PNNL-14249

Pacific Northwest
National Laboratory
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U.S. Department of Energy

Data Package for Calendar Year 2002 RCRA Groundwater Monitoring Wells at Single-Shell Tank Waste Management Area TX-TY

D. G. Horton

April 2003

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

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Pacific Northwest National Laboratory
Richland, Washington 99352

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1.0 Introduction

Two new Resource Conservation and Recovery Act (RCRA) groundwater monitoring wells were installed at the single-shell tank farm Waste Management Area (WMA) TX-TY in October and November 2002 in fulfillment of Tri-Party Agreement (Ecology et al. 1998) Milestone M-24-00N. The well names are 299-W14-19 and 299-W15-44; the corresponding well numbers are C3957 and C3956, respectively. Well 299-W14-19 is located east of the central part of the TX Tank Farm and is a downgradient well filling a gap in the monitoring network between wells 299-W14-14 and 299-W14-6. Well 299-W15-44 is located at the southwest corner of the TX Tank Farm in an area where groundwater flow has been artificially altered toward the southwest by the 200-ZP-1 Operable Unit pump-and-treat system. The well is in the cone of depression of the 200-ZP-1 extraction wells and is downgradient of WMA TX-TY. The locations of all wells in the WMA TX-TY monitoring network are shown on Figure 1.

The original assessment monitoring plan for WMA TX-TY was issued in 1993 (Caggiano and Chou 1993). That plan was updated for the continued assessment at WMA TX-TY in 2001 (Hodges and Chou 2001). The updated plan provides justification for the new wells. The new wells were constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160 and WAC 173-303, the updated assessment plan for WMA TX-TY (Hodges and Chou 2001), 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 wells 299-W14-19 and 299-W15-44. 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, Washington.

Except for survey coordinates, English units are used in this report (except for well surveys) 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.

(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.

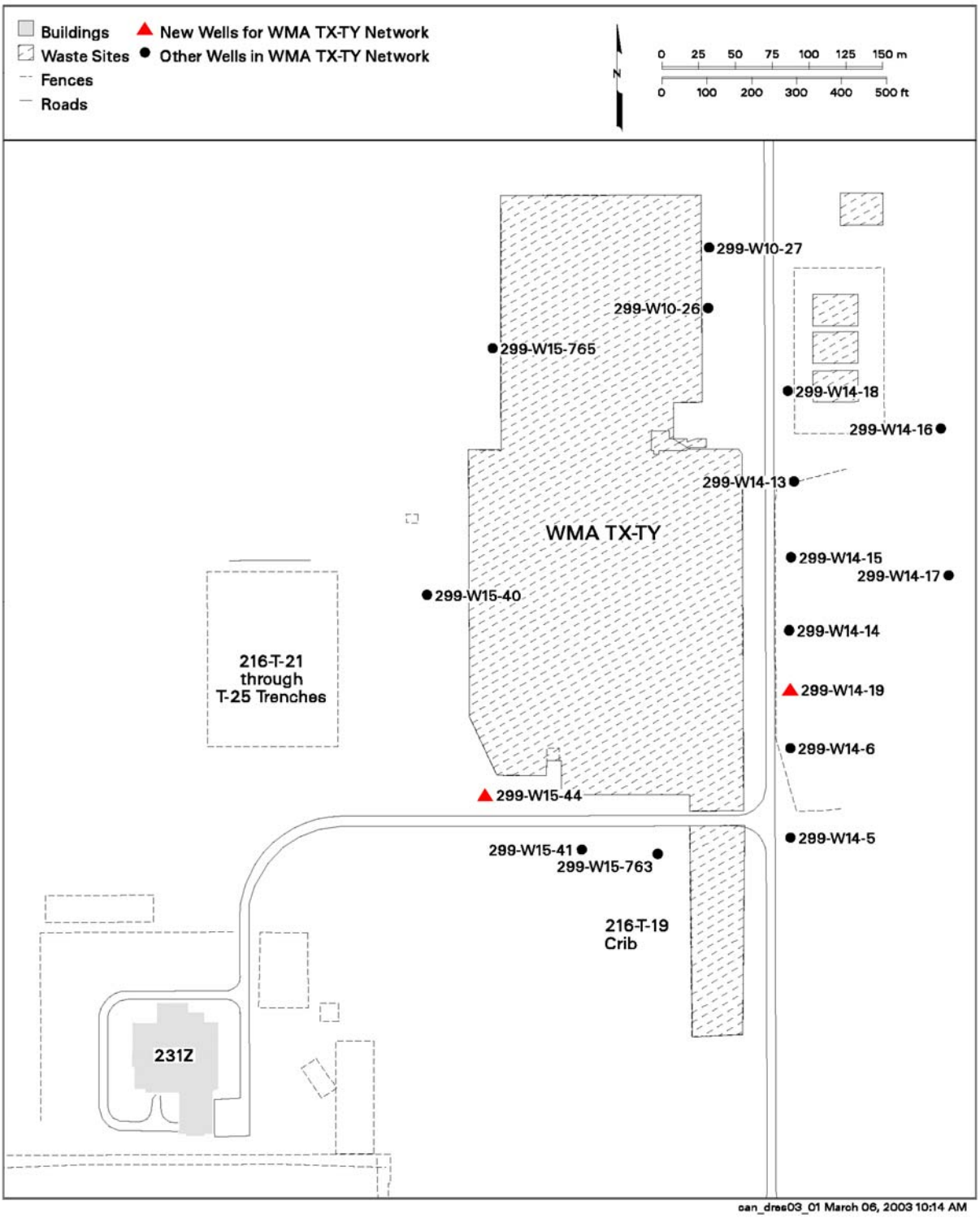

Figure 1. Map of Waste Management Area TX-TY Showing the Locations of All Wells in the Groundwater Monitoring Network

2.0 Well 299-W14-19

2.1 Drilling and Sampling

Well 299-W14-19 was drilled in October 2002 with a Becker hammer drill rig from 30 feet below ground surface (bgs) to a total depth of 344.3 feet bgs with temporary dual-wall carbon steel casing. The upper 30 feet of the borehole were declared medium risk with respect to encountering contamination and was drilled with an auger drill rig and 10.75 inches outside diameter casing. No water was added to the borehole during drilling.

The sediments encountered during drilling were predominantly Hanford formation sand, with some sandy gravel, from the base of backfill at 3 to 95 feet bgs; upper Cold Creek unit silty sand and silt from 95 to 109 feet bgs; lower Cold Creek unit silty sand and silty sandy gravel with caliche from 109 to 130 feet bgs; and Ringold Formation unit E gravel, sandy gravel and silty gravels from 130 feet bgs to total depth (344 feet). 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 233 and 257 feet bgs for analyses of particle size distribution. Particle size distribution data are in Appendix B.

Seven air-lifted slurries of sediment and groundwater were collected during drilling of well 299-W14-19. 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 from field testing 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. Less than 2 parts per million (ppm) carbon tetrachloride were detected in the borehole at depths of less than 30 feet. No contamination was detected outside the borehole.

The borehole was geophysically logged with a spectral gamma-ray tool on October 29 and 30, 2002. Cesium-137 was identified at 4 feet bgs with a concentration of 1 pCi/g. Geophysical logs are presented in Appendix D.

2.2 Well Completion

The borehole was backfilled with 4 to 8 mesh silica sand from 344.3 to 269.5 feet bgs and 0.25 inch bentonite pellets from 269.5 to 264.9 feet bgs.

The permanent casing and screen were installed in well 299-W14-19 in November 2002. A 4-inch-inner-diameter, stainless steel, wire wrap, 20 slot screen was set from 258.5 to 223.5 feet bgs. The permanent casing is 4-inch-inner diameter, stainless steel from 223.5 feet bgs to 1.5 feet above ground surface. A 2-foot-long stainless steel sump with end cap is below the screen from 260.5 to 258.5 feet depth.

The filter pack is 10 to 20 mesh silica sand from 264.9 to 213.5 feet bgs. The filter pack sand was settled by surge block. The annular seal is bentonite pellets from 213.5 to 208.3 feet, granular bentonite from 208.3 to 10.0 feet, and Portland cement from 10.0 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, four 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 Well Summary Sheet (as-built), Well Attributes Report, and Well Construction Summary Report are included in Appendix A.

A 20-foot-long section of the 10.75-inch diameter, temporary casing came unscrewed during well completion. The casing could not be removed from the borehole and was cemented into the annulus from 10 to 30 feet bgs.

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. Note that the survey data are measured and reported in meters.

Table 1. Survey Data for New Wells at Waste Management Area TX-TY

Well Name	Easting (m)[(a)]	Northing (m) [(a)]	Elevation (m)[(b)]	
299-W14-19	566898.60	136135.06	205.612	Top of casing
	566898.626	136135.321	204.899	Brass cap
299-W15-44	566685.02	136066.47	204.890	Top of casing
	566685.053	136066.817	204.168	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-W14-19 was developed in November 2002. A temporary, 5 horsepower (hp), submersible pump was used first to remove 3,405 gallons of formation water at 15 gallons per minute (gpm) with a drawdown of 10.7 feet. The pump intake was at 254.3 feet bgs. Then, 511 gallons of water were removed from 254.3 feet bgs at 7 gpm with a drawdown of 4.56 feet. Finally, the pump intake was raised to 234.3 feet bgs where 468 gallons of water were removed at 6 gpm with a drawdown of 3.14 feet. The final turbidity was 1.14 NTU.

A dedicated Grundfos Redi-Flo2, submersible sampling pump was installed in well 299-W14-19 on December 6, 2002. The sampling pump intake is at 232.8 feet bgs or about 9.3 feet below the water table.

Static water level was 226.9 feet below the top of casing on December 6, 2002. The protective casing extends 2.36 feet above the concrete pad.

2.4 Groundwater Sampling and Analysis

Seven air-lifted slurries of sediment and groundwater were collected during drilling of well 299-W14-19. Samples were collected at about 20 feet intervals beginning at 230 feet bgs (water table was at 225.9 feet bgs at the time of sampling) and continuing to total depth. The slurries were allowed to settle overnight and the groundwater was decanted into sample jars and sent to the Hanford Groundwater Project's contracted laboratories for analyses. Samples were analyzed for anions, metals, technetium-99 and tritium. All laboratory results are given in Appendix C.

In addition to laboratory analyses, aliquots of the slurry samples were collected for analyses of nitrate and specific conductance by field methods. Some groundwater samples also were collected by decanting groundwater from the archived grab samples of sediment. Finally, a few samples were collected for nitrate analyses by extracting soluble nitrate from archived sediment. The extractions were made by adding a known amount of deionized water to a known amount of sediment, shaking the mixture, and decanting the solution. The concentrations of nitrate in the extracts were corrected for dilution and for the moisture content of the sediment.

Table 2 gives the results of the field analyses for nitrate and specific conductance. Laboratory results for nitrate are also on the table. The laboratory and field analyses are in good agreement except for the sample from 69 feet below the water table. The data in Table 2 show a maximum nitrate concentration at about 39 feet and a minimum at about 54 to 59 feet below the water table. The minimum corresponds to the top of a cemented silty sandy gravel that the geologist notes as "very hard drilling with visible cement on gravel." Below the cemented zone, nitrate concentration increases to the bottom of the borehole. The laboratory data in Appendix C show similar trends for some of the metals (calcium and magnesium) and for technetium-99. These data will be further interpreted with respect to groundwater contaminant distribution and movement in other interpretive reports.

3.0 Well 299-W15-44

3.1 Drilling and Sampling

Well 299-W15-44 was drilled in October 2002 with a Becker hammer drill rig from 30 feet bgs to a total depth of 342 feet bgs with temporary dual-wall carbon steel casing. The upper 30 feet of the borehole were declared medium risk with respect to encountering contamination and was drilled with an auger drill rig and 10.75-inch-outside-diameter casing. No water was added to the borehole during drilling.

The sediments encountered during drilling were predominantly Hanford formation sand, silty sandy, silty sandy gravel, and gravelly sand from 15 to ~99 feet bgs; upper Cold Creek unit silty sand from 99 to 108 feet bgs; lower Cold Creek unit silty sand and gravelly sand with caliche from 108 to 126 feet bgs; and Ringold Formation unit E sandy gravel and silty sandy gravel with minor sand from 126 feet bgs to total depth (342 feet). The geologist's log is included in Appendix A.

Table 2. Field Measured Nitrate Concentration and Specific Conductance (and Available Laboratory Results for Comparison) in Samples from Well 299-W14-19

Sample Depth (feet below the water table)[a]	Sample Type	Nitrate Concentration[b] (μg/L)[c]	Specific Conductance (μS/cm)
4.1	Air lifted, field analysis	77,000	486
4.1	Air lifted, lab analysis	84,600	516
19.1	Air lifted, field analysis	126,000	574
19.1	Air lifted, lab analysis	111,000	630
24.1	Groundwater from sediment jar, field analysis	85,000	Not measured
34.1	Groundwater from sediment jar, field analysis	27,000	Not measured
39.1	Air lifted, field analysis	215,000	689
39.1	Air lifted, lab analysis	185,000	713
44.1	Groundwater from sediment jar, field analysis	101,000	Not measured
49.1	Water extract from sediment jar, field analysis	70,000	Not measured
54.1	Groundwater from sediment jar, field analysis	2,300	Not measured
59.1	Air lifted, field analysis	39,000	435
59.1	Air lifted, lab analysis	32,300	459
69.1	Air lifted, field analysis	43,000	438
69.1	Air lifted, lab analysis	67,300	464
94.1	Groundwater from sediment jar, field analysis	50,000	Not measured
99.1	Air lifted, field analysis	66,000	444
99.1	Air lifted, lab analysis	68,600	463
109.1	Groundwater from sediment jar, field analysis	63,000	Not measured
118.1	Air lifted, field analysis	105,000	498
118.1	Air lifted, lab analysis	102,000	540

(a) Depth to water was 225.9 feet below ground surface at the time the shallowest sample was collected
(b) Field nitrate was analyzed by the HACH company, chromotropic acid method and blank corrected.
(c) Laboratory analyses were by ion-chromotography.

Grab samples for geologic description and archive were collected every 5 feet throughout the borehole. Also, two grab samples were collected from 225 and 260 feet for analyses of particle size distribution. Particle size distribution data are in Appendix B.

Seven air-lifted slurries of sediment and groundwater were collected during drilling of well 299-W15-44. 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 of field testing are discussed below in Section 3.4. All laboratory analytical results are given in Appendix C.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contamination was detected. The borehole was geophysically logged with a spectral gamma-ray tool on October 17 and 18, 2002. No manmade radionuclides were detected. The geophysical logs are presented in Appendix D.

3.2 Well Completion

The well was backfilled with 4 to 8 mesh silica sand from 343 to 265.6 feet bgs and 0.25-inch bentonite pellets from 265.6 to 260.3 feet bgs.

The permanent casing and screen were installed in well 299-W15-44 in October 2002. A 4-inch-inner-diameter, stainless steel, wire wrap, 20 slot screen was set from 251.25 to 216.25 ft bgs. The permanent casing is 4-inch-inner-diameter, stainless steel from 216.25 feet bgs to 2.0 ft above ground surface. A 2-foot-long stainless steel sump with end cap is below the screen from 253.25 to 251.25 feet depth.

The filter pack is 10 to 20 mesh silica sand from 260.3 to 206.3 feet bgs. The filter pack was settled by surge block. The annular seal is bentonite pellets from 206.3 to 201.4 feet bgs, granular bentonite from 201.4 to 10.1 feet bgs, and Portland cement grout from 10.1 feet bgs to the surface. The tape used to tag the top of well completion materials broke during well completion. Two feet of steel tape remain in the annulus mixed with granular bentonite at 201.5 feet bgs.

A 4-by-4 foot 6-inch concrete pad was placed around the well at the surface. A protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The protective casing sticks up 2.95 feet above the concrete pad. The Well Summary Sheet (as-built), Well Attributes Report, and Well Construction Summary Report are included in Appendix A.

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. Note that the survey results are measured and reported in meters.

3.3 Well Development and Pump Installation

Well 299-W15-44 was developed in November 2002. A temporary, 5 hp, submersible pump was used first to remove 658 gallons of formation water at 7 gpm with a drawdown of 2.61 feet. The pump intake was at 247.7 feet bgs. The pump intake was then moved up to 232.0 feet bgs where 570 gallons of water were removed at 8.5 gpm with a drawdown of 2.68 feet. The final turbidity was 3.81 NTU.

A dedicated Redi-Flo2 submersible sampling pump was installed in well 299-W15-44 on December 5, 2002. The sampling pump intake is at 228.58 feet bgs or about 9.68 feet below the water table.

Static water level was 224.8 feet below the top of casing on December 5, 2002 (stick-up is 2.39 feet).

3.4 Groundwater Sampling and Analysis

Seven air-lifted slurries of sediment and groundwater were collected during drilling of borehole 299-W15-44. Samples were collected at about 20-foot intervals beginning at 225 feet bgs (water table was at 223.2 feet bgs at the time of sampling) and continuing to total depth. The slurries were 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. Samples were analyzed for anions, metals, technetium-99, and tritium. All laboratory results are given in Appendix C.

In addition to laboratory analyses, aliquots of the slurry samples were collected for analyses of nitrate by field methods. Some groundwater samples also were collected by decanting groundwater from the archived grab samples of sediment. Finally, one sample was collected for nitrate analyses by extracting soluble nitrate from archived sediment. The extraction was made by adding a known amount of deionized water to a known amount of sediment, shaking the mixture, and decanting the solution. The concentration of nitrate in the extract was corrected for dilution and for the moisture content of the sediment.

Table 3 gives the results of field analyses for nitrate. Laboratory results for nitrate are also on the table. The laboratory and field analyses are in very good agreement with each other. The data in Table 3 show a maximum nitrate concentration near the water table and a decrease in concentration to about 57 feet below the water table. At that depth, concentration increases over a short interval between about 62 to 67 feet, decreases again at 69 feet, and then increases toward the bottom of the borehole. The zone between about 62 and 72 feet below the water table consisted of heaving sand. These data will be further interpreted with respect to groundwater contaminant distribution and movement in other interpretive reports.

Table 3. Field Measured Nitrate Concentrations (and available laboratory data for comparison) in Samples from Borehole 299-W14-19

Sample Depth (feet below the water table)[(a)]	Sample Type	Nitrate Concentration (μg/L)[(b)]
1.8	Air lifted, field analysis	211,000
1.8	Air lifted, lab analysis	185,000
6.8	Water extract from sediment jar, field analysis	170,000
11.8	Water extract from sediment jar, field analysis	201,000
21.8	Air lifted, field analysis	89,000
21.8	Air lifted, lab analysis	92,100
31.8	Groundwater from sediment jar, field analysis	88,000
41.8	Air lifted, field analysis	77,400
41.8	Air lifted, lab analysis	74,400
51.8	Groundwater from sediment jar, field analysis	89,800
56.8	Groundwater from sediment jar, field analysis	50,000
61.8	Air lifted, field analysis	134,000
61.8	Air lifted, lab analysis	139,000
66.8	Groundwater from sediment jar, field analysis	149,000
68.8	Groundwater from sediment jar, field analysis	96,000
71.8	Groundwater from sediment jar, field analysis	110,000
76.8	Groundwater from sediment jar, field analysis	149,000
81.8	Air lifted, field analysis	140,000
81.8	Air lifted, lab analysis	139,000
86.8	Groundwater from sediment jar, field analysis	144,000
101.8	Air lifted, field analysis	126,000
101.8	Air lifted, lab analysis	123,000
106.8	Groundwater from sediment jar, field analysis	135,000
111.8	Water extract from sediment jar, field analysis	82,000
118.8	Air lifted, field analysis	166,000
120.8	Air lifted, lab analysis	166,000

(a) Depth to water was 223.2 feet below ground surface at the time the shallowest sample was collected

(b) Field nitrate was analyzed by the HACH company, chromotropic acid method and blank corrected. Laboratory analyses were by ion-chromotography.

4.0 References

Caggiano, J. A. and C. J. Chou. 1993. *Interim-Status Groundwater Quality Assessment Plan for the Single Shell Tank Waste Management Areas T and TX-TY.* WHC-SD-EN-AP-132, Rev. 0, Westinghouse Hanford Company, Richland, WA.

CP-14256, Rev. 0. 2003. *Calendar Year 2002 RCRA and CERCLA Groundwater Monitoring Well Summary Report.* C. R. Martinez, Fluor Hanford, Inc., Richland, Washington.

Ecology – Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy. 1998. *Hanford Federal Facility Agreement and Consent Order*. Document No. 89-10, Rev. 5 (The Tri-Party Agreement), Olympia, Washington.

Hodges, F. N. and C. J. Chou. 2001. *RCRA Assessment Plan for Single-Shell Tank Waste Management Area TX-TY at the Hanford Site.* PNNL-12072, Pacific Northwest National Laboratory, Richland, WA.

RCRA - Resource Conservation and Recovery Act. 1976. Public Law 94-580, as amended, 90 Stat. 2795, 42 USC 6901 et seq.

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 card # R05120

Start Date: 10/24/02
Finish Date: 11/18/02
Page 1 of 1

Well ID: C3957	Well Name: 299-W14-19	Approximate Location: East of TX-TY Tank Farm	
Project: RCRA Drilling		Other Companies: FH, CHG	
Drilling Company: Layne Christensen		Geologist(s): C. Martinez, J. Hocking	
Driller: Paul Ladder ("Derry")	License #: LG28 (WA)		

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
10 3/4" / 10 3/8" C.S. FJ	0' - 30'	11 1/2" / 10"
	-	
Dual wall casing FJ, CS	0' - 344'	9"
outer casing: 9"	-	
inner casing: 7"/6"	-	
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design		

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

Auger: ✓	Diameter 9"	From 0'	to 30'
Cable Tool:	Diameter ____	From ____	to ____
Air Rotary:	Diameter ____	From ____	to ____
A.R. w/Sonic:	Diameter ____	From ____	to ____
S.H. crowd in bit	Diameter 9"	From 30'	to 344.3'
	Diameter ____	From ____	to ____
	Diameter ____	From ____	to ____

Becker Hammer w/ 9" "crowd in" bit

Drilling Fluid: N/A

Total Drilled Depth: 344.3'	Hole Dia @ TD: 9"	Total Amt. Of Water Added During Drilling: —	
Well Straightness Test Results: 10/31/02 using 20' long tool		Static Water Level: 223.55'	Date: 11/04/02

4 1/2" O.D.

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	0' - 160'	10/29/02		-	
Spectral Gamma	126' - 344.3'	10/30/02		-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume ft³	Mesh Size
SS 304L casing (4" ID)	+1.5' - 223.5'	F480	N/A	Granular bentonite (50#)	100' - 208.3'	111	N/A
SS 304L wellscreen (4")	223.5' - 258.5'	"	0.020"	1/4" Bentonite Pellets (50#)	208.3' - 213.5'	7	1/4"
SS 304L sump (4" ID)	258.5' - 260.5'	"	N/A	Colorado Silica Sand (50#)	213.5' - 264.9'	49	10-20
	-			Bentonite Pellets (50#)	264.9' - 269.5'	3	1/4"
	-			Colorado Silica Sand (50#)	269.5' - 344.3'	69	4-8

OTHER ACTIVITIES

Aquifer Test: Well Development	Date: 11/13/02 11/18/02	Well Decommission:	Yes:	No:	Date:
Description: Pumped 15 gpm for 138 min w/ 15.44' x D. Resumed 11/18/02 @ 7 gpm. Pumped 73 min. Raised pump EP'. Pumped for 31 min @ 6 gpm. TD = 8.469'.		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 = 6.43 ft³; gran. bent. => 111 * 0.71 = 78.81 ft³; bent. pellets => 5 * 0.632 = 3.16 ft³
10-20 silica sand => 49 * 0.535 = 26.22 ft³; 4-8 silica sand => 69 * 0.662 = 45.68 ft³

Reported By: Charlene Martinez Title: Geologist/Scientist Signature: Charlene Martinez Date: 12/08/02

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

WELL SUMMARY SHEET

Start Date: 10/24/02
Finish Date: 11/04/02
Page: 1 of 2

Well ID: C3957
Well Name: 299-W14-19
Location: East of TX-TY Tank Farm
Project: RCRA Drilling
Prepared By: Charlene Martinez
Date: 11/04/02
Reviewed By: L.D. Walker
Date: 12/11/02
Signature: Charlene Martinez
Signature: LD Walker

CONSTRUCTION DATA

Description	Diagram
Protective casing (6" ID) set 1.53' above permanent casing.	
4" ID sched. 5 SS304L well casing: + 1.5' → 223.5'	
Portland Cement Grout: 0' → 10.0'	
Granular Bentonite: 10.0' → 208.3'	
1/4" Bentonite Pellets: 208.3' → 213.5'	
10-20 mesh silica sand: 213.5' → 264.9'	
4" ID 0.020" slot cont. wire-wrap, SS304L wellscreen: 223.5' → 258.5'	
All depths in feet below ground surface.	
20' of 10 3/4" OD carbon steel casing left in ground from 10'-30' bgs.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
0		0'-3' Backfill, crushed gravel
		3'-41' silty SAND (mS)
		Hanford Formation @ 41' bgs
40		41'-50' Sandy GRAVEL (sG)
		50'-95' SAND (S)
		Cold Creek unit @ 95' bgs.
80		95'-100' silty SAND (mS)
		100'-109' SILT (M)
		109'-115' CALICHE
		115'-125' silty SAND (mS)
120		125'-130' silty Sandy GRAVEL (mSG)
		130'-135' Sandy GRAVEL (sG)
		135'-145' GRAVEL (G)
		145'-150' silty sandy GRAVEL (mSG)
160		150'-175' Sandy GRAVEL (sG)
		175'-185' silty sandy GRAVEL (mSG)
		185'-190' Sandy GRAVEL (sG)
		190'-200' silty Sandy GRAVEL (mSG)
200		200'-205' SAND (S)
		205'-220' (est) Sandy GRAVEL (sG)
220		220'-225' silty sandy GRAVEL (mSG)

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

WELL SUMMARY SHEET

Start Date: 10/29/02 Finish Date: 11/04/02 Page: 2 of 2

Well ID: C3957 Well Name: 299-W14-19

Location: East of TX-TY Tank Farm Project: RCRA Drilling

Prepared By: Charlene Martinez Date: 11/05/02 Reviewed By: L.D. Walker Date: 12/11/02

Signature: Charlene Martinez Signature:

CONSTRUCTION DATA

Description	Diagram
SS 304L Sump: (4" ID) 258.5' → 260.5'	
1/4" Bentonite Pellets: 264.9' → 269.5'	
4-8 mesh silica sand: 269.5' → 344.3'	
All depths in feet below ground surface	
20' of 10 3/4" OD carbon steel casing left in ground from 10'-30' bgs.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
240		225'-285' Sandy GRAVEL (sG)
280		285'-295' silty sandy GRAVEL (msG)
		295'-344' Sandy GRAVEL (sG)
320		Static G.W. => 323.55' bgs (11/04/02)
		TD = 344.3' bgs
360		

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

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BOREHOLE LOG

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Date: 10/24/02

Well ID: C3957 | Well Name: 299-W14-19 | Location: East of TX-TY Tank 4 Farm

Project: RCRA drilling | 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		0-3' Backfill, crushed basaltic gravel	Hollow stem Auger
					RCT ck'g borehole.
					α,β,γ @ background
				3'-41' silty SAND (mS) 5% gravel,	Eas. @ 0'. 10/24/02
5				20% silt, 75% sand, Gravel, well-	start 10/25/02
				sorted, peasized, SR-R. Sand-v well sorted,	no grab @ 5' bgs. CCl4
				v fn-med. SR-R 10YR4/4 dark yellowish	@ 5' bgs, organics @
				brown (moist). Strong rxn HCl.	1.7 ppm (in pipe)
					α, β, γ @ background.
10	Grab Hollow stem Auger				Grab 10' archive.
					@ 10' bgs CCl4 organics @
					1.7 ppm (in pipe)
					α, β, γ @ background
15	Grab Hollow stem Auger				Grab 15' archive
					CCl4 & organics < detect.
					α, β, γ @ background
20	GRAB Hollow stem Auger				Grab 20' archive
					CCl4 & organics < detect.
					α, β, γ @ background
25	Grab Hollow stem Auger				Grab 25' archive
					CCl4 & organics < detect.
					α, β, γ @ background

Reported By: Charlene Martinez | Title: Geologist/Scientist | Signature: Charlene Martinez | Date: 10/24/02

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

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

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

BOREHOLE LOG

Page: 2 of 12

Date: 10-25-02

Well ID: C3957 | Well Name: 299-W14-19 | Location: East of TX-TY Tank Farm

Project: RCRA drilling | 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		41'–50' Sandy GRAVEL (SG) 55% gravel, 40% sand, 5% silt. Gravel poorly sorted, mps ~2.5". SR-A. Sand, mod-sorted, SR-SA, vfn-vcse, 60% basalt, 40% felsics. 10YR4/2, dk grayish brown (moist), slight rxn HCl.	Hollow stem to 30' bgs
	Grab				Grab 30' auger
	Becker Hammer 9"				Becker Hammer 9"
					@30' bgs
35					Low risk from 30' to TD
	Grab				Grab 35' archive
	Becker Hammer			50'–95' SAND (S) 100%, m-vcse SR-SA, mod-sorted, 35% basalt, 65% qtz (other), micaceous 10YR5/3 brown (moist), no rxn HCl.	
40	Grab				Grab 40' archive
	Becker Hammer				Hanford Fm. @41' bgs
45	Grab				Grab 45' archive
	Becker Hammer				
50	Grab				Grab 50' archive
	Becker Hammer				
55	Grab				Grab 55' archive
	Becker Hammer				

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

Title: Geologist/Scientist | Title: Geologist

Signature: Charlene Martinez | Date: 10/25/02 | Signature: L.D. Walker | Date: 12/11/02

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

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BOREHOLE LOG

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Date: 10/25/02

Well ID: C3957 | Well Name: 299-W14-19 | Location: East of TX-TY Tank Farm

Project: RCRA Drilling | 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 Grab Becker Hammer	n/a		Sand, 100%, m-vcse, med-sorted, SR-SA micaceous, 35% basalt, 65% qtz (other) no rxn HCl. 10YR5/3 (brown) (moist)	Becker Hammer 9"ID 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 Becker Hammer				Grab 80' archive
85	Grab Becker Hammer				Grab 85' archive

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

Title: Geologist / Scientist | Title: Geologist

Signature: Charlene Martinez | Date: 10/25/02 | Signature: L.D. Walker | Date: 12/11/02

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

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

BOREHOLE LOG

Date: 10/25/02

Well ID: C3957 | Well Name: 299-W14-19 | Location: East of TX-TY Tank farm

Project: RCRA Drilling | 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		95'-100' Silty SAND(mS) 25% silt, 75% sand vfn-fn, very well sorted non-basaltic, SR-R, micaceous, silt nodules, 10YR5/4, yellowish brown (moist) Strong rxn HCl.	Becker Hammer 0"-10' Grab 90' archive
95	Grab Becker Hammer				Grab 95' archive Cold Creek unit @95' bgs.
100	Grab Becker Hammer			100'-109' SILT(m) 10% sand, 90% silt. Sand, vfn-fn, very-well-sorted, SR-R, non-basaltic. 10YR5/4 yellowish brown (moist). Strong rxn HCl.	Grab 100' archive
105	Grab Becker Hammer			@106' trace CALICHE. STRONG RXN HCl	Grab 105' archive
110	Grab Becker Hammer			109'-115' CALICHE. Strong rxn HCl. Some massive. Predominately silt. Uniform color throughout. 7.5YR 8/2 pinkish white (dry)	Grab 110' archive
115	Grab Becker Hammer			115'-125' silty SAND(ms) 30% silt, 70% sand. Sand, SA-R, poorly sorted, vfn-cse, non-basaltic, micaceous, 10YR5/4 yellowish brown (moist) Strong rxn HCl	Grab 115' archive Trace caliche @117' bgs.

Reported By: Charlene Martinez | Title: Geologist/Scientist | Signature: Charlene Martinez | Date: 10/25/02

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

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

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BOREHOLE LOG

Page: 6 of 12
Date: 10/25/02

Well ID: C3957 | Well Name: 299-W14-19 | Location: East of TX-TY Tank Farm
Project: RCRA drilling | 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	N/A		125'-130' Silty Sandy GRAVEL (msG) 50% gravel, 30% sand, 20% silt. Gravel, mod sorted, SR-A, sand, vfn-fn v. well sorted, SR-R, non-basaltic micaceous, 10YR5/4, Yellowish brown (moist) Strong rxn HCl.	Becker Hammer 9" OD
	Grab Becker Hammer				Grab 120' archive
125	Grab Becker Hammer				Grab 125' archive
130	Grab Becker Hammer			130'-135' Sandy GRAVEL (sG) 65% gravel, 35% sand. Gravel, pea-sized to cobbles, v-poorly sorted, A-R. Sand, vcse-cse, mod. sorted, SR-SA. 80% basalt, 20% qtz (other) 10YR6/2, light brownish gray (dry) no rxn HCl.	Grab 130' archive. Ringold fmt @ 130' bgs.
135	Grab Becker Hammer				Grab 135' archive
140	Grab Becker Hammer			135'-145' Gravel (G) 80% gravel, 20% sand. Gravel, v. poorly sorted, SR-A peasized to cobbles. 80% basalt, 20% felsics. Sand, ese-vcse, mod sorted, SR-SA. 10YR6/2, light brownish gray (dry). No rxn HCl.	Grab 140' archive
145	Grab Becker Hammer			145'-150' Silty Sandy GRAVEL (msG) 70% gravel, 20% Sand, 10% Sand. Gravel, SR-SA, poorly sorted, sand SR-SA, poorly sorted, vfn-vcse, non-basaltic, some silt nodules (moist), trace caliche. 10YR5/4 Yellowish brown	Grab 145' archive. weak to mod rxn to HCl.

Reported By: Charlene Martinez | Reviewed By: L.D. Walker
Title: Geologist/Scientist | Title: Geologist
Signature: Charlene Martinez | Date: 10/25/02 | Signature: L.D. Walker | Date: 12/11/02

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

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BOREHOLE LOG

Page: 6 of 12
Date: 10/25/02

Well ID: C3957 | Well Name: 299-W14-19 | Location: East of TX-TY Tank Farm
Project: RCRA Drilling | 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 Becker Hammer	N/A		150'-175' Sandy GRAVEL (sG) 20% gravel, 30% sand. Gravel, poorly sorted, R-A, 80% basalt, 20% qtz (other) pea size - cobbles. Sand, cse-vcse mod-sorted, SR-SA, 35% basalt, 65% qtz (other) 10YR6/2, light brownish gray (dry) no rxn HCl.	Becker Hammer 9"/0 Grab 150' archive
155	Grab Becker Hammer			@ 165' sand => vfn-vcse, micaceous, poorly sorted.	Grab 155' archive
160	Grab Becker Hammer				Grab 160' archive
165	Grab Becker Hammer				Grab 165' archive