PNNL-14255

Pacific Northwest
National Laboratory
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U.S. Department of Energy

Data Package for Groundwater Monitoring Well 299-W15-43 at the 200-ZP-1 Operable Unit

D. G. Horton

April 2003

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RL01830

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Prepared for
the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest National Laboratory
Richland, Washington 99352

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1.0 Introduction

One new groundwater monitoring well was constructed in the 200-ZP-1 Operable Unit in November 2002. The purpose of the well is to monitor carbon tetrachloride concentrations in response to the 200-ZP-1 carbon tetrachloride pump-and-treat operations. The well name is 299-W15-43 and the corresponding well number is C3955. Well 299-W15-43 is located about 8 meters west of the 216-T-25 trench. The location of the well is shown on Figure 1.

Well 299-W15-43 was drilled in response to the recommendations of a Data Quality Objectives process that indicated a need for additional monitoring wells in the area (BHI-01576). The new well was constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160 and WAC 173-303, the Data Quality Objectives document (BHI-01576), and the description of work for well drilling and construction.[(a)]

This document compiles information on the drilling and construction, geophysical logging, and sediment and groundwater sampling applicable to the installation of well 299-W15-43. The information on drilling and construction, well development, and pump installation is summarized from CP-14265. Appendix A contains the Well Summary Sheets (as-built diagrams), the Well Construction Summary Reports, and the geologist's logs; Appendix B contains results of physical properties testing; Appendix C contains the analytical results from groundwater samples obtained during drilling; and Appendix D contains borehole geophysical logs. Additional documentation concerning well construction can be found in CP-14265 and is on file with Fluor Hanford, Inc., Richland, WA.

Except for surveyed coordinates, English units are used in this report because that is the system of units used by drillers to measure and report depths and well construction details. To convert feet to meters, multiply by 0.3048; to convert inches to centimeters multiply by 2.54.

2.0 Well 299-W15-43

2.1 Drilling and Sampling

Well 299-W15-43 was drilled in November 2002 with a Becker hammer drill rig from 30 feet below ground surface (bgs) to a total depth of 348.6 feet bgs with temporary dual-wall carbon steel casing (outside diameters 9 and 7 inches and inside diameter 6 inch). The upper 30 feet of the borehole were declared medium risk with respect to encountering contamination and were drilled with an auger drill rig and 10.75-inch-outside-diameter casing. No water was added to the borehole during drilling.

(a) Letter from J. S. Fruchter (Pacific Northwest National Laboratory, Richland, Washington) to R. L. Jackson (Fluor Hanford, Inc., Richland, Washington), *Description of Work for Drilling of CY 2001 RCRA and CERCLA Groundwater Monitoring Wells*, dated July 11, 2002.

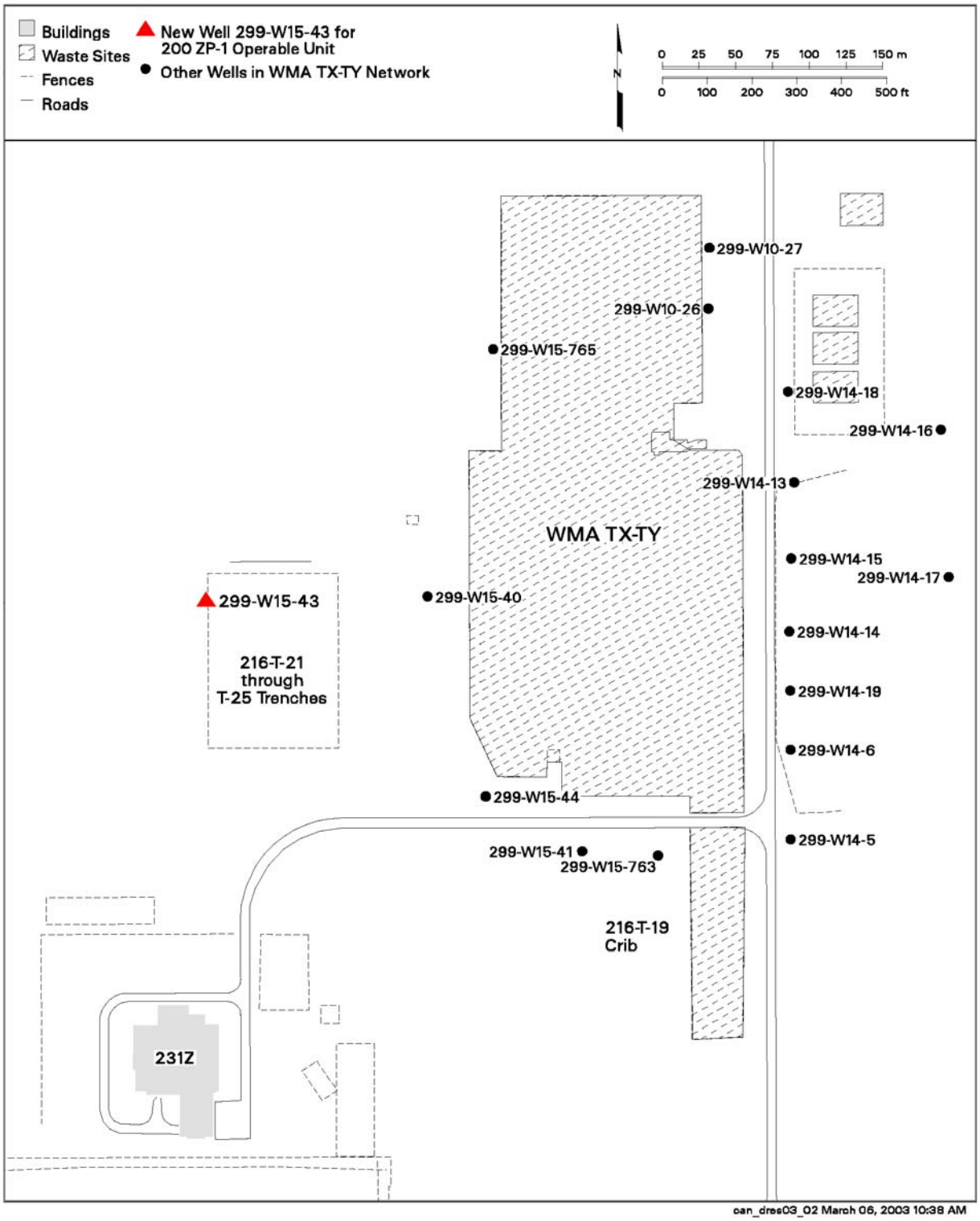

Figure 1. Location of Well 299-W15-43

The sediments encountered during drilling were predominantly Hanford formation sand, sandy gravel and silty sandy gravel from 20 to 113 feet bgs; upper Cold Creek unit sandy silt from 113 to 123 feet bgs; lower Cold Creek unit sandy silt with caliche from 123.3 to 131 feet bgs; upper Ringold Formation sand from 131 to 151 feet bgs; and Ringold Formation unit E gravel, sandy gravel and silty sandy gravel from 151 feet to total depth (348.6 feet bgs). The geologist's log is included in Appendix A.

Grab samples for geologic description and archive were collected every 5 feet throughout the borehole. Also, two grab samples were collected from 230 and 265 feet bgs for analysis of particle size distribution. Particle size distribution data are in Appendix B.

Six groundwater samples were collected during drilling of borehole 299-W15-43. The samples were collected to characterize the vertical distribution of contaminants at the location of the borehole. The sampling and analysis efforts and the results are discussed below in Section 2.4. All laboratory analytical results are given in Appendix C.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. Organic vapors were detected in the borehole and/or on sediment samples at depths of 245, 250, 260, 295, and 320 feet bgs. Concentrations were less than 3.6 ppm except at 320 feet where the concentration was 40 ppm. No organic vapors were detected in the breathing zone around the well during drilling and construction activities.

The borehole was geophysically logged with a spectral gamma-ray tool on November 13, 2002. No manmade radionuclides were detected.

2.2 Well Completion

The borehole was backfilled with 4 to 8 mesh silica sand from 348.6 to 270.5 feet bgs and 0.25-inch bentonite pellets from 270.5 to 265.7 feet bgs.

The permanent casing and screen were installed in well 299-W15-43 in November 2002. A 4-inch-inner-diameter, stainless steel, wire wrap, 20 slot screen was set from 261.37 to 226.37 feet bgs. The permanent casing is 4-inch-inner-diameter, stainless steel from 226.37 feet bgs to 2.0 feet above ground surface. A 2-foot-long stainless steel sump with end cap is below the screen from 263.37 to 261.37 feet depth.

The filter pack is 10 to 20 mesh silica sand from 265.7 to 216.5 feet bgs. The annular seal is bentonite pellets from 216.5 to 210.0 feet bgs, granular bentonite from 210.0 to 9.0 bgs, and Portland cement from 9.0 feet bgs to the surface. A 4-by-4-foot, 6-inch concrete pad was placed around the well at the surface. A protective casing with locking cap, 4 protective steel posts, and a brass marker stamped with the well number were set into the concrete. The protective casing sticks up 2.36 feet above the concrete pad.

The vertical and horizontal coordinates of the well were surveyed in February 2003. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington and the U.S. Army Corps of

Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing benchmarks established by the U. S. Army Corps of Engineers. Survey data are included in Table 1 and the survey data sheet is included in Appendix A.

Table 1. Survey Data for Well 299-W15-43

Well Name	Easting (m)[(a)]	Northing (m)[(a)]	Elevation (m)[(b)]	
299-W15-43	566490.13	136210.03	207.490	Top of casing
	566490.123	136210.339	206.777	Brass cap
(a) Washington coordinate system of 1983, South zone 1991 (b) North American vertical datum of 1988				

2.3 Well Development and Pump Installation

Well 299-W15-43 was developed in November 2002. A temporary, 5 horsepower, submersible pump was used first to remove 1,288 gallons of formation water at 23 gpm and then 192 gallons at 6 gpm with the pump intake at 258 foot bgs. Maximum drawdown at the 23 gpm pumping rate was 3.76 feet. Drawdown declined to 0.42 foot within 10 minutes of changing to a 6 gpm pump rate. The pump intake was raised to 238 foot bgs and well development continued by pumping 1,485 gallons of formation water at 15 gpm. Drawdown was 2.11 feet. The final turbidity was 0.63 NTU.

A dedicated Redi-Flo2® submersible sampling pump was installed in well 299-W15-43 on December 6, 2002. The sampling pump intake is at 248.7 feet bgs or about 18.1 feet below the water table.

Static water level was 230.6 feet below the top of casing on December 6, 2002.

2.4 Groundwater Sampling and Analysis

Six groundwater samples were collected during drilling of well 299-W15-43 at about 20-foot intervals beginning at 245 foot bgs (water table at 238.95 feet bgs at time of first sample) and continuing to total depth. The uppermost sample from 245 feet bgs was air lifted because the aquifer was not recharging sufficiently to pump a sample; the deeper samples were pumped after purging for 40 to 60 minutes. The sample for metals analysis from 280 feet bgs was not filtered; all other samples for metals analyses were filtered in the field. The air-lifted sample was allowed to settle overnight and the groundwater was decanted into sample jars and sent to the Hanford Groundwater Monitoring Project's contracted laboratories for analyses. All pumped samples were shipped to the contact laboratories. Samples were analyzed for metals, anions, technetium-99, tritium, and volatile organic compounds. All analytical results are given in Appendix C.

The groundwater data show a maximum carbon tetrachloride concentration of 3,300 μg/L at 280 feet bgs decreasing to 800 μg/L at 347 feet bgs, very near the bottom of the borehole. Nitrate increases with depth throughout the drilled portion of the aquifer and reaches 201,000 μg/L in the deepest sample. Other interpretive reports will investigate these analytical results with respect to the distribution and movement of contamination.

3.0 References

BHI-01576, Rev. 2. 2002. *DQO Summary Report for Establishing a 200-ZP-1 and 200-UP-1 Groundwater Monitoring Well Network*. Bechtel Hanford, Inc., Richland, Washington.

CP-14265, Rev. 0. 2003. *Calendar Year 2002 RCRA and CERCA Groundwater Monitoring Well Summary Report*. C. R. Martinez, Fluor Hanford, Inc., Richland, Washington.

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

WAC 173-303, Washington Administrative Code. *Dangerous Waste Regulations*. Olympia, Washington.

Appendix A

Well Construction and Completion Documentation

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 11/05/02
Finish Date: 11/25/02
Page 1 of 1

Startcard #R05118

Well ID: C3955	Well Name: 299-W15-43	Approximate Location: N. of PFP; 216-T-25	
Project: RCRA Drilling (CERCLA well)		Other Companies: FH, CHG	
Drilling Company: Layne Christensen		Geologist(s): C. Martinez	
Driller: Paul ("Perry") Lodder License #: 1628			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
10¾/10⅜ C.S. FJ	0' - 30'	none
Dual wall casing	-	
9" OD; 7" OD 1/16" ID	0' - 348.6'	9" OD
FJ, CS	-	
	-	

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

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

Auger: ✓	Diameter 9"	From 0'	to 348.6'
Cable Tool:	Diameter	From	to 30'
Air Rotary:	Diameter	From	to
A.R. w/Sonic:	Diameter	From	to
Becker Hammer w/ 9" OD "crowd in" bit	Diameter 9"	From 30'	to 348.6'
	Diameter	From	to
	Diameter	From	to

Drilling Fluid: N/A

Total Drilled Depth: 348.6'	Hole Dia @ TD: 9"	Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results: Passed using 20' Long, 4.5" OD Tool on 11/14/02		Static Water Level: 227.43'	Date: 11/15/02

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectra/Gamma	0' - 348.6'	11/13/02		-	
	-			-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
4" ID SS 304L casing	+2.00' - 226.37'	FJ80	N/A	Portland Cement (94#)	0 - 9.0'	5	N/A
4" ID SS 304L screen	226.37' - 261.37'	FJ80	0.020"	Granular Bentonite (50#)	9.0' - 210.0'	95	N/A
4" ID SS 304L sump	261.37' - 263.37'	FJ80	N/A	Bentonite Pellets (50#)	210.0' - 216.5'	3	¼"
	-			Colorado Silica Sand (50#)	216.5' - 265.7'	66.5	10-20
	-			Bentonite Pellets (50#)	265.7' - 270.5'	2	¼"
	-			Colorado Silica Sand (50#)	270.5 - 348.6'	93	4-8

OTHER ACTIVITIES

Aquifer Test: Well Development	Date: 11/22/02 - 11/25/02	Well Decommission:	Yes:	No:	Date:
Description: Pumped (intake @ 258' bgs) 23 gpm for 54 min w/ 22.05' drawdown. Reduced flow to 6 gpm for 32 min. w/ SWL = 25.44'. Resumed 11/25/02 w/pump intake @ 238' bgs. Pumped 15 gpm for 99 min.		Description:			

WELL SURVEY DATA (if applicable)

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

COMMENTS/REMARKS

Vol calcs: P.C. => 5 * 1.285 = 6.425 ft³; gran. bent => 95 * 0.71 = 67.45 ft³; bent. pellets => 5 * 0.62 = 3.1 ft³; 10-20 silica sand => 46.5 * 0.535 = 35.58 ft³; 4-8 silica sand => 93 bags * 0.917 ft³/bag * 0.5454 ft³/ft³ = 46.5 ft³

Reported By: Charlene Martinez Title: Geologist/Scientist Signature: Charlene Martinez Date: 12/06/02

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

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

WELL SUMMARY SHEET

Start Date: 11/05/02 Finish Date: 11/15/02 Page: 1 of 2

Well ID: C3955 Well Name: 299-W15-43

Location: P.O.F.F.P: 216-T-25 Project: RCRA Drilling (CERCLA well)

Prepared By: Charlene Martinez Date: 11/20/02 Reviewed By: L.D. Walker Date: 12/12/02

Signature: Charlene Martinez Signature: L.D. Walker

CONSTRUCTION DATA

Description	Diagram
6" ID protective casing set 0.95' above permanent casing.	
4" ID sched. 5 SS304L well casing: +2.00' → 226.37'	
Portland Cement Grout: 0' → 9.0'	
Granular Bentonite: 9.0' → 210.0'	
1/4" Bentonite Pellets: 210.0' → 216.5'	
10-20 mesh silica sand: 216.5' → 266.7'	
4" ID 0.020" slot cont. wirewrap well screen (SS304L): 226.37' → 261.37'	
All depths in feet below ground surface.	
All temporary casing removed from ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0'-20' no returns
		20'-25' silty SAND (mS)
		25'-30' gravelly silty SAND (gmS)
		30'-35' silty sandy GRAVEL (msG)
		Top Hanford fmt @ 25' bgs
40		35'-40' gravelly SAND (gS)
		40'-91' SAND (S)
80		91'-113' Sandy GRAVEL (sG)
		113'-123' Sandy SILT (sM)
		Top cold creek unit @ 113' bgs
120		123'-125' CALICHE
		125'-135' Sandy SILT (sM)
		135'-151' Sand (S)
		Top of Ringold fmt @ 135' bgs
		151'-185' Sandy GRAVEL (sG)
160		185'-190' silty sandy GRAVEL (msG)
200		190'-210' Sandy GRAVEL (sG)
		210'-215' silty sandy GRAVEL (msG)
		215'-220' Sandy GRAVEL (sG)
		220'-225' silty sandy GRAVEL (msG)

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BHI-EE-189 (02-20-2002)

WELL SUMMARY SHEET

Start Date: 11/05/02
Finish Date: 11/15/02
Page: 2 of 2

Well ID: C3955
Well Name: 299-W15-43
Location: A.O.F PFP: 216-T-25
Project: RCRA Drilling
Prepared By: Charlene Martinez Date: 11/20/02
Reviewed By: L.D. Walker Date: 12/12/02
Signature: Charlene Martinez
Signature: L.D. Walker

CONSTRUCTION DATA

Description	Diagram
4" ID ss 304L sump: 261.37' → 263.37'	
1/4" Bentonite Pellets: 266.7' → 270.5'	
4-8 mesh silica sand: 270.5' → 348.6'	
All depths in feet below ground surface:	
All temporary casing removed from ground.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
240		
		225'-270' Sandy GRAVEL(sG)
280		270'-285' silty sandy GRAVEL(msG)
		285'-290' Sandy GRAVEL (sG)
		290'-320' silty sandy GRAVEL(msG)
320		320'-345' Sandy GRAVEL(sG)
		345'-348.6' gravelly SAND(gS)
		TD = 348.6' bgs
		Static water level 227.42' bgs 11/15/02
360		

Original to: Document & Information Services, H0-09/HWIS
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BHI-EE-189 (02-20-2002)

BOREHOLE LOG

Page: 1 of 12
Date: 11/05/02

Well ID: C 3955 | Well Name: 299-W15-43 | Location: North of PFP. 216-T-25
Project: RCRA Drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0	Hollow Stem Auger	N/A		0'-20' no returns	Becker Hammer 9" OD Hollow stem auger to 30' bgs. EOS @ 0' bgs 11/05/02 start 11/06/02
5				20'- 25' silty sand. (mS) 25% silt, 75% sand. Sand, ufn-med, SR-R, well sorted, non-basaltic. 10YR5/4, yellowish brown (dry). Strong rxn HCl.	RCT / IH tech on site, providing cont. support for 1st 30' bgs. α, β, γ @ background
10				25'- 30' gravelly silty SAND (gmS) 10% gravel, 25% silt, 65% sand. Gravel, well sorted, mps ~ 0.5", SR-A, basaltic. Sand, ufn-med, SR-R, well sorted non-basaltic. 10YR5/4 yellowish brown (dry) Strong rxn HCl.	organics < detect.
15					
20	Grab Hollow Stem Auger			35'-40' gravelly SAND (gS) 25% gravel, 70% sand, 5% silt. Gravel R-A poorly sorted. mps ~ 4". Sand, SR-SA, ufn-vcrse, poorly sorted. 35% basalt 65% qtz (other) 10YR 4/3 brown (moist) no rxn HCl. (cm) wrong page.	Grab 20' archive
25	Grab Hollow Stem Auger				Grab 25' archive Hanford fmtn @ 25' bgs

Reported By: Charlene Martinez | Reviewed By: L. D. Walker
Title: Geologist / Scientist | Title: Geologist
Signature: Charlene Martinez | Date: 11/05/02 | Signature: L. D. Walker | Date: 12/12/02

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

BHI-EE-183 (02-20-2002)

BOREHOLE LOG

Date: 11/06/02

Well ID: C3955 | Well Name: 299-W15-43 | Location: N. of PFP: 216-T-25

Project: RCRA Drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
30	Hollow stem auger	N/A		30' - 35' Silty Sandy GRAVEL (msG)	Hollow stem to 30'
	Grab Becker Hammer			40% gravel, 25% sand, 10% silt.	Grab 30' archive.
				Gravel, poorly sorted, R-A, 70%	Becker Hammer 9" OD
				basalt, 30% qtz (other), Sand, vfn-med, well sorted, SR-R, non-basaltic.	from 30' to TD
35	Grab Becker Hammer			10YR 5/4 yellowish brown (dry) weak to mod rxn HCl.	Grab 35' archive
				35'-40' gravelly silty sand (gr,S) 25% gravel, 70% sand, 5% silt. Gravel, R-A v. poorly sorted, mps ~ 4". Sand, SR-SA, vfn-vcse, poorly sorted. 35% basalt 65% qtz (other) 10YR 4/3 brown (moist) no rxn HCl	Grab 40' archive
40	Grab Becker Hammer				
45	Grab Becker Hammer			40' - 90' Sand (S) 5% silt, 95% sand. SR-SA, vfn-vcse, poorly sorted. 35% basalt. 10YR 4/3 brown (moist) no rxn HCl.	Grab 45' archive
50	Grab Becker Hammer			@ 45' silt up slightly. Sand vfn-med, v. well sorted, SR-R. 10YR 4/4 dark yellowish brown. Weak rxn HCl. micaceous. 20% basalt, 80% qtz (other)	Grab 50' archive
55	Grab Becker Hammer			@ 55' Sand vfn-vcse, poorly sorted SR-SA, 35% basalt, 65% qtz (other) no rxn HCl	Grab 55' archive

Reported By: Charlene Martinez		Reviewed By: L.D. Walker	
Title: Geologist/Scientist		Title: Geologist	
Signature: Charlene Martinez	Date: 11/06/02	Signature: L.D. Walker	Date: 12/12/02

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

BHI-EE-183 (02-20-2002)

BOREHOLE LOG

Page: 3 of 12

Date: 11/06/02

Well ID: C3955 | Well Name: 299-W15-43 | Location: N. of PFP; 216-T-25

Project: RCRA Drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
60	Becker Hammer	N/A		@65' Sand. (S) 92% sand, 8% silt.	Becker Hammer 9" dia
	Grab Becker Hammer			Sand, well sorted, not as coarse. vfn - csg, SR-SA as 60' sample. no rxn HCl. 10YR6/2. light brownish gray (moist). 30% - basalt. 70% qtz (other) some mica.	Grab 60' archive
65	Grab Becker Hammer				Grab 65' archive
70	Grab Becker Hammer				Grab 70' archive
75	Grab Becker Hammer				Grab 75' archive
80	Grab				Grab 80' archive
	Collect samples for Battelle				Grab 80-85' samples for Battelle
85	Grab Becker Hammer			@85' Sand (S) vfn-med, SR-R, v. well sorted. silt ~ 8-9%. non-basaltic. 10YR5/4, yellowish brown (moist). weak rxn HCl.	Grab 85' archive

Reported By: Charlene Martinez | Reviewed By: L.D. Walker

Title: Geologist \ Scientist | Title: Geologist

Signature: Charlene Martinez | Date: 11/06/02 | Signature: L.D. Walker | Date: 12/12/02

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

BHI-EE-183 (02-20-2002)

BOREHOLE LOG

Page: 4 of 12

Date: 11/06/02

Well ID: C3955 | Well Name: 299-W15-43 | Location: N. of PFP; 216-T-25

Project: RCRA Drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
90	Becker Hammer / Grab Becker Hammer	N/A		@ 90' sand v. similar to 95' description	Becker Hammer 9"ø Grab 90' archive
				91'–113' Sandy GRAVEL (sG) 65% gravel, 30% sand, 5% silt. Gravel, v. poorly sorted, pea-sized to sm. cobbles, basaltic. Sand, poorly sorted, SR-SA, vfn-vcse, 10YR6/2 light brownish gray (dry) no rxn HCl	
95	Grab Becker Hammer			R-A	Grab 95' archive
				113'–123' Sandy SILT (sm) 20% sand, 80% silt. Sand, vfn-fn, v. well sorted, SR-R, 10YR5/4 yellowish brown (moist) non-basaltic. Strong rxn HCl.	
100	Grab Becker Hammer				Grab 100' archive Top of Cold Creek unit @ 113' bgs
105	Grab Becker Hammer				Grab 105' archive
110	Grab Becker Hammer				Grab 110' archive
				@ 115' trace caliche	Cold Creek unit @ 113' bgs
115	Grab Becker Hammer				Grab 115' archive

Reported By: Charlene Martinez | Title: Geologist/Scientist | Signature: Charlene Martinez | Date: 11/06/02

Reviewed By: L.D. Walker | Title: Geologist | Signature: L.D. Walker | Date: 12/12/02

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

BHI-EE-183 (02-20-2002)

BOREHOLE LOG

Page: 5 of 12
Date: 11/06/02

Well ID: C3955 | Well Name: 299-W15-43 | Location: N. of PFP: 216-T-25
Project: RCRA Drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
120	Becker Hammer Grab Becker Hammer	N/A			Becker Hammer 9" O/D Grab 120' archive
125	Grab Becker Hammer			123'-125' CALICHE. 80% silt, 20% sand, some massive caliche. Sand vfn-fn SR-R, trace gravel, non-basaltic. 10YR7/3, dry, strong rxn HCl.	Grab 125' archive
130	Grab Becker Hammer			125'-135' Sandy SILT (sm) 20% sand, 80% silt. Sand, vfn-fn, SR-R, v. well sorted, 10YR5/4 yellowish brown (moist) non basaltic. Strong rxn HCl.	Grab 130' archive
135	Grab Becker Hammer			135'-151' SAND(s) 95% sand, 5% silt. Sand, fn-med, R, well-sorted, non basaltic 10YR4/4 dark yellowish brown (moist) no rxn HCl.	Grab 135' archive Top of Ringold fmt @ 135' bgs
140	Grab Becker Hammer				Grab 140' archive
145	Grab Becker Hammer				Grab 145' archive

Reported By: Charlene Martinez | Reviewed By: L. D. Walker
Title: Geologist/Scientist | Title: Geologist
Signature: Charlene Martinez | Date: 11/06/02 | Signature: L D Walker | Date: 12/12/02

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

BHI-EE-183 (02-20-2002)

BOREHOLE LOG

Page: 6 of 12
Date: 4/04/02

Well ID: C3955 | Well Name: 299-W15-43 | Location: N. of PFP : 216-T-25
Project: RCRA Drilling (CERCLA work) | 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
150	Becker Hammer Grab Grab samples for Battelle	N/A		151'-185' Sandy GRAVEL (SG) Varying characteristics w/ depth. See individual descriptions.	Becker Hammer 9" OD Grab 150' archive Grab 150'-155' samples for Battelle
				@ 151'-160': Gravel 65%, Sand 27%, silt 8%. Gravel; v. poorly sorted, SR-A, pea-sized to cobbles. Sand, SR-SA, vfn-vcse, poorly sorted. 10YR5/3, brown (moist) no rxn HCl.	
155	Grab Becker Hammer				Grab 155' archive
160	Grab Becker Hammer			@ 160'-165': 65% gravel, 30% sand, 5% silt. Gravel, v. poorly sorted, SR-A; Sand, SR-E, med-vcse, well sorted, non basaltic. 2.5Y6/2 light brownish gray. no rxn HC.	Grab 160' archive
165	Grab Becker Hammer			@ 165'-170' same as 151'-160'	Grab 165' archive
170	Grab Becker Hammer			@ 170'-175' same as 160'-165' description	Grab 170' archive
175	Grab Becker Hammer			@ 175'-180' Gravel 65%, Sand 27% Silt 8% Gravel, SR-A, v. poorly sorted. Sand SR-SA, poorly sorted, vfn-vcse. 10YR5/3 (moist) brown, No rxn HCl.	Grab 175' archive

Reported By: Charlene Martinez | Reviewed By: L.D. Walker
Title: Geologist/Scientist | Title: Geologist
Signature: Charlene Martinez | Date: 4/04/02 | Signature: L.D. Walker | Date: 12/12/02

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

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BOREHOLE LOG

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Date: 4/06/02

Well ID: C3955 | Well Name: 299-W15-43 | Location: N. of PFP; 216-T-25

Project: RCRA Drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
180	Becker Hammer	N/A		@ 180'-185' 65% gravel, 30% sand, 5% silt	Becker Hammer 9" OD
	Grab Becker Hammer			gravel, R-A, v. poorly sorted. Sand, SR-SA med-vcse, well sorted, non basaltic. 2.5 Y 6/2 light brownish gray. No rxn HCl.	Grab 180' archive
185	Grab Becker Hammer			185'-190' silty sandy GRAVEL (msG) Gravel 65%, sand 25%, silt 10% gravel, SR-A, poorly sorted, 40% basalt, 60% qtz (other). Sand, SR-SA, fn-cse, mod. sorted, non basaltic. 10YR 6/3, pale brown (moist) No rxn HCl.	Grab 185' archive
190	Grab Becker Hammer				Grab 190' archive
				190' - 210' Sandy GRAVEL (sG) 65% gravel, 30% sand, 5% silt. Gravel, SR-A, max size - cobbles, v. poorly sorted Sand, SR-SA, med-vcse, well sorted. 2.5 Y 6/2 light brownish gray. No rxn HCl.	
195	Grab Becker Hammer				Grab 195' archive
		Battelle N/A			Grab 197' (Battelle)
200	Grab Becker Hammer				Grab 200' archive
		Battelle N/A			Grab 202' (Battelle)
205	Grab Becker Hammer				Grab 205' archive
		Battelle N/A			Grab 207' (Battelle)

Reported By: Charlene Martinez | Reviewed By: L.D. Walker

Title: Geologist/Scientist | Title: Geologist

Signature: Charlene Martinez | Date: 4/06/02 | Signature: L.D. Walker | Date: 12/12/02

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

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BOREHOLE LOG

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Date: 11/06/02

Well ID: C3955	Well Name: 299-W15-43	Location: N. of PFP: 216-T-25
Project: RCRA drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
210	Becker Hammer	N/A		210'-215' silty sandy GRAVEL (msG)	Becker Hammer 9"OD
	Grab Becker Hammer			60% gravel, 30% sand, 10% silt. gravel	Grab 210' archive
		Battelle N/A		R-A, v poorly sorted, basaltic. Sand,	Grab 212' (Battelle)
				SR-R, vfn-med, mod sorted, non-basaltic.	
				10YR6/2, light brownish gray (dry). no	
215	Grab Becker Hammer			rxn HCl.	Grab 215' archive
					Grab 217' (Battelle)
		Battelle N/A		215'-220' sandy GRAVEL (sG) 60%	
				gravel, 35% sand, 5% silt. Gravel, R-A	
				poorly sorted. Sand, SR-SA, m-vcse,	
220	Grab Becker Hammer			mod. sorted. 30% basalt, 70% qtz (other)	Grab 220' archive
				10YR5/4 yellowish brown (moist) no	Grab 222' (Battelle)
		Battelle N/A		rxn HCl.	
				220'-225'	
225	Grab Becker Hammer			~~225'~~ - 1 sandy gravel (msG) 60% gravel,	Grab 225' archive
				30% sand, 10% silt. Gravel, SR-A,	α, β, γ @ background
				v. poorly sorted, basaltic. Sand, SR-R,	organics < detect.
				vfn-med, mod sorted, non-basaltic.	E.O.S @ 227' (11/06/02)
				10YR6/2, light brownish gray (dry)	Start (11/07/02)
230	Grab Becker Hammer			no rxn HCl.	Grab 230' archive
					organics ~ 1-2 ppm
				225'-270' sandy GRAVEL (sG) 65%	α ~ 40-50 cpm
				gravel, 30% sand, 5% silt. Gravel,	(suspected Radon)
				SR-A, v. poorly sorted. Sand, SR-SA, med-	(A.m. ck's)
235	Grab Becker Hammer			vcse, mod. sorted. >70% qtz (other). 30%	
				basalt. 10YR5/4 yellowish brown, (moist)	Grab 235' archive.
				no rxn HCl.	

Reported By: Charlene Martiner		Reviewed By: L.D. Walker	
Title: Geologist/Scientist		Title: Geologist	
Signature: Charlene Martiner	Date: 11/06/02	Signature: L.D. Walker	Date: 12-12-02

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

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BOREHOLE LOG

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Date: 11/07/02

Well ID: C3955	Well Name: 299-W15-43	Location: N. of PFP: 216-T-25
Project: RCRA Drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
240	Becker Hammer Grab Becker Hammer	N/A		@ 240' 65% gravel, 30% sand, 5% silt Gravel, R-A, poorly sorted, sand, SE-SA, fn-vcse, mod sorted, 30-35% basalt, 65-70% qtz (other) sample, wet.	Becker Hammer 9" D/U Grab 240' archive
245	Grab Becker Hammer	Battelle N/A		@ 245' same as above	Grab 245' archive
250	Grab Becker Hammer			@ 255' silt content increasing slightly ~ 8%. gravel/sand descriptions same as above.	Grab 250' archive (em)
255	Grab Becker Hammer				Grab 255' archive
260	Grab Becker Hammer	Battelle N/A		@ 260' same as 255'. no change.	Grab 260' archive ≠ 8.8 @ background organics (detect. (p.m ck's) E.O.S. @ 260' (11/06/02)
265	Grab Becker Hammer	Sieve Sample N/A		Collect 265' bgs sample for sieve analysis.	START 11/11/02 organics @ 3.6 ppm (10.6ev lamp, OVM) in borehole ≠ 8.8 @ background.

Reported By: Charlene Martinez		Reviewed By: L.D. Walker	
Title: Geologist/Scientist		Title: Geologist	
Signature: Charlene Martinez	Date: 11/07/02	Signature: L.D. Walker	Date: 12/12/02

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

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BOREHOLE LOG

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Date: 11/11/02

Well ID: C3955 | Well Name: 299-W15-43 | Location: N. of PFP (2W-T-25)

Project: RCRA Drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
270	Becker Hammer	n/a		270'-285' silty sandy GRAVEL (msG)	Becker Hammer 9" dD
	Grab Becker Hammer			70% gravel, 20% sand, 10% silt. Gravel, R-A, v. poorly sorted, pea-sized to cobbles, 45% basalt, 55% qtz (other)	Grab 270' archive
				Sand, SR-SA, vfn-vcse, poorly sorted,	Harder drilling.
				35-40% basalt, 60-65% qtz (other). Sample	Possible cementation.
275	Grab Becker Hammer	Battelle n/a		wet.	Grab 275' archive
				↗ msG. Same as 270' description	Grab 275' (Battelle)
				@ 275', some cementation (visible) no rxn	
				HCl. WYR 6/2, lt brownish gray (dry)	
280	Grab Becker Hammer			@ 280' same as above	Grab 280' archive
					Organics < detect (pm ck)
					& B, Sr @ background (Am)
285	Grab Becker Hammer	Battelle n/a		285'-290' Sandy GRAVEL (SG) 70%	Grab 285' archive
				gravel, 25% sand, 5% silt. Gravel, SR-A	
				v. poorly sorted, 45% basalt, 55% qtz (other).	
				Sand, sr-sa, vfn-vcse, poorly sorted. Sample,	
				wet.	
290	Grab Becker Hammer				Grab 290' archive
				290'-320' Silty Sandy GRAVEL (msG) 65%	
				gravel, 25% sand, 10% silt. Gravel, SR-A,	
				poorly sorted, 45% basalt, 55% felsics,	
				sand, SR-SA, poorly sorted, vfn-vcse, 35%	
295	Grab Becker Hammer	Battelle n/a		basalt, 65% qtz (other) Sample wet.	
					E.O.S @ 295' bgs
					(11/12/02)
					Start 11/12/02

Reported By: Charlene Martinez | Title: Geologist/Scientist | Signature: Charlene Martinez | Date: 11/11/02

Reviewed By: L.D. Walker | Title: Geologist | Signature: L.D. Walker | Date: 12/12/02

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

BHI-EE-183 (02-20-2002)

BOREHOLE LOG

Date: 11/12/02

Well ID: c3955	Well Name: 299-W15-43	Location: D. OF PFP (216-T-25)
Project: RCRA Drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
300	Becker Hammer	N/A		@300' silty sandy GRAVEL (msG).	Becker Hammer 9" dD
	Grab Becker Hammer			See description on page 10 (295')	Grab 300' archive
					@295' EH tech (am.) detected organics of 1.6 ppm inside casing.
305	Grab Becker Hammer	Battelle N/A		Harder drilling @ 305' bgs @305' visible cementation in 305' archive sample taken. Still silty sandy GRAVEL	Grab 305' archive Grab 305' Battelle
310	Grab Becker Hammer			@310', silty sandy GRAVEL. Silt content up to 15%, sand 20%, gravel 65%.	Grab 310' archive
315	Grab Becker Hammer	Battelle N/A		@315' silt content back down to 10%. Still silty sandy gravel.	Grab 315' archive Grab 315' Battelle
320	Grab Becker Hammer			320-345' Sandy GRAVEL (sG) 65% gravel, 30% sand, 5% silt/clay Gravel, SR-SA v. poorly sorted, pea-sized to cobbles; Sand, vfm-v csc, SR-SA, mod sorted, 35% basalt, 65% qtz (other) sample wet	Grab 320' archive A.m. RCT ck of 3,3 @ background
325	Grab Becker Hammer	Battelle N/A			Grab 325' archive Grab 325' Battelle

Reported By: Charlene Martinez		Reviewed By: L.D. Walker	
Title: Geologist/Scientist		Title: Geologist	
Signature: Charlene Martinez	Date: 11/12/02	Signature: L.D. Walker	Date: 12/12/02

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

BHI-EE-183 (02-20-2002)

BOREHOLE LOG

Page: 12 of 12
Date: 11/12/02

Well ID: C3955 | Well Name: 299-W15-43 | Location: N. of PFP (216-T-25)
Project: RCRA drilling (CERCLA 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, Maximum Particle Size, Reaction to HCL	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
330	Becker Hammer Grab Becker Hammer	n/a		345'-348.6' Gravelly SAND (gS) 25% gravel, 70% sand, 5% silt. Gravel, mod-sorted, SR-R; Sand, vfn-vcse, SR-SA, mod-sorted. Very micaceous. No rxn HCl.	Becker Hammer 9" OD Grab 330' archive
335	Grab Becker Hammer	Battelle n/a			Grab 335' archive Grab 335' Battelle
340	Grab Becker Hammer				Grab 340' archive P.M. IH tech ck organics 40-50ppm in casing.
345	Grab	Battelle		TD => 348.6' / 347' bgs.	P.M. RST ck α,β,γ @ background Grab 347' archive Grab 347' Battelle
350				Tagged TD on 11/14/02 @ 348.6' bgs	
355					

Reported By: Charlene Martinez | Reviewed By: L.D. Walker
Title: Geologist/Scientist | Title: Geologist
Signature: Charlene Martinez | Date: 11/12/02 | Signature: L.D. Walker | Date: 12/12/02

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

BHI-EE-183 (02-20-2002)

Appendix B

Physical Properties Data

Appendix B

Physical Properties Data

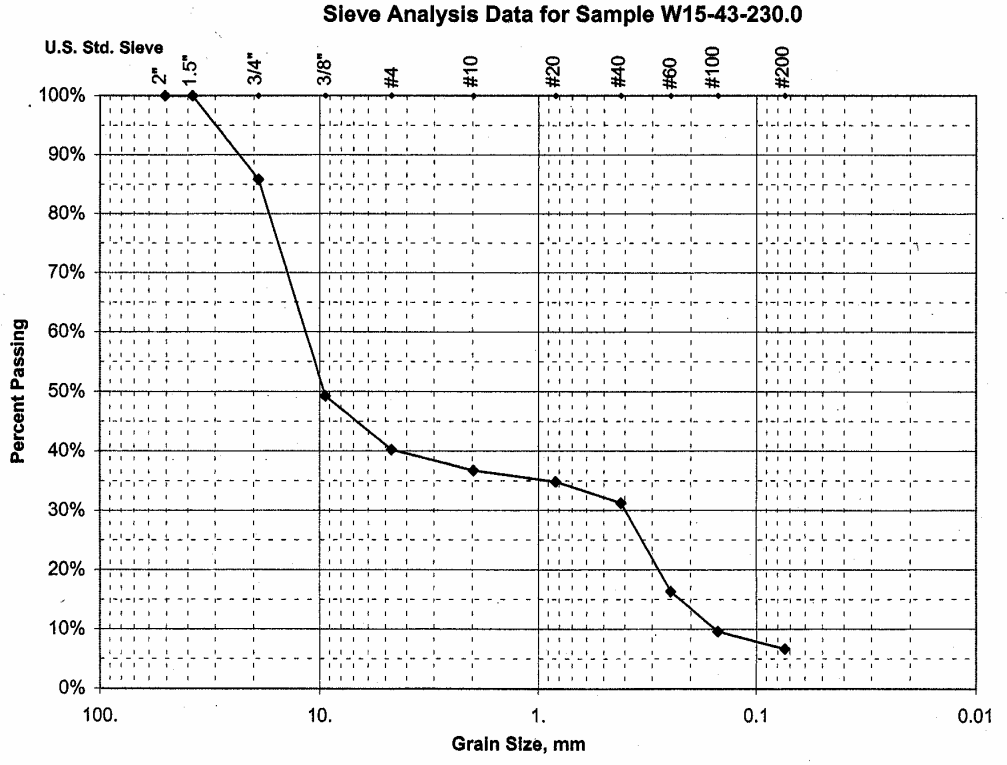
This appendix includes the results of testing for particle size distribution on grab samples from well 299-W15-43. The particle size analyses were done by CH2M Hill Hanford, Inc. using standard sieve techniques.

CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W15-43	DEPTH	230-235	SAMPLE#	W15-43-230.0	WELL ID#	C3955
TESTED BY	CRM	CONTACT	Dave Weekes	PHONE	372-9350	DATE	11/13/2002

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1276.60	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	180.7	14.2	85.8	19.05	
	3/8"	647.9	50.8	49.2	9.42	
	#4	763.3	59.8	40.2	4.70	
	#10	807.4	63.2	36.8	1.98	
	#20	831.8	65.2	34.8	0.83	
	#40	877.5	68.7	31.3	0.42	
	#60	1068.3	83.7	16.3	0.25	
	#100	1153.8	90.4	9.6	0.150	
	#200	1191.4	93.3	6.7	0.074	



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: [signature] Date: 12/9/02

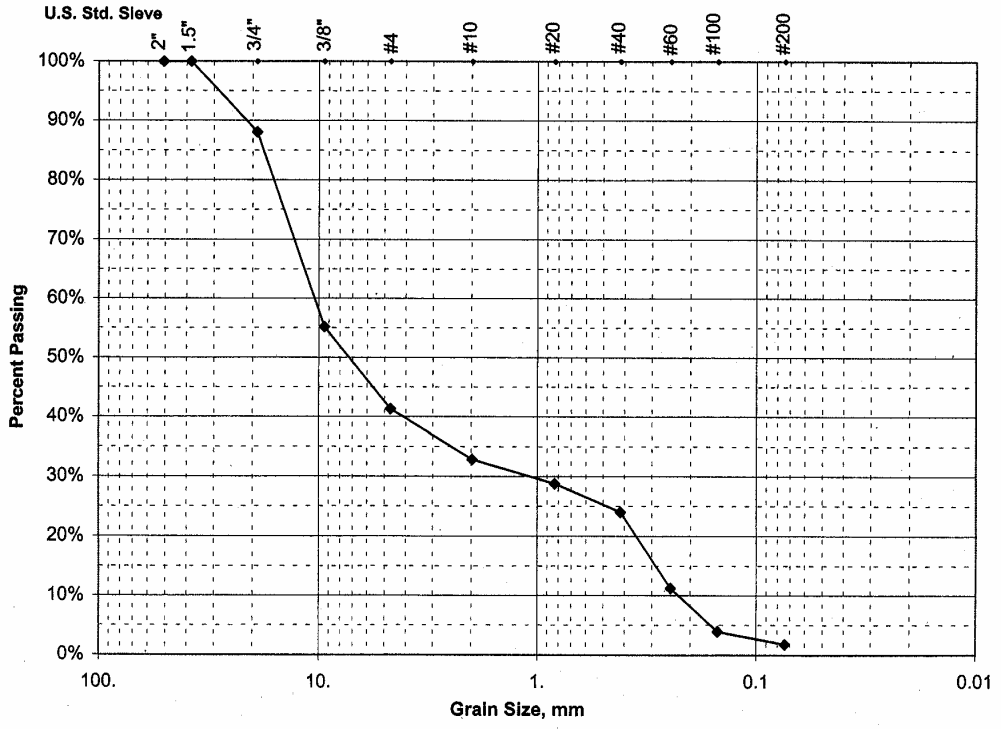
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W15-43	DEPTH	265	SAMPLE#	W15-43-265.0	WELL ID#	C3955
TESTED BY	CRM	CONTACT	Dave Weekes	PHONE	372-9350	DATE	11/13/2002

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
1261.30	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	150.9	12.0	88.0	19.05	
	3/8"	565.7	44.9	55.1	9.42	
	#4	740.4	58.7	41.3	4.70	
	#10	846.8	67.1	32.9	1.98	
	#20	898.0	71.2	28.8	0.83	
	#40	958.5	76.0	24.0	0.42	
	#60	1119.4	88.7	11.3	0.25	
	#100	1211.5	96.1	3.9	0.150	
	#200	1238.8	98.2	1.8	0.074	

Sieve Analysis Data for Sample W15-43-265.0



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: JC Weekes Date: 12/9/02

Appendix C

Groundwater Composition Data

Appendix C

Groundwater Composition Data

This appendix includes the results of laboratory analyses of groundwater samples collected during drilling of well 299-W15-43. All analyses were done by the Hanford Groundwater Monitoring Project's contracted analytical laboratories. All data area available in the Hanford Environmental Information System. Laboratory qualifiers in the following tables are: B = blank contamination, J = reported value is an estimate, U = not detected, D = dilution, N = presumed evidence of compound based on library search.

Well Name	Sample Number	Sample Date	Filtered	Constituent	Result	Units	Lab Qualifier
260 feet below ground surface							
299-W15-43	B15WX0	11/11/2002	N	1,1,1-Trichloroethane	0.17	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	1,1,2-Trichloroethane	0.05	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	1,1-Dichloroethane	0.2	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	1,2-Dichloroethane	0.08	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	1,4-Dichlorobenzene	0.11	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	1-Butanol	4.6	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	2-Butanone	0.29	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	4-Methyl-2-Pentanone	0.35	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	Acetone	0.82	µg/L	J
299-W15-43	B15WX1	11/11/2002	Y	Aluminum	18.3	µg/L	B
299-W15-43	B15WX1	11/11/2002	Y	Antimony	29.5	µg/L	U
299-W15-43	B15WX1	11/11/2002	Y	Barium	48.9	µg/L	B
299-W15-43	B15WX0	11/11/2002	N	Benzene	0.07	µg/L	U
299-W15-43	B15WX1	11/11/2002	Y	Beryllium	0.68	µg/L	U
299-W15-43	B15WX1	11/11/2002	Y	Cadmium	2.5	µg/L	U
299-W15-43	B15WX1	11/11/2002	Y	Calcium	55,900	µg/L	
299-W15-43	B15WX0	11/11/2002	N	Carbon disulfide	0.43	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	Carbon tetrachloride	2,700	µg/L	D
299-W15-43	B15WX0	11/11/2002	N	Chloroform	27	µg/L	
299-W15-43	B15WX1	11/11/2002	Y	Chromium	7	µg/L	B
299-W15-43	B15WX0	11/11/2002	N	cis-1,2-Dichloroethylene	0.06	µg/L	U
299-W15-43	B15WX1	11/11/2002	Y	Cobalt	5	µg/L	U
299-W15-43	B15WX1	11/11/2002	Y	Copper	0.86	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	Dissolved oxygen	7,230	µg/L	
299-W15-43	B15WX0	11/11/2002	N	Ethyl cyanide	1.3	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	Ethylbenzene	0.14	µg/L	U
299-W15-43	B15WX1	11/11/2002	Y	Iron	83.2	µg/L	BN
299-W15-43	B15WX1	11/11/2002	Y	Magnesium	18,400	µg/L	

Well Name	Sample Number	Sample Date	Filtered	Constituent	Result	Units	Lab Qualifier
299-W15-43	B15WX1	11/11/2002	Y	Manganese	10	µg/L	B
299-W15-43	B15WX0	11/11/2002	N	Methylenechloride	0.41	µg/L	J
299-W15-43	B15WX1	11/11/2002	Y	Nickel	15.8	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	pH Measurement	7.86	pH	
299-W15-43	B15WX1	11/11/2002	Y	Potassium	4,290	µg/L	B
299-W15-43	B15WX1	11/11/2002	Y	Silver	1.7	µg/L	U
299-W15-43	B15WX1	11/11/2002	Y	Sodium	14,700	µg/L	
299-W15-43	B15WX0	11/11/2002	N	Specific Conductance	516	µS/cm	
299-W15-43	B15WX1	11/11/2002	Y	Strontium	218	µg/L	
299-W15-43	B15WX2	11/11/2002	N	Technetium-99	18.9	pCi/L	
299-W15-43	B15WX0	11/11/2002	N	Temperature	18.92	Deg C	
299-W15-43	B15WX0	11/11/2002	N	Tetrachloroethene	1.1	µg/L	
299-W15-43	B15WX0	11/11/2002	N	Tetrahydrofuran	1.7	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	Toluene	0.56	µg/L	JN
299-W15-43	B15WX0	11/11/2002	N	trans-1,2-Dichloroethylene	0.17	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	Trichloroethene	6.8	µg/L	
299-W15-43	B15WX2	11/11/2002	N	Tritium	3,900	pCi/L	
299-W15-43	B15WX1	11/11/2002	Y	Vanadium	32.9	µg/L	
299-W15-43	B15WX0	11/11/2002	N	Vinyl chloride	0.25	µg/L	U
299-W15-43	B15WX0	11/11/2002	N	Xylenes (total)	0.28	µg/L	U
299-W15-43	B15WX1	11/11/2002	Y	Zinc	107	µg/L	
280 feet below ground surface							
299-W15-43	B15WX3	11/11/2002	N	1,1,1-Trichloroethane	0.17	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	1,1,2-Trichloroethane	0.05	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	1,1-Dichloroethane	0.2	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	1,2-Dichloroethane	0.08	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	1,4-Dichlorobenzene	0.11	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	1-Butanol	4.6	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	2-Butanone	0.29	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	4-Methyl-2-Pentanone	0.35	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	Acetone	0.97	µg/L	J
299-W15-43	B15WX4	11/11/2002	Y	Aluminum	21.1	µg/L	B
299-W15-43	B15WX4	11/11/2002	Y	Antimony	29.5	µg/L	U
299-W15-43	B15WX4	11/11/2002	Y	Barium	52.4	µg/L	B
299-W15-43	B15WX3	11/11/2002	N	Benzene	0.07	µg/L	U
299-W15-43	B15WX4	11/11/2002	Y	Beryllium	0.68	µg/L	U
299-W15-43	B15WX4	11/11/2002	Y	Cadmium	2.5	µg/L	U
299-W15-43	B15WX4	11/11/2002	Y	Calcium	59,200	µg/L	
299-W15-43	B15WX3	11/11/2002	N	Carbon disulfide	0.43	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	Carbon tetrachloride	3,300	µg/L	DN
299-W15-43	B15WX3	11/11/2002	N	Chloride	17,500	µg/L	D
299-W15-43	B15WX3	11/11/2002	N	Chloroform	19	µg/L	
299-W15-43	B15WX4	11/11/2002	Y	Chromium	7.7	µg/L	B

Well Name	Sample Number	Sample Date	Filtered	Constituent	Result	Units	Lab Qualifier
299-W15-43	B15WX3	11/11/2002	N	cis-1,2-Dichloroethylene	0.06	µg/L	U
299-W15-43	B15WX4	11/11/2002	Y	Cobalt	5	µg/L	U
299-W15-43	B15WX4	11/11/2002	Y	Copper	10.9	µg/L	B
299-W15-43	B15WX3	11/11/2002	N	Ethyl cyanide	1.3	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	Ethylbenzene	0.14	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	Fluoride	320	µg/L	
299-W15-43	B15WX4	11/11/2002	Y	Iron	550	µg/L	N
299-W15-43	B15WX4	11/11/2002	Y	Magnesium	19,400	µg/L	
299-W15-43	B15WX4	11/11/2002	Y	Manganese	21.3	µg/L	
299-W15-43	B15WX3	11/11/2002	N	Methylenechloride	0.3	µg/L	U
299-W15-43	B15WX4	11/11/2002	Y	Nickel	15.8	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	Nitrate	90,700	µg/L	D
299-W15-43	B15WX3	11/11/2002	N	Nitrite	36.1	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	pH Measurement	7.779	pH	
299-W15-43	B15WX4	11/11/2002	Y	Potassium	3,780	µg/L	B
299-W15-43	B15WX4	11/11/2002	Y	Silver	1.7	µg/L	U
299-W15-43	B15WX4	11/11/2002	Y	Sodium	13,900	µg/L	
299-W15-43	B15WX3	11/11/2002	N	Specific Conductance	481	µS/cm	
299-W15-43	B15WX4	11/11/2002	Y	Strontium	230	µg/L	
299-W15-43	B15WX3	11/11/2002	N	Sulfate	52,200	µg/L	DN
299-W15-43	B15WX5	11/11/2002	N	Technetium-99	24	pCi/L	
299-W15-43	B15WX3	11/11/2002	N	Temperature	18.9	Deg C	
299-W15-43	B15WX3	11/11/2002	N	Tetrachloroethene	0.93	µg/L	J
299-W15-43	B15WX3	11/11/2002	N	Tetrahydrofuran	1.7	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	Toluene	0.56	µg/L	JN
299-W15-43	B15WX3	11/11/2002	N	trans-1,2-Dichloroethylene	0.17	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	Trichloroethene	7.3	µg/L	
299-W15-43	B15WX5	11/11/2002	N	Tritium	4,120	pCi/L	
299-W15-43	B15WX3	11/11/2002	N	Turbidity	7.11	NTU	
299-W15-43	B15WX4	11/11/2002	Y	Vanadium	33	µg/L	
299-W15-43	B15WX3	11/11/2002	N	Vinyl chloride	0.25	µg/L	U
299-W15-43	B15WX3	11/11/2002	N	Xylenes (total)	0.28	µg/L	U
299-W15-43	B15WX4	11/11/2002	Y	Zinc	181	µg/L	
300 feet below ground surface							
299-W15-43	B15WX6	11/12/2002	N	1,1,1-Trichloroethane	0.17	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	1,1,2-Trichloroethane	0.05	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	1,1-Dichloroethane	0.2	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	1,2-Dichloroethane	0.08	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	1,4-Dichlorobenzene	0.11	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	1-Butanol	27	µg/L	
299-W15-43	B15WX6	11/12/2002	N	2-Butanone	0.29	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	4-Methyl-2-Pentanone	0.35	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	Acetone	1.8	µg/L	JB
299-W15-43	B15WX7	11/12/2002	Y	Aluminum	17	µg/L	U

Well Name	Sample Number	Sample Date	Filtered	Constituent	Result	Units	Lab Qualifier
299-W15-43	B15WX7	11/12/2002	Y	Antimony	29.5	µg/L	U
299-W15-43	B15WX7	11/12/2002	Y	Barium	52.8	µg/L	B
299-W15-43	B15WX6	11/12/2002	N	Benzene	0.07	µg/L	U
299-W15-43	B15WX7	11/12/2002	Y	Beryllium	0.68	µg/L	U
299-W15-43	B15WX7	11/12/2002	Y	Cadmium	2.5	µg/L	U
299-W15-43	B15WX7	11/12/2002	Y	Calcium	59,400	µg/L	
299-W15-43	B15WX6	11/12/2002	N	Carbon disulfide	0.43	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	Carbon tetrachloride	2,900	µg/L	DN
299-W15-43	B15WX6	11/12/2002	N	Chloride	18,000	µg/L	D
299-W15-43	B15WX6	11/12/2002	N	Chloroform	29	µg/L	
299-W15-43	B15WX7	11/12/2002	Y	Chromium	3.4	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	cis-1,2-Dichloroethylene	0.06	µg/L	U
299-W15-43	B15WX7	11/12/2002	Y	Cobalt	5	µg/L	U
299-W15-43	B15WX7	11/12/2002	Y	Copper	0.86	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	Dissolved oxygen	8,330	µg/L	
299-W15-43	B15WX6	11/12/2002	N	Ethyl cyanide	1.3	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	Ethylbenzene	0.14	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	Fluoride	380	µg/L	
299-W15-43	B15WX7	11/12/2002	Y	Iron	87.2	µg/L	B
299-W15-43	B15WX7	11/12/2002	Y	Magnesium	19,700	µg/L	
299-W15-43	B15WX7	11/12/2002	Y	Manganese	61	µg/L	
299-W15-43	B15WX6	11/12/2002	N	Methylenechloride	0.43	µg/L	JB
299-W15-43	B15WX7	11/12/2002	Y	Nickel	15.8	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	Nitrate	96,900	µg/L	D
299-W15-43	B15WX6	11/12/2002	N	Nitrite	36.1	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	pH Measurement	7.87	pH	
299-W15-43	B15WX7	11/12/2002	Y	Potassium	4,400	µg/L	B
299-W15-43	B15WX7	11/12/2002	Y	Silver	1.7	µg/L	U
299-W15-43	B15WX7	11/12/2002	Y	Sodium	14,200	µg/L	
299-W15-43	B15WX6	11/12/2002	N	Specific Conductance	602	µS/cm	
299-W15-43	B15WX7	11/12/2002	Y	Strontium	237	µg/L	
299-W15-43	B15WX6	11/12/2002	N	Sulfate	46,100	µg/L	D
299-W15-43	B15WX8	11/12/2002	N	Technetium-99	31	pCi/L	
299-W15-43	B15WX6	11/12/2002	N	Temperature	18.3	Deg C	
299-W15-43	B15WX6	11/12/2002	N	Tetrachloroethene	0.78	µg/L	J
299-W15-43	B15WX6	11/12/2002	N	Tetrahydrofuran	1.7	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	Toluene	0.12	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	trans-1,2-Dichloroethylene	0.17	µg/L	U
299-W15-43	B15WX6	11/12/2002	N	Trichloroethene	6	µg/L	
299-W15-43	B15WX8	11/12/2002	N	Tritium	3,320	pCi/L	
299-W15-43	B15WX6	11/12/2002	N	Turbidity	215	NTU	
299-W15-43	B15WX7	11/12/2002	Y	Vanadium	25.4	µg/L	
299-W15-43	B15WX6	11/12/2002	N	Vinyl chloride	0.25	µg/L	U

Well Name	Sample Number	Sample Date	Filtered	Constituent	Result	Units	Lab Qualifier
299-W15-43	B15WX6	11/12/2002	N	Xylenes (total)	0.28	µg/L	U
299-W15-43	B15WX7	11/12/2002	Y	Zinc	114	µg/L	
245 feet below ground surface							
299-W15-43	B15WW7	11/12/2002	N	1,1,1-Trichloroethane	0.17	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	1,1,2-Trichloroethane	0.05	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	1,1-Dichloroethane	0.2	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	1,2-Dichloroethane	0.08	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	1,4-Dichlorobenzene	0.11	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	1-Butanol	4.6	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	2-Butanone	0.29	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	4-Methyl-2-Pentanone	0.35	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	Acetone	10	µg/L	
299-W15-43	B15WW8	11/12/2002	Y	Aluminum	21.4	µg/L	B
299-W15-43	B15WW8	11/12/2002	Y	Antimony	29.5	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Barium	50	µg/L	B
299-W15-43	B15WW7	11/12/2002	N	Benzene	0.07	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Beryllium	0.68	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Cadmium	2.5	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Calcium	55,100	µg/L	
299-W15-43	B15WW7	11/12/2002	N	Carbon disulfide	0.43	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	Carbon tetrachloride	0.85	µg/L	JN
299-W15-43	B15WW7	11/12/2002	N	Chloride	21,700	µg/L	D
299-W15-43	B15WW7	11/12/2002	N	Chloroform	0.07	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Chromium	3.4	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	cis-1,2-Dichloroethylene	0.06	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Cobalt	5	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Copper	0.86	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	Ethyl cyanide	1.3	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	Ethylbenzene	0.14	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	Fluoride	260	µg/L	
299-W15-43	B15WW8	11/12/2002	Y	Iron	30.7	µg/L	BN
299-W15-43	B15WW8	11/12/2002	Y	Magnesium	17,500	µg/L	
299-W15-43	B15WW8	11/12/2002	Y	Manganese	297	µg/L	
299-W15-43	B15WW7	11/12/2002	N	Methylenechloride	0.3	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Nickel	15.8	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	Nitrate	80,100	µg/L	D
299-W15-43	B15WW7	11/12/2002	N	Nitrite	36.1	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Potassium	5,800	µg/L	
299-W15-43	B15WW8	11/12/2002	Y	Silver	1.7	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Sodium	21,300	µg/L	
299-W15-43	B15WW8	11/12/2002	Y	Strontium	216	µg/L	
299-W15-43	B15WW7	11/12/2002	N	Sulfate	56,600	µg/L	DN
299-W15-43	B15WW9	11/12/2002	N	Technetium-99	16.5	pCi/L	
299-W15-43	B15WW7	11/12/2002	N	Tetrachloroethene	0.17	µg/L	U

Well Name	Sample Number	Sample Date	Filtered	Constituent	Result	Units	Lab Qualifier
299-W15-43	B15WW7	11/12/2002	N	Tetrahydrofuran	1.7	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	Toluene	0.12	µg/L	UN
299-W15-43	B15WW7	11/12/2002	N	trans-1,2-Dichloroethylene	0.17	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	Trichloroethene	0.16	µg/L	U
299-W15-43	B15WW9	11/12/2002	N	Tritium	4,010	pCi/L	
299-W15-43	B15WW8	11/12/2002	Y	Vanadium	13.7	µg/L	B
299-W15-43	B15WW7	11/12/2002	N	Vinyl chloride	0.25	µg/L	U
299-W15-43	B15WW7	11/12/2002	N	Xylenes (total)	0.28	µg/L	U
299-W15-43	B15WW8	11/12/2002	Y	Zinc	2.2	µg/L	U
320 feet below ground surface							
299-W15-43	B15WX9	11/12/2002	N	1,1,1-Trichloroethane	0.17	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	1,1,2-Trichloroethane	0.05	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	1,1-Dichloroethane	0.2	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	1,2-Dichloroethane	0.08	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	1,4-Dichlorobenzene	0.11	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	1-Butanol	4.6	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	2-Butanone	0.29	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	4-Methyl-2-Pentanone	0.35	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	Acetone	1	µg/L	JB
299-W15-43	B15WY0	11/12/2002	Y	Aluminum	17	µg/L	U
299-W15-43	B15WY0	11/12/2002	Y	Antimony	29.5	µg/L	U
299-W15-43	B15WY0	11/12/2002	Y	Barium	57.4	µg/L	B
299-W15-43	B15WX9	11/12/2002	N	Benzene	0.07	µg/L	U
299-W15-43	B15WY0	11/12/2002	Y	Beryllium	0.68	µg/L	U
299-W15-43	B15WY0	11/12/2002	Y	Cadmium	2.5	µg/L	U
299-W15-43	B15WY0	11/12/2002	Y	Calcium	59,200	µg/L	
299-W15-43	B15WX9	11/12/2002	N	Carbon disulfide	0.43	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	Carbon tetrachloride	1,700	µg/L	DN
299-W15-43	B15WX9	11/12/2002	N	Chloride	16,500	µg/L	D
299-W15-43	B15WX9	11/12/2002	N	Chloroform	14	µg/L	
299-W15-43	B15WY0	11/12/2002	Y	Chromium	3.4	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	cis-1,2-Dichloroethylene	0.06	µg/L	U
299-W15-43	B15WY0	11/12/2002	Y	Cobalt	5	µg/L	U
299-W15-43	B15WY0	11/12/2002	Y	Copper	0.86	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	Dissolved oxygen	8,230	µg/L	
299-W15-43	B15WX9	11/12/2002	N	Ethyl cyanide	1.3	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	Ethylbenzene	0.14	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	Fluoride	400	µg/L	
299-W15-43	B15WY0	11/12/2002	Y	Iron	158	µg/L	
299-W15-43	B15WY0	11/12/2002	Y	Magnesium	19,900	µg/L	
299-W15-43	B15WY0	11/12/2002	Y	Manganese	26.6	µg/L	
299-W15-43	B15WX9	11/12/2002	N	Methylenechloride	0.31	µg/L	JB
299-W15-43	B15WY0	11/12/2002	Y	Nickel	15.8	µg/L	U

Well Name	Sample Number	Sample Date	Filtered	Constituent	Result	Units	Lab Qualifier
299-W15-43	B15WX9	11/12/2002	N	Nitrate	114,000	µg/L	D
299-W15-43	B15WX9	11/12/2002	N	Nitrite	36.1	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	pH Measurement	7.89	pH	
299-W15-43	B15WY0	11/12/2002	Y	Potassium	4,520	µg/L	B
299-W15-43	B15WY0	11/12/2002	Y	Silver	1.7	µg/L	U
299-W15-43	B15WY0	11/12/2002	Y	Sodium	13,100	µg/L	
299-W15-43	B15WX9	11/12/2002	N	Specific Conductance	603	µS/cm	
299-W15-43	B15WY0	11/12/2002	Y	Strontium	238	µg/L	
299-W15-43	B15WX9	11/12/2002	N	Sulfate	37,900	µg/L	D
299-W15-43	B15WY1	11/12/2002	N	Technetium-99	20.3	pCi/L	
299-W15-43	B15WX9	11/12/2002	N	Temperature	17.3	Deg C	
299-W15-43	B15WX9	11/12/2002	N	Tetrachloroethene	0.17	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	Tetrahydrofuran	1.7	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	Toluene	0.12	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	trans-1,2-Dichloroethylene	0.17	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	Trichloroethene	2.7	µg/L	
299-W15-43	B15WY1	11/12/2002	N	Tritium	662	pCi/L	
299-W15-43	B15WX9	11/12/2002	N	Turbidity	81.9	NTU	
299-W15-43	B15WY0	11/12/2002	Y	Vanadium	32.2	µg/L	
299-W15-43	B15WX9	11/12/2002	N	Vinyl chloride	0.25	µg/L	U
299-W15-43	B15WX9	11/12/2002	N	Xylenes (total)	0.28	µg/L	U
299-W15-43	B15WY0	11/12/2002	Y	Zinc	125	µg/L	
347 feet below ground surface							
299-W15-43	B15WY2	11/12/2002	N	1,1,1-Trichloroethane	0.17	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	1,1,2-Trichloroethane	0.05	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	1,1-Dichloroethane	0.2	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	1,2-Dichloroethane	0.08	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	1,4-Dichlorobenzene	0.11	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	1-Butanol	4.6	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	2-Butanone	0.29	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	4-Methyl-2-Pentanone	0.35	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Acetone	1.8	µg/L	JB
299-W15-43	B15WY3	11/12/2002	Y	Aluminum	17	µg/L	U
299-W15-43	B15WY3	11/12/2002	Y	Antimony	29.5	µg/L	U
299-W15-43	B15WY3	11/12/2002	Y	Barium	72.8	µg/L	B
299-W15-43	B15WY2	11/12/2002	N	Benzene	0.07	µg/L	U
299-W15-43	B15WY3	11/12/2002	Y	Beryllium	0.68	µg/L	U
299-W15-43	B15WY3	11/12/2002	Y	Cadmium	2.5	µg/L	U
299-W15-43	B15WY3	11/12/2002	Y	Calcium	69,200	µg/L	
299-W15-43	B15WY2	11/12/2002	N	Carbon disulfide	0.43	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Carbon tetrachloride	800	µg/L	DN
299-W15-43	B15WY2	11/12/2002	N	Chloride	15,100	µg/L	D
299-W15-43	B15WY2	11/12/2002	N	Chloroform	14	µg/L	
299-W15-43	B15WY3	11/12/2002	Y	Chromium	3.4	µg/L	U

Well Name	Sample Number	Sample Date	Filtered	Constituent	Result	Units	Lab Qualifier
299-W15-43	B15WY2	11/12/2002	N	cis-1,2-Dichloroethylene	0.06	µg/L	U
299-W15-43	B15WY3	11/12/2002	Y	Cobalt	5	µg/L	U
299-W15-43	B15WY3	11/12/2002	Y	Copper	0.86	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Dissolved oxygen	7,850	µg/L	
299-W15-43	B15WY2	11/12/2002	N	Ethyl cyanide	1.3	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Ethylbenzene	0.14	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Fluoride	380	µg/L	
299-W15-43	B15WY3	11/12/2002	Y	Iron	164	µg/L	
299-W15-43	B15WY3	11/12/2002	Y	Magnesium	23,400	µg/L	
299-W15-43	B15WY3	11/12/2002	Y	Manganese	21	µg/L	
299-W15-43	B15WY2	11/12/2002	N	Methylenechloride	0.61	µg/L	JB
299-W15-43	B15WY3	11/12/2002	Y	Nickel	15.8	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Nitrate	201,000	µg/L	D
299-W15-43	B15WY2	11/12/2002	N	Nitrite	36.1	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	pH Measurement	7.86	pH	
299-W15-43	B15WY3	11/12/2002	Y	Potassium	5,680	µg/L	
299-W15-43	B15WY3	11/12/2002	Y	Silver	1.7	µg/L	U
299-W15-43	B15WY3	11/12/2002	Y	Sodium	14,900	µg/L	
299-W15-43	B15WY2	11/12/2002	N	Specific Conductance	717	µS/cm	
299-W15-43	B15WY3	11/12/2002	Y	Strontium	284	µg/L	
299-W15-43	B15WY2	11/12/2002	N	Sulfate	32,900	µg/L	D
299-W15-43	B15WY4	11/12/2002	N	Technetium-99	32.7	pCi/L	
299-W15-43	B15WY2	11/12/2002	N	Temperature	19.2	Deg C	
299-W15-43	B15WY2	11/12/2002	N	Tetrachloroethene	0.17	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Tetrahydrofuran	1.7	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Toluene	0.34	µg/L	J
299-W15-43	B15WY2	11/12/2002	N	trans-1,2-Dichloroethylene	0.17	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Trichloroethene	2.6	µg/L	
299-W15-43	B15WY4	11/12/2002	N	Tritium	357	pCi/L	
299-W15-43	B15WY2	11/12/2002	N	Turbidity	21	NTU	
299-W15-43	B15WY3	11/12/2002	Y	Vanadium	27.5	µg/L	
299-W15-43	B15WY2	11/12/2002	N	Vinyl chloride	0.25	µg/L	U
299-W15-43	B15WY2	11/12/2002	N	Xylenes (total)	0.28	µg/L	U
299-W15-43	B15WY3	11/12/2002	Y	Zinc	173	µg/L	

Appendix D

Borehole Geophysical Logs

Appendix D

Borehole Geophysical Logs

This appendix contains the borehole geophysical logs obtained from borehole 299-W15-43. The logs were run and analyzed by Stoller Inc. Analyses of the results are included with the logs.

Stoller
Grand Junction Office established 1959

299-W15-43 (C3955)
Log Data Report

Borehole Information:

Borehole:	299-W15-43 (C3955)		Site: West of TX Farm		
Coordinates (WA State Plane)		GWL (ft)[1]: 227.0		GWL Date: 11/12/2002	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
N/A[3]	N/A	Oct. 2002	NA	347	Becker

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	0.0	11-3/4	10-3/4	1/2	0.0	30.0
Threaded Steel	3.0	9	8	1/2	+3.0	347.0
Threaded Steel	3.0	6-1/4	6	1/8	+3.0	347.0

The well site geologist was the source for the casing depth and stickup information. The 9-in. inside casing diameter was estimated. All other casing diameters and thicknesses were measured by the logging engineer.

Borehole Notes:

Well construction information is from measurements by Stoller personnel and the well site geologist. The well site geologist also supplied the depth to groundwater. Zero reference is the ground surface. The logging engineer measured the outside and inside casing diameters of the 6-in. and 11-in. casings using a steel tape and calipers. The outside diameter of the 9-in. casing was measured with a caliper and a steel tape. The inside casing diameter of the 9-in. casing was estimated. The Becker drilling system utilizes a special dual-wall casing string. Air passes through the annular space between the inner and outer casings, and drill cuttings are brought up inside the inner casing. For this well, the casing consisted of a 6-in. ID inner casing with 0.125-in. wall thickness inside an 8-in. ID outer casing with 0.5-in. wall thickness. The inner casing is thicker at casing joints, where wall thickness is 0.406 in. Casing joints are approximately 1 ft long overall and occur at 10-ft intervals. No contamination was detected during drilling.

Logging Equipment Information:

Logging System:	Gamma 3E (RLS-1)		Type: 70% HPGe
Calibration Date:	10/2002	Calibration Reference:	GJO-2002-386-TAR
		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	11/13/02	11/13/02	11/13/02		
Logging Engineer	Kos	Kos	Kos		
Start Depth (ft)	349.0	135.0	99.0		

Log Run	1	2/Repeat	3	4	5
Finish Depth (ft)	100.0	100.0	0.0		
Count Time (sec)	100	100	100		
Live/Real	R	R	R		
Shield (Y/N)	None	None	None		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	n/a[4]	n/a	n/a		
Pre-Verification	CE041CAB	CE041CAB	CE041CAB		
Start File	CE041000	CE041250	CE041286		
Finish File	CE041249	CE041285	CE041385		
Post-Verification	CE041CAA	CE041CAA	CE041CAA		
Depth Return Error (in.)	0.0	NA	0.0		
Comments	No fine gain adjustments.	No fine gain adjustments.	No fine gain adjustments.		

Logging Operation Notes:

Zero reference was the ground surface, and the borehole was logged through drill pipe. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the RLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. During logging run 3, liquid N_2 depleted at 1,800 hrs at a depth of 33.0 ft. The tool was winched to the ground surface, and the dewar was filled. The well was reentered and logging was resumed at a depth of 33.0 ft, file CE041352.

Analysis Notes:

Analyst:	Sobczyk	Date:	12/03/02	Reference:	GJO-HGLP 1.6.3, Rev. 0

RLS pre-run and post-run verification spectra were collected at the beginning and end of the day. File CE041CAB was slightly above the control limit for the 609-keV full-width at half-maximum value. File CE041CAA was slightly above the control limit for the 1461-keV full-width at half-maximum value. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were stable and between 1 and 2 percent of one another. Examinations of spectra indicate that the detector appears to have functioned normally during all of the logging runs.

Log spectra for the RLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Post-run 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: RLS-1Oct02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the ground surface. Data were analyzed using a uniform casing correction based on the cumulative wall thickness of 0.625 in. for the dual wall casing. This correction was applied from 30.0 to 349.0 ft. From ground surface to 30.0 ft, the casing correction factor was calculated based on 1.125 in., which represents the cumulative thickness of the dual wall casing and the 10.75-in. ID surface casing. The increase in casing thickness at the joints in the dual wall casing results in an apparent reduction in concentration, because the actual thickness increases to 0.9 in., but the casing correction is not changed. A water correction was applied to the RLS data at and below 227.0 ft. For the 70% HPGe detector, dead time at background count rates varies from 2 to 6 percent, averaging about 4 percent. This variation appears to be due to random fluctuation, as it does not correlate with count rate. The fluctuation is apparently an operational characteristic of the detector. Experiments with the detector in the calibration models indicate that the dead time is a function of count rate and that a dead time correction function similar to that developed for the SGLS can be used. Dead time values less than 10 percent should be ignored. Dead time corrections are required when dead time exceeds 18 percent. As the dead time did not exceed 18 percent, a dead time correction was not needed or applied.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the 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.

Results and Interpretations:

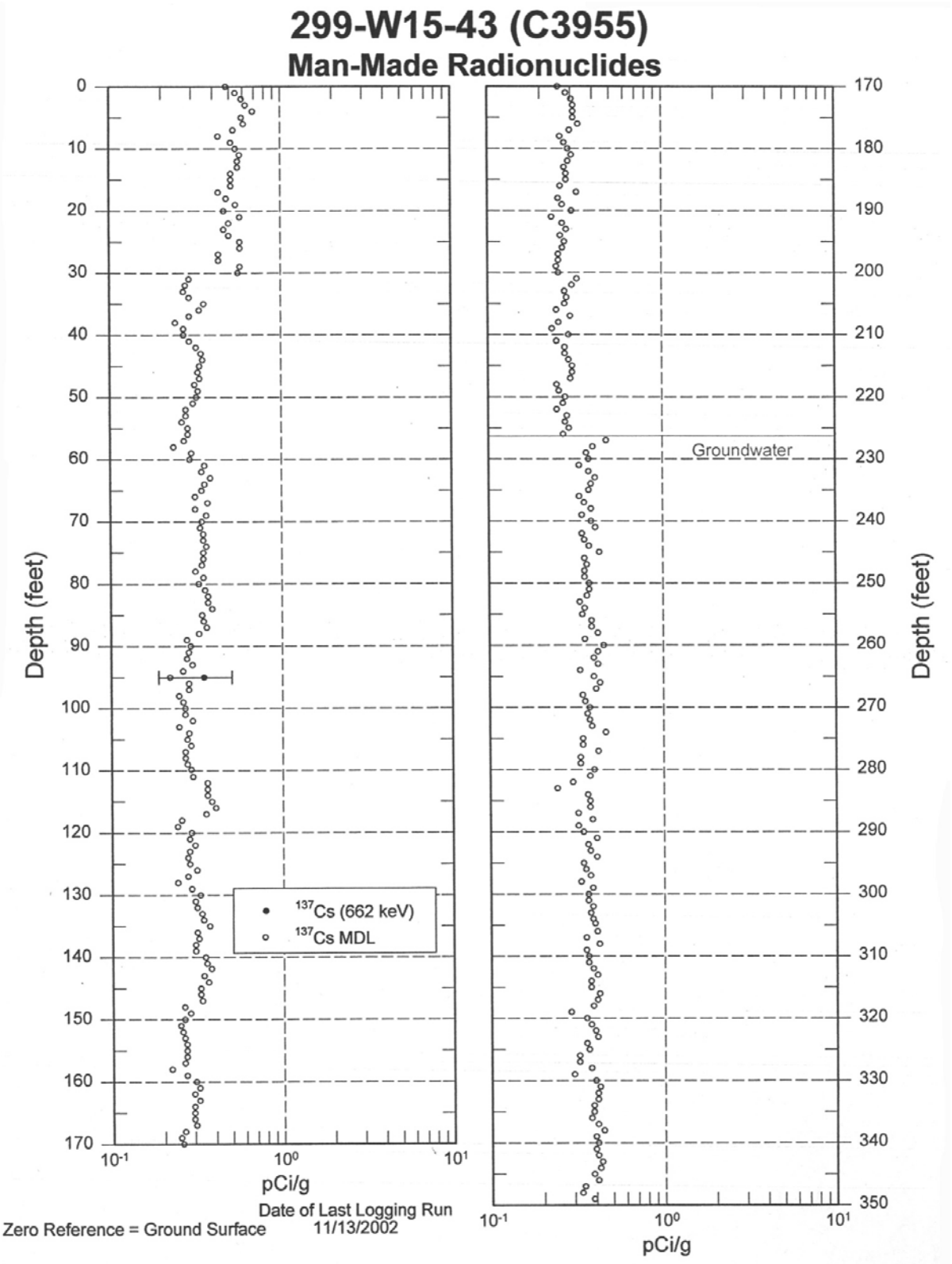
^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected by automated data processing at 95.0-ft log depth at an activity near its MDL of approximately 0.2 pCi/g. After examination of the individual spectrum, it was determined that there is no evidence of a photopeak at 662 keV. This isolated occurrence is the result of statistical fluctuation.

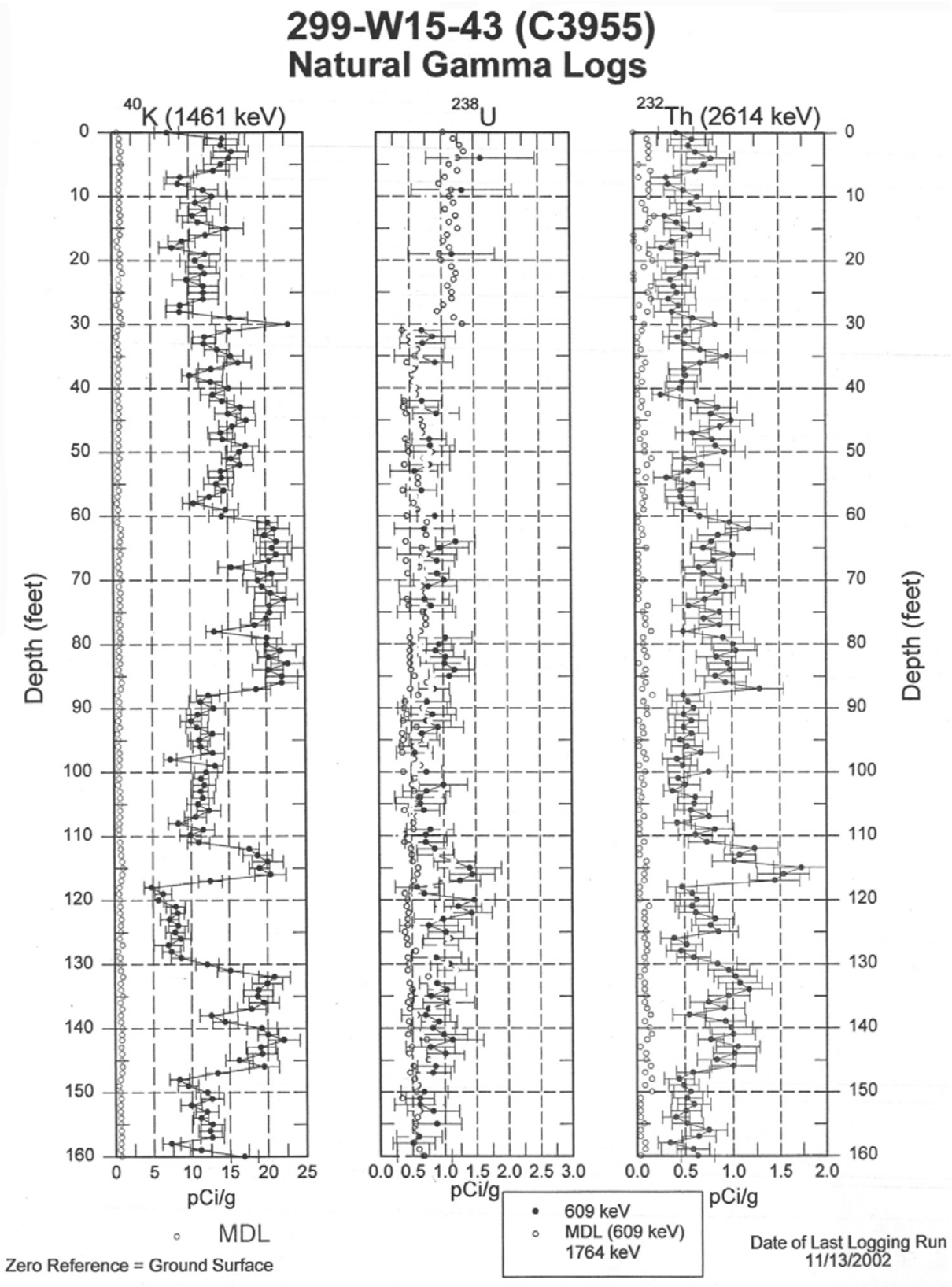
Recognizable changes in the KUT and total gamma logs occurred in this borehole. Starting at about 8 ft, decreases in total gamma and KUT concentrations occur every 10.0 ft at the casing joints in the dual wall casing. These concentration changes are due to an increase in gamma attenuation associated with the increase in casing thickness at the joints, rather than an actual change in activity. They are most apparent on the total gamma and ^{40}K (1461 keV) logs. At 61 ft, there is a 5-pCi/g increase in ^{40}K concentration and a 0.4-pCi/g increase in ^{232}Th concentration. These increases in apparent ^{40}K and ^{232}Th concentrations may correspond to the contact with the Hanford H2. At 87 ft, there is an 8-pCi/g decrease in ^{40}K concentration and a 0.4-pCi/g decrease in ^{232}Th concentration. These decreases in apparent ^{40}K and ^{232}Th concentrations may correspond to the contact with the Hanford H3. Between 111 and 117 ft, the fine-grained member of the Cold Creek Unit (formerly known as the Early Palouse Soil) is shown by an increase in total gamma (100 cps) and ^{232}Th (1.0 pCi/g). A 10-pCi/g decrease in ^{40}K and a 1.0-pCi/g decrease in ^{232}Th concentration occur at 117 ft. On the basis of low ^{40}K and ^{232}Th concentrations, the carbonate-rich paleosols of the Cold Creek Unit are interpreted as being between 117 and 130 ft.

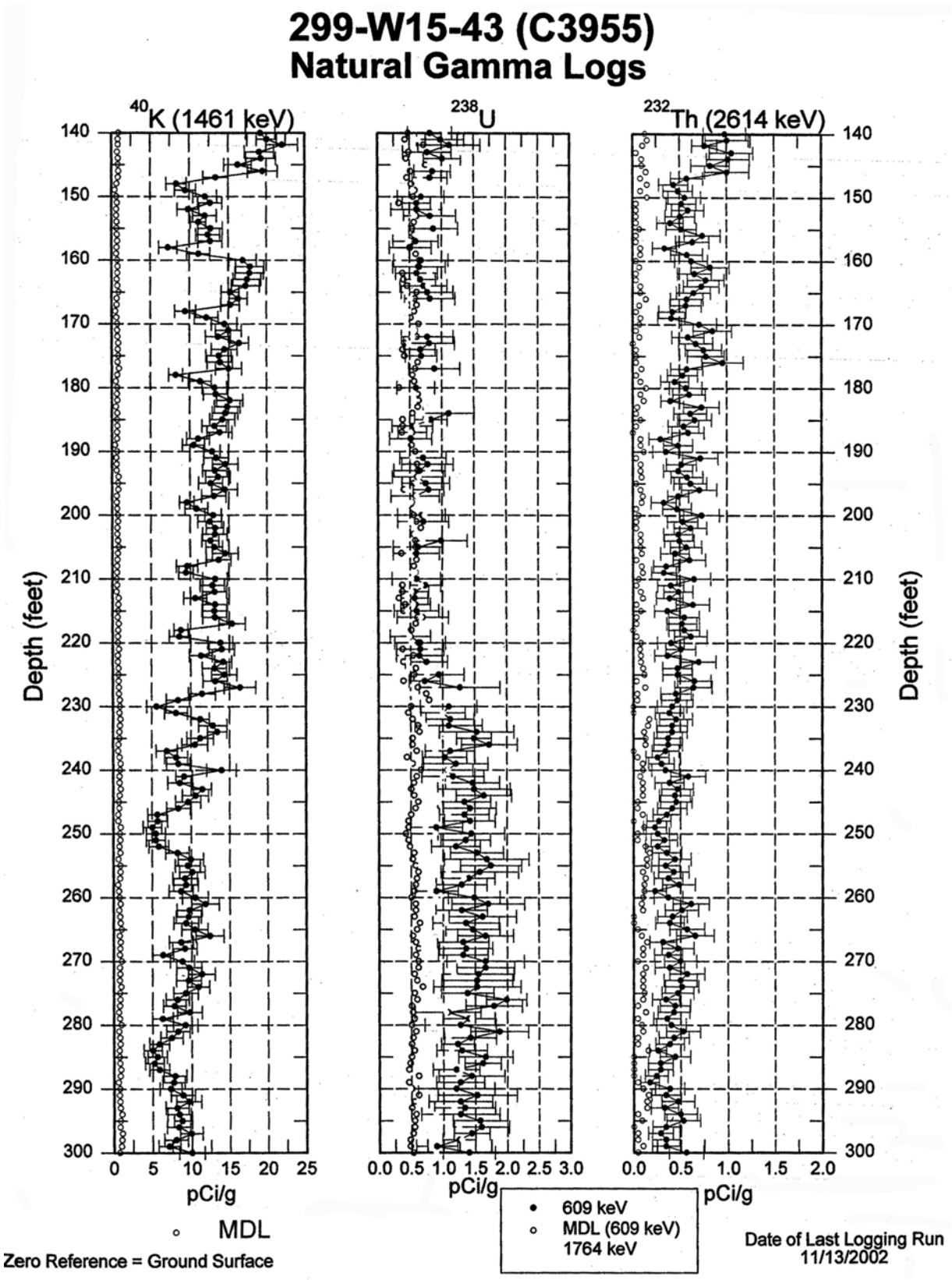
The plots of the repeat logs demonstrate good repeatability of the RLS data for the natural radionuclides at energy levels of 609, 1461, 1764, and 2614 keV.

---

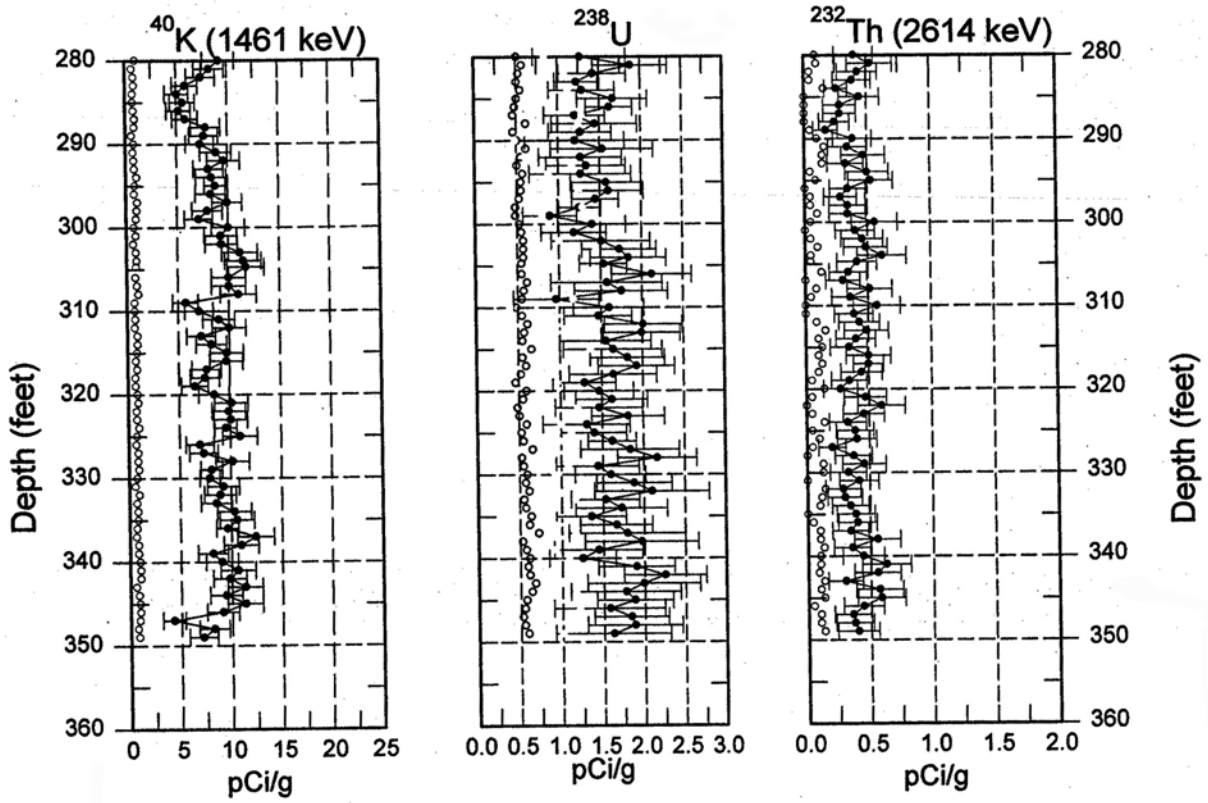
[1] GWL – groundwater depth
[2] TOC – top of casing
[3] N/A – not available
[4] n/a – not applicable


299-W15-43 (C3955)
Man-Made Radionuclides
Depth (feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
Groundwater
137Cs (662 keV)
137Cs MDL
10-1
100
101
pCi/g
Date of Last Logging Run
11/13/2002
Zero Reference = Ground Surface


299-W15-43 (C3955)
Natural Gamma Logs
40K (1461 keV)
238U
232Th (2614 keV)
Depth (feet)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
0 5 10 15 20 25
0.0 0.5 1.0 1.5 2.0 2.5 3.0
0.0 0.5 1.0 1.5 2.0
pCi/g
MDL
609 keV
MDL (609 keV)
1764 keV
Zero Reference = Ground Surface
Date of Last Logging Run
11/13/2002

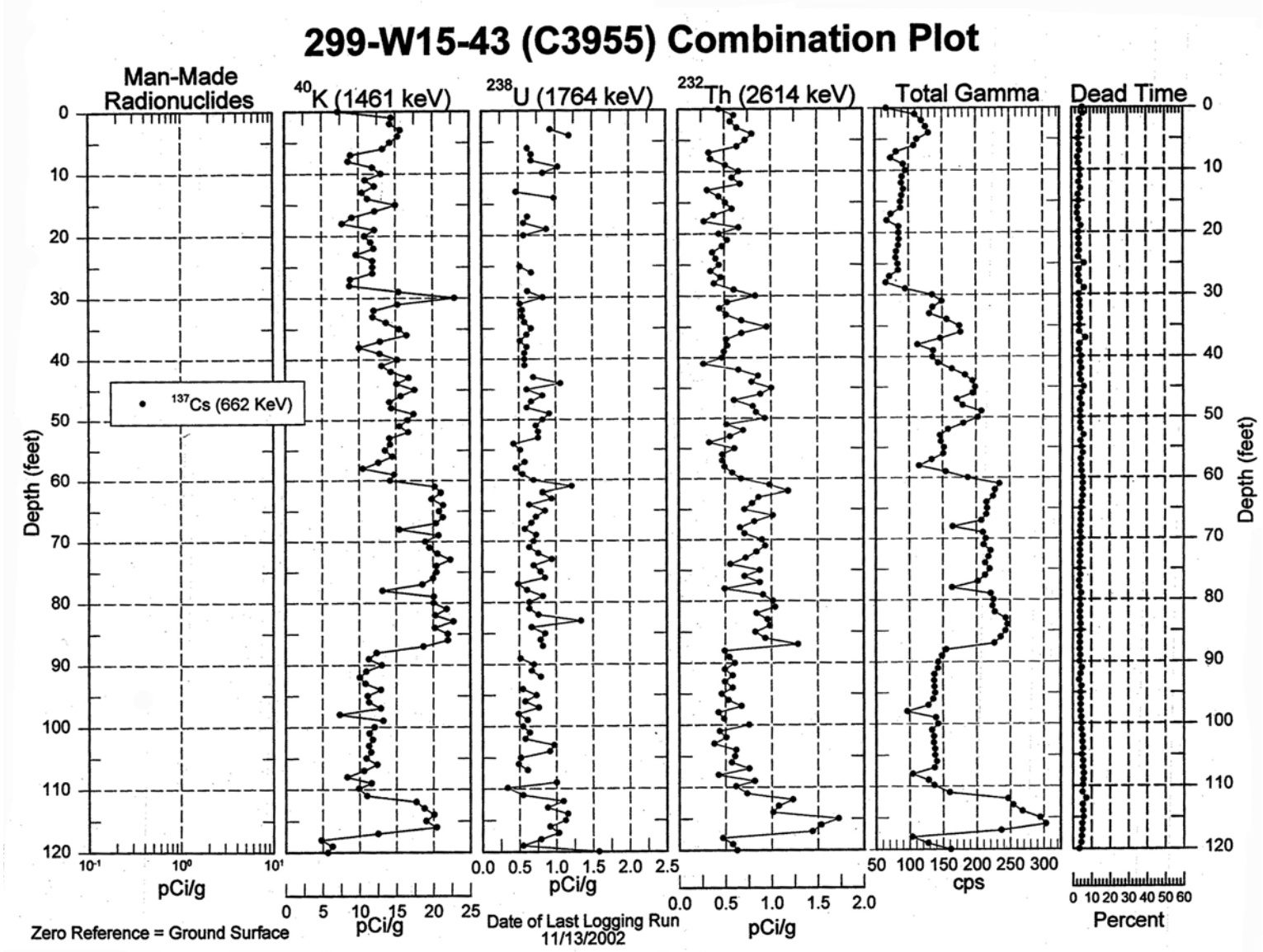

299-W15-43 (C3955)
Natural Gamma Logs
40K (1461 keV)
238U
232Th (2614 keV)
Depth (feet)
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
0 5 10 15 20 25
pCi/g
MDL
0.0 0.5 1.0 1.5 2.0 2.5 3.0
pCi/g
609 keV
MDL (609 keV)
1764 keV
0.0 0.5 1.0 1.5 2.0
pCi/g
Zero Reference = Ground Surface
Date of Last Logging Run
11/13/2002

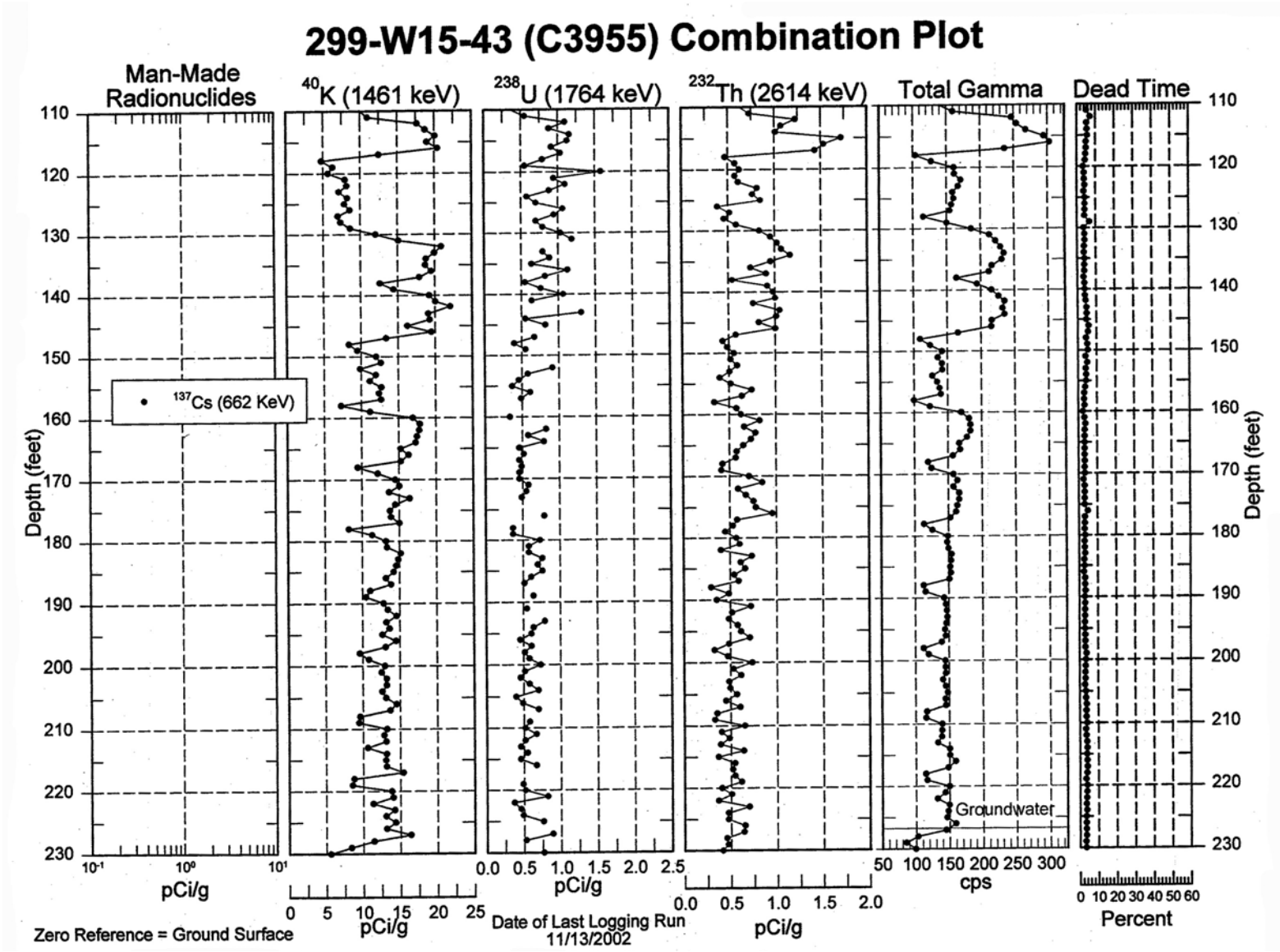
299-W15-43 (C3955)
Natural Gamma Logs

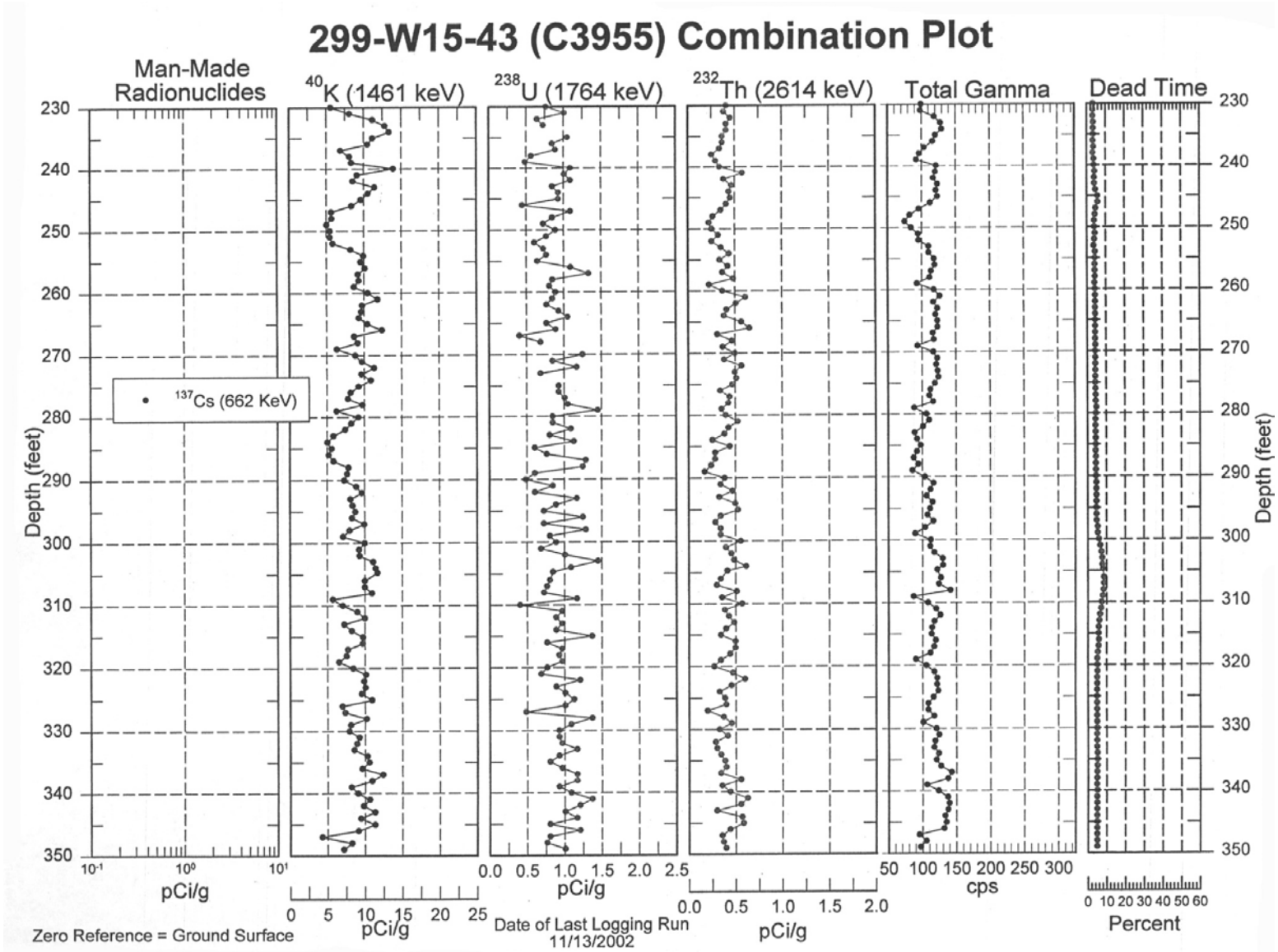


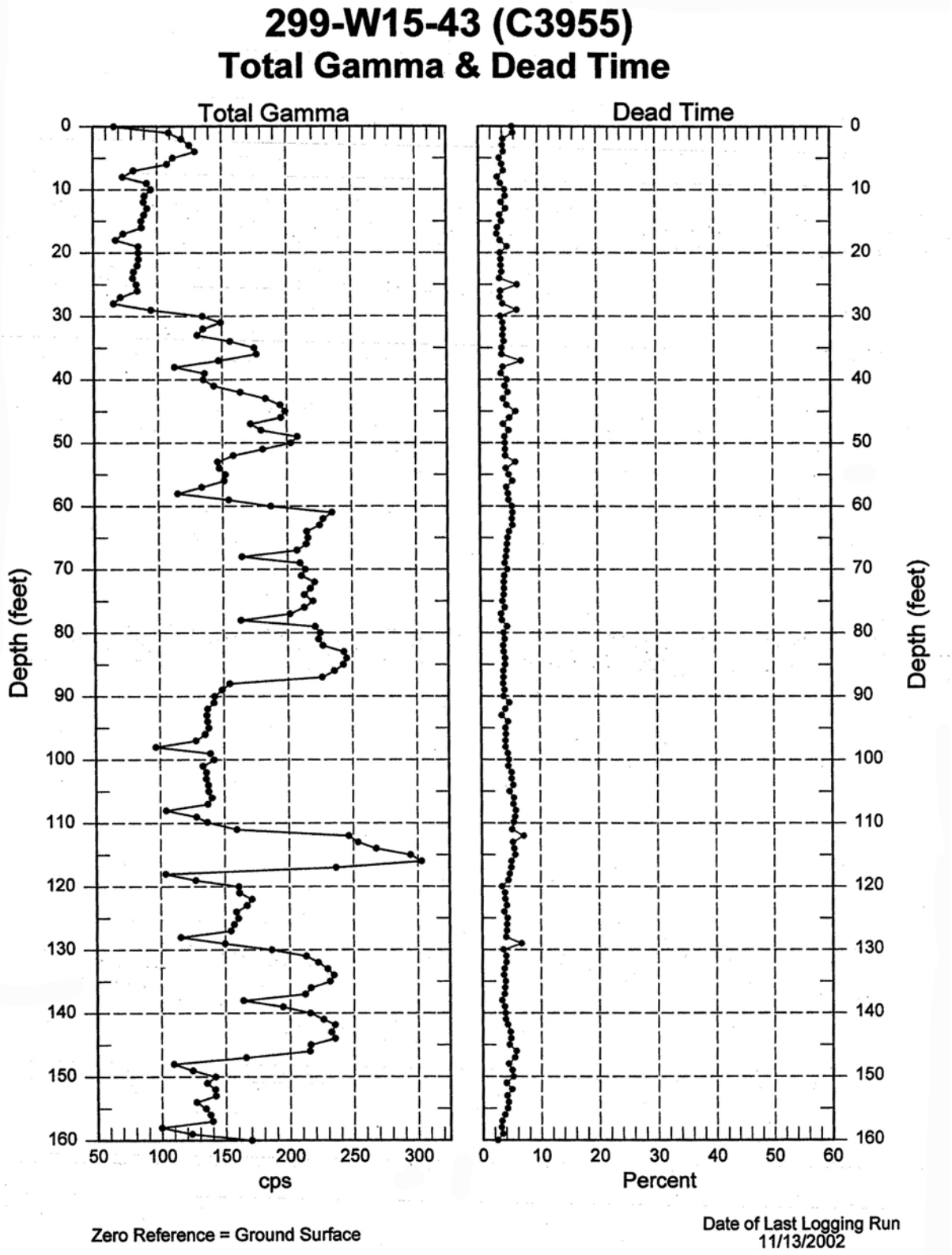
Zero Reference = Ground Surface

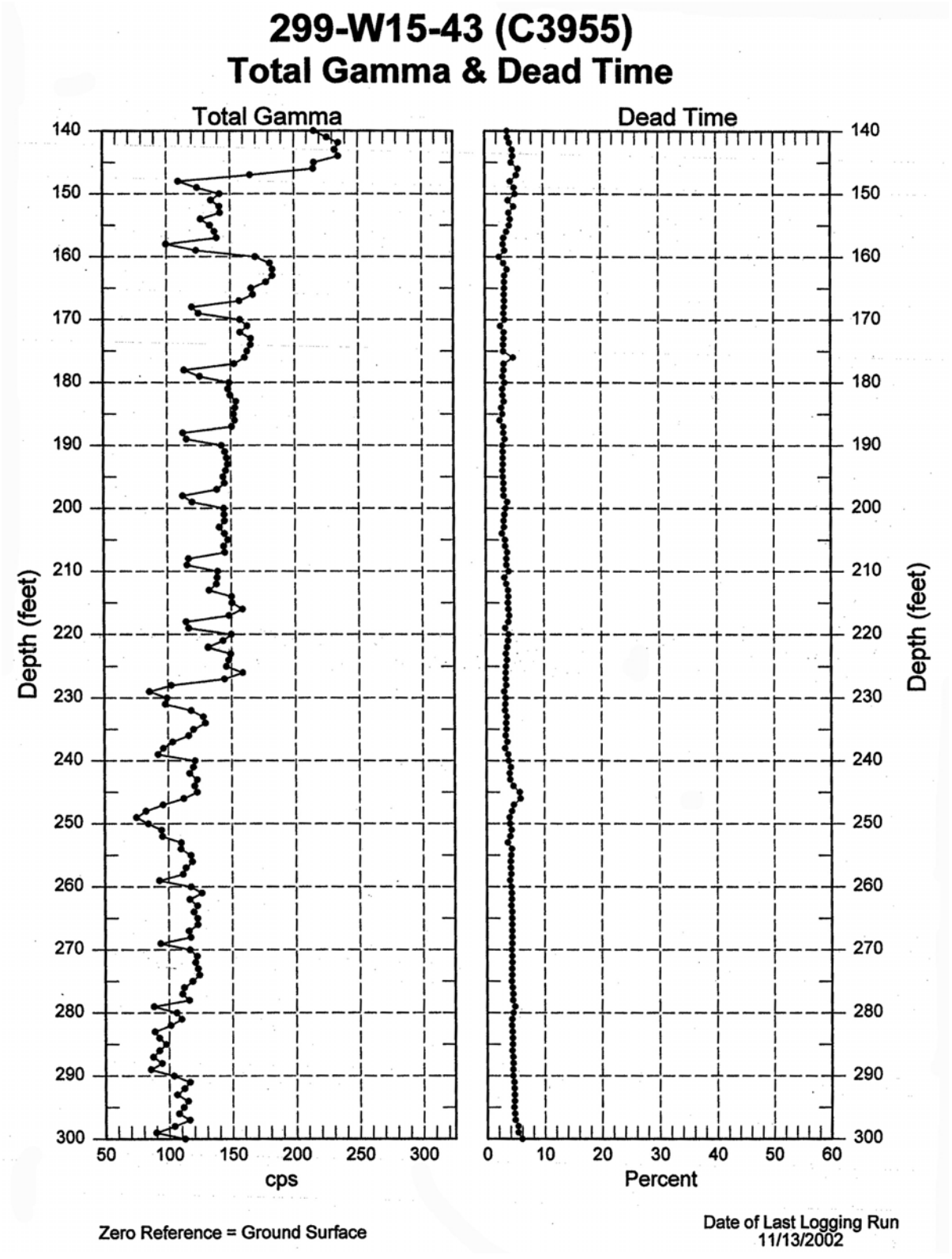
Date of Last Logging Run
11/13/2002


299-W15-43 (C3955) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Dead Time
137Cs (662 KeV)
Depth (feet)
pCi/g
cps
Percent
Zero Reference = Ground Surface
Date of Last Logging Run
11/13/2002

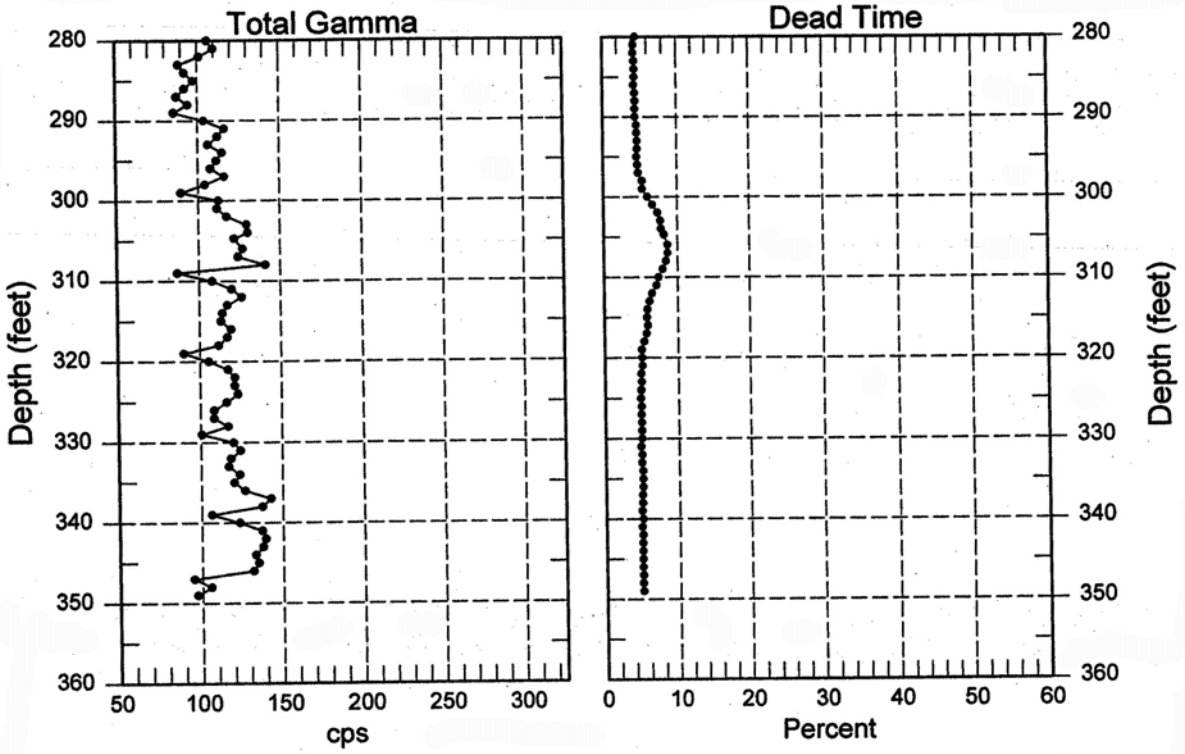

299-W15-43 (C3955) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Dead Time
137Cs (662 KeV)
Depth (feet)
pCi/g
cps
Percent
Groundwater
Zero Reference = Ground Surface
Date of Last Logging Run
11/13/2002


299-W15-43 (C3955) Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Dead Time
137Cs (662 KeV)
Depth (feet)
pCi/g
cps
Percent
Zero Reference = Ground Surface
Date of Last Logging Run
11/13/2002


299-W15-43 (C3955)
Total Gamma & Dead Time
Total Gamma
Dead Time
Depth (feet)
Depth (feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
50
100
150
200
250
300
cps
0
10
20
30
40
50
60
Percent
Zero Reference = Ground Surface
Date of Last Logging Run
11/13/2002

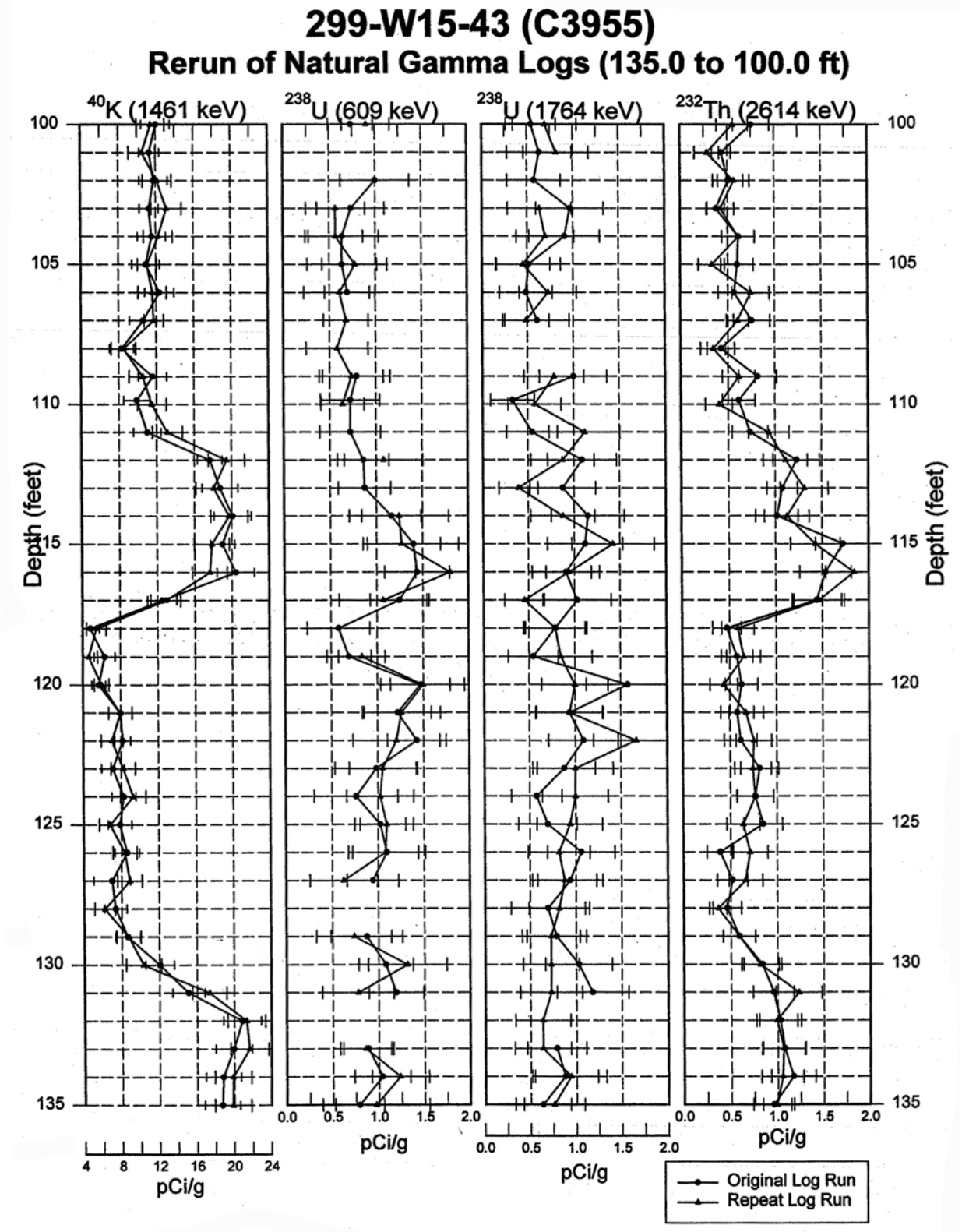

299-W15-43 (C3955)
Total Gamma & Dead Time
Total Gamma
Dead Time
Depth (feet)
Depth (feet)
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
50
100
150
200
250
300
cps
0
10
20
30
40
50
60
Percent
Zero Reference = Ground Surface
Date of Last Logging Run
11/13/2002

299-W15-43 (C3955)
Total Gamma & Dead Time



Zero Reference = Ground Surface

Date of Last Logging Run
11/13/2002


299-W15-43 (C3955)
Rerun of Natural Gamma Logs (135.0 to 100.0 ft)
40K (1461 keV)
238U (609 keV)
238U (1764 keV)
232Th (2614 keV)
Depth (feet)
100
105
110
115
120
125
130
135
4 8 12 16 20 24
pCi/g
0.0 0.5 1.0 1.5 2.0
pCi/g
Original Log Run
Repeat Log Run

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