PNNL-15776

Pacific Northwest
National Laboratory
Operated by Battelle for the
U.S. Department of Energy

Borehole Data Package for Two RCRA Wells 299-W11-25B and 299-W11-46 at Single-Shell Tank Waste Management Area T, Hanford Site, Washington

D. G. Horton
M. A. Chamness

April 2006

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. 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 Battelle Memorial Institute.

PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Printed in the United States of America

**Available to DOE and DOE contractors from the
Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831;
prices available from (615) 576-8401.**

**Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161**


This document was printed on recycled paper.

PNNL-15776

Borehole Data Package for Two RCRA Wells 299-W11-25B and 299-W11-46 at Single-Shell Tank Waste Management Area T, Hanford Site, Washington

D. G. Horton
M. A. Chamness

April 2006

Prepared for
the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Pacific Northwest National Laboratory
Richland, Washington 99352

Summary

One new *Resource Conservation and Recovery Act* (RCRA) groundwater monitoring and assessment well was installed at single-shell tank Waste Management Area (WMA) T in calendar year 2005 in partial fulfillment of commitments for well installations proposed in Hanford Federal Facility Agreement and Consent Order, revised Milestone M-24-57 (2004). The need for increased monitoring capability at this WMA was identified during a data quality objectives process for establishing a RCRA/ *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA)/*Atomic Energy Act* (AEA) integrated 200 West and 200 East Area Groundwater Monitoring Network.

The initial borehole, 299-W11-25B, was located about 20 ft from existing downgradient well 299-W11-39. The specific objective for the borehole was to determine the vertical distribution of contaminants in the unconfined aquifer at the northeast corner of WMA T. The permanent casing in borehole 299-W11-25B was damaged beyond repair during well construction and replacement borehole, 299-W11-46, was drilled about 10 ft from borehole 299-W11-25B. Borehole 299-W11-46 was completed as a RCRA monitoring well.

This document provides a compilation of all available geologic data, geophysical logs, hydrogeologic data and well information obtained during drilling, well construction, well development, pump installation, groundwater sampling and analysis activities, and preliminary results of slug tests associated with wells 299-W11-25B and 299-W11-46. Appendix A contains geologists logs, Well Construction Summary Reports, Well Summary Sheets (as-built diagrams), and Well Development and Testing Data sheets. Appendix B contains the results of chemical analysis of groundwater samples. Appendix C contains complete spectral gamma-ray logs and borehole deviation surveys and Appendix D contains initial results of slug tests. The non-conformance report for borehole 299-W11-46 is provided in Appendix E.

Additional well construction documentation is on file with Fluor Hanford, Inc. (FHI). The Records Management Information System (RMIS) and the Hanford Well Information System (HWIS) [http://apweb02/cfroot/rapidweb/phmc/cp/hwisapp/] are two electronic databases that also contain drilling and construction records for these two wells.

Contents

Figures

Tables

1.0 Introduction

One new *Resource Conservation and Recovery Act* (RCRA) groundwater monitoring and assessment well was installed at single-shell tank Waste Management Area (WMA) T in calendar year 2005 in partial fulfillment of commitments for well installations proposed in *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement; Ecology et al. 1989), revised Milestone M-24-57 (2004). The need for increased monitoring capability at this WMA was identified during a data quality objectives process for establishing a RCRA/*Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA)/*Atomic Energy Act* (AEA) integrated 200 West and 200 East Area Groundwater Monitoring Network (Byrnes and Williams 2003).

The initial borehole, 299-W11-25B, was located about 20 ft from existing downgradient well 299-W11-39. The specific objective for the borehole was to determine the vertical distribution of contaminants in the unconfined aquifer at the northeast corner of WMA T. The permanent casing in borehole 299-W11-25B was damaged beyond repair during well construction and replacement borehole, 299-W11-46, was drilled about 10 ft from borehole 299-W11-25B (Figure 1). Borehole 299-W11-46 was completed as a RCRA monitoring well. Both new wells were constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160, the groundwater monitoring description of work for drilling and installation,[1] and specifications used by Fluor Hanford, Inc. (FHI), Richland, Washington.

This document provides a compilation of all available geologic data, geophysical logs, hydrogeologic data and well information obtained during drilling, well construction, well development, pump installation, groundwater sampling and analysis activities, and preliminary results of slug tests associated with wells 299-W11-25B and 299-W11-46. Appendix A contains geologists logs, Well Construction Summary Reports, Well Summary Sheets (as-built diagrams), and Well Development and Testing Data sheets. Appendix B contains the results of chemical analysis of groundwater samples. Appendix C contains complete spectral gamma-ray logs and borehole deviation surveys and Appendix D contains initial results of slug tests. The non-conformance report for borehole 299-W11-46 is provided in Appendix E.

Additional well construction documentation is on file with FHI. The Records Management Information System (RMIS) and the Hanford Well Information System (HWIS) [http://apweb02/cfroot/rapidweb/phmc/cp/hwisapp/] are two electronic databases that also contain drilling and construction records for these two wells.

English units are used in this report to describe drilling and well completion activities because that is the system of units used by drillers to measure and report depths and well construction measurements. Conversion to metric can be done by multiplying feet by 0.3048 to obtain meters or by multiplying inches by 2.54 to obtain centimeters. Metric units are used to describe geochemical parameters.

---

[1] Williams BA. 2004. *Well Data Sheets for Drilling RCRA Groundwater Monitoring Wells at SST Waste Management Areas A-AX, S-SX, T, and TX-TY Tank Farms During Calendar Year 2004.* Report submitted by letter from JS Fruchter (Pacific Northwest National Laboratory, Richland, Washington) to JV Borghese (Fluor Hanford, Inc, Richland, Washington) on July 27, 2004.

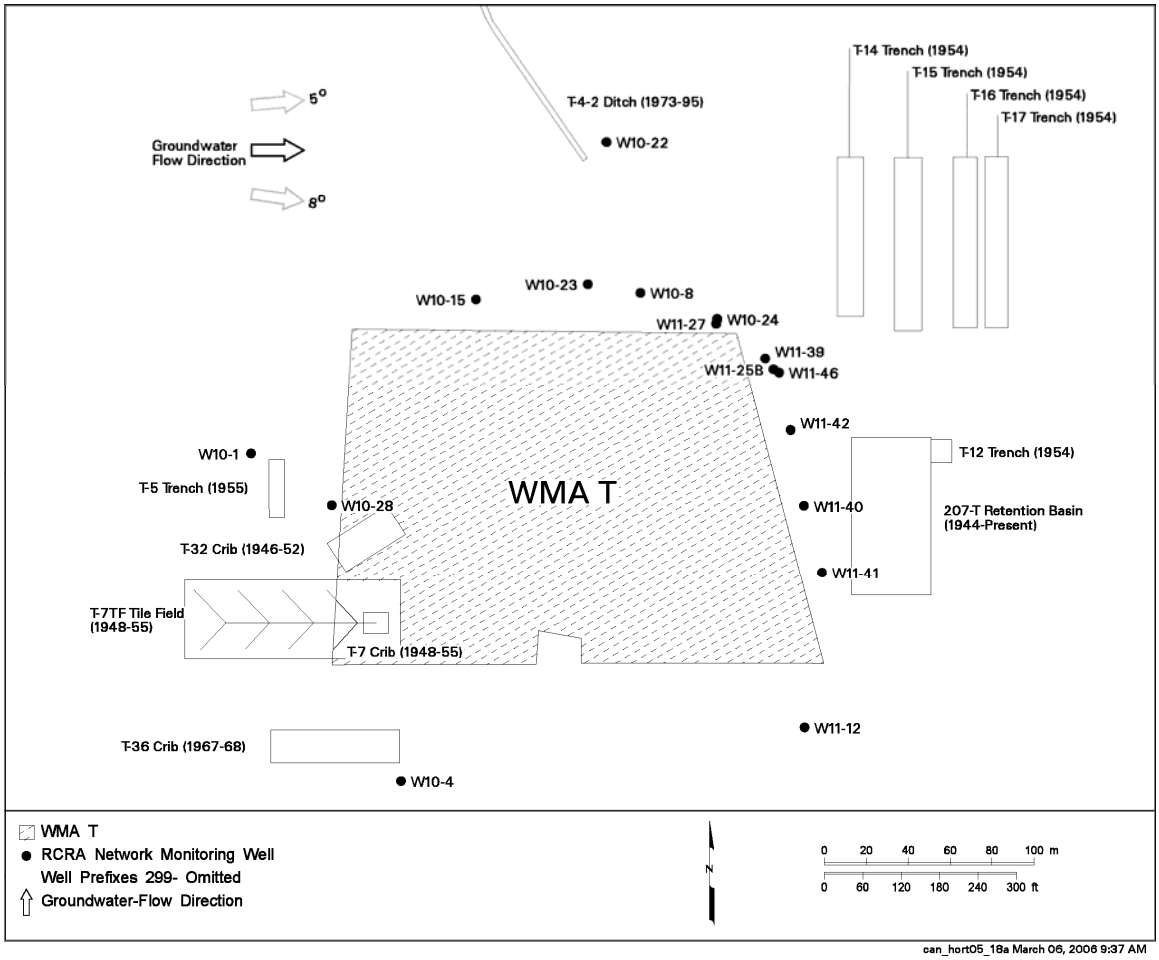


Figure 1. Map of Single-Shell Tank Waste Management Area T and Locations of New and Existing Wells in the Groundwater Monitoring Network

2.0 Well 299-W11-25B

Borehole 299-W11-25B (well ID C4669) was drilled approximately 20 ft from existing, downgradient well 299-W11-39 near the northeast corner of WMA T during February and March 2005. The purpose of the borehole was to delineate any vertical gradients in contaminant concentrations in the upper part of the unconfined aquifer and to serve as a new downgradient monitoring well in the WMA T monitoring network. The well reached the planned total depth of 120 ft below the water table on February 23, 2005. Because of very high technetium-99 concentrations encountered during drilling, it was decided on February 24, 2005, to continue drilling to the top of the Ringold Formation lower mud unit. The lower mud unit is about 50 ft deeper than the original planned depth.

The well casing in borehole 299-W11-25B was damaged during well construction and the borehole was decommissioned in accordance with WAC 173-160. Replacement well 299-W11-46 was drilled approximately 10 ft from 299-W11-25B in July and August 2005 and added to the WMA T monitoring

network in August. This section describes the drilling, geology, decommissioning, and sampling and analysis activities associated with borehole 299-W11-25B.

2.1 Drilling and Sediment Sampling

Borehole 299-W11-25B was drilled with a dual-wall percussion drill rig (Becker-hammer) from the surface to a total depth of 409.5 ft below ground surface (bgs). The borehole was drilled through the unconfined aquifer to the top of the Ringold formation lower mud unit. Temporary 9-in. outside diameter (OD), dual-wall casing was used during drilling to total depth. Drilling began on February 2, 2005 and total depth was reached on March 8, 2005.

Grab samples of sediment for geologic description and archives were collected at approximately 5-ft intervals from ground surface to the water table. Grab samples were not collected below the water table because of high technetium-99 concentrations in the aquifer. The grab samples were transferred to Hanford Geotechnical Library for archive. Split spoon samples were collected in Cold Creek Unit sediments at depths of 90, 110, and 115 ft with recoveries of 90, 100, and 40 percent, respectively. Some of these samples were capped and sealed for future analysis of physical properties.

Sediments encountered during drilling were predominantly unconsolidated sandy gravel of the Hanford formation H1 unit from 12 to approximately 35 ft bgs. There was no sediment recovery above 12-ft depth. Dominantly sand and gravelly sand of the Hanford formation H2 unit occurs between about 35 and 90 ft bgs. Fine sand and sandy silt make up the upper Cold Creek unit sediments between 90 and approximately 100 ft bgs and calcareous sands and silty sands make up the lower Cold Creek unit from 100 to 124 ft bgs.

The Taylor Flat member of the Ringold Formation occurs between about 124 and 132 ft bgs and is represented by sandy silt sediments. The sandy gravel and silty, sandy gravel of unit E of the Wooded Island member of the Ringold Formation occurs between 132 ft bgs and the top of the lower mud unit of the Wooded Island member, which occurs at about 406 ft bgs. The borehole reached total depth in the lower mud unit at 409.5 ft bgs.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No organic vapors were detected. Fixed contamination was found on a packer used during slug tests on February 24, 2005. On March 4, 36,000 disintegrations per minute (dpm) of fixed contamination was found on 2-in. temporary casing used to purge and sample groundwater. During well completion activities on March 18 4,500 dpm activity was measured on the swabbing bail.

Beginning on March 18, fixed contamination was found on the temporary 9-in. casing as it was being removed from the borehole. The fixed contamination was associated with rusty or gouged areas on the casing. Approximately 10% was removable contamination that was associated with condensation and wet sediments that had fallen off the casing. Table 1 shows the depth of the casing when the borehole was at maximum depth and the associated contamination measurements in dpm. The specific radionuclides fixed on the casing are unknown; no samples were analyzed from the contaminated casing.

Table 1. Levels of Casing Contamination and the Maximum Depth of Casing Below Ground Surface

Depth of Casing at T.D. (ft)	Contamination Measurement (dpm)
270	60,000
275	120,000
279	180,000
284	210,000
287	360,000
294	240,000
298	240,000
302	180,000
313	120,000
316	360,000
325	240,000
330	240,000
335	300,000
337	320,000
340	120,000
343	180,000
347	320,000
350	360,000
355	240,000
357	420,000
363	480,000
365	420,000
369	240,000
371	150,000
373	240,000
379	240,000
382	240,000
388	240,000
398	120,000
402	180,000

Spectral gamma ray logs were run in March 2005 by Stoller Corporation. A slight amount of cesium-137, near the minimum detection level (MDL, 0.2 pCi/g), was found sporadically throughout the borehole (Appendix C), and cobalt-60 was thought to be in solution in the groundwater. A section was logged again, but the cobalt-60 results were not repeatable.

2.2 Well Completion and Decommissioning

Completion of 299-W11-25B proceeded as normal for a monitoring well by filling the borehole with 8-12 mesh silica sand bringing the total depth from 409 up to 292.1 ft bgs. Bentonite pellets were placed from 292.1 to 286.8 ft bgs before adding the permanent casing and screen.

The permanent, stainless steel casing and screen were installed in well 299-W11-25B in March 2005. A 20-ft-long, 4-in. inside diameter (ID), stainless steel, continuous wire-wrap 20 slot (0.02-in. slot) screen

was set from 280.1 to 260.1 ft bgs. A 2-ft sump with end cap was installed below the screen. The permanent well casing was 4-in. ID, stainless steel from 260.1 ft bgs to 2 ft above ground surface.

The screen filter pack was 10-20 mesh silica sand placed from 286.8 to 249.9 ft bgs. The annular seal was composed of ¼-in. bentonite pellets from 249.9 to 239.7 ft bgs and granular bentonite crumbles from 239.7 to 10.2 ft bgs. A Portland cement grout surface seal was placed from 10.2 ft bgs to ground surface.

A depth-to-water measurement was attempted on March 30, 2005, in preparation for well development. After several failed attempts to get the tape below 162.97 ft bgs, a camera was used to survey the 4-in. permanent well casing. The survey showed that the 4-in. casing was damaged at about 162 ft bgs where the casing was almost completely pinched closed. Several attempts to remove the annular seal materials and the 4-in. casing failed and the well was subsequently decommissioned.

Well 299-W11-25B was decommissioned in July 2005. Approximately 100 ft of 4-in. ID stainless steel casing, from about 160 to 260 ft bgs, and the 20-ft section of 4 in. screen and 2-ft sump, from 260 to 282.1 ft bgs, were left in the borehole. The borehole was filled with Portland cement grout from 150 ft bgs to the surface.

The vertical and horizontal coordinates of the well were surveyed on August 29, 2005. The horizontal position of the well was referenced to horizontal control stations established by the U.S. Army Corps of Engineers (USACE). The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing USACE bench marks. Survey data are included in Table 2 and Appendix A.

Table 2. Survey Data for Abandoned Borehole 299-W11-25B at WMA T

Well Name (Well ID)	Easting (meters)	Northing (meters)	Elevation (meters)	Comments
299-W11-25B (C4669)	566912.34	136774.76	209.746	Brass survey marker

2.3 Groundwater Sampling and Analysis During Drilling

Two types of groundwater samples were collected during drilling of borehole 299-W11-25B: air lifted slurry samples and purge-and-pump samples. Samples consisting of slurries of groundwater and drill cuttings were collected as near to the water table as possible and at every 5-ft depth to the total depth 167 ft below the water table (409 ft bgs). These samples were collected in 1-gal, wide-mouth jars from the sediment/water return line on the drill rig. The containers were labeled and transferred to storage for 12 hours or more to allow most suspended sediments to settle out of suspension. Samples were not kept cold during the settling period.

Aliquots of the groundwater samples were pumped and filtered from the 1-gal jars into smaller sample containers and transported to the laboratory. Aliquots for the analyses of metals and technetium-99 were preserved with nitric acid; no other samples had added preservatives. Samples derived from the groundwater-drill cutting slurries were analyzed at the Pacific Northwest National Laboratory, Applied Geology and Geochemistry laboratory in the 325 Building. Analyses for metals and technetium-99 were done by inductively coupled plasma – mass spectrometry; analyses for anions were

done by ion chromatography. In addition, aliquots of pumped samples were analyzed for carbon tetrachloride at the Fluor Hanford, Inc. field laboratory and for tritium at the Groundwater Performance Assessment Project's contract laboratory. All analytical results are given in Appendix B.

Figure 2 shows the depth distribution of technetium-99 and nitrate below the water table in well 299-W11-25B. The maximum concentration is 181,600 pCi/L at 33 ft below the water table. The open symbols in Figure 2 are pumped samples and the solid symbols are air lifted samples. Differences between the pumped and air lifted values suggest that some of the technetium-99 was reduced in the air lifted samples as the groundwater sat overnight in contact with freshly crushed rock (drill cuttings). The data on Figure 2 show a general decrease in concentration with depth below about 40 ft bgs, although concentrations remain very high.

The nitrate concentration versus depth in well 299-W11-25B is also shown on Figure 2. The largest nitrate concentration is 663,000 μg/L at 33 ft below the water table. The concentrations of nitrate and technetium-99 appear to track each other fairly well throughout the drilled part of the aquifer.

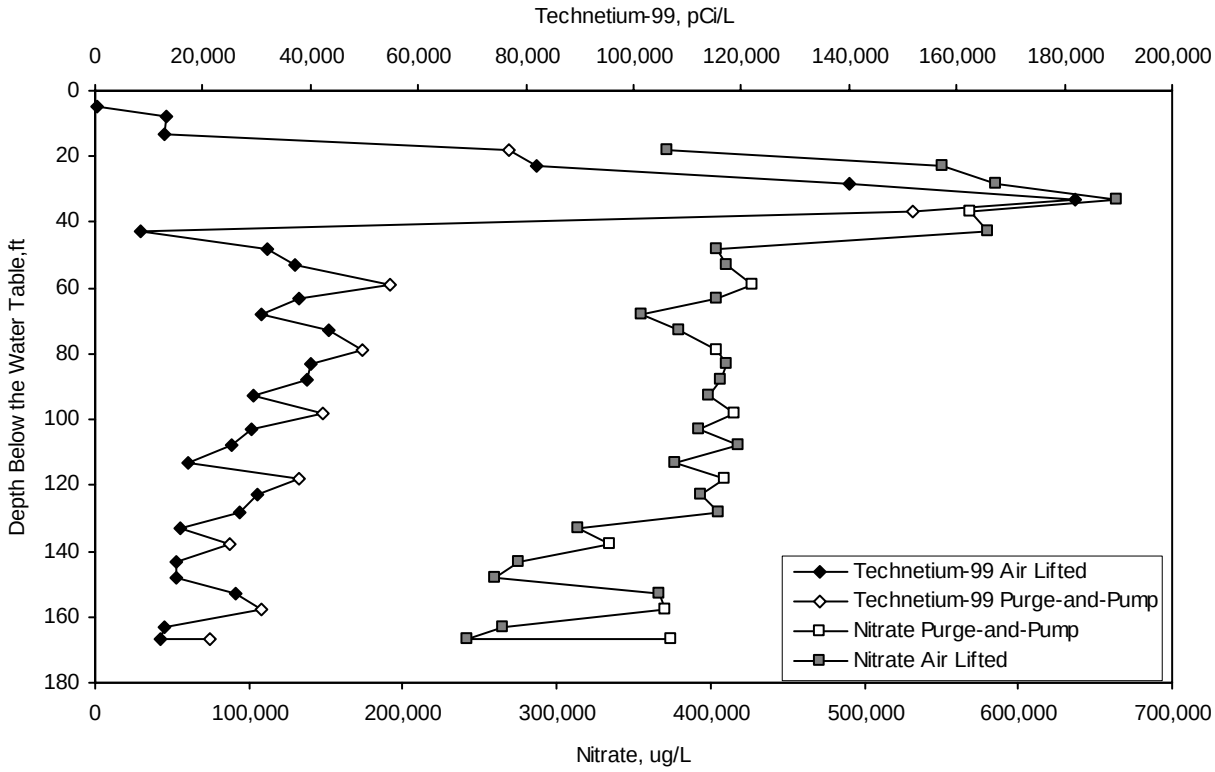


Figure 2. Concentrations of Technetium-99 and Nitrate Versus Depth in Well 299-W11-25B. Red symbols represent pumped samples; all other symbols are air lifted samples.

Figure 3 shows the concentrations of chromium and manganese in well 299-W11-25B. Open symbols represent samples collected by pumping after extensive purging of the well; solid symbols represent air lifted samples. There is a substantial difference between the air lifted and pumped results. The groundwater associated with the air lifted samples was in contact with the drill cuttings for at least 12 hours before analysis. It is probable that the soluble Cr^{6+} was reduced to insoluble Cr^{3+} by being in

contact with the fresh drill cuttings. Extensive purging of the well before collection of the pumped samples removed most or all of the groundwater affected by drilling so that the resulting chromium concentrations were unaffected by reducing conditions created during drilling. The highest chromium concentration in the pumped samples was 1,033 μg/L at 18 ft below the water table.

The distribution of manganese (Figure 3) supports the reduction of chromium in the air lifted samples. Soluble Mn^{2+} is expected to be released from the basaltic sediments during drilling and it is this manganese that is measured during analysis of the air lifted samples. Purging the well before collecting the pumped samples removes the drilling-related manganese and more natural, background manganese concentrations result.

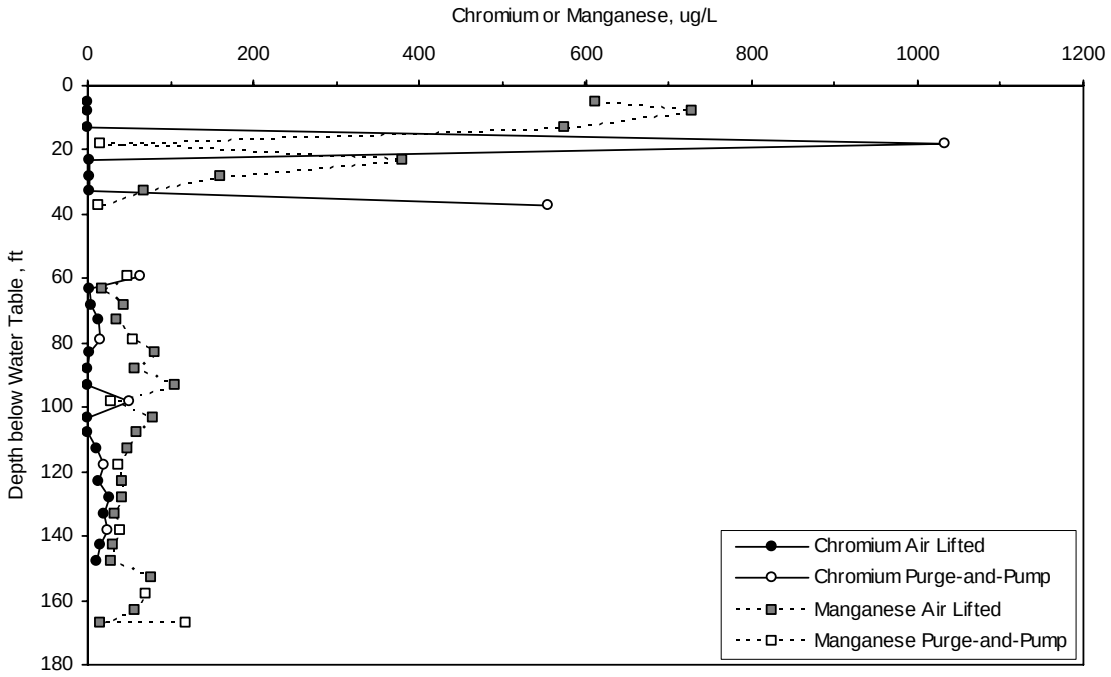


Figure 3. Concentrations of Chromium and Manganese Versus Depth in Well 299-W11-25B. Solid symbols represent air lifted samples; open symbols represent pumped samples.

2.4 Aquifer Tests

Five slug tests were performed in the unconfined aquifer of 299-W11-25B as the borehole was being drilled. These tests were run at approximate depths of 270 to 280 ft, 280 to 290 ft, 290 to 300 ft, 320 to 330 ft, and 350 to 360 ft bgs. Initial results are provided in Appendix D. A full description of the tests and results will be published separately.[2]

[2] Spane FA and DR Newcomer. Report in preparation, *Results of Detailed Hydrologic Characterization Tests – Fiscal and Calendar Year 2005*. Pacific Northwest National Laboratory, Richland, Washington.

3.0 Well 299-W11-46

Well 299-W11-46 (well ID C4950) is located near the northeast corner of WMA T approximately 10 ft from decommissioned well 299-W11-25B. The well was constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160, the groundwater monitoring description of work for drilling and installation[3] and specifications used by Fluor Hanford, Inc. (FHI), Richland, Washington.

3.1 Drilling and Sampling

Well 299-W11-46 was drilled with a dual wall, percussion hammer drill rig from the surface to a total depth of 285.5 ft bgs. Temporary 9-in. OD, dual-wall casing was used throughout the entire borehole to total depth. Drilling began on July 26, 2005, and total depth was reached on August 8, 2005.

Sediments encountered during drilling were predominantly unconsolidated sandy gravel of the Hanford formation H1 unit from 5 to about 35 ft bgs. There was no sediment recovery from 0- to 5-ft depth. Dominantly sand and gravelly sand of the Hanford formation H2 unit occurs between about 35 and 93 ft bgs. Fine sand and sandy silt make up the upper Cold Creek unit sediments between 90 and about 100 ft bgs and calcareous sands and silty sands make up the lower Cold Creek unit from 100 to 121 ft bgs.

The Taylor Flat member of the Ringold Formation occurs between about 121 and 148 ft bgs and is represented by silt and silty sand. The sandy gravel and silty, sandy gravel of unit E in the Wooded Island member of the Ringold Formation occurs from 148 ft bgs to the bottom of the well at 285.5 ft bgs. The well construction summary report, as-built diagram, well development data, pump installation records and well survey results are included in Appendix A.

No sediment grab or groundwater samples were collected because borehole 299-W11-25B, located 10 ft from this well, was thoroughly sampled. No geophysical logs were run in the borehole because spectral gamma logs are available from borehole 299-W11-25B. The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contamination was noted.

3.2 Well Construction

The field geologist's Borehole Log, Well Construction Summary Report and the Well Summary sheet are provided in Appendix A. The permanent casing and screen were installed in well 299-W11-46 in August 2005. A 320-ft, 4-in. ID stainless steel, continuous wire-wrap 20 slot (0.02-in. slot) screen was set from 263.4 to 283.4 ft bgs with a 2-ft-long stainless steel sump placed from 283.4 to 285.75 ft bgs. The permanent well casing is 4-in. ID, stainless steel from 263.4 ft bgs to 2.0 ft above ground surface.

[3] Williams BA. 2004. *Well Data Sheets for Drilling RCRA Groundwater Monitoring Wells at SST Waste Management Areas A-AX, S-SX, T, and TX-TY Tank Farms During Calendar Year 2004.* Report submitted by letter from JS Fruchter (Pacific Northwest National Laboratory, Richland, Washington) to JV Borghese (Fluor Hanford, Inc, Richland, Washington) on July 27, 2004.

The screen filter pack is 10-20 mesh silica sand placed from 248.5 to 285.5 ft bgs. The annular seal is composed of 1/4-in. bentonite pellets from 240.5 to 248.5 ft bgs and bentonite crumbles from 115.0 to 240.5 ft bgs.

The dual wall casing used to drill the well broke as it was being pulled out. A section of the 9-in. by 6-in. dual wall casing was left in place from 44.7 to 114 ft bgs. With approval from EPA, the annular seal from ground surface to 115.0 ft bgs was filled with Portland cement. The non-conformance report is included in Appendix A.

A 4-ft by 4-ft by 6-in. concrete pad was placed around the well at the surface. A protective well head casing with locking cap, four protective steel posts, and a brass marker stamped with the well ID number and Hanford well number were set into the concrete pad. A borehole deviation survey using a gyroscope was conducted in the completed well to determine the bottom hole location relative to the vertical borehole projection. Survey results are located in Appendix C.

The vertical and horizontal coordinates of the well were surveyed on August 29, 2005. The horizontal position of the well was referenced to horizontal control stations established by the USACE. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD88 and is based on existing USACE bench marks. Survey data are included in Table 3 and Appendix A. The static water level was 441.53 ft bgs on December 30, 2005.

Table 3. Survey Data for Well 299-W11-46 at WMA T

Well Name (Well ID)	Easting (meters)	Northing (meters)	Elevation (meters)	Comments
299-W11-46 (C4950)	566914.86	136773.27		Center of casing
			210.941	Top of casing, N. edge
			210.947	Top pump base plate, N. edge
			210.116	Brass survey marker

3.3 Well Development and Pump Installation

Well 299-W11-46 was developed on August 5, 2005. Development was performed at approximately 276 and 266 ft bgs using a temporary, 5-horsepower (hp) submersible pump. The depth to the water was 245.5 ft below top of casing prior to development. A pressure transducer was installed above the pump and connected to a Hermit datalogger to monitor water level during development. Table 4 contains the results of final well development, including pump intake depth, pump rate, pump run time, drawdown, recovery time, final turbidity and stabilized conductivity and temperature readings. A total of 8,251 gal of water were pumped. Field activity logs of well development activities are included in Appendix A.

A dedicated Redi-Flo-3, 0.7 hp, Grundfos™ submersible sampling pump was installed in well 299-W11-46 on August 10, 2005. The sampling pump intake was set 21.6 ft below the water table at 268.3 ft btc and connected to the surface with ¾-in. diameter stainless steel riser pipe.

Table 4. Well Development Information for 299-W11-46

Pump Rate (gpm)	Pump Intake Depth (ft btc)	Pumping Run Time (min)	Drawdown (feet)	Final Turbidity, Specific Conductivity and Temperature Readings
41	276	110	15.16	4.89 NTU, 1233 µS/cm, 22.1 C
43	266	87	14.8	3.88 NTU, 1288 µS/cm, 23.3 C

ft btc = Feet below top of casing.
gpm = Gallons per minute.
NTU = Nephelometric turbidity unit. µS/cm = microSiemens per centimeter.

3.4 Gyroscope Surveys

Downhole deviation surveys were performed in 299-W11-46 following construction using a down-hole gyroscope in the completed well to determine the bottom location relative to the vertical projection. For this tool, depths are measured from the top of casing to the top of the tool when it is sitting on the bottom of the well. The survey found that at a measured depth of 276.4 ft, the true vertical depth of the well is 276.18 ft, a difference of 0.22 ft. The gyroscope survey report can be found in Appendix C.

4.0 References

Atomic Energy Act (AEA). 1954. As amended, Ch. 1073, 68 Stat. 919, 42 USC 2011 et seq.

Byrnes ME and BA Williams. 2003. *Data Quality Objectives Summary Report for Establishing a RCRA/CERCLA/AEA Integrated 200 West and 200 East Area Groundwater Monitoring Network.* CP-15329, Rev. 0, Prepared by Fluor Hanford, Inc. for the U.S. Department of Energy, Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). 1980. Public Law 96-150, as amended, 94 Stat. 2767, 42 USC 9601 et seq.

Ecology - Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy. 1989. *Hanford Federal Facility Agreement and Consent Order*. Document No. 89-10, Rev. 6 (The Tri-Party Agreement), Olympia, Washington.

Milestone M-024-57. 2004. *Groundwater Protection, Monitoring and Remediation Well Installation Priority List for CY2 2004-CY 2007 and Modify Tri-Party Agreement Interim Milestone M-024-57.* Change number M-24-04-01.

NAD83. 1983. North American Datum of 1983.

NAVD88. 1988. North American Vertical Datum of 1988.

Washington Administrative Code (WAC). *Minimum Standards for Construction and Maintenance of Wells.* WAC 173-160, Washington Administrative Code, Olympia, Washington.

Appendix A

Geologic Logs, Well Construction, and Completion Documentation for Wells 299-W11-25B and 299-W11-46

BOREHOLE LOG

Page 1 of ___
Date: 02/03/05

Well ID: C4669 | Well Name: 299-W11-25 B | Location: WMA T

Project: RCRA Monitoring Well | 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		no recovery	no recovery	0-5': no recovery,	diesel hammer drill rig 9"x6" dual-wall casing
5				5-12': no recovery,	
10					
15	grab			12'-35': sandy gravel [s G], well/poorly sorted, 60% gravel/40% sand, trace silt, sand fraction is predominantly medium- to coarse-grained subangular basaltic particles, gravel fraction is subrounded to subangular heterolithic particles up to 1.5 cm in diameter	grab sample for archive (taken at 5' intervals throughout borehole unless otherwise noted)
20	grab				
25	grab				collected additional grab for PNNL
30	grab			[30'] gravel fraction becoming more dominant (~70%) with larger average particle size (max. particle remains ~1.5 cm)	
35	grab			35'-~~gravel~~ 41': gravelly sand [g SI] with trace silt, ~80% sand-medium- to coarse-grained subangular to subrounded particles, intermittently slightly moist, quartzite and basalt & lithic fragments	

Reported By: Jason M. Capron | Reviewed By:

Title: Field Geologist | Title:

Signature: [signature] Date: 02/03/05 | Signature: Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of ___
Date: 02/02/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMA T
Project: RCRA Monitoring Well | Reference Measuring Point: ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40	grab			~~[40']~~ gravelly sand continued from prev. page	
				[40'] sand becoming predominantly coarse-grained	
				41'-63': sand [S] medium- to coarse-grained, slightly moist subrounded particles	
45	grab			[45'] predominantly well-sorted medium-grained particles, subrounded, max. particle size = 1 mm	
50	grab			[50'] predominantly coarse-grained, subrounded moderately sorted sand	
				<5% very Fine to Fine gravel pebbles.	
55	grab			[55'] medium-grained sands predominate, poorly well-sorted with some coarse-grained particles, very few very Fine pebbles	
60	grab			[60'] more Fine-grained sands present, though still predominantly medium-grained, no gravels present	collected additional grab sample for PNNL
				63'-69': gravelly sand [gS], 25% subrounded heterolithic gravel (predominantly basaltic),	
65	grab			75% dry coarse to very coarse subrounded sands, moderately sorted	
				gravels are very Fine to Fine pebbles (up to 5 mm)	
70	grab			69'-75': sand [S] subrounded coarse to very coarse dry sand (max particle size = 3 mm)	
				unsure of exact transition to next layer due to rate of advancement	
75	grab			~~75'-81'~~ 81'QC 75'-81': previous layer transitions to gravelly sand [gS], 10-20% gravel-very Fine to Fine pebbles up to 1 cm across, subrounded to subangular	

Reported By: Jason M. Capron | Reviewed By:
Title: Field Geologist | Title:
Signature: [signature] Date: 02/03/05 | Signature: Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of ___
Date: 02/03/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMA T
Project: RCRA Monitoring Well | Reference Measuring Point: ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80	grab			gravelly sand [gS] continues From previous page	
				sand is predominantly coarse to very coarse, 50-60% basaltic subrounded to subangular poorly sorted dry particles	
85	grab			[85] gravel content decreasing -> ~10%	
				[86] started to observe siltic clasts indicative of very thin predominantly Fine-grained layers	
				87-91': sand [S] predominantly coarse-grained subrounded to subangular with <5% very fine pebbles, trace silt, basaltic and quartzitic particles, slight reaction w/ HCl	
90	grab				drove 2' split spoon From ~~91.7'~~ 90.8' - 92.8' For PNNL 90.3' samples
	sp sp	90% recovery			~90% recovery with predominantly silt layering
				91-95': sandy silt [sM] silt with very Fine sands, moderate reaction with HCl	
95	grab			95-105': silty sand [mS], 60% sand/ 40% silt, moderate reaction with HCl	
				sand is Fine to very Fine, moist	
100	grab			[100'] caliche nodules in cuttings (very strong reaction with HCl)	
				105'-119': slightly silty sand [(m)S], ~15% silt, 85% very Fine to Fine sand, slight reaction with HCl, 10 YR 5/4 moist (yellowish brown), ~10% mafic content	
105	grab				
	(grab)			[110'] large caliche nodules (up to 4 cm) 10 YR 7/2 dry (light gray)	drove 2' split spoon From 109.7' - 111.7' For PNNL samples (100% recovery)
110	sp sp	100% recovery			
	grab				drove 2' split spoon For PNNL samples 40% recovery (114.7'-115.7')
115	sp sp	40% recovery (in 2')			

109.7' - 111.7'

Reported By: Jason M. Capron | Reviewed By:
Title: Field Geologist | Title:
Signature: [signature] Date: 02/03/05 | Signature: Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of ___
Date: 02/03/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMA T
Project: RCRA Monitoring Well | Reference Measuring Point: ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	grab			119'-124': well-sorted medium- to coarse sand w/ intermittent (<5%) very coarse rounded basaltic gravel pebbles (up to 5 cm), reacts very strongly with HCl [S]	
125	grab			124'-132': sandy silt [s M], ~20% very fine sand, 75% silt, 5% very coarse rounded to sub-rounded basaltic pebbles silt/sand matrix is slightly moist, reacts strongly with HCl, 10 YR 5/4 dry (brown)	
130	grab				
135	grab			132'-184': sandy gravel [s G], predominantly quartzite and basalt rounded very coarse pebbles with small cobbles up to 15 cm across 10-15% very fine to fine sand, 5-10% silt fragments of small cobbles in cuttings reacts moderately with HCl	
140	grab				
145	grab				additional grab collected for PNNL
150	grab			silt fraction noticeably reduced, though trace amount still evident sand fraction is now predominantly fine to medium-grained silica sand with 10-15% mafic content	
155	grab				

Reported By: Jason M. Capron | Reviewed By:
Title: Field Geologist | Title:
Signature: [signature] | Date: 02/03/05 | Signature: | Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 5 of ___
Date: 02/03/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMA T
Project: RCRA Monitoring Well | Reference Measuring Point: ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160	grab			Sandy gravel continued from previous page	
165	grab			gravels are heterolithic - plurality is basalt, but quartzite, granite, chert, + gneiss also present Sand Fraction is predominantly subrounded to angular silica, no HCl reaction	
170	grab				
175	grab				
180	grab				
185	grab			185'-195': silty sandy gravel [ms GJ 10% silt, 10-15% very fine sand, remainder is coarse to very coarse gravel pebbles with occassional small cobble silt/sand matrix shows cementation on gravel (no reaction with HCl) silt/sand matrix is 2.5YR 6/4 dry (light yellowish brown)	
190	grab			[190'] more fine to medium-grained sands present, cementation no longer evident	
195	grab			195'- : sandy gravel [sG] 20% poorly sorted fine to medium-grained sands, 5% silt, 75% poorly sorted coarse to very coarse heterolithic gravel pebbles	

Reported By: Jason M. Capron | Reviewed By:
Title: Field Geologist | Title:
Signature: [signature] Date: 02/04/05 | Signature: Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of ___
Date: 02/04/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMA T
Project: RCRA Monitoring Well | Reference Measuring Point: ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200	grab			sandy gravel [sG] continued From previous page — sands are predominantly subrounded to angular silicates, dry, no reaction to HCl, many lithic Fragments up to 3 cm (max. unbroken particle = 7 cm across silt/sand color: 2.5Y 6/3 dry (light yellowish brown)	Diesel hammer, 9"x6" dual wall
205	grab			[200'] more medium pebbles present, many basalt large lithic Fragments	
210	grab			[205'] more small cobbles present (Fragments up to 12 cm across) only trace silt in cuttings	
215	grab			[210'] silt Fraction more evident (~5%) [212'] minor cementation of silt/sand on pebbles	
220	grab			[218'] cementation no longer evident	
225	grab			[225'] average ~~dge~~ grain size of sand fraction increased → sands now predominantly medium to coarse-grained angular to subrounded silicates with ~10% mafics light iron-staining on gravel pebbles	
230	grab				
235	grab			[235'] Cobbles up to 4" (10 cm), no evidence of iron staining. Fragments up to 13 cm.	

Reported By: Jason M. Capron | Reviewed By:
Title: Field Geologist | Title:
Signature: [signature] Date: 02/04/05 | Signature: Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 7 of ___

Date: 02/07/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMA T

Project: RCRA Monitoring Well | 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
240	grab			[240'] Increasing pebbles and sand (~10%), slightly moist	Diesel hammer, 9" x 6" dual wall
245	grab			[245'] Sandy gravel, as above, cobbles to 10cm, fine to coarse sand, wet.	
		water B1BW97			247': water slurry sample (PNNL)
250	grab	water B1BW98		[250'] Sandy gravel, approx. 20% sand, 5% silt. Gravel is largely quartzite, with remainder basaltic and granitic. Sand is coarse to v. coarse with quartz and basaltic. No rxn with HCl.	250': water slurry sample (PNNL)
255	grab	water B1BW99		[255'] Silty sandy gravel. Gravel ~55%, Sand ~35%, Silt ~10%. Gravel contains rounded to well-rounded pebbles and cobbles up to 25cm. Mostly quartzite/chert with some basaltic and granitics. Sand is coarse. No HCl rxn.	255': water slurry sample (PNNL)
260	grab	water B1BW8Φ		[260'] Same as above	~~pump 02/08/05~~ 260': ~~water slurry sample (PNNL)~~ pumped water samples: PNNL/PNNL
265	grab	water B1BW8Φ		[265'] Same as above	265': water slurry sample (PNNL)
270	grab	water B1BWB1		[269' - 274'] Sandy gravel. Gravel ~65%, Sand ~30%, Silt ~5%.	270': water slurry sample (PNNL)
275	grab	water B1BWB2		[275'] Silty sandy gravel. Gravel ~70%, Sand ~20%, Silt ~10%. Cobble avg. size ≈ 5cm, max. 10cm, medium to coarse sand with high basalt content.	275': water slurry sample (PNNL)

Reported By: NEIL MAIMER | Reviewed By:

Title: GEOLOGIST | Title:

Signature: Neil Maimer | Date: 02/08/05 | Signature: | Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 8 of ___
Date: 02/17/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMA T
Project: RCRA Monitoring Well | Reference Measuring Point: ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
280	grab			Sand, medium, dark brown, wet, ~~well~~ moderately well sorted, angular to sub-angular, quartz with ~5% mafic, some cobbles up to 8 cm, no HCl rxn.	Diesel hammer 9" x 6" dual wall casing 280': pumped water sample (PNNL)
285	grab	slurry B1BWB3			285': water slurry sample (PNNL)
290	grab	slurry B1BWB4		[287'] Sandy gravel (sG), 60-70% gravel, rounded to well-rounded cobbles 4-5", basalt, volcanics, and granities. 30-40% sand, medium to coarse, moderately well sorted, quartz w/~5% mafic. No rxn to HCl.	290': water slurry sample (PNNL)
295	grab	slurry B1BWB5			295': water slurry sample (PNNL)
300		slurry		[300'] Sandy gravel (sG) as above. Slightly cemented.	300': water slurry sample (PNNL)
305		slurry		[305'] - increasing sand to 309'.	305': water slurry sample (PNNL)
310		slurry		[310'] Sandy gravel (sG) as above.	310': water slurry sample (PNNL)
315		slurry			315': water slurry sample (PNNL)
				318-320': increasing pebbles, coarse to v. coarse, fewer cobbles.	

Reported By: N. MAIMER | Reviewed By:
Title: GEOLOGIST | Title:
Signature: Neil Maimer | Date: 2/18/05 | Signature: | Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 9 of 11

Date: 2/22/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMA T

Project: RCRA Monitoring Well | 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
320		slurry T-1-80		[320-323'] Sand (S), medium, dark brown, wet, moderately well-sorted, angular to subangular, quartz with ~5% mafic, some pebbles up to 5 cm, no Rxn to HCl.	Diesal hammer, 9"x6" dual wall 320': water slurry sample (PNNL)
325		slurry B1BWC5		[323'] Sandy gravel (sG), 60-70% gravel, rounded to well-rounded cobbles 4-5", basalt, volcanics, and granities. 30-40% sand, medium, moderately well-sorted, quartz with % mafics. No HCl rxn.	325': water slurry sample (PNNL)
330		slurry B1BWC6			330': WATER SLURRY SAMPLE (PNNL)
335		SLURRY B1BWC7		[335] SANDY GRAVEL (sG), 60% GRAVEL, ROUNDED TO WELL-ROUNDED COBBLES 2-4", BASALT, VOLCANICS, AND GRANITES. 40% SAND, COARSE - MEDIUM, MOD-WELL SORTED, QTZ/FELD WITH 0% MAFICS NO RXN HCL	335': WATER SLURRY SAMPLE (PNNL)
340		SLURRY + WATER SAMPLES			340': WATER SLURRY SAMPLE (PNNL) TAKEN W/ WATER SAMPLES #B1BWX8
345		SLURRY B1BWC8		[343-360] SANDY GRAVEL (sG), 70% GRAVEL, ROUNDED TO WELL ROUNDED COARSE COBBLES, SAND 30%, COARSE - MEDIUM, MOD SORTED NO RXN HCL	345': WATER SLURRY SAMPLE (PNNL) DRILLER NOTES HARD AND CEMENTED
350		SLURRY B1BWC9		SAME AS ABOVE, SLIGHTLY LESS CEMENTED	350': WATER SAMPLE SLURRY (PNNL)
355		SLURRY B1BWD0			355' WATER SLURRY SAMPLE (PNNL)
		SLURRY B1BWD1			360' WATER SLURRY SAMPLE (PNNC) WATER + SLUG TEST

Reported By: BJORN HELGESON | Reviewed By:

Title: GEOLOGIST | Title:

Signature: | Date: | Signature: | Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 10 of 11
Date: 3/03/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMAT
Project: RCRA MONITORING WELL | 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
360		Slurry B1BW93		[360-372] SANDY GRAVEL (SG)	360' WATER SLURRY SAMPLE (PNNL)
				70% GRAVEL, 30% SAND, CONSOLIDATED GRAVELS	WATER SAMPLE (B1B3F2, F3, F4, H7, H8)
				60% MAFIC, 40% GRANITICS, 6-8 cm PEBBLES, SR-A,	SLUG TEST (BY PNNL)
				POORLY SORTED; SAND (CEMENTED), MED-COARSE, DARK-	
				GRAY/BROWN, WET, MOD SORTED, A-SR, 60% MAFICS,	
365		Slurry B1BW91		40% QTZ, NO RXN HCL	365' WATER SLURRY SAMPLE (PNNL)
370		Slurry B1BW93		[372-380] SANDY GRAVEL (SG)	
				60% Gravel 40% sand same as above	370' WATER SLURRY SAMPLE (PNNL)
				~~376-378~~ LESS (CEMENTED), TRACE OF SILT	
375		Slurry B1BW95			375' WATER SLURRY SAMPLE (PNNL)
					EASIER DRILLING
380		Slurry B1BW88		[380-397'] SANDY GRAVEL (SG)	
				70% GRAVEL, 30% SAND	380' WATER SLURRY SAMPLE (PNNL)
				CEMENTED GRAVES UP TO 12cm	WATER SAMPLE (B1BW88, B1BX10)
					~~SCREEN~~
385		Slurry B1BW03			385' WATER SLURRY SAMPLE (PNNL)
				[387] INCREASING SAND	~~WATER~~
390		Slurry B1BW02			390' WATER SLURRY SAMPLE (PNNL)
					DIFFICULTY DRILLING
395		Slurry B1BW05		[397-] SANDY GRAVEL (SG)	
				60% GRAVEL, 40% SAND SAME GRAVELS,	395 WATER SLURRY SAMPLE (PNNL)
				SAND MORE COARSE AND ANGULAR	
					397-400 EASIER DRILLING

Reported By: BRIAN HELGESON | Reviewed By:
Title: GEOLOGIST | Title:
Signature: [signature] Date: | Signature: Date:

A-6003-642 (03/03)

BOREHOLE LOG

Page 11 of 11
Date: 3/7/05

Well ID: C4669 | Well Name: 299-W11-25 | Location: WMA T

Project: RCRA MONITORING WELL | 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
400		slurry B1BWD8 PUMP SAMPLE		[397 - 406'] SANDY GRAVEL (sG) 60% GRAVEL, 40% SAND, SEMI-CONSOLIDATED GRAVELS 60% MAFIC, 40% GRANITICS, 6-12 cm BROKEN PEBBLE TO COBBLE, R-SR, MOD SORTED; SAND (LOOSLY CEMENTED), COARSE, DARK BROWN, WET, WELL SORTED, A-SR, 60% MAFIC, NO RXN HCL	400' WATER SLURRY SAMPLE (PUMP PUMP WATER SAMPLE (B1BWD8, B1CDP)
405		slurry B1BWF1			405' WATER SLURRY SAMPLE (PUMP)
410		slurry B1BWF4 PUMP SAMPLE		[406 - 409'] SILTY SAND (mS) 60% SAND, 40% SILT SAND 60% MAFIC, 40% QTZ/OTHER, M-FG, SA-SR; SILT LOW PLASTICITY, WET, OLIVE COLOR, MILD RXN TO HCL	409.5 TOTAL DEPTH 410 WATER SLURRY SAMPLE PUMP WATER SAMPLE (B1BWF7, B1CDPS)
				[409' - 409.5'] SILT (M) WET, MEDIUM PLASTICITY, DARK OLIVE/ BROWN COLOR, NO HCL RXN	

Reported By: BJORN HELGESON | Reviewed By:

Title: GEOLOGIST | Title:

Signature: [signature] Date: 3/8/05 | Signature: Date:

A-6003-642 (03/03)

This well no longer exists.

WELL SUMMARY SHEET

Start Date: 2/02/05
Finish Date: 7/26/05
Page 1 of 5

Well ID: C4669
Well Name: 299-W11-25B
Location: WMA T
Project: RCRA MONITORING WELL
Prepared By: BJORN HELGESON Date: 3/31/05
Reviewed By: L.D. Walker Date: 8/10/05
Signature: Bj Hel
Signature:

CONSTRUCTION DATA

Description	Diagram
6-in. DIAMETER PROTECTIVE SS CASING SET ABOVE THE 4-in CASING	
4-in. ID SCHEDULE 5, SS 304L WELL CASING → 260.15'	
PORTLAND CEMENT GROUT: 0' → 10.2'	
GRANULAR BENTONITE 10.2' → 239.7'	
¼" BENTONITE PELLETS 239.7' → 249.9'	
10-20 MESH COLORADO SILICA SAND 249.9' → 286.8'	
¼" BENTONITE PELLETS 286.8' → 292.1'	
8-12 MESH COLORADO SILICA SAND 292.1' → 409.5'	
† ALL DEPTHS IN FEET BELOW GROUND SURFACE.	
ALL TEMP. CASING REMOVED FROM THE GROUND.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0	NO RECOVERY	0 – 12': No Recovery
		12' → 36': Sandy Gravel
		Well destroyed during construction
25		
		36' → 41': Gravelly Sand
		41' → 63': Sand
50		
		63' → 69': Gravelly Sand
		69' → 75': Sand
75		75' → 87': Gravelly Sand
		87' → 91': Sand
		91' → 95': Sandy Silt
		95' → 105': Silty Sand
100		100: Caliche Nodules
		105' → 119': Slightly Silty Sand
		110: Large Caliche Nodules
		119' → 124': Sand
125		124' → 132': Sandy Silt
		132' → 184': Sandy Gravel

A-6003-643 (03/03)

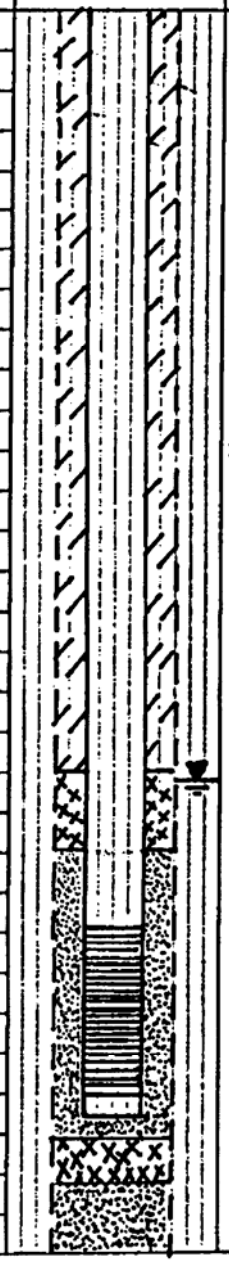
WELL SUMMARY SHEET

Start Date: 2/2/05
Finish Date: 7/26/05
Page 2 of 5

Well ID: C4669
Well Name: 299-W11-25B
Location: WMA T
Project: RCRA Monitoring Well
Prepared By: Brian Helgeson
Date: 3/29/05
Reviewed By: L.D. Walker
Date: 8/10/05
Signature: Brian Helgeson
Signature: L.D. Walker

CONSTRUCTION DATA

Description	Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
150		132' - 185': Sandy Gravel
175		
		185' → 195': Silty Sandy Gravel
		195' → 255': Sandy Gravel
200		
225		
		W.L. = 241.90' bgs
250		255' → 269': Silty Sandy Gravel
		269' → 274': Sandy Gravel
275		275' → 287': Silty Sandy Gravel
		287' → 320': Sandy Gravel

A-6003-643 (03/03)

WELL SUMMARY SHEET

Start Date: 2/2/05
Finish Date: 7/26/05
Page 3 of 5

Well ID: C4669
Well Name: 299-W11-25 B
Location: WMAT
Project: RCRA Monitoring Well
Prepared By: Bjorn Helgeson Date: 3/28/05
Reviewed By: L.D. Walker Date: 8/10/05
Signature: Bjorn Helgeson
Signature: L.D. Walker

CONSTRUCTION DATA

Description	Diagram
Well Screen 4-in ID, 0.020-in. slot Cont. Wire-Wrap, SS Type 304 260.2' → 280.2'	
Sump 4-in ID SS 304 L 280.2 → 282.2	
Temporary Casing 9" x 6" Dual Wall Carbon steel 0' → 409.5	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
300		287' → 320': Sandy Gravel
		320' → 323': Sand
325		323' → 406': Sandy Gravel
350		
375		
		406' → 409': Silty Sand
400		409' → 409.5': Silt (lower fluvial mud)
		T.D. = 409.5'

A-6003-643 (03/03)

WELL SUMMARY SHEET

Start Date: 2/02/05
Finish Date: 7/26/05
Page 4 of 5

Well ID: C4669
Well Name: 299-W11-25B
Location: WMA T
Project: RCRA MONITORING WELL
Prepared By: BRIAN HELGESON Date: 8-8-05
Reviewed By: L.D. Walker Date: 8/10/05
Signature: B. H.
Signature:

CONSTRUCTION DATA

Description	Diagram
4-IN ID SCHEDULE 5, SS 304L WELL CASING ~160 → 260.15'	
PORTLAND CEMENT GROUT: 0 → 150'	
GRANULAR BENTONITE 150' → 239.7'	
1/4" BENTONITE PELLETS 239.7' → 249.9'	
10-20 MESH COLORADO SILICA SAND 249.9' → 286.8'	
1/4" BENTONITE PELLETS 286.8' → 292.1'	
8-12 MESH COLORADO SILICA SAND 292.1' → 409.5'	
4-IN ID, 0.020-IN SLOT. CONT. WIRE-WRAP, S.S. TYPE 304L 260.2' → 280.2	
4-IN ID, SS. 304L SUMP 280.2' → 282.2'	

* ALL DEPTHS IN FT BELOW GROUND SURFACE

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		SEE PAGES 1-3 OF WELL SUMMARY
50		
100		
150		
200		
250		

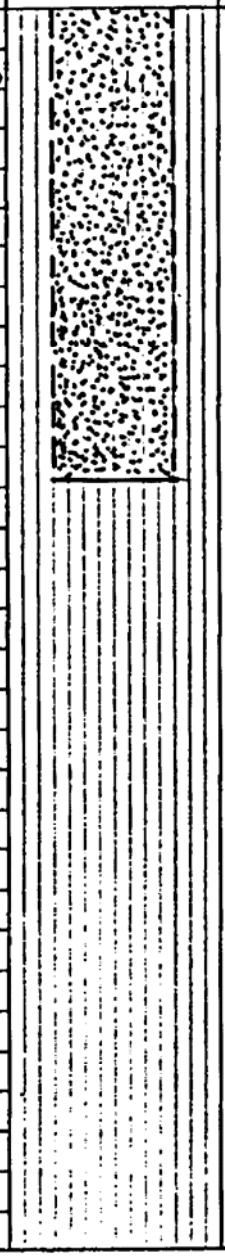
A-6003-643 (03/03)

WELL SUMMARY SHEET

Start Date: 2/02/05
Finish Date: 7/26/05
Page 5 of 5

Well ID: C4669
Well Name: 299-W11-25B
Location: WMA-C
Project: RCRA MONITORING WELL
Prepared By: BJORN HELGESON
Date: 8-8-05
Reviewed By: L.D. Walker
Date: 8/10/05
Signature: Bjorn Helgeson
Signature: L.D. Walker

CONSTRUCTION DATA

Description	Diagram
ALL TEMP. CASING REMOVED FROM THE GROUND	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
300		
350		
400		
450		

A-6003-643 (03/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 2/02/05
Finish Date: 3/22/05
Page 1 of 1

Well ID: C4669 | Well Name: 299-W11-25B | Approximate Location: WMA T
Project: FY05 RCRA Monitoring Well | Other Companies: Firestone Environmental, North Wind
Drilling Company: Layne | Geologist(s): Jason Capron, Bjorn Helgeson
Driller: David Dewitt (Dewey) License #: 2695

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
Dual-Wall, Carbon Steel, FJ 9" OD 7"/6" ID	0' - 409.5'	9"
	-	
	-	
	-	
	-	

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

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

Drilling Method	Hole Diameter (In.) / Interval (ft)
Auger:	Diameter ___ From ___ to ___
Cable Tool:	Diameter ___ From ___ to ___
Air Rotary:	Diameter ___ From ___ to ___
A.R. w/Sonic:	Diameter ___ From ___ to ___
Reverse Air (Hammer Driven)	Diameter 9" From 0' to 409.5'
	Diameter ___ From ___ to ___
	Diameter ___ From ___ to ___

Drilling Fluid: n/a
Total Drilled Depth: 409.5' | Hole Dia @ TD: 9" | Total Amt. Of Water Added During Drilling: -
Well Straightness Test Results: Passed | Static Water Level: 242.25 ft Date: 3/23/05

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
	-			-	
	-			-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" ID SS 304 SCH 5 Casing	2.0 - 260.15	F480	n/a	Portland Cement (94#)	3.0' - 10.2	2	n/a
4" ID SS 304 SCH 5 Screen	260.15 - 280.15	"	0.020	Granular Bentonite (50#)	10.2 - 239.7	136	n/a
4" ID SS 304 SCH 5 Sump	280.15 - 292.15	"	n/a	Bentonite Pellets (1/4")	239.7 - 244.9	4	1/4"
	-			Colorado Silica Sand	249.9 - 286.8	104	10-20
	-			Bentonite Pellets (1/4")	286.8 - 292.1	5	1/4"
				Colorado Silica Sand	292.1 - 409.5	157	8-12

OTHER ACTIVITIES

Aquifer Test: | Date:
Description:

Well Decommission: | Yes: ✓ | No: | Date: 7-26-05
Description: Portland Cement Grout (79 Bags) Filled Borehole 147.6' → 0' bgs, Unknown Amount of S.S. 4-in Remains in Borehole

WELL SURVEY DATA (If applicable)

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

COMMENTS / REMARKS

Vol. Calcs: P.C. => 2 bags * 1.285 ft³/bag = 2.57 ft³ : Granules => 136 * 0.71 ft³/bag = 96.56 ft³ : Pellets => 4 buckets * 0.62 ft³/bucket = 2.48 ft³ : 10-20 Sand => 104 * 0.535 ft³/bag = 55.64 ft³ : Pellets => 5 buckets * 0.62 ft³/bucket = 3.1 ft³ : 8-12 Sand => 157 bags * 0.505 ft³/bag = 79.29 ft³

Reported By: Bjorn Helgeson | Title: Geologist | Signature: Bj Hel | Date: 3/30/05

A-6003-658 (04/03)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** N.P. Fastabend **Company:** FGG
Date Requested: 08/17/05	**Requestor:** Chris S. Wright (FH)
Date of Survey: 08/29/05	**Surveyor:** N.P. Fastabend
ERC Point of Contact:	**Survey Co. Point of Contact:** G.F. Brazil (PLS)
Description of Work: Civil Survey of Brass Cap Marker in Concrete for Decommissioned Well C4669 / 299-W11-25B	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** Meters **Hanford Area Designation:** 200W

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
2W-16 (FGG) and 2W-20 (FGG)

Vertical Control Monuments:
2W-16 (FGG) and 2W-20 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C4669	299-W11-25B	566912.34	136774.76	209.746	Brass Survey Marker

Notes:

Equipment Used: Trimble GPS 5800 RTK
Trimble DiNi 12 Level

Original to
Distribution by OIS

BOREHOLE LOG

Page 1 of 8

Date: 7/26/05

Well ID: C4950 | Well Name: 299-W11-46 | Location: WMA T (South EAST of C4669)

Project: FY 2005 RCRA Monitoring Well | 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		No Recovery	No Recovery	0-5': No Recovery	Diesel Hammer Drill Rig 9"x6" Dual-Wall Casing
5				5-15': Sandy Gravel [SG] 60% Gravel, 30% Sand, 10% Silt; Gravel, SR-R, Poorly Sorted, 60% Basaltic, 40% Qtz/Others; Sand 60% Qtz/Oth, 40% Basaltic, SA-R, C-Gn, Moist Brown to Gray.	
10					
15				15-35': Sandy Gravel [SG] 70% Gravel, 25% Sand, 5% Silt Increasing Gravel Fraction Same as above	
20				22' - Sandy Gravel (SG) - as above	
25				25' - Sandy Gravel (SG) - as above	
30				30' - Sandy Gravel (SG) - as above	> fines @ 33'
35				33' - gravelly Sand (gS) - 20% gravel, 80% sand. 20% VFP FP Sand. FS-VCS predom. MS-CS, dark grayish brown, 10YR 4/2, mod rxn HCl, slightly moist	

NO SAMPLES COLLECTED

Reported By: Bjorn Hellegouw | Title: Geologist | Signature: [signature] | Date: 8/3/05

Reviewed By: L.D. Walker | Title: Geologist | Signature: [signature] | Date: 8/10/05

A-6003-642 (03/03)

BOREHOLE LOG

Date: 7-27-05

Well ID: C4950 | Well Name: 299-W11-46 | Location: East of WMA T, 200 West

Project: FY 2005 RCRA Monitoring Well | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
40		NO SAMPLES COLLECTED		40' Sand (S), trace gravel, w/ silt, FS-VCS, predom MS-CS, 10% basalt, 60% qtz/other, grayish brown 10YR 5/2, slight rxn HCl, slight moisture	Diesel Hammer 9" x 6" dual-wall drill casing
45				45' Sand (S) - as above.	
50				50' Sand (S) - as above.	
					> 1
55				55' Sand (S) - 8% gravel, 92% sand, gravel VFP-FP, Sand FS-VCS, predom MS-CS, grayish brown 10YR 5/2, mod rxn HCl, slight moisture	
60				60' gravelly Sand (gS) - 25% gravel, 75% sand, gravel VFP-FP, sand - same as above, grayish brown 10YR 5/2	
65				65' gravelly Sand (gS) - as above	
70				70' gravelly Sand (gS) - as above, slight increase gravel fraction than above.	
75				75' gravelly Sand (gS) - as above, slight decrease gravel fraction than above	

Reported By: Bjorn Helgeson
Title: Geologist
Signature: Bjorn Helgeson Date: 8/3/05

Reviewed By: L.D. Walker
Title: Geologist
Signature: L.D. Walker Date: 8/10/05

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 8
Date: 7-27-05

Well ID: C4250 | Well Name: 299-W11-46 | Location: East of WMA T, 200 West
Project: FY 2005 RCRA Monitoring Well | Reference Measuring Point: Ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
80		NO SAMPLES COLLECTED		80' Sand (S) 5% gravel 95% sand - gravel VFP-FP, sand FS-VCS, predom CS, dark grayish brown 10YR 4/2, strong rxn HCl, slight moisture	Diesel Hammer 9"x6" dual wall casing
85				85' Sand (S) - as above - slight > gravel than above	
90				90' Sand (S) - as above	
					Δ lithology @ 93'
95				95' Silt (M) - 5% VFS 95% silt brown 10YR 5/3, strong rxn HCl	
100				100' silty Sand (mS) - 75% sand 25% silt, VFS-MS, predom FS, caliche nodules, very strong rxn HCl, brown 10YR 5/3	Note CaCO3 nodules
105				105' silty Sand (mS) - as above w/ caliche nodules	
					Δ drill rate @ 110'
110				110' slightly silty Sand (mS) - 85% VFS-FS 15% silt, brown 10YR 5/3, strong rxn HCl	
					> caliche 110
115				115' ~~Slightly Silty Sand (mS)~~ sandy Silt (SiM) w/ CaCO3 cementation. Large caliche chunks indicate significant cementation, pale brown 10YR 6/3, very strong rxn HCl	Δ @ 117' - increase gravel fraction < CaCO3

Reported By: Bjorn Helgeson
Title: Geologist
Signature: Bjorn Helgeson Date: 8/3/05

Reviewed By: L.D. Walker
Title: Geologist
Signature: LD Walker Date: 8/10/05

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 8
Date: 7-27-05

Well ID: C4950 | Well Name: 299-W11-46 | Location: East of WMA T, 200 West
Project: FY 2005 RCRA Monitoring Well | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120				120' sandy Gravel (SG) - 75% gravel, 25% sand, gravel VFP-FP 50% basalt, 50% gt/gr/other, A-SA, sand FS-VCS, predom VCS, 30% basalt 70% gt/gr/other, grayish brown 10YR 5/2, strong rxn HCl,	Diesel Hammer 9"x6" dual wall casing < measurement
125				125' silt (ML) 5% VFS 95% silt, brown 10YR 4/3, strong, rxn HCl, moist	Δ @ 121' (silt)
130				130' sandy Gravel (SG) 75% gravel 20% sand 5% silt - gravel VFP-FP (very fine clasts), sand FS-VCS, predom CS-VCS, strong rxn HCl, grayish brown 10YR 5/2	Δ @ 130' (sandy Gravel) Δ @ 133'
135				135' ~~sandy Silt (ML)~~ ~~silty Sand (MS)~~ silty Sand (SM) 25% VFS-FS 75% silt, brown 10YR 4/3, strong rxn HCl, moist	
140				140' silty Sand (MS) 55% VFS-FS 45% silt, brown 10YR 4/3, med-strong rxn HCl	
145				145' silty Sand (MS) as above	Δ @ 148' (gravel)
150				150' Gravel (G) 90% gravel 10% sand, gravel VFP-MP, 65% basalt 35% gt/gr/te, granite, SA-SR, dark gray 10YR 4/1, no rxn HCl	
155				~~155' Gravel (G) as above~~ 155' sandy Gravel (SG) - 65% gravel 35% sand, gravel most clasts 20-50 mm, SR-R, 60% basalt 40% gt/gr/te, sand MS-VCS, 50% basalt 50% gt/gr/other, no rxn HCl	Large cobbles noted @ 158'.

NO SAMPLES COLLECTED

Reported By: Bjorn Helgeson | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: [signature] Date: 8/3/05 | Signature: [signature] Date: 8/10/05

A-6003-642 (03/03)

5 8

BOREHOLE LOG

Page 4 of 7 cw

Date: 7-27-05

Well ID: C3950 | Well Name: 299-W11-46 | Location: WMA-T, 200 West

Project: FY 2005 RCRA Monitoring Well | Reference Measuring Point: Ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
160				Cobbly gravel (G) gravel/cobbles 90% sand - 10% trace silt gravel/cobble is r/sb and ~40% basalt + 60% qtz-ide/granite. As Little sand recovery, Cobbles to several feet based on large broken frags in cuttings. No rxn HCl, dry.	v. slow drilling 3hr/ 5ft Lithology Cut 160' Diesel Hammer 9"x6" dual wall drill casing
165					
170				168' - inc in basalt drag portion for 1ft 170 - as above	
175				175' as above, better sand recovery. confirms 10% fg to cg sand. Poorly sorted material.	
180				Gravelly cobble [Cg] poorly sorted cobbles 60% Gravel 30% sand 10% cobbles/gravel 30% basalt, qtz/granite 20% rest. Sand is predom qtz, fsp, mc, no reaction to HCl, dry	180' Δ lithology
185				185' cobbles to 9" in cuttings, increase in Basalt portion,	
190				196' As above,	
195				195 LESS COBBLES THAN ABOVE PEBBLE-COBBLE GRAVEL 30% BASALT OTHERS 70% OF CLASTS DRY NO RXN TO HCl V. POORLY SORTED - CUTTINGS TO	+ 6" LONG AXIS

No samples collected

Reported By: 1954 Greg Kasza | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] Date: 7-28-05 | Signature: [signature] Date: 8/10/05

A-6003-642 (03/03)

6 of 8

BOREHOLE LOG

Page 5 of 57
Date: 9-28-05

Well ID: C4950 | Well Name: 299-W11-46 | Location: WMA-T
Project: FY 2005 RCRA Monitoring Well | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
200					RAD NON CONTAMINATION
				SAME AS ABOVE SILT-VF. SAND % MAY	CONTINUOUS RCT
				BE INCREASING (DRILLING CASING)	ON SITE ↓
				SILT-VF FINE SAND FRACTION 2.5Y 7/2	
				LT GRAY	
205					Diesel Hammer
				AS ABOVE - LESS COBBLE SIZE MATERIAL	rig with 9"x
				IN CUTTINGS	6" dual wall
					casing
210				AS ABOVE BASALT FRACTION STILL	
				≈ 30% IN PEBBLE-COBBLE	
215				AS ABOVE BASALT FRACTION NOW	
				20% IN PEBBLE COBBLE CLASTS	
				OCCASIONAL COBBLES WITH 8" LONG	
				AXIS FOUND IN CUTTINGS	
220				AS ABOVE	NO CONTAMINATION
					FOUND 11.7eV PID
225				NO RECOGNIZED CHANGES FROM	
				ABOVE	
230				AS ABOVE AIR VELOCITY IN	
				CYCLONE RE PREVENTING RECOVERY	
				OF REPRESENTATIVE SAMPLE	
235				- DIFFICULT TO CAPTURE FINE FRACTION	
240				235 - AS ABOVE - DRY	

Reported By: Greg Kasza | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: [signature] | Date: 7-29-05 | Signature: [signature] | Date: 8/10/05

A-6003-642 (03/03)

7 8

BOREHOLE LOG

Page 6 of 7 cw

Date: 7-29 05

Well ID: C 49-50 | Well Name: 299-W11-46 | Location: WMA-T

Project: FY 2005 RCRA Monitoring Well | Reference Measuring Point: G.S

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				AS ABOVE - CONDENSATION FORMED ON LID OF CHIP TRAY :. TR MOISTURE	DRUMMING CUTTINGS
					243.0' bgs = STATIC WATER LEVEL
245				AS ABOVE NO VISIBLE MOISTURE	
				247 LESS DUST FROM CYCLONE MOIST SILT ON CUTTINGS NO FREE WATER WITH CUTTINGS	
250				250' AS ABOVE	
255				255-270' SILTY SANDY GRAVEL GRAVEL 55%, SAND 35%, SILT 10%; GRAVEL 70% QTZ, 30% BASALTIC, SR-R, PEBBLES + COBBLES UP TO 30cm; SAND 50% QTZ, 50% BASALT M-C, NO HCL RXN YELLOWISH BROWN 10YR 5/3	
260					
265				264-267' ~~269~~ - INCREASE IN SILT + H_2O	↑ H_2O
270				270-279' SANDY GRAVEL (GW), GRAVEL 70% SAND 20%, SILT 10%; GRAVEL 50% QTZ, 50% BASALT, SA-R, COBBLE SIZE 4-12cm; SAND 80% BASALTIC, M-C, NO HCL RXN 10YR 7/3	
275					

Reported By: BSORN HOLGESON | Reviewed By: L.D. Walker

Title: GEOLOGIST | Title: Geologist

Signature: By Hol | Date: 8/1/05 | Signature: LD Walker | Date: 8/10/05

A-6003-642 (03/03)

8 8

BOREHOLE LOG

Page 7 of 7 CW

Date: 7-29-05

Well ID: C4950 | Well Name: 299-W11-46 | Location: WMA T

Project: FY05 MONITORING WELL | Reference Measuring Point: GROUND SURFACE

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
280				279-285' SAND	HEAVING SANDS
				SAND 65% BASALTIC, 35% QTZ/OTHER,	
				MED-CR, SA-A NO RXN HCL	
				10YR 5/3	
285					T.D. = 285.75 bgs

Not used [illegible] 8-10-05

Reported By: BRIAN HELGESON | Reviewed By: L.D. Walker

Title: GEOLOGIST | Title: Geologist

Signature: [signature] Date: 8-1-05 | Signature: [signature] Date: 8/10/05

A-6003-642 (03/03)

WELL SUMMARY SHEET

Start Date: 7-26-05
Finish Date: 8-8-05
Page 1 of 1

Well ID: C4950
Well Name: 299-W11-46
Location: WMAT (SOUTHEAST OF C4669)
Project: FY05 MONITORING WELL (REPLACEMENT OF C4669)
Prepared By: BJORN HELGESON Date: 8-8-05
Reviewed By: L.D. Walker Date: 8/10/05
Signature: Bjorn Helgeson
Signature: L.D. Walker

CONSTRUCTION DATA

Description	Diagram
6-IN DIAMETER PROTECTIVE S.S. CASING SET 2.7' ABOVE THE 4-IN CASING	
4-IN ID SCHEDULE 10, S.S. 304L WELL CASING → 263.4'	
4-IN ID SCHEDULE 10, S.S. 304L 0.020 WELL SCREEN 263.4 → 283.4'	
4-IN ID SCHEDULE 10, S.S. 304L SUMP 283.4 → 285.75'	
TEMPORARY CASING (9"x6" DUAL WALL) REMAINING IN BOREHOLE (44.7-115.0')	
PORTLAND CEMENT GROUT: 0' → 115.0'	
GRANULAR BENTONITE: 83.8 → 240.5'	
1/4" BENTONITE PELLETS: 240.5 → 248.5'	
10-20 MESH COLORADO SILICA SAND: 248.5' → 285.5'	
* ALL DEPTHS IN FEET BELOW GROUND SURFACE	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0	NO RECOVERY	0-5: NO RECOVERY
		5-35': SANDY GRAVEL
		35-40': GRAVELLY SAND
50		40-60': SAND
		60-80': GRAVELLY SAND
		80-93': SAND
		93-100': SILT
100		100-110: SILTY SAND w/ $CaCO_3$ NODULES
		110-120: SANDY SILT w/ CALICHE
		120-121: SANDY GRAVEL
		121-133: SILT
		133-148': SILTY SAND
150		148-158': GRAVEL
		158-160': SANDY GRAVEL
		160'-180': GRAVEL
		180-255: SANDY GRAVEL
200		
		243.0' = STATIC WATER LEVEL
250		255-270': SILTY SANDY GRAVEL
		270-279': SANDY GRAVEL
		279-285': SAND
		T.D. = 285.75'

A-6003-643 (03/03)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 7-26-05
Finish Date: 8-8-05
Page 1 of 1

Well ID: C4950	Well Name: 299-W11-46	Approximate Location: NE CORNER OF T TANK FARM	
Project: FY05 MONITORING WELL		Other Companies: FREESTONE ENVIRONMENTAL	
Drilling Company: LAYNE		Geologist(s): BJORN HELGESON, GREG KASZA, KELLY WOODWORTH	
Driller: DAVID DEWITT	License #: 2695		

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
DUAL WALL CARBON STEEL	0' - 285.75	9" / 7"/6"
	-	
	-	
	-	
	-	

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

DRILLING METHOD

Auger:	
Cable Tool:	
Air Rotary:	
A.R. w/Sonic:	
BECKER DIESEL HAMMER	

HOLE DIAMETER (in.) / INTERVAL (ft)

Diameter ____ From ____ to ____	
Diameter ____ From ____ to ____	
Diameter ____ From ____ to ____	
Diameter 9" From 0' to 285.5	
Diameter ____ From ____ to ____	
Diameter ____ From ____ to ____	

Drilling Fluid: N/A

Total Drilled Depth: 285.5 | Hole Dia @ TD: 9"

Total Amt. Of Water Added During Drilling: —

Well Straightness Test Results: O.K.

Static Water Level: 243.5' bgs | Date: 8/5/05

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
	-			-	
	-			-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" ID SS 304L SCH 10 CASING	2.0 - 263.4	FL180	N/A	PORTLAND CEMENT (#94)	3.0 - 115.0	20	N/A
4" ID SS 304L SCH SCREEN	263.4 - 283.4	"	0.020	GRANULAR BENTONITE (#8)	115.0 - 240.5	75	N/A
4" ID SS 304L SCH SUMP	283.4 - 285.75	"	N/A	BENTONITE PELLETS (1/4")	240.5 - 248.5	2.5	1/4"
	-			COLORADO SILICA SAND (10-20)	248.5 - 285.5	19	10-20
	-				-		

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA (if applicable)

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

COMMENTS / REMARKS

VOL. CALS: P.C. => 20 BAGS * 1.285 ft^3/bgs = 25.7 ft^3 ; GRANULES => 75 * 0.71 ft^3/bgs = 53.25 ft^3 ; PELLETS => 2.5 BUCKETS * 0.62 $ft^3/bucket$ = 1.55 ft^3 ; 10-20 SAND => 19 * 0.535 ft^3/bgs = 10.165 ft^3

Reported By: BJORN HELGESON | Title: GEOLOGIST | Signature: Bjorn Helgeson | Date: 8-8-05

A-6003-658 (04/03)

WELL DEVELOPMENT AND TESTING DATA

Well Name:	Well ID:	Well Location:	Date:
C4950	299-W11-46	WMAT (SE of C4669)	8/5/05

Reference Measuring Point (unless otherwise noted): TOP OF ~~OUTER~~ INNER CASING (TOC)

Has the well been surveyed? ○ Yes ⊗ No

Does the well have a cement pad? ○ Yes ⊗ No

PART 1

STATIC WATER LEVEL:

Start of Job	245.50' toc
End of Job	245.52' toc

DEPTH TO BOTTOM:

Start of Job	287.17' toc
End of Job	

PART 2

WELL DEVELOPMENT DATA

Pump Model	
Intake Depth	276' / 266' bgs
Starting Turbidity	~1000 NTU

Pump Start	Stop	Flow Rate
0836	1026	41 gal/min
1128	1255	43 gal/min

Total Pumped	~2400 gal
Final Turbidity	3.88 NTU
XD SN/Range (PSI)	SEE FAR DAILY 8-5-05

PART 3

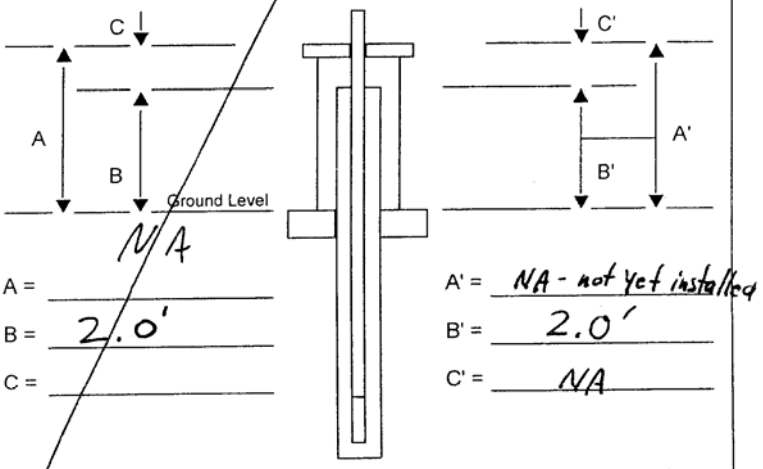
INSTANTANEOUS SLUG TEST

Static Water Level (TOC)	
Transducer Depth	
Baseline Start	
Injection Start	
Baseline Start	
Withdrawal Start	
Slug Volume	
XD SN/Range (PSI)	

PART 4

Last Recorded Measurements Date:

Current Measurements Date: 8/5/05



N/A

A =

B = 2.0'

C =

A' = NA - not yet installed

B' = 2.0'

C' = NA

Are there any reference marks on the casing strings? ○ Yes ⊗ No

PART 5

COMMENTS:

TOC = Top of 4" INNER CASING

SEE FAR DAILY 8-5-05 FOR XD DETAILS

Prepared by (print name):	Signature:	Date:
BJORN HELGASON		8-5-05
Reviewed by (print name):	**Signature:**	**Date:**
L.D. Walker		8-9-05

A-6003-644 (03/03)

FIELD ACTIVITY REPORT - DAILY DRILLING

Page 1 of 3

Date: 8/5/05

Well ID: C4950 | Well Name: 299-W11-46

Location: WMA T | Report No.: 9

Start	Finish	Total
Time 0600	Time 1400	Time 800
Hole Depth/Csg ∅ / ∅	Hole Depth/Csg NA /	Hole Depth/Csg NA /

Reference Measuring Point: GROUND SURFACE

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

Rod Size: Well Development

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
0600	0620	P.O.D
		DTB = 287.97' bgs LOC
		Thermo Orion 135A conductivity meter
		Single Shot meter
		1415 micromho/cm 1415
		Hach 2100P Turbidimeter S/N 95080000845
		Gelex standard reading
		564 Ntu 562 Ntu
		47.3 47.5
		4.85 4.85
		pH Tests 3+
		Buffer Meter
		7.0 7.0
		10.00 10.01
		Transducer 5217 20psi
		Data Logger In-Situ Hermit 3000 "Jeff"
		PUMP INTAKE DEPTH 13x21' = 273' + 2.5 = 275.5'
0630		SET UP FOR WELL DEVELOPMENT
0715	0800	TRIP IN PUMP

Reported By: BJORN HELGESON | Title: GEOLOGIST | Date: 8/5/05

Signature: Bjorn Helgeson

Reviewed By: L.D. Walker | Title: Geologist | Date: 8/9/05

Signature: LD Walker

A-6003-651 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
Continuation Page

Date: 8/5/05

Well Name: 299-W11-46 | Well ID: C4950

Location: WMA T | Continuation of Report No.: 9

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth
0815		DTW = 245.5 LOC T
		INITIAL XD = 27.641 1ST INTERVAL ~276' bgs

Time	Turbidity	pH	Conductivity	Temp	XD	drawdown	pump rate
0848	184	8.22	1173	20.2	14.730	12.911	41 gal/min
0902	21.0	8.16	1211	20.4	13.309	14.332	41
0917	19.4	8.07	1220	20.6	13.001	14.640	41
0933	8.79	8.05	1220	21.0	12.797	14.844	41
0947	9.85	8.07	1226	20.9	12.590	15.051	41
1001	6.83	8.05	1216	21.3	12.531	15.110	41
1014	6.23	8.05	1234	21.6	12.511	15.130	41
1026	4.89	8.06	1233	22.1	12.480	15.161	41

0836		START TEST 1 DRAWDOWN
0900		PUMP RATE TEST 5 GAL IN 7.25 SEC = 41.6 gal/min
1026		START TEST 2 RECOVERY
1033	1125	PURGE TRUCK OFF SITE TO BE EMPTIED
1045		WET BULB = 83° AIR TEMP 92°F
		INITIAL XD = ~~14.44~~ 16.414 2ND INTAKE DEPTH ~266' bgs
1128		START TEST 3 DRAWDOWN

Time	Turbidity	pH	Conductivity	Temp	XD	Drawdown	Pump rate
1135	13.4	8.11	1251	23.2	2.910	13.504	43
1150	11.8	8.11	1261	22.7	2.613	13.801	43
1205	7.21	8.11	1277	21.7	1.609	14.805	41
1221	6.31	8.11	1279	21.9	1.152		

Reported By: Bjorn Helgdson | Title: Geologist | Date: 8-5-05 | Signature: Bjorn Helg

Reviewed By: L.D. Walker | Title: Geologist | Date: 8/9/05 | Signature: LD Walker

A-6003-652 (04/03)

FIELD ACTIVITY REPORT - DAILY DRILLING
CONTINUATION

Date: 8-05-05

Well ID: C4950 | Well Name: 299-W11-46

Location: WMA-T | Report No.: 9

Start	Finish	Total
Time	Time	Time
Hole Depth/Csg ——/——	Hole Depth/Csg ——/——	Hole Depth/Csg ——/——

Reference Measuring Point: GROUND SURFACE

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

Rod Size:

Time/Depth From	Time/Depth To	Description of Activities/Operations with Depth (Attach applicable drawings and document straightness test results)
		FINAL READINGS
1255		3.86 NTU, 1.288 COND @ 23.3°, 8.18 pH, YD= 1.695
1255		4TH TEST
1250		COLLECTED SAMPLES FOR PNNL
1257		JIM HOGAN ON SITE TO PICKUP SAMPLES
1320		TRIP OUT PUMP + TRIMMIE
1330		WET BULB 91° - ACTION LEVEL 25% WORK 75% REST
1345		SHUTDOWN FOR DAY DUE TO EXTREME TEMP.
1400		DRILLER + GEO OFF SITE
		NOT USED BH

Reported By: BJORN HELGESON

Title: GEOLOGIST | Date: 8/5/05

Signature: BJ Helgeson

Reviewed By: L.D. Walker

Title: Geologist | Date: 8/9/05

Signature: LD Walker

A-6003-651 (04/03)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** N.P. Fastabend **Company:** FGG
Date Requested: 08/17/05	**Requestor:** C.S. Wright (FH)
Date of Survey: 08/29/05	**Surveyor:** N.P. Fastabend FGG
ERC Point of Contact:	**Survey Co. Point of Contact:** G.F. Brazil (PLS)
Description of Work: Civil Survey of Groundwater Monitoring Well C4950 / 299-W11-46.	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** Meters **Hanford Area Designation:** 200W

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
2W-16 (FGG) and 2W-20 (FGG)

Vertical Control Monuments:
2W-16 (FGG) and 2W-20 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
C4950	299-W11-46	566914.86	136773.27		Center of Casing
				210.947	Top Pump Baseplate, N. Edge
				210.941	Top of Casing, N. Edge
				210.116	Brass Survey Marker

Notes:

Equipment Used: Trimble GPS 5800 RTK
Trimble DiNi 12 Level

Surveyor Statement:
I, Grant F. Brazil, a Professional Land Surveyor registered in the State of Washington (Registration No. 22326), hereby certify that this report is based on a field survey performed in August, 2005 under my direct supervision, and that the data contained here is true and correct.

Original to
Distribution by DIS

Appendix B

Analytical Results from Groundwater Samples Collected During Drilling of Well 299-W11-25B

Table B.1. Results of Groundwater Sampling During Drilling of Well 299-W11-25B

Sample Depth (ft bgs)	Depth Below Water Table (ft)[a]	Sample Method	Tc-99 (pCi/L)	Cr (µg/L)	Mn-55 (µg/L)	Fluoride (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Tritium (pCi/L)	I-129 (pCi/L)	Carbon Tetrachloride (µg/L)
247	5	Air lift	232.95	(0.745)	611	2.82	33.13	Acidified[b]	184.6		1.4418U	
250	8	Air lift	13046	(0.891)	729	1.86	36.08	Acidified[b]	179.61			
255	13	Air lift	12693	(0.749)	575	1.83	36.48	Acidified[b]	201.36			
260	18	Pump	76898	1033	15.4	<1.17	37.9	371.7	146.68	5760		797
265	23	Air lift	81726	2.34	380	1.35	43.75	550.4	145.88			
270	28	Air lift	139809	1.95	161	1.46	36.01	585.94	102.95			
275	33	Air lift	181595	2.24	67.5	1.46	33.7	663.54	84.21		13.691U	
279	37	Pump	151505	555	14.2	1.61	35.36	569.23	102.65	7020		957
285	43	Air lift	8524	(1.1)	20.9	1.33	29.59	579.88	72.13		4.9976U	
290	48	Air lift	31946	(1.15)	23.1	2.81	24.19	404.03	70.48			
295	53	Air lift	36928	(1.36)	80.2	2.8	26.64	410.39	77.08			
301	59	Air lift	49418	(4.49)	76.3	ND	ND	ND	ND			
		Pump	54575	63.7	47.8	2.7	27.63	426.81	83.81	5300		1146
305	63	Air lift	37758	2.73	16.9	3.47	25.52	404.41	73.83			
310	68	Air lift	30734	4.04	43.8	3.15	22.16	354.52	61.73			
315	73	Air lift	43332	13.3	35.8	3.13	23.29	379.72	64.48			
321	79	Air lift	13512	(0.98)	81.1	ND	ND	ND	ND			
		Pump	49626	14.3	54.9	3.01	26.12	403.54	69.71	6660		997
325	83	Air lift	39908	1.46	81.7	3.1	24.71	410.42	72.35			
330	88	Air lift	39323	(1.06)	57.6	2.6	27.25	406.49	81.7			
335	93	Air lift	29522	(1.15)	105	2.15	26.33	399.49	73.99			
340	98	Pump	42299	50.2	28.6	2.82	25.9	415.32	74.73	7280		520
345	103	Air lift	28776	(2.72)	78.2	2.46	23.51	392.36	70.01			
350	108	Air lift	25489	(1.53)	60.2	2.73	25.4	418.61	76.79			
355	113	Air lift	17325	10	48.6	1.83	21.86	376.47	64.8			
360	118	Air lift	11463	13.5	60.2	ND	ND	ND	ND			
		Pump	37601	18.7	36.5	2.5	24.77	409.12	73.63	8770		1341

Table B.1. (contd)

Sample Depth (ft bgs)	Depth Below Water Table (ft)[a]	Sample Method	Tc-99 (pCi/L)	Cr (µg/L)	Mn-55 (µg/L)	Fluoride (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Tritium (pCi/L)	I-129 (pCi/L)	Carbon Tetrachloride (µg/L)
365	123	Air lift	29945	12.20	42.2	1.91	26.47	393.78	83.85			
			30270	12.60	42.4	ND	ND	ND	ND			
			20000									
370	128	Air lift	26820	26.30	40.6	2.07	24.15	405.69	75.77			
			27008	25.70	40.3	ND	ND	ND	ND			
375	133	Air lift	15638	20.80	32.5	1.23	19.57	314.57	65.59			
			16020	20.20	24.1	ND	ND	ND	ND			
380	138	Pump	25062	24.40	39.7	1.75	20.2	334.98	65.51			
			25539	16.10	30.3	ND	ND	ND	ND			998
385	143	Air lift	15167	16.40	31.2	<1.17	17.04	275.4	58.11			
			15230	17.10	31.5	ND	ND	ND	ND			
390	148	Air lift	15162	10.30	28.7	<1.17	17.43	260.11	55.62			
			15230	10.30	29.3	ND	ND	ND	ND			
395	153	Air lift	25915	(1.03)	76.9	1.81	22.62	366.38	71.14			
			26487	(1.51)	71.6	ND	ND	ND	ND			
400	158	Pump	30706	(0.59)	71.1	2.39	23.17	370.44	69.2			
			30100	(0.74)	71.5	ND	ND	ND	ND			
			17400									1050
405	163	Air lift	12991	(1.74)	57.9	1.3	16.53	264.7	55.78			
			13229	(2.08)	56	ND	ND	ND	ND			
409	167	Air lift	12088	(1.32)	15.8	<1.17	15.81	241.75	51.64			
			12249	(0.90)	15.2	ND	ND	ND	ND			
409	167	Pump	21259	(1.05)	119	2.54	23.84	374.48	62.84			
			20962	(0.25)	109	ND	ND	ND	ND			884

(a) Water table at 242 ft bgs.
(b) Sample.
( ) = Less than sample quantitation limit for chromium.
< = Less than equipment quantitation limit value shown.
ND = Not determined.
U = Less than detected.

Table B.2. Results from Sampling During Development of Well 299-W11-46

Constituent	Results	Units
Aluminum	337	ug/L
Antimony	23U	ug/L
Barium	59	ug/L
Beryllium	0.18U	ug/L
Cadmium	0.86U	ug/L
Calcium	34400	ug/L
Chromium	248	ug/L
Cobalt	1.7U	ug/L
Copper	12.4	ug/L
Iron	612	ug/L
Magnesium	11100	ug/L
Manganese	35.7	ug/L
Nickel	4.5	ug/L
Potassium	5740	ug/L
Silver	2.2U	ug/L
Sodium	223000	ug/L
Strontium	177	ug/L
Vanadium	44.4	ug/L
Zinc	18.8	ug/L
Alkalinity	127000	ug/L
Chloride	27100	ug/L
Fluoride	3600	ug/L
Nitrate	465000	ug/L
Nitrite	122	ug/L
pH Measurement	8.11	pH
Specific Conductance	1279	uS/cm
Sulfate	66500	ug/L
Temperature	23.1	Deg C
Turbidity	5.13	NTU
Antimony-125	24.6U	pCi/L
Cesium-134	-11.9U	pCi/L
Cesium-137	-0.28U	pCi/L
Cobalt-60	-11.8U	pCi/L
Europium-152	8.33U	pCi/L
Europium-154	74U	pCi/L
Europium-155	42.2U	pCi/L
Potassium-40	-310U	pCi/L
Ruthenium-106	145U	pCi/L
Technetium-99	36000	pCi/L
Tritium	8650	pCi/L

Appendix C

Spectral Gamma Ray Logs and Gyroscope Survey Data Results

Spectral Gamma Ray Logs

Hanford Office

DOE-EM/GJ837-2005

299-W11-25 (C4669)
Log Data Report

Borehole Information:

Borehole:	299-W11-25 (C4669)		Site:	Near T Tank Farm	
Coordinates (WA State Plane)		GWL (ft)[1]:	241.8	GWL Date:	03/08/05
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
Not Available	Not Available	Mar. 2005	Not Applicable	408	Becker

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded steel	0.15	6 5/8	5 3/8	0.625	0.15	50
Becker dual wall (outer)	3.33	9	8	0.5	3.33	408
Becker dual wall (inner)	3.33	6.24	6	0.12	3.33	408

Borehole Notes:

This borehole was first drilled and logged in January 2005 to approximately 50 ft. The borehole was completed in March 2005 to an approximate depth of 408 ft. Casing diameter for the threaded steel casing was measured by the logging engineer using a steel tape. The Becker casing dimensions are derived from published specifications. Zero reference is the ground surface.

Logging Equipment Information:

Logging System:	Gamma 4E		Type: SGLS (70%) 34TP40587A
Calibration Date:	05/04	Calibration Reference:	DOE-EM/GJ692-2004
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 Repeat	3	4	5
Date	01/12/05	01/12/05	03/09/05	03/10/05	03/14/05
Logging Engineer	Spatz	Spatz	Pope	Pope	Pope
Start Depth (ft)	48.5	36.5	47.0	172.0	266.0
Finish Depth (ft)	0.5	31.5	173.0	267.0	408.0
Count Time (sec)	100	100	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A[3]	N/A	N/A	N/A	N/A
Pre-Verification	DE561CAB	DE561CAB	DE691CAB	DE701CAB	DE711CAB
Start File	DE561000	DE561049	DE691000	DE701000	DE711000
Finish File	DE561048	DE561054	DE691126	DE701095	DE711141

Log Run	1	2 Repeat	3	4	5
Post-Verification	DE561CAA	DE561CAA	DE691CAA	DE691CAA	DE711CAA
Depth Return Error (in.)	0	0	+ 1	- 3.5	- 2
Comments	No fine-gain adjustment made.	No fine-gain adjustment made.	No fine-gain adjustment made.	No fine-gain adjustment made.	Fine-gain adjustment made at 361 ft.

Log Run	6 Repeat	7 Repeat	8 Repeat		
Date	03/15/05	03/15/05	03/15/05		
Logging Engineer	Pope	Pope	Pope		
Start Depth (ft)	360.0	381.0	400.0		
Finish Depth (ft)	401.0	381.0	400.0		
Count Time (sec)	200	500	500		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A	N/A	N/A		
Pre-Verification	DE721CAB	DE721CAB	DE721CAB		
Start File	DE721000	DE721100	DE721101		
Finish File	DE721041	DE721100	DE721101		
Post-Verification	DE721CAA	DE721CAA	DE721CAA		
Depth Return Error (in.)	N/A	N/A	N/A		
Comments	No fine-gain adjustment made.	No fine-gain adjustment made.	No fine-gain adjustment made.		

Logging Operation Notes:

Zero reference was ground surface. Before starting log event 1 (January, 2005), the borehole was swabbed and no contamination was observed. Before placing the sonde in the borehole for log event 2 (March 2005), the Radiological Control Technician (RCT) noted there was ^{99}Tc on the pump and pipe that had been removed from the borehole. Consequently, a plastic sleeve was placed over the sonde before logging to prevent possible contamination. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the Spectral Gamma Logging System (SGLS) employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 115. Repeat log sections were acquired from 31.5 to 36.5 ft and 360 to 401 ft. Two depth intervals (381 and 400 ft) were selected for a 500-sec counting time.

Analysis Notes:

Analyst:	Henwood	Date:	03/17/05	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day of logging. All of the verification spectra were within the acceptance criteria. Examination of spectra indicates the detector functioned normally during logging, and the spectra are accepted.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. The verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G4EJul04.xls). The casing configuration for log event 1 (January 2005) was assumed as one string of 6-in. casing with a thickness of 5/8 in. to 48.9 ft (total logging depth). Dead time and water corrections were not required for log event 1. For log event 2 (March 2005), the casing configuration was assumed to be dual wall casing (8 and 6-in. ID) with an additive thickness of 0.620-in. from 50 to 408 ft. Corrections for these casing thicknesses were applied to the data. Joints where the casings are connected

have an additive thickness of 1.115-in.; no additional correction for the thicker joints was applied. A water correction was applied to the data below 241 ft.

Log Plot Notes:

Separate log plots are provided for naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of repeat logs versus the original logs are included. 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 correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it exhibited slightly higher net counts per second.

Separate plots are included for ^{60}Co (1173 and 1333 keV energy peaks) and total gamma. Because ^{60}Co is believed to exist in the groundwater, and not in the formation for which the calibration is valid, all detections of ^{60}Co are reported in counts per second (cps).

Results and Interpretations:

^{137}Cs was detected at the surface and at a few sporadic depth locations throughout the borehole near the MDL of 0.2 pCi/g. Except for the surface measurement, these detections are probably the result of statistical fluctuations and may not be valid.

^{60}Co was generally detected throughout the depth interval below the groundwater level of approximately 242 ft to total depth. The detections shown on the log plots are near the MDL of 0.05 cps. Close scrutiny of spectra recorded in the groundwater where detections are not shown suggests ^{60}Co exists, but the peaks were not considered statistically valid by the routine processing. This consistency of the existence of ^{60}Co at essentially indistinguishable count rates throughout the groundwater interval suggests the contaminant is in solution in the groundwater and not in the formation. Therefore, the calibration function based on uniform distribution in the formation is not considered valid for these occurrences of ^{60}Co. Consequently, all ^{60}Co detections are reported in cps.

Modeling of radiation was used for a scenario of the detector immersed in water contaminated with ^{60}Co (count rates determined from the SGLS measurements) inside a 6-in. ID casing and assuming no formation contamination. Modeling results suggest the concentration of ^{60}Co in the groundwater (determined from the 1333 keV energy peak) at the MDL of 0.05 cps would be approximately 50 pCi/L.

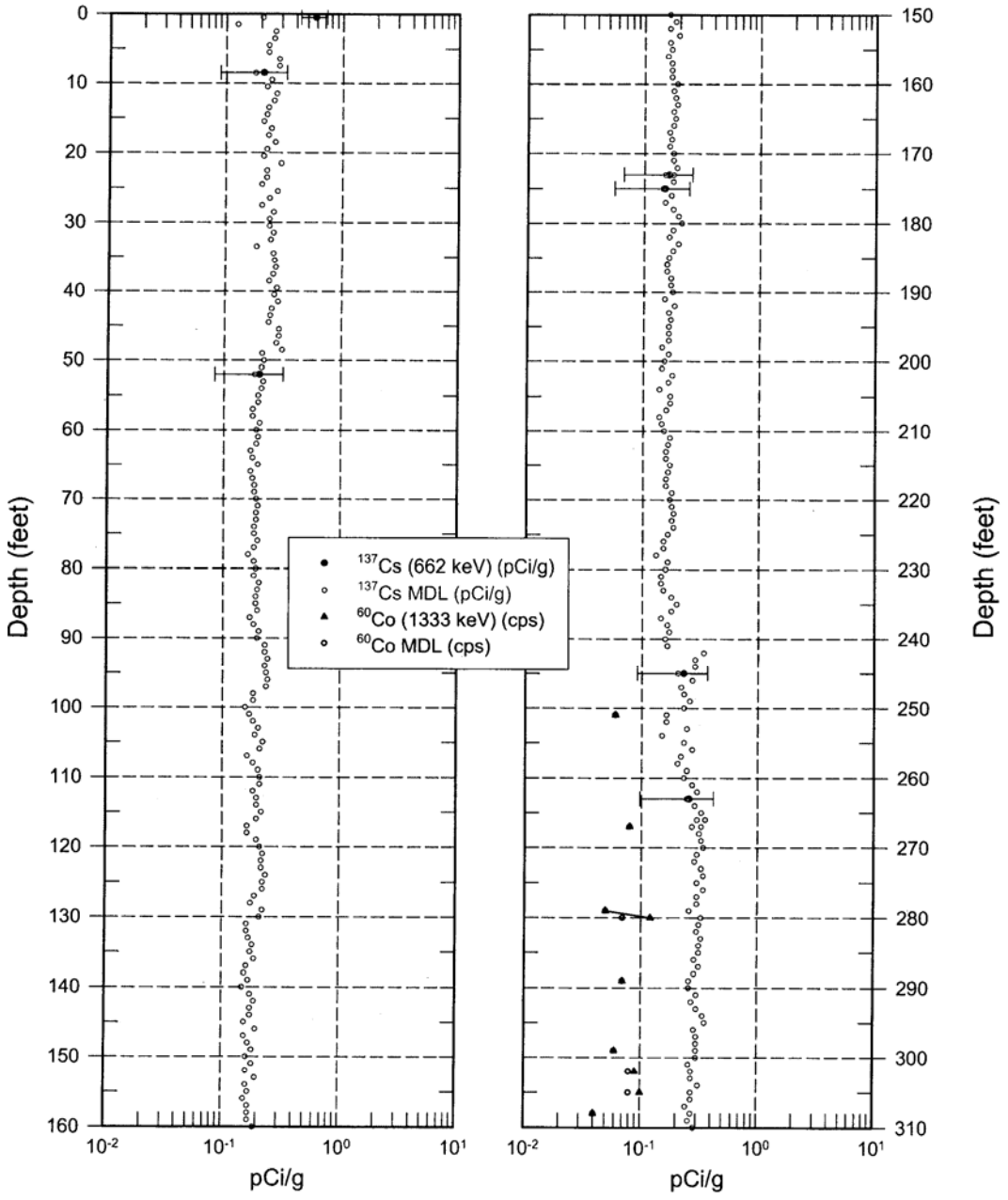
The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 1461, 1764, and 2614 keV. The repeat section plot of ^{60}Co in cps as determined from the 1173 and 1333 keV energy peaks indicate a lack of repeatability at these low levels of activity. Additional counting time would be necessary to reduce the MDL and improve the repeatability.

Enhanced levels of radon were observed in the borehole for the depth intervals from 172 to 267 ft (03/10/05) and from 266 to 408 ft (03/14/05).

---

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

299-W11-25 (C4669)
Man-Made Radionuclides

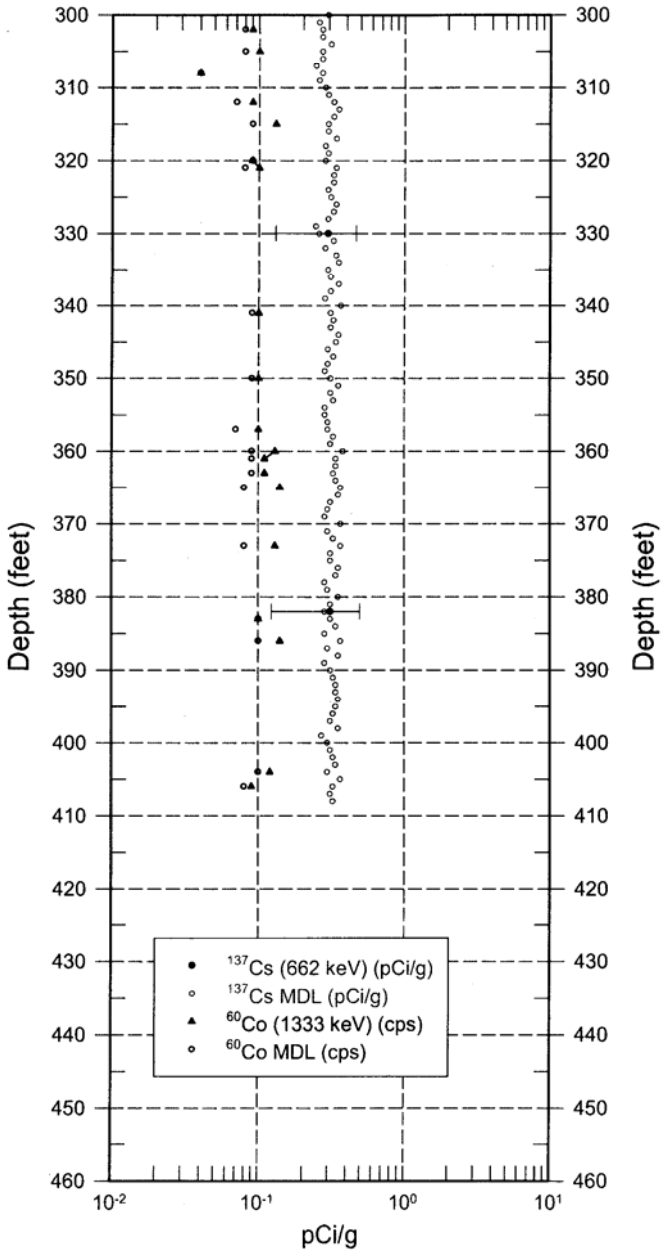


Zero Reference = Ground Surface

Depth Scale: 1"=20 ft

Last Log Date - 03/15/05

299-W11-25 (C4669)
Man-Made Radionuclides

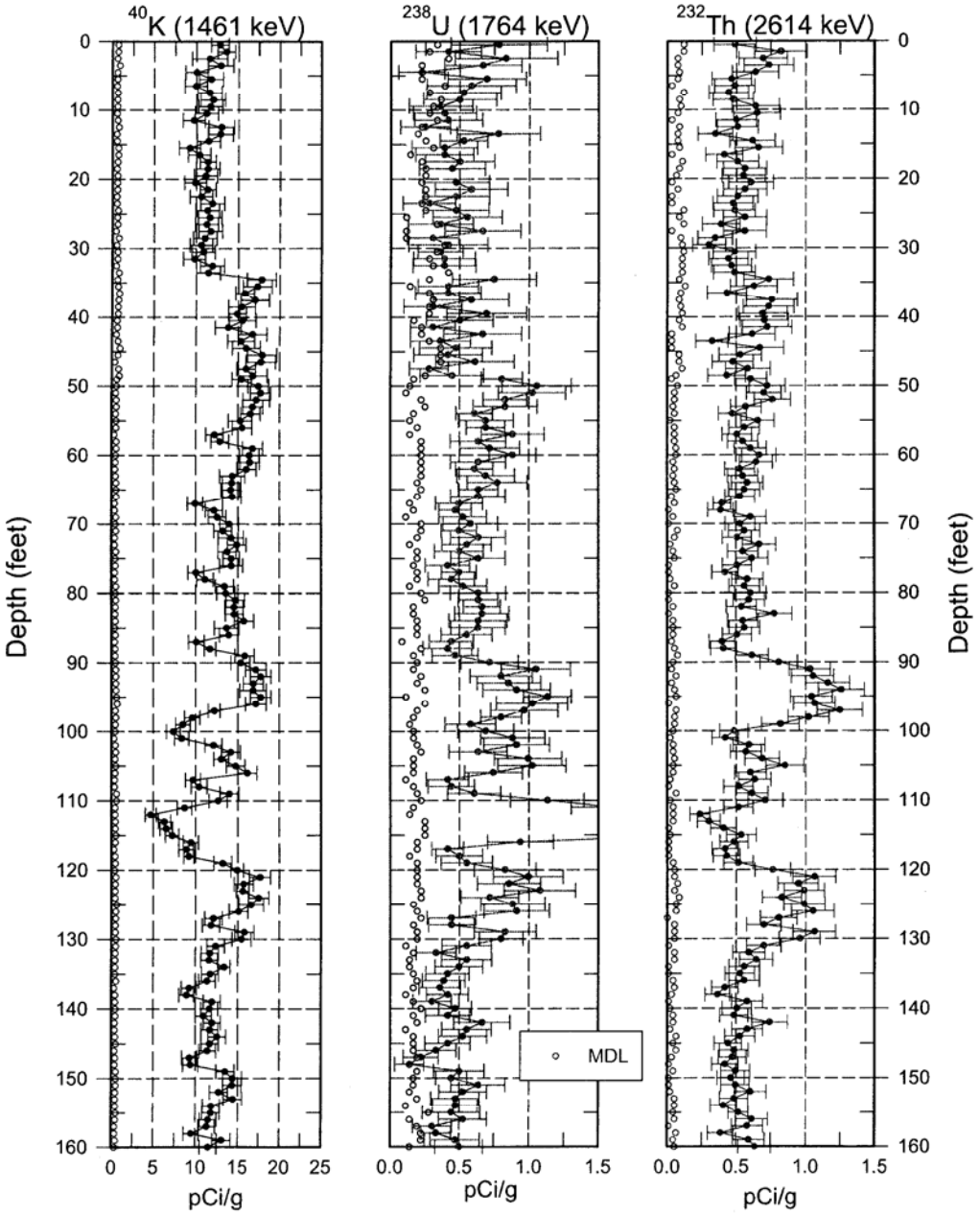


Zero Reference = Ground Surface

Depth Scale: 1"=20 ft

Last Log Date - 03/15/05

299-W11-25 (C4669)
Natural Gamma Logs

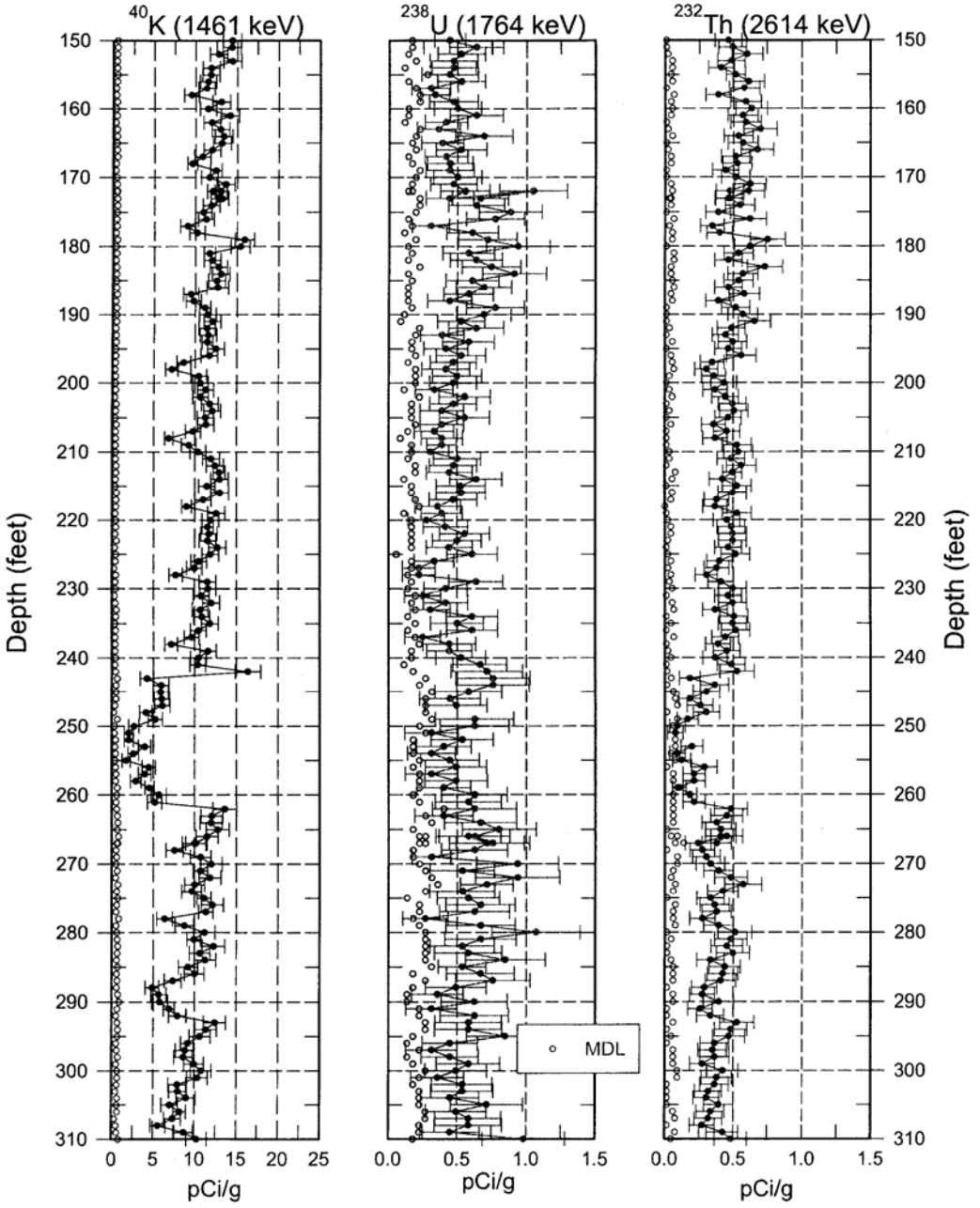


Zero Reference = Ground Surface

Depth Scale = 1" = 20 ft

Last Log Date - 03/15/05

299-W11-25 (C4669)
Natural Gamma Logs

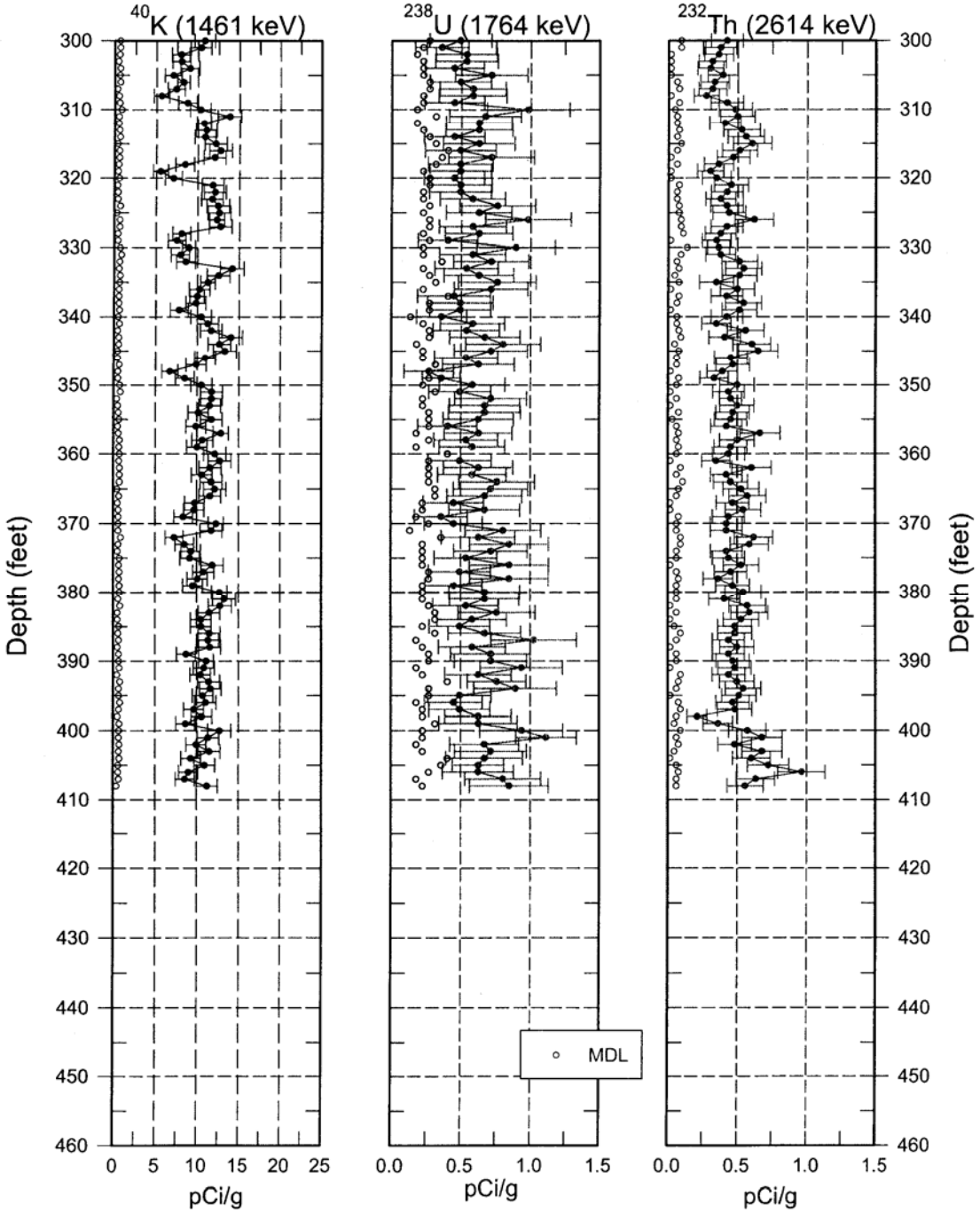


Zero Reference = Ground Surface

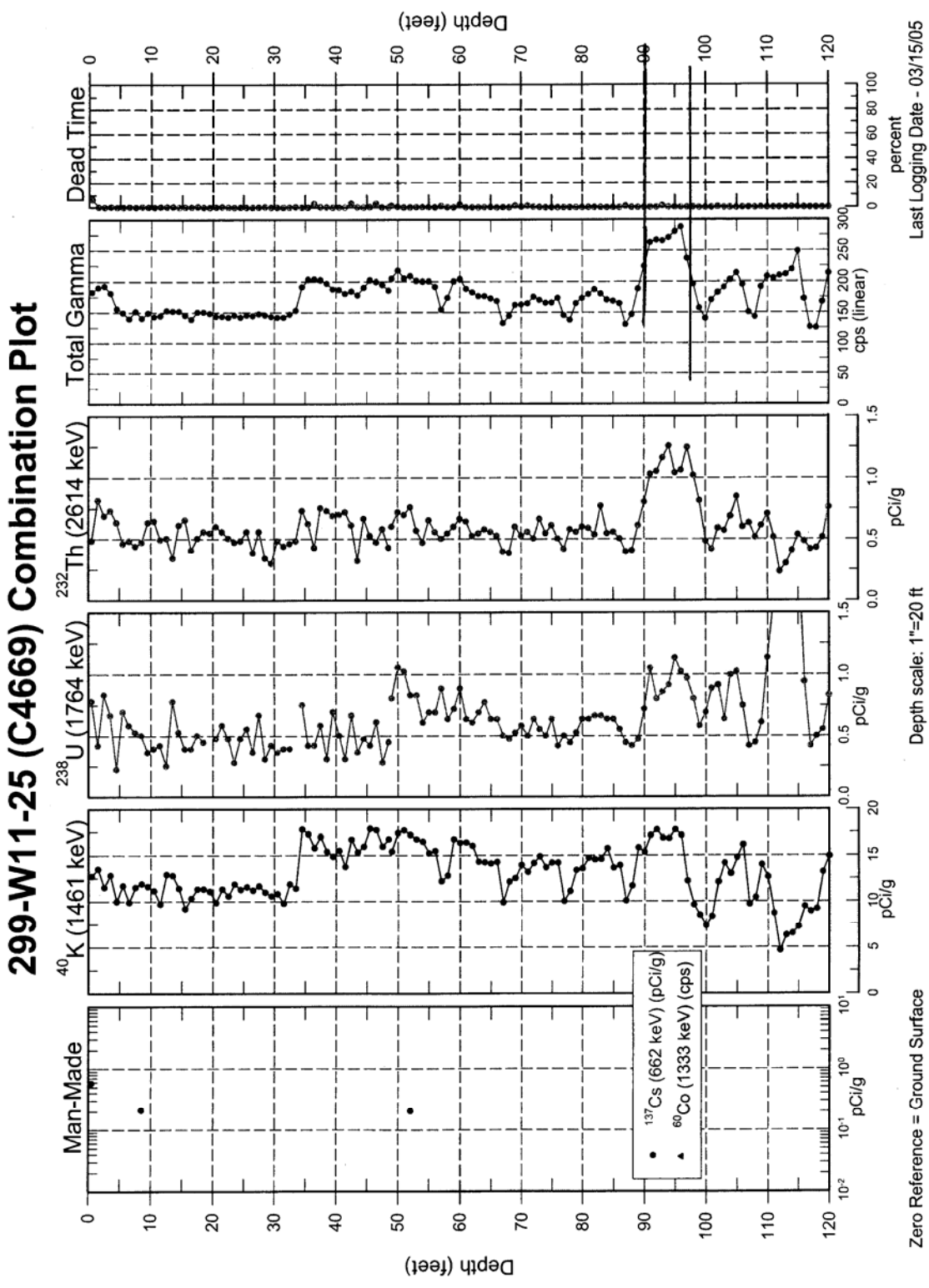
Depth Scale = 1" = 20 ft

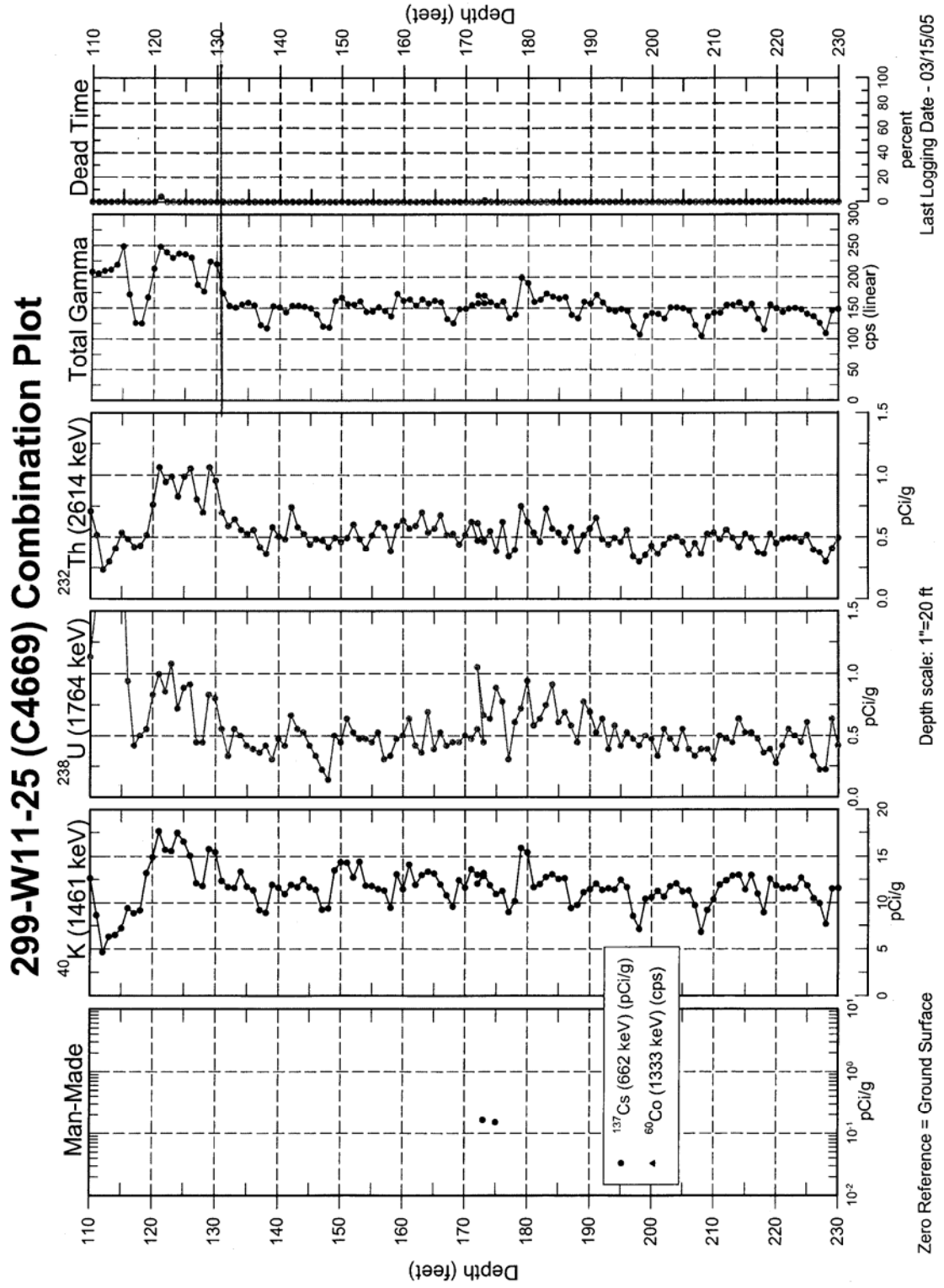
Last Log Date - 03/15/05

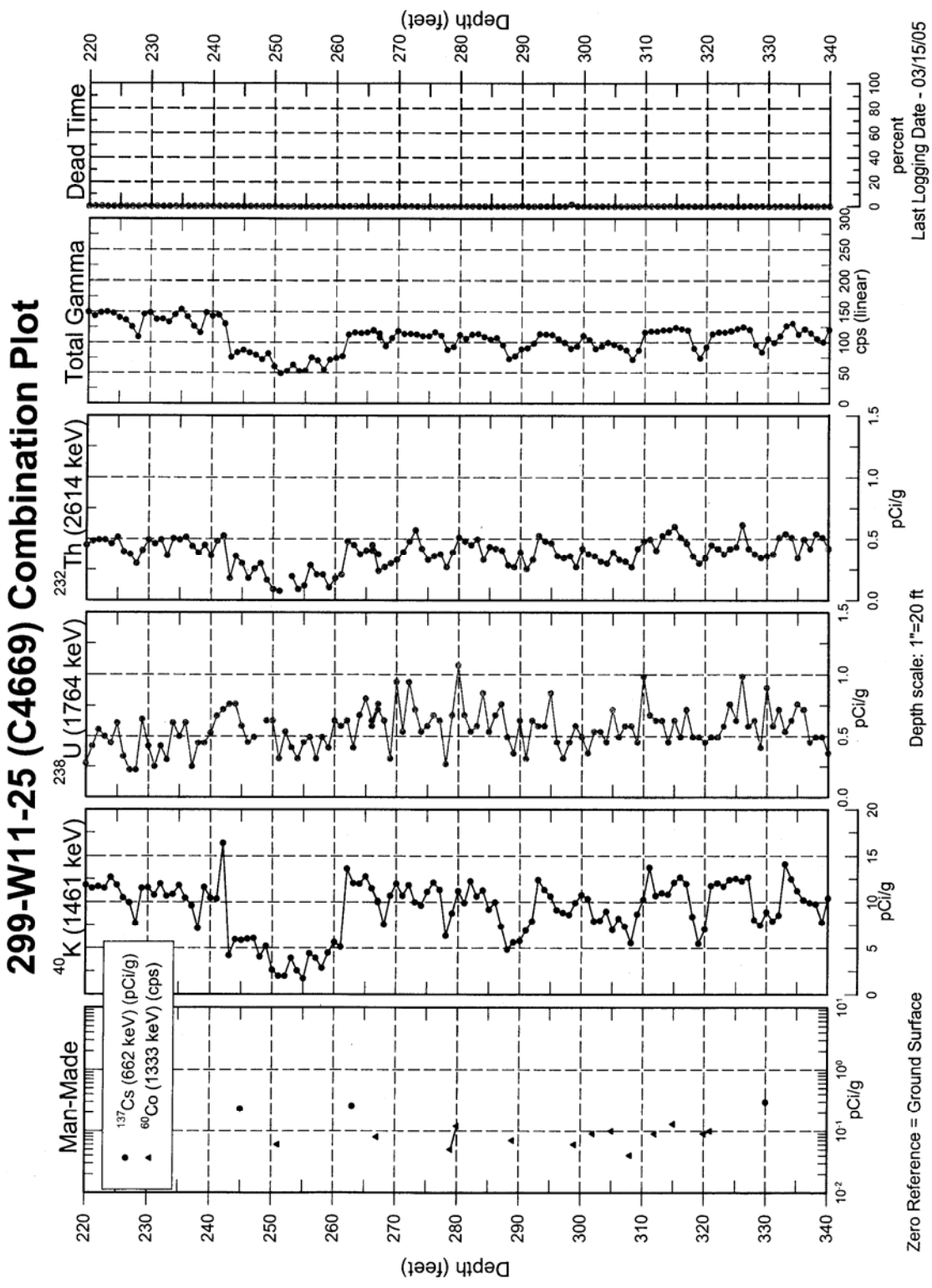
299-W11-25 (C4669)
Natural Gamma Logs

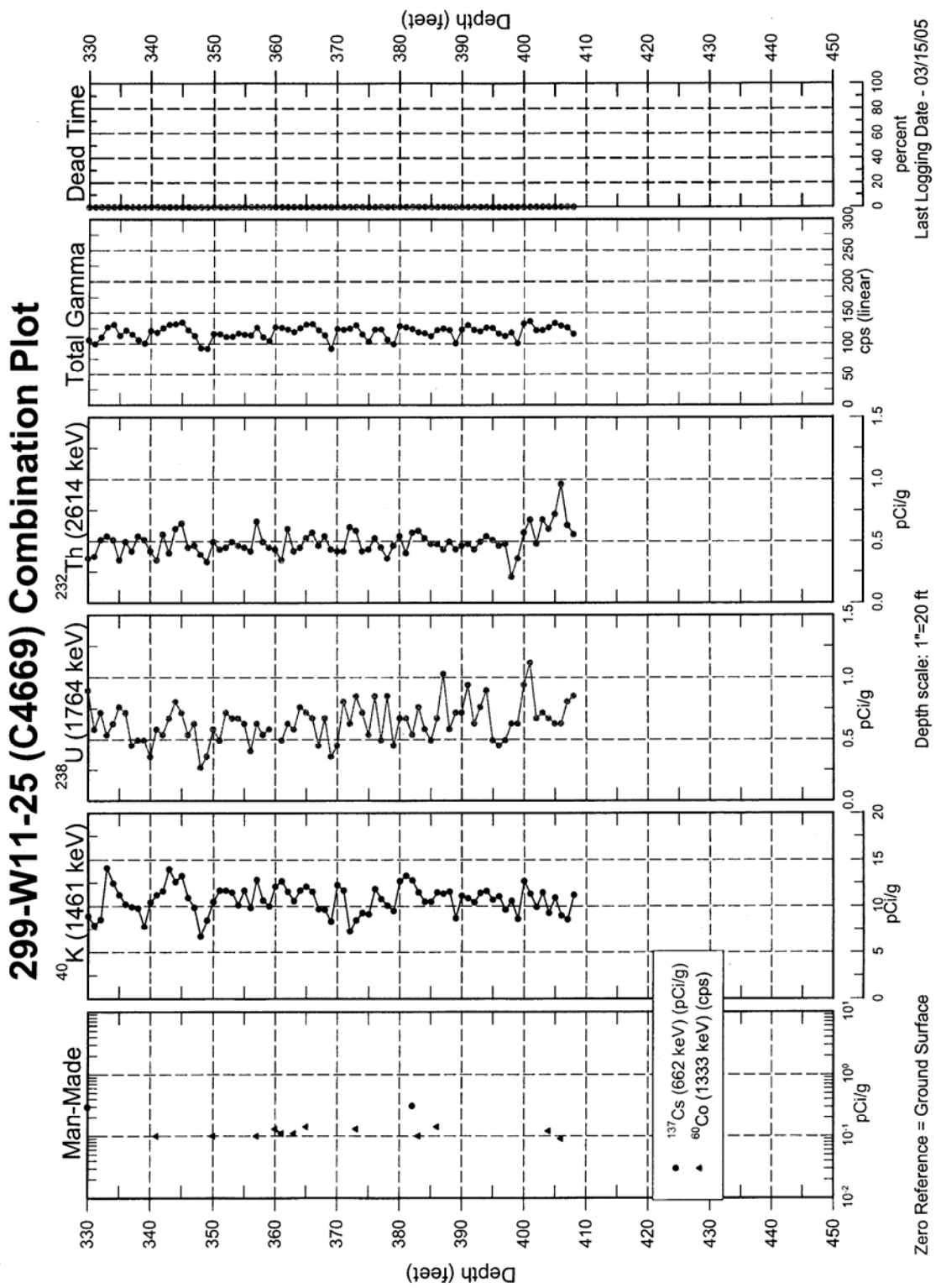


Zero Reference = Ground Surface Depth Scale = 1" = 20 ft Last Log Date - 03/15/05


299-W11-25 (C4669) Combination Plot
Man-Made
^{40}K (1461 keV)
^{238}U (1764 keV)
^{232}Th (2614 keV)
Total Gamma
Dead Time
Depth (feet)
pCi/g
cps (linear)
percent
^{137}Cs (662 keV) (pCi/g)
^{60}Co (1333 keV) (cps)
Zero Reference = Ground Surface
Depth scale: 1"=20 ft
Last Logging Date - 03/15/05

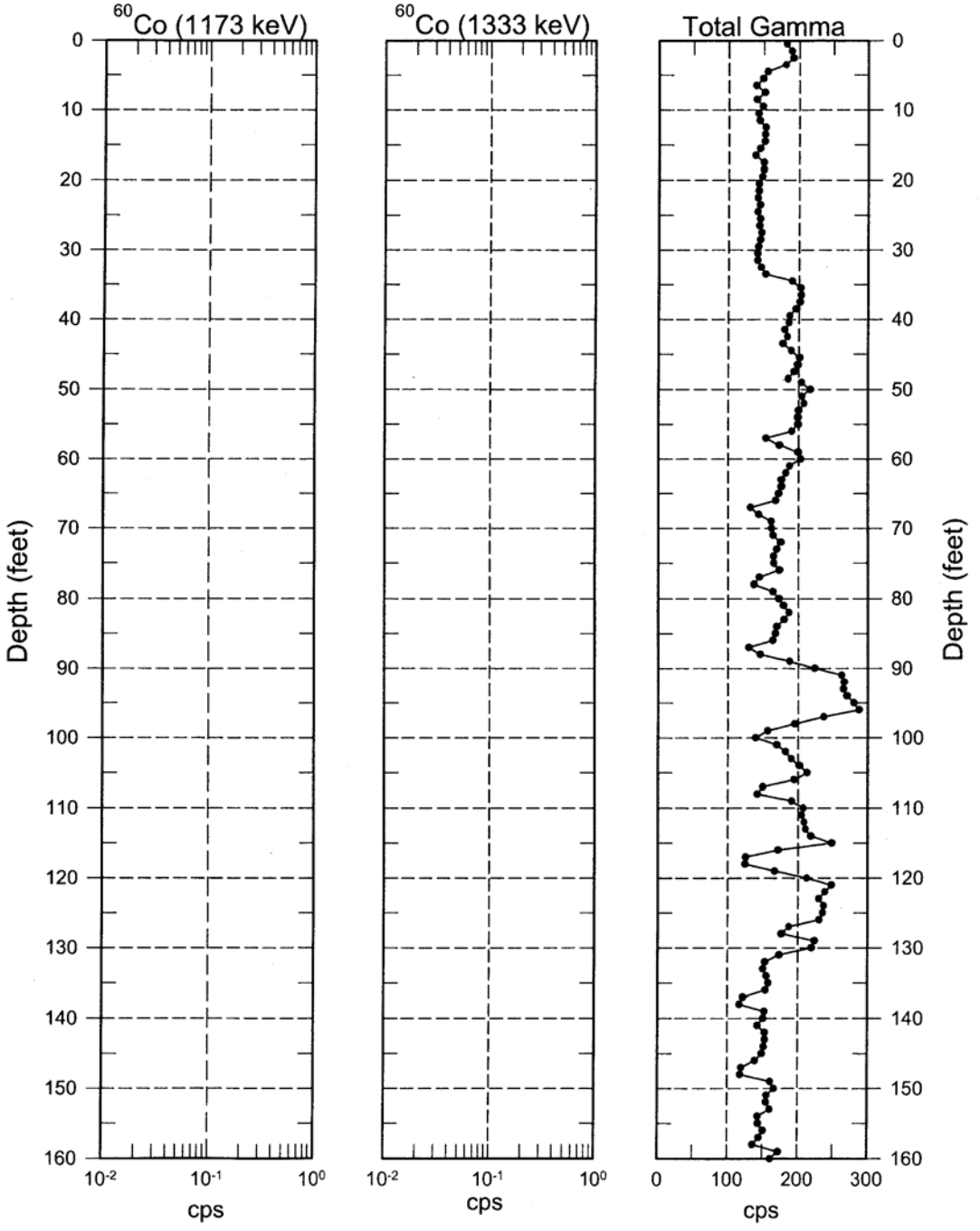

299-W11-25 (C4669) Combination Plot
Man-Made
^{40}K (1461 keV)
^{238}U (1764 keV)
^{232}Th (2614 keV)
Total Gamma
Dead Time
Depth (feet)
pCi/g
cps (linear)
percent
^{137}Cs (662 keV) (pCi/g)
^{60}Co (1333 keV) (cps)
Zero Reference = Ground Surface
Depth scale: 1"=20 ft
Last Logging Date - 03/15/05


299-W11-25 (C4669) Combination Plot
Man-Made
137Cs (662 keV) (pCi/g)
60Co (1333 keV) (cps)
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Dead Time
Depth (feet)
pCi/g
cps (linear)
percent
Zero Reference = Ground Surface
Depth scale: 1"=20 ft
Last Logging Date - 03/15/05


299-W11-25 (C4669) Combination Plot
Man-Made
^{40}K (1461 keV)
^{238}U (1764 keV)
^{232}Th (2614 keV)
Total Gamma
Dead Time
Depth (feet)
^{137}Cs (662 keV) (pCi/g)
^{60}Co (1333 keV) (cps)
pCi/g
cps (linear)
percent
Zero Reference = Ground Surface
Depth scale: 1"=20 ft
Last Logging Date - 03/15/05

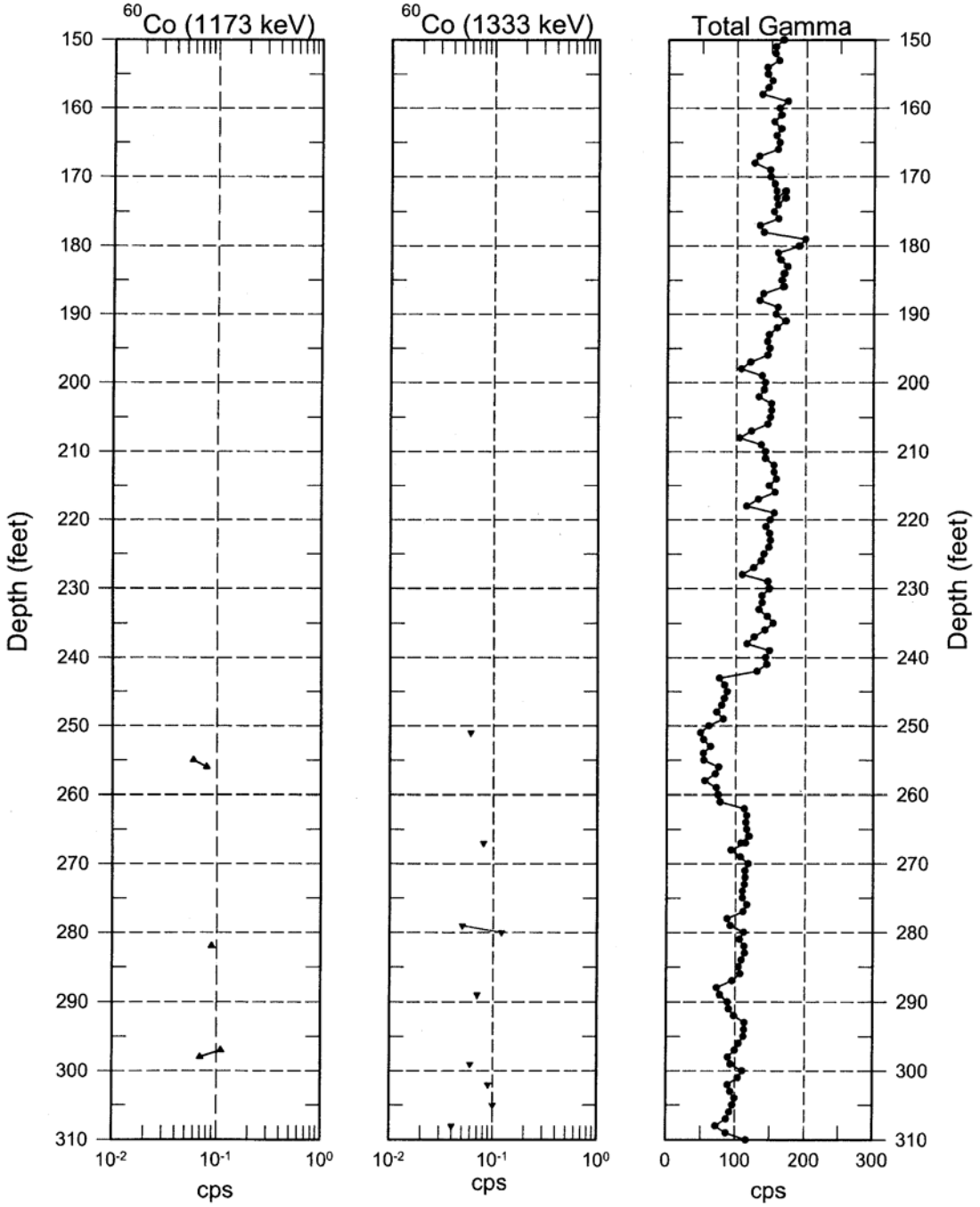
299-W11-25 (C4669)

^{60}Co & Total Gamma



299-W11-25 (C4669)

^{60}Co & Total Gamma



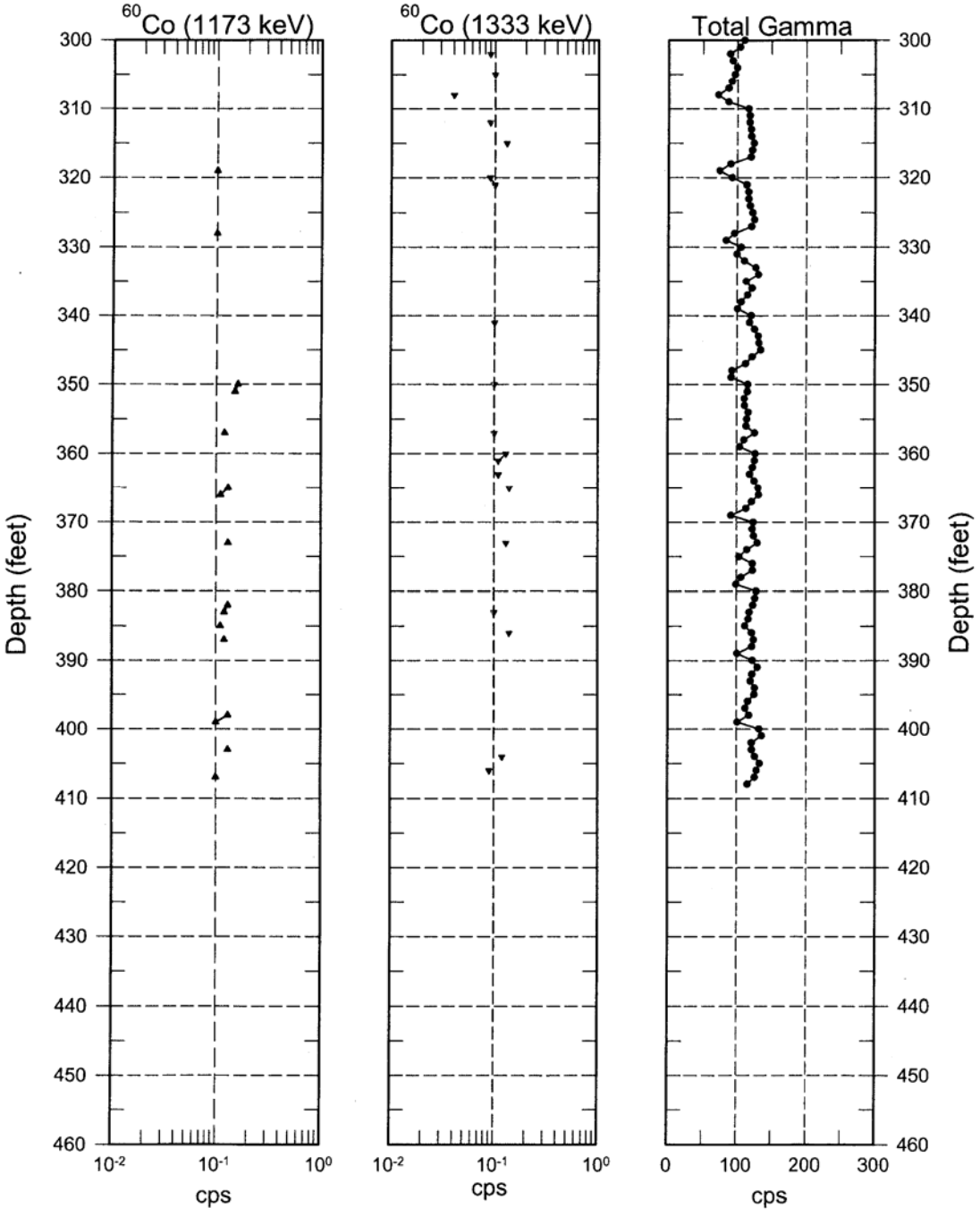
Zero Reference = Ground Surface

Depth Scale = 1" = 20 ft

Last Log Date - 03/15/05

299-W11-25 (C4669)

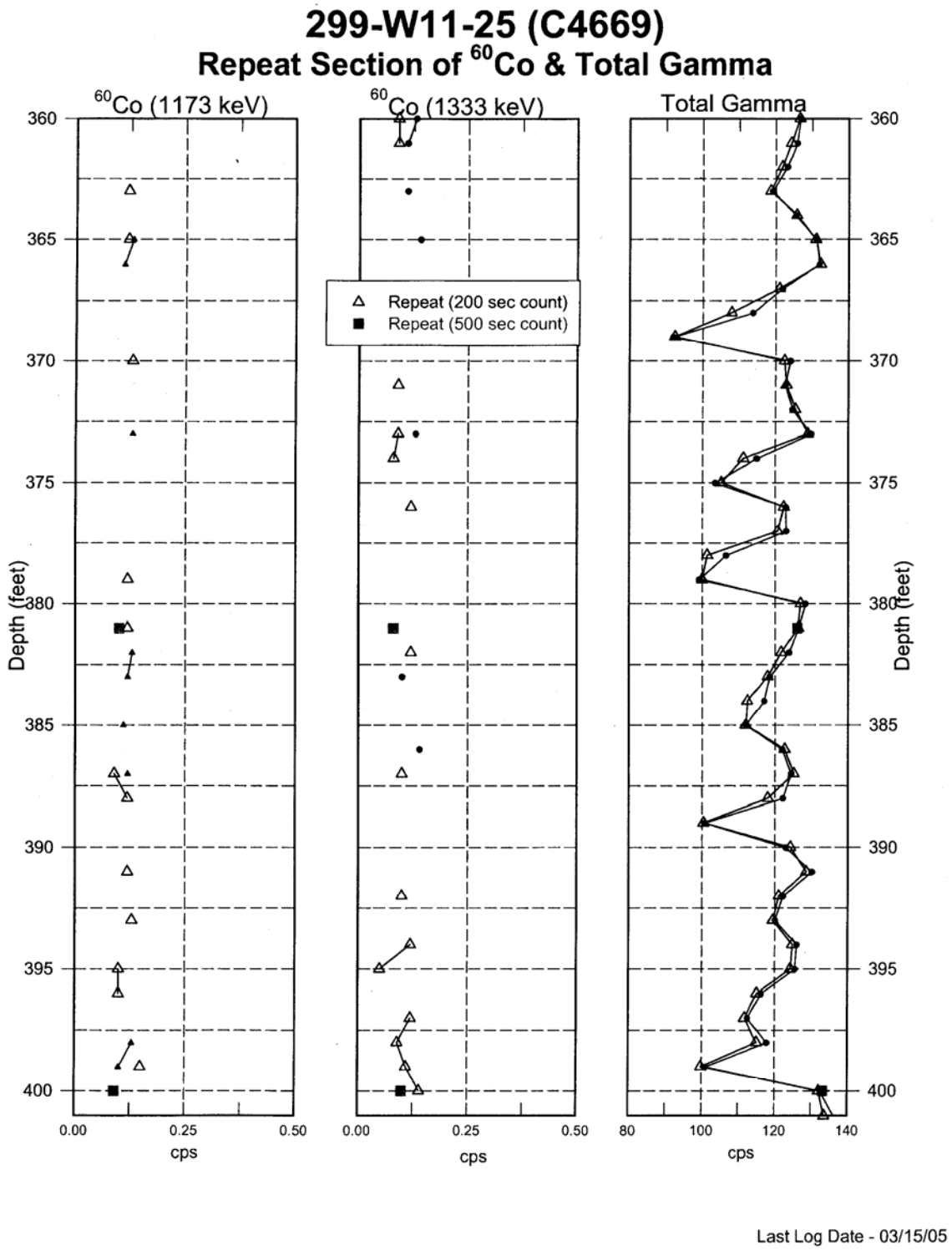
^{60}Co & Total Gamma

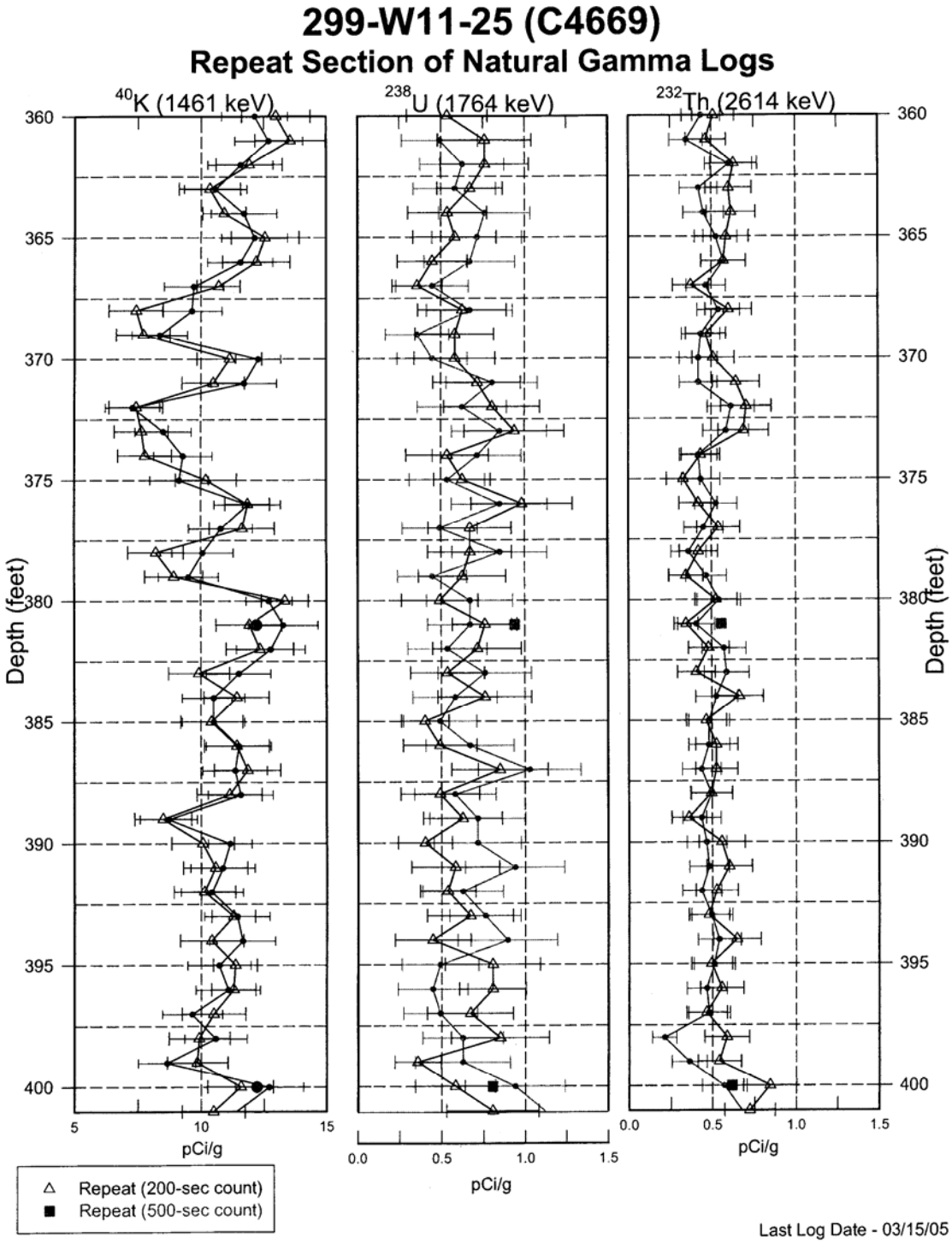


Zero Reference = Ground Surface

Depth Scale = 1" = 20 ft

Last Log Date - 03/15/05


299-W11-25 (C4669)
Repeat Section of 60Co & Total Gamma
60Co (1173 keV)
60Co (1333 keV)
Total Gamma
Repeat (200 sec count)
Repeat (500 sec count)
Depth (feet)
360
365
370
375
380
385
390
395
400
0.00
0.25
0.50
80
100
120
140
cps
Last Log Date - 03/15/05


299-W11-25 (C4669)
Repeat Section of Natural Gamma Logs
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Depth (feet)
360
365
370
375
380
385
390
395
400
5
10
15
0.0
0.5
1.0
1.5
pCi/g
Repeat (200-sec count)
Repeat (500-sec count)
Last Log Date - 03/15/05

Gyroscope Survey Data Results

Survey File: C:\DSE\C4950.RAW
Date: Sep 23, 2005
Time: 10:24
Description: Borehole Deviation Survey
LOCATION: 299-W11-46
CUSTOMER: PNNL
OPERATOR: Weakley
Comments:

HUMPHREY TOOL IDENTIFICATION
Gyroscope Model: DG69-0901-4 #4654
TX Series #0002
EI Series #0003
AC Series #0004
Accel.Voltage Limits: Xmax= 9.92; Xmin=-9.89; Ymax= 9.9; Ymin=-9.89
Comments:

Warm-Up Duration: 30.11 min
----------SURVEY REFERENCE DATA----------
Sight Reference Description: Corresponding Magnetic Compass Reading
Well 299-W11-42
Local Magnetic Declination: 19 deg.
REFERENCE SUMMARY
Survey Reference Point: 161 deg.
Local Grid Offset: -19 deg.
Drift Correction Method: Least Squares Drift Linearization
Computation Method: Minimum Curvature

Target Direction (deg): 0
INRUN record set

Measured Depth (feet)	Course Inclin fromVert.	Course Direction (deg)	TrueVert. Depth (feet)	Rectangular Coordinates +N/-S	+E/-W	Dogleg Severity °/100 f	Vertical Section (feet)
0.00	0.84	180.7	0.00	0.00	0.00	0.00	0.0
20.00	0.94	193.5	20.00	-0.31	-0.04	1.10	-0.3
40.00	1.47	211.5	39.99	-0.68	-0.21	3.20	-0.7
60.00	1.80	216.4	59.99	-1.15	-0.53	1.80	-1.2
80.00	2.12	234.4	79.97	-1.62	-1.02	3.40	-1.6
100.00	1.91	242.9	99.96	-1.99	-1.62	1.80	-2.0
120.00	2.34	250.7	119.95	-2.28	-2.30	2.60	-2.3
140.00	2.78	259.4	139.93	-2.50	-3.16	2.90	-2.5
160.00	2.89	258.0	159.90	-2.69	-4.13	0.60	-2.7
180.00	2.12	221.0	179.88	-3.08	-4.87	8.70	-3.1
200.00	2.67	166.4	199.87	-3.81	-5.00	11.20	-3.8
220.00	2.49	127.9	219.85	-4.53	-4.55	8.50	-4.5
240.00	1.70	81.7	239.84	-4.75	-3.91	9.00	-4.8
260.00	3.07	19.9	259.82	-4.21	-3.44	13.60	-4.2
276.40	5.74	351.2	276.18	-2.98	-3.41	20.70	-3.0

Bottom:
True Vertical Depth 276.18 feet
Closure Distance 4.5 feet
Closure Direction 228.8 deg.
Course Direction 351.2 deg.

DEFINITIONS:

Closure Direction:	An angle between Main Reference direction (for example True North) and a line from coordinate origin to horizontal projection of current borehole point.
Closure Distance:	A distance between coordinate origin and a horizontal projection of current borehole point.
Course Direction:	An angle between Main Reference direction and a tangent to a horizontal projection of the borehole in current point.
ToolFace Gravity:	An angle between tool reference mark direction and a tangent to a horizontal projection of the borehole.
ToolFace Gyro:	An angle between tool reference mark direction and initial Survey Sight direction (which is gyroscope direction, if gyro drift =0).

Appendix D

Slug Test Characterization Results for Well 299-W11-25B (C4669)

Battelle
. . . Putting Technology To Work

Project No. F71091

Internal Distribution
E.P. Dresel
J.S. Fruchter
S.P. Luttrell
R.M. Smith
B.A. Williams

File/LB

Date March 16, 2005

To D. G. Horton

From F.A. Spane

Subject Interim Report: Preliminary Slug Test Characterization Results for Multi- Test/Depth Intervals Conducted During the Drilling of WMA-T Well 299-W11-25B (C4669)

The following interim report presents preliminary analysis results for multi-stress slug tests that were performed at five specific test/depth intervals within well 299-W11-25B (C4669). A final detailed letter report will be issued in approximately three months, which will include the complete final analysis results and test descriptions for the respective test/depth zone intervals. The well is located immediately outside the Waste Management Area T (WMA-T), as indicated in Figure 1 (designated Well T-1). The test intervals were characterized as the borehole was advanced to its final depth to the top of the Lower Mud at ~124.7 m below ground surface (bgs). The primary objective of the hydrologic tests was to provide information pertaining to the variability and vertical distribution of hydraulic conductivity with depth within this region of the WMA-T facility. This type of characterization information is important for predicting/simulating contaminant migration (i.e., numerical flow/transport modeling) and designing proper monitor well strategies for WMA locations.

Summary

Overall, the test results indicate that slug testing can be utilized to provide high-quality, vertically distributed hydraulic property characterization information. Diagnostic analysis of slug tests conducted for the various test/depth intervals indicate expected exponential decay (over-damped) conditions for three of the five test depth intervals (Table 1). Heterogeneous formation/composite response conditions were indicated for two of the test/depth intervals (Zones 2 and 3). This composite pattern exhibits a high permeability, inner zone response (oscillatory, under-damped), which is superimposed on a lower permeability (exponential decay, over-damped) outer zone formation response. An example of this type of response condition is shown in Figure 2. It is currently not known whether the high permeability inner zone represents the natural in-situ formation or is reflective of artificially created conditions due to setting of the packer/well-screen assembly and retraction of the drill casing to expose the test/depth interval. An examination of the drilling log geologic description indicates that 4 to 5-in cobbles embedded in a sand/silt matrix are representative of these two depth test intervals. Creation of an artificial high permeability inner zone (surrounding the temporary well screen), representative of dislodged cobbles during retraction of the drill casing, therefore, is a possibility.

Results from discrete test/depth interval slug test characterization during drilling of well 299-W11-25B are representative of the middle Ringold Formation (Unit 5). Hydraulic conductivity estimates range between 0.73 and 8.21 m/day (Table 2). These hydraulic conductivity estimates do not include values determined for the high permeability inner zones that were exhibited for Test Zones 2 and 3. The results for the high-K inner zone are listed as >100 m/day. A more quantitative value for these high permeability tests is not available (at this time), since (as noted in Zubruchen et al. 2002 and Butler et al. 2003) these type of analyses require the pressure sensor for monitoring slug test responses to be located in close proximity of the water-table surface. This was not the test system deployment utilized for these two test/depth intervals.

Figure 3 shows the vertical depth distribution of hydraulic conductivity determined for the five test/depth intervals for the well site location. When combined with results obtained at nearby well 299-W11-39, together with subsequent testing following well completion, approximately 45% of the composite unconfined aquifer will be characterized at this test site location.

For areal comparison purposes, Figures 4 and 5 present hydraulic conductivity histogram analysis results for other, recently tested WMA T and TX-TY test wells (combined), and WMA T wells (only), respectively. These test results are reported in Spane et al. (2001a, 2001b, 2002, 2003) and Spane and Newcomer (2003), and are reflective of hydraulic conditions within the upper 10 m of the unconfined aquifer. The vertical depth results at well 299-W11-25 (Table 2) are generally lower than the geometric mean value of 5.66 m/day calculated previously for **all** shallow WMA T wells (Figure 5). A closer association, however, is exhibited for the upper depth zones at well 299-W11-25 (Table 2) and three neighboring wells located along the north-northeast boundary of the WMA T (i.e., 299-W10-23, -W10-24, -W11-39), which exhibit values ranging between 1.6 and 2.4 m/day.

References

Butler and Garnett 2000 – Table D.2

Butler JJ, Jr., EJ Garnett, and JM Healey. 2003. "Analysis of slug tests in formations of high hydraulic conductivity." *Ground Water* 41(5):620-630.

Spane FA and DR Newcomer. 2003. "Results of detailed hydrologic characterization tests – FY 2003." PNNL-14804, Pacific Northwest National Laboratory, Richland, Washington.

Spane FA, Jr., PD Thorne, and DR Newcomer. 2001a. *Results of detailed hydrologic characterization tests – fiscal year 1999*. PNNL-13378, Pacific Northwest National Laboratory, Richland, Washington.

Spane FA, Jr., PD Thorne, and DR Newcomer. 2001b. *Results of detailed hydrologic characterization tests – fiscal year 2000*. PNNL-13514, Pacific Northwest National Laboratory, Richland, Washington.

Spane FA, Jr., PD Thorne, and DR Newcomer. 2002. *Results of detailed hydrologic characterization tests – fiscal year 2001*. PNNL-14113, Pacific Northwest National Laboratory, Richland, Washington.

Spane FA Jr., PD Thorne, and DR Newcomer. 2003. *Results of detailed hydrologic characterization tests – FY 2002*. PNNL-14186, Pacific Northwest National Laboratory, Richland, Washington.

Thorne et al. 1993 – Table D.1

Zubruchen BR, VA Zlotnik, and JJ Butler, Jr. 2002. “Dynamic interpretation of slug tests in highly permeable aquifers.” *Water Resources Research*, 38(3):10.1029/2001WR000354.

Table D.1. Slug-Test Characteristics for Selected Test/Depth Intervals at Well 299-W11-25B

Test Zone	Test Parameters				Diagnostic Slug Test Response Model	Hydrogeologic Unit Tested
	Test Date	Number of Slug Tests	Depth to Water (m bgs)	Depth/Test Interval (m bgs)		
Zone 1	2/9/05	3	73.75	82.30 - 85.34 (3.04)	Exponential Decay (over-damped)	Ringold Formation (Unit 5)
Zone 2	2/10/05	4	-	85.34 -88.38 (3.04)	Composite: HighK Oscillatory (under-damped) inner zone/and Exponential Decay (over-damped) outer zone	Ringold Formation (Unit 5)
Zone 3	2/16/05	3	73.80	88.09 - 91.13 (3.04)	Composite: HighK Oscillatory (under-damped) inner zone/and Exponential Decay (over-damped) outer zone	Ringold Formation (Unit 5)
Zone 4	2/18/05	3	73.73	97.26 - 100.30 (3.04)	Exponential Decay (over-damped)	Ringold Formation (Unit 5)
Zone 5	2/24/05	3	73.79	106.68 - 109.72 (3.04)	Exponential Decay (over-damped)	Ringold Formation (Unit 5)

Note: For all test wells, r_c = 0.051 meter; r_w = 0.1143 meter.
Unit number in parentheses indicates the relevant groundwater-flow model layer, as described in Thorne et al. 1993.

Table D.2. Preliminary Slug-Test Results

Test Zone	Bouwer and Rice Analysis Method	Type-Curve Analysis Method		High-K Analysis Method[(b)]	
	Hydraulic Conductivity, $K_{h,}$[(a)] (m/day)	Hydraulic Conductivity, $K_{h,}$[(a)] (m/day)	Specific Storage, S_s (m^{-1})	Hydraulic Conductivity, $K_{h,}$[(a)] (m/day)	Dimensionless Damping Parameter, C_D
Zone 1	(analysis in progress)	2.59 - 3.02 (2.79)	3.0E-5 - 5.0E-5	NA	NA
Zone 2	(analysis in progress)	Outer Zone: 0.73 (analysis in progress)	1.0E-5	Inner Zone: >100	0.275
Zone 3	(analysis in progress)	Outer Zone: 1.60 - 1.81 (analysis in progress)	1.0E-6	Inner Zone: >100	0.25 - 0.35
Zone 4	(analysis in progress)	3.89 (analysis in progress)	1.0E-5	NA	NA
Zone 5	(analysis in progress)	7.34 - 8.21 (analysis in progress)	1.0E-4 - 1.0E-5	NA	NA

NA = Not applicable analytical method.
Number in parentheses is the average value for all tests.
(a) Assumed to be uniform within the well-screen test section. For tests exhibiting a heterogeneous formation response, only outer zone analysis results are considered representative of in-situ formation conditions.
(b) Standard analytical methods are not valid. Results based on High-K analysis method presented in Butler and Garnett (2000).

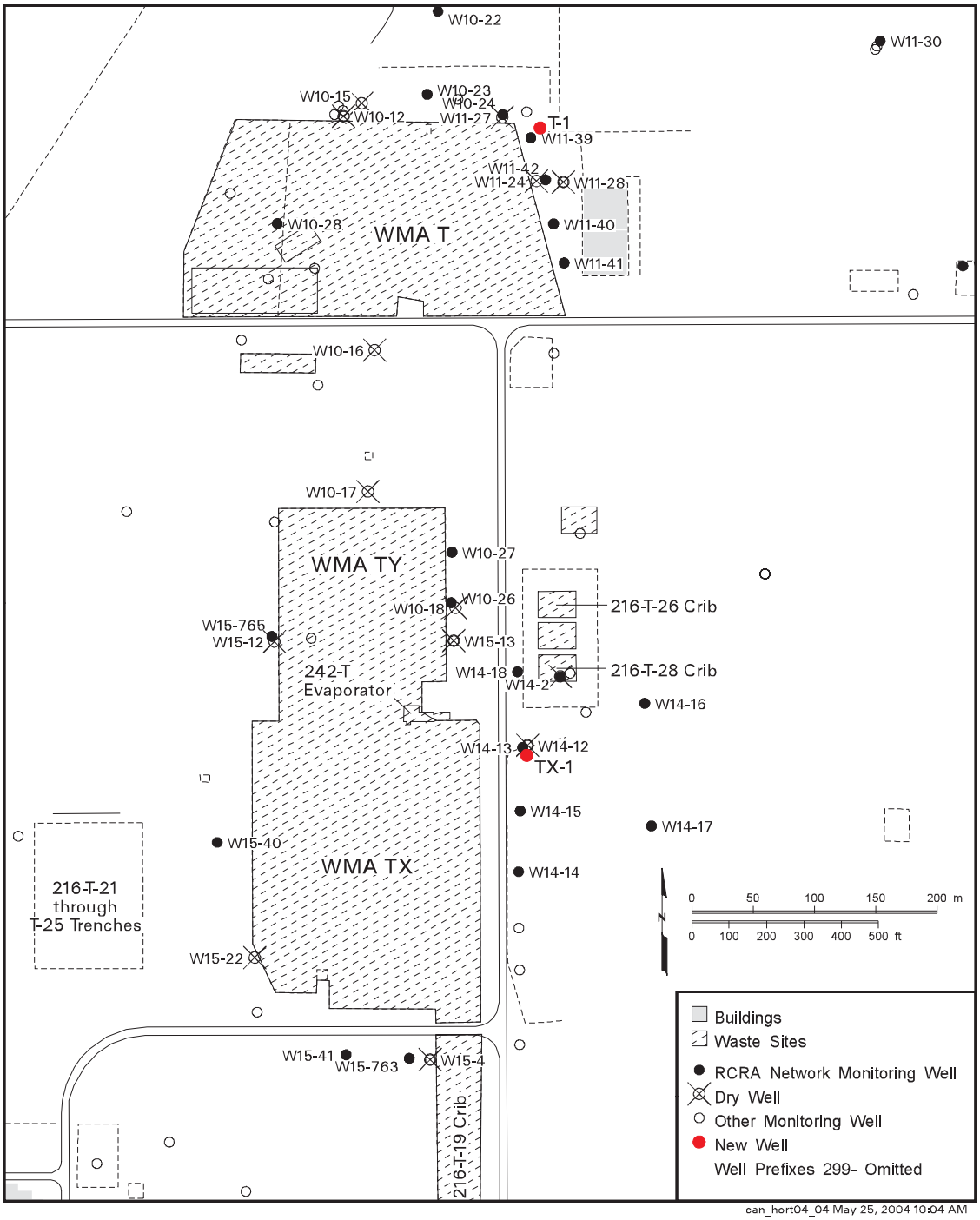


Figure D.1. Site Location Map

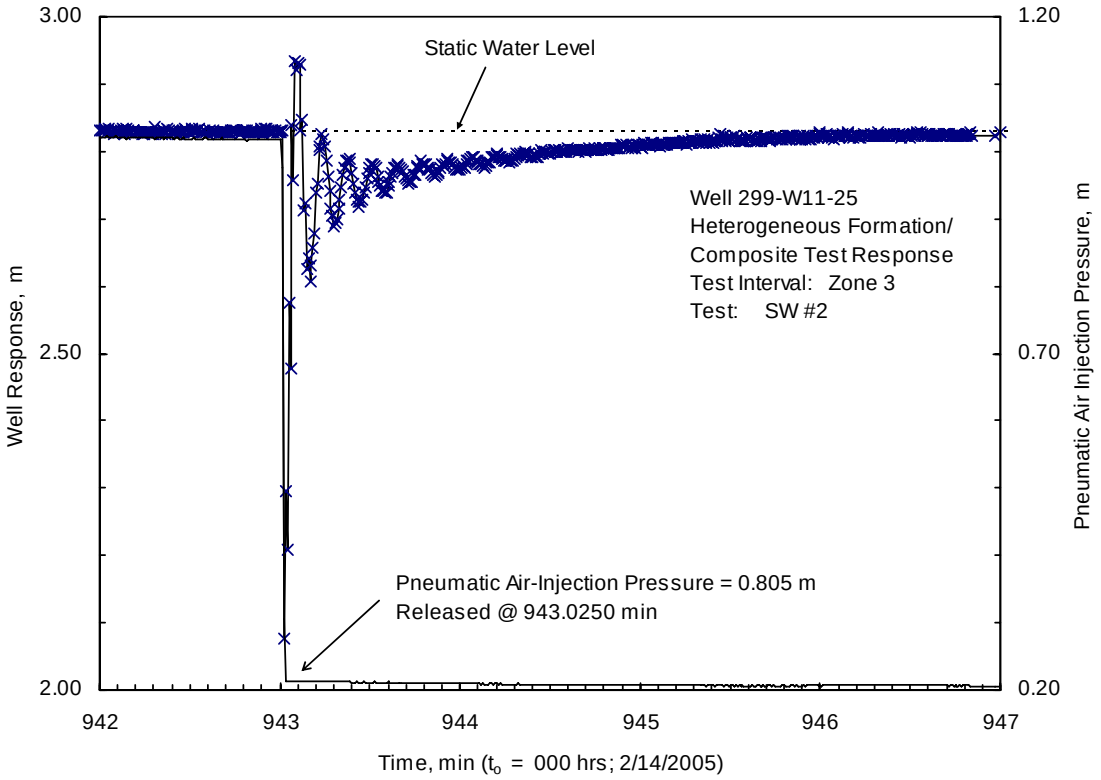


Figure D.2. Example of Heterogeneous Formation/Composite Test Response: Test Zone 3

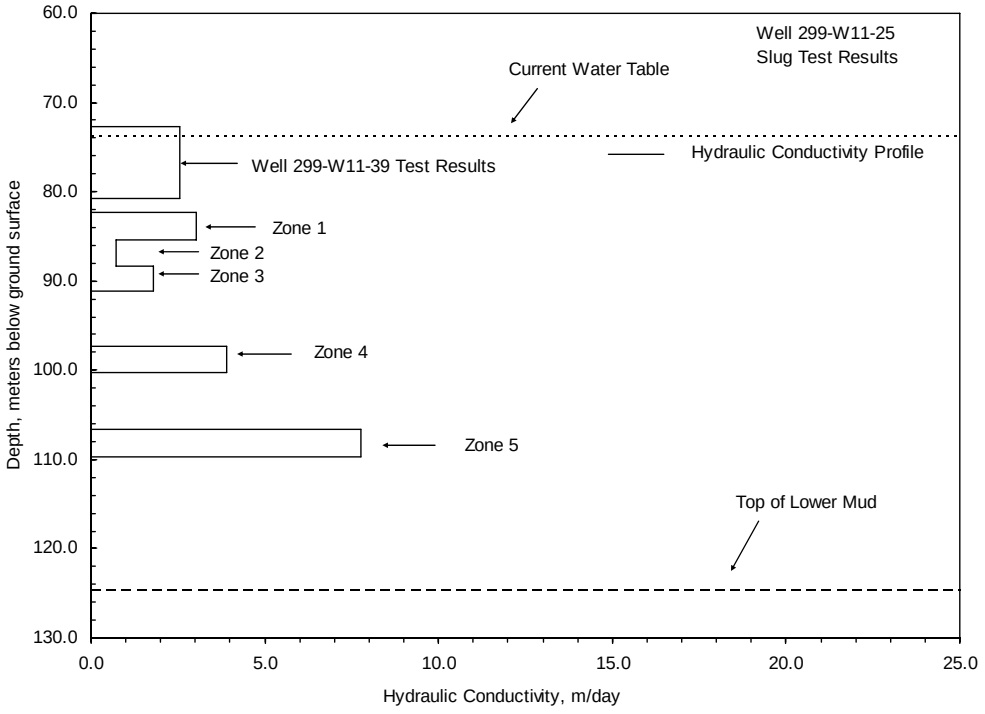


Figure D.3. Preliminary Hydraulic Conductivity Profile at Borehole 299-W11-25B

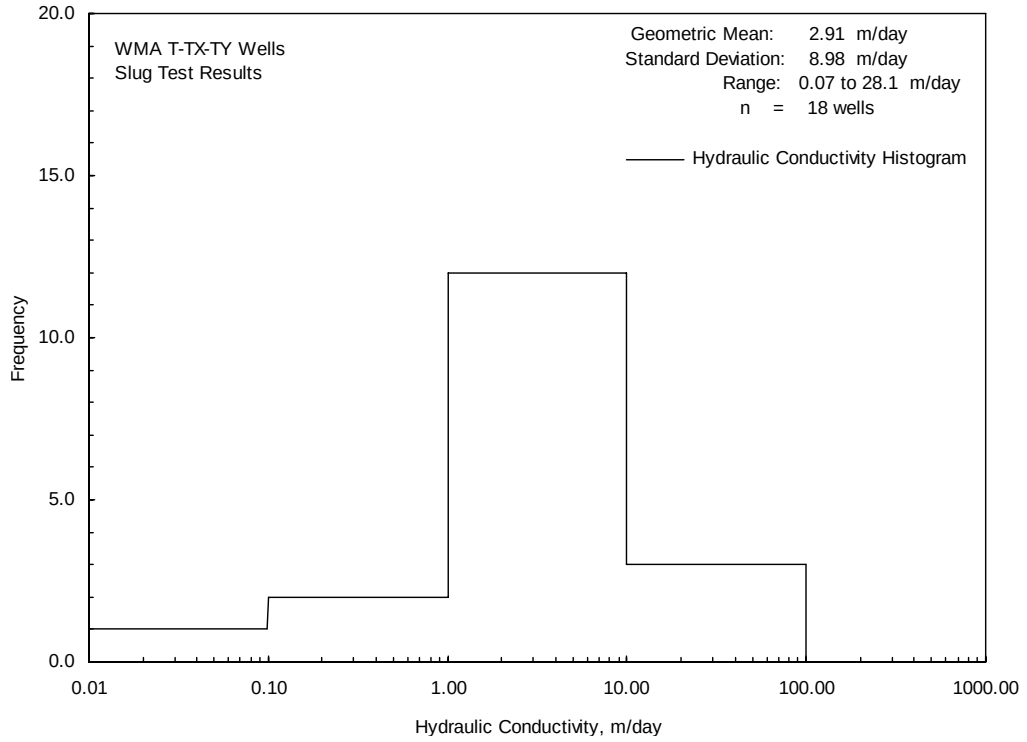


Figure D.4. Hydraulic Conductivity Histogram for Recently Tested WMA T and TX-TY Wells

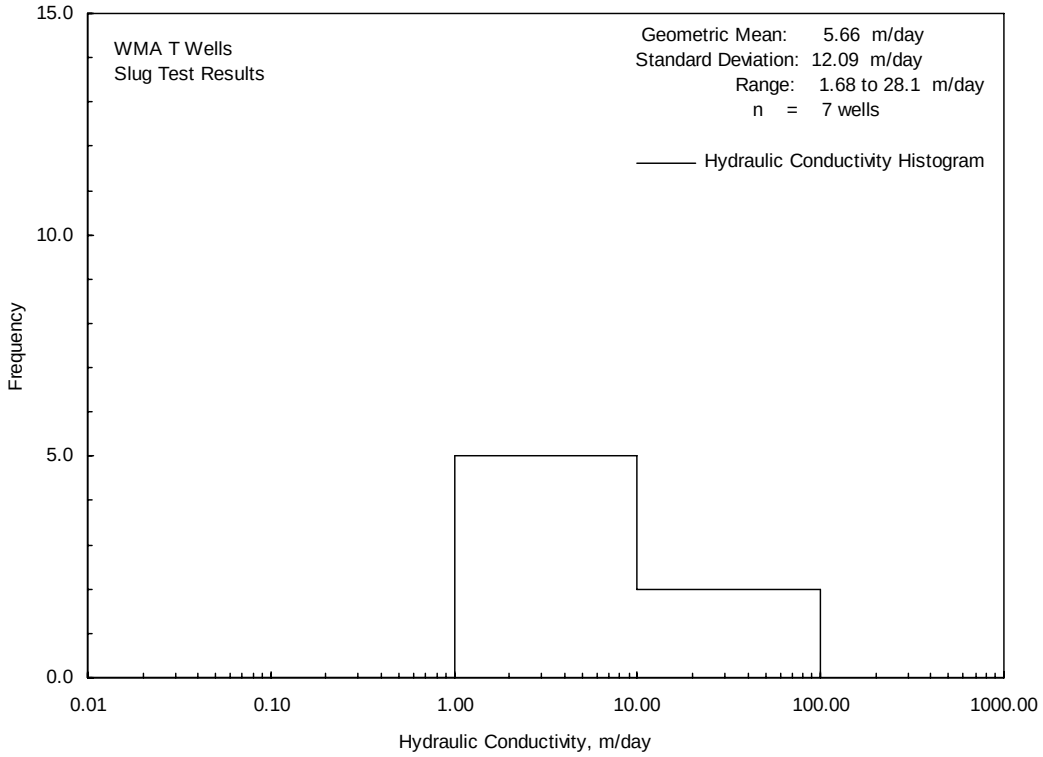


Figure D.5. Hydraulic Conductivity Histogram for Recently Tested WMA T Wells

Appendix E

Non-Conformance Report

NONCONFORMANCE REPORT

NCR No. NCR-05-GRP-003 Page 1 of 6

1. P.O./W.O./Job Control No.	2. Responsible Program, Project, Facility, or SSC	
18618-011	CERCLA SST WMA T	
3. Item or Material I.D. No./Catalog No./Other	4. Dwg./Spec./Other No./Rev.	5. Safety Classification
Monitoring Well	WMP-23256 Rev 0	GS
6. Lot/Heat/Serial No.	7. Lot Size/Sample Size/Quantity Accepted	8. ASME Code Item?
C4950/299-W11-46	N/A	☐ Yes ☒ No (If yes, notify authorized inspector.)

9. Supplier Name/Address	10. Suspect / Counterfeit Item?	11. Procurement Related?
Layne Christensen Co 10906 D St. E Tacoma, WA 98445	☐ Yes ☒ No (If Yes, Occurrence Report Required)	☒ Yes ☐ No (If Yes, Notify Contract Specialist)

DESCRIPTION OF NONCONFORMANCE

12. Description of Nonconformance

(a) Required Condition/Origin of Requirement

WMP-23256 Rev 0 Figure 3-1 Anticipated Well Design, shows the well construction materials in direct contact with the borehole wall and the only casing left in the hole is non-reactive (stainless steel).

(b) Actual Condition

Well C4950 was drilled as a replacement for C4669 (which was rejected for collapsed permanent casing). During the well completion backpulling operation the dual wall carbon steel temporary casing parted due to heavy resistance. The result was that 70 feet of the temporary casing remains in the boring at a depth of 44.7 feet to 114 feet below ground surface. The situation was presented to the Washington State Dept. of Ecology Point of Contact. Ecology concurrence was obtained to leave the dual wall carbon steel casing in the hole and fill the remaining annulus with cement grout (instead of continuing bentonite crumbles up to 10 feet BGS). The integrity of the 4 inch permanent casing was verified by lowering a dual flange surge block into the well. The grouting was completed as approved by Ecology.

NCR IDENTIFICATION / VALIDATION

	Print Full Name	Signature	Date
13. NCR Initiator	WR Thackaberry	WR Thackaberry	8/5/05
14. NCR Validation. Initiating Organization QA Manager or designee	DG Farwick	DG Farwick	8/5/05

A-7310-104 (06/05)

NONCONFORMANCE REPORT (continued)

NCR No. NCR-05-GRP-003

DISPOSITION

15. Interim Disposition (Check One) ☒ N/A (See Final Disposition) ☐ Conditional Accept/Use ☐ Other

Use only if actions are needed prior to determining final disposition or to facilitate continued work or testing on a conditional and controlled basis.

Technical Justification, USQ or CX No. _____, required for "Conditional Accept/Use" disposition. Include the extent and any required instructions.

Contract Specialist Acknowledgement

Print Full Name	Signature	Date

APPROVAL

15.1 Design Authority or ☐ N/A if not applicable

Print Full Name	Signature	Date

15.2 Responsible Organization's QA Representative or Manager or ☐ N/A if not applicable

Print Full Name	Signature	Date

15.3 ASME Authorized Code Inspector or ☐ N/A if not applicable

Print Full Name	Signature	Date

15.4 Other or ☐ N/A if not applicable

Organization/Discipline Represented _____

Print Full Name	Signature	Date

INTERIM DISPOSITION COMPLETION

16. Interim Disposition Complete (Check One) ☐ Complete ☒ N/A if not applicable

Responsible Organization QA or QC Representative

Print Full Name	Signature	Date

FINAL DISPOSITION

17. Final Disposition (Check appropriate box[es])

☒ Accept-As-Is ☐ Reject ☐ Repair ☐ Rework

(a) Technical Justification or Engineering Document Change (EDC), Facility Modification Package (FMP), or Design Change Notice (DCN) Number N/A (required for "Accept-As-Is" and "Repair" dispositions.) If EDC, FMP, or DCN Number is not required, explain why and perform USQ screening in accordance with applicable procedure. USQ or CX No. N/A.

Use N/A for "Reject" or "Rework" dispositions.

Groundwater samples will be unaffected by the lost segment of carbon steel casing. The observed interval in this well is 248.5 ft. to 285.5 feet below ground surface. Compliant annular seal (bentonite pellets and crumbles) is present from 114 ft. BGS to 248.5 ft. BGS. The lost segment of temporary casing is 130 feet above the static water level. The grouted annular seal from GS to (into) the parted casing at 45 ft. and the 134.5 feet of bentonite annular seal should preclude infiltration of surface water. Ecology concurred with the remedial action. The surface protection features will be installed as designed.

NONCONFORMANCE REPORT (continued)

NCR No. NCR-05-GRP-003

(b) Instructions for Completion. For "Repair" and Rework," include Inspection Criteria. For "Reject," identify method of disposal, e.g., scrap, return to vendor or other.

Use N/A for "Accept-As-Is."

N/A

Contract Specialist Acknowledgement

Print Full Name	Signature	Date
RD Miles	Robert D Miles	8/5/05

APPROVAL

17.1 Design Authority

Print Full Name	Signature	Date
RL Biggerstaff	Richard L Biggerstaff	8/8/05

17.2 Responsible Organization's QA Representative or Manager

Print Full Name	Signature	Date
WR Thackaberry	W R Thackaberry	8/5/05

17.3 ASME Authorized Code Inspector or ☒ N/A if not applicable

Print Full Name	Signature	Date

17.4 Other or ☐ N/A if not applicable

Organization/Discipline Represented GRP Well Drilling Task Lead

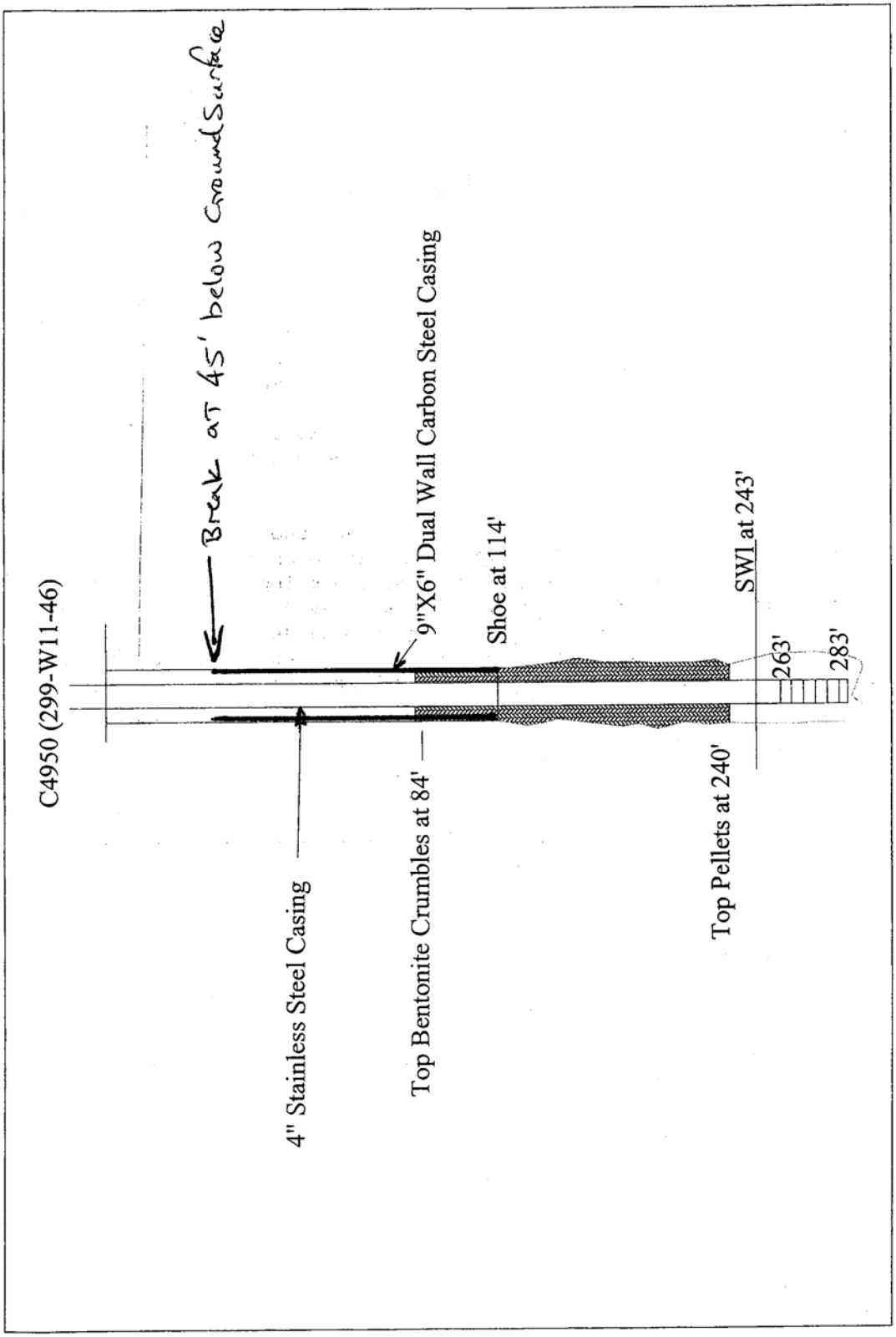
Print Full Name	Signature	Date
CS Wright	C S Wright	8/5/05

CLOSURE

18. NCR Closure ☒ Approved Disposition Actions Complete and Verified ☐ Follow-on NCR

QA or QC Representative

Print Full Name	Signature	Date
W. R. Thackaberry	W R Thackaberry	8-8-05


Break at 45' below Ground Surface
C4950 (299-W11-46)
9"X6" Dual Wall Carbon Steel Casing
Shoe at 114'
SWI at 243'
263'
283'
4" Stainless Steel Casing
Top Bentonite Crumbles at 84'
Top Pellets at 240'

Distribution

No. of Copies

Offsite

2 Nez Perce Tribe
Environmental Restoration/Waste Management
P.O. Box 365
Lapwai, ID 83540-0365
ATTN: S. Sobcyzk
S. Lilligren

T. Repasky
Confederated Tribes of the Umatilla Indian Reservation
P.O. Box 638
Pendleton, OR 97801

W. Rigsbee
Confederated Tribes and Bands of the Yakama Nation
6304 Collins Road
West Richland, WA 99353

T. M. Stoops
Oregon Office of Energy
Nuclear Safety Division
625 Marion Street N.E.
Salem, OR 97303

Onsite

5 **DOE Richland Operations Office**

R. D. Hildebrand	A6-38
K. M. Thompson	A6-38
A. C. Tortoso	A3-04
DOE Public Reading Room (2)	H2-53

No. of Copies

CH2M HILL Hanford Group, Inc.

D. A. Myers	H6-03

2 **Fluor Hanford, Inc.**

J. V. Borghese	E6-35
C. Wright	E6-35

3 **U.S. Environmental Protection Agency**

A. Boyd	B1-46
C. E. Cameron	B1-46
D. A. Faulk	B1-46

5 **Washington State Department of Ecology**

J. A. Caggiano	H0-57
L. J. Cusack	H0-57
D. Goswami	H0-57
J. Hedges	H0-57
M. Mills	H0-57

11 **Pacific Northwest National Laboratory**

J. S. Fruchter	K6-96
D. G. Horton (3)	K6-75
S. P. Luttrell	K6-96
B. E. Opitz	K6-75
B. A. Williams (3)	K6-75
Hanford Technical Library (2)	P8-55