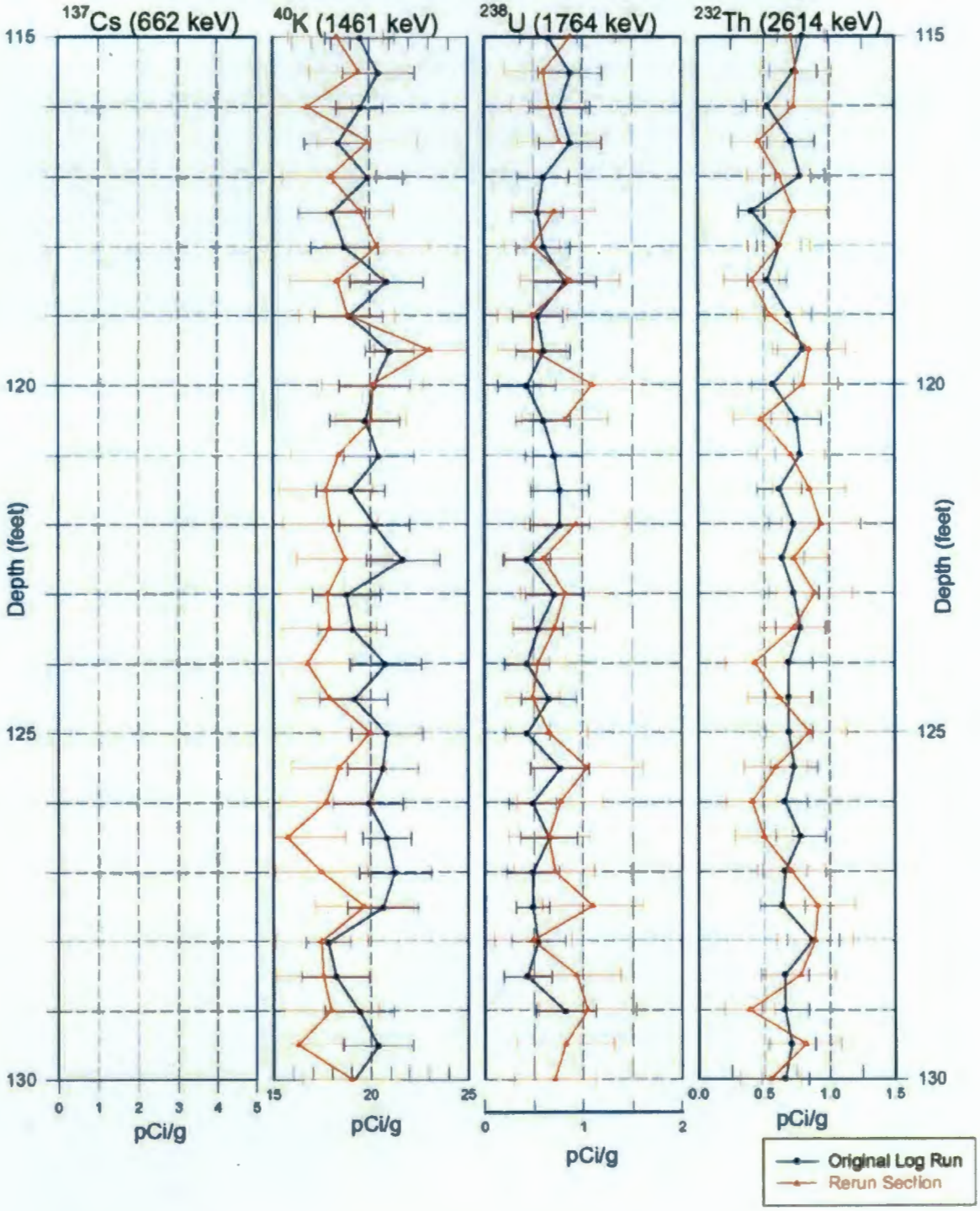


C3104
Second Rerun Section of Spectral Gamma Logs

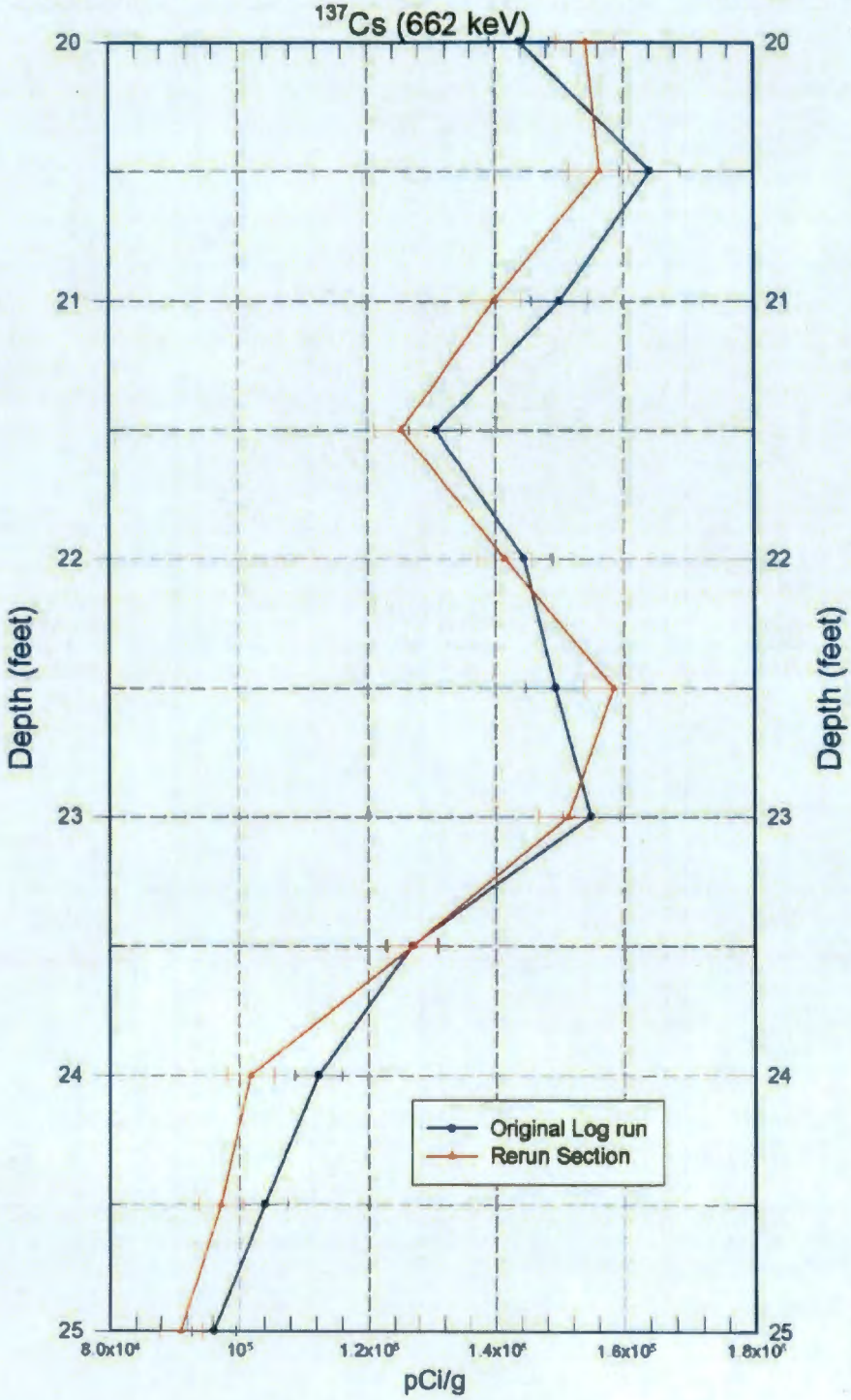


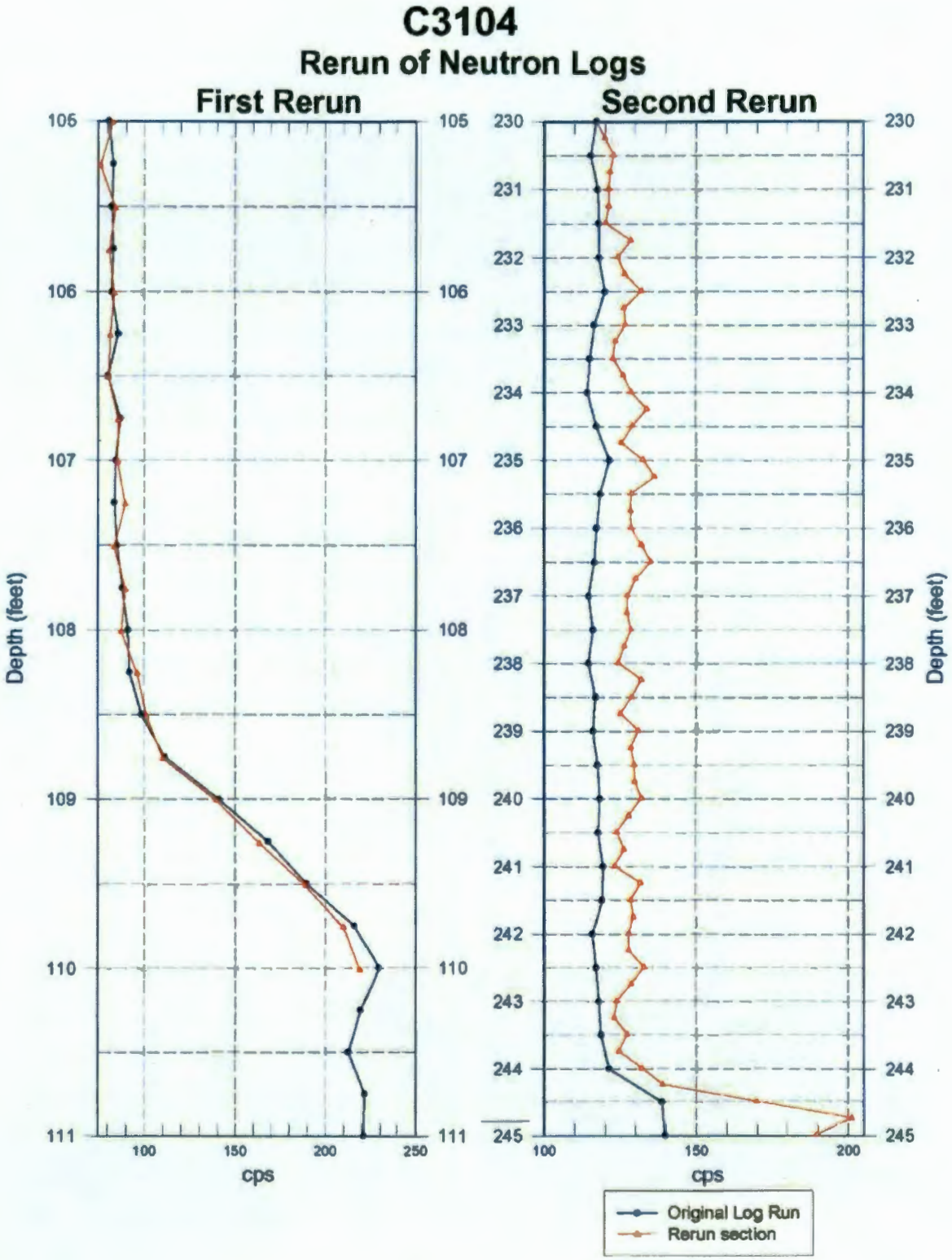
C3104

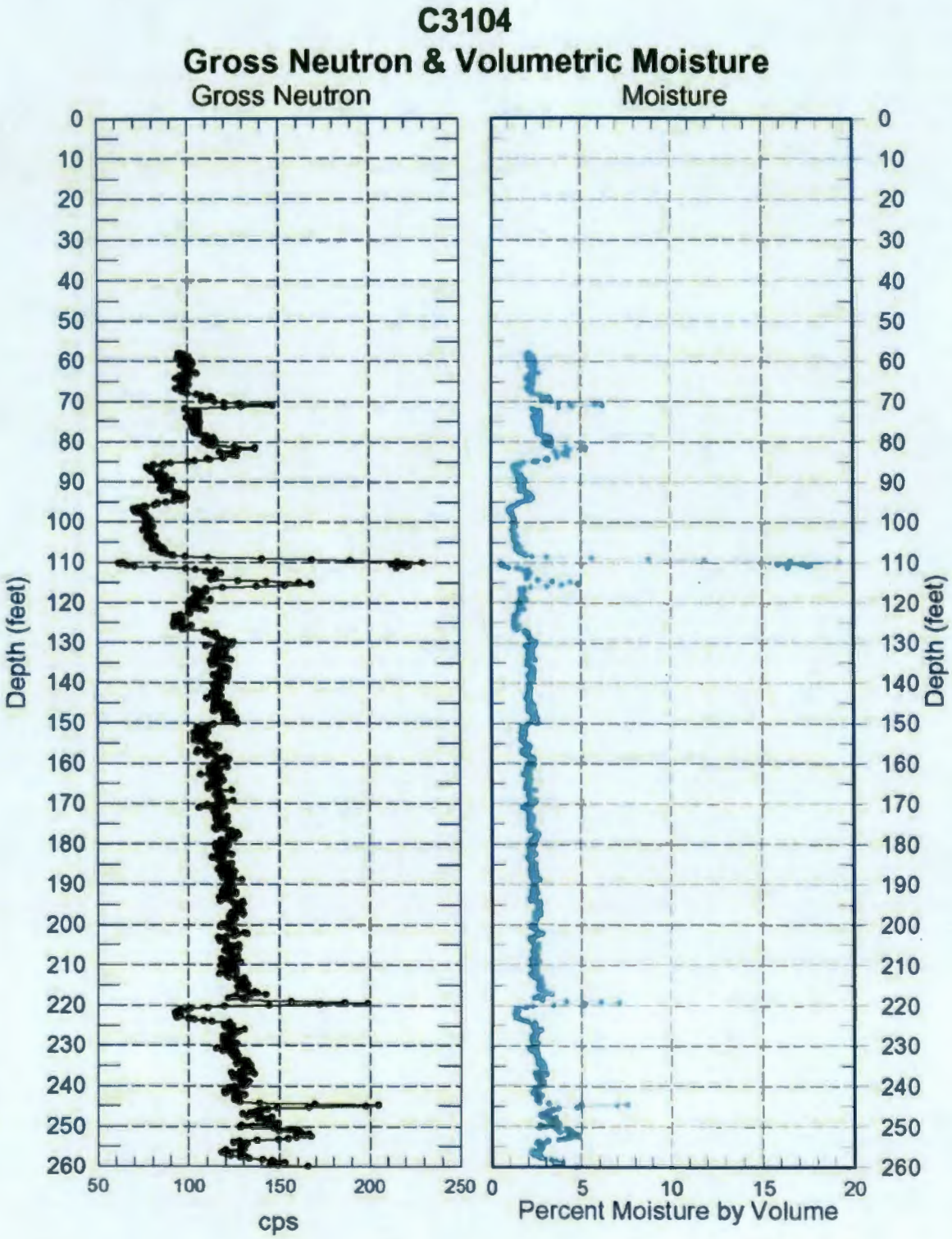
Third Rerun Section of Spectral Gamma Logs

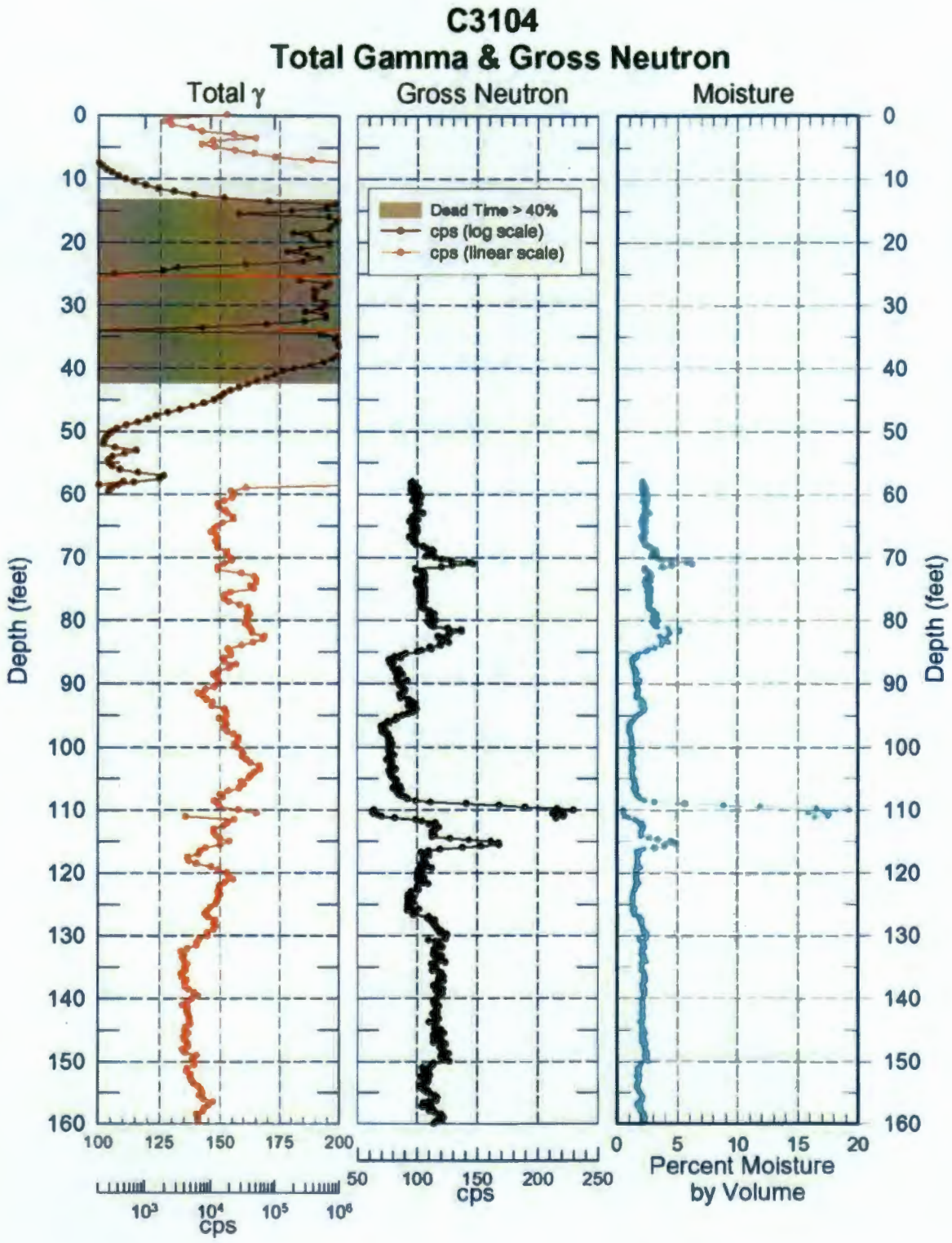


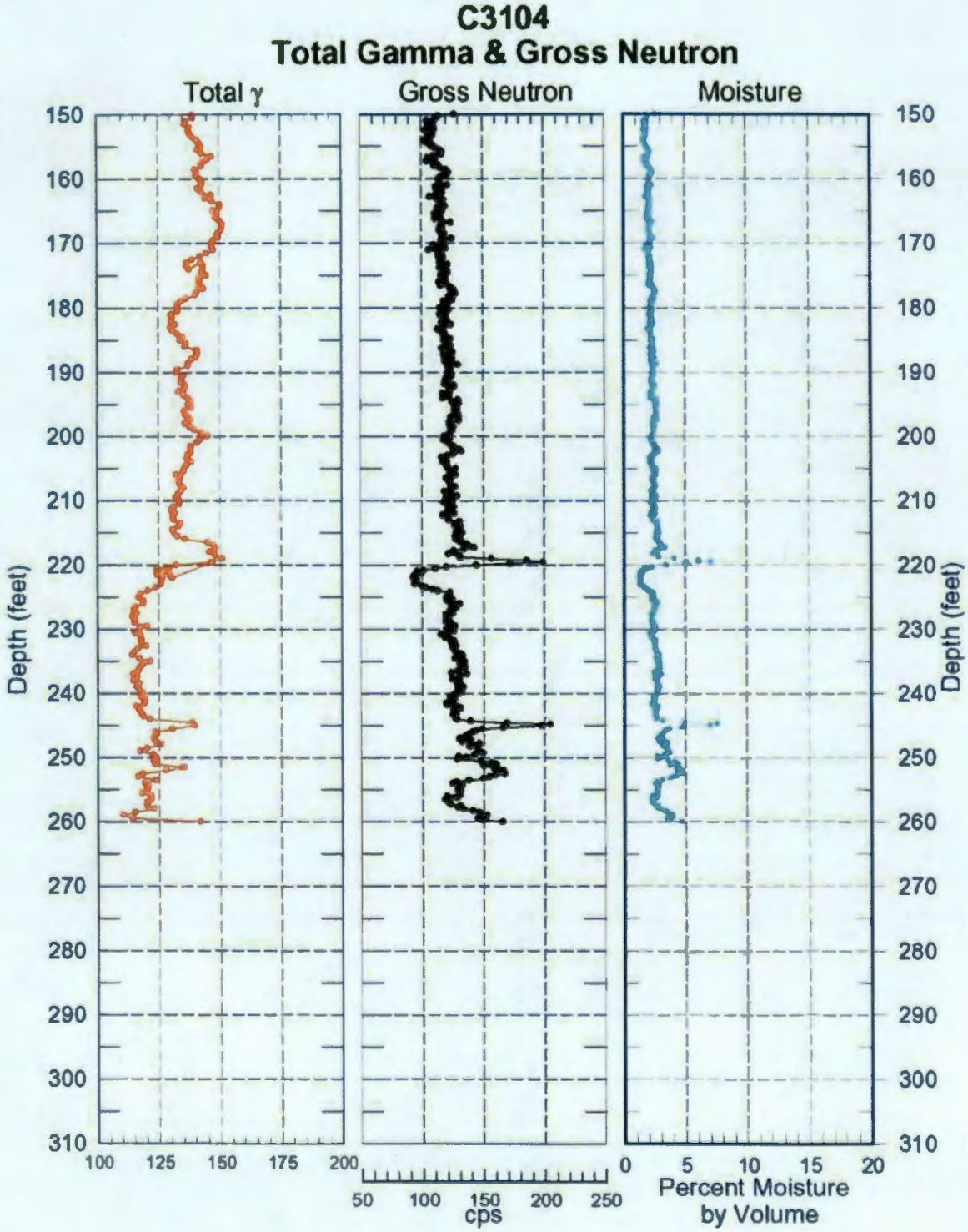
C3104
Rerun Section of High Rate Gamma Logs



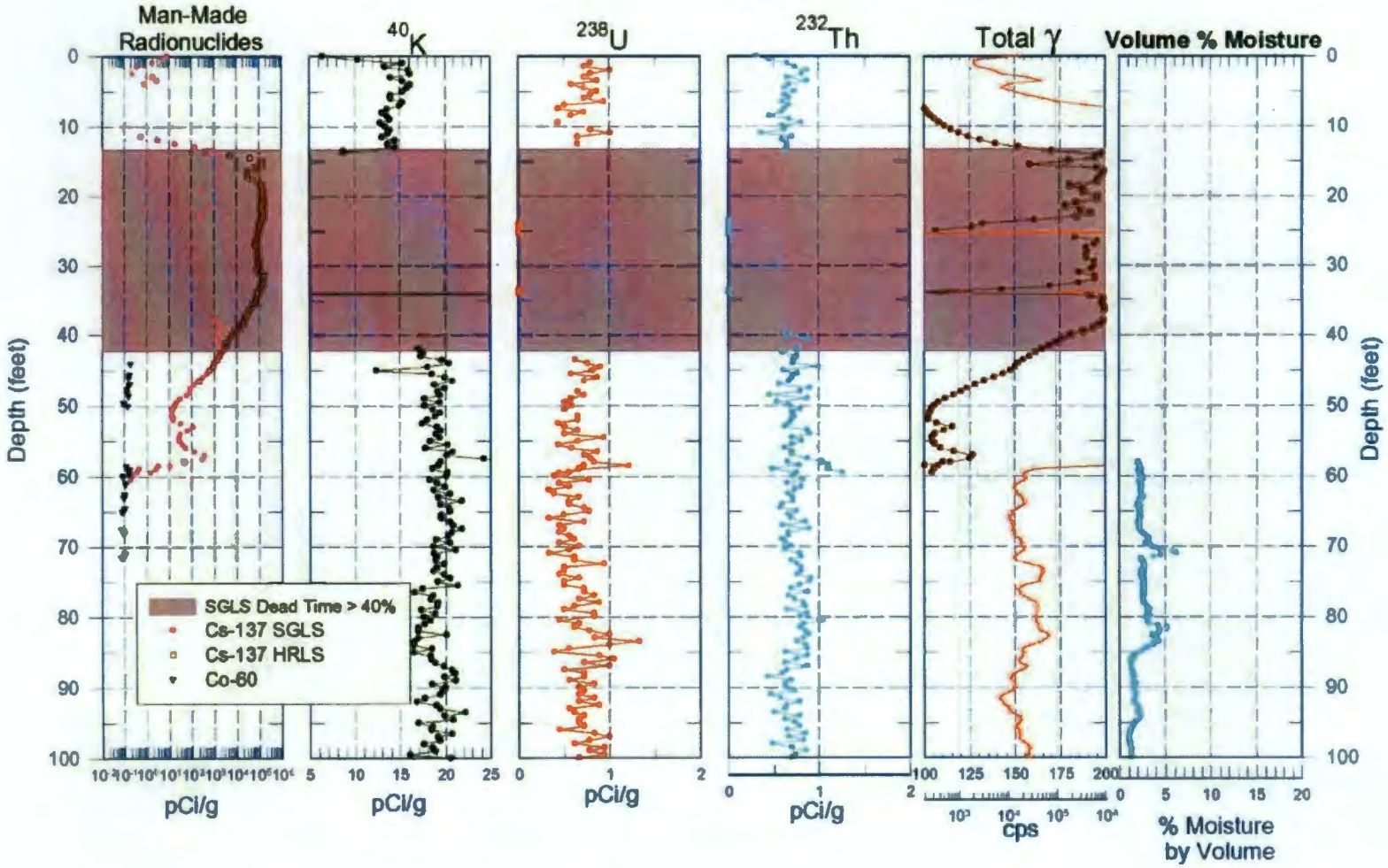

C3104
Rerun of Neutron Logs
First Rerun
Second Rerun
Depth (feet)
cps
Original Log Run
Rerun section


C3104
Gross Neutron & Volumetric Moisture
Gross Neutron
Moisture
Depth (feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
50
100
150
200
250
cps
0
5
10
15
20
Percent Moisture by Volume

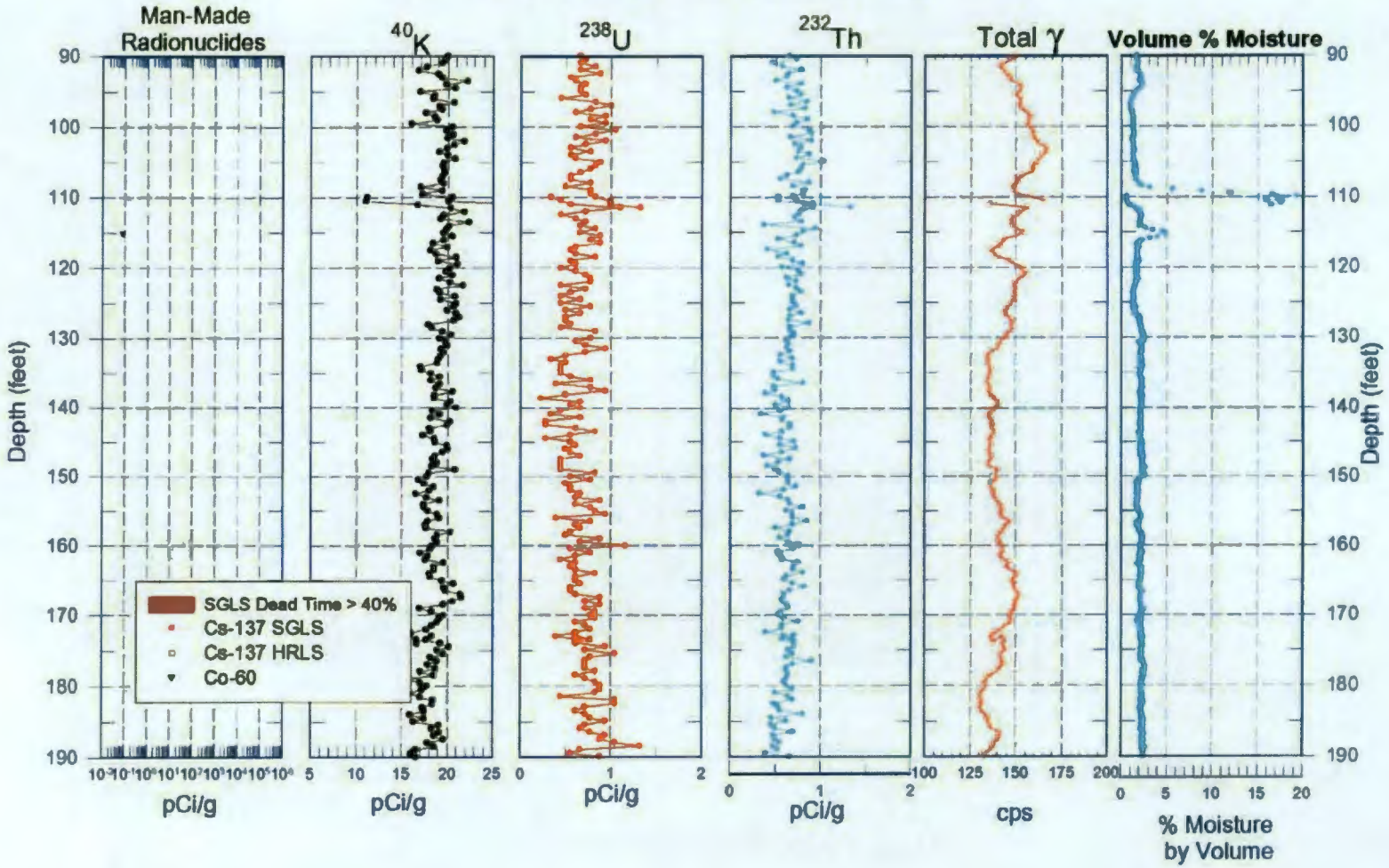

C3104
Total Gamma & Gross Neutron
Total γ
Gross Neutron
Moisture
Dead Time > 40%
cps (log scale)
cps (linear scale)
Depth (feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
100
125
150
175
200
10³
10⁴
10⁵
10⁶
cps
50
100
150
200
250
cps
0
5
10
15
20
Percent Moisture
by Volume

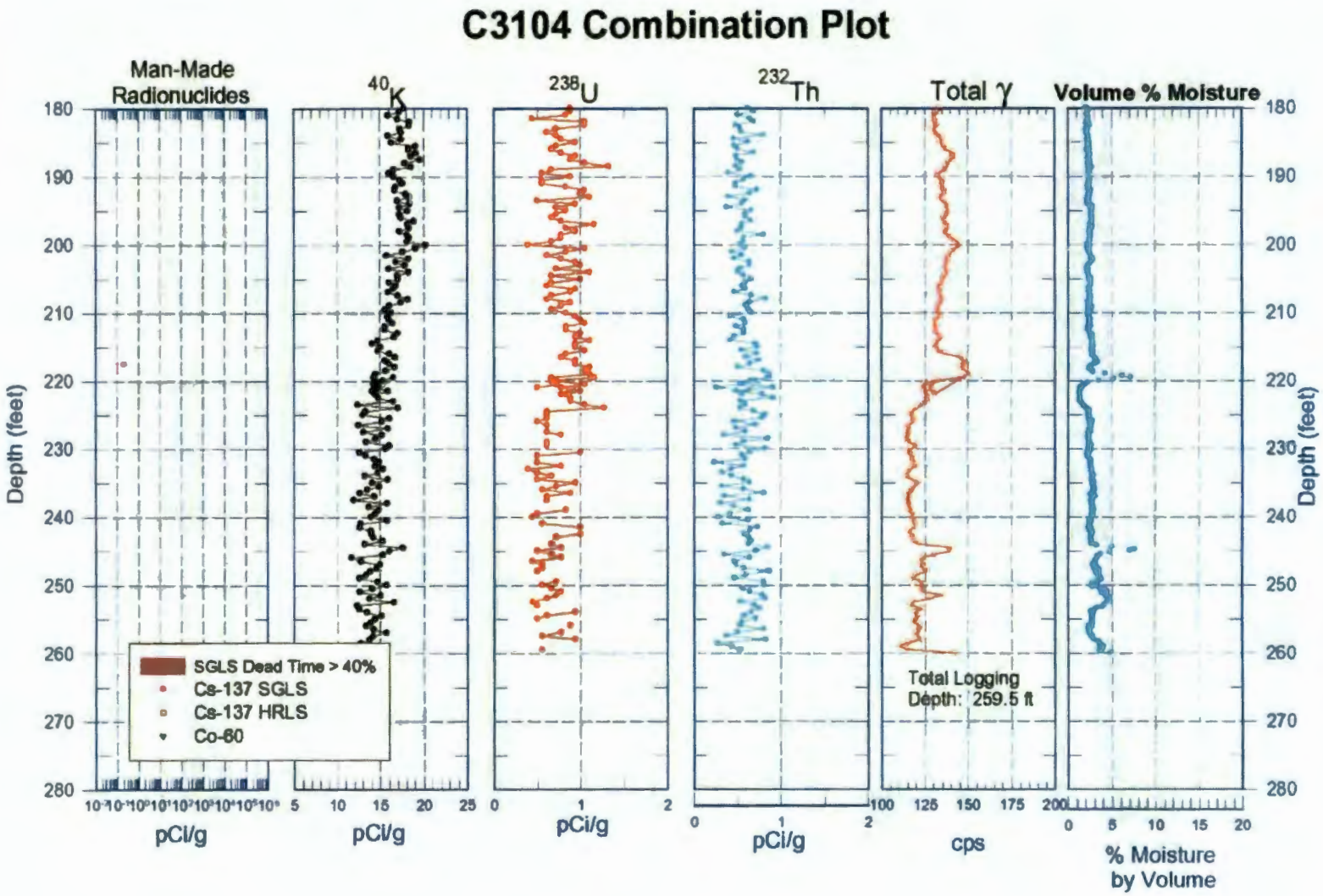

C3104
Total Gamma & Gross Neutron
Total γ
Gross Neutron
Moisture
Depth (feet)
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
100
125
150
175
200
50
100
150
200
250
cps
0
5
10
15
20
Percent Moisture
by Volume

C3104 Combination Plot



C3104 Combination Plot




C3104 Combination Plot
Man-Made Radionuclides
40K
238U
232Th
Total γ
Volume % Moisture
Depth (feet)
SGLS Dead Time > 40%
Cs-137 SGLS
Cs-137 HRLS
Co-60
Total Logging Depth: 259.5 ft
pCi/g
pCi/g
pCi/g
pCi/g
cps
% Moisture by Volume

C-3103

Log Data Report

Borehole Information

Borehole: C-3103			Site: 216-B-7A Crib		
Coordinates (Plant)		– GWL[1] (ft):	n/a[2]	GWL Date:	n/a
North	East	Drill Date	TOC[3] Elevation	Total Depth (ft)	Type
137385.743	573803.238	09/01	199.049	219.0	cable tool

Casing Information

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel (threaded)	1.0	6.625	5.625	0.5	0	56.5
Steel (threaded)	0.7	11.75	10.75	0.5	0	50.75
Steel (threaded)	1.4	8.75	7.75	0.5	0	130.5
Steel (threaded)	3.5	6.625	5.625	0.5	0	218.0

Borehole Notes:

The casing depth information provided above is derived from personal communication with the Bechtel Hanford Incorporated site representative. The casing size information is derived from caliper measurements collected in the field by MACTEC-ERS personnel. Logging measurements are referenced to ground surface. The original 6-in. casing in place from 0 to 56.5 ft was removed and replaced with the 11-in. casing from 0 to 50.75 ft. Drilling was stopped at about 220 ft where perched groundwater was encountered.

Logging Equipment Information

Logging System:	Gamma 1C		Type: HRLS
Calibration Date:	09/00	Calibration Reference:	GJO-2001-244-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	Gamma 1D		Type: SGLS (35%)
Calibration Date:	07/01	Calibration Reference:	GJO-2001-243-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	Gamma 2A		Type: SGLS (35%)
Calibration Date:	09/00	Calibration Reference:	GJO-2001-246-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	Gamma 2B		Type: SGLS (35%)
Calibration Date:	09/00	Calibration Reference:	GJO-2001-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	Gamma 2E	Type:	NMLS
Calibration Date:	05/01	Calibration Reference:	GJO-2001-247-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	RLS-1	Type:	Moisture
Calibration Date:	07/01	Calibration Reference:	RLSM00.0 (Randall 2001)
		Logging Procedure:	MAC-HGLP 1.6.5

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4 (Repeat)	5
Date	08/29/01	08/29/01	08/29/01	08/29/01	09/24/01
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth	2.0	19.0	36.5	55.0	54.0
Finish Depth	18.5	36.0	55.5	49.0	130.5
Count Time (sec)	200	30	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	n/a	n/a	n/a	n/a	n/a
Pre-Verification	B0041CAB	B0041CAB	B0041CAB	B0041CAB	B0057CAB
Start File	B0042000	B0042034	B0042069	B0042108	B0057000
Finish File	B0042033	B0042068	B0042107	B0042120	B0057153
Post-Verification	B0042CAA	B0042CAA	B0042CAA	B0042CAA	B0057CAA

Log Run	6 (Repeat)	7	8	9 (Repeat)	
Date	09/24/01	09/27/01	09/27/01	09/27/01	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth	130.5	129.0	147.0	218.5	
Finish Depth	122.5	148.0	218.5	209.5	
Count Time (sec)	200	200	200	200	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	0.5	0.5	0.5	0.5	
ft/min	n/a	n/a	n/a	n/a	
Pre-Verification	B0057CAB	A0003CAB	A0003CAB	A0003CAB	
Start File	B0057154	A0003000	A0003039	A0003183	
Finish File	B0057170	A0003038	A0003182	A0003201	
Post-Verification	B0057CAA	A0003CAA	A0003CAA	A0003CAA	

High Rate Logging System (HRLS) Log Run Information:

Log Run	10	11 (Repeat)	12		
Date	08/30/01	08/30/01	08/30/01		
Logging Engineer	Musial	Musial	Musial		
Start Depth	17.5	37.0	24.0		
Finish Depth	37.0	33.0	22.0		
Count Time (sec)	300	300	1200		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	0.5	0.5	1.0		
ft/min	n/a	n/a	n/a		
Pre-Verification	D0004CAB	D0004CAB	D0004CAB		
Start File	D0004000	D0004040	D0004049		

Page 2

Log Run	10	11 (Repeat)	12		
Finish File	D0004039	D0004048	D0004051		
Post-Verification	D0004CAA	D0004CAA	D0004CAA		

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	13	14 (Repeat)	15	16 (Repeat)	
Date	08/29/01	08/29/01	09/24/01	09/24/01	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth	3.5	55.25	54.0	130.5	
Finish Depth	55.55	49.73	130.5	122.5	
Count Time (sec)	n/a	n/a	15	15	
Live/Real	n/a	n/a	L	L	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	n/a	n/a	0.25	0.25	
ft/min	1.0	1.0	n/a	n/a	
Pre-Verification	C0013CAB	C0013CAB	C0018CAB	C0018CAB	
Start File	C0013000	C0013213	C0018000	C0018307	
Finish File	C0013212	C0013235	C0018306	C0018339	
Post-Verification	C0013CAA	C0013CAA	C0018CAA	C0018CAA	

Radionuclide Logging System (RLS) Moisture Log Run Information:

Log Run	17	18 (Repeat)			
Date	09/27/01	09/27/01			
Logging Engineer	Spatz	Spatz			
Start Depth	128.0	219.0			
Finish Depth	219.0	210.0			
Count Time (sec)	n/a	n/a			
Live/Real	n/a	n/a			
Shield (Y/N)	N	N			
MSA Interval (ft)	n/a	n/a			
ft/min	1.0	1.0			
Pre-Verification	C0192CAB	C0192CAB			
Start File	C0192000	C0192365			
Finish File	C0192364	C0192401			
Post-Verification	C0192CAA	C0192CAA			

Logging Operation Notes:

SGLS, HRLS, NMLS, and RLS logging were performed in this borehole between August and September 2001 on three separate days. The logging occurred inside three different casing configurations as the borehole was drilled. A longer count time (200 sec) than usual (100 sec) was required with the SGLS because of the relatively thick casing and to possibly detect plutonium that was thought to exist in the area. The HRLS was utilized to collect data in a high gamma flux zone between 17.5 and 37 ft where high SGLS dead times were encountered. In addition, test spectra were collected with the HRLS between 22 and 24 ft using a 1,200 second counting time. Because the HRLS planar detector is more sensitive to lower energy gamma photons than high-energy photons, it was believed low-yield plutonium-239 (^{239}Pu) energy peaks between about 59 and 414 keV might be observed in the spectra. Neutron moisture log data were also collected in this borehole. Data repeat sections for each logging system were collected to measure the systems' performance.

Analysis Notes:

Analyst:	Henwood	Date:	10/16/01	Reference:	MAC-VZCP 1.7.9 Rev. 2

Pre-run and post-run verifications of the logging tools were performed for each day's log event. Acceptance criteria were met for the SGLS and HRLS. The post-verification spectra were used for the energy and resolution calibration for the data processing.

Verification measurements were also collected for the NMLS and RLS moisture systems. Acceptance criteria have not yet been established for the logging systems. However, the pre- and post-run total count rate measurements agree within about 5%, suggesting the logging systems were operating properly during data collection.

Each spectrum collected during a log run was processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL using an efficiency function and corrections for casing as appropriate. Dead time corrections are applied to log data, including the total gamma data, where the dead time is in excess of 10 percent. In zones of high dead time (> 40%) gross count rates and radionuclide concentrations are not considered reliable, and may be significantly higher than the reported values. The HRLS is utilized when high dead times are encountered. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations rather than the ^{214}Bi peak at 609 keV. The 609-keV energy peak cannot be distinguished as a result of interference from the ^{137}Cs peak at 662 keV in higher concentration zones.

For the neutron moisture logs, calibration functions are available for 6-in. and 8-in.-diameter boreholes with conventional ASTM schedule-40 steel casing. The calibration function converts total neutron count rate to volume percent moisture content. Neutron moisture data from the interval between 54 and 130.5 ft were analyzed using the calibration function for an 8-in. borehole. Neutron moisture data from the intervals between 3.5 and 55.5 ft and 128 and 219 ft were analyzed using the calibration function for a 6-in. borehole. A correction factor developed from data provided by Meisner, Price, and Randall (WHC-SD-EN-TI-306) was applied to the data in the 8-in. interval to account for the 0.5-in. casing thickness. This factor increased the calculated moisture content by approximately 17 percent. No such correction factor was available for a 6-in. borehole; therefore, the same correction factor was also applied over depth intervals where a 6-in., 0.5-in.-thick casing was present.

Repeat log plots at selected depth intervals for spectral gamma concentrations and neutron moisture measurements were evaluated. The spectral gamma plots indicate good agreement between successive log runs, demonstrating repeatability in both depth and concentration measurement. The moisture plots also indicate good agreement for log data collected within the same casing configuration. Repeatability of calculated volumetric moisture content is not good in depth intervals where log data were collected in different sized casings (e.g., see moisture repeat section from 50 to 55 ft). As noted above, the correction applied to the 6-in. casing is the same as that applied to the 8-in. casing even though a correction for 6-in. casing has not been experimentally derived. It appears this casing thickness correction causes an overestimation of the volumetric moisture in 6-in. boreholes, particularly where the moisture content is less than 5 percent by volume; calibration data are not collected for curve fitting between zero and 5 percent moisture.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclides (^{137}Cs and ^{154}Eu), naturally occurring radionuclides (^{40}K, ^{232}Th, ^{238}U [KUT]), a combination of man-made, KUT, total gamma and moisture, total gamma plotted with dead time, and repeat section plots for spectral gamma and moisture measurements. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead

time correction, casing corrections, or water corrections. These errors are discussed in the calibration report.

Results and Interpretations:

The man-made radionuclides detected in this borehole were ^{137}Cs and ^{154}Eu. ^{137}Cs is detected continuously from near the ground surface to about 56 ft in depth with the highest concentration of about 300,000 pCi/g measured at about 23 ft. ^{154}Eu is detected between 16 and 18 ft and probably exists at some depth intervals within the high rate zone between 18 and 27 ft. The HRLS detector is less efficient than the SGLS in detecting higher energy peaks such as the 1274-keV ^{154}Eu peak. No other man-made radionuclide was detected in this borehole, including ^{239}Pu, for which longer counting times were employed to enhance the possibility of detection.

SGLS measurements were collected between 54 and 55.5 ft in both log run 3 and log run 5 (see man-made radionuclide plot). A 6-in. casing was in place at this depth interval during log run 3. When log data were collected during log run 5, the original 6-in. casing had been removed and an 8-in. casing existed in the depth interval. The calculated ^{137}Cs concentrations from log run 5 were much lower than in log run 3. The discrepancy in concentrations between the two log runs suggests contaminated material had been dragged down from the high-rate interval to lower depths during the drilling process or the original casing was contaminated. Once the casing was removed and the borehole was drilled to a larger diameter, the ^{137}Cs concentrations measured about 1 pCi/g. Most of the ^{137}Cs contamination measured during log run 3 below about 43 ft is likely the result of borehole contamination.

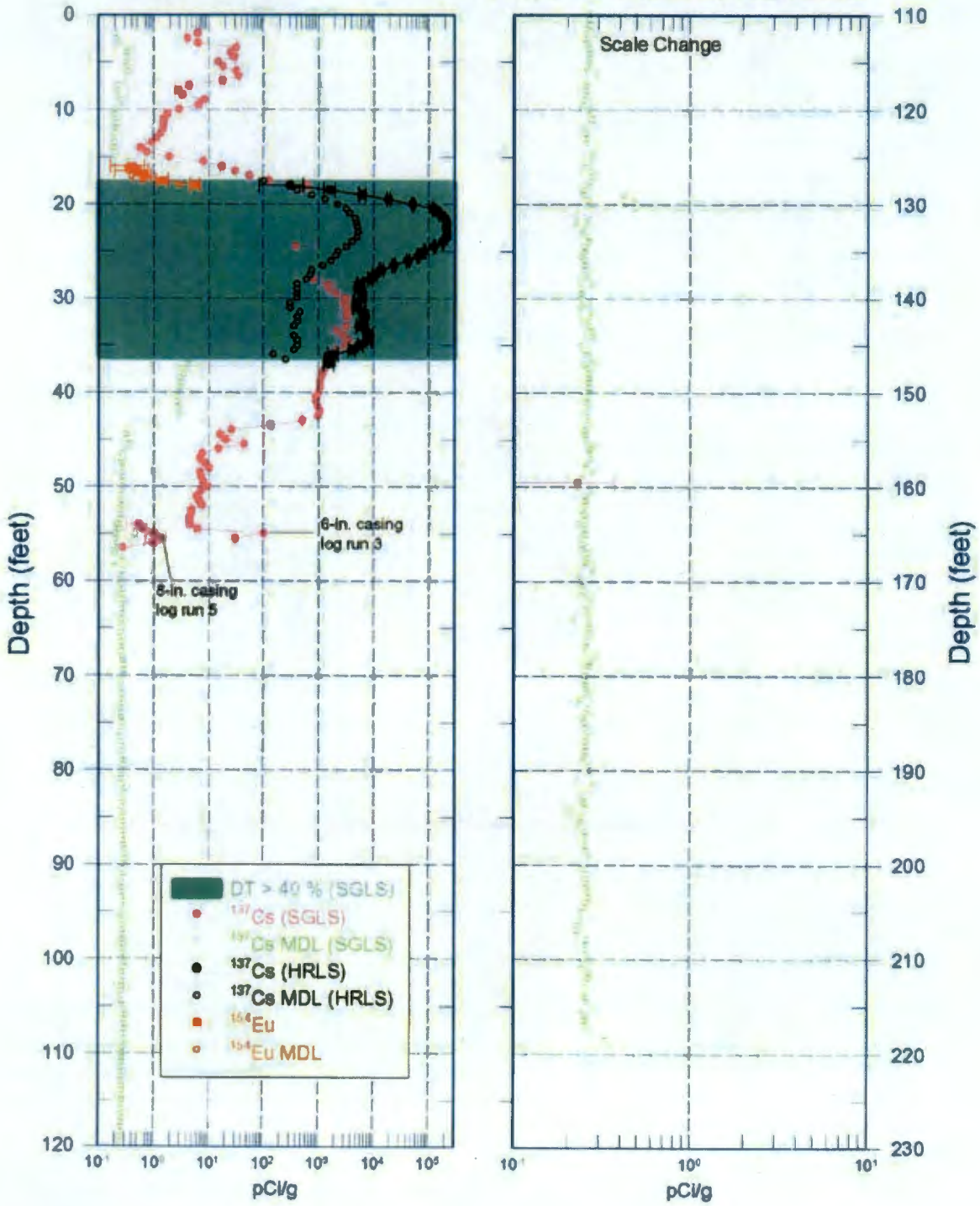
The KUT logs do not delineate any definitive lithologic units. Changes in the ^{40}K concentrations from about 12 pCi/g at about 18 ft to about 17 pCi/g near 37 ft suggest a lithologic change occurs in the high rate interval. A thin bed with relatively high ^{232}Th concentrations occurs at about 107 ft and may be useful to correlate in nearby boreholes.

Relatively higher moisture content appears to exist in the interval from 18 to 37 ft. The highest moisture content occurs at 20 ft in depth, just above the depth where the highest ^{137}Cs concentrations were measured. An interval between about 80 and 100 ft indicates slightly higher moisture that corresponds with finer grained soil as indicated by slightly higher concentrations of ^{40}K and ^{232}Th. The remainder of the borehole exhibits consistent moisture content in the soils. The moisture content is increasing near the bottom of the borehole and the final data point at 218 ft indicates the detector is in close proximity to groundwater but has not fully entered the saturated interval.

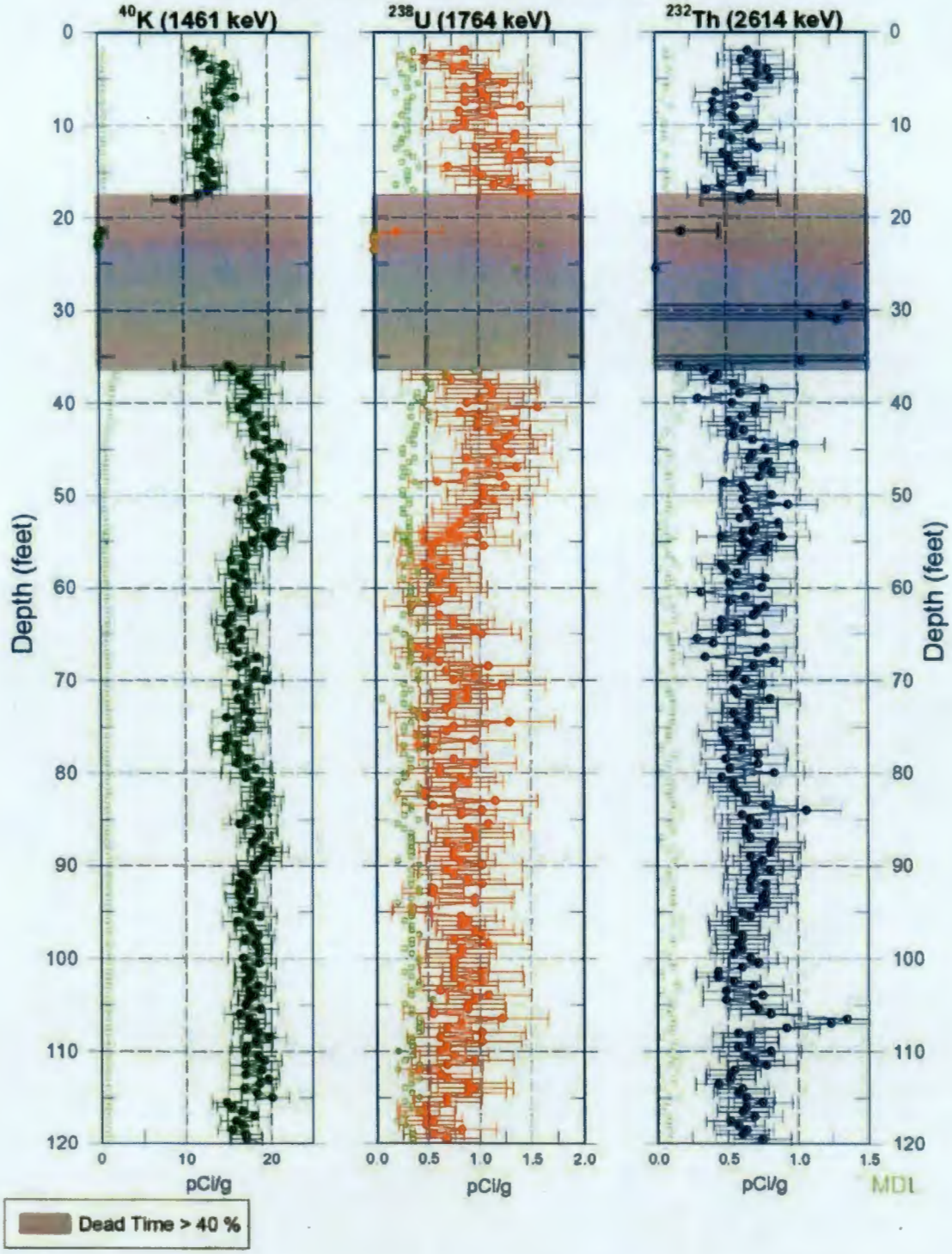
---

[1] GWL – groundwater level
[2] n/a – not applicable
[3] TOC – top of casing

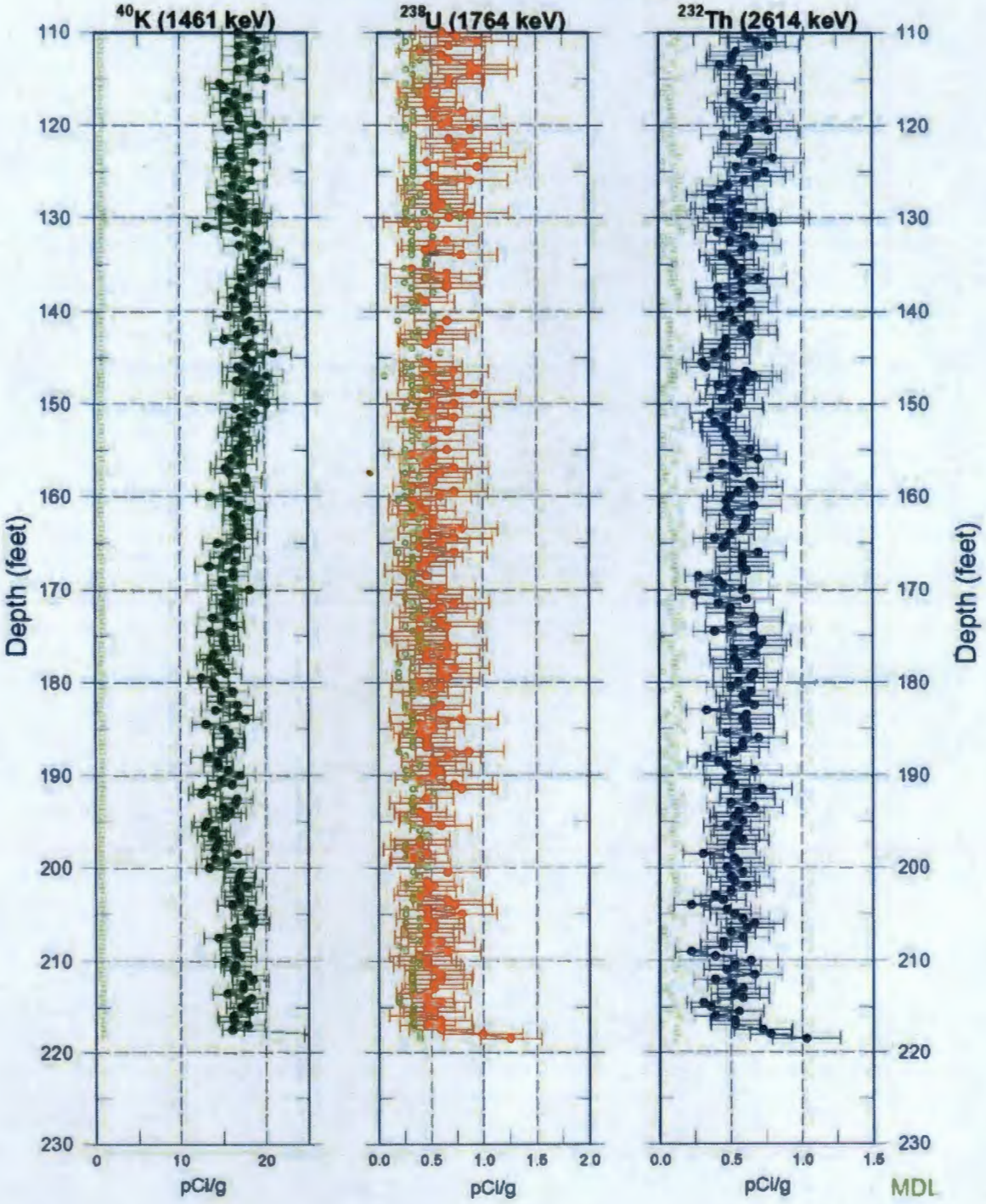
C-3103
Man-Made Radionuclide Concentrations



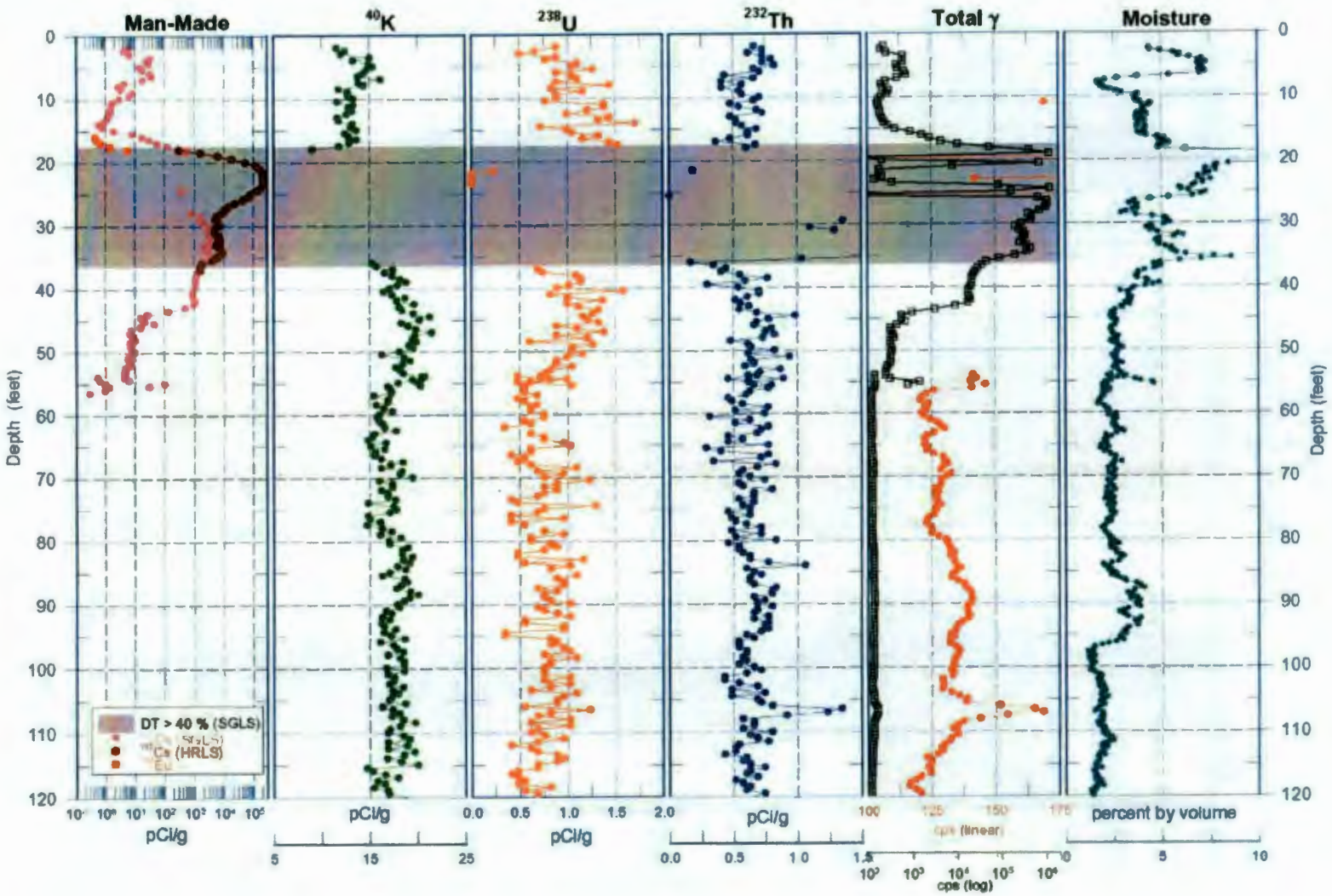
C-3103
Natural Gamma Logs

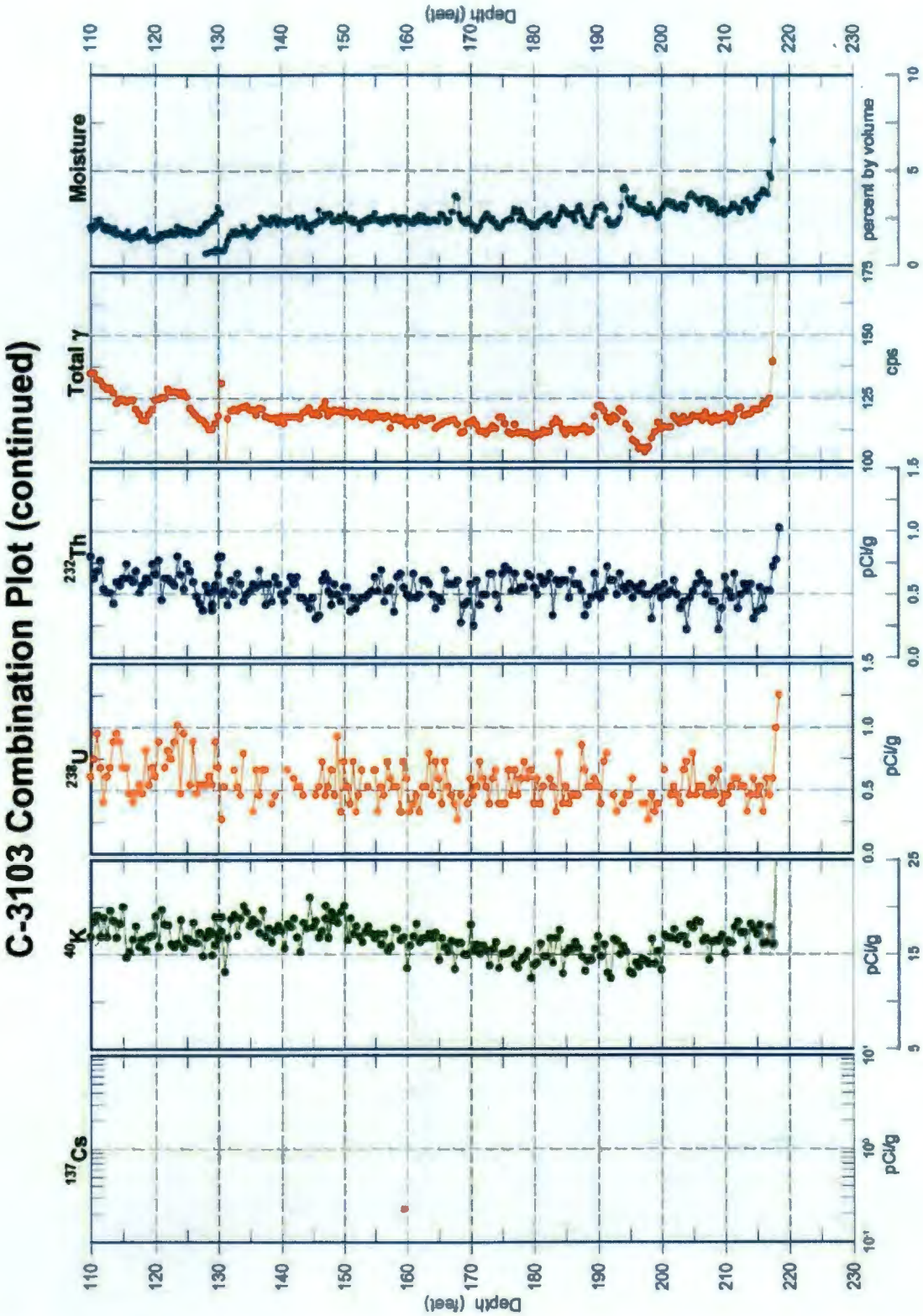


C-3103
Natural Gamma Logs

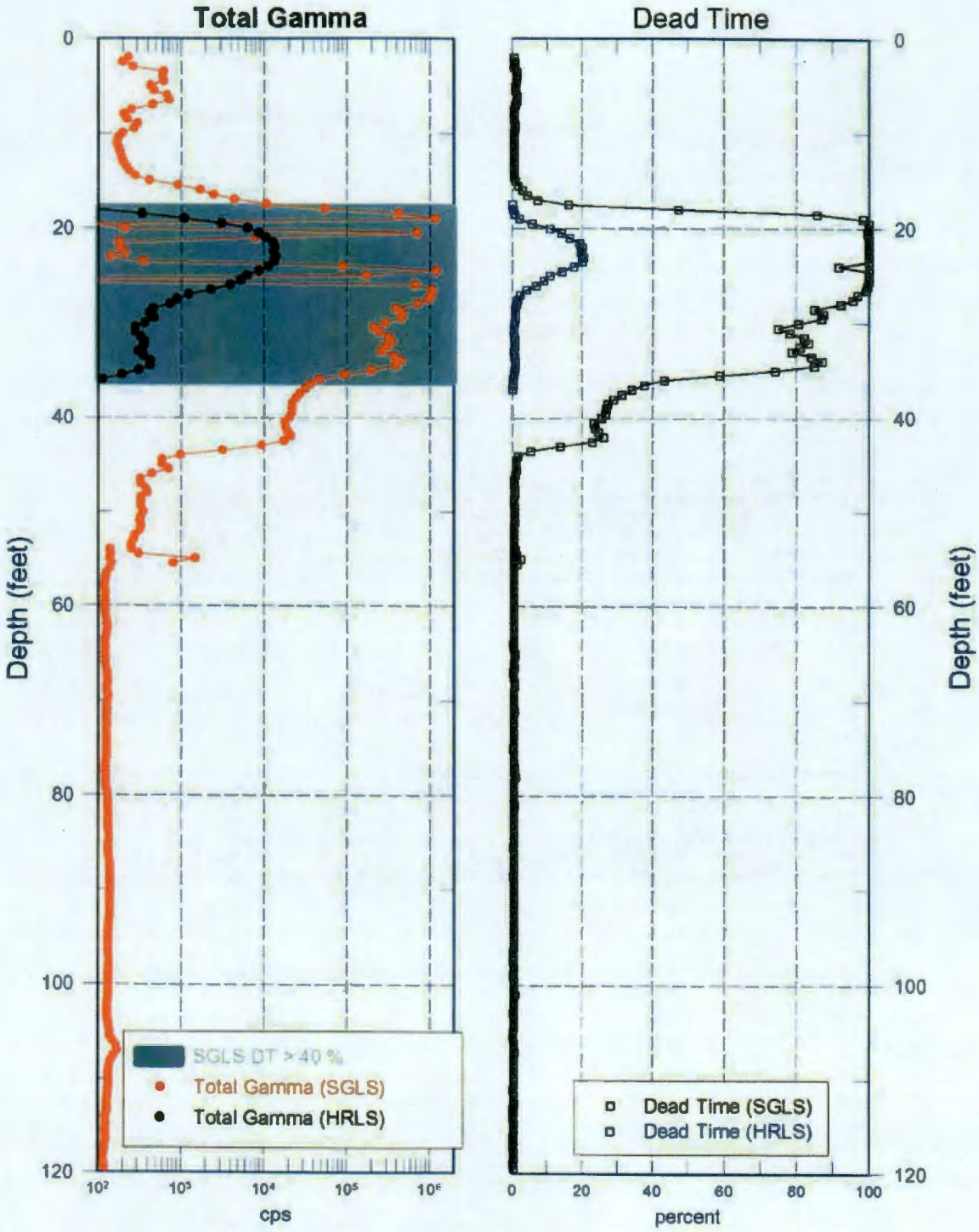


C-3103 Combination Plot

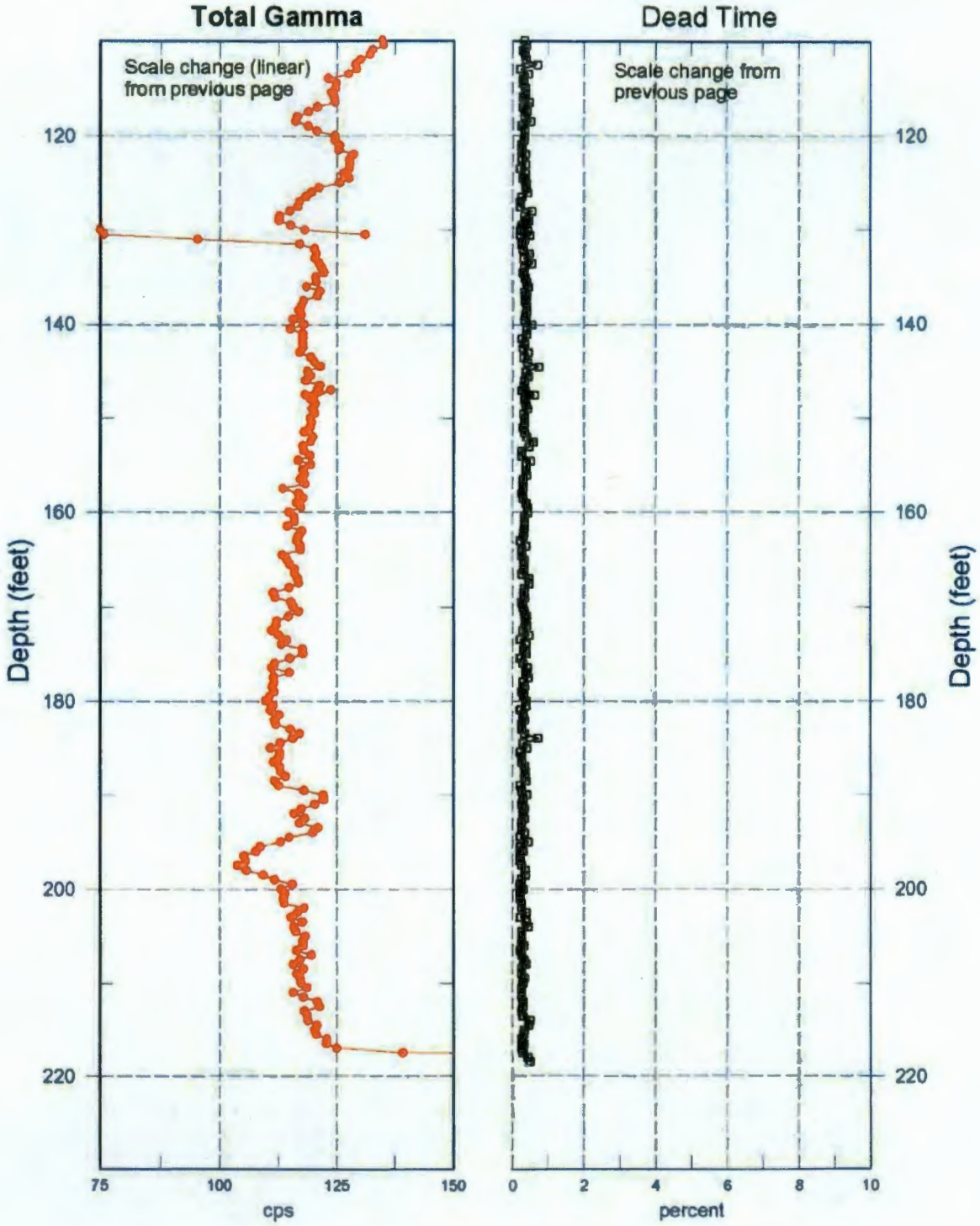



C-3103 Combination Plot (continued)
Moisture
Total γ
232Th
233U
40K
137Cs
percent by volume
cps
pCi/g
Depth (feet)

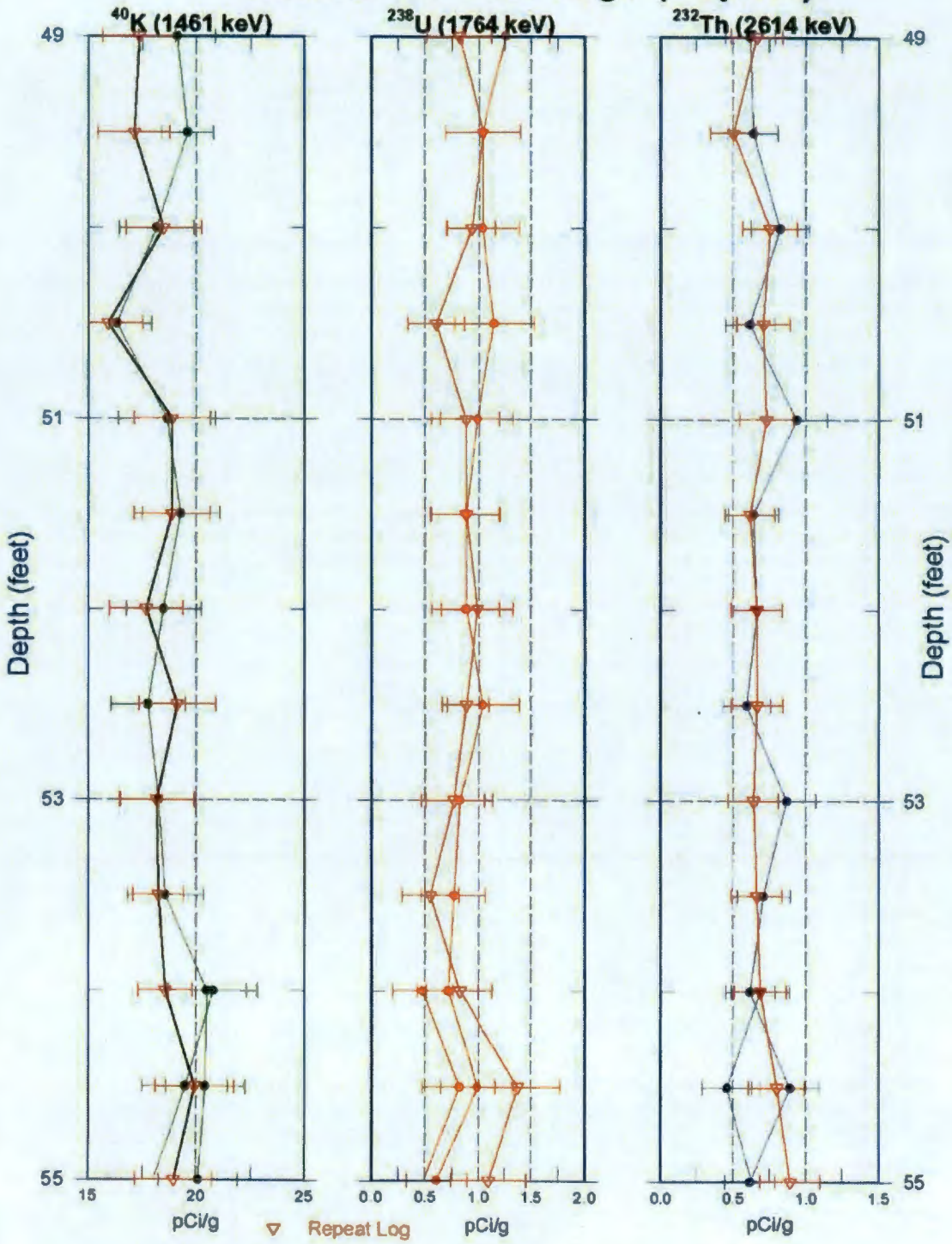
C-3103


Total Gamma
Dead Time
Depth (feet)
0
20
40
60
80
100
120
SGLS DT > 40 %
Total Gamma (SGLS)
Total Gamma (HRLS)
Dead Time (SGLS)
Dead Time (HRLS)
10^2
10^3
10^4
10^5
10^6
cps
0
20
40
60
80
100
percent

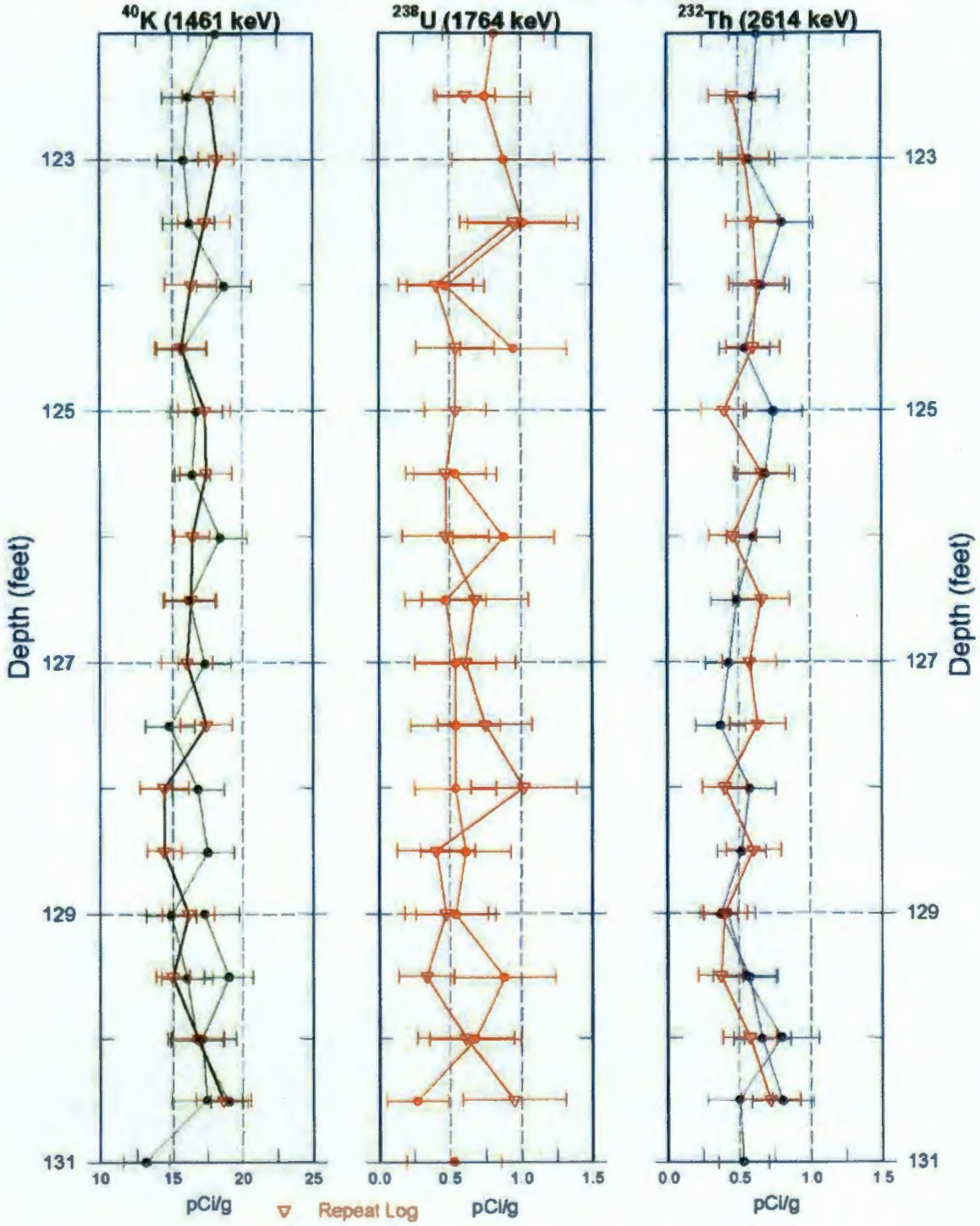
C-3103 (continued)



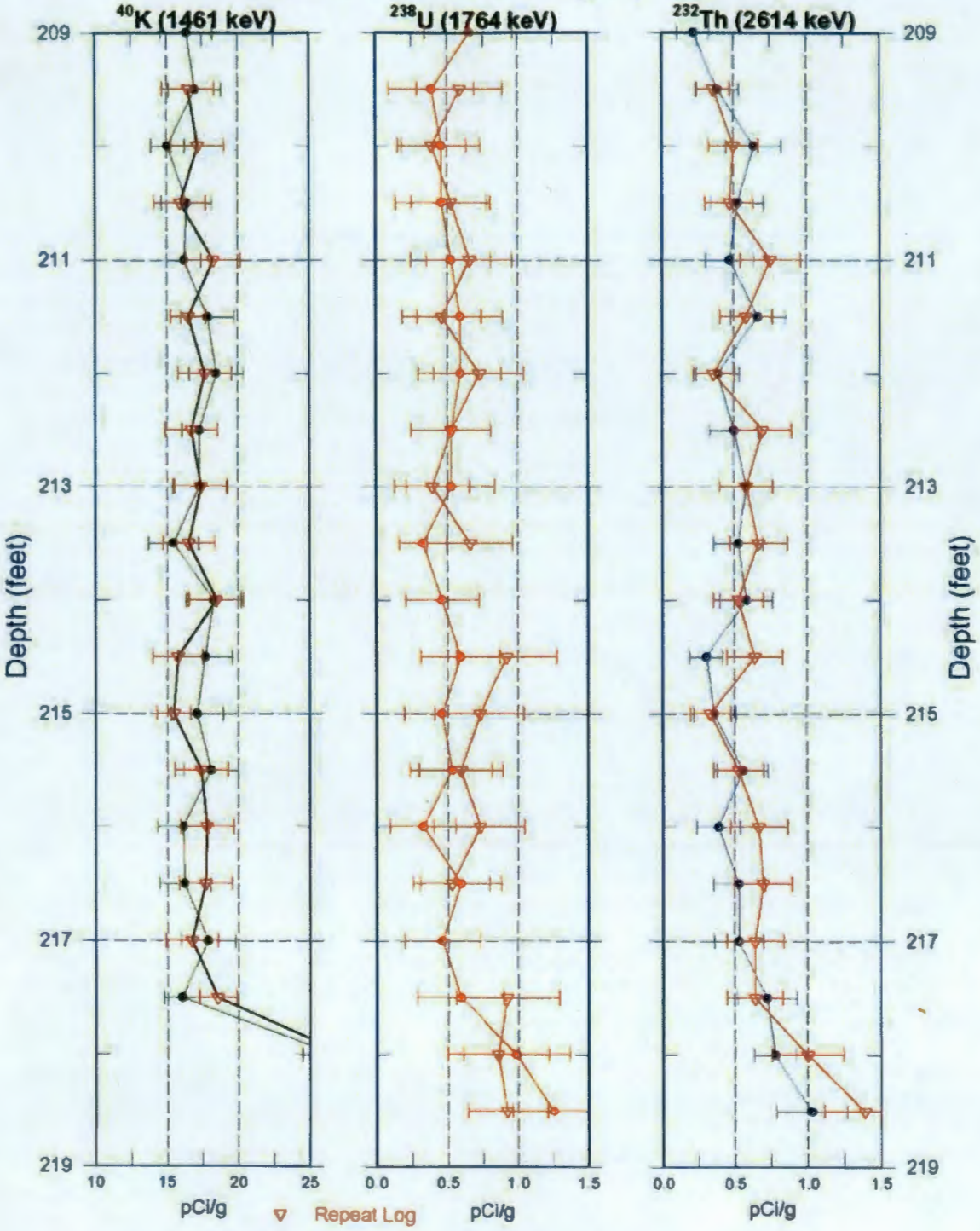
C-3103
Natural Gamma Logs (Repeat)



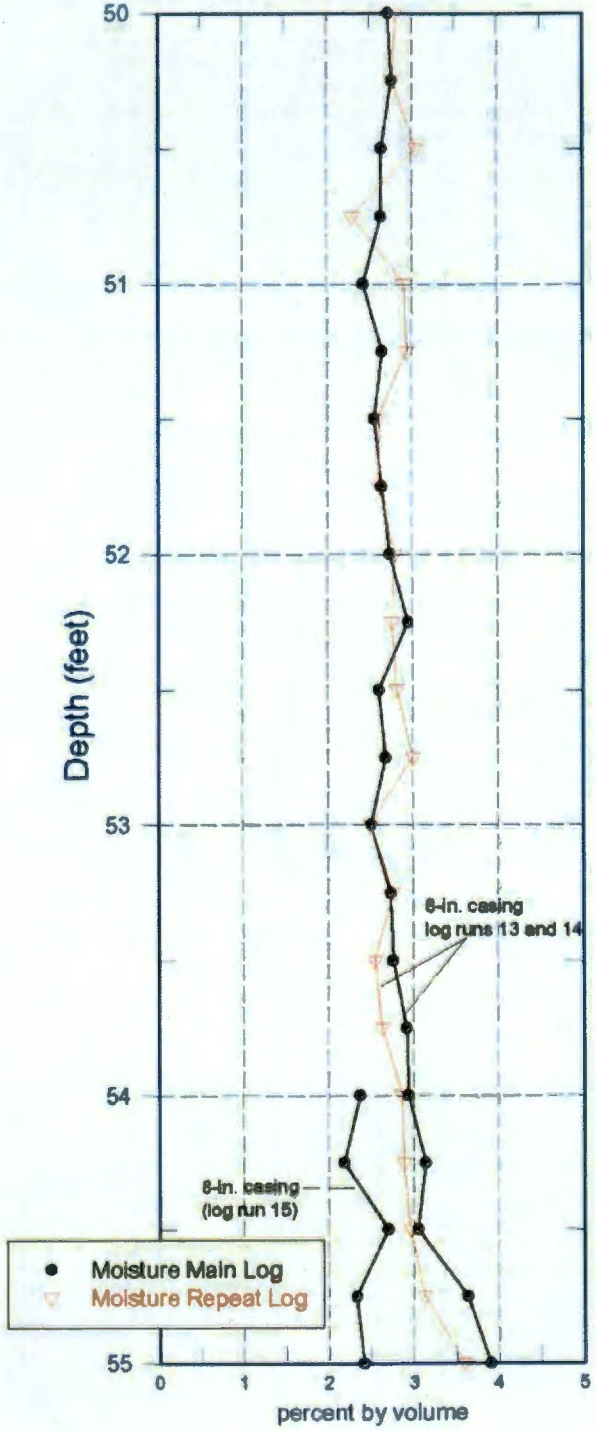
C-3103
Natural Gamma Logs (Repeat)



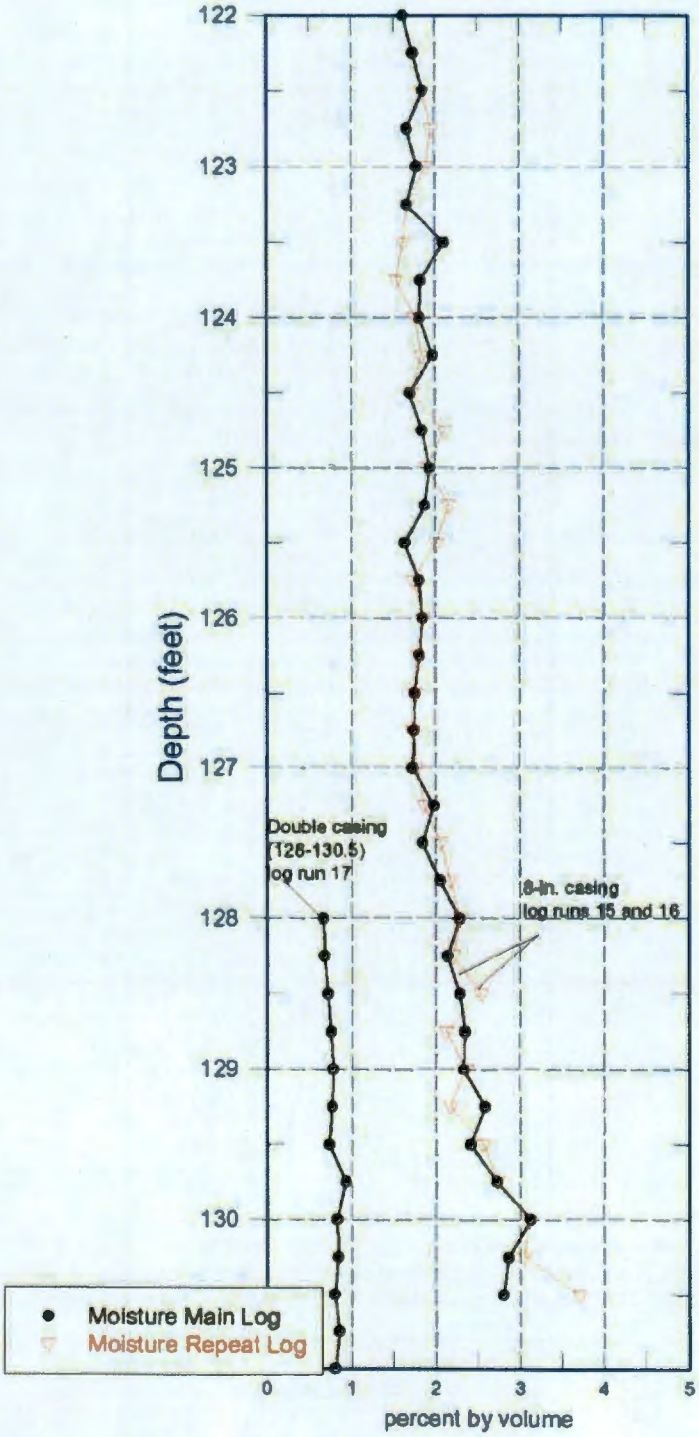
C-3103
Natural Gamma Logs (Repeat)



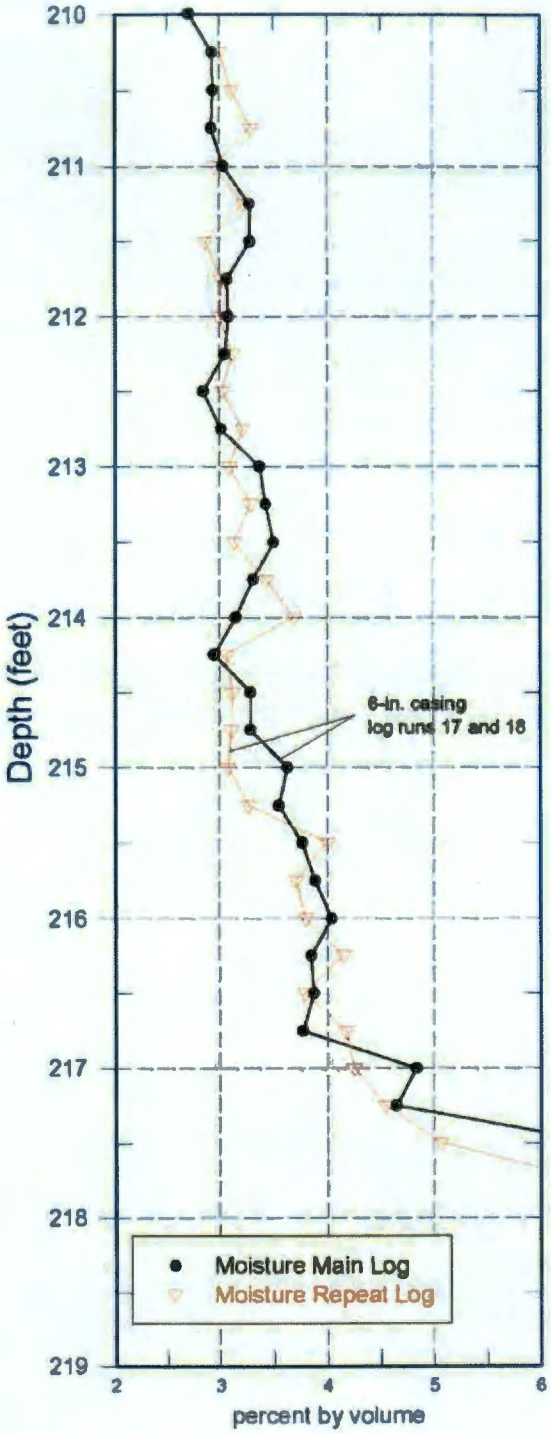
C-3103
Moisture Repeat Section



C-3103
Moisture Repeat Section



C-3103
Moisture Repeat Section



APPENDIX C

SURFACE GEOPHYSICAL SURVEY REPORT— GROUND PENETRATING RADAR

085931

Job No. 22192
Written Response Required: NO
Due Date: N/A
Actionee: N/A
Closes CCN: N/A
OU:
TSD:
ERA:
Subject Code: 8280

Environmental Restoration Contractor **ERC Team**

Interoffice Memorandum

TO: C. Cearlock/H9-0

DATE: January 30, 2001

COPIES: M. E. Todd H9-03
L. A. Dietz H0-20
C. D. Wittreich H9-03
Document and Info Services H0-09

FROM: T. H. Mitchell/K. A. Bergstrom
Design and Geoscience
H9-02/372-9690/372-9591

SUBJECT: **RESULTS OF THE GEOPHYSICAL INVESTIGATIONS AT THE 216-T-26 CRIB, 216-B-7A CRIB AND THE 216-B-38 TRENCH AND ASSOCIATED BURIAL GROUND.**

Geophysical investigations were conducted at three waste sites in the 200 Areas, the 216-T-26 Crib in 200 West and the 216-B-7A Crib and 216-B-38 Trench in 200 East. Ground Penetrating Radar and Electromagnetic Induction were the geophysical methods used for the investigations.

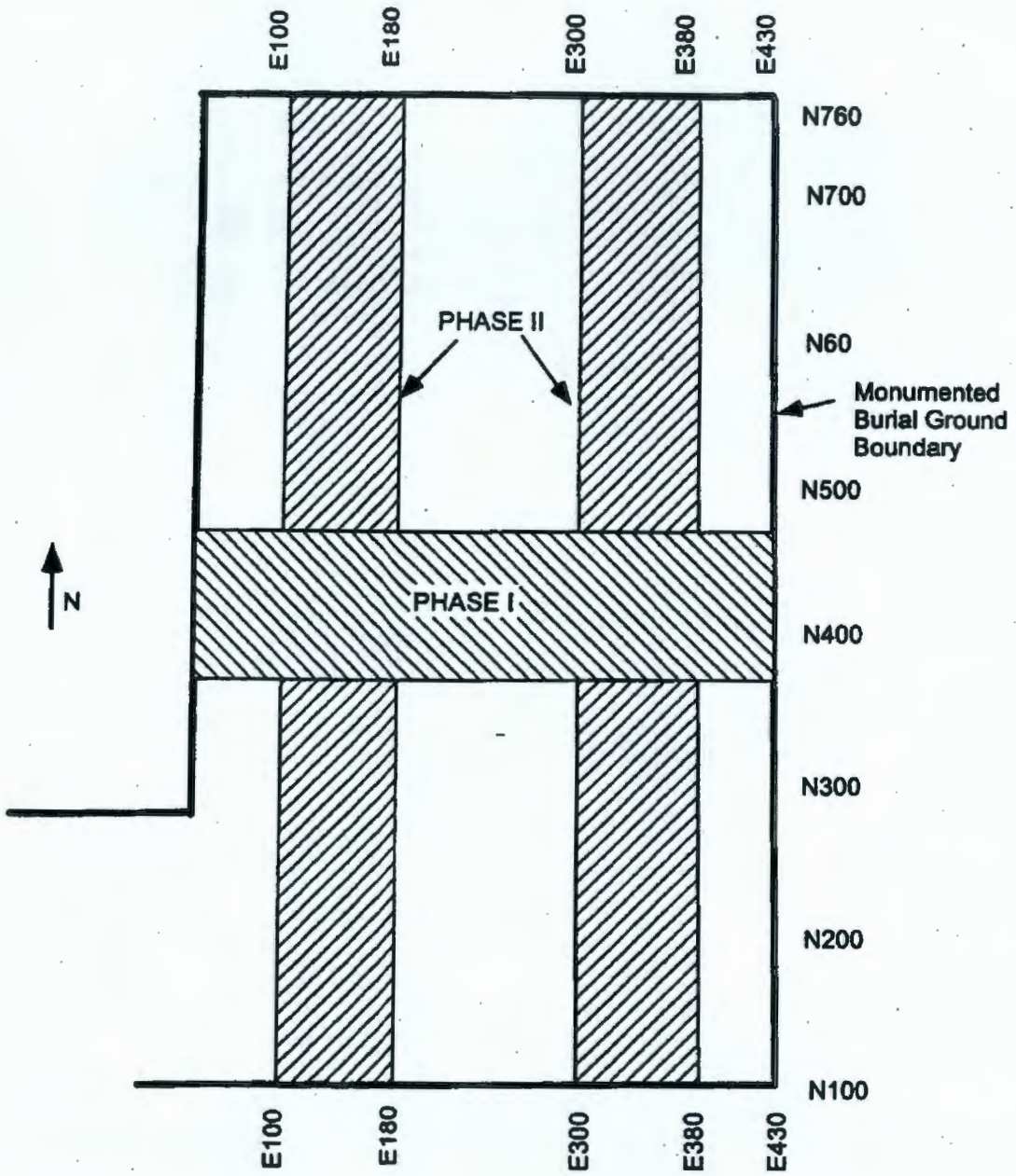
Attached are the results from the three investigations. If there are any questions contact Tom Mitchell at 372-9691 or Kevin Bergstrom at 372-9591.

KAB:mrc

Attachment: Investigation Results

H:\Coy. Michelle\ERC\ERC IOMS\216-IOM.doc

Bechtel Hanford, Inc. – CH2M Hill Hanford, Inc. – Thermo Hanford, Inc.



General Layout of the Geophysical Surveys at the 216-B-38 Trench.

GEOPHYSICAL SITE INVESTIGATION SUMMARY FORM

Site:	216-B-38 trench	**Document Number:**	IOM#085931	**Date:**	1/2001
Sponsor/Contact:	Mary Todd, Chris Cearlock	**Phone:**	372-9631		
Location:	200 East Area, North side of 241-B Tank Farm, East side of Baltimore Ave.				
Objectives:	To confirm location of trench.				

Investigators

Name:	Tom Mitchell	**Company**	CHI
Phone:	372-9690	**E-Mail**	Thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CHI
Phone:	372-9591	**E-Mail**	Kabergst@bhi-erc.com

Site Description

Cultural Resource Setting:	NA		
Terrain:	Gently slopes from south to north		
Vegetation:	Bunch grass used to stabilize cover over burial ground.		
Soil/sediments/rock type:	Fill material, gravel, sand and silt at surface. Subsurface unknown		
Anticipated Bedrock:	**Depth:** None	**Type:**	NA
Hydro properties*:	Soil was dry during data collection		
Obstacles:**	None		
Site Limitations:	None		
Overall assessment of site for geophysical investigations:	Soil showed minimal lateral variations/character across site thus limiting the effectiveness of GPR.		

Equipment

Type/Model:	Ground Penetrating Radar GSSI SIR10A system, 300 Mhz antenna model 3105 pulled by ATV EMI: EM-31 Geonics ground conductivity meter.		
Data Format:	**Disk** ☒	**Tape** ☐	**Hardcopy** ☒

Data Collection/Processing Parameters

Survey Parameters/Grid:	Data collected in three segments. The initial segment was a 10 x 10-ft grid over an area 350 feet long (east-west) by 80 feet wide (north-south). The survey was expanded to include two long north-south segments, 660 feet long by 80 feet wide. GPR data were collected along north-south profiles spaced 10 feet apart (i.e. perpendicular to the trenches). EMI data were also collected along north-south profiles spaced 10 feet apart with data recorded at 5 foot intervals.
Equipment Settings:	Data collected in continuous mode with 2x stacking of scans. 108 ns data recording window. Filters and gains were set in the field to match local soil conditions. Both in-phase and quadrature EMI data were collected with the boom parallel to the profiles at ~ 3 feet above the ground.

Summary of Results (Data quality, types of information, etc.)

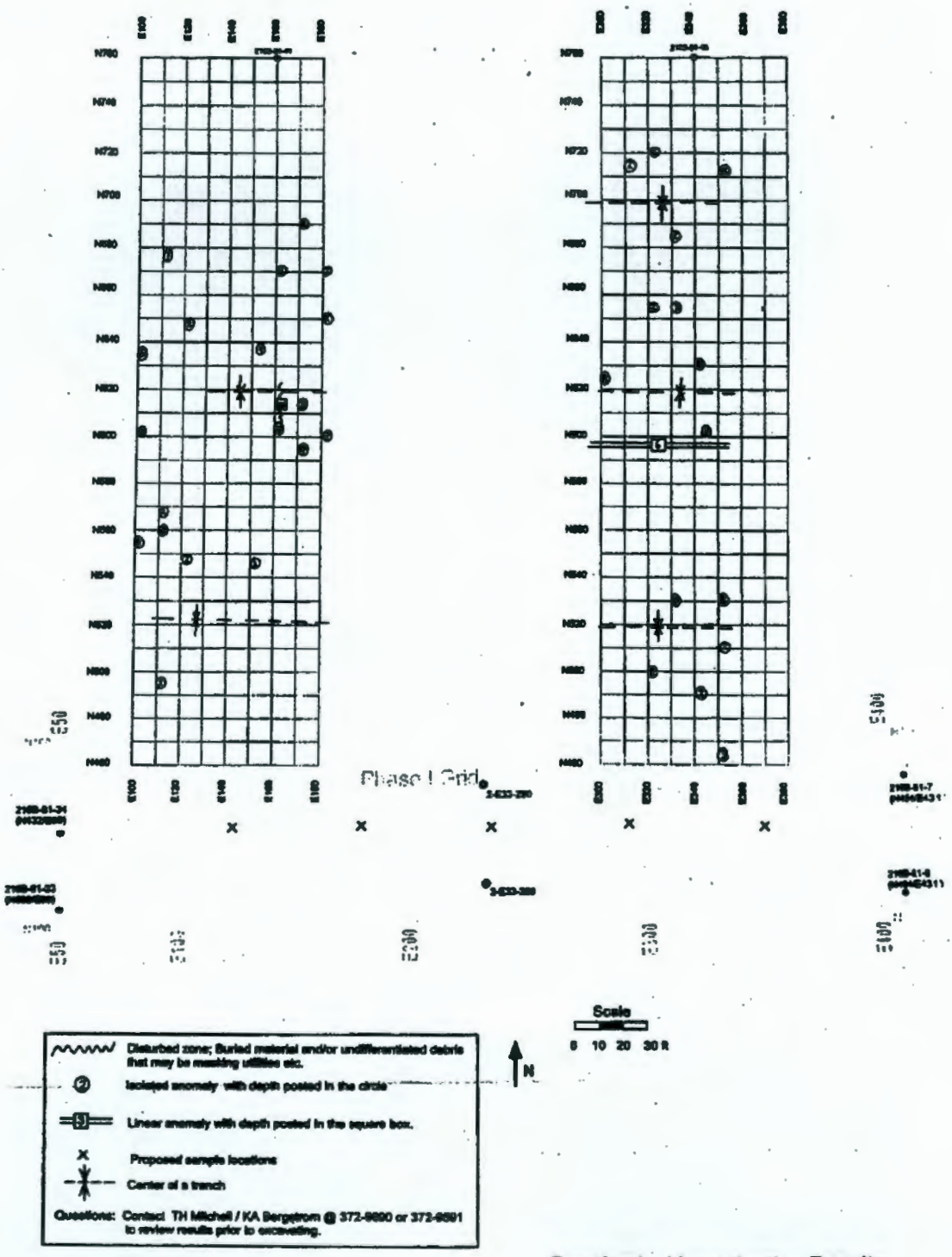
The GPR data suggests that there are at least seven trenches across the site. In addition several linears (i.e. suspect pipes) were detected across the site. It is not clear if the linears area associated with the trenches. The proposed sample locations appear to be within trench 216-B-38.

Lessons Learned (None)

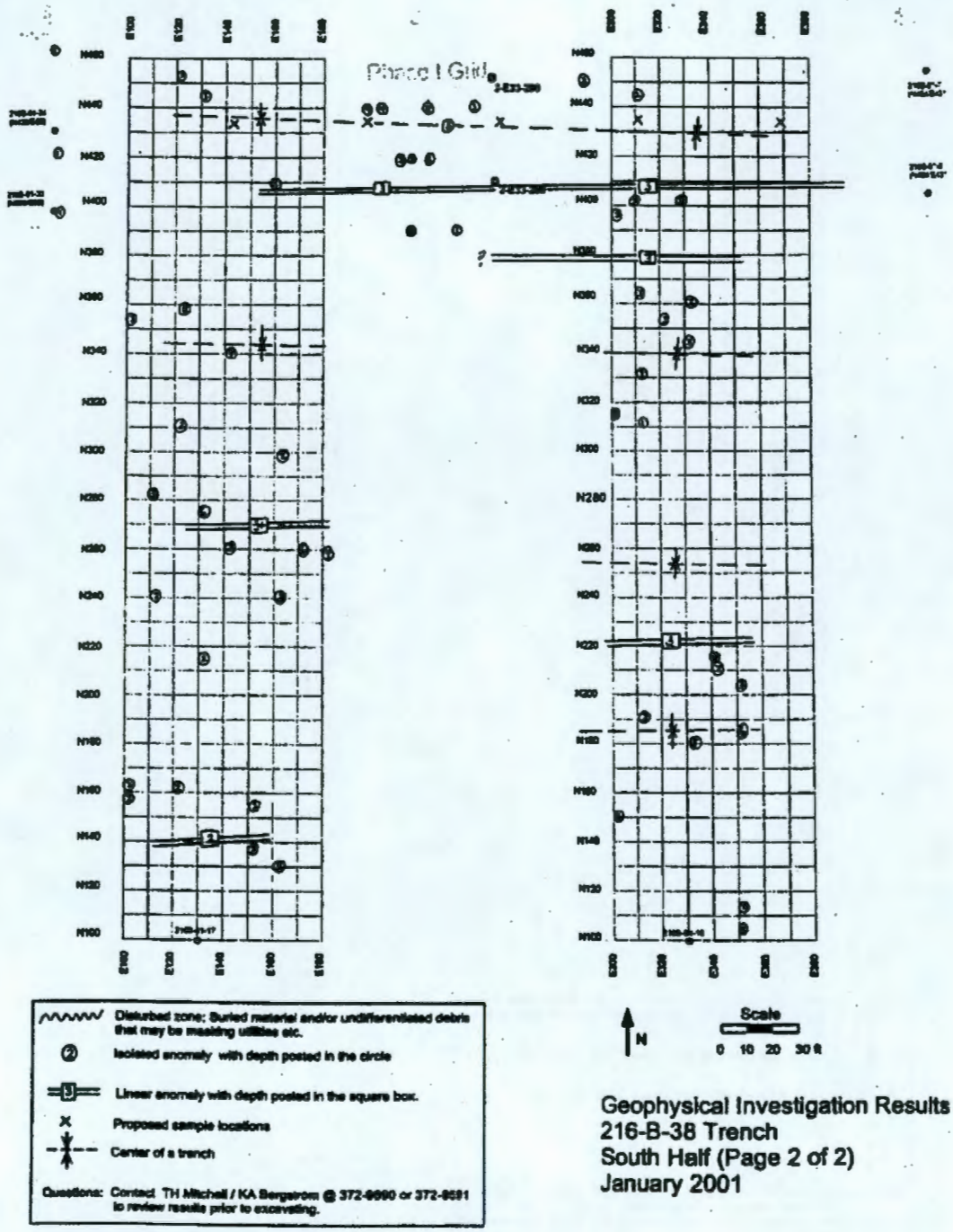
***water table, moisture, etc:**
**** rocks, trees, buildings, etc.**

Note: To use the check box electronically - double click on box and change default value to checked.

BHI-EE-259 (09/29/2000)



Geophysical Investigation Results
216-B-38 Trench
North Half (Page 1 of 2)
January 2001



Geophysical Investigation Results
216-B-38 Trench
South Half (Page 2 of 2)
January 2001

GEOPHYSICAL SITE INVESTIGATION SUMMARY FORM

Site: 216-B-7A Crib **Document Number:** IOM#085931 **Date:** 1/2001

Sponsor/Contact: Mary Todd, Chris Cearlock **Phone:** 372-9631

Location: 200 East Area, North side of 241-B Tank Farm, East side of Baltimore Ave.

Objectives: To confirm location of crib and locate associated underground piping.

Investigators

Name:	Tom Mitchell	**Company**	CHI
Phone:	372-9690	**E-Mail**	Thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CHI
Phone:	372-9591	**E-Mail**	Kabergst@bhi-erc.com

Site Description

Cultural Resource Setting: NA

Terrain: Slopes from north to south from N130 to N100 with ~ 10-ft of relief. Flat between N130 to N200

Vegetation: None

Soil/sediments/rock type: Fill material, gravel and cobbles at surface. Subsurface unknown

Anticipated Bedrock: **Depth:** None **Type:** NA

Hydro properties*: Soil was dry during data collection

Obstacles:** CA (contamination area between N100 and perimeter fence at N90.

Site Limitations: None

Overall assessment of site for geophysical investigations: GPR did not penetrate deep enough to locate and map crib and associated piping.

Equipment

Type/Model: Ground Penetrating Radar GSSI SIR10A system, 200 Mhz antennat model 5106
EMI: EM-31 Geonics ground conductivity meter.

Data Format: **Disk** ☒ **Tape** ☐ **Hardcopy** ☒

Data Collection/Processing Parameters

Survey Parameters/Grid: 5 x 5-ft grid over a 100 x 100-ft area. GPR data were collected along profiles spaced 5 feet apart in both the north-south and east-west direction. EMI data were collected along north-south profiles spaced 5 feet apart with data recorded at 5 foot intervals.

Equipment Settings: GPR data collected in continuous mode with 2x stacking of scans. 150 ns data recording window. Filters and gains were set in the field to match local soil conditions. GSSI RADAN software used for post processing, with no improvement in locating features of interest.
Both in-phase and quadrature EMI data were collected with the boom parallel to the profiles at ~ 3 feet above the ground.

Summary of Results (Data quality, types of information, etc.)

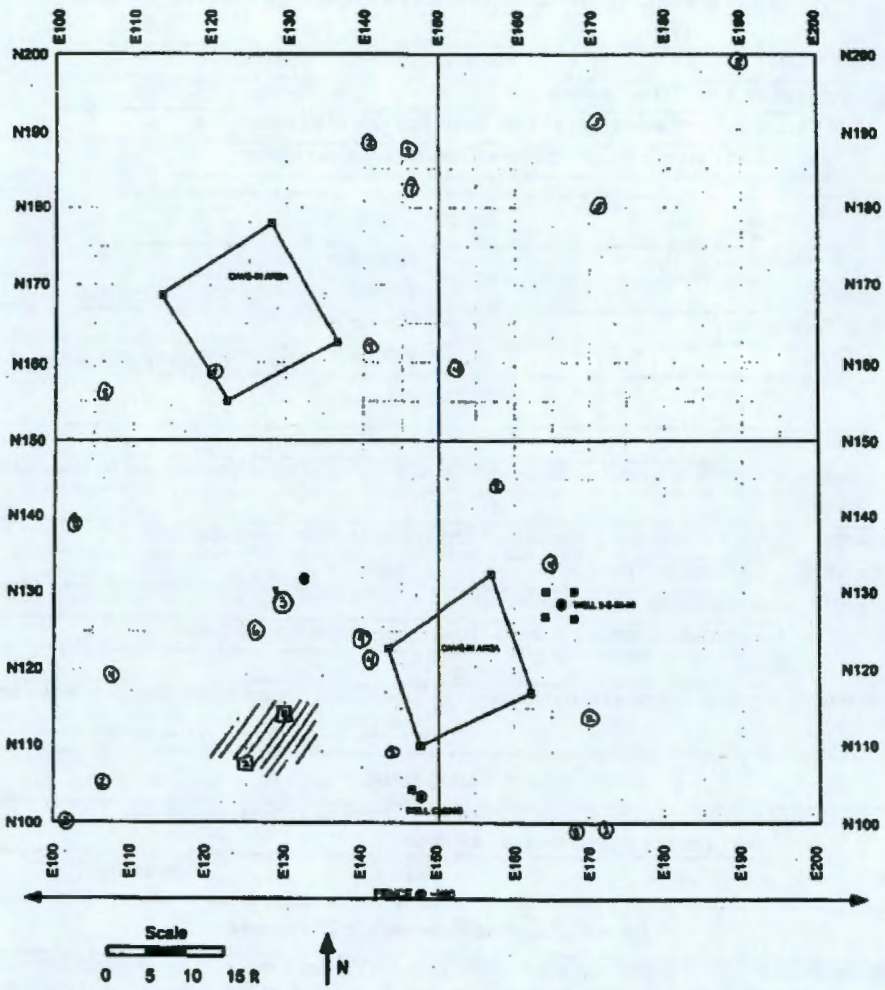
The cribs and piping were not located. An anomalous zone was detected with both the EMI and GPR data to the west of the anticipated location of the crib. None of the available historical drawing indicated the presence of a buried anthropogenic feature in that area thus it is not clear what the source of the anomalous zone is.

Lessons Learned

Neither GPR and EMI were effective at locating 3 inch steel pipes at depth of ~16-ft. Thickness of fill material over original land surface too deep to locate original excavation boundaries of crib.

***water table, moisture, etc:**
**** rocks, trees, buildings, etc.**

Note: To use the check box electronically - double click on box and change default value to checked.
BHI-EE-259 (09/29/2000)



Isolated anomaly with depth posted in the circle

Linear anomaly (None detected).

Zone dominated with strong reflective horizon

Well casing

Metal fence post

Questions: Contact TH Mitchell / KA Bergstrom @ 372-9660 or 372-9581 to review results prior to excavating.

Ground Penetrating Radar Results
216-B-7A Crib, 200 East
January, 2001

GEOPHYSICAL SITE INVESTIGATION SUMMARY FORM

Site:	216-T-26 Crib	**Document Number:**	IOM#085931	**Date:**	Jan. 2001
Sponsor/Contact:	Mary Todd (CHI)	**Phone:**	372-9631		
Location:	200 West, East Side of Camden Rd across from TY Tank Farm				
Objectives:	To locate and map the distribution piping within the crib and find a location within the crib for a borehole.				

Investigators

Name:	Kevin Bergstrom	**Company**	CHI
Phone:	372-9591	**E-Mail**	Kabergst@bhi-erc.com
Name:	Tom Mitchell	**Company**	CHI
Phone:	372-9690	**E-Mail**	Thmitche@bhi-erc.com

Site Description

Cultural Resource Setting:	NA
Terrain:	Flat
Vegetation:	Scattered bunch grass used to stabilize site.
Soil/sediments/rock type:	Sand, silt and cobbles (fill material)
Anticipated Bedrock:	**Depth:** NA **Type:** NA
Hydro properties*:	Relatively moist
Obstacles:**	Wells
Site Limitations:	The antenna "bounced" around due to the bunch grass effecting data quality along some profiles.
Overall assessment of site for geophysical investigations:	GPR was effective down to ~14 feet.

Equipment

Type/Model:	Ground Penetrating Radar: GSSI SIR10A, 300 MHz antenna
Data Format:	**Disk** ☒ **Tape** ☐ **Hardcopy** ☒

Data Collection/Processing Parameters

Survey Parameters/Grid:	5 x 5 ft grid over a 50 x 50 ft area
Equipment Settings:	Data were stacked @ 2x; 108 ns window, gains and filters set in field to match soil conditions.

Summary of Results (Data quality, types of information, etc.)

The data were sufficient to locate and map the pipes within the crib with the aid of the drawings.

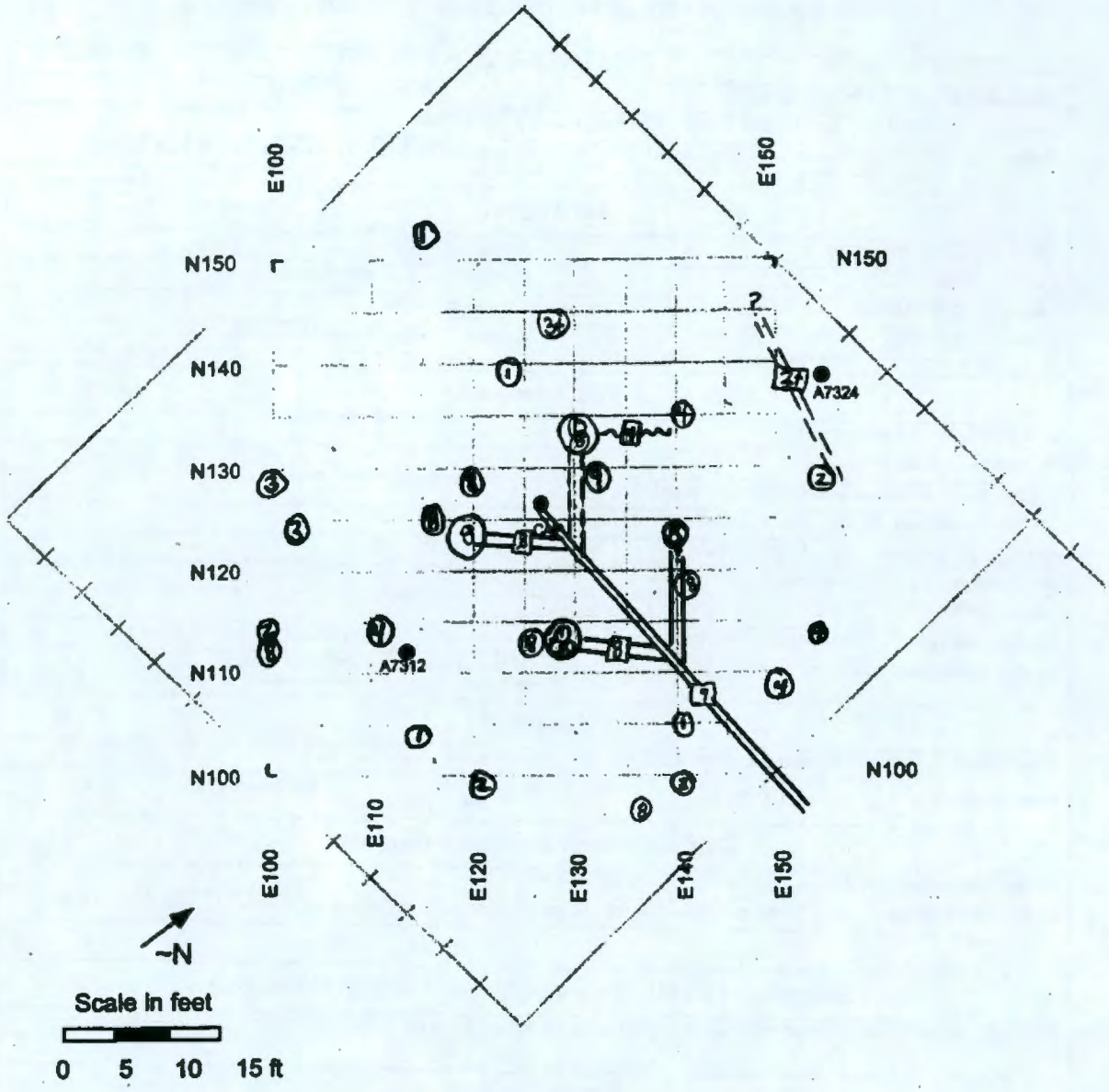
Lessons Learned

The drawings that were provided significantly enhanced the interpretation.

***water table, moisture, etc:**
**** rocks, trees, buildings, etc.**

Note: To use the check box electronically - double click on box and change default value to checked.

BHI-EE-259 (09/29/2000)



Disturbed zone; Buried material and/or undifferentiated debris that may be masking utilities etc.

Isolated anomaly with depth posted in the circle

Linear anomaly with depth posted in the square box.

Surface Obstruction

Questions: Contact TH Mitchell / KA Bergstrom @ 372-9690 or 372-9591 to review results prior to excavating.

GPR Survey Results
216-T-26, Crib
200 East
1/5/2001

DISTRIBUTION

U.S. Department of Energy
Richland Operations Office

B. L. Foley	A6-38

ERC Team

K. A. Anselm, CHI	H9-02
B. H. Ford, BHI	H0-21
K. M. Singleton, CHI	H9-02
M. E. Todd, CHI (8)	H9-03
C. D. Wittreich, CHI	H9-03

CH2MHILL Hanford Group, Inc.

A. J. Knepp	H0-22

Pacific Northwest National Laboratory

G. V. Last	K6-81

Document and Information Services (3)	H0-09
DOE-RL Public Reading Room	H2-53
Hanford Technical Library	P8-55