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200-UW-1 Field Summary Report for Fiscal Years 2004 and 2005

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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K. B. Allison
Fluor Hanford

Date Published
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CONTENTS

1.0 INTRODUCTION 1-1

1.1 PURPOSE OF FIELD INVESTIGATION 1-3

1.2 REPORT OVERVIEW 1-3

2.0 DESCRIPTION OF FIELD ACTIVITIES 2-1

2.1 SURFACE GEOPHYSICAL SURVEYS 2-1

2.2 GEOPHYSICAL LOGGING OF DIRECT PUSH TECHOLOGY CASING 2-2

2.3 GEOPHYSICAL LOGGING OF EXISTING WELLS 2-6

2.4 AUGER SOIL SAMPLING 2-6

2.4.1 Lithologic Data 2-7

2.5 WASTE MANAGEMENT ACTIVITIES 2-7

3.0 RESULTS 3-1

3.1 SURFACE GEOPHYSICAL SURVEYS 3-7

3.2 GEOPHYSICAL LOGGING RESULTS 3-7

3.2.1 216-U-1/216-U-2 Cribs 3-8

3.2.2 216-U-8 Crib 3-10

3.2.3 216-U-12 Crib 3-12

3.3 AUGER SOIL SAMPLING RESULTS 3-13

3.3.1 Lithologic Data 3-21

3.3.2 Data Verification 3-21

3.4 WASTE MANAGEMENT ANALYSES 3-21

3.5 INVESTIGATION DATA SUPPORT OF FATE AND TRANSPORT MODELING 3-22

3.6 CRIB WASTE SITES DATA SUMMARY 3-22

4.0 WELL COMPLETION ACTIVITIES OR DECOMMISSIONING 4-1

5.0 CONCLUSIONS 5-1

6.0 REFERENCES 6-1

APPENDICES

A SURVEY DATA REPORTS ..... A-i

B SURFACE GEOPHYSICS ..... B-i

C WASTE MANAGEMENT SUMMARY ..... C-i

D U PLANT CLOSURE AUGER SAMPLE ANALYTICAL RESULTS ..... D-i

E MODELING DATA ..... E-i

FIGURES

1-1. 200-UW-1 Operable Unit Waste Sites, Locations, and Preferred Remedial Alternatives (taken from DOE/RL-2003-24). 1-4

3-1. 216-U-1/216-U-2 Crib Plan View of Maximum Cesium-137 Concentration, 0 to 15 ft bgs. 3-15

3-2. 216-U-8 Crib Plan View of Maximum Cesium-137 Concentration, 0 to 15 ft bgs. 3-17

3-3. 216-U-12 Crib Plan View of Maximum Cesium-137 Concentration, 0 to 15 ft bgs. 3-19

3-4. 216-U-1/216-U-2 Crib Plan View Contours for the Maximum Uranium Concentration, 0 to 60 ft bgs. 3-25

3-5. 216-U-1/216-U-2 Crib Plan View Contours for the Maximum Tc-99 Concentration, 0 to 60 ft bgs. 3-27

3-6. 216-U-8 Crib Plan View Contours for the Maximum Uranium Concentration, 0 to 60 ft bgs. 3-29

3-7. 216-U-8 Crib Plan View Contours for the Maximum Nitrogen Concentration, 0 to 60 ft bgs. 3-31

3-8. 216-U-8 Crib Plan View Contours for the Maximum Tc-99 Concentration, 0 to 60 ft bgs. 3-33

3-9. 216-U-12 Crib Plan View Contours for the Maximum Uranium Concentration, 0 to 60 ft bgs. 3-35

3-10. 216-U-12 Crib Plan View Contours for the Maximum Nitrogen Concentration, 0 to 60 ft bgs. 3-37

3-11. 216-U-12 Crib Plan View Contours for the Maximum Tc-99 Concentration, 0 to 60 ft bgs. 3-39

3-12. West to East Geologic Cross Section through 216-U-1/216-U-2. 3-41

3-13. West to East Geologic Cross Section through 216-U-8 3-43

3-14. North to South Geologic Cross Section through 216-U-8 3-45

3-15. West to East Geologic Cross Section through 216-U-12 3-47

TABLES

Table 1-1. Summary of Data Needs for 200-UW-1 OU Waste Sites. (3 pages) 1-1

Table 2-1. Geophysical Logging Summary (2 pages). 2-3

Table 3-1. Summary of Data Results for 200-UW-1 OU Waste Sites (6 pages). 3-1

Table 3-2. Summary of Geophysical Logging of DPT Casings and Selected Wells at the 216-U-1/216-U-2 Cribs. (2 pages) 3-8

Table 3-3. Summary of Geophysical Logging of DPT Casings and Selected Wells at the 216-U-8 Crib. (2 pages) 3-10

Table 3-5. Maximum Concentration Values for Uranium, Nitrogen as Nitrate/Nitrite, and Tc-99 from Auger Samples. (2 Pages) 3-13

Figure 3-1. 216-U-1/216-U-2 Crib Plan View of Maximum Cesium-137 Concentration, 0 to 15 ft bgs. (Based on Spectral Gamma Logging of Identified Wells and Soil Samples.) 3-15

TERMS

ASTM	American Society for Testing and Materials
bgs	below ground surface
COI	contaminant of interest
COC	contaminant of concern
d/min	disintegrations per minute
DPT	direct push technology
DOE	U.S. Department of Energy
EMI	electromagnetic induction
FDEM	frequency domain electromagnetic induction
FH	Fluor Hanford, Inc.
FY	fiscal year
GPR	ground-penetrating radar
HWIS	Hanford Well Information System
ICP-MS	inductively coupled plasma-mass spectroscopy
MDL	minimum detection level
NA	not available
OU	operable unit
SAP	sampling and analysis plan
SGLS	Spectral Gamma-Ray Logging System
TDEM	time domain electromagnetic induction
WAC	Washington Administrative Code
WIDS	Waste Information Data system

1.0 INTRODUCTION

This report documents the results of field characterization activities performed in fiscal year (FY) 2004 and FY 2005 in support of the remedial design of engineered barriers, the remedial design for remove, treat, and disposal sites, and the confirmation of remedies at select soil waste sites within the 200-UW-1 Operable Unit (OU).

Characterization was performed in accordance with the draft *Sampling and Analysis Plan for the U Plant Closure Area Waste Sites (SAP)* (DOE/RL-2003-51). The SAP established site-specific requirements for data collection in support of remedy confirmation and implementation. Table 1-1 presents a list of the waste sites, as well as the specific characterization approach defined in the SAP and addressed in this report for each site.

Table 1-1. Summary of Data Needs for 200-UW-1 OU Waste Sites. (3 pages)

Site Names	Recommended Approach in Table 1-1 Summary of Data Needs DOE/RL-2003-51[a]
Sites Identified for the Engineered Barrier Alternative[b]	
216-U-1/216-U-2 Cribs (including 241-361 Settling Tank)	1) Use ground-penetrating radar (GPR) analyses to identify the locations of underground anomalies. 2) Use geophysical techniques to determine an initial area of lateral contamination for input to the barrier design. 3) Using auger drilling techniques: a. Collect samples at nine (9) locations as identified in the Sampling and Analysis Plan (SAP), Appendix A. At one location, sample at 11, 31, 36, and 43 ft below ground surface (bgs). Sample the remaining eight (8) locations at approximately 45 ft bgs or the maximum contaminant depth, based on spectra gamma-ray logging system (SGLS) results from nearby casings/wells. Analyze samples as follows: Tc-99, nitrogen as nitrate/nitrite, mercury, cadmium, uranium (metal), U-235, U-238, antimony, and arsenic. b. Ecology requested reporting other metals from the inductively coupled plasma-mass spectroscopy (ICP-MS) method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc. c. To support waste management decisions, the following contaminants of interest (COIs) would also be analyzed: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene.
UPR-200-W-19	1) Use geophysical techniques to verify site boundaries. 2) Use 241-U-361 Settling Tank characterization data plus drive casing data from the site perimeter. Use spectral gamma logging data to identify an appropriate sample location and collect one analytical soil sample for lab analysis. (Note: The collection of the soil sample was not in the scope of this field investigation.)

Table 1-1. Summary of Data Needs for 200-UW-1 OU Waste Sites. (3 pages)

Site Names	Recommended Approach in Table 1-1 Summary of Data Needs DOE/RL-2003-51[a]
216-U-8 Crib	1) Use GPR analyses to identify the locations of underground anomalies. 2) Use geophysical techniques to determine an initial area of lateral contamination for input to the barrier design. 3) Using auger drilling techniques: a. Collect samples at nine (9) locations as identified in the SAP, Appendix A. At one location, sample at 2, 38, and 45 ft bgs. Sample the remaining eight (8) locations at approximately 45 ft bgs or the maximum contaminant depth, based on SGLS results from nearby casings/wells. Analyze samples as follows: Tc-99, nitrogen as nitrate/nitrite, mercury, cadmium, uranium (metal), U-235, U-238, antimony, and arsenic. b. Ecology requested reporting other metals from the ICP-MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc. c. To support waste management decisions, the following COIs would also be analyzed: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene.
216-U-12 Crib	1) Use GPR analyses to identify the locations of underground anomalies. 2) Use geophysical techniques to determine an initial area of lateral contamination for input to the barrier design. 3) Using auger drilling techniques: a. Collect samples at nine (9) locations as identified in the SAP, Appendix A. At one location, sample at 19, 39, and 45 ft bgs. Sample the remaining eight (8) locations at approximately 45 ft bgs or the maximum contaminant depth, based on SGLS results from nearby casings/wells. Analyze samples as follows: Tc-99, nitrogen as nitrate/nitrite, mercury, cadmium, uranium (metal), U-235, U-238, antimony, and arsenic. b. Ecology requested reporting other metals from the ICP-MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc. c. To support waste management decisions, the following COIs would also be analyzed: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene.
Sites Identified for the Removal, Treatment, and Disposal Alternative[b]	
200-W-42/ UPR-200-W-163	Use geophysical techniques to verify site boundaries and underground utilities.
200-W-85	Use geophysical techniques to verify site boundaries.
216-U-4B French Drain	Use geophysical techniques to verify site boundaries and underground utilities.
UPR-200-W-33	Use geophysical techniques to verify site boundaries and underground utilities.
UPR-200-W-55	Use geophysical techniques to verify site boundaries and underground utilities.
216-U-5 Trench	Use geophysical techniques to verify site boundaries.

Table 1-1. Summary of Data Needs for 200-UW-1 OU Waste Sites. (3 pages)

Site Names	Recommended Approach in Table 1-1 Summary of Data Needs DOE/RL-2003-51[a]
216-U-6 Trench	Use geophysical techniques to verify site boundaries.
216-U-15 Trench	Use geophysical techniques to verify site boundaries.
Sites Identified for the Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation Alternative[b]	
216-U-16 Crib	Use GPR analyses to identify the locations of underground anomalies.
216-U-17 Crib	Use GPR analyses to identify the locations of underground anomalies.
200-W-71 Pit	Use GPR analyses to identify the locations of underground anomalies.
2607 W5 Septic Tank and Tile Field	Use GPR analyses to identify the locations of underground anomalies.
Sites Identified for the No Action Alternative[b]	
200-W-8 UPR	Use GPR analyses to identify the locations of underground anomalies.

a. *Sampling and Analysis Plan for the U Plant Closure Area Waste Sites* (DOE/RL-2003-51).

b. *Proposed Plan for the 200-UW-1 Operable Unit* (DOE/RL-2003-24).

Figure 1-1, reprinted from the *Proposed Plan for 200 UW 1 Operable Unit* (DOE/RL 2003 24), shows the locations of the waste sites and identifies the preferred remedial alternatives for each of these sites. Field activities at the sites included geophysical surface surveys, geophysical logging of driven casing, auger soil sampling, and waste management activities necessary to comply with the requirements of DOE/RL-2003-51.

1.1 PURPOSE OF FIELD INVESTIGATION

The purpose of this investigation is to provide analytical and/or field-screening data in support of the remedial design of engineered barriers, the remedial design for remove, treat, and disposal sites, and the confirmation of remedies. This data will also support waste designation, disposal, and waste management decisions.

1.2 REPORT OVERVIEW

This report is organized into five sections, including the introduction:

- Section 2.0 describes the field activities performed at the waste sites.
- Section 3.0 presents the results of the field activities.
- Section 4.0 discusses borehole decommissioning activities.

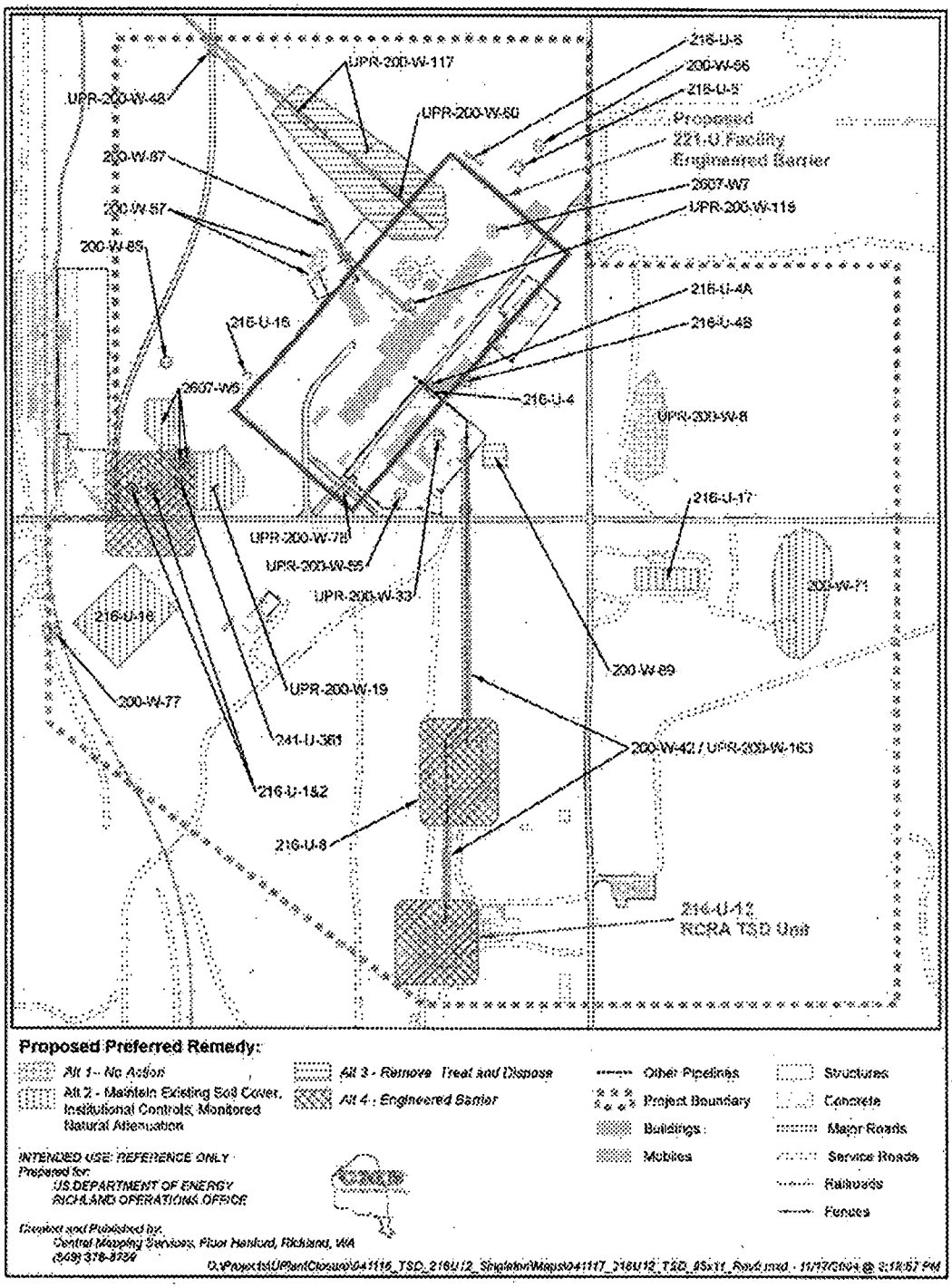

Figure 1-1. 200-UW-1 Operable Unit Waste Sites, Locations, and Preferred Remedial Alternatives (taken from DOE/RL-2003-24).

- Section 5.0 presents a summary of the report.
- Section 6.0 provides the report references.

This report additionally provides appendixes containing detailed information regarding specific components of the field investigations:

- Appendix A: Presents the borehole location survey data and survey data of other principal features.
- Appendix B: Presents the results of the surface geophysical surveys.
- Appendix C: Presents the Waste Management Summary.
- Appendix D: Presents the U Plant Closure Auger Sample Analytical Results
- Appendix E: Presents the investigation data used to develop the contaminant distribution profiles to support modeling of the fate and transport of vadose zone contaminants of concerns at the 216-U-1/216-U-2, 216-U-8, and 216-U-12 sites.

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2.0 DESCRIPTION OF FIELD ACTIVITIES

Field activities performed at the waste sites identified in Table 1-1 included surface geophysical surveys, drive casing placement, borehole geophysical surveys, auger drilling, environmental monitoring, and waste management. These activities were conducted in accordance with the SAP requirements applicable to the specific activity:

- Drive casing placement and auger drilling activities were performed in accordance with approved Fluor Hanford, Inc. (FH) procedures and *Washington Administrative Code* (WAC) 173-160, "Minimum Standards for Construction and Wells."
- The DPT casings and auger borings were surveyed in accordance with *Survey Requirements and Techniques* (CP-GPP-EE-01-1.6).
- Waste containment, labeling, and tracking activities were performed in accordance with *Sample Documentation Processing* (CP-GPP-EE-01-2.1) and *Data Package Receipt and Control* (CP-GPP-EE-01-2.2). These procedures have been prepared to implement the requirements of the Washington State Department of Ecology, found in "Environmental Restoration Program Strategy for Management of Investigation Derived Waste" (Ecology et al. 1999).
- Waste management activities at the sites were performed in accordance with *Environmental Protection Processes* (HNF-PRO-15333) and *Hanford Site Solid Waste Acceptance Criteria* (HNF-EP-0063). Management of investigation-derived waste, minimization practices, and waste types applicable to this field investigation are described in *Waste Control Plan for the U Plant Closure Area Waste Sites* (WMP-18128).

The sections below describe the sampling techniques and strategies used for the field activities.

2.1 SURFACE GEOPHYSICAL SURVEYS

Surface geophysical surveys were used for the following two purposes:

1. Establish waste site boundaries and identify the locations of underground anomalies (for example, structures or geological changes).
2. Identify locations with no underground obstructions, in order to perform subsurface sampling employing either a direct push technique (DPT) or a borehole.

The surface geophysical survey techniques included ground-penetrating radar (GPR) analyses; electromagnetic induction (EMI), including time domain electromagnetic induction (TDEM; Geonics EM-61) and frequency domain electromagnetic induction (FDEM; Geonics EM-31); and Magnetic Total Field and Gradient contour plots. The objectives, physical obstructions, and size and/or complexity of a given site determined the selection of the specific geophysical techniques used at that site.

Over each of the sites, regularly spaced location control points, referred to as nodes, were established using a portable Global Positioning System (GPS). Between each GPS-located node, a rag tape was used to establish a finer location grid of points, marked with pin flags, stakes, and/or paint, at intervals that had been predetermined by the survey objectives.

The GPR data are collected in the continuous mode along parallel profiles, spaced accordingly in both north-south and east-west directions. GPR data are typically collected throughout the entire survey area, although the GPR data collection areas are often guided by the initial EMI and/or magnetic surveys. The equipment data collection parameters are selected in accordance with the manufacture's instructions and adjusted in the field to match the local soil conditions.

Geonics EM61 data are collected in accordance with the manufacture's instructions. A wheel encoder, which is set to collect data at a specific interval (typically 0.19 m), is pulled along north-south profiles, spaced in accordance with survey objectives?

Geonics EM31 data are collected in accordance with the manufacture's instructions. Both the quadrature and in-phase component is recorded and plotted. Data are collected along north-south profiles, spaced in accordance with survey objectives. Data recordings along each profile are typically spaced 1.5 to 2 m apart.

Magnetic gradiometer data are collected in accordance with the manufacture's instructions. Data were collected along north-south profiles, with readings every 0.5 seconds (~0.5 meters).

Field data is processed and plotted to create graphical representations of the data, which are then "interpreted" onto a site map. The geophysical data is integrated with available historical drawings and detailed surface maps when available. The resulting interpretation maps represent a "snap shot" of the subsurface at the time of data collection. Not all of the features that have been identified with the geophysical methods can be correlated with features from a drawing or map. The Geophysical Site Investigation Summary Forms presented in Appendix B identify the specific techniques and survey parameters used at individual waste sites.

2.2 GEOPHYSICAL LOGGING OF DIRECT PUSH TECHNOLOGY CASING

Thirty-eight direct push technology (DPT) casings were installed at 216-U-1/216-U-2, 216-U-8, and 216-U-12, the waste sites designated to receive surface barriers. As shown in Table 2-1, each DPT casing was assigned a well identification number and generally pushed to depths of 50 to 60 ft below ground surface (bgs). The SGLS reports listed in Table 2-1 are available on the WEB at http://www.gjo.doe.gov/programs/hanf/

Coordinates for each location were recorded using North American Vertical Datum of 1988 (NAVD88) and the Washington State Plane (South Zone) North American Datum of 1983 (NAD83) with the 1991 adjustment for horizontal coordinates. Survey data of these locations are presented in Appendix A.

Table 2-1. Geophysical Logging Summary (2 pages).

Well Identification Number (Well Name)	Waste Site Area	Total Depth (ft bgs)	Initial Geophysical Logging Date	Geophysical Logging Interval (ft bgs)	Stoller Geophysical Logging Report Number
C4201	216-U-1/216-U-2	50.4	2/3/04	0.5-48.87	GJO-2004-575-TAC
C4202	UPR-200W-19	50.1	2/24/04	0-48.39	GJO-2004-600-TAC
C4203	216-U-1/216-U-2	50.2	2/11/04	0-49	GJO-2004-588-TAC
C4204	216-U-1/216-U-2	50.5	2/3/04	1-49.12	GJO-2004-574-TAC
C4205	216-U-1/216-U-2	50.1	3/10/04	0.5-48.85	DOE-EM/GJ612-2004
C4206	UPR-200W-19	50.4	2/26/04	0-49.33	GJO-2004-608-TAC
C4207	216-U-1/U-2	50.4	2/26/04	0.5-48.65	GJO-2004-607-TAC
C4208	216-U-1/U-2	50.8	3/11/04	0-49.38	DOE-EM/GJ616-2004
C4209	216-U-361	50.5	2/6/04	0.5-48.83	GJO-2004-584-TAC
C4210	216-U-361	50.4	2/6/04	0.5-48.83	GJO-2004-585-TAC
C4211	216-U-361	50.9	2/10/04	0.5-49.50	GJO-2004-586-TAC
C4212	UPR-200W-19	50.2	2/26/04	0.5-48.58	GJO-2004-599-TAC
C4213	216-U-361	50.0	3/2/04	0-49.05	GJO-2004-605-TAC
C4215	216-U-361	49.9	3/1/04	0-48.45	GJO-2004-606-TAC
C4217	216-U-8	50.3	2/2/04	0.5-48.91	GJO-2004-572-TAC
C4218	216-U-8	50.3	2/2/04	0.5-48.9	GJO-2004-573-TAC
C4219	216-U-8	50.5	1/27/04	0.5-48.5	GJO-2004-571-TAC
C4221	216-U-8	50.2	3/11/04	0-48.86	DOE-EM/GJ615-2004
C4222	216-U-8	50.0	3/15/04	0-49.10	DOE-EM/GJ614-2004
C4223	216-U-8	56.6	3/16/04	0-54.08	DOE-EM/GJ621-2004
C4224	216-U-8	55.0	3/16/04	0.5-54.62	DOE-EM/GJ619-2004
C4225	216-U-12	50.0	1/26/04	1-48	GJO-2004-563-TAC
C4226	216-U-12	50.5	1/26/04	0.5-48.5	GJO-2004-564-TAC
C4227	216-U-12	50.5	1/26/04	0.5-48.5	GJO-2004-565-TAC
C4228	216-U-12	50.5	1/27/04	0.5-48.5	GJO-2004-566-TAC
C4229	216-U-12	50.6	3/17/04	0-49.14	DOE-EM/GJ620-2004
C4231	216-U-12	50.0	5/13/04	0-49.5	DOE-EM/GJ661-2004

Table 2-1. Geophysical Logging Summary (2 pages).

Well Identification Number (Well Name)	Waste Site Area	Total Depth (ft bgs)	Initial Geophysical Logging Date	Geophysical Logging Interval (ft bgs)	Stoller Geophysical Logging Report Number
C4232	216-U-12	50.2	3/18/04	0-49.21	DOE-EM/GJ618-2004
C4547	216-U-8	50.2	1/27/04	0.5-48.5	GJO-2004-570-TAC
C4548	216-U-1/U-2	60.0	6/1/04	0-59.6	DOE-EM/GJ679-2004
C4549	216-U-1/U-2	50.0	5/28/04	0.5-49.57	DOE-EM/GJ675-2004
C4550	216-U-1/U-2	50.0	5/27/04	0-49.12	DOE-EM/GJ674-2004
C4551	216-U-8	60.0	5/26/04	0-59.57	DOE-EM/GJ669-2004
C4552	216-U-8	60.0	5/13/04	0-59.56	DOE-EM/GJ656-2004
C4553	216-U-8	60.0	5/13/04	0-59.14	DOE-EM/GJ657-2004
C4554	216-U-8	60.0	5/14/04	0-59.57	DOE-EM/GJ658-2004
C4555	216-U-12	50.0	5/12/04	0-49.63	DOE-EM/GJ659-2004
C4556	216-U-12	50.0	5/12/04	0-49	DOE-EM/GJ660-2004

Stoller Geophysical Services of Grand Junction, Colorado, conducted the geophysical logging of the DPT casings (216 U 1 and 216 U 2 crib area), 299 W19 70 (216 U 8 crib) and 299 W19 71 (216 U 8 crib).

A spectral gamma-ray logging system (SGLS) was deployed to the 38 DPT casings completed during this phase of characterization. Location C4220 was not completed due to refusal and was replaced by C4547. As the SGLS became saturated, or reached the top end of the reliability curve, a High Rate Logging System was employed to determine the total activity of the material present. The logging system provided a gamma-ray spectrum for radionuclides present in the adjacent soils at one-foot intervals, through a single thickness of casing to total driven depth. The gamma-ray spectra were then identified and quantified. Section 3.1 presents the results of this effort.

Although not required by the SAP, a neutron moisture logging tool was employed at each waste site designated to receive a barrier to generate a moisture profile of the vadose zone in one of the DPT casings. The technique uses a neutron source and one or more neutron detectors. Neutrons generated by the source are high-energy neutrons. Scattering interactions with the nuclei in the

tank material will degrade the energy of the neutron. Very slow-energy neutrons are known as thermal neutrons, and slightly higher energy neutrons are known as epithermal neutrons. The low-energy neutrons are counted by detectors. Because hydrogen atoms are the most effective at slowing down neutrons, the neutron scattering is a strong function of the surrounding moisture concentration. The tool was calibrated and deployed in accordance with applicable procedures (http://www.gjo.doe.gov/programs/hanf/) to provide an indication of the volumetric moisture content up to about 20 percent in 6-inch diameter cased boreholes. Section 3.0 presents a discussion of the results.

Evaluation of gamma energy spectra provides identification and quantification of naturally occurring and man-made radionuclides based on the characteristic energy emissions associated with their decay. Only gamma rays of sufficient energy to penetrate the steel borehole casing and detector housing can be detected by the SGLS or High-Rate Logging System.

The SGLS can detect radionuclides that emit one or more gamma rays at energies between about 150 and 2,800 keV. The minimum detectable concentration is dependent upon detector efficiency at the appropriate energy level, background activity, and the yield (gamma rays emitted, on average, per decay). Factors such as casing, water, shielding, and the presence of other radionuclides also have an effect. Because waste disposal to the soil column in the areas sampled has been discontinued, radionuclides with half-lives of less than one year have not been detected on the spectral gamma logs and are presumed to have decayed to insignificant levels.

Other radionuclides of interest, such as tritium, Sr-90, and Tc-99, are "pure" beta emitters and do not emit any gamma rays that can be detected with the SGLS. However, the presence of Sr-90 at concentrations greater than about 1,000 pCi/g can be inferred from the bremsstrahlung generated from interaction of the Sr-90 high-energy beta emissions with the steel casing.

Field gamma spectra are processed and analyzed in accordance with a data analysis manual (manual in revision). Conventional gamma spectra analysis software is used to detect gamma energy peaks, identify the source radionuclide, and determine the net count rate, counting error, and minimum detectable activity.

Values of the calibration function are updated annually and documented in calibration certificates and a calibration report, *Hanford Geophysical Logging Project, 2001, Recalibration of Logging Systems for Characterization of Subsurface Contamination at the Hanford Site*, (GJO-2002-328-TAR). Concentration error and minimum detectable concentration are calculated using similar equations. The reported concentration error is based on only the estimated counting error. No effort is made to include the effects of errors in the calibration function or correction factors. The minimum detection level (MDL) of a radionuclide represents the lowest concentration at which the positive identification of a gamma-ray peak for that radionuclide is statistically defensible.

For a counting time of 100 seconds, the MDL for Cs-137 typically is about 0.2 pCi/g. The MDL differs slightly for each spectrum depending on count time, background activity, and concentrations of other radionuclides at the data point, as well as casing thickness. In regions of higher man-made radionuclide concentrations, the Compton background continuum becomes elevated, increasing the MDL value.

The MDLs for U-238 are 10 to 15 pCi/g. These values are also typical for a 100-second counting time.

In accordance with conventional logging practices, log data are presented in terms of depth relative to a well-defined fixed point, such as the top of the casing in existing boreholes or wells. Where a fixed reference point is not available, depth relative to ground surface generally is used. In many cases, a reference elevation may not be available at the time log data are collected. When comparing features between boreholes or in stratigraphic correlation, elevation relative to a common reference datum (which is typically mean sea level) is used. This provides a consistent indication of the spatial position of the feature or bed and eliminates confusion that can arise when boreholes are located at different ground surface elevations.

2.3 GEOPHYSICAL LOGGING OF EXISTING WELLS

Stoller Geophysical Services of Grand Junction, Colorado, performs baseline characterization of the vadose zone near liquid waste disposal sites and solid waste burial grounds in the 200 Areas for the DOE Richland Operations Office (DOE-RL). Selected well logs from that program (listed in Table 2-2) supplement the data collected from SGLS logging of the DPT casings. Typically, wells were selected that were through or adjacent to the cribs and had detectable man-made radionuclides. The SGLS reports listed in Table 2-2 are available on the WEB at http://www.gjo.doe.gov/programs/hanf/

2.4 AUGER SOIL SAMPLING

Twenty-six auger boreholes were assigned a well identification number and drilled to depths of 40 to 45 ft below ground surface (bgs). Although the sample depths were predetermined by the requirements of DOE/RL-2003-51, some allowances were made for field changes, based on interpretations of field screening data and performed at the direction of the geologist. Each borehole was drilled with a plug in the auger stem; the plug was taken out, and a split spoon sampler was driven ahead of the auger flights, in accordance with FH procedures for using a split-spoon sampler.

The 1.5-ft long split spoon samplers were equipped with separate stainless steel liners. Soil was transferred to a pre-cleaned, stainless steel mixing bowl, homogenized, and then containerized in accordance with the sampling procedure. If sample volume requirements could not be met, samples were collected according to the priority presented in the SAP. Following collection, samples were packaged, stored when required, and then shipped to the laboratory for analysis.

Drilling began around the 216-U-1/216-U-2 Crib in February 2005 and ended in March 2005. To present a summary of all the auger boreholes sampled, Table 2-2 lists the data sets from both this February to March 2005 effort and the baseline characterization of the vadose zone mentioned in Section 2.3.

Table 2-2. Geophysical Logging Summary of Existing Wells.

Well Identification Number (Well Name)	Waste Site Area	Total Depth (ft bgs)	Initial Geophysical Logging Date	Geophysical Logging Interval (ft bgs)	Stoller Geophysical Logging Report Number
A4947 (299-W19-15)	216-U-1/216-U-2	NA	5/17/04	0-251	DOE-EM/GJ666-2004
A7770 (299-W19-70)	216-U-8	NA	3/18/04	2-90.17	DOE-EM/GJ623-2004
A7771 (299-W19-71)	216-U-8	NA	3/23/04	3.5-87.91	DOE-EM/GJ624-2004
A7772 (299-W19-72)	216-U-1/216-U-2	74		1-74	DOE-EM/GJ946-2005
A7773 (299-W19-73)	216-U-1/216-U-2	75		1-74	DOE-EM/GJ967-2005
A7877 (299-W22-73)	216-U-12	60		1.5-59.5	DOE-EM/GJ1033-2005
A7879 (299-W22-75)	216-U-12	176.25		2-176	NA

Coordinates for each location were recorded using North American Vertical Datum of 1988 (NAVD88) and the Washington State Plane (South Zone) North American Datum of 1983 (NAD83) with the 1991 adjustment for horizontal coordinates. Appendix A presents survey data of these locations.

2.4.1 Lithologic Data

In addition to the borehole summary and borehole construction/decommissioning information, lithologic descriptions of the soil types observed in the split spoon samples were also recorded on geological logs. Samples were collected in the Hanford formation, which can be generally characterized as unconsolidated gravel and sand with silt layers. A well construction summary report, including the geological log for each auger borehole, is available on the Internet at http://apweb02.rl.gov/cfroot/rapidweb/phmc/cp/hwisapp/.

2.5 WASTE MANAGEMENT ACTIVITIES

Drilling at the sites generated eighty-nine 55-gallon drums of waste, including the soil removed following the augering of the six lodged casings.

As recommended in DOE/RL-2003-51, additional contaminant analyses were performed on the auger samples to support waste designation, disposal, and management decisions in accordance with Environmental Restoration Disposal Facility requirements. Additional soils were collected at one of the auger sample intervals at each waste site, and analyzed for acetone, bromomethane, chloromethane, di-n-butylphthalate, methylene chloride, pentachlorophenol (D037), tetrachloroethene (D039), and toluene. Section 3.4 discusses the laboratory results and Appendix D presents the tabulated results of these analyses.

3.0 RESULTS

The following sections discuss the results of the 200-UW-1 field activities performed in FY 2004 and FY 2005, including surface geophysical surveys, geophysical logging results, auger sampling analytical results, and waste management sampling analytical results. Also presented in this section are the contaminant distribution plan view figures developed from the geophysical logging results and soil sample analytical data for the 216-U-1/216-U-2 Cribs, 216-U-8 Crib, and 216-U-12 Crib. Table 3-1 summarizes the results of the data collected by the field investigation at each waste site as recommended in DOE/RL-2003-51.

Table 3-1. Summary of Data Results for 200-UW-1 OU Waste Sites (6 pages).

Site Names	Recommended Approach in DOE/RL-2003-51[a]	Summary of Results
Sites Identified for the Engineered Barrier Alternative[b]		
216-U-1/216-U-2 Cribs (including 241-361 Settling Tank)	1) Use (GPR) analyses to identify the locations of underground anomalies.	1) Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the crib or crib infrastructure. Most of the anomalies appear to be within the fill material that created the mound that covers the site. All anomalies and anomalous disturbed areas should be avoided. (See Appendix B, Figures 2a, 2b, 2c, 2d)
	2) Use geophysical techniques to determine an initial area of lateral contamination for input to the barrier design.	2) Table 3-2 summarizes the geophysical logging results for the 216-U-1/216-U-2 Cribs (including 241-361 Settling Tank and UPR 200 W 19) locations.
	3) Using auger drilling techniques:	3) Auger drilling results
	a. Collect samples at nine (9) locations as identified in the SAP, Appendix A. At one location, sample at 11, 31, 36, and 43-feet bgs. Sample the remaining eight (8) locations at approximately 45 ft bgs or the maximum contaminant depth, based on SGLS results from nearby casings/wells. Analyze samples as follows: Tc-99, nitrogen as nitrate/nitrite, mercury, cadmium, uranium (metal), U-235, U-238, antimony, and arsenic.	a. The maximum values for uranium, nitrogen as nitrate/nitrite, and Tc-99 are provided in Table 3-5. Appendix D provides the results for mercury, cadmium, U-235, U-238, antimony, and arsenic.
	b. Ecology requested reporting other metals from the ICP-MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc.	b. Appendix D provides the results for barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc.

Table 3-1. Summary of Data Results for 200-UW-1 OU Waste Sites (6 pages).

Site Names	Recommended Approach in DOE/RL-2003-51[a]	Summary of Results
	c. To support waste management decisions, the following COIs would also be analyzed: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene.	c. Appendix D presents the values for waste management constituents: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene.
UPR-200-W-19	1) Use geophysical techniques to verify site boundaries.	1) Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the crib or crib infrastructure. Most of the anomalies appear to be within the fill material that created the mound that covers the site. All anomalies and anomalous disturbed areas should be avoided. (See Appendix B, Figures 2a, 2c, and 2d.)
	2) Use 241-U-361 Settling Tank characterization data plus drive casing data from the site perimeter. Use spectral gamma logging data to identify an appropriate sample location and collect one analytical soil sample for lab analysis.	Based on 241-U-361 Settling Tank historical characterization data, Cs-137 was selected as the primary indicator of the unplanned release. A review of the Cs-137 results from the top 15 feet of the geophysical survey showed the maximum Cs-137 value to be at C4202, with a value of 341 pCi/g located at 7 feet bgs. Therefore, it is recommended that the sample be collected at this location. (The collection of the sample was not in the scope of this field investigation.)
216-U-8 Crib	1) Use GPR analyses to identify the locations of underground anomalies	1) Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the crib or crib infrastructure. Most of the anomalies appear to be within the fill material that created the mound that covers the site. All anomalies and anomalous disturbed areas should be avoided. (See Appendix B, Figures 3a, 3b, 3c, and 3d.)
	2) Use geophysical techniques to determine an initial area of lateral contamination for input to the barrier design	2) Table 3-3 summarizes the geophysical logging results for the 216-U-8 Crib locations.

Table 3-1. Summary of Data Results for 200-UW-1 OU Waste Sites (6 pages).

Site Names	Recommended Approach in DOE/RL-2003-51[a]	Summary of Results
	3) Using auger drilling techniques: a. Collect samples at nine (9) locations as identified in the SAP, Appendix A. At one location, sample at 2, 38, and 45 ft bgs. Sample the remaining eight (8) locations at approximately 45 ft bgs or the maximum contaminant depth, based on SGLS results from nearby casings/wells. Analyze samples as follows: Tc-99, nitrogen as nitrate/nitrite, mercury, cadmium, uranium (metal), U-235, U-238 antimony, and arsenic.	3) Auger drilling results: a. The maximum values for uranium, nitrogen as nitrate/nitrite, and Tc-99 are provided in Table 3-5. Appendix D provides results for mercury, cadmium, U-235, U-238, antimony, and arsenic.
	b. Ecology requested reporting other metals from the ICP-MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc.	b. Appendix D provides results for barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc.
	c. To support waste management decisions, the following COIs would also be analyzed: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene.	c. Appendix D provides results for waste management constituents: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene.
216-U-12 Crib	1) Use GPR analyses to identify the locations of underground anomalies	1) Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the crib or crib infrastructure. Most of the anomalies appear to be within the fill material that created the mound that covers the site. All anomalies and anomalous disturbed areas should be avoided. (See Appendix B, Figures 4a, 4b, and 4c.)
	2) Use geophysical techniques to determine an initial area of lateral contamination for input to the barrier design	2) Table 3-4 summarizes the geophysical logging results for the 216-U-12 Crib locations.

Table 3-1. Summary of Data Results for 200-UW-1 OU Waste Sites (6 pages).

Site Names	Recommended Approach in DOE/RL-2003-51[a]	Summary of Results
	3) Using auger drilling techniques: a. Collect samples at nine (9) locations as identified in the SAP, Appendix A. At one location, sample at 19, 39, and 45 ft bgs. Sample the remaining eight (8) locations at approximately 45 ft bgs or the maximum contaminant depth, based on SGLS results from nearby casings/wells. Analyze samples as follows: Tc-99, nitrogen as nitrate/nitrite, mercury, cadmium, uranium (metal), U-235, U-238, antimony, and arsenic.	3) Auger drilling results: a. The maximum values for uranium, nitrogen as nitrate/nitrite, and Tc-99 are provided in Table 3-5. Appendix D provides results for mercury, cadmium, U-235, U-238, antimony, and arsenic.
	b. Ecology requested reporting other metals from the ICP-MS method such as barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc.	b. Appendix D provides results for barium, chromium (total), cobalt, copper, lead, manganese, nickel, selenium, silver, strontium, thallium, titanium, vanadium, and zinc.
	c. To support waste management decisions, the following COIs would also be analyzed: acetone, , bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene	c. Appendix D provides results for waste management constituents: acetone, bromomethane, chloromethane, Di-n-butylphthalate, methylene chloride, pentachlorophenol (DO37), tetrachloroethene (DO39), and toluene.
Sites Identified for the Removal, Treatment, and Disposal Alternative[b]		
200-W-42/ UPR-200-W-163	Use geophysical techniques to verify site boundaries and underground utilities.[c]	Numerous linear anomalies interpreted to be utilities were detected and mapped. One linear anomaly detected and mapped falls near the center of the Waste Information Data System (WIDS) boundary for this waste site. This linear anomaly is assumed the 200-W-42 pipeline. (See Appendix B, Figures 8a and 8b and the technical memorandum.)
200-W-85	Use geophysical techniques to verify site boundaries.	A disturbed area was identified beneath the stabilization layer inside the marked boundary for this site. The marked boundary coincides with the WIDS boundary. Precise boundaries for the site could not be verified with the geophysical results. (See the technical memorandum for geophysical results.)

Table 3-1. Summary of Data Results for 200-UW-1 OU Waste Sites (6 pages).

Site Names	Recommended Approach in DOE/RL-2003-51[a]	Summary of Results
216-U-4B French Drain	Use geophysical techniques to verify site boundaries and underground utilities.	Utilities near the 216-U-4B French Drain structure were detected and mapped. No pipeline feeding into the 216-U-4B French Drain was detected. The geophysical investigation extended approximately 2 to 3 m beyond the WIDS boundary for this site on all sides. Precise boundaries for the site could not be verified with the geophysical results. (See the technical memorandum for geophysical results.)
UPR-200-W-33	Use geophysical techniques to verify site boundaries and underground utilities.	Utilities were detected and mapped near the WIDS location of this unplanned release. Precise boundaries for the site could not be verified with the geophysical results. (See the technical memorandum for geophysical results.)
UPR-200-W-55	Use geophysical techniques to verify site boundaries and underground utilities.	Utilities were detected and mapped near the WIDS location of this unplanned release. Precise boundaries for the site could not be verified with the geophysical results. (See the technical memorandum for geophysical results.)
216-U-5 Trench	Use geophysical techniques to verify site boundaries.	An anomaly consistent with a burial pit or crib structure was detected and mapped within the marked boundary of this site. The location of this anomaly coincides with the WIDS location for this site. (See the technical memorandum for geophysical results.)
216-U-6 Trench	Use geophysical techniques to verify site boundaries.	Anomalies consistent with a trench that was backfilled with fill material containing debris were detected and mapped. These anomalies extend out of the marked site boundaries to the southeast. A portion of the anomalies coincided with the WIDS boundaries for the site. (See the technical memorandum for geophysical results.)
216-U-15 Trench	Use geophysical techniques to verify site boundaries.	A subtle anomaly consistent with a backfilled excavation was detected and mapped, although the anomaly could also have been caused by a natural (geologic) feature. This anomaly is not located at the original WIDS location of this site. One edge of it does touch one of the secondary possible locations of the site. The WIDS boundary for the site was changed based on these results. (See the technical memorandum for geophysical results.)

Table 3-1. Summary of Data Results for 200-UW-1 OU Waste Sites (6 pages).

Site Names	Recommended Approach in DOE/RL-2003-51[a]	Summary of Results
Sites Identified for the Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation Alternative[b]		
216-U-16 Crib	Use GPR analyses to identify the locations of underground anomalies	Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the crib or crib infrastructure. Most of the anomalies appear to be within the fill material that created the mound that covers the site. All anomalies and anomalous disturbed areas should be avoided. (See Appendix B, Figures 5a and 5b.)
216-U-17 Crib	Use GPR analyses to identify the locations of underground anomalies	Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the crib or crib infrastructure. Most of the anomalies appear to be located within the fill material that created the mound that covers the site. All anomalies and anomalous disturbed areas should be avoided. (See Appendix B, Figures 6a and 6b.)
200-W-71 Pit	Use GPR analyses to identify the locations of underground anomalies	Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the 200-W-71 Pit or its infrastructure. Most of the anomalies appear to be located within the fill material that created the mound that covers the site. All anomalies and anomalous disturbed areas should be avoided. (See Appendix B, Figures 10a, 10b, 10c, 10d, 10e, and 10f.) In addition, locations most likely to represent buried waste were designated on the survey map to aid location of test pit placement.
2607 W5 Septic Tank and Tile Field	Use GPR analyses to identify the locations of underground anomalies	Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the 2607 W5 Septic Tank and Tile Field or its infrastructure. Most of the anomalies appear to be located within the fill material that created the mound that covers the site. All anomalies and anomalous disturbed areas should be avoided. (See Appendix B, Figures 2a, 2b, 2c, and 2d.)

Table 3-1. Summary of Data Results for 200-UW-1 OU Waste Sites (6 pages).

Site Names	Recommended Approach in DOE/RL-2003-51[a]	Summary of Results
Sites Identified for the No Action Alternative[b]		
200-W-8 UPR	Use GPR analyses to identify the locations of underground anomalies	Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the crib or crib infrastructure. Most of the anomalies appear to be located within the fill material that created the mound that covers the site. All anomalies and anomalous disturbed areas should be avoided. (See Appendix B, Figures 7a, 7b, 7c, 7d, and 7e.) In addition, locations most likely to represent buried waste were designated on the survey map to aid location of test pit placement

a. *Sampling and Analysis Plan for the 200-UW-1 Operable Unit* (DOE/RL-2003-51).

b. *Proposed Plan for the 200-UW-1 Operable Unit* (DOE/RL-2003-24).

c. CH2M HILL Technical Memorandum, "200 UW 1 OU Surface Geophysical Surveys," dated September 2005, to Ken Allison/FH, from Michael Galgoul/CHG.

3.1 SURFACE GEOPHYSICAL SURVEYS

Surface geophysical surveys are documented in Appendix B and in CH2M Hill's Technical Memorandum, "200-UW-1 OU Surface Geophysical Surveys," dated September 2005, to Ken Allison/FH from Michael Galgoul/CHG. Appendix B contains detailed surface geophysics reports, which include the approach, site specific instrumentation, and site specific maps,

Table 3-1 summarizes the results of the surface geophysical data collected at each waste site as recommended in DOE/RL-2003-51. The data results for the remedial design waste sites have been reviewed by the project team and determined to meet the requirements of the remedial design.

3.2 GEOPHYSICAL LOGGING RESULTS

The spectral gamma logs present the vertical distribution of radionuclides in the vadose zone beneath the waste sites. Spectral gamma logging equipment calibration is conducted annually, and the calibration data are used to calculate casing attenuation factors that convert measured peak area count rates to radionuclide concentrations. A neutron moisture-logging tool, which generates a moisture profile of the vadose zone, was also used in selected DPT casings at the direction of the barrier design lead.

While the focus of this report is Cs-137 and man-made U-238 (as identified in *The Focused Feasibility Study for the 200-UW-1 Operable Unit* [DOE/RL-2003-23]), information regarding

additional detected radionuclides is also presented. Man-made U-235 is always present with U-238; however, its concentration is roughly a factor of 20 times lower than that of U-238, and that concentration is not always detected by the spectral gamma logging detector.

The following sections offer a synopsis of the complete geophysical log data reports listed in Table 2-1 and 2-2 (available on the WEB at http://www.gjo.doe.gov/programs/hanf/).

3.2.1 216-U-1/216-U-2 Cribs

Fourteen push holes were completed around the 216-U-1/216-U-2 Cribs and the adjacent 241-U-361 Tank. The casings generally would push easily into the upper 25 ft of the soil, then slow considerably pushing to total depth. Three wells were geophysically logged.

Table 3-2 summarizes the man-made radionuclides detected at each push site and the maximum values plotted in Figures 3-1, 3-2, and 3-3.

Table 3-2. Summary of Geophysical Logging of DPT Casings and Selected Wells at the 216-U-1/216-U-2 Cribs. (2 pages)

DPT Casing/ Well Number	Cesium-137	Uranium-238/Uranium-235	Other man-made contaminants detected
C4201	1.5 to 6.5 ft: 0.3 to 20.8 pCi/g (max at 2.5 ft) 30.5 to 40.5 ft: 0.4 to 60 pCi/g (max at 31.5 ft)	U-238: 35.5 to 44.5 ft, 22 to 155 pCi/g (max at 43.5 ft) No U-235 detected	None
C4202 (UPR-200-W-19)	1 to 12 ft: 0.4 to 341 pCi/g (max at 7 ft)	None detected	None
C4203	0 ft: 0.556 pCi/g 30 to 39 ft: 0.3 to 160 pCi/g (max at 32 ft)	U-238: 31 to 46 ft (max of 389 pCi/g at 38 ft) No U-235 detected	Co-60: 37 and 39 ft (max of 8 pCi/g at 37 ft) Sr-90: 36 to 49 ft
C4204	2 to 7 ft: 0.3 to 21.9 pCi/g (max at 3 ft)	U-238: 26 and 44 to 46 ft (max of 34 pCi/g at 26 ft) No U-235 detected	None
C4205	1.5 to 9.5 ft: 0.3 to 42.9 pCi/g (max at 2.5 ft) 39.5 ft: near its minimum detection level (MDL) of 0.2 pCi/g	U-238: 41.5 to 42.5 ft, 19 to 32 pCi/g (max at 42.5 ft) No U-235 detected	None
C4206 (UPR-200-W-19)	1 to 4 ft: 0.2 to 15.7 pCi/g (max at 2 ft)	None detected	None
C4207	0 to 3.5 ft: 0.773 pCi/g (max at 0.5 ft) 30.5 to 32.5 ft: 6 pCi/g (max at 31.5 ft)	U-238: 31.5 ft (24 pCi/g), 41.5 ft (32 pCi/g) and 42.5 ft (25 pCi/g)	None
C4208	2 to 7 ft: 0.2 to 45 pCi/g (max at 3 ft)	None detected	None

Table 3-2. Summary of Geophysical Logging of DPT Casings and Selected Wells at the 216-U-1/216-U-2 Cribs. (2 pages)

DPT Casing/ Well Number	Cesium-137	Uranium-238/Uranium-235	Other man-made contaminants detected
C4209	0.5 to 16.5 ft: 0.2 to 42.9 pCi/g (max at 3.5 ft)	None detected	None
C4210	1.5 to 3.5 ft: 0.3 to 01.87 pCi/g (max at 2.5 ft)	None detected	None
C4211	1.5 to 10.5 ft: 0.2 to 9.69 pCi/g (max at 2.5 ft)	None detected	None
C4212 (UPR-200W-19)	None detected	None detected	None
C4213	0 to 8 ft: 0.3 to 44.1 pCi/g (max at 1 ft) 10 to 16 ft: 0.3 to 18 pCi/g (max at 14 ft), 4 pCi at 15 ft	None detected	None
C4215	1 to 7 ft: 0.3 to 83.3 pCi/g (max at 3 ft)	None detected	None
C4548	0 to 3 ft: 0.3 to 1.1 pCi/g (max at 0 ft)	U-238: 52 ft (27 pCi/g) and 53 ft (42 pCi/g) No U-235 detected	None
C4549[a]	0.5 ft: 0.874 pCi/g	None detected	None
C4550	1 to 6 ft: 0.3 to 0.886 pCi/g (max at 2 ft)	None detected	None
A4947 (299-W19-15)[b]	Found sporadically near its maximum contaminant MDL of 0.315 pCi/g No detection 15-60 ft	U-238 found sporadically near the MDL of 15 pCi/g. Maximum concentration of 30 pCi/g at 244 ft U-235 at 244 ft, 4 pCi/g	None
A7772 (299-W19-72)	0 to 74 ft: Up to 4 million pCi/g (max at 26 ft), 1230 pCi/g at 11 ft.	Processed uranium: 9 ft, 13 ft, and from 37 to 74 ft. Probable processed uranium between 13 and 37 ft. U-238: maximum of 27,000 pCi/g, and U-235: maximum of 750 pCi/g, at 40 ft.	Co-60: 41 to 47 ft, (max of 0.9 pCi/g at 41 ft. Co-60 probable between 15 and 41 ft at higher concentrations.) Eu-154: 37 to 44 ft, (max of 16 pCi/g at 38 ft. Probable between 15 and 41 ft at higher concentrations.)

Table 3-2. Summary of Geophysical Logging of DPT Casings and Selected Wells at the 216-U-1/216-U-2 Cribs. (2 pages)

DPT Casing/ Well Number	Cesium-137	Uranium-238/Uranium-235	Other man-made contaminants detected
A7773 (299-W19-73)	0 to 62 ft: 0.16 to 4 million pCi/g (max at 27 ft), 310 pCi/g at 6 ft. 65 to 67 ft: Sporadically near 0.13 pCi/g.	U-238 present from 42 to 72 ft. Due to high levels of Cs-137 U-238 was not determined in the high activity zone. U-238: max of 87.8 pCi/g, and U-235: max of 17.5 pCi/g, at 43 ft.	Co-60: 43 to 53 ft, (max of 0.2 pCi/g at 50 ft probable between 18 to 42 ft at higher concentrations.) Ag-108m: 48 to 51 ft at about 1.5 pCi/g.

a. Location of neutron moisture logging.

b. Grout placed between 20 and 85 ft and 170 and 197 ft to seal this well increases the uncertainty in the uranium concentrations in this range, which may actually be higher than reported.

The results of neutron moisture logging run in DPT Casing C4549, located southwest of the 216-U-2 crib, showed volumetric moisture ranging from 1.4 percent at 0.25 ft to a maximum of 11.5 percent at approximately 20 ft. While the maximum value appears at 20 ft, there is a significant zone between 43.5 and 46 ft where the volumetric moisture measured between 9.1 and 9.8 percent.

3.2.2 216-U-8 Crib

Thirteen push holes were completed around the 216-U-8 Crib, and two wells were geophysically logged. The casings generally would push easily into the upper 25 ft of the soil, then slow considerably pushing to total depth. Table 3-3 summarizes the man-made radionuclides detected at each push site.

Table 3-3. Summary of Geophysical Logging of DPT Casings and Selected Wells at the 216-U-8 Crib. (2 pages)

DPT Casing/ Well Number	Cesium-137	Uranium-238/Uranium-235	Other man-made contaminants detected
C4217	0.5 ft at 0.368 pCi/g 32.5 to 36.5 and 23.5 ft: 0.2 to 37 pCi/g (max at 33.5 ft)	U-238: 32.5 to 34.5 ft, 39 to 300 pCi/g (max at 33.5 ft) U-235: 33.5 ft at 13.4 pCi/g	None
C4218	1.51 ft at 0.283 pCi/g	U-238: 37.5 ft at 34 pCi/g No U-235 detected	None
C4219	2.5 ft at 0.383 pCi/g 30.5 to 48.5 ft: 0.3 to 3,000 pCi/g (max at 37.5 ft) Note: detector was saturated from 33.5 to 37.5 ft.	U-238: 40 to 45 ft, to 3,100 pCi/g (max at 43.5 ft) U-235: 41 to 46 ft, max of 141 pCi/g at 43.5 ft	None
C4220	Not logged	Not logged	Not logged; did not reach 50 ft

Table 3-3. Summary of Geophysical Logging of DPT Casings and Selected Wells at the 216-U-8 Crib. (2 pages)

DPT Casing/ Well Number	Cesium-137	Uranium-238/Uranium-235	Other man-made contaminants detected
C4221	0 to 1 ft: 0.3 to 0.702 pCi/g (max at surface)	None detected	None
C4222	9 ft: 0.276 pCi/g	None detected	None
C4223	3 ft: 0.276 pCi/g 29 to 54 ft: 0.3 to 52,000 pCi/g (max at 33 ft)	U-238: 41 ft at 229 pCi/g No U-235 detected	Eu-154: 41 ft at 2 pCi/g
C4224	0.5 ft: 0.529 pCi/g 40.5 to 44.5 ft: 1.1 to 84 pCi/g (max at 41.5 ft)	U-238: 50.5 ft at 18 pCi/g No U-235 detected	None
C4547	0.5 ft: 0.362 pCi/g 33.5 to 48.5 ft: 0.3 to 534 pCi/g (max at 34.5 ft)	U-238: 34.5 to 35.5 ft, 157 pCi/g (max at 34.5 ft) No U-235 detected	None
C4551	0 ft at 0.315 pCi/g	None detected	None
C4552[a]	0 ft at 0.263 pCi/g 46 to 57 ft: 0.5 to 600 pCi/g (max at 49 ft)	None detected	None
C4553	0 ft at 0.926 pCi/g 47 to 59.14 ft: to 85 pCi/g (max at 49 ft)	U-238: 46 ft and 48 ft - 9 and 17 pCi/g, respectively No U-235 detected	None
C4554	0 ft at 1 pCi/g 46 ft at 0.1 pCi/g	None detected	None
A7770 (299-W19-70)	3 to 13 ft: 0 to 0.91 pCi/g (max at 5 ft) 34 to 90 ft: 71,000 pCi/g (max at 39 ft)	U-238: 45 to 90 ft (max of 1,400 pCi/g at 45 ft) No U-235 detected	None
A7771 (299-W19-71)	3.5 to 14.5 ft: 0.2 to 6.13 pCi/g (max at 8.5 ft) 31.5 to 87.91 ft: 0.2 to 28,500 pCi/g (max at 39.5 ft)	U-238: 46.5 to 68.5 ft and 79.5 to 87.91 ft, 24 to 184 pCi/g (max at 46.5 ft) U-235: 46.5 to 68.5 and 79.5 to 87.91, 1.7 to 12 pCi/g (max at 56.5 ft)	None

a. Location of neutron moisture logging.

The results of neutron moisture logging run in DPT Casing C4552, located directly south of the 216-U-8 Crib, showed volumetric moisture ranging from approximately 0.8 percent at 0.25 ft to a maximum of 9.3 percent at approximately 38.5 ft. The majority of the values measured between 2 and 4 percent.

3.2.3 216-U-12 Crib

Nine large-diameter DPT casings were placed around the 216-U-12 Crib. To support the discussion of the contaminant distribution model, the results from geophysical logging of 299-W22-22 (southeast of 216-U-12), 299-W22-23 (south of 216-U-12), and 299-W22-75 (inside the south half of the 216-U-12) are additionally included. Table 3-4 summarizes the man-made radionuclides detected at the DPT casings and well sites.

Table 3-4. Summary of Geophysical Logging of DPT Casings and Selected Wells at the 216-U-12 Crib. (2 pages)

DPT Casing/ Well Number	Interval of Detection of Cs-137 in Feet and Concentration Range	Interval of Detection of U-238/U-235 in Feet and Concentration Range
C4225	9 to 21 ft: 0.3 to 80 pCi/g (max at 10 ft) 29 and 41 ft: 0.2 pCi/g	None detected
C4226	23.5 ft: 0.3 pCi/g	None detected
C4227	None detected	None detected
C4228	None detected	U-238: 32.5 to 41.5 ft, 17 to 61 pCi/g (max at 40 ft) U-235: 31.5 to 40.5 ft, 2.1 to 3.8 pCi/g (max at 33.5 ft)
C4229	0 ft: 0.3 pCi/g 10 to 11 ft: 1.1 to 1.22 pCi/g (max at 10 ft)	None detected
C4231	0 ft: 0.653 pCi/g 2 ft: 0.3 pCi/g	None detected
C4232	0 ft: 0.207 pCi/g 17 ft: 0.1 pCi/g	U-238: 26 to 40 ft, to 77 pCi/g (max at 38 ft) U-235: 34 to 40 ft, to 4 pCi/g (max at 39 ft)
C4555[a]	0 to 1 ft: 0.3 to 1.31 pCi/g (max at 0 ft)	None detected
C4556	0 ft: 0.967 pCi/g	None detected
299-W22-22	Detected at a few sporadic locations in the borehole near its MDL of approximately 0.2 pCi/g	None
299-W22-23	Detected at a few sporadic locations in the borehole near its MDL of approximately 0.2 pCi/g	None
A7879 (299-W22-75)	12 to 61 ft: 0.3 to 8,400 pCi/g. (max at 25 ft)	U-238: 17 to 20 ft, 55 to 330 pCi/g. 29 to 31 ft; 20 to 30 pCi/g. 37 to 53 ft; 17 to 75 pCi/g. 61 to 81 ft ; 17 to 335 pCi/g. (max at 76 ft, although the highest concentration may be in the interval of high dead time 20-27 ft where the MDL significantly increases) U-235: 18 to 19 ft; 6 to 9 pCi/g. 68 to 81 ft ;1.8 to 22 pCi/g. (max at 75 ft)

Table 3-4. Summary of Geophysical Logging of DPT Casings and Selected Wells at the 216-U-12 Crib. (2 pages)

DPT Casing/ Well Number	Interval of Detection of Cs-137 in Feet and Concentration Range	Interval of Detection of U-238/U-235 in Feet and Concentration Range
A7877 (299-W22-73)	1.5 to 57.5 ft: 5 pCi/g at 10 ft (max 130 pCi/g at 23.5 ft)	U-238 and U-235 from 19.5 to 29.5 ft, max U-238 of 40 pCi/g and max U-235 of 2 pCi/g at 21 ft.

a. Location of neutron moisture logging.

The results from neutron moisture logging run in DPT Casing C4555, located directly west of the 216-U-12 crib, showed volumetric moisture ranging from approximately 0.3 percent at 0.25 ft to a maximum of 12 percent at 41 ft. The majority of the values measured between 2 and 4 percent.

3.3 AUGER SOIL SAMPLING RESULTS

Table 3-5 presents a summary of the maximum values from the auger samples for uranium, nitrogen as nitrate/nitrite, and Tc-99. Detailed information is presented in Appendix D. Well Construction Summary Reports are available through the Hanford Well Information System (HWIS) database.

Table 3-5. Maximum Concentration Values for Uranium, Nitrogen as Nitrate/Nitrite, and Tc-99 from Auger Samples. (2 Pages)

Well Identification Number	Waste Site Area	Sample Interval (ft bgs)	Uranium (mg/kg)	Uraniu m MDL	Nitrogen as Nitrate/ Nitrite (mg/kg)	N (mg/kg) MDL	Tc-99 (pCi/g)	Tc-99 (pCi/g) MDC/MDA
C4705	216-U-1/ 216-U-2	44 to 45.5	U[a]	0.94	6.1	0.5	U	0.642
C4706	216-U-1/ 216-U-2	42 to 43.5	2.86	0.15	3.7	0.5	U	0.612
C4707	216-U-1/ 216-U-2	44 to 45.5	U	0.97	2	0.5	U	0.648
C4708	216-U-1/ 216-U-2	44 to 45.5	U	0.93	1.1	0.5	U	0.612
C4709	216-U-1/ 216-U-2	46.5 to 48	U	0.99	1.1	0.5	U	0.642
C4710	216-U-1/ 216-U-2	44.5 to 46	3.9	0.16	0.8	0.5	U	0.642
C4711	216-U-1/ 216-U-2	44 to 45.5	U	0.92	0.86	0.5	U	0.585
C4712	216-U-1/ 216-U-2	10 to 11.5	1.61	1	1.3	0.5	U	0.642
C4712	216-U-1/	30 to 31.5	U	0.99	2.2	0.5	U	0.642

Table 3-5. Maximum Concentration Values for Uranium, Nitrogen as Nitrate/Nitrite, and Tc-99 from Auger Samples. (2 Pages)

Well Identification Number	Waste Site Area	Sample Interval (ft bgs)	Uranium (mg/kg)	Uranium MDL	Nitrogen as Nitrate/ Nitrite (mg/kg)	N (mg/kg) MDL	Tc-99 (pCi/g)	Tc-99 (pCi/g) MDC/MDA
	216-U-2							
C4712	216-U-1/ 216-U-2	35 to 36.5	U	1	3.4	0.5	U	0.612
C4712	216-U-1/ 216-U-2	42 to 43.5	U	0.81	2.7	0.5	U	0.587
C4713	216-U-1/ 216-U-2	40 to 41.5	2.56	0.15	2.6	0.5	U	0.584
C4714	216-U-8	44 to 45.5	0.724	0.16	11	0.5	U	0.663
C4716	216-U-8	47.5 to 50.5	21.9	0.083	8	0.5	U	0.614
C4717	216-U-8	1 to 2.5	1.34	0.16	3.4	0.5	U	0.652
C4717	216-U-8	37 to 38.5	3.2	0.16	45.4	1	U	0.653
C4717	216-U-8	44 to 45.5	7.74	0.16	150	2	U	0.653
C4718	216-U-8	44 to 45.5	0.416	0.16	3.4	0.5	U	0.655
C4719	216-U-8	44 to 45.5	0.475	0.16	7.2	0.5	U	0.648
C4720	216-U-8	44 to 45.5	U	0.99	25.7	2	U	0.647
C4721	216-U-8	42 to 43.5	3.19	0.95	59.2	5	U	0.613
C4722	216-U-8	43 to 44.5	17.3	0.95	6.7	0.5	U	0.658
C4728	216-U-8	48 to 49.7	6.01	0.15	366	10	U	0.627
C4715	216-U-12	44 to 45.5	0.838	0.15	11	0.5	U	0.664
C4723	216-U-12	44 to 45.5	0.413	0.12	5	0.5	U	0.673
C4724	216-U-12	44 to 45.5	0.501	0.15	82.9	2	0.993	0.626
C4725	216-U-12	44 to 45.5	0.517	0.12	3.2	0.5	U	0.629
C4726	216-U-12	41 to 42.5	3.12	0.15	544	10	2.36	0.0951
C4727	216-U-12	44 to 45.5	0.476	0.15	3.7	0.5	U	0.63
C4729	216-U-12	44 to 45.5	0.399	0.16	6.9	0.5	U	0.625
C4730	216-U-12	18 to 19.5	0.848	0.15	U	0.5	U	0.633
C4730	216-U-12	38 to 39.5	8.01	0.16	149	2	0.707	0.625
C4730	216-U-12	44 to 45.5	3.63	0.16	109	0.5	U	0.628

a. U indicates that the contaminant was undetected at the shown location.

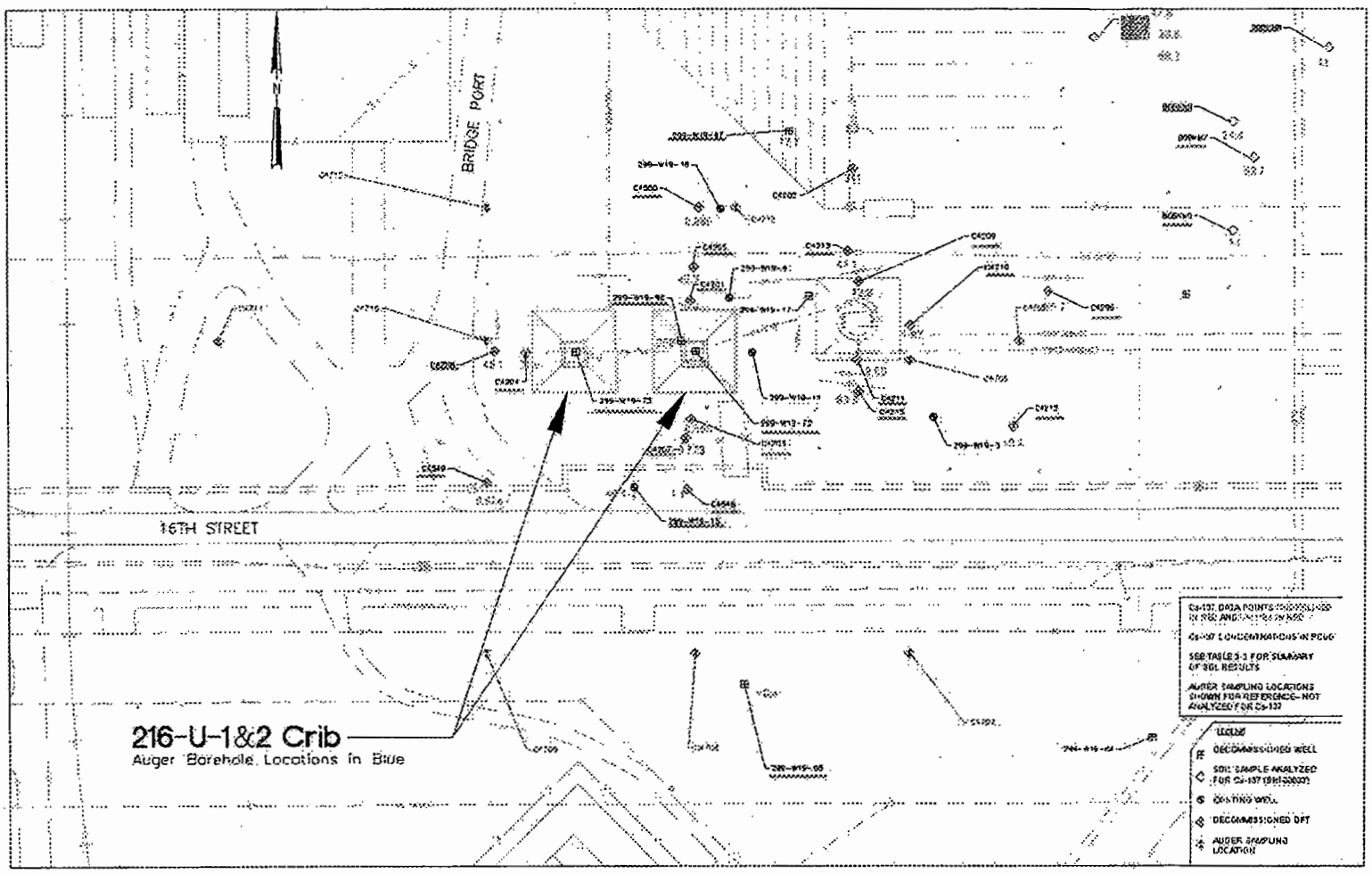

Figure 3-1. 216-U-1/216-U-2 Crib Plan View of Maximum Cesium-137 Concentration, 0 to 15 ft bgs. (Based on Spectral Gamma Logging of Identified Wells and Soil Samples.)

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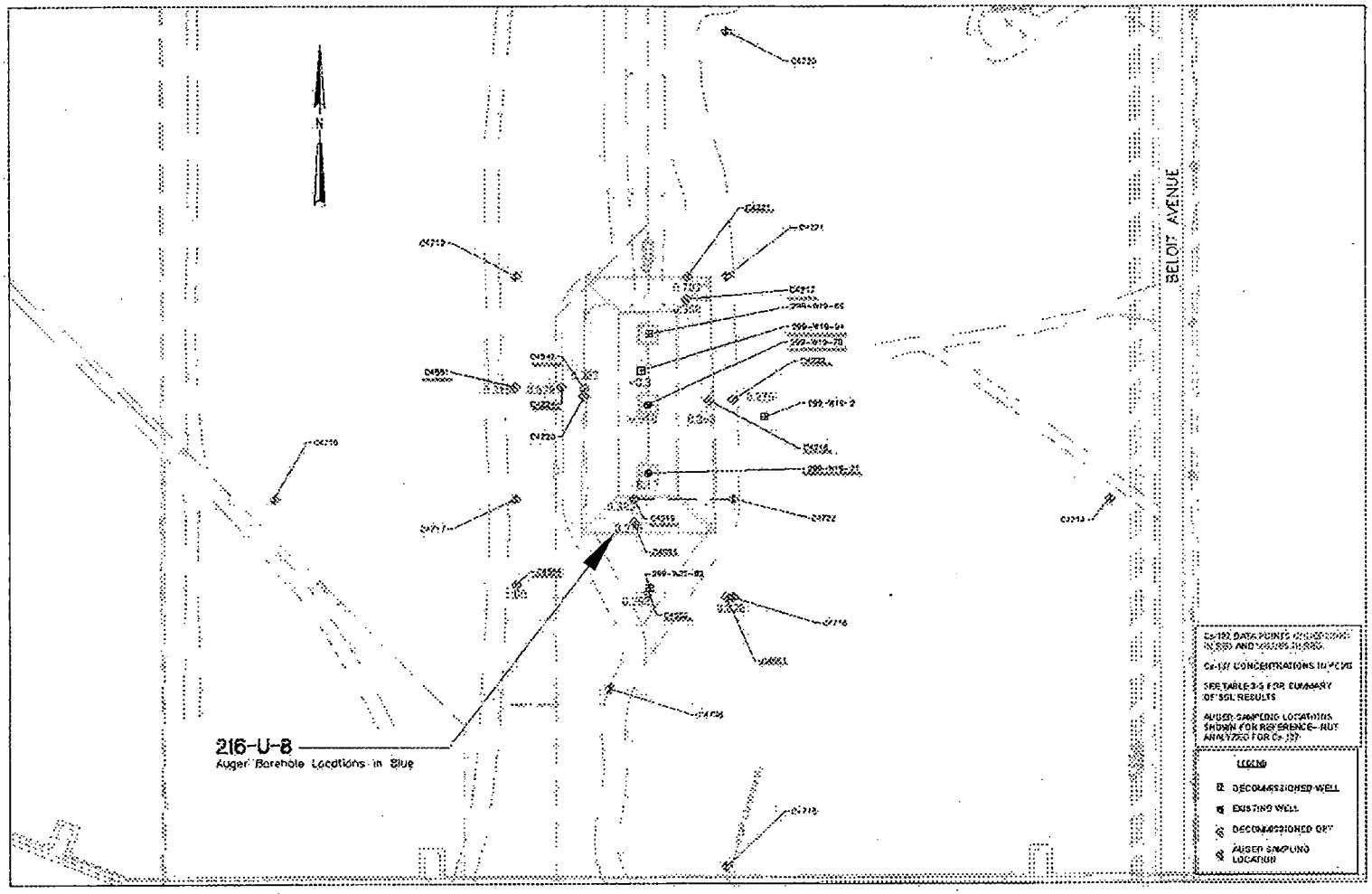

Figure 3-2. 216-U-8 Crib Plan View of Maximum Cesium-137 Concentration, 0 to 15 ft bgs. (Based on Spectral Gamma Logging of Identified Wells and Soil Samples.)

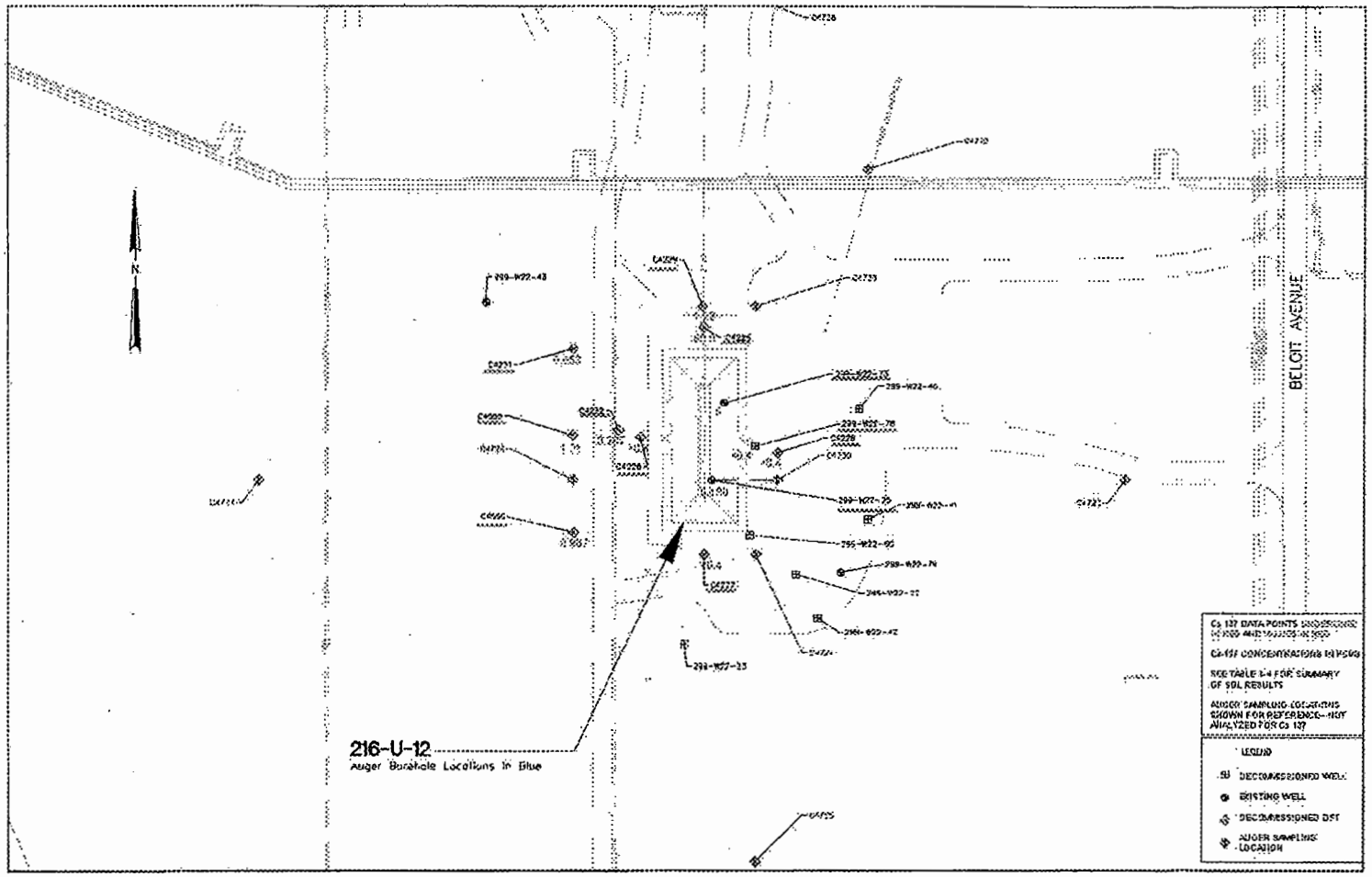

Figure 3-3. 216-U-12 Crib Plan View of Maximum Cesium-137 Concentration, 0 to 15 ft bgs. (Based on Spectral Gamma Logging of Identified Wells and Soil Samples.)

3.3.1 Lithologic Data

Augering brings soil cuttings to the surface that are disturbed and intervals between split-spoon samples were generally examined as drill cuttings at the surface. The split spoon sampler was 1.5 ft long with a 2-in outer diameter. Three 6-in long by 1.5-in inner diameter stainless steel liners were used. Though the split spoon samplers collected an undisturbed 1.5 ft core in three steel liners at defined depths, the steel liners prevented any direct observation of "undisturbed" samples. Processing for contaminant analyses requires that the soil be pushed out of the liners into a stainless steel bowl for homogenization. This process disturbs the soil structure. Only the finer fraction (e.g. silt and sand) is used for contaminant analyses, and no distinct soil layering can be observed from the disturbed/processed soil samples.

Soil recovery rates varied from 80 to 100 percent. Blow counts were recorded for most intervals, although the ASTM standard was not specifically followed. Generally, the samples consisted of sand with 5 to 10 percent silt. Some significant gravel content up to 25 percent was observed in Borehole C4712 on the northwest corner of 216-U-1/U-2.

3.3.2 Data Verification

Review and verification of auger soil sampling data was performed by the laboratory to confirm that the sampling and chain of custody documents were complete, the sample numbers were correctly assigned to the sampling locations, the required holding times were met, and the analyses satisfied the data quality requirements specified in DOE/RL–2003-51. As the samples were analyzed as a quick analytical turn-around (7-day), no validation of data was conducted. In accordance with volume 4 of the *Analytical Services Quality Assurance Requirements Document*, "Laboratory Technical Requirements" (DOE/RL 96 68), a data verification assessment was performed by FH Sample Management and documented for each sample delivery group in the Integrated Document Management System. The verification identified no significant problems that would prevent the data from being used for the purpose stated in DOE/RL–2003-51.

In addition to the verification, all analytical data packages were subjected to a technical review by project staff and determined to be acceptable for use in supporting remedial decisions.

The data will be managed and stored in the Hanford Environmental Information System database by the Fluor Hanford organization responsible for sampling and characterization, in accordance with CP-GPP-EE-01-2.0.

3.4 WASTE MANAGEMENT ANALYSES

Waste management samples collected from selected auger boreholes were analyzed for all COIs. Only di-n-butylphthalate was detected, exhibiting concentrations of 330 ug/kg in C4710 and 190 ug/kg in C4722. Appendix D presents all the waste designation sample results.

3.5 INVESTIGATION DATA SUPPORT OF FATE AND TRANSPORT MODELING

Data collected from field investigations of the 216-U-1/216-U-2, 216-U-8, and 216-U-12 sites provided information on the distribution of the contaminants in the vadose zone. This served as input to developing the contaminants distribution profiles to support modeling of the fate and transport of vadose zone contaminants of concerns at investigation at 216-U-1/216-U-2, 216-U-8, and 216-U-12 sites. Data from this investigation, as outlined below, was combined with data from past investigations to develop contaminant concentration distribution profiles:

- Past soil sampling from characterization boreholes drilled through or adjacent to the waste sites
- Recent spectral gamma logs of existing boreholes or drywells through the waste sites
- Recent spectral gamma logs of drill casing pushed to approximately 50 to 60 ft bgs around the waste sites
- Recent soil sampling from auger borings to approximately 40 to 45 ft bgs around the waste sites
- Soil surface samples.

The files created from combining these data sets and the assumptions associated with them are presented in Appendix E. These files serve as direct input to developing vertical plume geometries from existing characterization data to support barrier performance modeling.

3.6 CRIB WASTE SITES DATA SUMMARY

This section presents a comprehensive picture of the distribution of key contaminants located zero to approximately 60 ft bgs at the 216-U-1/216-U-2 Cribs, 216-U-8 Crib and 216-U-12 Crib. In addition to the field data from spectral-gamma logging and analysis of the soil samples from the auger borings presented in this report, data sets from other data collection activities have been included for completeness, including the following:

- Surface soil samples and vadose zone samples from wells 299-W19-95, 299-W19-96, and 299-W19-97 (respectively, south, inside, and north of the 216-U-1 Crib), well 299-W19-94 (in the 216-U-8 Crib), and well 299-W22-78 (adjacent to the 216-U-12 Crib); presented in the 1994 *Surface and Near Surface Field Investigation Data Summary Report for the 200-UW-2 Operable Unit* (BHI-00033) and the *Focused Feasibility Study for the 200-UW-1 Operable Unit* (DOE/RL-2003-23).
- Geophysical spectral gamma results for U-238 from logging the DPT casings and adjacent wells listed in Table 2-1. The U-238 values were converted to uranium and presented in mg/kg. (Reports are located at the Hanford Geophysical Logging Project, available at http://www.gjo.doe.gov/programs/hanf/).

To support decisions regarding the possible placement of a bio-barrier within the proposed engineered barrier at each waste site, the maximum Cs-137 concentrations for each soil sample, borehole, and drive casing location within 0 to 15 feet bgs are presented in plan view in Figures 3-1 through 3-3. The SAP (DOE/RL-2003-51) determined that the focus of this investigation would be the interval from ground surface to 60 ft, as that is the vadose zone section most influenced by the construction of an engineered barrier. The lateral distributions of uranium and Tc-99 at the 216-U-1/216-U-2 Cribs and uranium, nitrogen, and Tc-99 at the 216-U-8 and 216-U-12 Cribs are of interest to determining the eventual coverage of the proposed engineered barrier over the waste sites. Figures 3-4 to 3-11 provide plan views depicting the lateral concentration contours for the maximum contaminant values found zero to approximately 60 ft bgs. (These contours were initially created using TechPlot, a data plotting and visualization software tool that calculated and plotted a concentration contour for each contaminant using an algorithm to create a distribution of contaminants based on the discrete data points. The contours were then interpreted into a plan view drawing of each waste site. Contour intervals were chosen to be consistent with contaminant distributions used in DOE/RL-2003-23.)

Figures 3-12 to 3-15 illustrate cross sections of the geology at 216-U-1/216-U-2 Cribs, the 216-U-8, and 216-U-12 Cribs.

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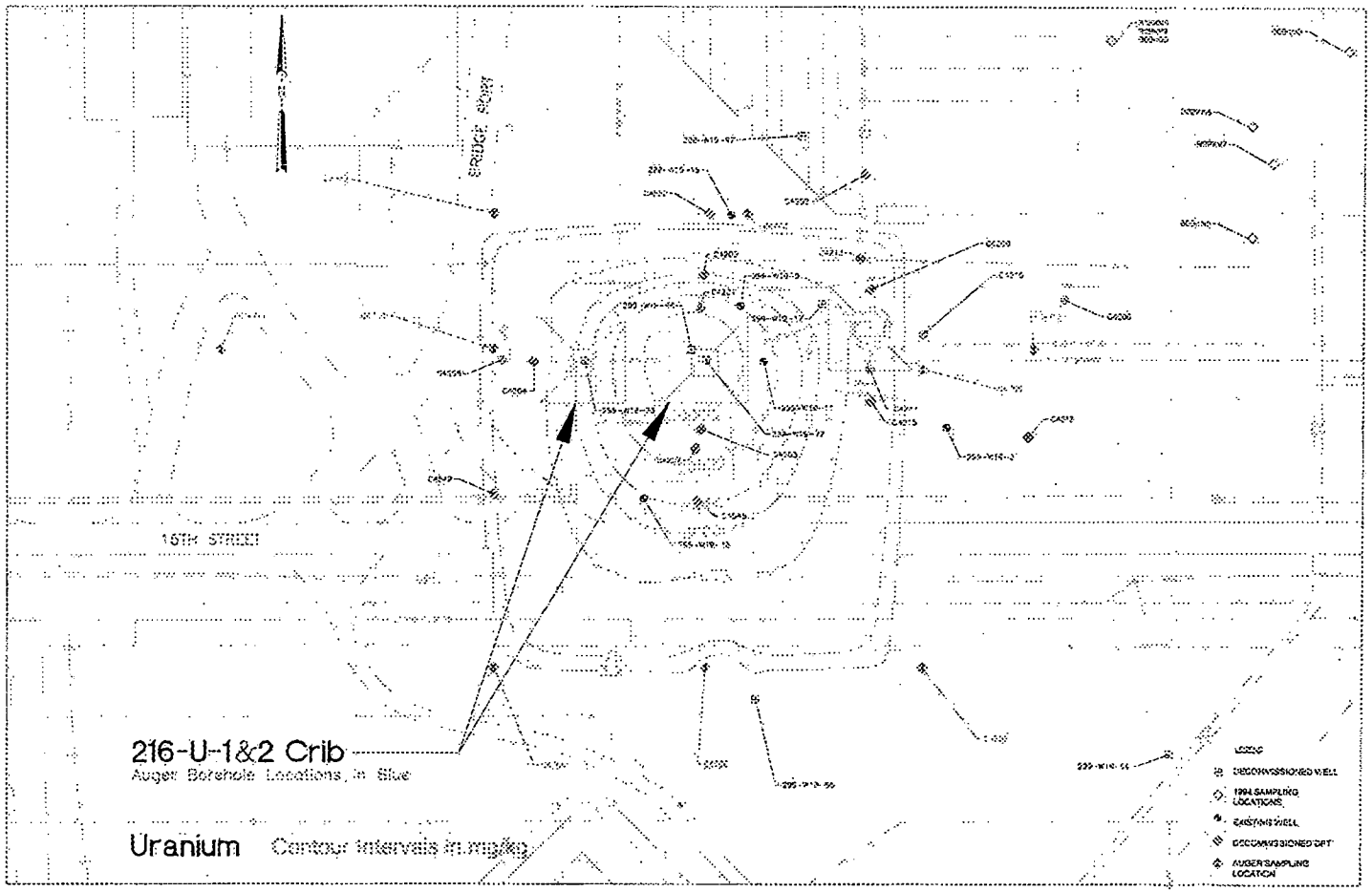

Figure 3-4. 216-U-1/216-U-2 Crib Plan View Contours for the Maximum Uranium Concentration, 0 to 60 ft bgs

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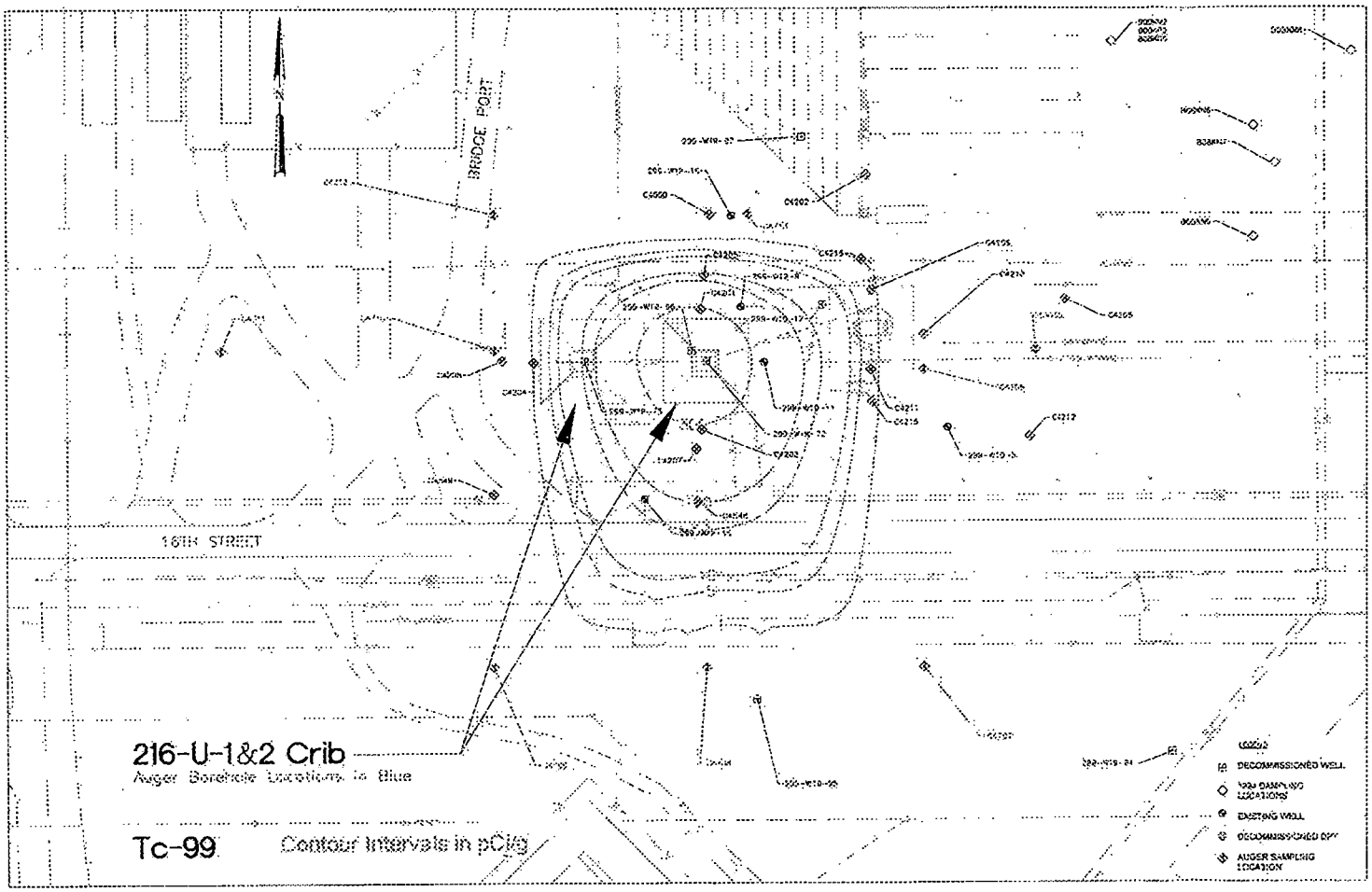

Figure 3-5. 216-U-1/216-U-2 Crib Plan View Contours for the Maximum Tc-99 Concentration, 0 to 60 ft bgs.

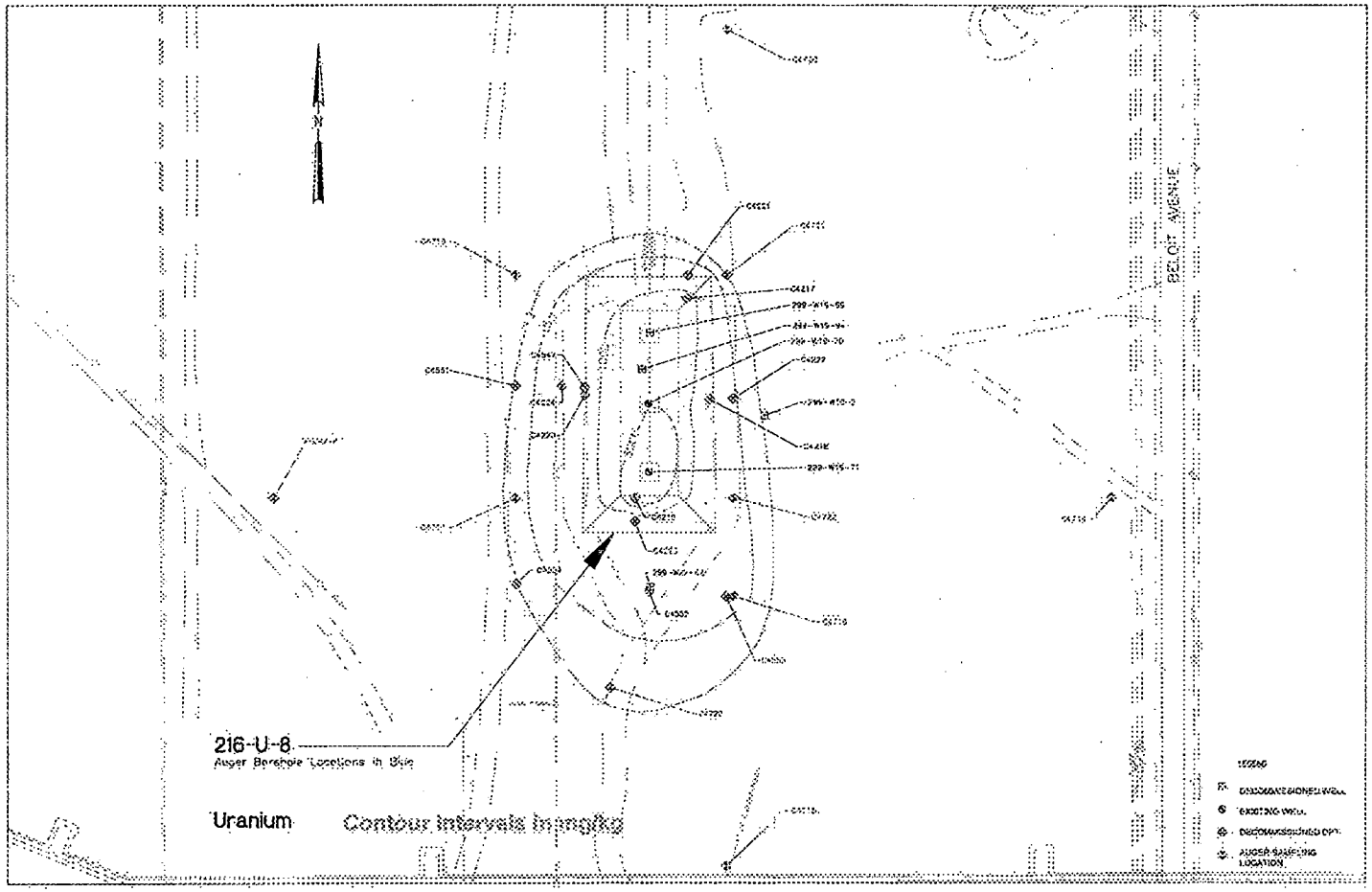

Figure 3-6. 216-U-8 Crib Plan View Contours for the Maximum Uranium Concentration, 0 to 60 ft bgs.

Page 49 of 185 of DA01917974

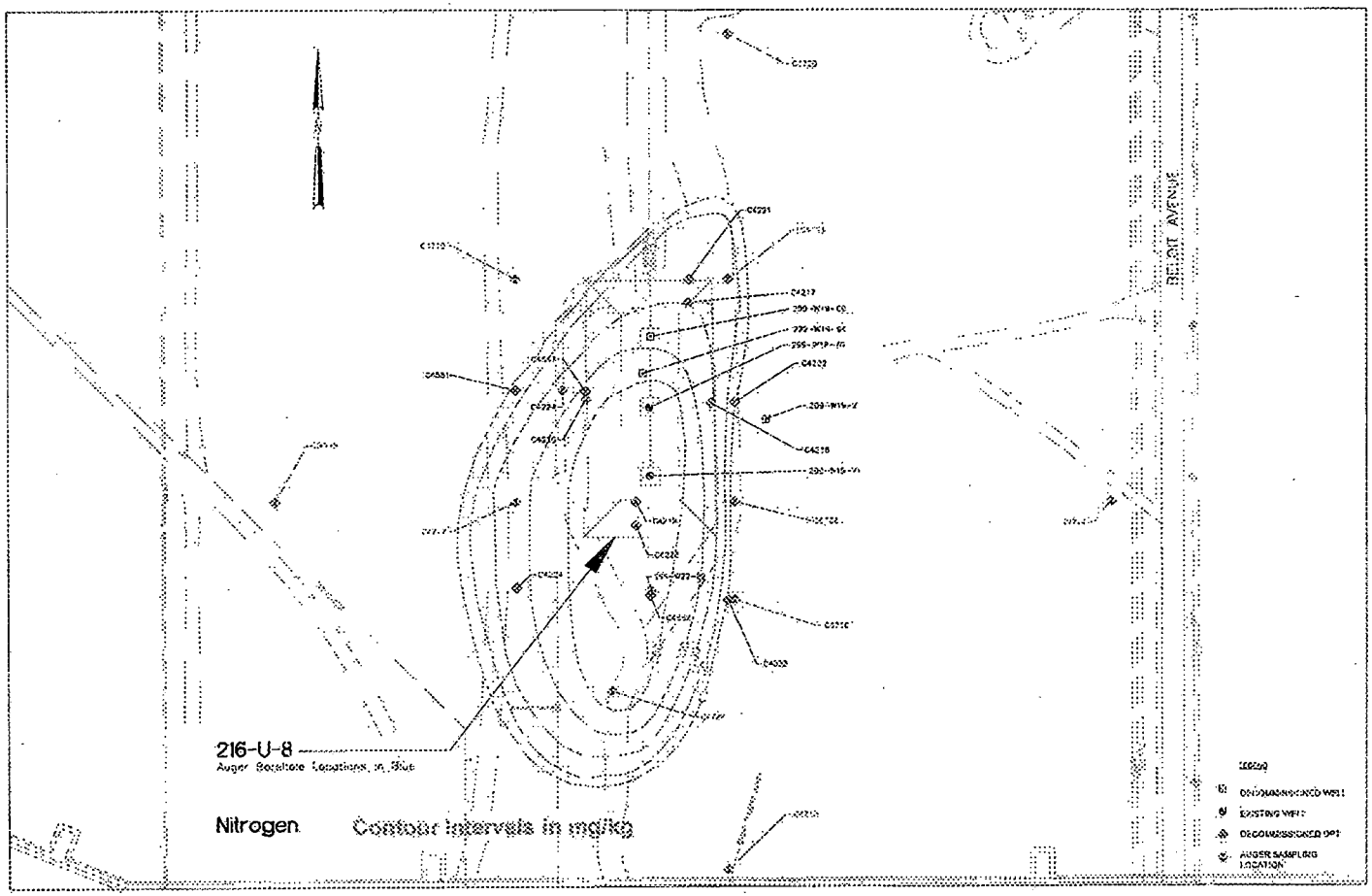

Figure 3-7. 216-U-8 Crib Plan View Contours for the Maximum Nitrogen Concentration, 0 to 60 ft bgs.

Page 50 of 185 of DA01917974

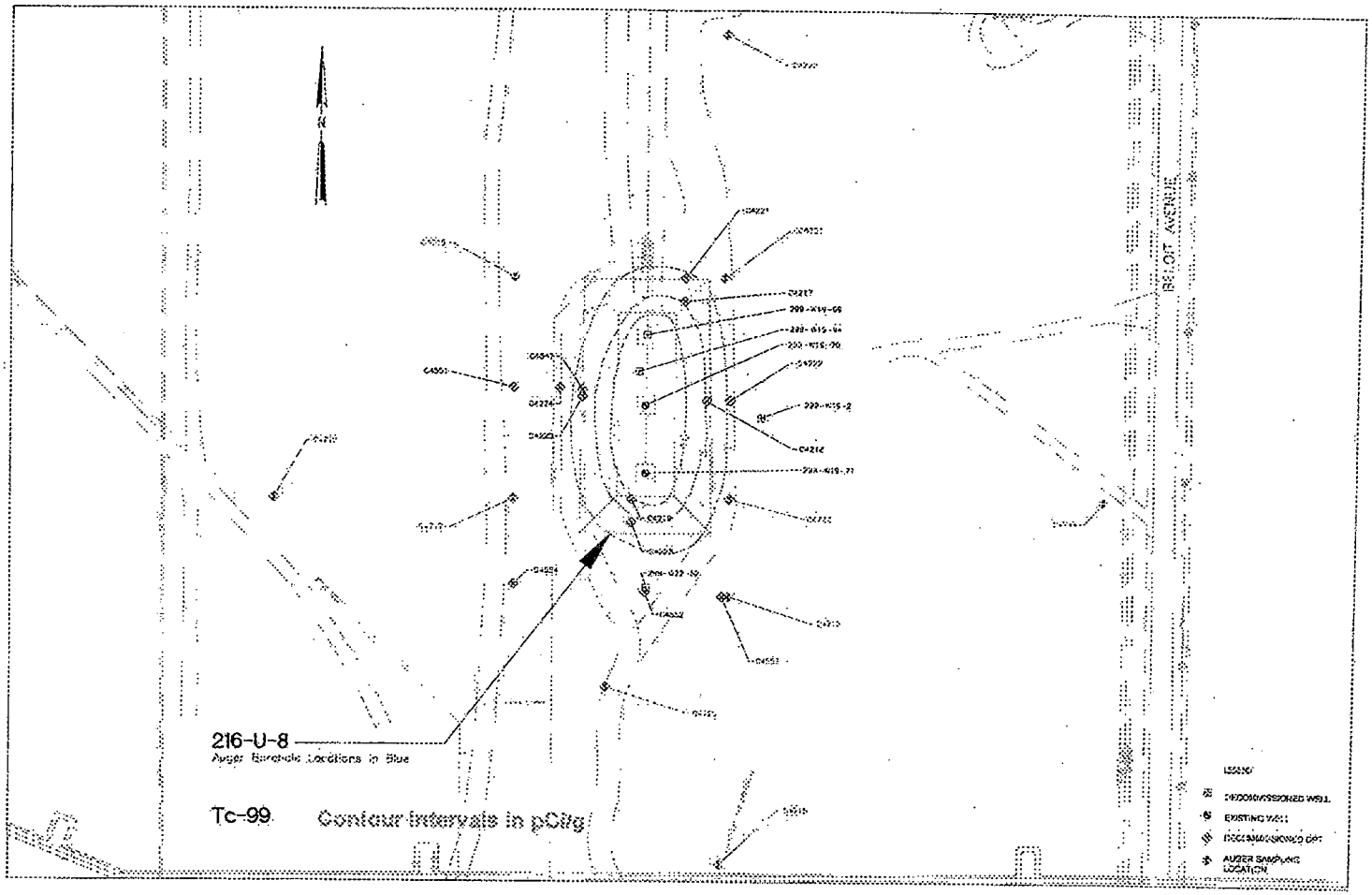

Figure 3-8. 216-U-8 Crib Plan View Contours for the Maximum Tc-99 Concentration, 0 to 60 ft bgs.

Page 51 of 185 of DA01917974

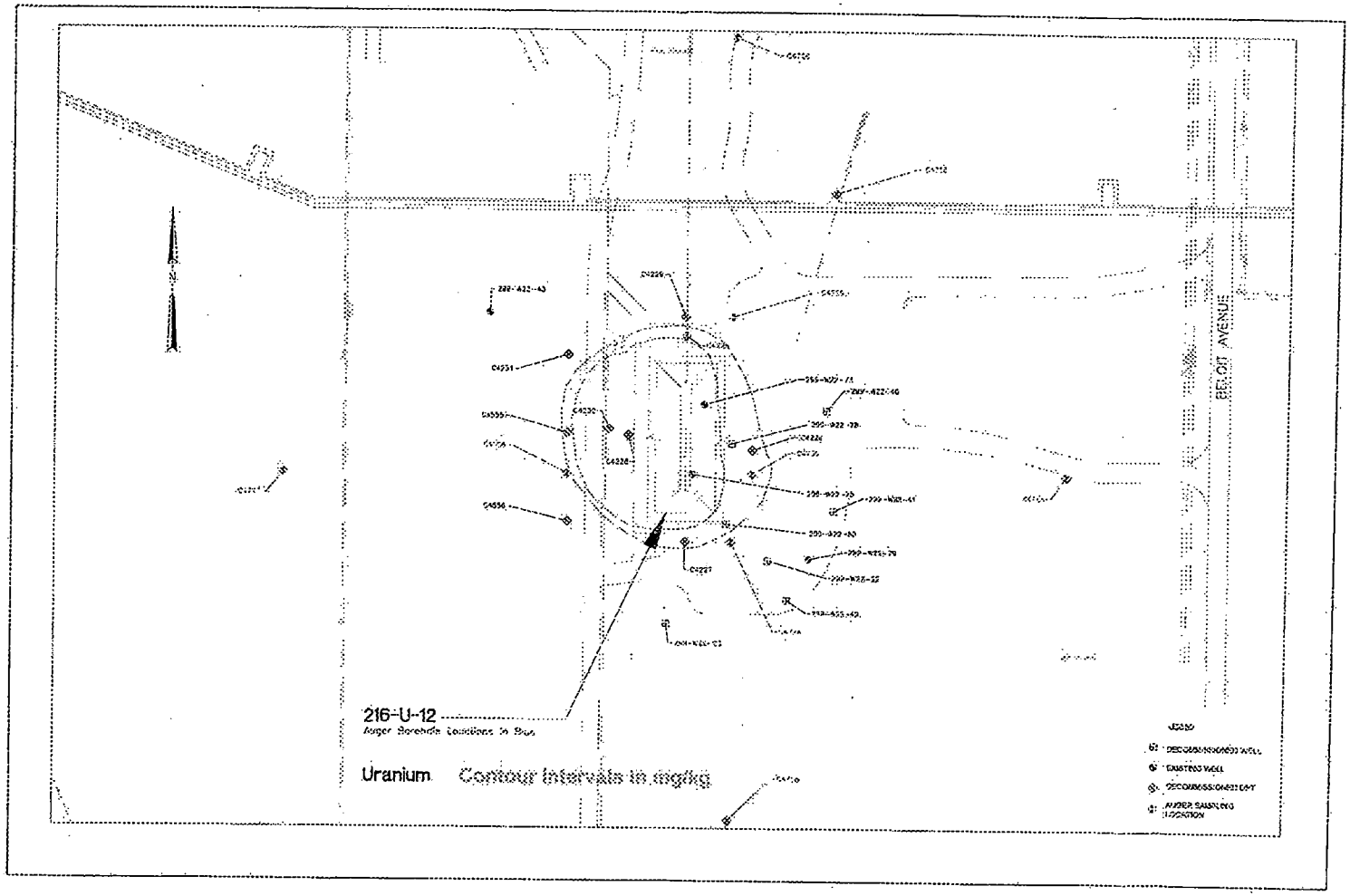

Figure 3-9. 216-U-12 Crib Plan View Contours for the Maximum Uranium Concentration, 0 to 60 ft bgs.

Page 52 of 185 of DA01917974

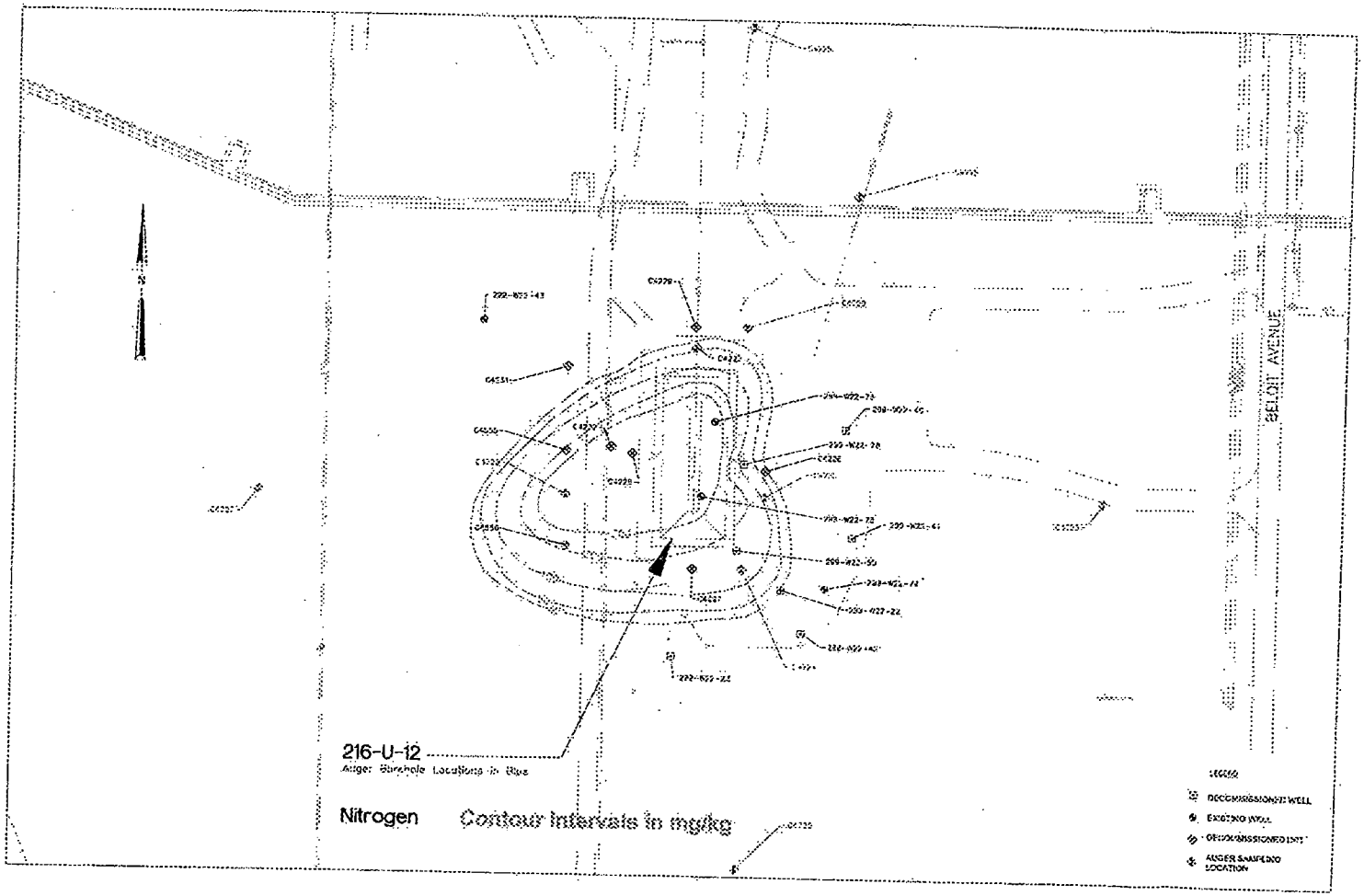

Figure 3-10. 216-U-12 Crib Plan View Contours for the Maximum Nitrogen Concentration, 0 to 60 ft bgs.

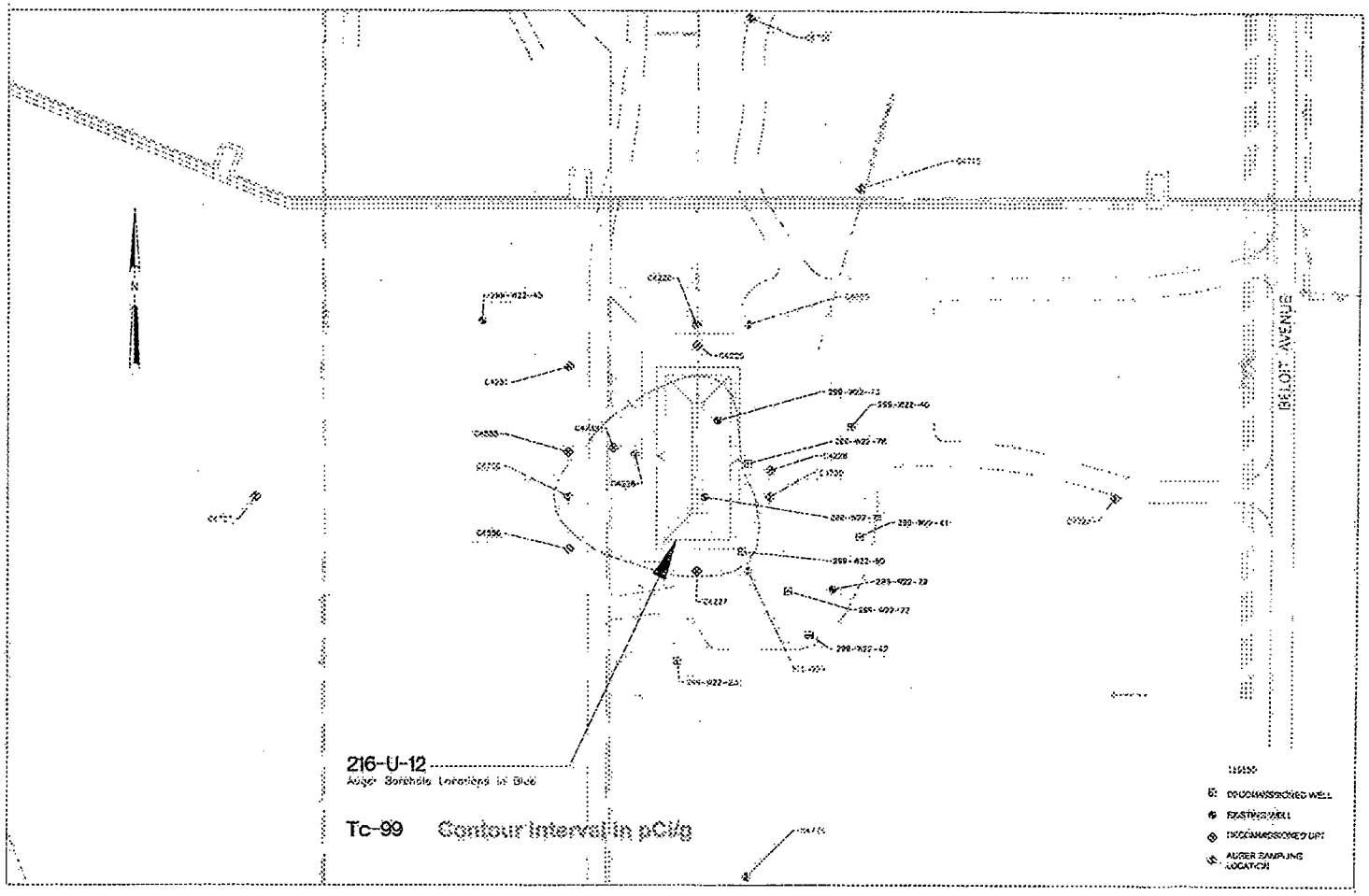

Figure 3-11. 216-U-12 Crib Plan View Contours for the Maximum Tc-99 Concentration, 0 to 60 ft bgs.

Page 54 of 185 of DA01917974

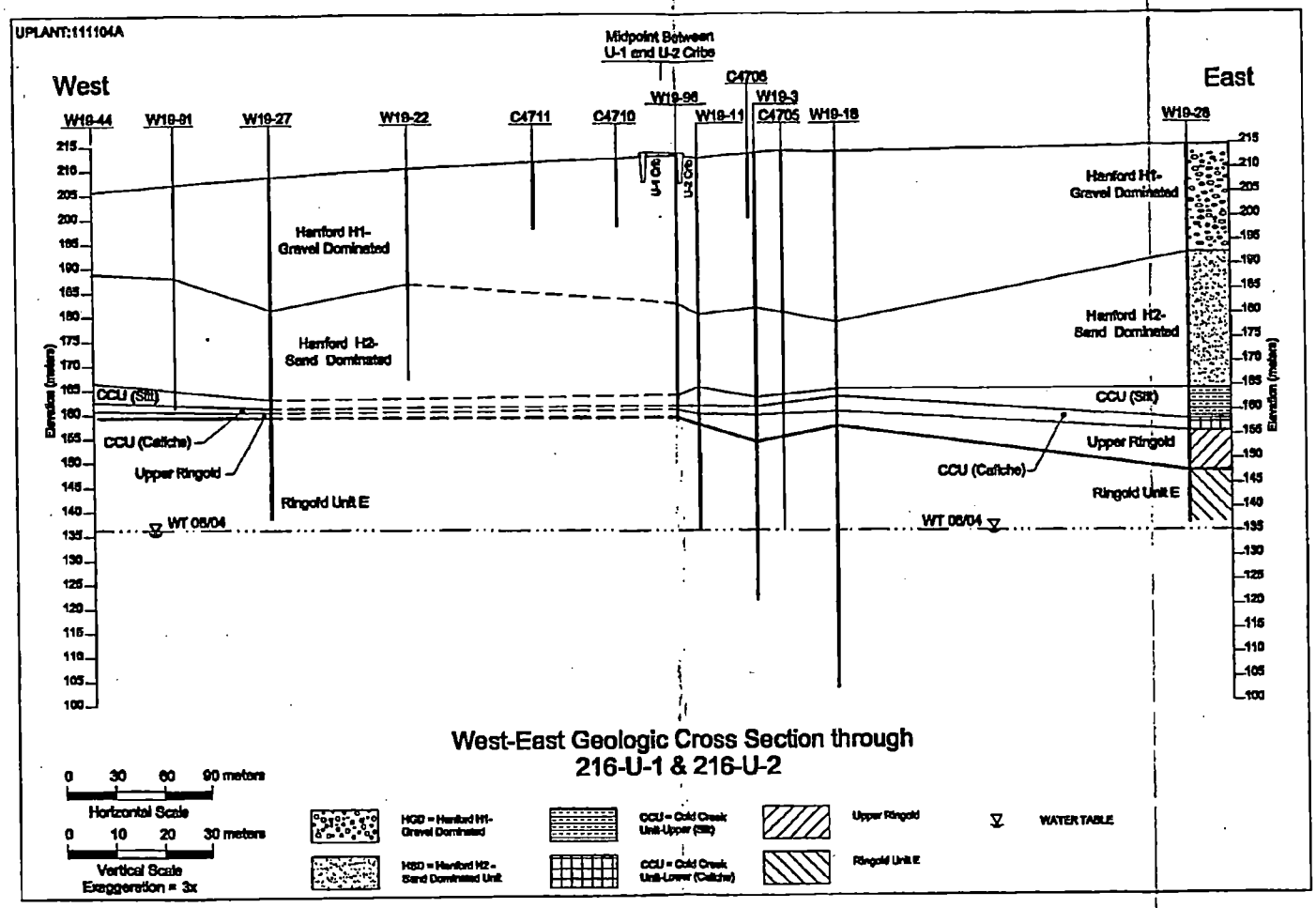

Figure 3-12. West to East Geologic Cross Section through 216-U-1/216-U-2.

Page 55 of 185 of DA01917974

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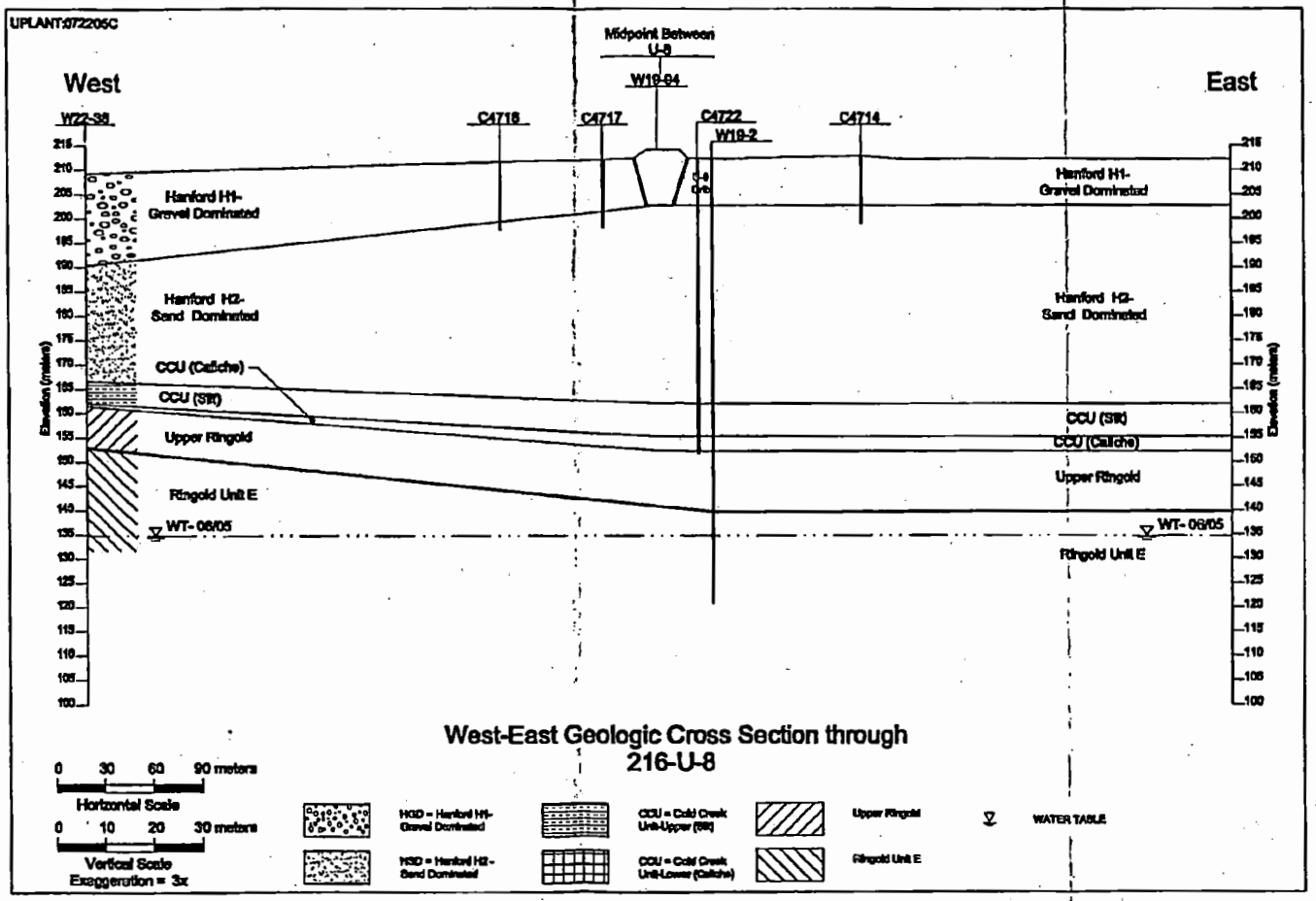

Figure 3-13. West to East Geologic Cross Section through 216-U-8.

Page 57 of 185 of DA01917974

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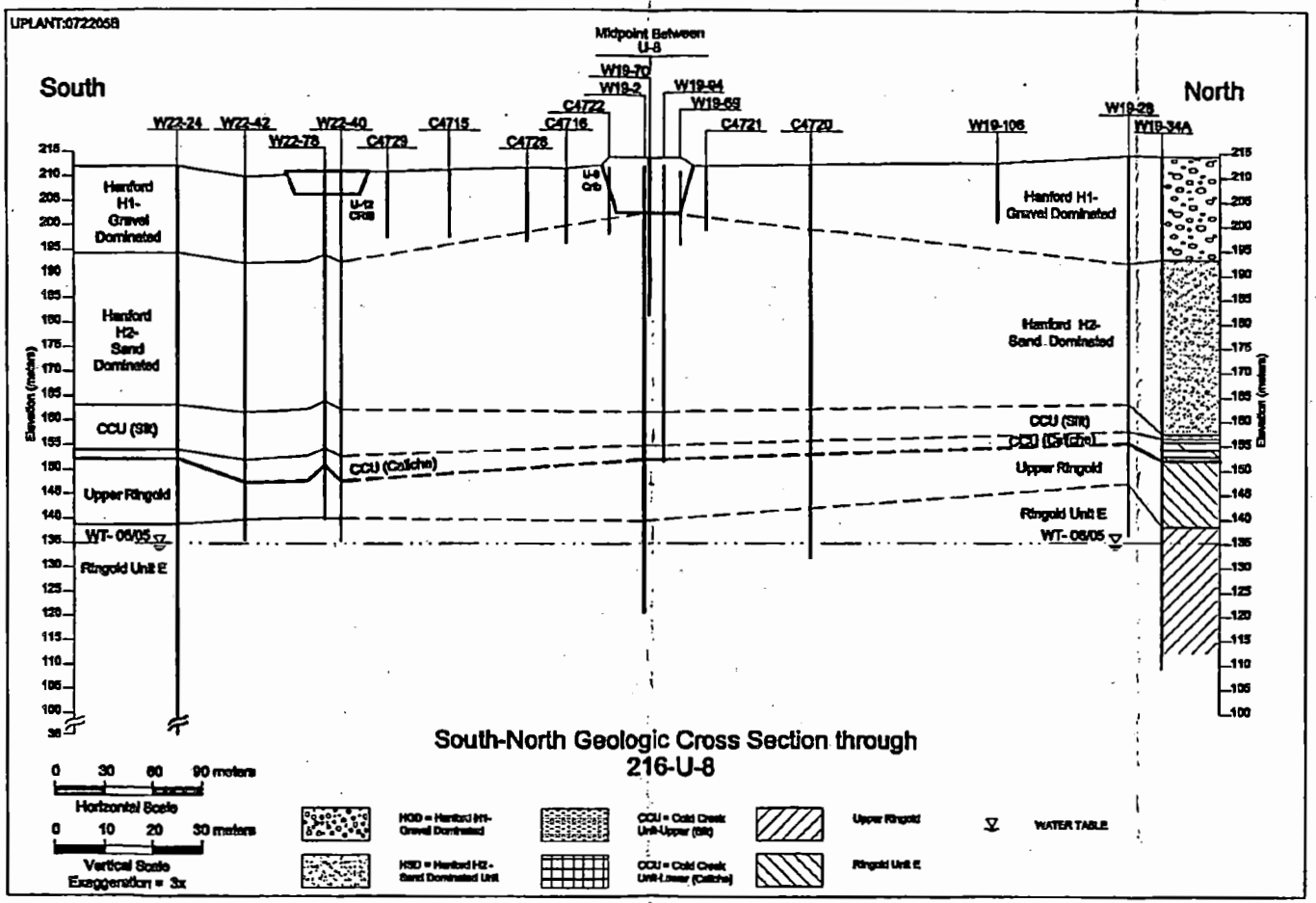

Figure 3-14. North to South Geologic Cross Section through 216-U-8.

Page 59 of 185 of DA01917974

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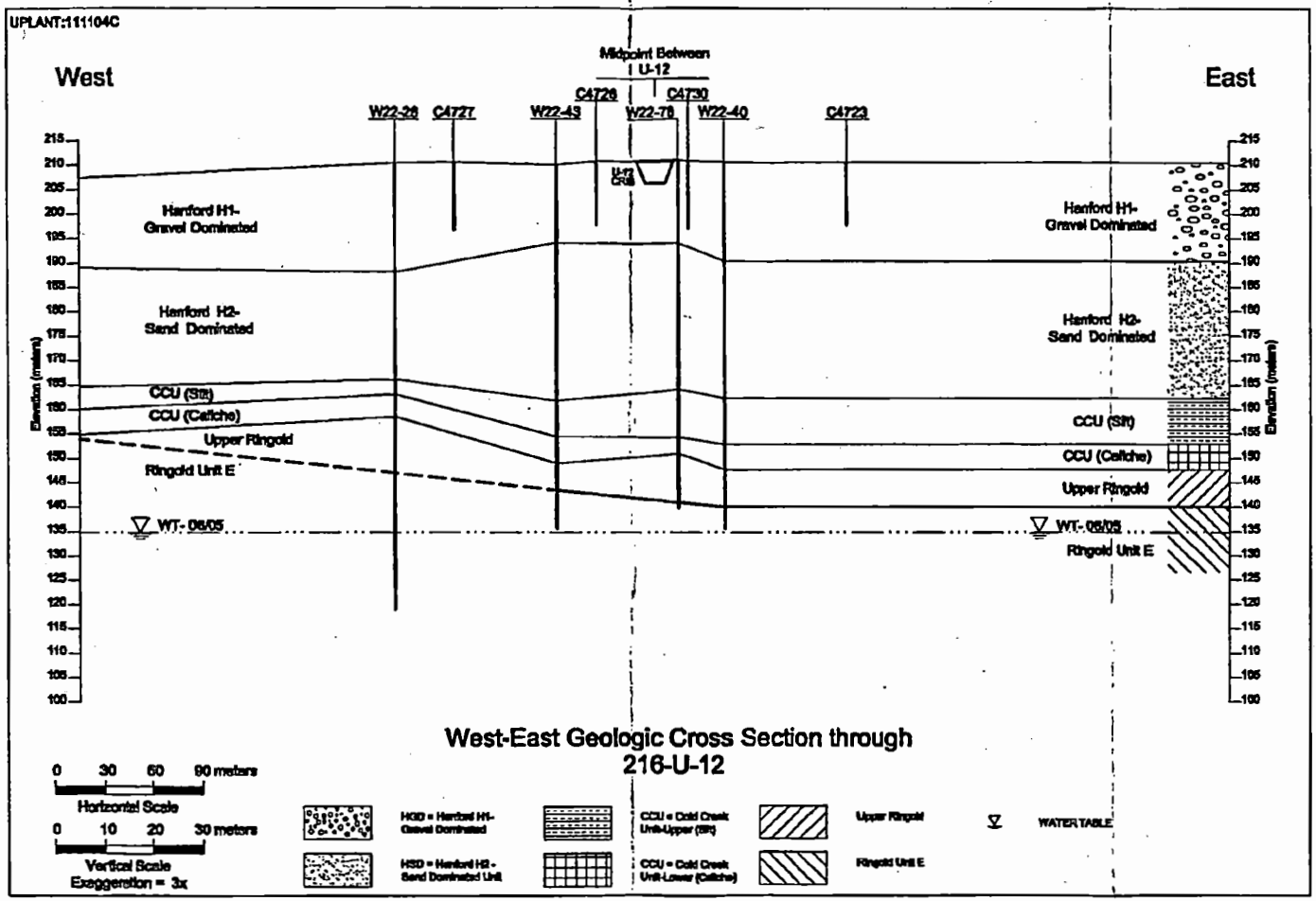

Figure 3-15. West to East Geologic Cross Section through 216-U-12.

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4.0 WELL COMPLETION ACTIVITIES OR DECOMMISSIONING

Following data collection, all DPT casing and auger boring holes were decommissioned in accordance with WAC 173-160 regulations. For both DPT casings and auger borings, bentonite crumbles were placed from total depth to about 1 ft bgs while the casing was being pulled from the ground. The upper foot of the hole was filled with Portland cement to affect a surface seal flush with the existing ground and a brass pin with a well identification number was set in the cement.

Six of the casings (C4219, C4220, C4225, C4226, C4227, and C4228) could not be removed from the ground with either the drill rig or hydraulic jacks pulling the casing at ground surface. An expandable "spear"—a device that fits snugly inside the casing and can then be expanded at a desired depth—was lowered inside the casing to the bottom in an attempt to remove it, but this method proved unsuccessful. A hollow stem auger capable of drilling around each lodged casing was subsequently required to remove them and the resulting soils were collected and drummed. Decommissioning for the DPT casings was completed on August 19, 2004.

Each of the sites coordinates were located by a land survey. The survey results are presented in Appendix A.

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5.0 CONCLUSIONS

This report summarizes the results of the field investigation, which included geophysical surface surveys, geophysical logging of driven casing, and auger soil sampling, as identified in the SAP and outlined Table 1-1. In addition, this report documents data collection techniques that meet the SAP requirements.

However, the scope of this field investigation does not involved additional SAP data collection activities at these waste sites, including boreholes, test pits, and collection of confirmation samples for confirmation of the maintain existing soil cover, institutional controls, and monitored natural attenuation alternatives or the no action alternative.

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6.0 REFERENCES

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APPENDIX A

SURVEY DATA REPORTS

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Table A-1 in this appendix contains borehole location survey data of wells, DPTs, auger holes and survey data of other principal features used in this report. All data are in meters. The weblink to the well survey data is

HTTP://APWEB02.RL.GOV/CFROOT/RAPIDWEB/PHMC/CP/HWISAPP/.

Table A-1. Borehole Location Survey Data.

Well Number	Northing (m)	Easting (m)	Elevation (m)
A4947 (299-W19-15)	134975.778	567254.252	211.978
A7770 (299-W19-70)	134697.757	567615.853	212.646
A7771 (299-W19-71)	134679.761	567616.007	212.693
A7772 (299-W19-72)	135001.90	567265.77	215.95
A7773 (299-W19-73)	135001.83	567242.92	215.95
A7879 (299-W22-75)	134490.42	567594.19	211.586
A7882 (299-W22-78)	134499.76	567606.03	210.997
A9796 (299-W19-94)	134706.8	567614.16	212.313
A7791 (299-W19-95)	134937.83	567275.32	212.17
A9797 (299-W19-96)	135003.79	567263.16	212.79
A7792 (299-W19-97)	135044.06	567283.78	212.81
C4201	135011.594	567264.841	212.962
C4202	135036.886	567295.8	212.835
C4203	134988.833	567265.105	212.154
C4204	135001.492	567233.662	212.365
C4205	135017.962	567265.549	212.914
C4206	135013.334	567333.277	213.258
C4207	134985.18	567264.055	212.133
C4208	135001.851	567227.742	212.349
C4209	135015.164	567296.887	213.279
C4210	135006.742	567306.65	213.086
C4211	135000.099	567296.679	213.262
C4212	134987.44	567326.476	213.088
C4213	135020.973	567294.855	213.156

Table A-1. Borehole Location Survey Data.

Well Number	Northing (m)	Easting (m)	Elevation (m)
C4215	134994.041	567296.925	212.939
C4217	134725.399	567626.076	212.523
C4218	134698.91	567632.196	212.263
C4219	134672.85	567612.35	212.86
C4220	134699.98	567599.31	212.26
C4221	134731.525	567626.29	212.392
C4222	134699.077	567638.381	212.085
C4223	134666.718	567612.406	212.36
C4224	134702.322	567593.278	212.493
C4225	134532.42	567591.99	210.87
C4226	134497.82	567612.21	210.83
C4227	134469.87	567592.14	210.90
C4228	134502.34	567574.63	210.77
C4229	134538.215	567591.641	210.972
C4231	134526.486	567556.382	210.837
C4232	134504.128	567568.712	210.75
C4547	134701.943	567599.255	212.365
C4548	134975.306	567264.375	212.014
C4549	134976.634	567226.191	211.571
C4550	135029.414	567266.591	212.669
C4551	134702.38	567581.133	212.351
C4552	134648.214	567616.114	212.047
C4553	134646.969	567636.668	211.635
C4554	134650.234	567581.386	211.8
C4555	134502.794	567556.265	210.656

Table A-1. Borehole Location Survey Data.

Well Number	Northing (m)	Easting (m)	Elevation (m)
C4556	134475.942	567556.51	210.942
C4705	135003.85	567327.41	213.57
C4706	135000.08	567307.76	212.96
C4707	134942.74	567306.52	212.19
C4708	134943.06	567268.38	211.98
C4709	134942.76	567226.11	211.45
C4710	135003.34	567226.02	212.09
C4711	135002.52	567175.20	211.48
C4712	135029.57	567226.33	212.01
C4713	135029.01	567273.63	212.80
C4714	134673.27	567738.10	212.80
C4715	134576.03	567636.06	211.37
C4716	134647.00	567638.48	211.72
C4717	134672.85	567581.43	212.00
C4718	134673.09	567517.65	211.43
C4719	134731.43	567581.30	212.34
C4720	134795.88	567636.50	212.66
C4721	134731.51	567636.68	212.24
C4722	134672.59	567638.30	211.86
C4723	134490.24	567707.88	211.42
C4724	134470.13	567606.09	210.83
C4725	134385.16	567605.72	210.49
C4726	134490.59	567556.24	210.69
C4727	134490.39	567470.27	210.47
C4728	134622.84	567606.03	211.83

Table A-1. Borehole Location Survey Data.

Well Number	Northing (m)	Easting (m)	Elevation (m)
C4729	134538.29	567605.36	211.20
C4730	134490.27	567612.14	210.74

APPENDIX B

SURFACE GEOPHYSICAL SURVEY REPORT

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This appendix documents the geophysical investigation conducted at waste sites in the vicinity of the U Plant, Figure 1.

The following sites that were investigated:

216-U-1 Crib and 216-U-2 Crib
241-361 Settling Tank (including 2607-W5 Septic Tank)
216-U-8 Crib
216-U-12 Crib
216-U-16 Crib
216-U-17 Crib
200-W-8 UPR
200-W-42 UPR
200-W-56 Debris Pile
200-W-71 Burial Area

Attachments to this appendix include: 1) a geophysical investigation summary form for each site, 2) a final integrated interpretation map for each site, 3) Electromagnetic Induction (EMI), [time domain (TDEM; EM-61) and frequency domain (FDEM; EM-31)], and magnetic total field and gradient contour plots for the sites in which these method were used.

Ground penetrating radar (GPR), EMI, TDEM, and magnetic total field and gradient were the key geophysical methods that were used for the investigations because they are cost-effective, non-intrusive, and have been used successfully in similar waste site characterization projects conducted on the Hanford Site. Not every geophysical method was used at each site. The methods that were selected for each investigation were based on the objectives, physical obstructions, and size and/or complexity of a site.

The geophysical data were integrated with available historical drawings and detailed surface maps when available. In essence, the interpretation maps represent a "snap-shot" of the subsurface at the time of data collection. Not all of the features that have been identified with GPR or EMI can be correlated with features from a drawing or map. It is also likely that not all of the features within the surveyed area were identified due to the line spacing of the surveys. These interpretation maps are subject to change with the "discovery" of additional drawings and/or geophysical information that may be acquired in the future.

OBJECTIVES OF INVESTIGATION

The primary objective of most of the investigations was to locate and map the documented attributes of the individual waste sites. However, several of the investigations were only designed to identify a location, with no underground obstructions, for subsurface sampling using either a direct push method or a borehole.

SUMMARY OF RESULTS

200-U-1 and 200-U-2 Cribs (Figures 2a, 2c, 2d)

The 200-U-1 and 200-U-2 Cribs were combined into a single investigation. Numerous isolated GPR anomalies were detected throughout the site. Most of the GPR anomalies do not have a corresponding TDEM anomaly suggesting that the features causing the anomalous response in the GPR data are not metallic and most likely related to changes in the soil conditions. Several disturbed areas were also detected that may be masking deeper features of interest. Disturbed areas are usually related to notable changes in the soil caused by a localized excavation, a distinct change in the character of soil, or a small concentration of buried debris. Linear anomalies that were detected are usually related to buried pipelines or utilities. The primary underground lines that fed the cribs were not detected because they were too deep. All anomalies, anomalous disturbed areas, and linears and/or their projected extensions should be avoided when taking subsurface samples.

241-U-361 (including 2607-W5 Septic Tank) (Figures 2b, 2c, 2d)

The 241-U-361 survey is an eastern extension of the 200-U-1/2 investigation. Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. The linear anomalies that were detected are most likely related to buried pipelines or utilities. The primary underground lines that fed the cribs were not detected because they were too deep. All anomalies, anomalous disturbed areas, and linears and/or their projected extensions should be avoided when taking subsurface samples.

216-U-8 Crib (Figures 3a, 3b, 3c, and 3d)

Numerous isolated GPR anomalies were detected throughout the site. Most do not have a corresponding TDEM response suggesting that the features causing the anomalous response in the GPR data are non-metallic features and/or are related to localized changes in the soil conditions. Several disturbed areas were also identified that may be masking deeper features of interest. No features were identified that appear to be directly associated with the crib or crib infrastructure. Most of the anomalies appear to be within the fill material that created the mound that covers the site. All isolated anomalies, anomalous zones, and linears and/or their projected extensions should be avoided when taking subsurface samples.

216-U-12 Crib (Figures 4a, 4b, and 4c)

The excavation edges for the crib were detected and mapped and define the crib boundary. Numerous isolated anomalies were detected both within and outside of the crib boundary. Several anomalous disturbed zones were also detected that may be masking deeper features of interest. Most anomalies and anomalous zones do not have a corresponding TDEM response suggesting that these features are non-metallic and most are likely related to changes in the soil conditions.

Several disturbed zones were also identified that may be masking deeper features of interest. A linear anomaly that was detected in the western extension is most likely related to a buried pipeline(s) or utility. The underground line that fed the crib from the north was not detected, but the excavation edges for the pipeline trench were delineated and mapped. All isolated anomalies and anomalous zones, and linears and/or their projected extensions and/or their projected extensions should be avoided when taking subsurface samples.

216-U-16 Crib (Figures 5a and 5b)

The objective of the investigation was to locate any subsurface obstructions that need to be avoided by a borehole. Defining the attributes of the crib was not one of the objectives.

Only a few isolated anomalies were detected. There were no subsurface features that were detected that appear to be related to the crib except for a linear anomaly that was detected to the east of the primary grid. It is possible that this is the pipeline that fed the crib. However, it is a subtle, intermittent feature thus inconclusive.

All isolated anomalies and anomalous zones, and linears and/or their projected extensions, should be avoided when taking subsurface samples.

216-U-17 Crib (Figures 6a and 6b)

Only a few isolated anomalies were detected but most were outside of the crib. The southern and northern excavation boundary for the crib was detected but not the eastern and western edges because the grid did not extend far enough to the east or west. The anomalies should be avoided when finalizing the location for the borehole.

200-W-8 (Figures 7a, 7b, 7c, 7d, and 7e)

Several concentrations of anomalies (zones) were detected indicating that there are buried features/debris/material within the study area. Most of these anomalous zones were only detected with the magnetometer. The linear pattern of the anomalies suggests that the features/debris/material were intentionally concentrated and not randomly scattered debris that is often found throughout much of the Hanford site. It is not known whether these anomalous features are related to the 200-W-8 Waste Site.

Most of these magnetic anomalous zones have no corresponding EMI anomalies suggesting that some are likely crushed, basalt rich, gravel which was used for road bedding etc. Basalt rich gravels are often readily detected with a magnetometer. However, scattered ferrous metal debris may be mixed in amongst these anomalies and could be "hidden" within the anomalous response to the basalt.

There were several linear features that were detected that have the character of a buried pipeline/utility. They are predominately north-south trending and were detected in the western half of the site. There is a notable linear in the EMI data that crosses the northern half of the site. It has above ground signs marking it as underground cables.

The rest of the anomalies are widely scattered across the site. Due to the spacing between the geophysical profiles, it is anticipated that there are additional scattered, isolated features that were missed.

If it becomes necessary to characterize the anomalous features/zones detected across the site, a detailed data analysis of the geophysical data is recommended which integrates aerial photographs, the surface features map, and historical drawings.

200-W-42 (Figures 8a and 8b)

The excavation boundaries for the pipeline were detected and mapped but the actual pipeline was not detected. Within the excavation boundary, numerous GPR anomalies were detected. All anomalies should be avoided when selecting the final sample(s) point. The center of the excavation should also be avoided to reduce the potential for hitting the pipeline when sampling.

200-W-56 (Figures 9a, 9b, 9c, and 9d)

There is an abundance of magnetic anomalies throughout the northern and eastern portion of the site that extend beyond the boundaries of the survey. There are no corresponding EMI anomalies. The primary EMI anomalies are in the southwestern corner of the site and are primarily associated with the power pole, burial ground monument and associated chains. It is not clear what is causing the magnetic anomalies but due to the lack of EMI anomalies it appears the anomalies are predominately soil/fill material related.

The anomalous signature of the debris pile does not appear to extend beyond the debris pile.

200-W-71 (Figures 10a, 10b, 10c, 10d, 10e and 10f)

Two surface depressions in the vicinity of N200/E165 are in the middle of an anomalous magnetic and EMI zone that extends from roughly N184 to N230. There is also some scattered surface debris in this zone. This area appears to be within the 200-W-71 trench/burial ground. The abundance of anomalous magnetic features in the northwest corner appears to correlate primarily with changes within the soil (due to the lack of corresponding anomalies in the EMI and/or TDEM data).

A notable east-west linear feature that crosses the southern portion of the site correlates with the documented pipeline that is marked on the surface. The east-west linear feature along the northern edge most likely is a buried utility that parallels the paved road.

FIGURES

Figure 1. U-Plant Waste Sites Geophysical Investigations Location Map

Figure 2a. 216-U-1 & 2 Geophysical Site Investigation Summary Form

Figure 2b. 241-U-361 Geophysical Site Investigation Summary Form

Figure 2c. 216-U-1 & 2, 241-U-361 EM-61 Contour Plot

Figure 2d. 216-U-1 & 2, 241-U-361 Interpretation Map

Figure 3a. 216-U-8 Crib Geophysical Site Investigation Summary Form

Figure 3b. 216-U-8 Crib EM-31 Contour Plots

Figure 3c. 216-U-8 Crib EM-61 Metal Detector Contour Plots

Figure 3d. 216-U-8 Crib Interpretation Map

Figure 4a. 216-U-12 Geophysical Site Investigation Summary Form

Figure 4b. 216-U-12 EM-61 Metal Detector Contour Plots

Figure 4c. 216-U-12 Interpretation Map

Figure 5a. 216-U-16 Crib Geophysical Site Investigation Summary Form

Figure 5b. 216-U-16 Crib Interpretation Map

Figure 6a. 216-U-17 Crib Geophysical Site Investigation Summary Form

Figure 6b. 216-U-17 Crib Interpretation Map

Figure 7a. 200-W-8 Geophysical Site Investigation Summary Form

Figure 7b. 200-W-8 Magnetic Gradient Contour Plot

Figure 7c. 200-W-8 EM-31 Ground Conductivity Contour Plot

Figure 7d. 200-W-8 EM-31 In-Phase Contour Plot

Figure 7e. 200-W-8 Interpretation Map

Figure 8a. 216-W-42 Pipeline Geophysical Site Investigation Summary Form

Figure 8b. 216-W-42 Pipeline Interpretation Map (plotted on Figure 3d)

Figure 9a. 200-W-56 Geophysical Site Investigation Summary Form

Figure 9b. 200-W-56 Magnetic Gradient Contour Plot

Figure 9c. 200-W-56 EM-31 Contour Plots

Figure 9d. 200-W-56 Interpretation Map

Figure 10a. 200-W-71 Geophysical Site Investigation Summary Form

Figure 10b. 200-W-71 Magnetic Gradient Contour Plot

Figure 10c. 200-W-71 EM-61 Metal Detector Contour Plots

Figure 10d. 200-W-71 EM-31 Ground Conductivity Contour Plot

Figure 10e. 200-W-71 EM-31 In-Phase Contour Plot

Figure 10f. 200-W-71 Interpretation Map

Figure 1. U-Plant Waste Sites Geophysical Investigations Location Map.

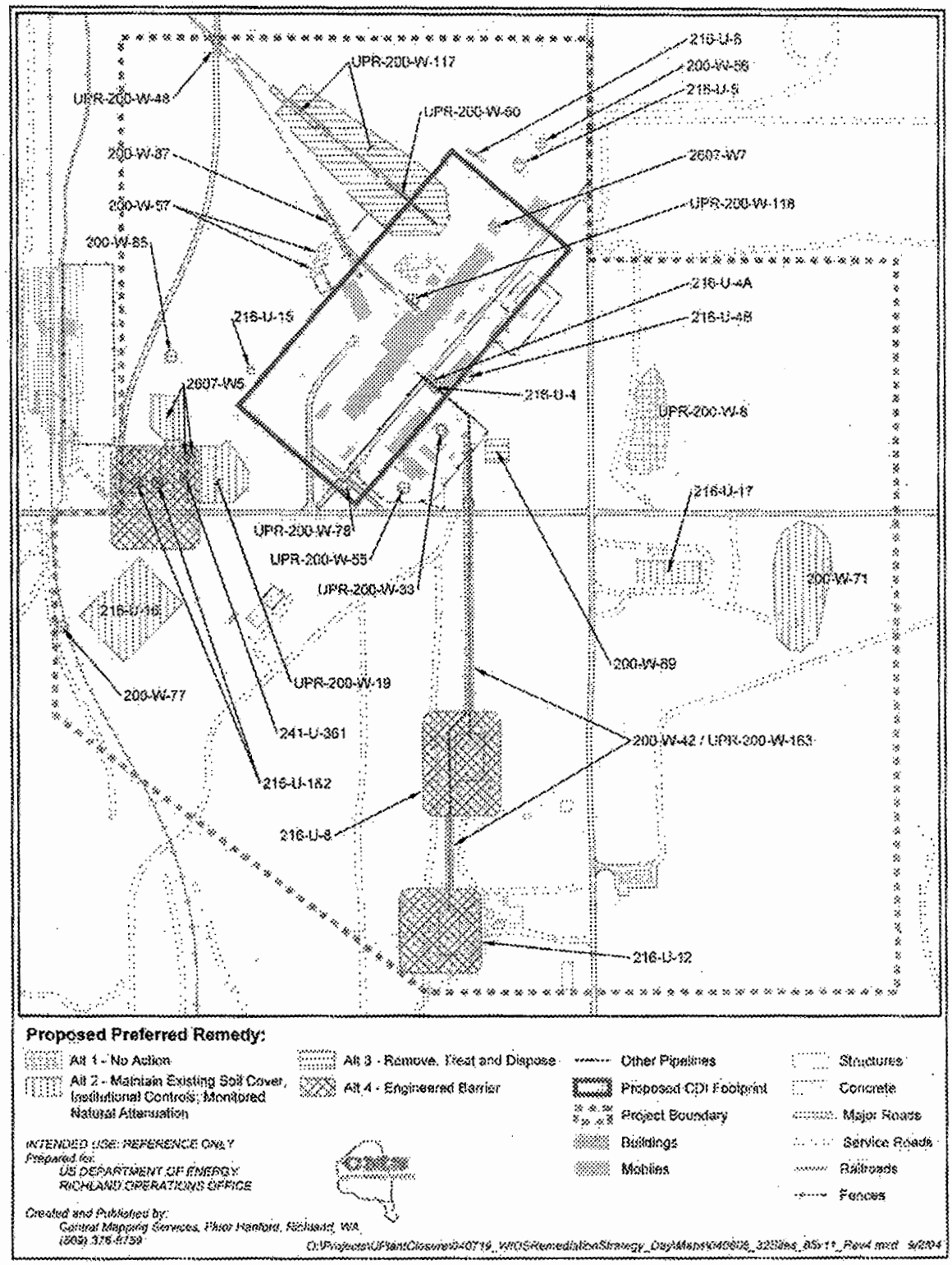


Figure 2a. 216-U-1 & 2 Geophysical Site Investigation Summary Form.

Site:	216-U-1 & 2 Cribs (combined with 241-U-361 site)	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 300 meters west of U plant and 30 meters north side of 16th Street.				
Objectives:	To identify potential subsurface obstructions at direct push sampling locations. Characterize Waste site for future remediation of the cribs.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M Hill, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A Entire site disturbed by activities related to the construction and/or operations of Hanford facilities.
Terrain:	Flat except along the southern and western edges where the ground drops ~0.5 meters to the surrounding flat terrain
Vegetation	None
Soil/sediments/rock type:	Gravel, cobbles and sand. Surface fill of gravel and cobbles cover the entire site.
Anticipated Bedrock:	**Depth:** NA **Type:** NA
Hydro properties*:	Moist at time of data collection.
Obstacles:**	Chained off areas around both cribs were not accessible for data collection.
Site Limitations:	No data over actual cribs
Overall assessment of site for geophysical investigations:	Good conditions for geophysical investigation

Site:	216-U-1 & 2 Cribs (combined with 241-U-361 site)	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Equipment

Type/Model: Ground Penetrating Radar (GPR): Geophysical Survey Systems, Inc., (GSSI) SIR-10; 200 MHz antenna

Time Domain Electromagnetics (TDEM): Geonics EM-61

Data Format: Disk ☐ Tape ☐ Hardcopy ☒

Data Collection/Processing Parameters

Survey Grid Parameters:

A 2 x 2-meter location control grid was established within approximately a 30x 100-meter area. Seven extensions to the grid were made as adjustments to the sampling plan called for the investigation of sites outside of the original grid.

Data Collection Parameters:

- The GPR data were collected in the continuous mode along parallel profiles spaced 2-meters apart in both north-south and east-west directions. GPR was collected throughout the entire gridded area including the extensions.
- GPR: 108-nanosecond window was used at 50 scans per second with a 2x stack. Filters and data collection parameters were set in the field to match the local soil conditions.
- TDEM data: 4 channels, 3x time windows with differential mode. Data collected using wheel encoder (readings @0.19 meter intervals) along north-south profiles spaced 2 meters apart.
- TDEM data were collected only in the original grid. Data were not collected in the extensions.

Data Processing Parameters:

- Minimal post-processing of the GPR data was performed.
- TDEM data were contoured using the nearest neighbor algorithm and Golden Software's SURFER.

Summary of Results

Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. Linears anomalies that were detected are most likely related to buried pipelines or utilities. The primary underground lines that fed the cribs were not detected because they were too deep. All anomalies, anomalous disturbed areas, and linears should be avoided when taking subsurface samples.

Figure 2b. 241-U-361 Geophysical Site Investigation Summary Form.

Site:	241-U-361 Settling Tank (combined with 2607-W5 Septic Tank)	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 300 meters west of U plant and 30 meters north side of 16th Street. Eastern end of 216-U-1 & 2 investigation.				
Objectives:	To identify potential subsurface obstructions at direct push sampling locations. Characterize Waste site for future remediation of the cribs.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M HILL Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M HILL Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M HILL, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A Entire site disturbed by activities related to the construction and/or operations of Hanford facilities.
Terrain:	Flat except along the southern and western edges where the ground drops ~0.5 meters to the surrounding flat terrain
Vegetation	None
Soil/sediments/rock type:	Gravel, cobbles and sand. Surface fill of gravel and cobbles cover the entire site.
Anticipated Bedrock:	**Depth:** NA **Type:** NA
Hydro properties*:	Moist at time of data collection.
Obstacles:**	Chained off areas around the tank not accessible for data collection.
Site Limitations:	No data over the tank.
Overall assessment of site for geophysical investigations:	Good conditions for geophysical investigation

Site:	241-U-361 Settling Tank (combined with 2607-W5 Septic Tank)	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Equipment

Type/Model: Ground Penetrating Radar (GPR): Geophysical Survey Systems, Inc., (GSSI) SIR-10; 200 MHz antenna

Time Domain Electromagnetics (TDEM): Geonics EM-61

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

Data Collection/Processing Parameters

Survey Grid Parameters:

A 2 x 2-meter location control grid was established within approximately a 30x 100-meter area. The 216-U-1 and 2 crib and 241-U-361 Tank investigations were combined into a single investigation. Seven extensions to the grid were made as adjustments to the sampling plan called for the investigation of sites outside of the original grid.

Data Collection Parameters:

- The GPR data were collected in the continuous mode along parallel profiles spaced 2-meters apart in both north-south and east-west directions. GPR was collected throughout the entire gridded area including the extensions.
- GPR: 108-nanosecond window was used at 50 scans per second with a 2x stack. Filters and data collection parameters were set in the field to match the local soil conditions.
- TDEM data: 4 channels, 3x time windows with differential mode. Data collected using wheel encoder (readings @0.19 meter intervals) along north-south profiles spaced 2 meters apart.
- TDEM data were collected only in the original grid. Data were not collected in the extensions.

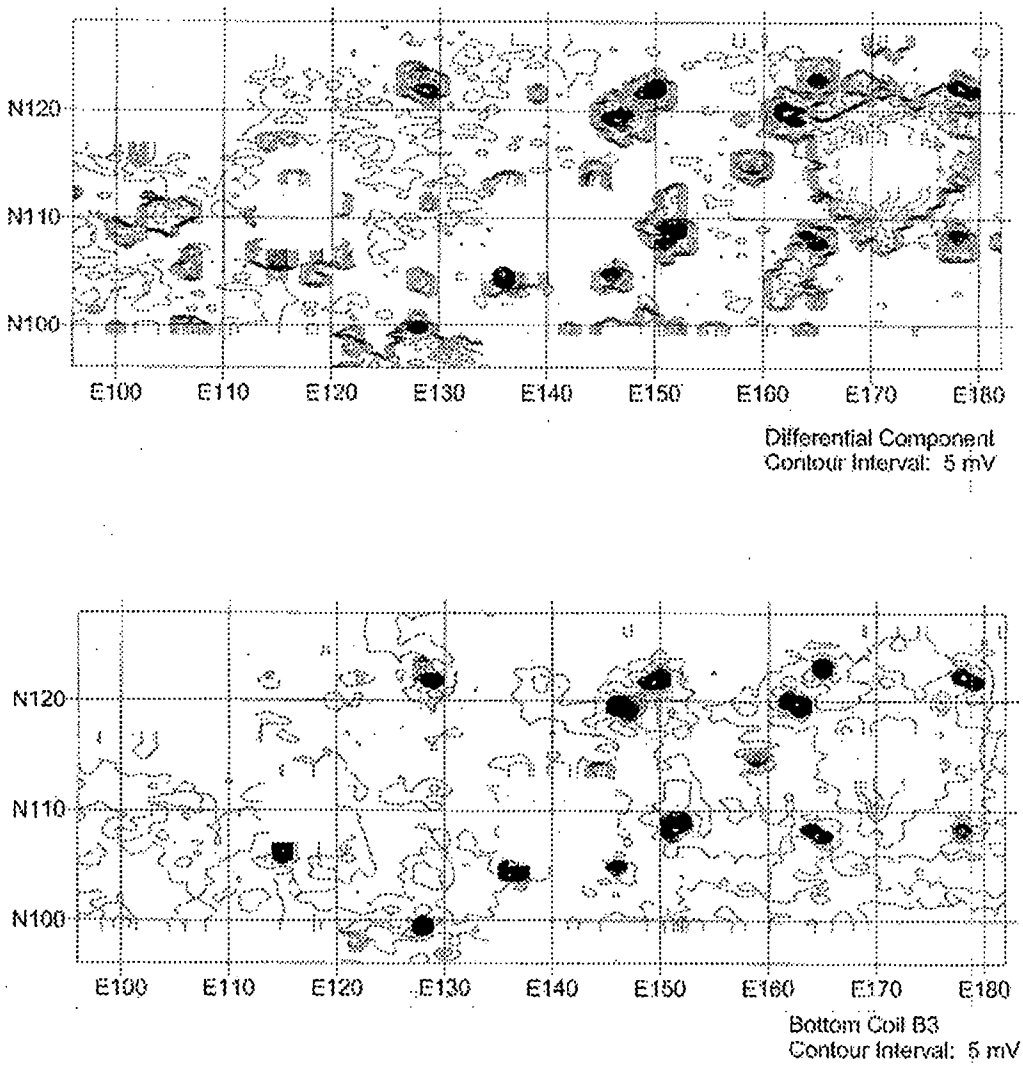
Data Processing Parameters:

- Minimal post-processing of the GPR data was performed.
- TDEM data were contoured using the nearest neighbor algorithm and Golden Software's SURFER.

Summary of Results

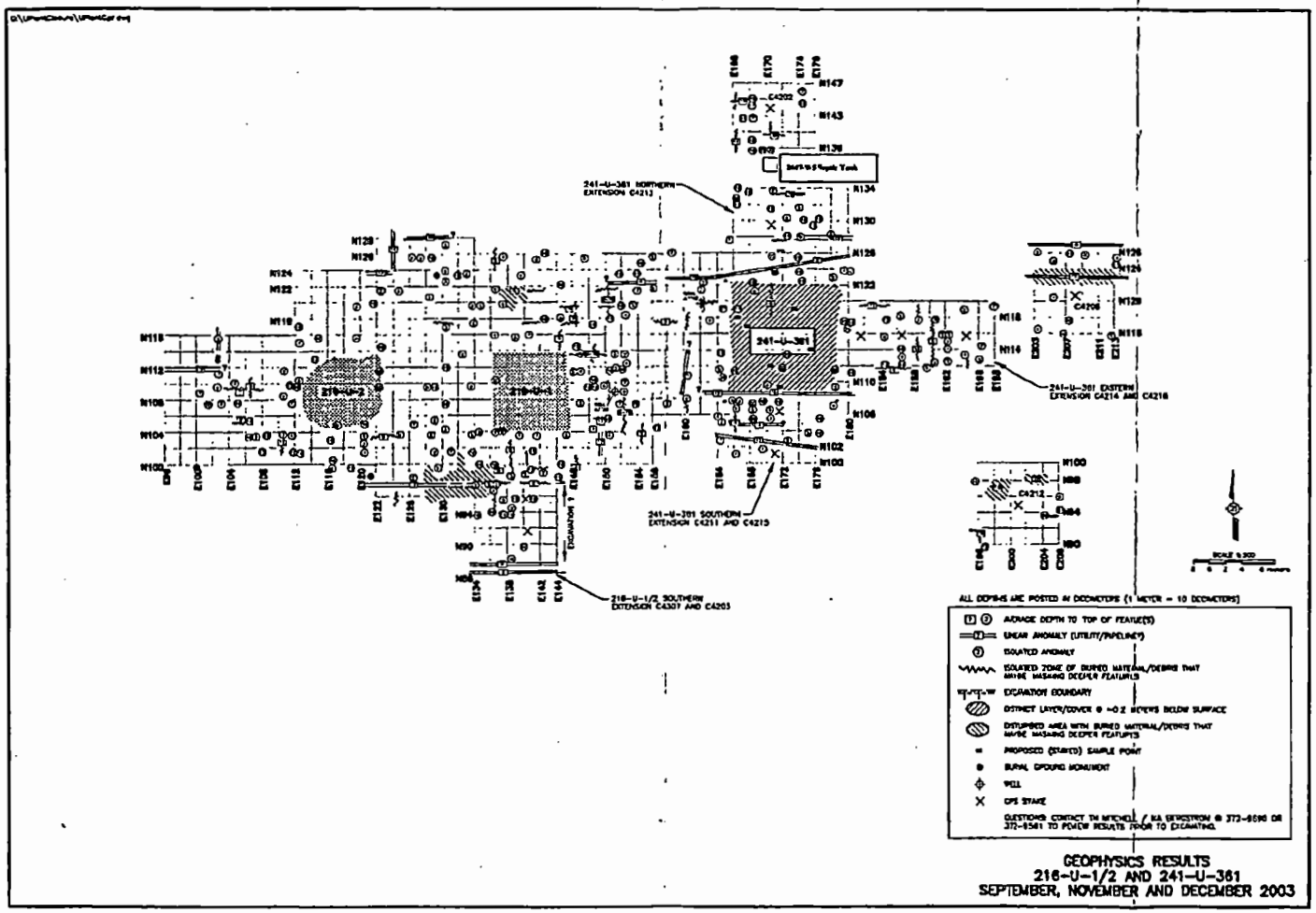
Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. Linears anomalies that were detected are most likely related to buried pipelines or utilities. The primary underground lines that fed the cribs were not detected because they were too deep. All anomalies, anomalous disturbed areas, and linears should be avoided when taking subsurface samples.

Figure 2c. 216-U-1 & 2, 241-U-361 EM-61 Contour Plot.



216-U-1&2, 241-U-361
EM-61 Metal Detector
September 2003

Figure 2d. 216-U-1 & 2, 241-U-361 Interpretation Map.



Page 89 of 185 of DA01917974

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Figure 3a. 216-U-8 Crib Geophysical Site Investigation Summary Form.

Site:	216-U-8 Crib	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 200 meters south of U plant				
Objectives:	To identify potential subsurface obstructions at direct push sampling locations. Characterize Waste site for future remediation of the crib.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M Hill, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A Entire site disturbed by activities related to the construction and/or operations of Hanford facilities.
Terrain:	Site consist of a flat top mound with steep slopes off of the mound to the west, north, and east. The mound is approximately 2 meters high. The southern side of the mound is a gentle slope.
Vegetation	None
Soil/sediments/rock type:	Gravel, cobbles and sand. Surface fill of gravel and cobbles cover the entire site.
Anticipated Bedrock:	**Depth:** NA **Type:** NA
Hydro properties*:	Moist at time of data collection.
Obstacles:**	A few vertical vents in the center of the site..
Site Limitations:	No data along slopes of the mound.
Overall assessment of site for geophysical investigations:	Good conditions for geophysical investigation

Site:	216-U-8 Crib	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Equipment

Type/Model: Ground Penetrating Radar (GPR): Geophysical Survey Systems, Inc., (GSSI) SIR-10; 200 MHz antenna

Time Domain Electromagnetics (TDEM): Geonics EM-61

Data Format: Disk ☐ Tape ☐ Hardcopy ☒

Data Collection/Processing Parameters

Survey Grid Parameters:

A 2 x 2-meter location control grid was established within approximately a 22x 56-meter area. The three sites are all tied to the location control used for the 216-U-8 site.

Data Collection Parameters:

- The GPR data were collected in the continuous mode along parallel profiles spaced 2-meters apart in both north-south and east-west directions. GPR was collected throughout the entire gridded area including the extensions.
- GPR data were collected at three additional sites in the flat area surrounding the mound.
- GPR: 108-nanosecond window was used at 50 scans per second with a 2x stack. Filters and data collection parameters were set in the field to match the local soil conditions.
- TDEM data: 4 channels, 3x time windows with differential mode. Data collected using wheel encoder (readings @0.19 meter intervals) along north-south profiles spaced 2 meters apart.
- TDEM data were collected only in the original grid. Data were not collected in the three extensions to the primary grid.

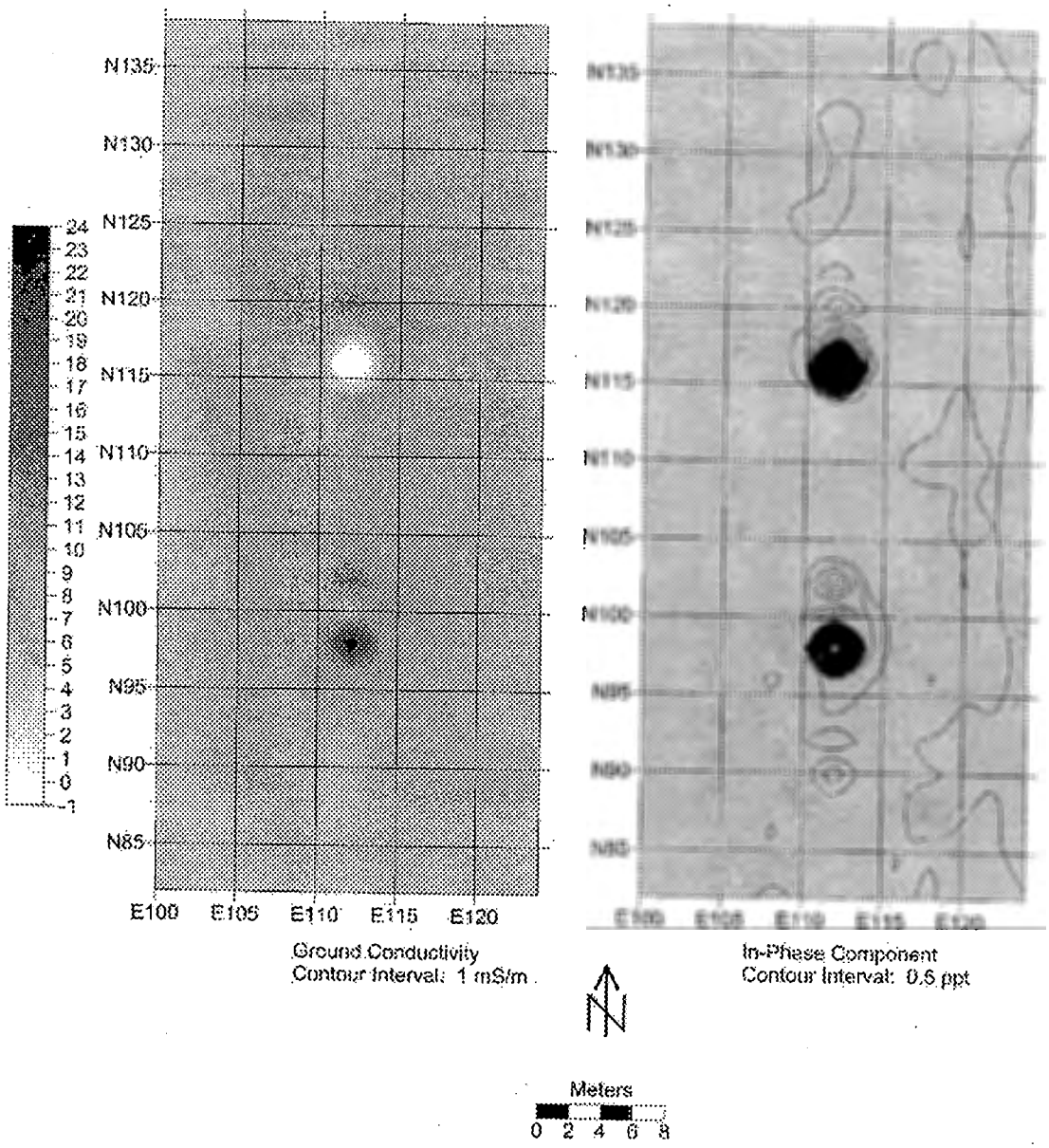
Data Processing Parameters:

- Minimal post-processing of the GPR data was performed.
- TDEM data were contoured using the nearest neighbor algorithm and Golden Software's SURFER.

Summary of Results

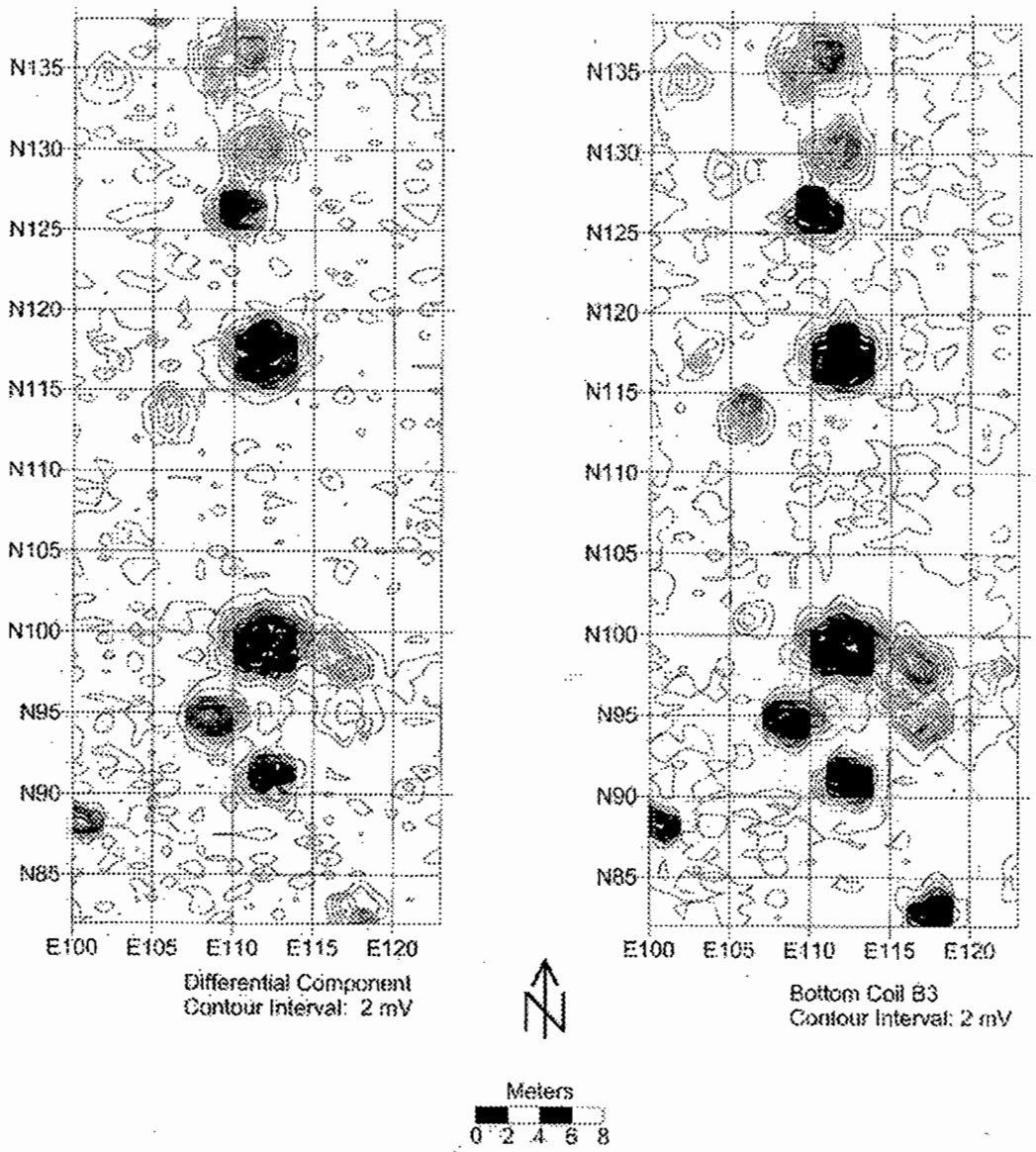
Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. No features were identified that appear to be associated with the crib or crib infrastructure. Most of the anomalies appear to be within the fill material that created the mound that covers the site. All anomalies, and anomalous disturbed areas should be avoided when taking subsurface samples.

Figure 3b. 216-U-8 Crib EM-31 Contour Plots.



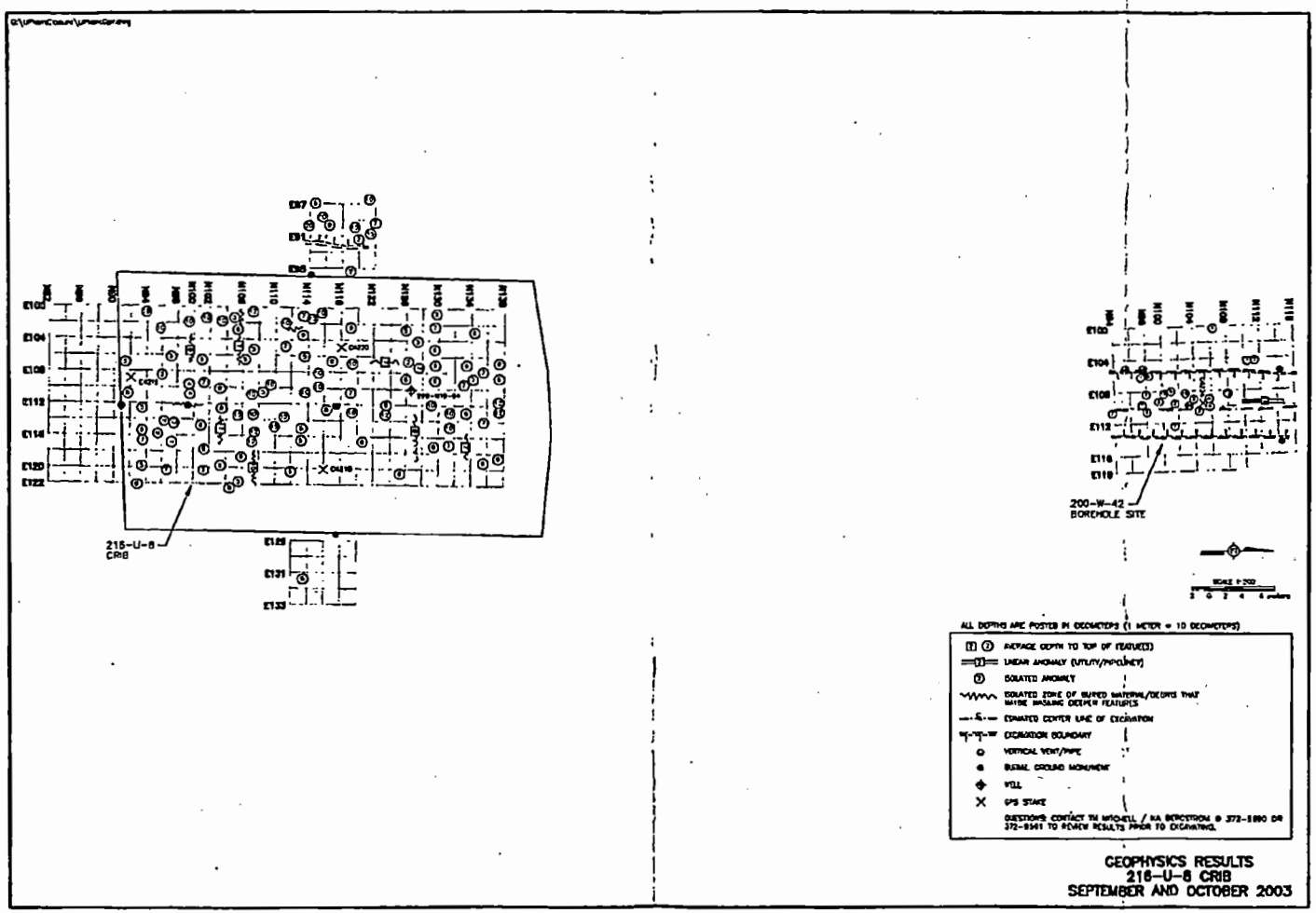
216-U-8, 200 West
Electromagnetic Induction (EM-31)
September 2003

Figure 3c. 216-U-8 Crib EM-61 Metal Detector Contour Plots.



216-U-8, 200 West
EM-61 Metal Detector
September 2003

Figure 3d. 216-U-8 Crib Interpretation Map.



Page 95 of 185 of DA01917974

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Figure 4a. 216-U-12 Geophysical Site Investigation Summary Form.

Site:	216-U-12 Crib	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 400 meters south of U plant.				
Objectives:	To identify potential subsurface obstructions at direct push sampling locations. Characterize Waste site for future remediation of the cribs.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M Hill, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A Entire site disturbed by activities related to the construction and/or operations of Hanford facilities.		
Terrain:	Flat		
Vegetation	Rabbit brush & other miscellaneous vegetation in the northern, southern, and western extensions only.		
Soil/sediments/rock type:	Gravel, cobbles and sand.		
Anticipated Bedrock:	**Depth:** NA	**Type:**	NA
Hydro properties*:	Moist at time of data collection.		
Obstacles:**	Data collection limited to area outside the construction laydown area near the eastern extension grid		
Site Limitations:	Grid extensions only- Vegetation and construction laydown area;		
Overall assessment of site for geophysical investigations:	Good conditions for geophysical investigation		

Site:	216-U-12 Crib	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Equipment

Type/Model: Ground Penetrating Radar (GPR): Geophysical Survey Systems, Inc., (GSSI) SIR-10; 200 MHz antenna

Time Domain Electromagnetics (TDEM): Geonics EM-61

Data Format: Disk ☐ Tape ☐ Hardcopy ☒

Data Collection/Processing Parameters

Survey Grid Parameters:

A 2 x 2-meter location control grid was established within approximately a 32x 58-meter area. Four extensions to the grid were made as adjustments to the sampling plan called for the investigation of sites outside of the original grid.

Eastern extension: 10 x 16 meters. Western extension: 4x12 meters. Southern extension: 4 x 14 meters. Northern extension: 4 x 40 meters.

Data Collection Parameters:

- The GPR data were collected in the continuous mode along parallel profiles spaced 2-meters apart in both north-south and east-west directions. GPR was collected throughout the entire gridded area including the extensions.
- GPR: 108-nanosecond window was used at 50 scans per second with a 2x stack. Filters and data collection parameters were set in the field to match the local soil conditions.
- TDEM data: 4 channels, 3x time windows with differential mode. Data collected using wheel encoder (readings @0.19 meter intervals) along north-south profiles spaced 2 meters apart.
- TDEM data were collected only in the original grid. Data were not collected in the extensions.

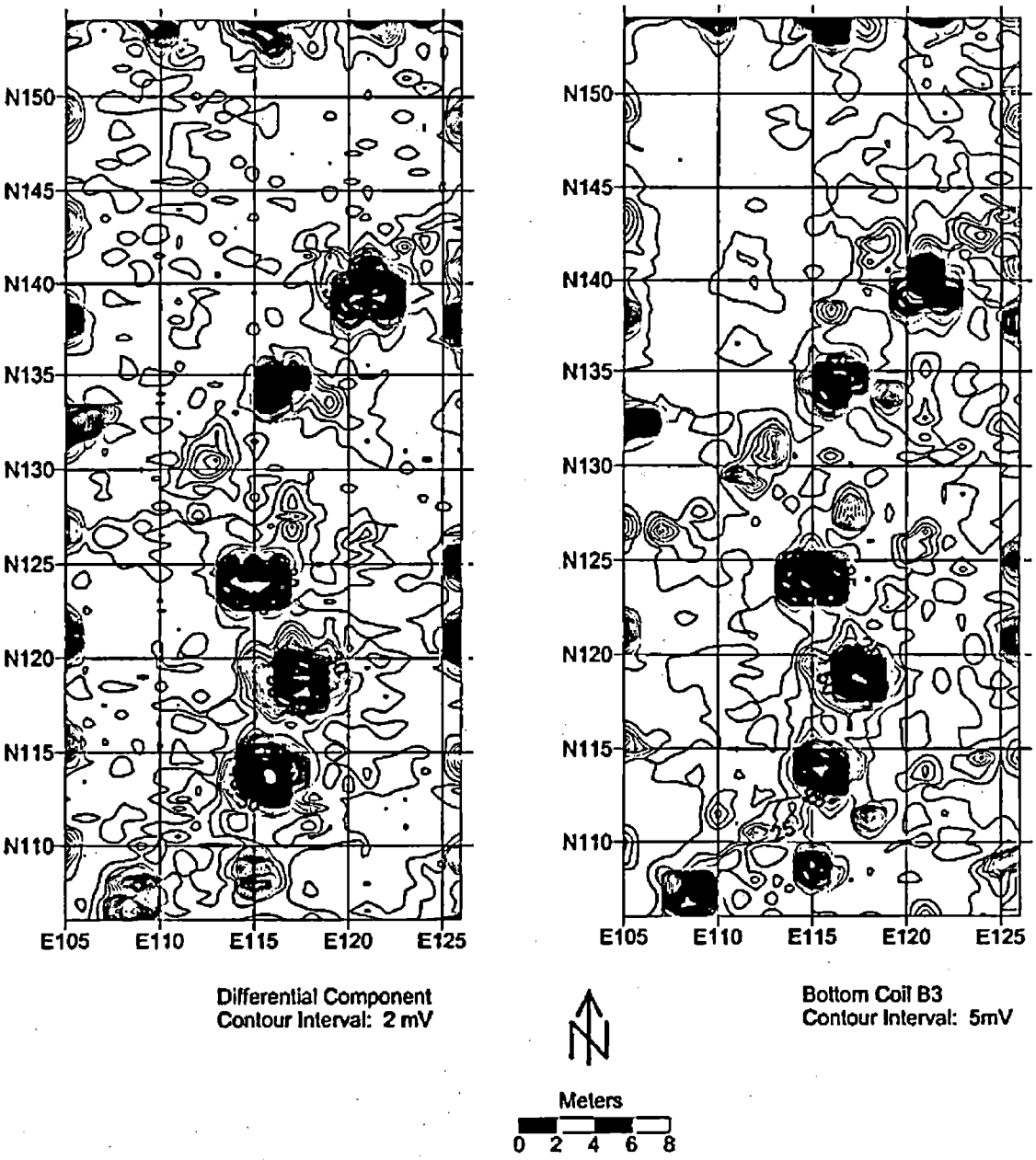
Data Processing Parameters:

- Minimal post-processing of the GPR data was performed.
- TDEM data were contoured using the nearest neighbor algorithm and Golden Software's SURFER.

Summary of Results

Numerous isolated anomalies were detected throughout the site. Several disturbed areas were also detected that may be masking deeper features of interest. The linear anomaly that was detected in the western extension is most likely related to buried pipelines or utility. The underground line that fed the crib from the north was not detected but the excavation for the pipeline was delineated and mapped.

Figure 4b. 216-U-12 EM-61 Metal Detector Contour Plots.



216-U-12, 200 West
EM-61 Metal Detector
September 2003

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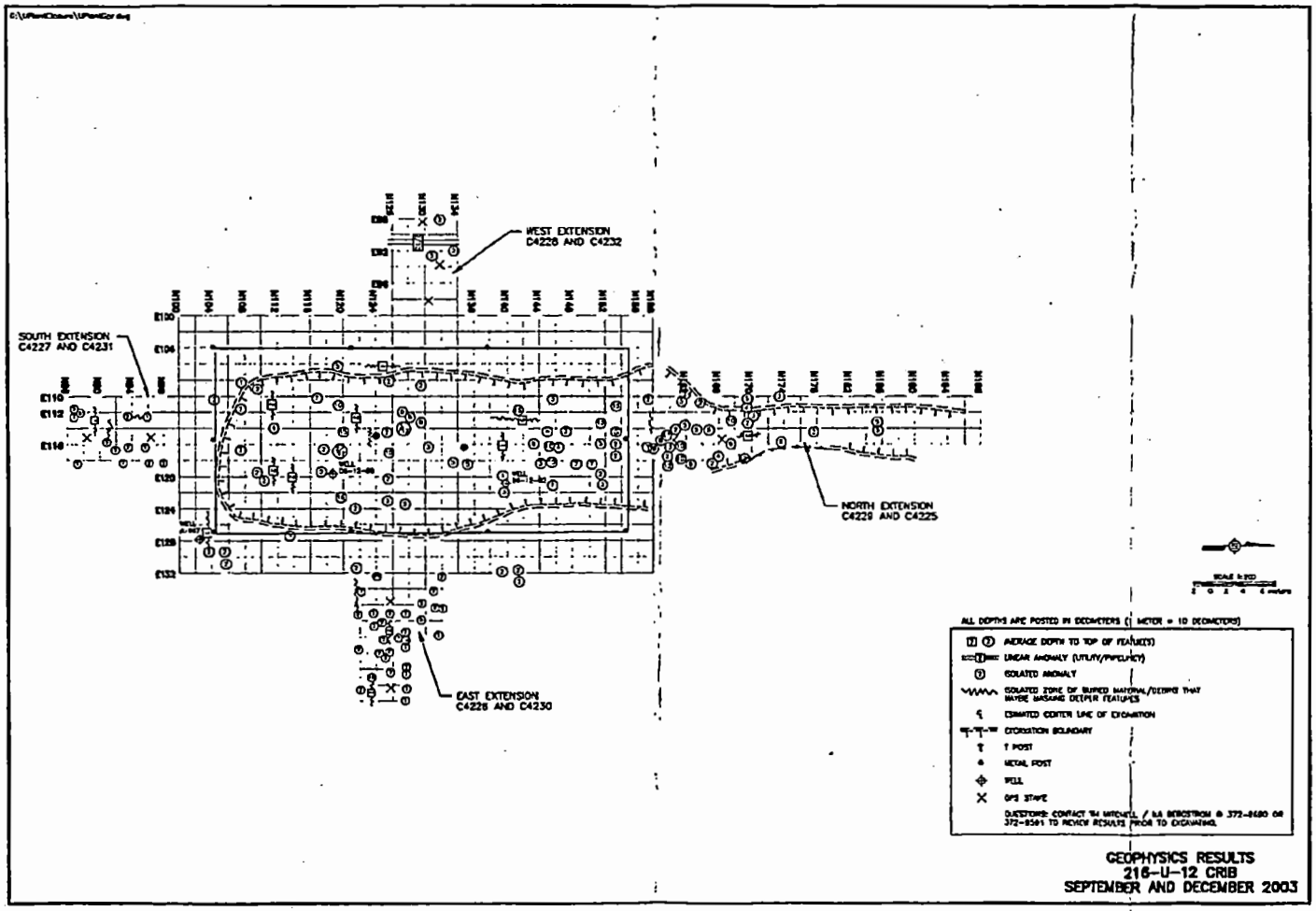
Figure 4c. 216-U-12 Interpretation Map.



Page 101 of 185 of DA01917974

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Figure 5a. 216-U-16 Crib Geophysical Site Investigation Summary Form.

Site:	216-U-16 Crib	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 300 meters southwest of U plant on the south side of 16th street.				
Objectives:	To identify potential subsurface obstructions for a borehole. The objective of the eastern extension was to only locate and map the underground pipeline that fed the crib.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M Hill, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A Entire site disturbed by activities related to the construction and/or operations of Hanford facilities.		
Terrain:	Flat		
Vegetation	None		
Soil/sediments/rock type:	Gravel, cobbles and sand.		
Anticipated Bedrock:	**Depth:** NA	**Type:** NA	
Hydro properties*:	Moist at time of data collection.		
Obstacles:**	none		
Site Limitations:	none		
Overall assessment of site for geophysical investigations:	Good conditions for geophysical investigation		

Site:	216-U-16 Crib	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Equipment

Type/Model: Ground Penetrating Radar (GPR): Geophysical Survey Systems, Inc., (GSSI) SIR-10; 200 MHz antenna

Data Format: Disk ☐ Tape ☐ Hardcopy ☒

Data Collection/Processing Parameters

Survey Grid Parameters:

A 2 x 2-meter location control grid was established within approximately a 10x 12-meter area. The grid was extended to the east 52 meters.

Data Collection Parameters:

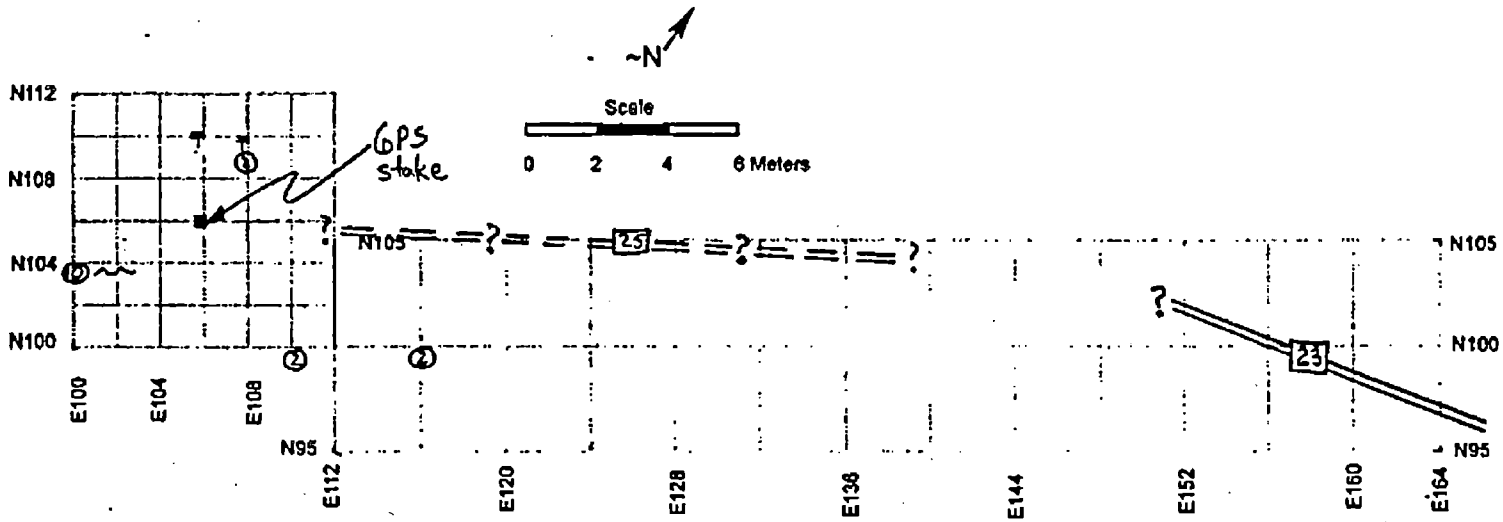
- The GPR data were collected in the continuous mode along parallel profiles spaced 2-meters apart in both north-south and east-west directions in the primary 10 x 12 meter grim. GPR was only collected along north-south profiles spaced 2 meters apart in the eastern extension.
- GPR: 108-nanosecond window was used at 50 scans per second with a 2x stack. Filters and data collection parameters were set in the field to match the local soil conditions.

Data Processing Parameters:

Minimal post-processing of the GPR data was performed.

Summary of Results

Only a few isolated anomalies were detected. No notable features were detected that might be related to the crib The linear anomaly that was detected in the eastern extension is suspected as being the pipe line that fed the crib however it was a very subtle feature thus was not conclusive.



All depths are posted in decimeters
(1 Meter = 10 decimeters)

- Average depth to top of feature(s)
- Linear anomaly (Utility/pipeline?)
- Isolated Anomaly
- Isolated zone of buried material/debris that maybe masking deeper features

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

Geophysics Results
216-U-16 Crib
September 2003

Figure 5b. 216-U-16 Crib Interpretation Map.

Figure 6a. 216-U-17 Crib Geophysical Site Investigation Summary Form.

Site:	216-U-17 Crib	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 300 meters southeast of U plant on the south east corner of 16th and Beloit street.				
Objectives:	To identify potential subsurface obstructions for a borehole.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M Hill, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A Entire site disturbed by activities related to the construction and/or operations of Hanford facilities.
Terrain:	Flat
Vegetation	None
Soil/sediments/rock type:	Gravel, cobbles and sand.
Anticipated Bedrock:	**Depth:** NA **Type:** NA
Hydro properties*:	Moist at time of data collection.
Obstacles:**	none
Site Limitations:	none
Overall assessment of site for geophysical investigations:	Good conditions for geophysical investigation

Site:	216-U-17 Crib	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Equipment

Type/Model: Ground Penetrating Radar (GPR): Geophysical Survey Systems, Inc., (GSSI) SIR-10; 200 MHz antenna

Data Format: Disk ☐ Tape ☐ Hardcopy ☒

Data Collection/Processing Parameters

Survey Grid Parameters:

A 2 x 2-meter location control grid was established within approximately a 12x 34-meter area.

Data Collection Parameters:

- The GPR data were collected in the continuous mode along parallel profiles spaced 2-meters apart in both north-south and east-west directions.
- GPR: 108-nanosecond window was used at 50 scans per second with a 2x stack. Filters and data collection parameters were set in the field to match the local soil conditions.

Data Processing Parameters:

Minimal post-processing of the GPR data was performed.

Summary of Results

Only a few isolated anomalies were detected but most were outside or the crib. The southern and northern excavation boundary for the crib was detected but not the eastern and western edges (the grid did not extend far enough to the east or west). The anomalies should be avoided when finalizing the location for the borehole.

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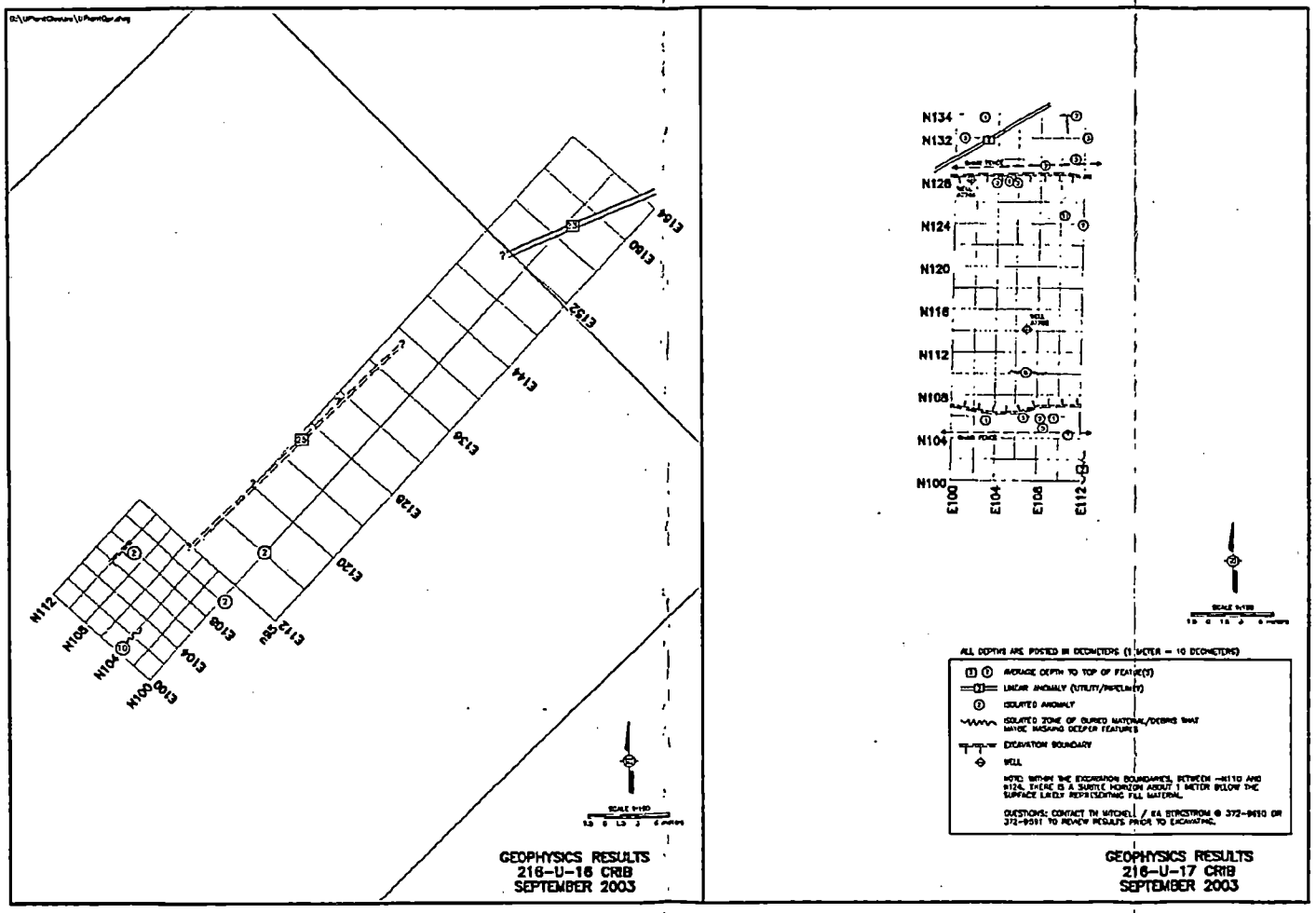
Figure 6b. 216-U-17 Crib Interpretation Map.



Page 109 of 185 of DA01917974

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Figure 7a. 200-W-8 Geophysical Site Investigation Summary Form.

Site:	200-W-8	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 200 meters east of U plant on the northeastern corner of 16th and Beloit Street..				
Objectives:	To identify potential subsurface obstructions at assist in locating the optimum place for a test pit. Characterize the waste site for future remediation efforts.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M Hill, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A, the entire site is disturbed by activities related to the construction and/or operations of Hanford facilities.		
Terrain:	Flat		
Vegetation	None		
Soil/sediments/rock type:	Gravel, cobbles and sand..		
Anticipated Bedrock:	**Depth:** NA	**Type:**	NA
Hydro properties*:	Surface dry at time of data collection.		
Obstacles:**	None		
Site Limitations:	None		
Overall assessment of site for geophysical investigations:	Good conditions for geophysical investigation		

Equipment

Site:	200-W-8	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Type/Model: Magnetometer: Geometrics G858-G Cesium Vapor Magnetometer

Frequency Domain Electromagnetics (EMI): Geonics EM-31

Data Format: Disk ☐ Tape ☐ Hardcopy ☒

Data Collection/Processing Parameters

Survey Grid Parameters:

A 30 x 30-meter location control grid was established using GPS over a 210x 300-meter area. Between each GPS located node, grid flags and/or stakes were used to establish east-west profiles with flags or stakes every 6 meters. The result was east-west rows of flags/stakes, every 30 meters across the entire site. Location control between flagged/staked profiles was estimated by walking pace and by projecting the most direct route between flagged/staked rows. Thus locations between the flagged/staked baselines are only approximate locations.

Data Collection Parameters:

- Magnetic gradiometer data were collected but only the top sensor total field data were used due to failure of the bottom sensor. Data were collected along north-south profiles, spaced 2 meters apart, with readings every 0.5 seconds (~0.5 meters).
- EM-31 data: 2 components, quadrature and in-phase. Data collected along N-S profiles spaced 2 meters apart. Data recordings along each profile were spaced 2 meters apart.

Data Processing Parameters:

- Magnetic and EMI data were contoured using the nearest neighbor algorithm and Golden Software's SURFER, Version 7.

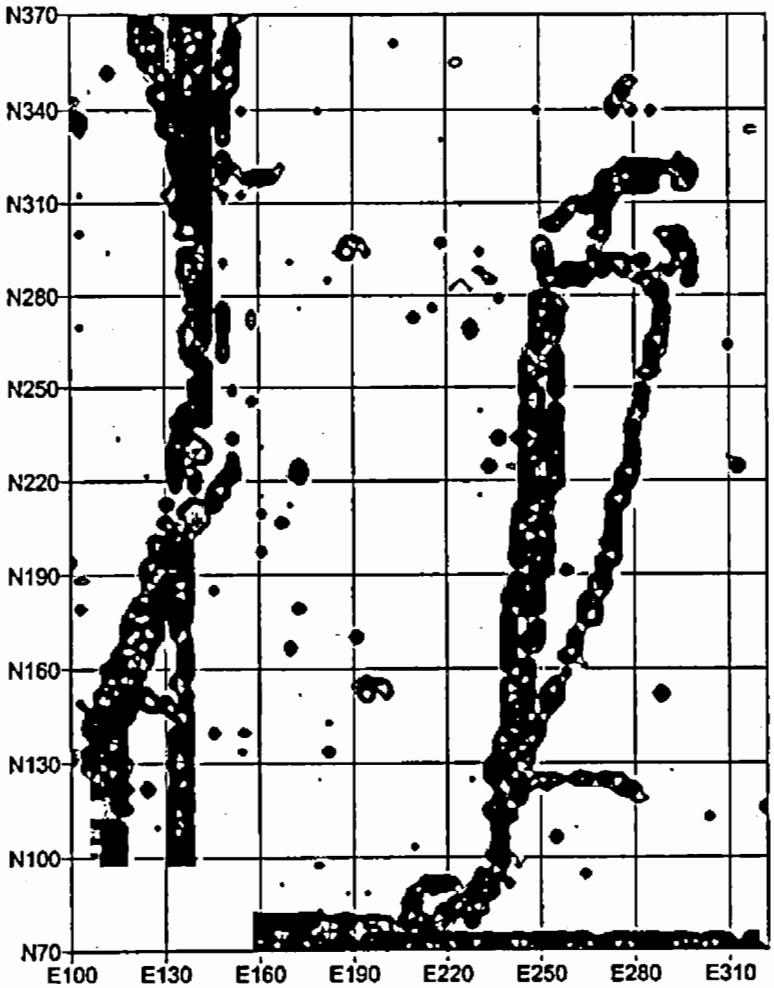
Summary of Results

Several concentrations of anomalies (zones) were detected indicating that there are previously unknown buried debris features/debris within the study area. Most of these anomalous zones are in the eastern half of the site and were only detected with the magnetometer. The linear pattern of the anomalies suggests that the features /debris was intentionally concentrated and not just the typical random scattered debris that is found throughout much of the Hanford site. It is not clear whether these anomalous features are related to the 200-W-8 Waste Site.

There were several linear features that were detected that have the character of a buried pipelines/utility. They are predominately north-south trending and were detected in the western half of the site. There was an east-west trending linear EMI anomaly that crosses the northern half of the site that has the character of a pipeline (non ferrous).

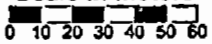
The rest of the anomalies are very scattered across the site. Due to the spacing between the geophysical profiles, it is anticipated that there are additional scattered isolated features that were missed.

Figure 7b. 200-W-8 Magnetic Gradient Contour Plot.



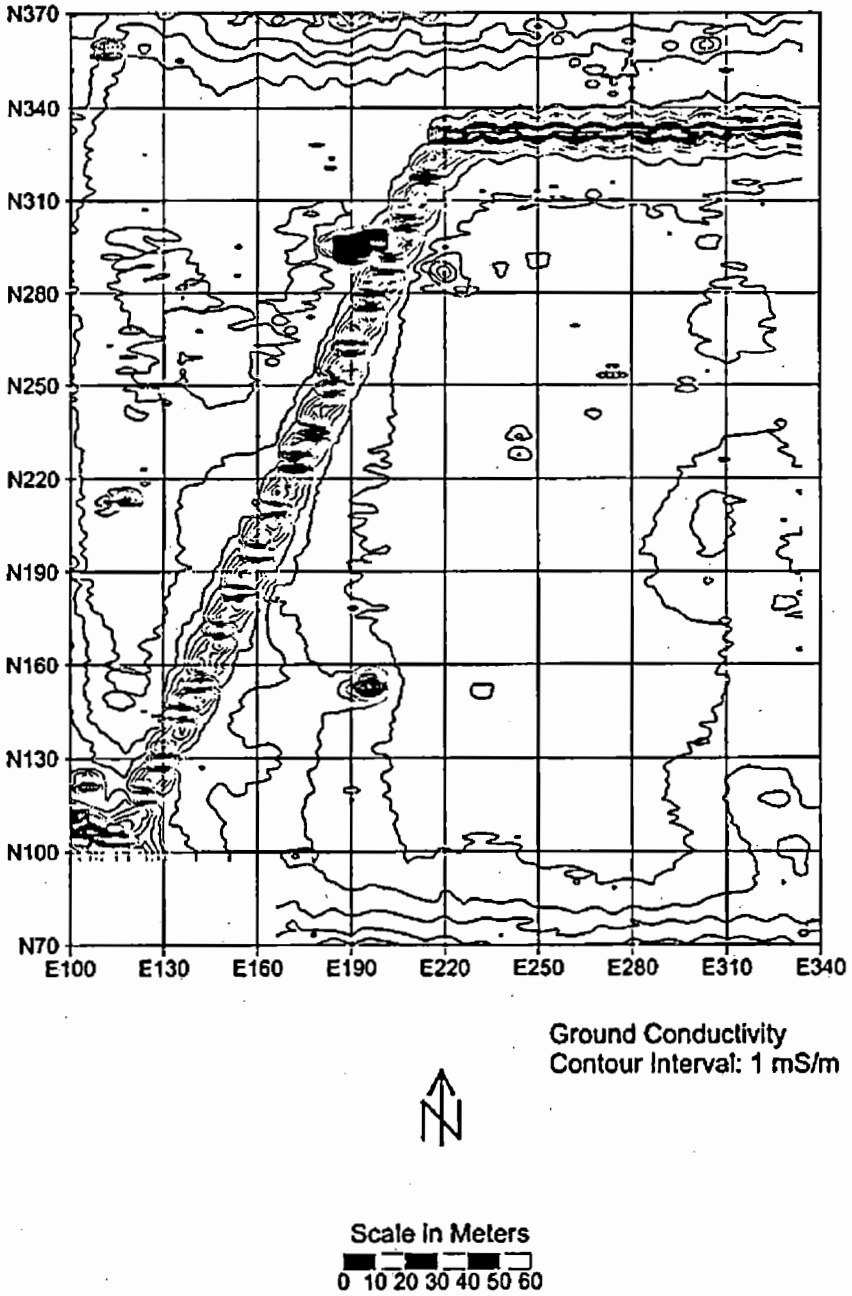
Magnetic Field Vertical Gradient
Plotted Range 100 to 5000 Gamma
Contour Interval: 20 gamma

Scale in Meters



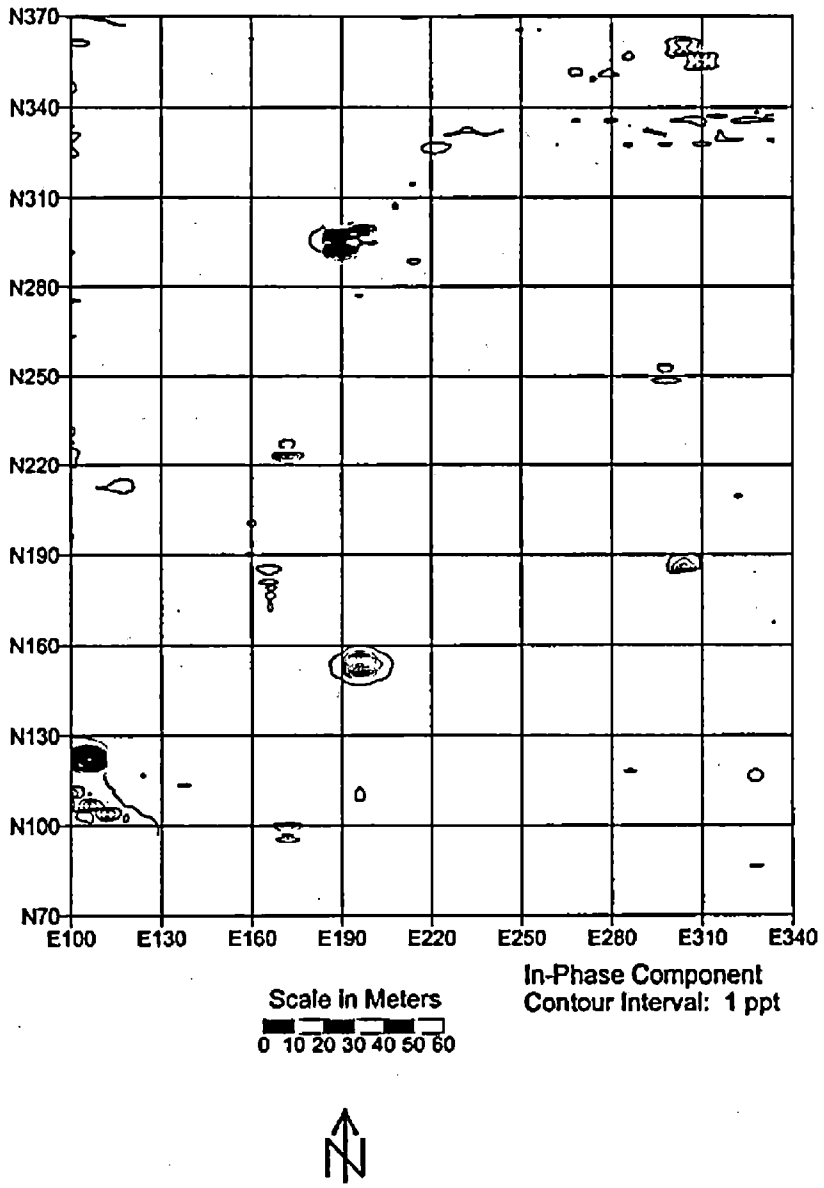
200-W-8, 200 West Area
Magnetic Gradient
December 2003

Figure 7c. 200-W-8 EM-31 Ground Conductivity Contour Plot.



200-W-8, 200 West
Electromagnetic Induction (EM-31)
Ground Conductivity
December 2003

Figure 7d. 200-W-8 EM-31 In-Phase Contour Plot.



200-W-8, 200 West
Electromagnetic Induction (EM-31)
In-Phase Component
December 2003

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Figure 7e. 200-W-8 Interpretation Map.

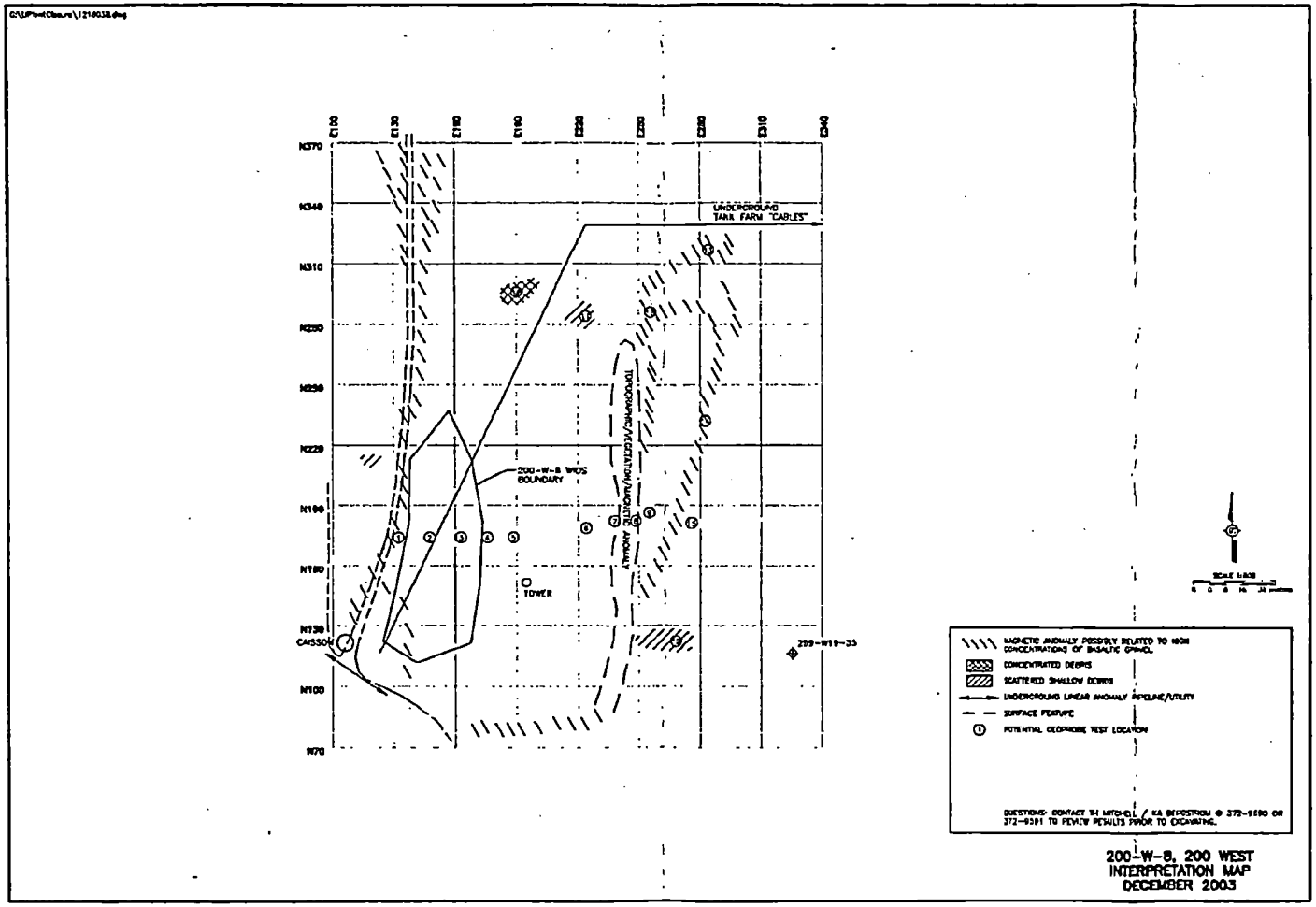

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Figure 8a. 216-W-42 Pipeline Geophysical Site Investigation Summary Form.

Site:	216-W-42 Pipeline	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 300 meters south of U plant.				
Objectives:	To identify potential subsurface obstructions at direct push sampling locations.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M Hill, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A Entire site disturbed by activities related to the construction and/or operations of Hanford facilities.
Terrain:	Approximately 0.5 meter berm, with a flat top, runs down the center of the site. The berm is fill material over the top of the buried pipeline.
Vegetation	None
Soil/sediments/rock type:	Gravel, cobbles and sand.
Anticipated Bedrock:	**Depth:** NA **Type:** NA
Hydro properties*:	Moist at time of data collection.
Obstacles:**	None
Site Limitations:	None
Overall assessment of site for geophysical investigations:	Good conditions for geophysical investigation

Site:	216-W-42 Pipeline	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Equipment

Type/Model: Ground Penetrating Radar (GPR): Geophysical Survey Systems, Inc., (GSSI) SIR-10; 200 MHz antenna

Data Format: Disk ☐ Tape ☐ Hardcopy ☒

Data Collection/Processing Parameters

Survey Grid Parameters:

A 2 x 2-meter location control grid was established within approximately a 16 x 18-meter area.

Data Collection Parameters:

- The GPR data were collected in the continuous mode along parallel profiles spaced 2-meters apart in both north-south and east-west directions. GPR was collected throughout the entire gridded area.
- GPR: 108-nanosecond window was used at 50 scans per second with a 2x stack. Filters and data collection parameters were set in the field to match the local soil conditions.

Data Processing Parameters:

- Minimal post-processing of the GPR data was performed.

Summary of Results

The excavation boundaries for the pipeline were detected and mapped. Within the excavation boundary, numerous GPR anomalies were detected. All anomalies should be avoided when selecting the final sample(s) point. The center of the excavation should also be avoided to reduce the potential for hitting the pipeline when sampling.

Figure 9a. 200-W-56 Geophysical Site Investigation Summary Form.

Site:	200-W-56	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 200 meters northeast of U plant on the west side Beloit Street.				
Objectives:	Characterize the waste site for future remediation efforts.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M Hill, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A, the entire site is disturbed by activities related to the construction and/or operations of Hanford facilities.		
Terrain:	Flat		
Vegetation	Rabbit brush and other miscellaneous scrub brush.		
Soil/sediments/rock type:	Gravel, cobbles and sand..		
Anticipated Bedrock:	**Depth:** NA	**Type:**	NA
Hydro properties*:	Surface dry at time of data collection.		
Obstacles:**	Pile of miscellaneous debris that defines the site		
Site Limitations:	Can't "see" geophysically below the surface debris		
Overall assessment of site for geophysical investigations:	Good conditions for hand carried geophysical tools.		

Site:	200-W-56	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Equipment

Type/Model: Magnetometer: Geometrics G858-G Cesium Vapor Magnetometer

Frequency Domain Electromagnetics (EMI): Geonics EM-31

Data Format: Disk ☐ Tape ☐ Hardcopy ☒

Data Collection/Processing Parameters

Survey Grid Parameters:

A 30 x 30-meter location control grid was established using GPS over a 30x 60-meter area. Between each GPS located node, grid flags and/or stakes were used to establish east-west profiles with flags or stakes every 6 meters. The result was east-west rows of flags/stakes, every 30 meters across the entire site. Location control between flagged/staked profiles was estimated by walking pace and by projecting the most direct route between flagged/staked rows. Thus locations between the flagged/staked baselines are only approximate locations.

Data Collection Parameters:

- Magnetic gradiometer data were collected but only the top sensor total field data were used due to failure of the bottom sensor. Data were collected along north-south profiles, spaced 2 meters apart, with readings every 0.5 seconds (~0.5 meters).
- EM-31 data: 2 components, quadrature and in-phase. Data collected along N-S profiles spaced 2 meters apart. Data recordings along each profile were spaced 2 meters apart.

Data Processing Parameters:

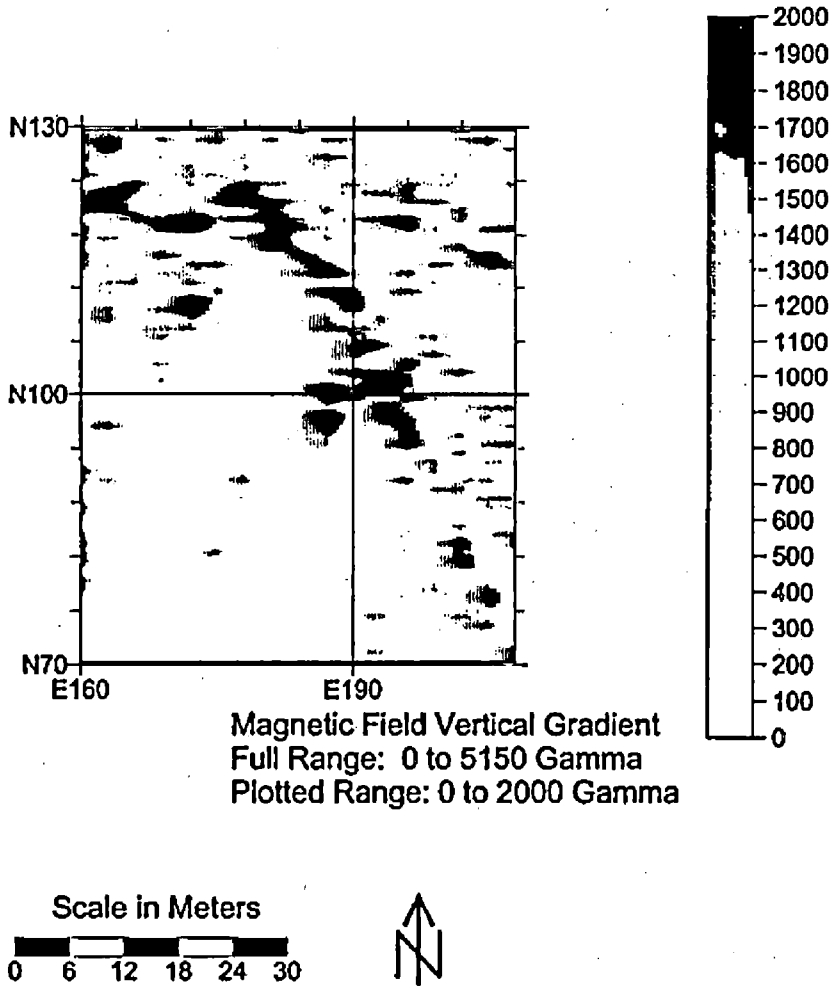
- Magnetic and EMI data were contoured using the nearest neighbor algorithm and Golden Software's SURFER, Version 7.

Summary of Results

There are an abundance of magnetic anomalies throughout the northern and eastern portion of the site that have no corresponding EMI anomalies and appear to extend beyond the boundaries of the survey. The primary EMI anomalies are in the southwestern corner of the site and have no corresponding magnetic anomalies. It is not clear what is causing the magnetic anomalies but due to the lack of EMI anomalies it appears the anomalies are predominately soil related.

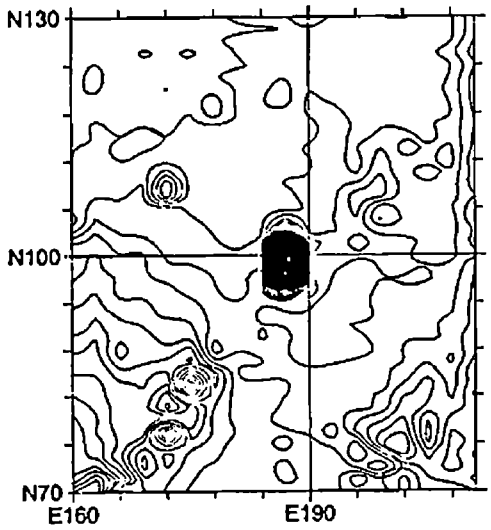
The anomalous signature off of the debris pile do not appear to extend beyond the debris pile.

Figure 9b. 200-W-56 Magnetic Gradient Contour Plot.

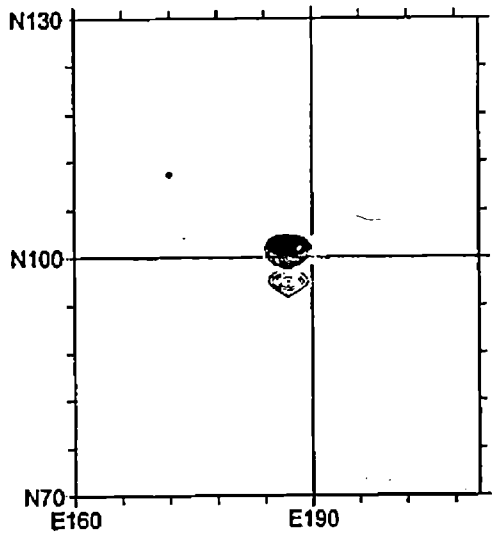


200-W-56, 200 West
Vertical Magnetic Gradient
November 2003

Figure 9c. 200-W-56 EM-31 Contour Plots.



Ground Conductivity
Contour Interval: 0.5 mS/m



In-Phase Component
Contour Interval: 1 ppt

Scale in Meters

0 6 12 18 24 30

N

200-W-56, 200 West
Electromagnetic Induction (EM-31)
November 2003

Figure 9d. 200-W-56 Interpretation Map.

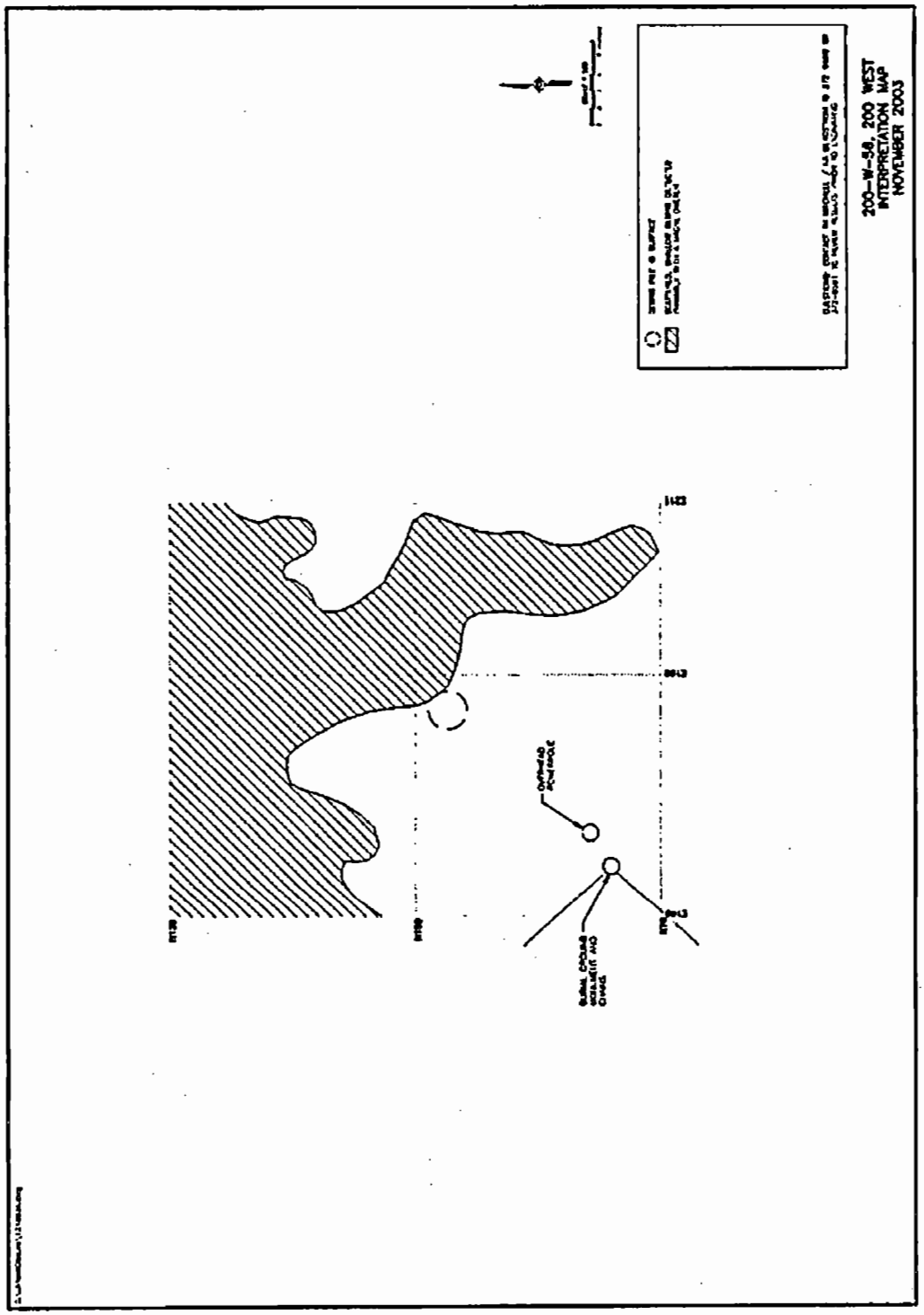


Figure 10a. 200-W-71 Geophysical Site Investigation Summary Form.

Site:	200-W-71	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		
Location:	Approximately 400 meters southeast of U plant on the south side of 16th street..				
Objectives:	Optimize the location of a test pit. Characterize the waste site for future remediation efforts.				

Investigators

Name:	Tom Mitchell	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9690	**E-Mail**	thmitche@bhi-erc.com
Name:	Kevin Bergstrom	**Company**	CH2M Hill Hanford, Inc
Phone:	509-372-9591	**E-Mail**	kabergst@bhi-erc.com
Name:	Bill Hudson	**Company**	CH2M Hill, Inc
Phone:	509-375-3444 x210	**E-Mail**	bhudson1@ch2m.com

Site Description

Cultural Resource Setting:	N/A, the entire site is disturbed by activities related to the construction and/or operations of Hanford facilities.		
Terrain:	Flat		
Vegetation	Rabbit brush, Russian Thistle, and other miscellaneous scrub brush. Very thick in some areas..		
Soil/sediments/rock type:	Gravel, cobbles and sand..		
Anticipated Bedrock:	**Depth:** NA	**Type:**	NA
Hydro properties*:	Surface dry at time of data collection.		
Obstacles:**	None		
Site Limitations:	None		
Overall assessment of site for geophysical Investigations:	Good conditions for hand carried geophysical tools.		

Site:	200-W-71	**Document Number:**	CH2MHILL Memo	**Date:**	Dec. 2003
Sponsor/Contact:	Rich Mahood, George Kelty, Flour Daniel	**Phone:**	373-4443, 373-4458		

Equipment

Type/Model: Magnetometer: Geometrics G858-G Cesium Vapor Magnetometer

Frequency Domain Electromagnetics (EMI): Geonics EM-31

Time Domain Electromagnetics (TDEM): Geonics EM-61

Data Format: Disk ☐ Tape ☐ Hardcopy ☒

Data Collection/Processing Parameters

Survey Grid Parameters:

A 30 x 30-meter location control grid was established using GPS over a 140x 140-meter area. Between each GPS located node, grid flags and/or stakes were used to establish east-west profiles with flags or stakes every 6 meters. The result was east-west rows of flags/stakes, every 30 meters across the entire site. Location control between flagged/staked profiles was estimated by walking pace and by projecting the most direct route between flagged/staked rows. Thus locations between the flagged/staked baselines are only approximate locations. Later extended grid in northwest corner an additional 30 x 60m.

Data Collection Parameters:

- Magnetic gradiometer data were collected but only the top sensor total field data were used due to failure of the bottom sensor. Data were collected along north-south profiles, spaced 2 meters apart, with readings every 0.5 seconds (~0.5 meters).
- EM-61 data: 4 channels, 3x time windows with differential mode. Data collected using wheel encoder (readings @ 0.19 meter intervals) along north-south profiles spaced 2 meters apart.
- EM-61 was to only use in the expanded 30 x 60 meter area. It was to only data collected in that area.
- EM-31 data: 2 components, quadrature and in-phase. Data collected along N-S profiles spaced 2 meters apart. Data recordings along each profile were spaced 2 meters apart.

Data Processing Parameters:

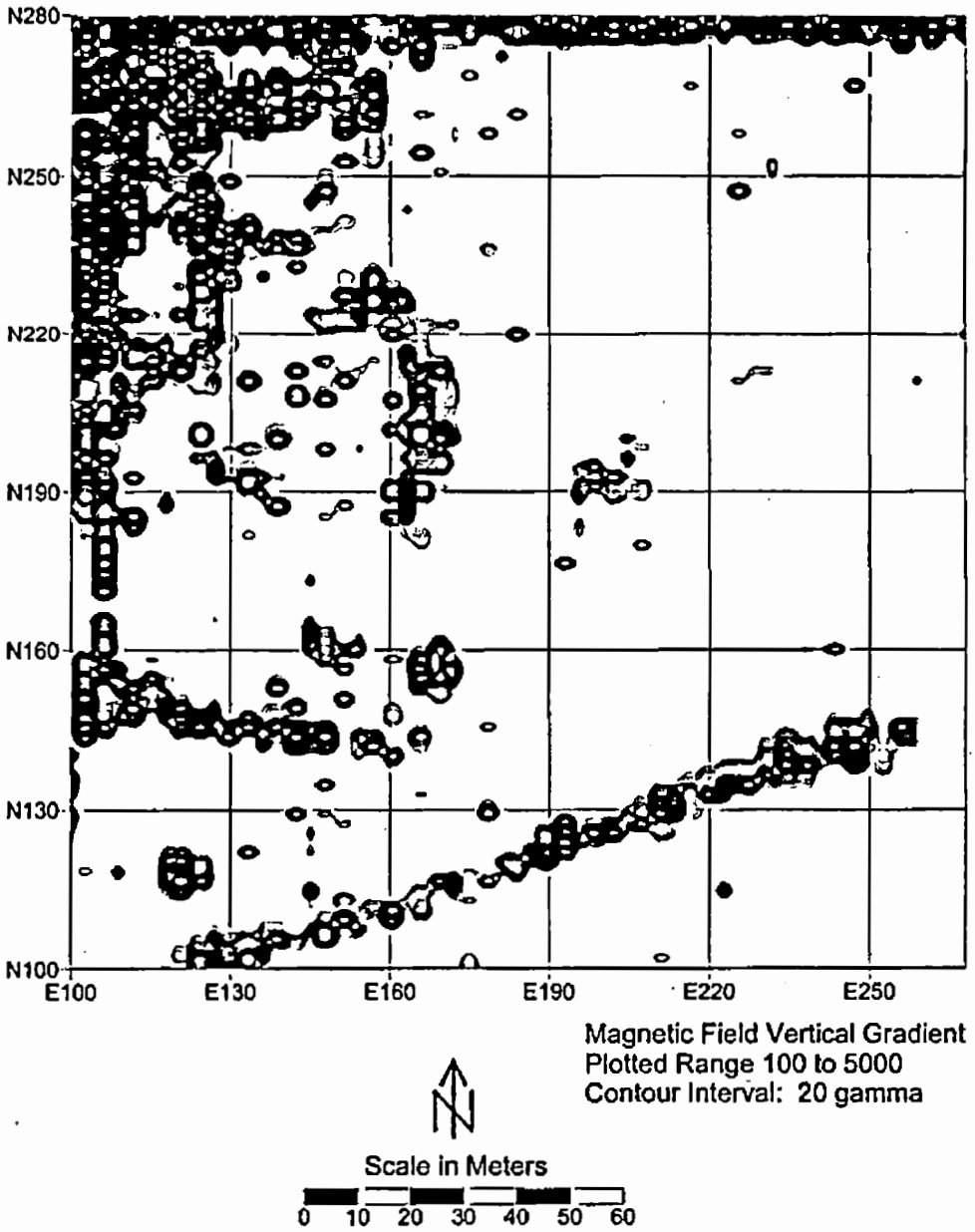
- Magnetic, TDEM, and EMI data were contoured using the nearest neighbor algorithm and Golden Software's SURFER, Version 7.

Summary of Results

Two depressions in the vicinity of N200/E165 are in the middle of an anomalous magnetic and EMI zone that extends between roughly N184 to N230. The depressions are in also in a zone with scattered surface debris. This area is apparently within the 200-W-71 trench/burial ground. The abundance of anomalous magnetic features in the northwest corner appears primarily to correlate with changes within the soil (due to the lack of corresponding anomalies in the EMI and/or TDEM data).

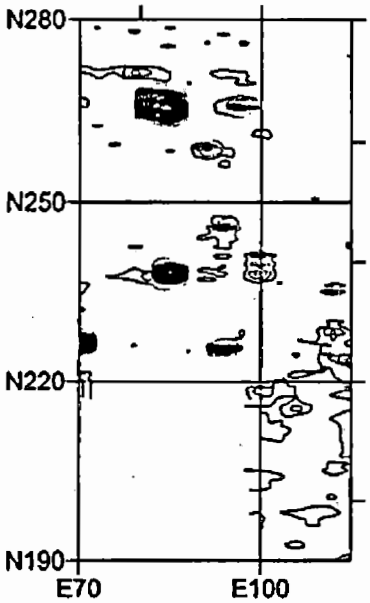
A notable east-west linear that crosses the southern portion of the site correlates with the documented pipeline that is marked on the surface. The east-west linear along the northern edge most likely is a buried utility that parallels the paved road.

Figure 10b. 200-W-71 Magnetic Gradient Contour Plot.

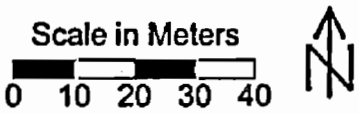


200-W-71, 200 West
Magnetic Gradient
November 2003

Figure 10c. 200-W-71 EM-61 Metal Detector Contour Plots.

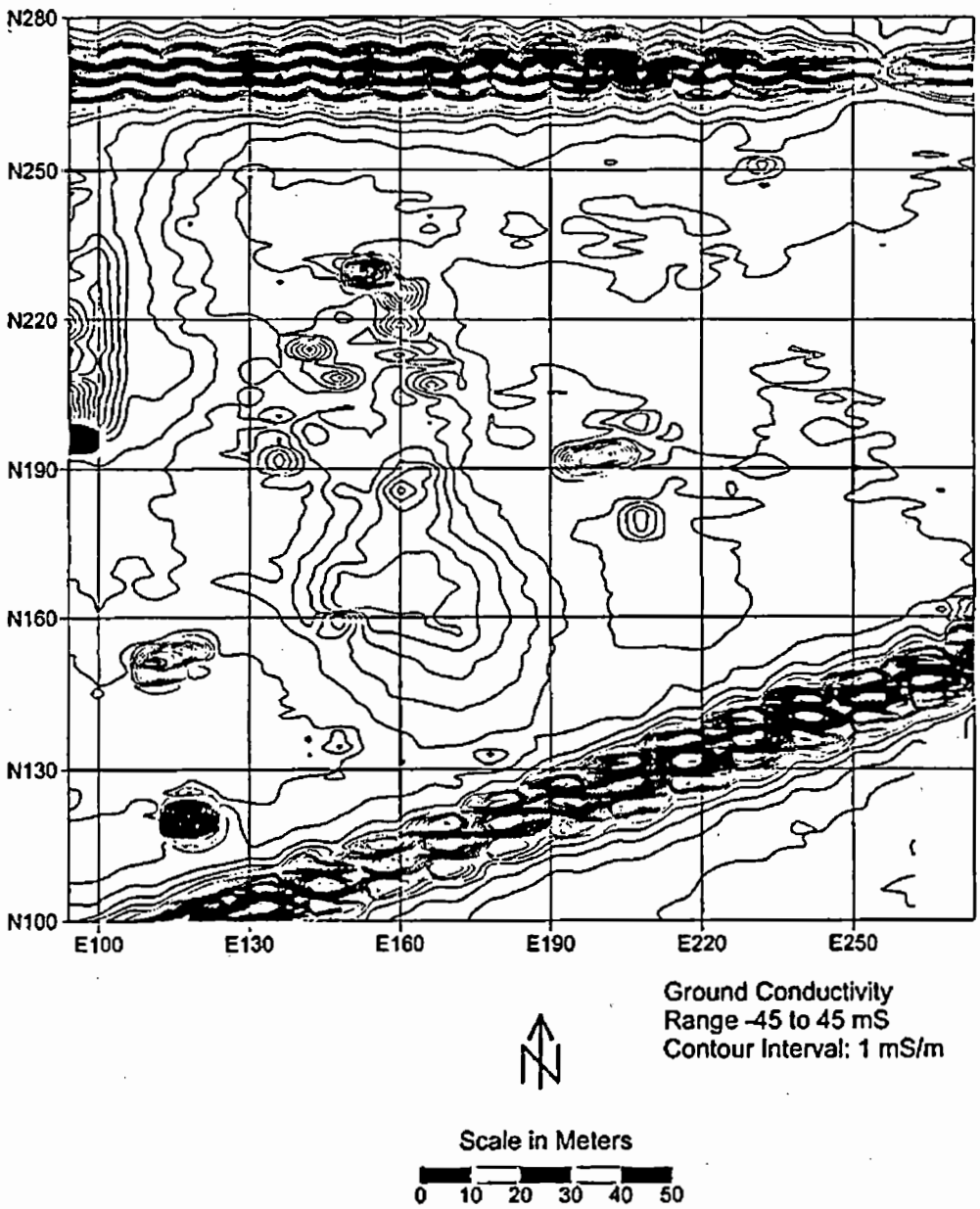


Differential Component
Plotted Range: -700 to 500
Contour Interval: 10 mV



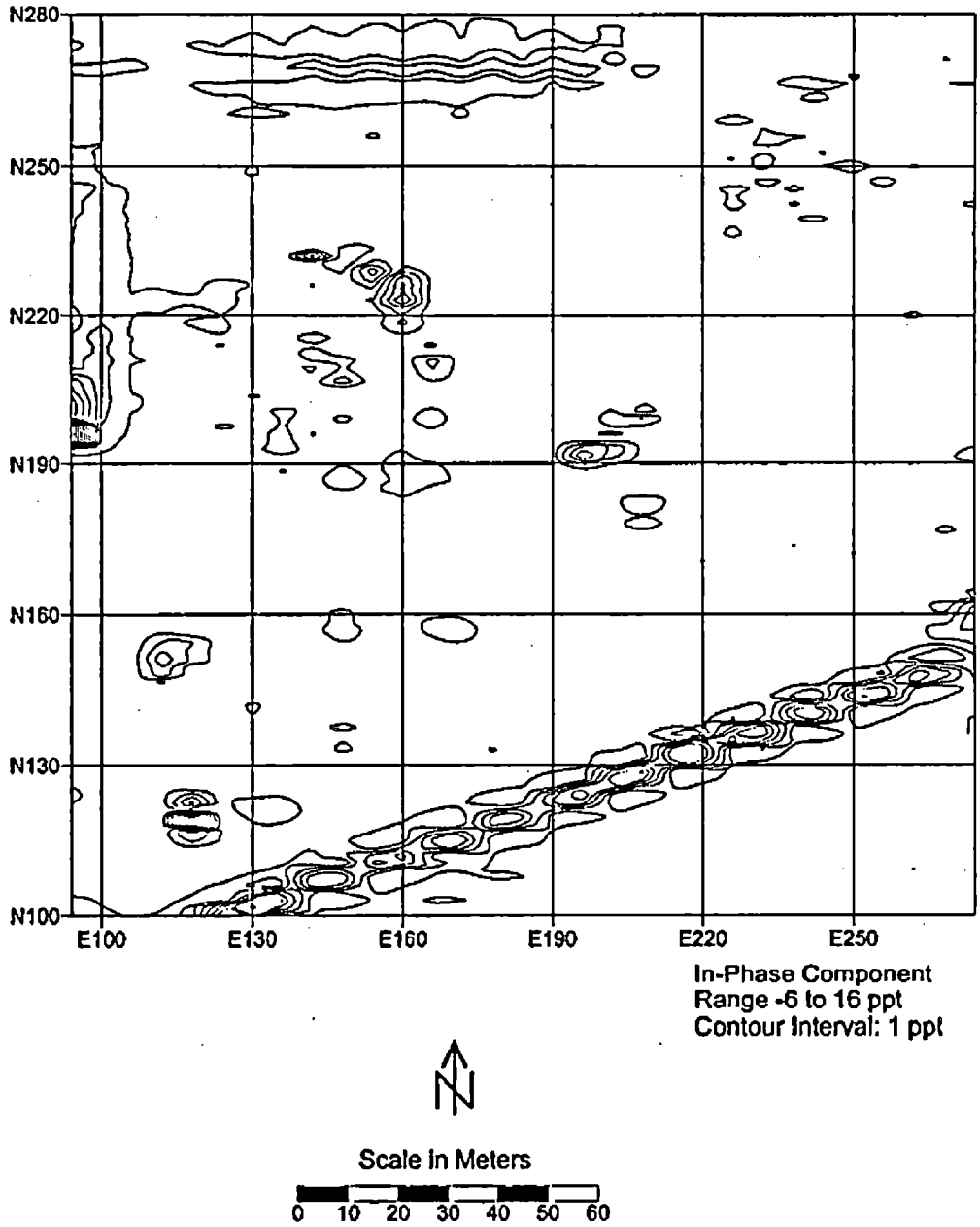
200-W-71, 200 West
EM-61 Metal Detector
December 2003

Figure 10d. 200-W-71 EM-31 Ground Conductivity Contour Plot.



200-W-71, 200 West
Electromagnetic Induction (EM-31)
Ground Conductivity
November 2003

Figure 10e. 200-W-71 EM-31 In-Phase Contour Plot.



200-W-71, 200 West
Electromagnetic Induction (EM-31)
In-Phase Component
November 2003

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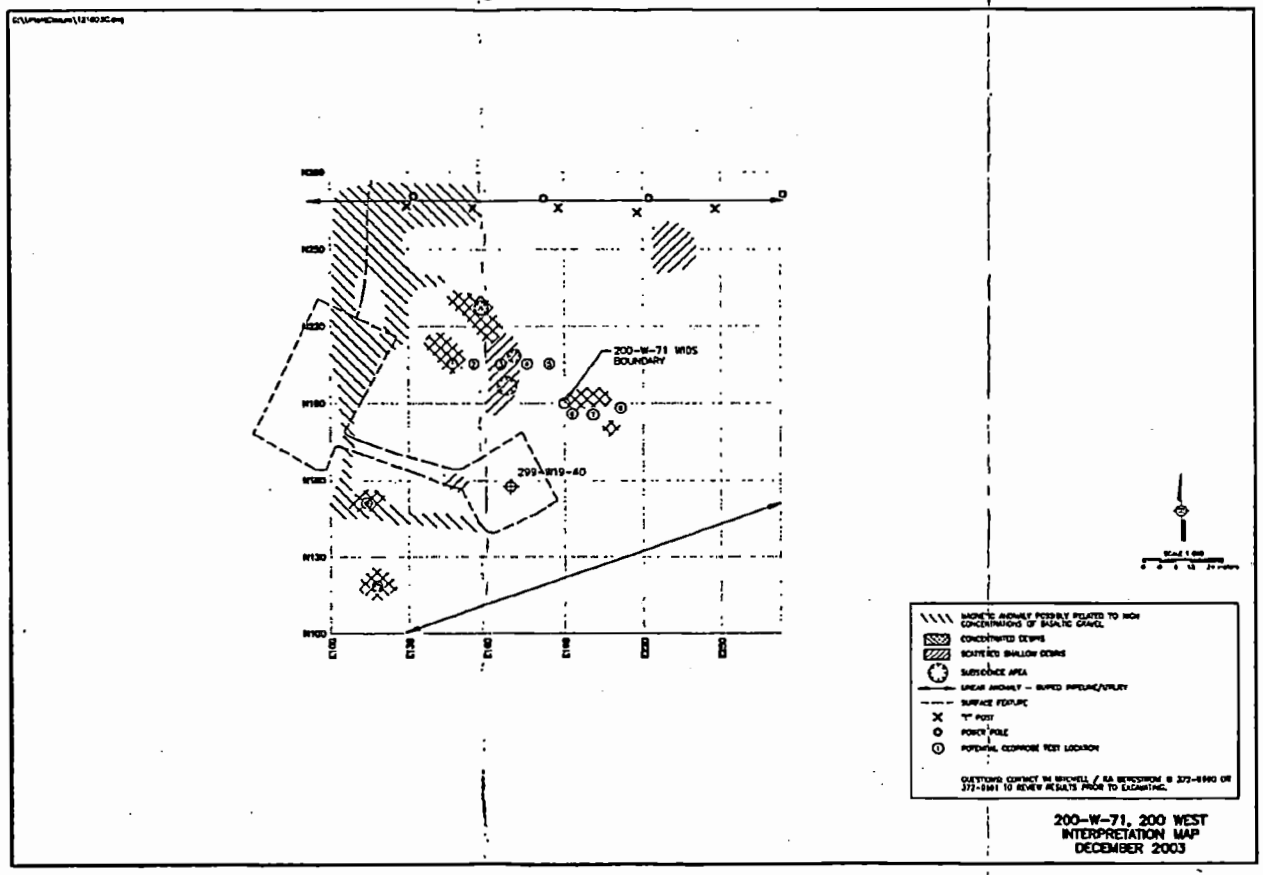
Figure 10f. 200-W-71 Interpretation



Map.

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APPENDIX C

WASTE MANAGEMENT SUMMARY

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Table C-1 presents a list of waste containers generated during the DPT pushes and auger holes.

Table C-1. Waste Generated During Field Activities.

PIN	Container Size gal)	Waste Description	Date Opened	Date Sealed	Comments
UP-04-001	55	MSW	03/19/04	03/20/04	Well C4207, C4228
UP-04-002	55	Soil 42 to 47 ft Vadose Zone @ C4228	08/09/04	08/09/04	C4228
UP-04-003	55	Soil 47 ft Auger clean out @ C4228	08/09/04	08/09/04	C4228
UP-04-004	55	Soil 0 to 15 ft Vadose Zone @ C4225	08/11/04	08/11/04	C4225
UP-04-005	55	Soil 15 to 25 ft Vadose Zone @ C4225	08/12/04	08/12/04	C4225
UP-04-006	55	Soil 25 to 35 ft Vadose Zone @ C4225	08/12/04	08/12/04	C4225
UP-04-007	55	Soil 35 to 45 ft Vadose Zone @ C4225	08/12/04	08/12/04	C4225
UP-04-008	55	Soil 45 to 50 ft Vadose Zone @ C4225	08/16/04	08/16/04	C4225
UP-04-009	55	Soil 50 ft Auger clean out @ C4225	08/16/04	08/16/04	C4225
UP-04-010	55	Soil 50 ft Auger clean out @ C4220	08/17/04	08/17/04	C4220
UP-04-011	55	MSW	08/18/04	08/18/04	C4219
UP-04-012	55	Soil 48 to 50 ft Vadose Zone @ C4219	08/18/04	08/18/04	C4219
UP-04-013	55	Soil 50 ft Auger clean out @ C4219	08/19/04	08/19/04	C4219
UP-04-014	55	Soil 0 to 50 ft Vadose Zone C4226 (Spoil Pile)	09/10/04	09/10/04	C4226
UP-04-015	55	Soil 0 to 50 ft Vadose Zone C4226 (Spoil Pile)	09/10/04	09/10/04	C4226

Table C-1. Waste Generated During Field Activities.

PIN	Container Size gal)	Waste Description	Date Opened	Date Sealed	Comments
UP-04-016	55	Soil 0 to 50 ft Vadose Zone C4226 (Spoil Pile)	09/10/04	09/10/04	C4226
UP-04-017	55	Soil 0 to 50 ft Vadose Zone C4226 (Spoil Pile)	09/10/04	09/10/04	C4226
UP-04-018	55	Soil 0 to 50 ft Vadose Zone C4226 (Spoil Pile)	09/10/04	09/10/04	C4226
UP-04-019	55	Soil 0 to 50 ft Vadose Zone C4226 (Spoil Pile)	09/10/04	09/10/04	C4226
UP-04-020	55	Soil 0 to 50 ft Vadose Zone C4227 (Spoil Pile)	09/10/04	09/10/04	C4227
UP-04-021	55	Soil 0 to 50 ft Vadose Zone C4227 (Spoil Pile)	09/10/04	09/10/04	C4227
UP-04-022	55	Soil 0 to 50 ft Vadose Zone C4227 (Spoil Pile)	09/10/04	09/10/04	C4227
UP-04-023	55	Soil 0 to 50 ft Vadose Zone C4227 (Spoil Pile)	09/10/04	09/10/04	C4227
UP-04-024	55	Soil 0 to 50 ft Vadose Zone C4227 (Spoil Pile)	09/10/04	09/10/04	C4227
UP-04-025	55	MSW C4226, C4227	09/13/04	09/13/04	C4226, C4227
UP-04-026	55	Soil 0 to 47 ft Vadose Zone C4228 (Spoil Pile)	09/13/04	09/13/04	C4228
UP-04-027	55	Soil 0 to 47 ft Vadose Zone C4228 (Spoil Pile)	09/12/04	09/12/04	C4228
UP-04-028	55	Soil 0 to 47 ft Vadose Zone C4228 (Spoil Pile)	09/13/04	09/13/04	C4228
UP-04-029	55	Soil 0 to 47 ft Vadose Zone C4228 (Spoil Pile)	09/13/04	09/13/04	C4228
UP-04-030	55	Soil 0 to 40 ft Vadose Zone C4220 (Spoil Pile)	09/13/04	09/13/04	C4220

Table C-1. Waste Generated During Field Activities.

PIN	Container Size gal)	Waste Description	Date Opened	Date Sealed	Comments
UP-04-031	55	Soil 0 to 40 ft Vadose Zone C4220 (Spoil Pile)	09/13/04	09/13/04	C4220
UP-04-032	55	Soil 0 to 40 ft Vadose Zone C4220 (Spoil Pile)	09/13/04	09/13/04	C4220
UP-04-033	55	Soil 0 to 40 ft Vadose Zone C4220 (Spoil Pile)	09/13/04	09/13/04	C4220
UP-04-034	55	Soil 0 to 48 ft Vadose Zone C4219 (Spoil Pile)	09/13/04	09/13/04	C4219
UP-04-035	55	Soil 0 to 48 ft Vadose Zone C4219 (Spoil Pile)	09/13/04	09/13/04	C4219
UP-04-036	55	Soil 0 to 48 ft Vadose Zone C4219 (Spoil Pile)	09/13/04	09/13/04	C4219
UP-04-037	55	MSW C4219, C4220, C4228	09/13/04	09/13/04	C4219, C4220, C4228
UP-05-001	55	Soil 0 to 45 ft Vadose Zone C4710	02/24/05	02/24/05	C4710
UP-05-002	55	Soil 0 to 45 ft Vadose Zone C4710	02/24/05	02/24/05	C4710
UP-05-003	55	Soil 0 to 40 ft Vadose Zone C4713	02/25/05	02/25/05	C4713
UP-05-004	55	Soil 0 to 42 ft Vadose Zone C4706	02/25/05	02/25/05	C4706
UP-05-005	55	Soil 0 to 42 ft Vadose Zone C4706	02/28/05	02/28/05	C4706
UP-05-006	55	MSW C4705 through C4730	02/24/05	03/15/05	C4705 through C4730
UP-05-007	55	Soil 0 to 35 ft Vadose Zone C4705	2/28/2005	02/28/05	C4705

Table C-1. Waste Generated During Field Activities.

PIN	Container Size gal)	Waste Description	Date Opened	Date Sealed	Comments
UP-05-008	55	Soil 35 to 44 ft Vadose Zone C4705	2/28/2005	02/28/05	C4705
UP-05-009	55	Soil 0 to 44 ft Vadose Zone C4711	2/28/2005	02/28/05	C4711
UP-05-010	55	Soil 0 to 44 ft Vadose Zone C4711	2/28/2005	02/28/05	C4711
UP-05-011	55	Soil 0 to 42 ft Vadose Zone C4712	3/1/2005	03/01/05	C4712
UP-05-012	55	Soil 0 to 42 ft Vadose Zone C4712	3/1/2005	03/01/05	C4712
UP-05-013	55	Soil 0 to 40 ft Vadose Zone C4709	3/2/2005	03/02/05	C4709
UP-05-014	55	Soil 40 to 46 ft Vadose Zone C4709	3/2/2005	03/02/05	C4709
UP-05-015	55	Soil 0 to 44 ft Vadose Zone C-4708	3/2/2005	03/02/05	C4708
UP-05-016	55	Soil 0 to 44 ft Vadose Zone C-4708	3/2/2005	03/02/05	C4708
UP-05-017	55	Soil 0 to 44 ft Vadose Zone C4707	3/2/2005	03/02/05	C4707
UP-05-018	55	Soil 0 to 44 ft Vadose Zone C4707	3/2/2005	03/02/05	C4707
UP-05-019	55	Soil 0 to 44 ft Vadose Zone C4720	3/3/2005	03/03/05	C4720
UP-05-020	55	Soil 0 to 44 ft Vadose Zone C4720	3/3/2005	03/03/05	C4720
UP-05-021	55	Soil 0 to 35 ft Vadose Zone C4721	3/3/2005	03/03/05	C4721
UP-05-022	55	Soil 35 to 42 ft Vadose Zone C4721	3/3/2005	03/03/05	C4721

Table C-1. Waste Generated During Field Activities.

PIN	Container Size gal)	Waste Description	Date Opened	Date Sealed	Comments
UP-05-023	55	Soil 0 to 35 ft Vadose Zone C4722	3/3/2005	03/04/05	C4722
UP-05-024	55	Soil 35 to 44 ft Vadose Zone C4722	3/3/2005	03/04/05	C4722
UP-05-025	55	Soil 0 to 44 ft Vadose Zone C4722	3/4/2005	03/08/05	C4722
UP-05-026	55	Soil 0 to 30 ft Vadose Zone C4714	3/8/2005	03/08/05	C4714
UP-05-027	55	Soil 30 to 44 ft Vadose Zone C4714	3/5/2005	03/08/05	C4714
UP-05-028	55	Soil 0 to 40 ft Vadose Zone C4718	3/8/2005	03/08/05	C4718
UP-05-029	55	Soil 0 to 44 ft Vadose Zone C4718	3/8/2005	03/08/058	C4718
UP-05-030	55	Soil 0 to 35 ft Vadose Zone C4717	3/9/2005	03/09/05	C4717
UP-05-031	55	Soil 35 to 44 ft Vadose Zone C4717	3/9/2005	03/09/05	C4717
UP-05-032	55	Soil 0 to 35 ft Vadose Zone C4719	3/9/2005	03/09/05	C4719
UP-05-033	55	Soil 35 to 44 ft Vadose Zone C4719	3/9/2005	03/09/05	C4719
UP-05-034	55	Soil 0 to 44 ft Vadose Zone C4715	3/9/2005	03/09/05	C4715
UP-05-035	55	Soil 0 to 44 ft Vadose Zone C4715	3/9/2005	03/09/05	C4715
UP-05-036	55	Soil 0 to 40 ft Vadose Zone C4728	3/10/2005	03/10/05	C4728
UP-05-037	55	Soil 0 to 40 ft Vadose Zone C4728	3/10/2005	03/10/05	C4728

Table C-1. Waste Generated During Field Activities.

PIN	Container Size gal)	Waste Description	Date Opened	Date Sealed	Comments
UP-05-038	55	Soil 0 to 44 ft Vadose Zone C4729	3/10/2005	03/10/05	C4729
UP-05-039	55	Soil 0 to 44 ft Vadose Zone C4729	3/10/2005	03/10/05	C4729
UP-05-040	55	Soil 0 to 44 ft Vadose Zone C4730	3/10/2005	03/10/05	C4730
UP-05-041	55	Soil 0 to 44 ft Vadose Zone C4730	3/10/2005	03/10/05	C4730
UP-05-042	55	Soil 0 to 35 ft Vadose Zone C4724	3/11/2005	03/11/05	C4724
UP-05-043	55	Soil 35 to 44 to Vadose Zone C4724	3/11/2005	03/11/05	C4724
UP-05-044	55	Soil 0 to 35 ft Vadose Zone C4725	3/11/2005	03/11/05	C4725
UP-05-045	55	Soil 35 to 44 ft Vadose Zone C4725	3/11/2005	03/11/05	C4725
UP-05-046	55	Soil 0 to 44 ft Vadose Zone C4723	3/11/2005	03/11/05	C4723
UP-05-047	55	Soil 0 to 44 ft Vadose Zone C4723	3/14/2005	03/14/05	C4723
UP-05-048	55	Soil 0 to 41 ft Vadose Zone C4726	3/14/2005	03/14/05	C4726
UP-05-049	55	Soil 0 to 41 ft Vadose Zone C4726	3/14/2005	03/14/05	C4726
UP-05-050	55	Soil 0 to 41 ft Vadose Zone C4727	03/14/05	3/14/2005	C4727
UP-05-051	55	Soil 40 to 49 ft Vadose Zone C4716	03/15/05	3/15/2005	C4716

Table C-1. Waste Generated During Field Activities.

PIN	Container Size gal)	Waste Description	Date Opened	Date Sealed	Comments
UP-05-052	55	Soil 0 to 40 ft Vadose Zone C4716	03/15/05	3/15/2005	C4716

MSW = miscellaneous solid waste.
PIN = package identification number.

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APPENDIX D

U PLANT CLOSURE AUGER SAMPLE ANALYTICAL RESULTS

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Table D-1. All Laboratory Analyses for Soil Samples.

Well	Waste Site	Actual Sample Interval (ft)	Tc-99 (pCi/g) PRG=1 pCi/g	Tc-99 (pCi/g) MDC/MDA	Nitrate/nitrite as Nitrogen (mg/kg) PRG=40 mg/kg	N (mg/kg) RL	Uranium (mg/kg) PRG=3.2	Uranium MDL	U-234 (pCi/g)	U-234 (pCi/g) MDC/MDA	U-235 (pCi/g)	U-235 (pCi/g) MDC/MDA	U-238 (pCi/g)	U-238 (pCi/g) MDC/MDA
C4705	216-U-1/216-U-2	44 to 45.5	U	0.642	6.1	0.5	U	0.94	0.777	0.0303	0.0257	0.0192	0.766	0.0249
C4706	216-U-1/216-U-2	42 to 43.5	U	0.612	3.7	0.5	2.86	0.15	1.23	0.0261	0.0453	0.0221	1.06	0.0292
C4707	216-U-1/216-U-2	44 to 45.5	U	0.648	2	0.5	U	0.97	0.693	0.0196	U	0.0175	0.761	0.0196
C4708	216-U-1/216-U-2	44 to 45.5	U	0.612	1.1	0.5	U	0.93	0.468	0.0153	0.0223	0.00863	0.472	0.00863
C4708LD	216-U-1/216-U-2	44 to 45.5	NA	NA	1.1	0.5	NA	NA	NA	NA	NA	NA	NA	NA
C4709	216-U-1/216-U-2	46.5 to 48	U	0.646	0.88	0.5	U	0.99	0.637	0.00998	U	0.0176	0.614	0.0176
C4709SD	216-U-1/216-U-2	46.5 to 48	U	0.646	1.1	0.5	U	1	0.637	0.00998	U	0.0176	0.614	0.0176
C4709LD	216-U-1/216-U-2	46.5 to 48	U	0.642	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4710	216-U-1/216-U-2	44.5 to 46	U	0.642	0.8	0.5	3.9	0.16	0.722	0.00949	0.0385	0.00949	0.76	0.0168
C4711	216-U-1/216-U-2	44 to 45.5	U	0.585	0.86	0.5	U	0.92	0.614	0.0223	U	0.02	0.578	0.0223
C4712	216-U-1/216-U-2	10 to 11.5	U	0.642	1.3	0.5	1.61	1	0.747	0.027	U	0.0228	0.805	0.0228
C4712LD	216-U-1/216-U-2	10 to 11.5	NA	NA	1.3	0.5	NA	NA	NA	NA	NA	NA	NA	NA
C4712	216-U-1/216-U-2	30 to 31.5	U	0.642	2.2	0.5	U	0.99	0.636	0.0154	0.0454	0.0154	0.585	0.0154
C4712	216-U-1/216-U-2	35 to 36.5	U	0.612	3.4	0.5	U	1	0.592	0.0383	U	0.0242	0.603	0.0334
C4712	216-U-1/216-U-2	42 to 43.5	U	0.587	2.7	0.5	U	0.81	0.607	0.0291	0.0298	0.0264	0.633	0.0232
C4713	216-U-1/216-U-2	40 to 41.5	U	0.584	2.6	0.5	2.56	0.15	0.925	0.00836	0.0278	0.00836	0.864	0.00836
C4714	216-U-8	44 to 45.5	U	0.663	11	0.5	0.724	0.16	0.6	0.0313	0.0443	0.0269	0.559	0.0292
C4715	216-U-12	44 to 45.5	U	0.664	11	0.5	0.838	0.15	0.778	0.0479	U	0.0354	0.792	0.0423
C4716	216-U-8	47.5 to 50.5	U	0.615	8	0.5	14.9	0.14	13.1	0.0341	0.595	0.0262	13.9	0.0341
C4717	216-U-8	1 to 2.5	U	0.652	3.4	0.5	1.34	0.16	0.841	0.0415	0.0547	0.0362	0.866	0.0381
C4717	216-U-8	37 to 38.5	U	0.653	45.4	1	3.2	0.16	1.68	0.0507	0.0664	0.0298	1.77	0.0507
C4717	216-U-8	44 to 45.5	U	0.653	150	2	7.74	0.16	4.43	0.0255	0.175	0.0216	4.46	0.0216
C4718	216-U-8	44 to 45.5	U	0.655	3.4	0.5	0.416	0.16	0.416	0.0174	U	0.0174	0.461	0.0174
C4719	216-U-8	44 to 45.5	U	0.648	7.2	0.5	0.475	0.16	0.572	0.0126	0.0279	0.0126	0.617	0.0223
C4720	216-U-8	44 to 45.5	U	0.647	25.7	2	U	0.99	0.631	0.0336	0.036	0.0212	0.687	0.0276
C4721	216-U-8	42 to 43.5	U	0.613	59.2	5	3.19	0.95	2.49	0.0352	0.0693	0.0223	2.51	0.0338
C4722	216-U-8	43 to 44.5	U	0.658	6.7	0.5	17.3	0.95	8.22	0.49	U	0.403	7.95	0.451
C4723	216-U-12	44 to 45.5	U	0.673	5	0.5	0.413	0.12	0.6690	0.0183	U	0.0104	0.647	0.0104
C4724	216-U-12	44 to 45.5	0.993	0.626	82.9	2	0.501	0.15	0.6000	0.0181	U	0.0102	0.503	0.0102
C4725	216-U-12	44 to 45.5	U	0.629	3.2	0.5	0.517	0.12	0.8110	0.0127	0.0231	0.0189	0.75	0.0127
C4726	216-U-12	41 to 42.5	1.56	0.627	544	10	3.12	0.15	2.0600	0.0206	0.0882	0.0176	1.62	0.0218
C4727	216-U-12	44 to 45.5	U	0.63	3.7	0.5	0.476	0.15	0.6330	0.0224	0.0271	0.0181	0.481	0.0273
C4728	216-U-8	48 to 49.7	U	0.629	366	10	5.47	0.12	1.6900	0.0132	0.0775	0.0196	1.78	0.0132

Table D-1. All Laboratory Analyses for Soil Samples.

Well	Waste Site	Actual Sample Interval (ft)	Tc-99 (pCi/g) PRG=1 pCi/g	Tc-99 (pCi/g) MDC/MDA	Nitrate/nitrite as Nitrogen (mg/kg) PRG=40 mg/kg	N (mg/kg) RL	Uranium (mg/kg) PRG=3.2	Uranium MDL	U-234 (pCi/g)	U-234 (pCi/g) MDC/MDA	U-235 (pCi/g)	U-235 (pCi/g) MDC/MDA	U-238 (pCi/g)	U-238 (pCi/g) MDC/MDA
C4729	216-U-12	44 to 45.5	U	0.625	6.9	0.5	0.399	0.16	0.7410	0.0184	0.0313	0.0201	0.778	0.0109
C4730	216-U-12	18 to 19.5	U	0.633	U	0.5	0.848	0.15	0.8950	0.0287	0.0268	0.0264	0.796	0.0264
C4730	216-U-12	38 to 39.5	0.707	0.625	149	2	8.01	0.16	5.7200	0.0287	0.272	0.0187	4.38	0.0287
C4730	216-U-12	44 to 45.5	U	0.628	109	0.5	3.63	0.16	6.0400	0.0428	0.29	0.0309	4.86	0.039

Table D-1. All Laboratory Analyses for Soil Samples Continued.

Well	Waste Site	Actual Sample Interval (ft)	% moisture	Alpha (pCi/g)	Beta (pCi/g)	Gamma (pCi/g) Cs-137 Cs-137 PRG=23.4 pCi/g	Magnesium (mg/kg) PRG=NA	Titanium (mg/kg) PRG=unlimited	Titanium MDL	Manganese (mg/kg) PRG=512	Manganese MDL	Nickel (mg/kg) PRG=130	Nickel MDL	Silver (mg/kg) PRG=13.6
C4705	216-U-1/216-U-2	44 to 45.5	6.4	U	7	NA	5600	1220	0.096	403	2.8	9.66	4.7	U
C4706	216-U-1/216-U-2	42 to 43.5	7.6	U	6.9	NA	5210	1280	0.098	380	6.6	13	0.2	0.0512
C4707	216-U-1/216-U-2	44 to 45.5	8.7	U	5	NA	5650	1030	0.099	338	2.9	10.2	4.9	2.6
C4708	216-U-1/216-U-2	44 to 45.5	3.5	U	7.8	NA	3850	1530	0.099	262	2.8	10	4.6	4.72
C4708LD	216-U-1/216-U-2	44 to 45.5	1.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4709	216-U-1/216-U-2	46.5 to 48	2.8	U	9.5	NA	5120	1100	0.096	239	3	21.9	4.9	2.59
C4709SD	216-U-1/216-U-2	46.5 to 48	3.2	U	3.5	NA	4260	1140	0.099	257	3	11.2	5	U
C4709LD	216-U-1/216-U-2	46.5 to 48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4710	216-U-1/216-U-2	44.5 to 46	2.4	U	6.7	NA	5960	2080	0.097	220	6.8	7.69	0.2	0.15
C4711	216-U-1/216-U-2	44 to 45.5	2.4	U	7.7	NA	5000	1180	0.098	234	2.8	8.37	4.6	U
C4712	216-U-1/216-U-2	10 to 11.5	4.6	U	6.6	NA	6020	2510	0.098	370	3	8.64	5	U
C4712LD	216-U-1/216-U-2	10 to 11.5	4.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4712	216-U-1/216-U-2	30 to 31.5	6.8	U	5.8	NA	5740	2000	0.097	417	3	11.5	5	2.28
C4712	216-U-1/216-U-2	35 to 36.5	6.4	U	8.3	NA	10500	1920	0.095	268	3	9.85	5	U
C4712	216-U-1/216-U-2	42 to 43.5	6.5	U	7.3	NA	3860	1760	0.099	309	2.4	9.24	4	U
C4713	216-U-1/216-U-2	40 to 41.5	5.5	U	7.2	NA	4950	1060	0.098	339	6.6	10.6	0.2	0.103
C4714	216-U-8	44 to 45.5	NA	U	3.9	NA	NA	1220	0.098	292	6.9	11	0.21	U
C4715	216-U-12	44 to 45.5	NA	U	18.2	NA	NA	1360	0.099	305	6.5	7.52	0.2	U
C4716	216-U-8	47.5 to 50.5	2.2	18.6	71	5.06	NA	1060	0.099	208	6.1	8.12	0.18	0.123
C4717	216-U-8	1 to 2.5	NA	U	3.7	NA	NA	1960	0.1	395	6.8	9.16	0.21	0.111
C4717	216-U-8	37 to 38.5	NA	U	10.7	NA	NA	1960	0.097	457	6.9	13.1	0.21	0.3
C4717	216-U-8	44 to 45.5	NA	U	15.6	NA	NA	1280	0.099	317	7	8.37	0.21	U
C4718	216-U-8	44 to 45.5	NA	U	2.6	NA	NA	1460	0.1	272	6.8	7.05	0.2	U

Table D-1. All Laboratory Analyses for Soil Samples Continued.

Well	Waste Site	Actual Sample Interval (ft)	% moisture	Alpha (pCi/g)	Beta (pCi/g)	Gamma (pCi/g) Cs-137 Cs-137 PRG=23.4 pCi/g	Magnesium (mg/kg) PRG=NA	Titanium (mg/kg) PRG=unlimited	Titanium MDL	Manganese (mg/kg) PRG=512	Manganese MDL	Nickel (mg/kg) PRG=130	Nickel MDL	Silver (mg/kg) PRG=13.6
C4719	216-U-8	44 to 45.5	NA	U	20.4	NA	NA	1510	0.099	296	7	9.14	0.21	U
C4720	216-U-8	44 to 45.5	2.5	U	14	NA	NA	1310	0.1	228	3	17.5	4.9	2.29
C4721	216-U-8	42 to 43.5	9.5	U	6.7	NA	NA	1700	0.099	348	2.8	9.84	4.8	U
C4722	216-U-8	43 to 44.5	3.1	79	200	120	NA	1150	0.096	288	2.9	8.75	4.8	U
C4723	216-U-12	44 to 45.5	NA	U	9.4	NA	NA	1280	0.1	270	5.4	10.5	0.16	U
C4724	216-U-12	44 to 45.5	NA	U	7.2	NA	NA	1130	0.098	259	6.5	9.27	0.2	U
C4725	216-U-12	44 to 45.5	NA	U	5.1	NA	NA	1360	0.096	372	5.3	14.2	0.16	U
C4726	216-U-12	41 to 42.5	NA	U	65.4	U	NA	1840	0.099	472	6.7	10.1	0.2	U
C4727	216-U-12	44 to 45.5	NA	U	3	NA	NA	1160	0.098	326	6.7	11.4	0.2	U
C4728	216-U-8	48 to 49.7	NA	U	16.4	NA	NA	1230	0.098	438	5.1	14.7	0.15	U
C4729	216-U-12	44 to 45.5	NA	U	5.9	NA	NA	1100	0.098	508	6.9	13.1	0.21	U
C4730	216-U-12	18 to 19.5	NA	U	12	NA	NA	2120	0.099	303	6.6	8.04	0.2	U
C4730	216-U-12	38 to 39.5	NA	22.7	94	U	NA	1030	0.099	317	7	8.83	0.21	U
C4730	216-U-12	44 to 45.5	NA	3.9	43.1	U	NA	1060	0.096	261	6.8	9.18	0.2	U

Table D-1. All Laboratory Analyses for Soil Samples Continued.

Well	Waste Site	Actual Sample Interval (ft)	Silver MDL	Antimony (mg/kg) PRG=5.4	Antimony MDL	Barium (mg/kg) PRG=132	Barium MDL	Cadmium (mg/kg) PRG=0.81	Cadmium MDL	Chromium (mg/kg) PRG=67	Chromium MDL	Cobalt (mg/kg) PRG=290	Cobalt MDL	Copper (mg/kg) PRG=217
C4705	216-U-1/216-U-2	44 to 45.5	1.9	U	4.7	83.8	1.9	U	0.94	9.2	2.8	7.08	1.9	13.6
C4706	216-U-1/216-U-2	42 to 43.5	0.0095	U	6.8	93.4	0.87	0.0346	0.019	13	3.2	7.58	0.18	14.5
C4707	216-U-1/216-U-2	44 to 45.5	2	U	4.9	81.8	2	U	0.97	10.8	2.9	6.96	2	13
C4708	216-U-1/216-U-2	44 to 45.5	1.9	U	4.6	71.2	1.9	U	0.93	7.93	2.8	5.84	1.9	20.7
C4708LD	216-U-1/216-U-2	44 to 45.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4709	216-U-1/216-U-2	46.5 to 48	2	U	4.9	68	2	U	0.99	10.8	3	5.44	2	11.4
C4709SD	216-U-1/216-U-2	46.5 to 48	2	U	5	81.1	2	U	1	7.24	3	4.99	2	30.3
C4709LD	216-U-1/216-U-2	46.5 to 48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4710	216-U-1/216-U-2	44.5 to 46	0.0097	U	6.9	60	0.89	0.398	0.019	7.63	3.3	6.85	0.18	16.3
C4711	216-U-1/216-U-2	44 to 45.5	1.8	U	4.6	63	1.8	U	0.92	8.39	2.8	5.01	1.8	11.2
C4712	216-U-1/216-U-2	10 to 11.5	2	U	5	84.3	2	U	1	5.79	3	9.46	2	14.9
C4712LD	216-U-1/216-U-2	10 to 11.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4712	216-U-1/216-U-2	30 to 31.5	2	U	5	95	2	U	0.99	8.16	3	10.5	2	19.8

Table D-1. All Laboratory Analyses for Soil Samples Continued.

Well	Waste Site	Actual Sample Interval (ft)	Silver MDL	Antimony (mg/kg) PRG=5.4	Antimony MDL	Barium (mg/kg) PRG=132	Barium MDL	Cadmium (mg/kg) PRG=0.81	Cadmium MDL	Chromium (mg/kg) PRG=67	Chromium MDL	Cobalt (mg/kg) PRG=290	Cobalt MDL	Copper (mg/kg) PRG=217
C4712	216-U-1/216-U-2	35 to 36.5	2	U	5	63.2	2	U	1	8.6	3	6.76	2	14.6
C4712	216-U-1/216-U-2	42 to 43.5	1.6	U	4	80.6	1.6	U	0.81	7.71	2.4	6.82	1.6	14.8
C4713	216-U-1/216-U-2	40 to 41.5	0.0095	U	6.8	76	0.87	U	0.019	10.3	3.2	7.34	0.18	13.7
C4714	216-U-8	44 to 45.5	0.0099	U	7	59.4	0.91	0.0867	0.02	8.9	3.3	6.59	0.19	10.8
C4715	216-U-12	44 to 45.5	0.0093	U	6.6	65.9	0.86	0.0786	0.019	7.74	3.1	5.81	0.18	14
C4716	216-U-8	47.5 to 50.5	0.0088	U	6.2	46	0.81	U	0.018	7.58	2.9	4.57	0.17	9.21
C4717	216-U-8	1 to 2.5	0.0098	U	7	91.1	0.9	0.318	0.02	9.65	3.3	9.56	0.19	15.9
C4717	216-U-8	37 to 38.5	0.0099	U	7.1	111	0.91	0.635	0.02	11.6	3.3	11.2	0.19	17.9
C4717	216-U-8	44 to 45.5	0.01	U	7.1	90.7	0.92	0.239	0.02	10.1	3.4	6.58	0.19	15.9
C4718	216-U-8	44 to 45.5	0.0098	8.35	7	44.2	0.9	0.126	0.02	8.04	3.3	6.53	0.19	19.6
C4719	216-U-8	44 to 45.5	0.01	U	7.1	64.2	0.92	U	0.02	8.57	3.4	7.03	0.19	12.1
C4720	216-U-8	44 to 45.5	2	U	4.9	67.8	2	U	0.99	7.5	3	6.66	2	21.2
C4721	216-U-8	42 to 43.5	1.9	U	4.8	102	1.9	U	0.95	5.87	2.8	8.33	1.9	14.7
C4722	216-U-8	43 to 44.5	1.9	U	4.8	60.2	1.9	U	0.95	11	2.9	5.44	1.9	10.2
C4723	216-U-12	44 to 45.5	0.0073	U	5.5	72	0.71	U	0.016	9.09	2.6	6.16	0.15	12.5
C4724	216-U-12	44 to 45.5	0.0094	U	6.7	64	0.86	0.118	0.019	8.42	3.2	5.83	0.18	11.4
C4725	216-U-12	44 to 45.5	0.0077	U	5.5	85.6	0.7	0.188	0.015	12.7	2.6	7.73	0.15	14.6
C4726	216-U-12	41 to 42.5	0.0096	U	6.8	108	0.88	U	0.019	9.89	3.2	10.9	0.18	15
C4727	216-U-12	44 to 45.5	0.0096	U	6.8	67.6	0.88	0.069	0.019	9.77	3.2	8.01	0.18	19.6
C4728	216-U-8	48 to 49.7	0.0073	U	5.2	74.2	0.99	0.178	0.015	14.6	2.4	10.3	0.14	20
C4729	216-U-12	44 to 45.5	0.0099	U	7	76	0.91	U	0.02	13.7	3.3	7.69	0.19	13.1
C4730	216-U-12	18 to 19.5	0.0095	U	6.8	71.8	0.88	0.159	0.019	6.47	3.2	7.94	0.18	14.4
C4730	216-U-12	38 to 39.5	0.01	U	7.1	107	0.92	U	0.02	10.1	3.4	6.09	0.19	14.8
C4730	216-U-12	44 to 45.5	0.0097	U	7	118	0.9	U	0.02	8.6	3.3	5.77	0.18	11

Table D-1 All Laboratory Analyses for Soil Samples Continued.

Well	Waste Site	Actual Sample Interval (ft)	Copper MDL	Vanadium (mg/kg) PRG=2240	Vanadium MDL	Zinc (mg/kg) PRG=360	Zinc MDL	Lead (mg/kg) PRG=118	Lead MDL	Mercury (mg/kg) PRG=2.09	Mercury MDL	Arsenic (mg/kg) PRG=6.47	Arsenic MDL	Selenium (mg/kg) PRG=1
C4705	216-U-1/216-U-2	44 to 45.5	4.7	33.4	3.7	49.6	37	U	11	1.07	0.94	6.52	2.8	U
C4706	216-U-1/216-U-2	42 to 43.5	0.6	47.7	0.27	54.6	2.4	4.56	0.25	1.64	0.0095	5.9	2.3	U
C4707	216-U-1/216-U-2	44 to 45.5	4.9	35	3.9	60.2	39	U	12	U	0.97	U	2.9	U

Table D-1 All Laboratory Analyses for Soil Samples Continued.

Well	Waste Site	Actual Sample Interval (ft)	Copper MDL	Vanadium (mg/kg) PRG=2240	Vanadium MDL	Zinc (mg/kg) PRG=360	Zinc MDL	Lead (mg/kg) PRG=118	Lead MDL	Mercury (mg/kg) PRG=2.09	Mercury MDL	Arsenic (mg/kg) PRG=6.47	Arsenic MDL	Selenium (mg/kg) PRG=1
C4708	216-U-1/216-U-2	44 to 45.5	4.6	36.5	3.7	U	37	U	11	1.11	0.93	U	2.8	U
C4708LD	216-U-1/216-U-2	44 to 45.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4709	216-U-1/216-U-2	46.5 to 48	4.9	30.5	4	39.8	40	U	12	1.04	0.99	5.14	3	U
C4709SD	216-U-1/216-U-2	46.5 to 48	5	24.7	4	43.1	40	U	12	U	1	U	3	U
C4709LD	216-U-1/216-U-2	46.5 to 48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4710	216-U-1/216-U-2	44.5 to 46	0.62	59.9	0.28	71	2.4	3.13	0.25	0.457	0.0097	3.26	2.3	U
C4711	216-U-1/216-U-2	44 to 5.5	4.6	30.7	3.7	39.3	37	U	11	U	0.92	6.01	2.8	2.87
C4712	216-U-1/216-U-2	10 to 11.5	5	52.7	4	52.2	40	U	12	1.1	1	4.2	3	U
C4712LD	216-U-1/216-U-2	10 to 11.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4712	216-U-1/216-U-2	30 to 31.5	5	54.2	4	51	40	U	12	1.31	0.99	U	3	U
C4712	216-U-1/216-U-2	35 to 36.5	5	33	4	41.3	40	U	12	U	1	8.91	3	U
C4712	216-U-1/216-U-2	42 to 43.5	4	33.9	3.2	41.2	32	U	9.7	U	0.81	U	2.4	U
C4713	216-U-1/216-U-2	40 to 41.5	0.61	44.8	0.28	52.9	2.4	5.2	0.25	2.25	0.0095	U	2.3	U
C4714	216-U-8	44 to 45.5	0.63	42.7	0.29	41.2	2.5	3.64	0.26	U	0.0099	5.31	2.4	1.4
C4715	216-U-12	44 to 45.5	0.6	42	0.27	49.5	2.3	4.13	0.24	U	0.0093	6.77	2.2	U
C4716	216-U-8	47.5 to 50.5	0.56	33.5	0.25	45.4	2.2	3.19	0.23	0.543	0.0088	U	2.1	1.61
C4717	216-U-8	1 to 2.5	0.63	56.2	0.28	55.8	2.4	7.01	0.26	0.052	0.0098	9.07	2.4	1.23
C4717	216-U-8	37 to 38.5	0.63	61.7	0.29	65.2	2.5	6.49	0.26	0.091	0.0099	7.84	2.4	1.03
C4717	216-U-8	44 to 45.5	0.64	37.3	0.29	54.8	2.5	4.73	0.26	U	0.01	4.47	2.4	U
C4718	216-U-8	44 to 45.5	0.62	43.6	0.28	67.8	2.4	3.36	0.25	U	0.0098	6.02	2.3	1.02
C4719	216-U-8	44 to 45.5	0.64	45	0.29	42.3	2.5	2.78	0.26	U	0.01	U	2.4	U
C4720	216-U-8	44 to 45.5	4.9	39.1	4	49.8	40	U	12	1.03	0.99	8.5	3	U
C4721	216-U-8	42 to 43.5	4.8	44.5	3.8	47.2	38	U	11	U	0.95	8.06	2.8	U
C4722	216-U-8	43 to 44.5	4.8	32.4	3.8	U	38	U	11	U	0.95	7.62	2.9	U
C4723	216-U-12	44 to 45.5	0.5	42.1	0.22	49.7	1.9	2.7	0.2	U	0.0077	5.39	1.9	1.3
C4724	216-U-12	44 to 45.5	0.6	36.7	0.27	40.5	2.3	2.69	0.24	U	0.0094	2.74	2.2	1.11
C4725	216-U-12	44 to 45.5	0.49	46.9	0.22	47.4	1.9	3.58	0.2	U	0.0077	5.6	1.8	0.729
C4726	216-U-12	41 to 42.5	0.61	62	0.28	61.9	2.4	5.39	0.25	U	0.0096	7.82	2.3	1.92
C4727	216-U-12	44 to 45.5	0.61	54.7	0.28	56.7	2.4	3.57	0.25	U	0.0096	4.91	2.3	0.984
C4728	216-U-8	48 to 49.7	0.47	48.6	0.21	61.1	1.8	7.86	0.19	U	0.0073	7.3	1.8	0.6
C4729	216-U-12	44 to 45.5	0.63	39.1	0.29	51.4	2.5	4.47	0.26	U	0.0099	7	2.4	0.95
C4730	216-U-12	18 to 19.5	0.61	49.2	0.28	50.9	2.4	4.61	0.25	0.0728	0.0095	3.72	2.3	1.63
C4730	216-U-12	38 to 39.5	0.64	41.1	0.29	55.8	2.5	2.97	0.26	U	0.01	6.06	2.4	U

Table D-1 All Laboratory Analyses for Soil Samples Continued.

Well	Waste Site	Actual Sample Interval (ft)	Copper MDL	Vanadium (mg/kg) PRG=2240	Vanadium MDL	Zinc (mg/kg) PRG=360	Zinc MDL	Lead (mg/kg) PRG=118	Lead MDL	Mercury (mg/kg) PRG=2.09	Mercury MDL	Arsenic (mg/kg) PRG=6.47	Arsenic MDL	Selenium (mg/kg) PRG=1
C4730	216-U-12	44 to 45.5	0.62	37.9	0.28	43.4	2.4	3.1	0.25	U	0.0097	5.76	2.3	U

Table D-1 All Laboratory Analyses for Soil Samples Continued.

Well	Waste Site	Actual Sample Interval (ft)	Selenium MDL	Thallium (mg/kg) PRG=1.59	Thallium MDL	Strontium (mg/kg) PRG=2920	Strontium MDL
C4705	216-U-1/216-U-2	44 to 45.5	2.8	U	0.94	33.3	0.94
C4706	216-U-1/216-U-2	42 to 43.5	0.69	0.605	0.019	34.8	0.95
C4707	216-U-1/216-U-2	44 to 45.5	2.9	1.41	0.97	32.2	0.97
C4708	216-U-1/216-U-2	44 to 45.5	2.8	3.82	0.93	33	0.93
C4708LD	216-U-1/216-U-2	44 to 45.5	NA	NA	NA	NA	NA
C4709	216-U-1/216-U-2	46.5 to 48	3	U	0.99	24.5	0.99
C4709SD	216-U-1/216-U-2	46.5 to 48	3	U	1	43	1
C4709LD	216-U-1/216-U-2	46.5 to 48	NA	NA	NA	NA	NA
C4710	216-U-1/216-U-2	44.5 to 46	0.71	0.938	0.019	29.6	0.97
C4711	216-U-1/216-U-2	44 to 45.5	2.8	U	0.92	24.6	0.92
C4712	216-U-1/216-U-2	10 to 11.5	3	U	1	25	1
C4712LD	216-U-1/216-U-2	10 to 11.5	NA	NA	NA	NA	NA
C4712	216-U-1/216-U-2	30 to 31.5	3	3.63	0.99	34.4	0.99
C4712	216-U-1/216-U-2	35 to 36.5	3	1.13	1	26.5	1
C4712	216-U-1/216-U-2	42 to 43.5	2.4	U	0.81	32.5	0.61
C4713	216-U-1/216-U-2	40 to 1.5	0.69	0.934	0.019	34.6	0.95
C4714	216-U-8	44 to 45.5	0.72	0.279	0.02	27.9	0.99
C4715	216-U-12	44 to 45.5	0.68	0.221	0.019	30.8	0.93
C4716	216-U-8	47.5 to 50.5	0.64	0.237	0.016	25.3	0.88
C4717	216-U-8	1 to 2.5	0.72	2.94	0.02	33.6	0.98
C4717	216-U-8	37 to 38.5	0.72	1.31	0.02	37.5	0.99
C4717	216-U-8	44 to 45.5	0.73	0.642	0.02	35.3	1
C4718	216-U-8	44 to 45.5	0.71	0.28	0.02	26.3	0.98
C4719	216-U-8	44 to 45.5	0.73	0.15	0.02	26.6	1
C4720	216-U-8	44 to 45.5	3	U	0.99	29	0.99

Table D-1 All Laboratory Analyses for Soil Samples Continued.

Well	Waste Site	Actual Sample Interval (ft)	Selenium MDL	Thallium (mg/kg) PRG=1.59	Thallium MDL	Strontium (mg/kg) PRG=2920	Strontium MDL
C4721	216-U-8	42 to 43.5	2.8	U	0.95	27.6	0.95
C4722	216-U-8	43 to 44.5	2.9	U	0.95	29.5	0.95
C4723	216-U-12	44 to 45.5	0.56	0.149	0.016	33.6	0.77
C4724	216-U-12	44 to 45.5	0.68	0.139	0.019	35.8	0.94
C4725	216-U-12	44 to 45.5	0.56	0.102	0.015	46.5	0.77
C4726	216-U-12	41 to 42.5	0.7	0.122	0.019	40	0.96
C4727	216-U-12	44 to 45.5	0.7	0.0711	0.019	31.6	0.96
C4728	216-U-8	48 to 49.7	0.53	0.144	0.015	53.7	0.73
C4729	216-U-12	44 to 45.5	0.72	0.0798	0.02	34.9	0.99
C4730	216-U-12	18 to 19.5	0.69	0.108	0.019	26.3	0.95
C4730	216-U-12	38 to 39.5	0.73	0.133	0.02	38.7	1
C4730	216-U-12	44 to 45.5	0.71	0.114	0.02	37.9	0.97

Table D-2. Waste Designation Samples.

Well	Waste Site	Actual Sample Interval (ft)	4-Nitrophenol (ug/kg)	4-Nitrophenol (ug/kg) MDL	1,4-Dichlorobenzene (ug/kg)	1,4-Dichlorobenzene (ug/kg) MDL	Phenol (ug/kg)	Phenol (ug/kg) MDL	1,2,4-Trichlorobenzene (ug/kg)	1,2,4-Trichlorobenzene (ug/kg) MDL	2,4-Dinitrotoluene (ug/kg)	2,4-Dinitrotoluene (ug/kg) MDL	Pyrene (ug/kg)	Pyrene (ug/kg) MDL
C4710WD	216-U-1/216-U-2	44.5 to 46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4710	216-U-1/216-U-2	44.5	U	90	U	140	U	72	U	95	U	56	U	81
C4722LDWD	216-U-8	43 to 44.5	U	89	U	140	U	71	U	94	U	56	U	80
C4726WD	216-U-12	41 to 42.5	U	96	U	150	U	77	U	100	U	61	U	87
			4-Chloro-3-methyphenol (ug/kg)	4-Chloro-3-methyphenol (ug/kg) MDL	N-Nitrosodi-n-dipropylamine (ug/kg)	N-Nitrosodi-n-dipropylamine (ug/kg) MDL	Acenaphthene (ug/kg)	Acenaphthene (ug/kg) MDL	Pentachlorophenol (ug/kg)	Pentachlorophenol (ug/kg) MDL	2-Chlorophenol (ug/kg)	2-Chlorophenol (ug/kg)	Di-n-butylphthalate (ug/kg)	Di-n-butylphthalate (ug/kg) MDL
C4710	216-U-1/216-U-2	44.5 to 46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4710	216-U-1/216-U-2	44.5	U	49	U	78	U	72	U	76	U	79	330	170
C4722	216-U-8	43 to 44.5	U	48	U	77	U	71	U	75	U	78	190	170
C4726	216-U-12	41 to 42.5	U	52	U	84	U	77	U	81	U	85	U	180

Table D-2. Waste Designation Samples.

Well	Waste Site	Actual Sample Interval (ft)	1,1-Dichloroethene (ug/kg)	1,1-Dichloroethene (ug/kg) MDL	Trichloroethene (ug/kg)	Trichloroethene (ug/kg) MDL	Benzene (ug/kg)	Benzene (ug/kg) MDL	Toluene (ug/kg)	Toluene (ug/kg) MDL	Chlorobenzene (ug/kg)	Chlorobenzene (ug/kg) MDL	Tetrachloroethene (ug/kg)	Tetrachloroethene (ug/kg) MDL
C4710	216-U-1/216-U-2	44 to 5-46	U	2	U	2	U	2	U	2	U	2	U	2
C4722	216-U-8	43 to 44.5	U	5.2	U	5.2	U	5.2	U	5.2	U	5.2	U	5.2
C4726	216-U-12	41 to 42.5	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2
			Acetone (ug/kg)	Acetone (ug/kg) MDL	Bromomethane (ug/kg)	Bromomethane (ug/kg) MDL	Chloromethane (ug/kg)	Chloromethane (ug/kg) MDL	Methylenchloride (ug/kg)	Methylenchloride (ug/kg) MDL				
C4710	216-U-1/216-U-2	44.5 to 46	U	2	U	2	U	2	U	2				
C4722	216-U-8	43 to 44.5	U	5.2	U	5.2	U	5.2	U	5.2				
C4726	216-U-12	41 to 42.5	U	2.2	U	2.2	U	2.2	U	2.2				

Note: Soil Samples collected and analyzed per SAP (DOE/RL-2003-51, Rev 0).
LD=Laboratory Duplicate
SD=Sampler Duplicate
BD=Blind Duplicate
WD=Waste Designation sample

Table D-3. Reference Information for Laboratory Analyses of Soil Samples

Well	Waste Site	Sample Date collected	Sample Time collected	Report # for alpha, beta, and gamma scan	Activity Sample ID	Actual Sample Interval (ft)	Analysis Date	SDG#	Severn Trent-Richland sample (Tc-99 and Isotopic U)	SDG #	Severn Trent-STL sample (Nitrate and moisture)	SDG#	ICP Metals Sample
C4705	216-U-1/216-U-2	02/28/2005	1300	WSCF20050469	B1CDF1	44 to 45.5	03/01/2005	W04569	B1CDH3	W04569	B1CDJ5	WSCF20050470	B1CDB3
C4706	216-U-1/216-U-2	02/28/2005	930	WSCF20050461	B1CDF0	42 to 43.5	03/01/2005	W04569	B1CDH2	W04569	B1CDJ4	WSCF20050464	B1CDB2
C4707	216-U-1/216-U-2	03/02/2005	1530	WSCF20050502	B1CDD9	44 to 45.5	03/03/2005	W04569	B1CDH1	W04524	B1CDJ3	WSCF20050503	B1CDB1
C4708	216-U-1/216-U-2	03/02/2005	1240	WSCF20050502	B1CDD8	44 to 45.5	03/03/2005	W04569	B1CDH0	W04524	B1CDJ2	WSCF20050503	B1CDB0
C4709	216-U-1/216-U-2	03/02/2005	1000	WSCF20050502	B1CDD7	46.5 to 48	03/03/2005	W04569	B1CDF9	W04524	B1CDJ1	WSCF20050503	B1CD99
C4710	216-U-1/216-U-2	02/24/2005	1330	WSCF20050456	B1CDD4	44.5 to 46	03/01/2005	W04569	B1CDF6	W04569	B1CDH8	WSCF20050458	B1CD96
C4711	216-U-1/216-U-2	02/28/2005	1610	WSCF20050483	B1CDD6	44 to 45.5	03/02/2005	W04569	B1CDF8	W04569	B1CDJ0	WSCF20050482	B1CD98

Table D-3. Reference Information for Laboratory Analyses of Soil Samples

Well.	Waste Site	Sample Date collected	Sample Time collected	Report # for alpha, beta, and gamma scan	Activity Sample ID	Actual Sample Interval (ft)	Analysis Date	SDG#	Severn Trent-Richland sample (Tc-99 and Isotopic U)	SDG #	Severn Trent-STL sample (Nitrate and moisture)	SDG#	ICP Metals Sample
C4712	216-U-1/216-U-2	03/01/2005	850	WSCF20050483	B1CDD0	10 to 11.5	03/02/2005	W04569	B1CDF2	W04569	B1CDH4	WSCF20050482	B1CD92
C4712	216-U-1/216-U-2	03/01/2005	950	WSCF20050483	B1CDD1	30 to 31.5	03/02/2005	W04569	B1CDF3	W04569	B1CDH5	WSCF20050482	B1CD93
C4712	216-U-1/216-U-2	03/01/2005	1030	WSCF20050483	B1CDD2	35 to 36.5	03/02/2005	W04569	B1CDF4	W04569	B1CDH6	WSCF20050482	B1CD94
C4712	216-U-1/216-U-2	03/01/2005	1110	WSCF20050483	B1CDD3	42 to 43.5	03/02/2005	W04569	B1CDF5	W04569	B1CDH7	WSCF20050482	B1CD95
C4713	216-U-1/216-U-2	02/25/2005	940	WSCF20050461	B1CDD5	40 to 41.5	03/01/2005	W04569	B1CDF7	W04569	B1CDH9	WSCF20050464	B1CD97
C4714	216-U-8	03/08/2005	1215	WSCF20050552	B1CF51	44 to 45.5	03/10/2005	W04589	B1CF64	W04589	B1CF75	WSCF20050554	B1CF40
C4715	216-U-8	03/09/2005	1430	WSCF20050557	B1CF52	44 to 45.5	03/10/2005	W04589	B1CF65	W04589	B1CF76	WSCF20050558	B1CF41
C4716	216-U-8	03/15/2005	1015	WSCF20050590	B1CF61	47.5 to 50.5	03/16/2005	W04597	B1CF74	W04597	B1CF85	WSCF20050592	B1CF50
C4717	216-U-8	03/09/2005	820	WSCF20050552	B1CF54	1 to 2.5	03/10/2005	W04589	B1CF67	W04589	B1CF78	WSCF20050554	B1CF43
C4717	216-U-8	03/09/2005	905	WSCF20050552	B1CF55	37 to 38.5	03/10/2005	W04589	B1CF68	W04589	B1CF79	WSCF20050554	B1CF44
C4717	216-U-8	03/09/2005	930	WSCF20050552	B1CF56	44 to 45.5	03/10/2005	W04589	B1CF69	W04589	B1CF80	WSCF20050554	B1CF45
C4718	216-U-8	03/08/2005	1530	WSCF20050552	B1CF57	44 to 45.5	03/10/2005	W04589	B1CF70	W04589	B1CF81	WSCF20050554	B1CF46
C4719	216-U-8	03/09/2005	1207	WSCF20050557	B1CF58	44 to 45.5	03/10/2005	W04589	B1CF71	W04589	B1CF82	WSCF20050558	B1CF47
C4720	216-U-8	03/03/2005	1100	WSCF20050511	B1CF59	44 to 45.5	03/07/2005	W04569	B1CF72	W04524	B1CF83	WSCF20050512	B1CF48
C4721	216-U-8	03/03/2005	1350	WSCF20050511	B1CF60	42 to 43.5	03/07/2005	W04569	B1CF73	W04524	B1CF84	WSCF20050512	B1CF49
C4722	216-U-8	03/04/2005	820	WSCF20050515	B1CF53	43 to 44.5	03/07/2005	W04578	B1CF66	W04524	B1CF77	WSCF20050516	B1CF42
C4723	216-U-12	03/11/2005	1430	WSCF20050568	B1CFB1	44 to 45.5	03/15/2005	W04589	B1CFC3	W04589	B1CFC3	WSCF20050569	B1CF89
C4724	216-U-12	03/11/2005	910	WSCF20050568	B1CFB2	44 to 45.5	03/15/2005	W04589	B1CFC4	W04589	B1CFC4	WSCF20050569	B1CF90
C4725	216-U-12	03/11/2005	1210	WSCF20050568	B1CFB3	44 to 45.5	03/15/2005	W04589	B1CFC5	W04589	B1CFC5	WSCF20050569	B1CF91
C4726	216-U-12	03/14/2005	1045	WSCF20050573	B1CFB4	41 to 42.5	03/15/2005	W04589	B1CFC6	W04589	B1CFC6	WSCF20050574	B1CF92
C4727	216-U-12	03/14/2005	1300	WSCF20050573	B1CFB5	44 to 45.5	03/15/2005	W04589	B1CFC7	W04589	B1CFC7	WSCF20050574	B1CF93
C4728	216-U-12	03/10/2005	920	WSCF20050568	B1CFB6	48 to 49.7	03/15/2005	W04589	B1CFC8	W04589	B1CFC8	WSCF20050569	B1CF94
C4729	216-U-12	03/10/2005	1231	WSCF20050568	B1CFB7	44 to 45.5	03/15/2005	W04589	B1CFC9	W04589	B1CFC9	WSCF20050569	B1CF95
C4730	216-U-12	03/10/2005	1450	WSCF20050568	B1CFB8	18 to 19.5	03/15/2005	W04589	B1CFD0	W04589	B1CFD0	WSCF20050569	B1CF96
C4730	216-U-12	03/10/2005	1535	WSCF20050568	B1CFB9	38 to 39.5	03/15/2005	W04589	B1CFD1	W04589	B1CFD1	WSCF20050569	B1CF97
C4730	216-U-12	03/10/2005	1600	WSCF20050568	B1CFC0	44 to 45.5	03/15/2005	W04589	B1CFD2	W04589	B1CFD2	WSCF20050569	B1CF98

Table D-4. Splits and Duplicates Information

Well	Waste Site	Sample Date collected	Sample Time collected	Report #	Activity Sample ID	Actual Sample Interval (ft)	Analysis Date	Type	SDG#	Type	Severn Trent-Richland sample (Tc-99 and Isotopic U)	SDG #	Type	Severn Trent-STL sample (Nitrate and moisture)	SDG#	Type	ICP Metals
C4708	216-U-1/216-U-2	03/02/2005	1240	NA	NA	44 to 45.5	NA	NA	NA	NA	NA	W04524	Lab dup	B1CDJ2 Dup	NA	NA	NA
C4709	216-U-1/216-U-2	03/02/2005	1000	WSC F20050502	B1CF37	46.5 to 48	03/03/2005	Dup - sampler	W04569	Dup - sampler	B1CF38	W04524	Dup - sampler	B1CF39	WSCF20050503	Dup - sampler	B1CF36
C4709	216-U-1/216-U-2	03/02/2005	1000	NA	NA	46.5 to 48	NA	NA	W04569	Lab dup	B1CDF9 Dup	NA	NA	NA	NA	NA	NA
C4710	216-U-1/216-U-2	02/24/2005	1330	NA	NA	44.5 to 46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4712	216-U-1/216-U-2	03/01/2005	850	NA	NA	10 to 11.5	NA	NA	NA	NA	NA	W04569	Lab dup	B1CDH4 Dup	NA	NA	NA
C4714	216-U-8	03/08/2005	1215	NA	NA	44 to 45.5	NA	NA	W04589	Lab dup	B1CF64 Dup	NA	NA	NA	NA	NA	NA
C4715	216-U-8	03/09/2005	1430	NA	NA	44 to 45.5	NA	NA	W04589	Blind dup	B1CF87	W04589	Blind dup	B1CF88	WSCF20050558	Blind dup	B1CF86
C4715	216-U-8	03/09/2005	1430	NA	NA	44 to 45.5	NA	NA	W04589	Lab dup	B1CF65 Dup	NA	NA	NA	NA	NA	NA
C4716	216-U-8	03/15/2005	1015	NA	NA	47.5 to 50.5	NA	NA	W04597	Lab dup	B1CF74 Dup	W04597	Lab dup	B1CF85 dup	NA	NA	NA
C4720	216-U-8	03/03/2005	1100	NA	NA	44 to 45.5	NA	NA	W04569	Lab dup	B1CF72 Dup	NA	NA	NA	NA	NA	NA
C4722	216-U-8	03/04/2005	820	NA	NA	43 to 44.5	NA	NA	W04578	Lab dup	B1CF66 Dup	NA	NA	NA	NA	NA	NA
C4726	216-U-12	03/14/2005	1045	NA	NA	41 to 42.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C4728	216-U-12	03/10/2005	920	NA	NA	48 to 49.7	NA	NA	W04589	Dup - sampler	B1CFD3	W04589	Dup - sampler	B1CFC8	WSCF20050569	Dup - sampler	B1CF99

Well	Waste Site	Sample Date collected	Sample Time collected	SDG	VOA/SemiVOA sample
C4710	216-U-1/216-U-2	02/24/2005	1330	WSCF20050458	B1CDJ6
C4710	216-U-1/216-U-2	05/12/2005	940	WSCF20051044	B1D2P7
C4722	216-U-8	03/04/2005	820	WSCF20050562	B1CF62
C4726	216-U-12	03/14/2005	1045	WSCF20050575	B1CFC2

APPENDIX E

MODELING DATA

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This appendix contains conversion factors, assumptions, and the investigation data used to develop the contaminants distribution profiles to support modeling of the fate and transport of vadose zone contaminants of concerns at the 216-U-1/216-U-2, 216-U-8, and 216-U-12 sites. Sources used to create the modeling data set included spectral gamma logging of existing wells, soil sample analyses in the Hanford Environmental Information System (HEIS) database, spectral logging of direct push technology (DPT) borings, and auger sample data.

Key steps and assumptions in the process included:

- Verifying that the values in the HEIS database were correct by comparing the original analytical reports with the database
- Converting Tc-99 values from ug/g to pCi/g. Some Tc-99 values were reported by the laboratory as ug/g but the HEIS database reported the values as pCi/g. The laboratory values needed to be converted to pCi/g for use in the models, so a conversion factor was used (1 ug/g Tc-99 is equivalent to 16,960 pCi/g Tc-99)
- Evaluating new spectral gamma log data from existing wells and the DPT borings and using the data when above detection limits
- Converting spectral gamma log data values for U-238 (pCi/g) to total uranium (mg/Kg) for use in the models (1 pCi/g U-238 is equivalent to 2.98 mg/kg uranium)
- Converting sample depths in feet to elevations in meters referenced to the North American Vertical Datum of 1988 (NAVD88) (1 foot is equivalent to 0.3048 meter)
- Evaluating different analytical values for each sample interval (including reruns and duplicates) and using the highest value for modeling purposes
- Computing major lithologic contact elevations for use in modeling.

The letter explaining the conversion factor used to convert spectral gamma U-238 values in pCi/g to total uranium in mg/Kg is presented here.

From: Rick McCain [mailto:rick.mccain@gjo.doe.gov]
Sent: Wednesday, April 27, 2005 3:52 PM
To: Galgoul, Michael J
Subject: RE: U-238 conversion to Uranium mg/kg

Mike;

1 pCi/g U-238 is equivalent to 2.98 mg/Kg concentration. The attached file shows how this is derived.

Rick

-----Original Message-----
From: Galgoul, Michael J [mailto:Michael_J_Galgoul@RL.gov]
Sent: Wednesday, April 27, 2005 2:33 PM
To: rick.mccain@gjo.doe.gov
Subject: U-238 conversion to Uranium mg/kg

Rick, Do you have a rule of thumb for estimating the total uranium in mg/kg based on the SGLS values of U-238? If you do,is there a reference to a document where it was used? I would like to use it for the U-8 and U-12 SGLS Data. I have tried ratios of our sample data but I get no consistent results.

THANKS,
MICHAEL
(509) 372-9590

Conversion of activity to concentration for uranium:

Specific activity:

$$S_A = \lambda \times \frac{N_A}{A}\left(\frac{dps}{g}\right) = \frac{\ln(2)}{T_{1/2}(y)} \times \frac{6.022E23}{A} \times \frac{1}{3.7E10}\left(\frac{Ci}{dps}\right) \times \frac{1}{60 \times 60 \times 24}\left(\frac{d}{s}\right) \times \frac{1}{365.25}\left(\frac{y}{d}\right)$$

$$S_A = \frac{3.575E5}{T_{1/2} \times A}(Ci/g) \quad \text{for } T_{1/2} \text{ in years}$$

For ^{238}U, A = 238 & $T_{1/2}$ = 4.47E9 years: S_a = 3.36E-7 Ci/g = 3.36E5 pCi/g

$$1\left[\frac{pCi}{g}\right] \times \left(\frac{1}{3.36E5}\right)\left[\frac{g}{pCi}\right] \times 1000\left[\frac{mg}{g}\right] \times 1000\left[\frac{g}{Kg}\right] = 2.98\left[\frac{mg}{Kg}(ppm)\right]$$

Table E-1. Data Compiled for Modeling 216-U-1/216-U-2 Crib.

Borehole	Waste Site	Actual Sample Interval (ft bgs)	Actual Sample Interval top (ft bgs)	Actual Sample Interval bottom (ft bgs)	Actual Sample Interval midpoint (ft bgs)	Easting (m NAD83(91))	Northing (m NAD83(91))	Elevation (m NAVD88)	Actual Sample Interval top (m NAVD88)	Actual Sample Interval bottom (m NAVD88)	Actual Sample Interval midpoint (m NAVD88)	Tc-99 (pCi/g) PRG=1 pCi/g	Tc-99 (pCi/g) MDC/MDA	Uranium (mg/kg) PRG=3.2 mg/kg	Uranium MDL
C4705	216-U-1/216-U-2	44 to 45.5	44.0	45.5	44.8	567327.41	135003.85	213.57	200.16	199.70	199.93	U	0.642	U	0.94
C4706	216-U-1/216-U-2	42 to 43.5	42.0	43.5	42.8	567307.76	135000.08	212.96	200.16	199.70	199.93	U	0.612	2.86	0.15
C4707	216-U-1/216-U-2	44 to 45.5	44.0	45.5	44.8	567306.52	134942.74	212.19	198.78	198.32	198.55	U	0.648	U	0.97
C4708	216-U-1/216-U-2	44 to 45.5	44.0	45.5	44.8	567268.38	134943.06	211.98	198.57	198.11	198.34	U	0.612	U	0.93
C4709	216-U-1/216-U-2	46.5 to 48	46.5	48.0	47.3	567226.11	134942.76	211.45	197.28	196.82	197.05	U	0.642	U	0.99
C4710	216-U-1/216-U-2	44.5 to 46	44.5	46.0	45.3	567226.02	135003.34	212.09	198.53	198.07	198.30	U	0.642	3.9	0.16
C4711	216-U-1/216-U-2	44 to 45.5	44.0	45.5	44.8	567175.20	135002.52	211.48	198.07	197.61	197.84	U	0.585	U	0.92
C4712	216-U-1/216-U-2	10 to 11.5	10.0	11.5	10.8	567226.33	135029.57	212.01	208.96	208.50	208.73	U	0.642	1.61	1
C4712	216-U-1/216-U-2	30 to 31.5	30.0	31.5	30.8	567226.33	135029.57	212.01	202.87	202.41	202.64	U	0.642	U	0.99
C4712	216-U-1/216-U-2	35 to 36.5	35.0	36.5	35.8	567226.33	135029.57	212.01	201.34	200.88	201.11	U	0.612	U	1
C4712	216-U-1/216-U-2	42 to 43.5	42.0	43.5	42.8	567226.33	135029.57	212.01	199.21	198.75	198.98	U	0.587	U	0.81
C4713	216-U-1/216-U-2	40 to 41.5	40.0	41.5	40.8	567273.63	135029.01	212.80	200.61	200.15	200.38	U	0.584	2.56	0.15
A7791 (299-W19-95)	216-U-1/216-U-2	4 to 6	4	6	5.0	567275.32	134937.83	212.17	210.95	210.34	210.65	U	0.3	2.1	0.04
		14.5 to 16.5	14.5	16.5	15.5	567275.32			207.75	207.14	207.45	U	1	2.2	0.04
		30 to 32.5	30	32.5	31.3	567275.32			203.03	202.26	202.65	U	0.2	1.8	0.03
		45 to 47.5	45	47.5	46.3	567275.32			198.45	197.69	198.07	U	0.3	1.6	0.03
A9797 (299-W19-96)	216-U-1/216-U-2	4 to 6	4	6	5.0	567263.16	135003.79	212.79	211.57	210.96	211.27	U	0.4	2	0.03
		15 to 17	15	17	16.0	567263.16			208.22	207.61	207.91	12.72	NR	U	NR
		22 to 24	22	24	23.0	567263.16			206.08	205.47	205.78	49.01	NR	9140	NR
		24.5 to 27	24.5	27	25.8	567263.16			205.32	204.56	204.94	32.90	NR	15300	NR
		27 to 29.5	27	29.5	28.3	567263.16			204.56	203.80	204.18	98.54	NR	32700	NR
		29.5 to 32	29.5	32	30.8	567263.16			203.80	203.04	203.42	106.85	NR	16400	NR
		40.5 to 42.5	40.5	42.5	41.5	567263.16			200.44	199.84	200.14	350	1	4300	2

Table E-1. Data Compiled for Modeling 216-U-1/216-U-2 Crib.

Borehole	Waste Site	Actual Sample Interval (ft bgs)	Actual Sample Interval top (ft bgs)	Actual Sample Interval bottom (ft bgs)	Actual Sample Interval midpoint (ft bgs)	Easting (m NAD83(91))	Northing (m NAD83(91))	Elevation (m NAVD88)	Actual Sample Interval top (m NAVD88)	Actual Sample Interval bottom (m NAVD88)	Actual Sample Interval midpoint (m NAVD88)	Tc-99 (pCi/g) PRG=1 pCi/g	Tc-99 (pCi/g) MDC/MDA	Uranium (mg/kg) PRG=3.2 mg/kg	Uranium MDL
		50 to 52	50	52	51.0	567263.16			197.55	196.94	197.24	6.4	0.3	23	0.2
A7792 (299-W19-97)	216-U-1/216-U-2	4 to 6	4	6	5.0	567283.78	135044.06	212.81	211.59	210.98	211.29	U	0.2	2	0.03
		10 to 12.5	10	12.5	11.3	567283.78			209.76	209.00	209.38	0.43	0.3	1.6	0.03
		20 to 22.5	20	22.5	21.3	567283.78			206.71	205.95	206.33	U	0.2	1.4	0.03
		30 to 32	30	32	31.0	567283.78			203.67	203.06	203.36	U	0.3	1.5	0.03
		50 to 52.5	50	52.5	51.3	567283.78			197.57	196.81	197.19	0.21	0.1	1.1	0.03

Table E-1. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points)

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
C4201	216-U-1/216-U-2	567264.84	135011.59	212.96	44.5	199.40	150.9
C4201	216-U-1/216-U-2	567264.84	135011.59	212.96	43.5	199.70	462.4
C4201	216-U-1/216-U-2	567264.84	135011.59	212.96	42.5	200.01	141.4
C4201	216-U-1/216-U-2	567264.84	135011.59	212.96	41.5	200.31	376.6
C4201	216-U-1/216-U-2	567264.84	135011.59	212.96	39.5	200.92	438.5
C4201	216-U-1/216-U-2	567264.84	135011.59	212.96	38.5	201.23	178.0
C4201	216-U-1/216-U-2	567264.84	135011.59	212.96	36.5	201.84	95.3
C4201	216-U-1/216-U-2	567264.84	135011.59	212.96	35.5	202.14	65.1
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	46.0	198.13	100.6
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	45.0	198.44	100.6
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	44.0	198.74	77.2
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	40.0	199.96	196.2
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	39.0	200.27	355.3
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	38.0	200.57	1158.3
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	36.0	201.18	188.3
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	35.0	201.49	68.9
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	34.0	201.79	90.4
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	33.0	202.10	59.8

Table E-1. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points)

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	32.0	202.40	304.6
C4203	216-U-1/216-U-2	567265.105	134988.833	212.154	31.0	202.71	94.7
C4204	216-U-1/216-U-2	567233.66	135001.49	212.37	46	198.34	79.4
C4204	216-U-1/216-U-2	567233.66	135001.49	212.37	26	204.44	101.7
C4204	216-U-1/216-U-2	567233.66	135001.49	212.37	44	198.95	81.0
C4204	216-U-1/216-U-2	567233.66	135001.49	212.37	43	199.26	79.4
C4205	216-U-1/216-U-2	567265.55	135017.96	212.91	42.5	199.96	100.9
C4205	216-U-1/216-U-2	567265.55	135017.96	212.91	41.5	200.26	65.3
C4207	216-U-1/216-U-2	567264.06	134985.18	212.13	42.5	199.18	74.7
C4207	216-U-1/216-U-2	567264.06	134985.18	212.13	41.5	199.48	95.3
C4207	216-U-1/216-U-2	567264.06	134985.18	212.13	31.5	202.53	71.5
C4548	216-U-1/216-U-2	567264.38	134975.31	212.01	53	195.86	154.9
C4548	216-U-1/216-U-2	567264.38	134975.31	212.01	52	196.16	90.9
A4947 (299-W19-15)	216-U-1/216-U-2	567254.25	134975.78	211.98	59	193.99	55.78
A4947 (299-W19-15)	216-U-1/216-U-2	567254.25	134975.78	211.98	71	190.34	70.66
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	13	211.99	164.5
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	37	204.67	62851.8
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	38	204.37	70390.1
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	39	204.06	74130.3
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	40	203.76	80049.5
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	41	203.45	74584.6
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	42	203.15	36198.2
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	43	202.84	46946.3
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	44	202.54	27066.5
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	45	202.23	5765.2

Table E-1. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points)

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	46	201.93	4665.8
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	47	201.62	3888.1
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	48	201.32	3057.6
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	49	201.01	4025.4
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	50	200.71	2909.0
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	55	199.19	603.7
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	56	198.88	232.7
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	57	198.58	107.1
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	58	198.27	66.8
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	59	197.97	106.0
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	60	197.66	96.8
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	61	197.36	103.7
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	62	197.05	65.7
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	63	196.75	39.2
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	65	196.14	69.1
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	66	195.83	40.3
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	67	195.53	43.8
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	69	194.92	65.7
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	70	194.61	117.5
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	71	194.31	100.2

Table E-1. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points)

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	72	194.00	40.3
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	73	193.70	57.6
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	74	193.39	42.6
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	54.67	199.29	603.7
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	54	199.49	1368.7
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	53	199.80	4568.7
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	52	200.10	3183.2
A7772 (299-W19-72)	216-U-1/216-U-2	567265.77	135001.90	215.95	51	200.41	2873.3
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	43	202.84	261.5
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	44	202.54	137.1
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	45	202.23	110.6
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	46	201.93	85.3
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	47	201.62	87.6
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	48	201.32	61.1
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	49	201.01	40.3
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	50	200.71	47.2
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	51	200.41	61.1
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	52	200.10	68.0
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	53	199.80	56.5
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	54	199.49	47.2

Table E-1. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points)

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	55	199.19	53.0
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	56	198.88	70.3
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	57	198.58	91.0
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	58	198.27	35.7
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	59	197.97	47.2
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	64	196.44	44.9
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	68	195.22	44.9
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	70	194.61	36.9
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	71	194.31	43.8
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	72	194.00	59.9
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	73	193.70	39.2
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	74	193.39	46.1
A7773 (299-W19-73)	216-U-1/216-U-2	567242.92	135001.83	215.95	75	193.09	38.0

Table E-2. Data Compiled for Modeling 216-U-8 Crib.

Borehole	Waste Site	Actual Sample Interval (ft bgs)	Actual Sample Interval top (ft bgs)	Actual Sample Interval bottom (ft bgs)	Actual Sample Interval midpoint (ft bgs)	Easting (m NAD83(91))	Northing (m NAD83(91))	Elevation (m NAVD88)	Actual Sample Interval top (m NAVD88)	Actual Sample Interval bottom (m NAVD88)	Actual Sample Interval midpoint (m NAVD88)	Tc-99 (pCi/g) PRG=1 pCi/g	Tc-99 (pCi/g) MDC/MDA	Nitrate/nitrite as Nitrogen (mg/kg) PRG=40 mg/kg	N (mg/kg) RL	Uranium (mg/kg) PRG=3.2	Uranium MDL
C4714	216-U-8	44 to 45.5	44.0	45.5	44.8	567738.10	134673.27	212.80	199.39	198.93	199.16	U	0.663	11	0.5	0.724	0.16
C4716	216-U-8	47.5 to 50.5	47.5	50.5	49.0	567638.48	134647.00	211.72	197.24	196.33	196.78	U	0.614	8	0.5	21.9	0.083
C4717	216-U-8	1 to 2.5	1.0	2.5	1.8	567581.43	134672.85	212.00	211.70	211.24	211.47	U	0.652	3.4	0.5	1.34	0.16
C4717	216-U-8	37 to 38.5	37.0	38.5	37.8	567581.43	134672.85	212.00	200.72	200.27	200.49	U	0.653	45.4	1	3.2	0.16

Table E-2. Data Compiled for Modeling 216-U-8 Crib.

Borehole	Waste Site	Actual Sample Interval (ft bgs)	Actual Sample Interval top (ft bgs)	Actual Sample Interval bottom (ft bgs)	Actual Sample Interval midpoint (ft bgs)	Easting (m NAD83(91))	Northing (m NAD83(91))	Elevation (m NAVD88)	Actual Sample Interval top (m NAVD88)	Actual Sample Interval bottom (m NAVD88)	Actual Sample Interval midpoint (m NAVD88)	Tc-99 (pCi/g) PRG=1 pCi/g	Tc-99 (pCi/g) MDC/MDA	Nitrate/nitrite as Nitrogen (mg/kg) PRG=40 mg/kg	N (mg/kg) RL	Uranium (mg/kg) PRG=3.2	Uranium MDL
C4717	216-U-8	44 to 45.5	44.0	45.5	44.8	567581.43	134672.85	212.00	198.59	198.13	198.36	U	0.653	150	2	7.74	0.16
C4718	216-U-8	44 to 45.5	44.0	45.5	44.8	567517.65	134673.09	211.43	198.02	197.56	197.79	U	0.655	3.4	0.5	0.416	0.16
C4719	216-U-8	44 to 45.5	44.0	45.5	44.8	567581.30	134731.43	212.34	198.93	198.47	198.70	U	0.648	7.2	0.5	0.475	0.16
C4720	216-U-8	44 to 45.5	44.0	45.5	44.8	567636.50	134795.88	212.66	199.25	198.79	199.02	U	0.647	25.7	2	U	0.99
C4721	216-U-8	42 to 43.5	42.0	43.5	42.8	567636.68	134731.51	212.24	199.44	198.98	199.21	U	0.613	59.2	5	3.19	0.95
C4722	216-U-8	43 to 44.5	43.0	44.5	43.8	567638.30	134672.59	211.86	198.75	198.30	198.53	U	0.658	6.7	0.5	17.3	0.95
C4728	216-U-8	48 to 49.7	48.0	49.7	48.9	567606.03	134622.84	211.83	197.20	196.68	196.94	U	0.627	366	10	6.01	0.15
299-W19-94	216-U-8	4 to 6	4	6	5.0	567614.16	134706.8	212.313	211.09	210.48	210.79	U	0.03	7.08	NA	1.5	NA
299-W19-94	216-U-8	15.5 to 17.5	15.5	17.5	16.5	567614.16	134706.8	212.313	207.59	206.98	207.28	U	0.083	12.8	NA	1.3	NA
299-W19-94	216-U-8	28 to 30	28	30	29.0	567614.16	134706.8	212.313	203.78	203.17	203.47	U	0.039	NA	NA	2.2	NA
299-W19-94	216-U-8	30 to 32	30	32	31.0	567614.16	134706.8	212.313	203.17	202.56	202.86	19.84	NA	NA	NA	216	NA
299-W19-94	216-U-8	33.5 to 36	33.5	36	34.8	567614.16	134706.8	212.313	202.10	201.34	201.72	3.46	NA	128	NA	206	NA
299-W19-94	216-U-8	38 to 40	38	40	39.0	567614.16	134706.8	212.313	200.73	200.12	200.43	U	0.85	261	NA	88	NA
299-W19-94	216-U-8	48 to 50	48	50	49.0	567614.16	134706.8	212.313	197.68	197.07	197.38	U	0.19	56.8	NA	13	NA
299-W19-94	216-U-8	57.5 to 59.5	57.5	59.5	58.5	567614.16	134706.8	212.313	194.79	194.18	194.48	U	0.29	128	NA	18	NA
C4715	216-U-12	44 to 45.5	44.0	45.5	44.8	567636.06	134576.03	211.37	197.96	197.50	197.73	U	0.664	11	0.5	0.838	0.15

Table E-2. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points.

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
C4219	216-U-8	567612.35	134672.85	212.86	45.5	198.99	499.4
C4219	216-U-8	567612.35	134672.85	212.86	44.5	199.30	844.1
C4219	216-U-8	567612.35	134672.85	212.86	43.5	199.60	9349.6
C4219	216-U-8	567612.35	134672.85	212.86	42.5	199.91	2593.2

Table E-2. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points.

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
C4219	216-U-8	567612.35	134672.85	212.86	41.5	200.21	3360.2
C4219	216-U-8	567612.35	134672.85	212.86	40.5	200.52	5391.5
C4223	216-U-8	567612.41	134666.72	212.36	41	199.86	682.8
299-W19-70	216-U-8	567615.85	134697.76	214.469	90.17	186.99	114.8
299-W19-70	216-U-8	567615.85	134697.76	214.469	90	187.04	145.9
299-W19-70	216-U-8	567615.85	134697.76	214.469	89	187.34	107.6
299-W19-70	216-U-8	567615.85	134697.76	214.469	88	187.65	88.5
299-W19-70	216-U-8	567615.85	134697.76	214.469	86	188.26	55.0
299-W19-70	216-U-8	567615.85	134697.76	214.469	84	188.87	64.6
299-W19-70	216-U-8	567615.85	134697.76	214.469	83	189.17	64.6
299-W19-70	216-U-8	567615.85	134697.76	214.469	82	189.48	74.1
299-W19-70	216-U-8	567615.85	134697.76	214.469	80	190.09	117.2
299-W19-70	216-U-8	567615.85	134697.76	214.469	78	190.69	71.8
299-W19-70	216-U-8	567615.85	134697.76	214.469	76	191.30	57.4
299-W19-70	216-U-8	567615.85	134697.76	214.469	74	191.91	53.5
299-W19-70	216-U-8	567615.85	134697.76	214.469	73	192.22	63.7
299-W19-70	216-U-8	567615.85	134697.76	214.469	71	192.83	69.4
299-W19-70	216-U-8	567615.85	134697.76	214.469	70	193.13	81.3
299-W19-70	216-U-8	567615.85	134697.76	214.469	69	193.44	55.0
299-W19-70	216-U-8	567615.85	134697.76	214.469	64	194.96	57.4
299-W19-70	216-U-8	567615.85	134697.76	214.469	63	195.27	47.8
299-W19-70	216-U-8	567615.85	134697.76	214.469	49	199.53	146.4
299-W19-70	216-U-8	567615.85	134697.76	214.469	46	200.45	1922.1
299-W19-70	216-U-8	567615.85	134697.76	214.469	44.99	200.76	4148.3
299-W19-71	216-U-8	567616.01	134679.76	214.516	87.5	187.85	74.1
299-W19-71	216-U-8	567616.01	134679.76	214.516	86.5	188.15	129.2
299-W19-71	216-U-8	567616.01	134679.76	214.516	85.5	188.46	193.7
299-W19-71	216-U-8	567616.01	134679.76	214.516	84.5	188.76	160.3
299-W19-71	216-U-8	567616.01	134679.76	214.516	83.5	189.07	270.3
299-W19-71	216-U-8	567616.01	134679.76	214.516	82.5	189.37	330.1
299-W19-71	216-U-8	567616.01	134679.76	214.516	81.5	189.67	169.8
299-W19-71	216-U-8	567616.01	134679.76	214.516	80.5	189.98	74.1

Table E-2. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points.

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
299-W19-71	216-U-8	567616.01	134679.76	214.516	79.5	190.28	76.5
299-W19-71	216-U-8	567616.01	134679.76	214.516	68.5	193.64	71.8
299-W19-71	216-U-8	567616.01	134679.76	214.516	67.5	193.94	83.7
299-W19-71	216-U-8	567616.01	134679.76	214.516	65.5	194.55	69.4
299-W19-71	216-U-8	567616.01	134679.76	214.516	59.5	196.38	155.5
299-W19-71	216-U-8	567616.01	134679.76	214.516	58.5	196.69	102.9
299-W19-71	216-U-8	567616.01	134679.76	214.516	57.5	196.99	342.0
299-W19-71	216-U-8	567616.01	134679.76	214.516	56.5	197.29	700.8
299-W19-71	216-U-8	567616.01	134679.76	214.516	55.5	197.60	83.7
299-W19-71	216-U-8	567616.01	134679.76	214.516	54.5	197.90	191.3
299-W19-71	216-U-8	567616.01	134679.76	214.516	53.5	198.21	147.8
299-W19-71	216-U-8	567616.01	134679.76	214.516	52.5	198.51	255.2
299-W19-71	216-U-8	567616.01	134679.76	214.516	51.5	198.82	449.5
299-W19-71	216-U-8	567616.01	134679.76	214.516	47.5	200.04	370.9
299-W19-71	216-U-8	567616.01	134679.76	214.516	46.5	200.34	548.0
C4217	216-U-8	567626.076	134725.399	212.523	34.5	202.01	131.2
C4217	216-U-8	567626.076	134725.399	212.523	33.5	202.31	1018.8
C4217	216-U-8	567626.076	134725.399	212.523	32.5	202.62	116.6
C4217	216-U-8	567626.076	134725.399	212.523	31.5	202.92	102.0
C4218	216-U-8	567632.196	134698.910	212.263	37.5	200.83	102.0
C4224	216-U-8	567593.278	134702.322	212.493	50.5	197.10	54.0
C4547	216-U-8	567599.255	134701.943	212.365	35.5	201.54	94.7
C4547	216-U-8	567599.255	134701.943	212.365	34.5	201.85	466.5
C4553	216-U-8	567636.668	134646.969	211.635	48.0	197.00	49.4
C4553	216-U-8	567636.668	134646.969	211.635	46.0	197.61	27.8

Table E-3. Data Compiled for Modeling 216-U-12 Crib.

Borehole	Waste Site	Actual Sample Interval (ft bgs)	Actual Sample Interval top (ft bgs)	Actual Sample Interval bottom (ft bgs)	Actual Sample Interval midpoint (ft bgs)	Easting (m NAD83(91))	Northing (m NAD83(91))	Elevation (m NAVD88)	Actual Sample Interval top (m NAVD88)	Actual Sample Interval bottom (m NAVD88)	Actual Sample Interval midpoint (m NAVD88)	Tc-99 (pCi/g) PRG=1 pCi/g	Tc-99 (pCi/g) MDC/MDA	Nitrate/nitrite as Nitrogen (mg/kg) PRG=40 mg/kg	N (mg/kg) RL	Uranium (mg/kg) PRG=3.2	Uranium MDL
C4715	216-U-12	44-45.5	44.0	45.5	44.8	567636.06	134576.03	211.37	197.96	197.50	197.73	U	0.664	11	0.5	0.838	0.15
C4723	216-U-12	44-45.5	44.0	45.5	44.8	567707.88	134490.24	211.42	198.01	197.55	197.78	U	0.673	5	0.5	0.413	0.12
C4724	216-U-12	44-45.5	44.0	45.5	44.8	567606.09	134470.13	210.83	197.42	196.96	197.19	0.993	0.626	82.9	2	0.501	0.15
C4725	216-U-12	44-45.5	44.0	45.5	44.8	567605.72	134385.16	210.49	197.08	196.62	196.85	U	0.629	3.2	0.5	0.517	0.12
C4726	216-U-12	41-42.5	41.0	42.5	41.8	567556.24	134490.59	210.69	198.19	197.74	197.96	2.36	0.0951	544	10	3.12	0.15
C4727	216-U-12	44-45.5	44.0	45.5	44.8	567470.27	134490.39	210.47	197.06	196.60	196.83	U	0.63	3.7	0.5	0.476	0.15
C4729	216-U-12	44-45.5	44.0	45.5	44.8	567605.36	134538.29	211.20	197.79	197.33	197.56	U	0.625	6.9	0.5	0.399	0.16
C4730	216-U-12	18-19.5	18.0	19.5	18.8	567612.14	134490.27	210.74	205.25	204.80	205.03	U	0.633	U	0.5	0.848	0.15
C4730	216-U-12	38-39.5	38.0	39.5	38.8	567612.14	134490.27	210.74	199.16	198.70	198.93	0.707	0.625	149	2	8.01	0.16
C4730	216-U-12	44-45.5	44.0	45.5	44.8	567612.14	134490.27	210.74	197.33	196.87	197.10	U	0.628	109	0.5	3.63	0.16
299-W22-78	216-U-12	4-6	4.0	6.0	5.0	567606.03	134499.76	210.997	209.78	209.17	209.47	U	0.6	U	2.45	1.7	NA
299-W22-78	216-U-12	9-11	9.0	11.0	10.0	567606.03	134499.76	210.997	208.25	207.64	207.95	U	0.1	U	2.48	1	NA
299-W22-78	216-U-12	21-23	21.0	23.0	22.0	567606.03	134499.76	210.997	204.60	203.99	204.29	U	0.3	12.3	NA	2.9	NA
299-W22-78	216-U-12	38-40.6	38.0	40.6	39.3	567606.03	134499.76	210.997	199.41	198.62	199.02	0.94	NA	35.7	NA	5.1	NA
299-W22-78	216-U-12	49.5-52	49.5	52.0	50.8	567606.03	134499.76	210.997	195.91	195.15	195.53	0.6	NA	55.3	NA	2.1	NA

Table E-3. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points.)

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
299-W22-75	216-U-12	567594.19	134490.42	211.586	81	186.90	149.0
299-W22-75	216-U-12	567594.19	134490.42	211.586	80	187.20	241.3
299-W22-75	216-U-12	567594.19	134490.42	211.586	79	187.51	342.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	78	187.81	690.6
299-W22-75	216-U-12	567594.19	134490.42	211.586	77	188.12	946.6

Table E-3. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points.)

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
299-W22-75	216-U-12	567594.19	134490.42	211.586	76	188.42	997.1
299-W22-75	216-U-12	567594.19	134490.42	211.586	75	188.73	992.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	74	189.03	757.1
299-W22-75	216-U-12	567594.19	134490.42	211.586	73	189.34	83.7
299-W22-75	216-U-12	567594.19	134490.42	211.586	72	189.64	89.9
299-W22-75	216-U-12	567594.19	134490.42	211.586	71	189.95	110.8
299-W22-75	216-U-12	567594.19	134490.42	211.586	70	190.25	102.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	69	190.55	120.6
299-W22-75	216-U-12	567594.19	134490.42	211.586	68	190.86	126.8
299-W22-75	216-U-12	567594.19	134490.42	211.586	66	191.47	145.3
299-W22-75	216-U-12	567594.19	134490.42	211.586	65	191.77	88.6
299-W22-75	216-U-12	567594.19	134490.42	211.586	61	192.99	49.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	53	195.43	201.8
299-W22-75	216-U-12	567594.19	134490.42	211.586	52	195.74	208.6
299-W22-75	216-U-12	567594.19	134490.42	211.586	51	196.04	213.7
299-W22-75	216-U-12	567594.19	134490.42	211.586	50	196.35	227.8
299-W22-75	216-U-12	587594.19	134490.42	211.586	49	196.65	175.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	48	196.96	117.1
299-W22-75	216-U-12	587594.19	134490.42	211.586	47	197.26	124.8
299-W22-75	216-U-12	567594.19	134490.42	211.586	46	197.57	203.5
299-W22-75	216-U-12	567594.19	134490.42	211.586	45	197.87	136.3
299-W22-75	216-U-12	567594.19	134490.42	211.586	44	198.17	188.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	43	198.48	188.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	44	198.17	184.3
299-W22-75	216-U-12	567594.19	134490.42	211.586	43	198.48	188.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	42	198.78	119.0
299-W22-75	216-U-12	567594.19	134490.42	211.586	41	199.09	126.7
299-W22-75	216-U-12	567594.19	134490.42	211.586	40	199.39	65.3
299-W22-75	216-U-12	567594.19	134490.42	211.586	39	199.70	80.6
299-W22-75	216-U-12	567594.19	134490.42	211.586	38	200.00	90.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	37	200.31	49.9
299-W22-75	216-U-12	567594.19	134490.42	211.586	31	202.14	96.0

Table E-3. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points.)

Borehole	Waste Site	Easting (m NAD83(91))	Northing (m NAD83(91))	Reference Point Elev (m NAVD88)	Actual Sample Depth (ft below ref pt)	Actual Sample Elevation (m NAVD88)	Calculated U (mg/kg)
299-W22-75	216-U-12	567594.19	134490.42	211.586	30	202.44	53.8
299-W22-75	216-U-12	567594.19	134490.42	211.586	29	202.75	69.3
299-W22-75	216-U-12	567594.19	134490.42	211.586	20	205.49	979.3
299-W22-75	216-U-12	567594.19	134490.42	211.586	19	205.79	967.7
299-W22-75	216-U-12	567594.19	134490.42	211.586	18	206.10	570.3
299-W22-75	216-U-12	567594.19	134490.42	211.586	17	206.40	163.2
299-W22-75	216-U-12	567594.19	134490.42	211.586	81	186.90	123.1
299-W22-75	216-U-12	567594.19	134490.42	211.586	80	187.20	261.0
299-W22-75	216-U-12	567594.19	134490.42	211.586	79	187.51	355.8
299-W22-75	216-U-12	567594.19	134490.42	211.586	78	187.81	705.4
299-W22-75	216-U-12	567594.19	134490.42	211.586	77	188.12	919.6
299-W22-75	216-U-12	567594.19	134490.42	211.586	76	188.42	898.6
299-W22-75	216-U-12	567594.19	134490.42	211.586	75	188.73	952.8
299-W22-75	216-U-12	567594.19	134490.42	211.586	74	189.03	780.5
299-W22-75	216-U-12	567594.19	134490.42	211.586	73	189.34	132.9
299-W22-75	216-U-12	567594.19	134490.42	211.586	72	189.64	84.9
299-W22-75	216-U-12	567594.19	134490.42	211.586	71	189.95	100.9
299-W22-75	216-U-12	567594.19	134490.42	211.586	70	190.25	75.1
299-W22-75	216-U-12	567594.19	134490.42	211.586	69	190.55	115.7
299-W22-75	216-U-12	567594.19	134490.42	211.586	68	190.86	109.6
299-W22-75	216-U-12	567594.19	134490.42	211.586	67	191.16	89.9
299-W22-75	216-U-12	567594.19	134490.42	211.586	66	191.47	173.6
299-W22-75	216-U-12	567594.19	134490.42	211.586	65	191.77	124.3
C4228	216-U-12	567574.63	134502.34	210.77	41.5	198.12	141.4
C4228	216-U-12	567574.63	134502.34	210.77	40.5	198.43	180.7
C4228	216-U-12	567574.63	134502.34	210.77	39.5	198.73	180.7
C4228	216-U-12	567574.63	134502.34	210.77	38.5	199.04	151.6
C4228	216-U-12	567574.63	134502.34	210.77	37.5	199.34	118.1
C4228	216-U-12	567574.63	134502.34	210.77	36.5	199.64	64.1
C4228	216-U-12	567574.63	134502.34	210.77	34.5	200.25	73.0
C4228	216-U-12	567574.63	134502.34	210.77	33.5	200.56	169.1
C4228	216-U-12	567574.63	134502.34	210.77	32.5	200.86	49.6

Table E-3. Continued. Uranium Concentration Data Below was Calculated from U-238 Spectral Gamma Data (Nitrogen and Tc-99 not available for these points.)

Borehole	Waste Site	Easting (m NAD83(91))	Northing ((m NAD83(91))	Reference Point Elev ((m NAVD88))	Actual Sample Depth ((ft below ref pt))	Actual Sample Elevation (m NAVD88)	Calculated U ((mg/kg)
C4228	216-U-12	567574.63	134502.34	210.77	24.5	203.30	70.0
C4232	216-U-12	567568.712	134504.128	210.75	40	198.56	111.5
C4232	216-U-12	567568.712	134504.128	210.75	39	198.86	226.3
C4232	216-U-12	567568.712	134504.128	210.75	38	199.17	229.7
C4232	216-U-12	567568.712	134504.128	210.75	37.01	199.47	94.6
C4232	216-U-12	567568.712	134504.128	210.75	36.01	199.77	209.4
C4232	216-U-12	567568.712	134504.128	210.75	35.01	200.08	128.4
C4232	216-U-12	567568.712	134504.128	210.75	34	200.39	77.7
C4232	216-U-12	567568.712	134504.128	210.75	28	202.22	43.9
C4232	216-U-12	567568.712	134504.128	210.75	27	202.52	94.6

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The horizontal datum used for all the boreholes and wells is NAD83(91) with coordinates referenced to the Washington State Plane Coordinate system (South Zone). The vertical datum used for all the boreholes and wells is North American Vertical Datum of 1988 (NAVD88). To convert feet to meters, feet were multiplied by 0.3048. The depth of the sample was subtracted from the ground surface or top of casing elevation (whichever was appropriate).

Table E-4. List of Tc-99 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Interval (ft bgs)	Tc-99 (ug/g)	Converted Tc-99 (pCi/g)
A9797 (299-W19-96)	216-U-1/216-U-2	15 to 17	0.000750	12.72
A9797 (299-W19-96)	216-U-1/216-U-2	22 to 24	0.002890	49.01
A9797 (299-W19-96)	216-U-1/216-U-2	24 to 5-27	0.001940	32.90
A9797 (299-W19-96)	216-U-1/216-U-2	27 to 29.5	0.005810	98.54
A9797 (299-W19-96)	216-U-1/216-U-2	29.5 to 32	0.006300	106.85
A9796 (299-W19-94)	216-U-8	30 to 32	0.001170	19.84
A9796 (299-W19-94)	216-U-8	33.5 to 36	0.000204	3.46

Table E-5. List of U-238 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Depth (ft below ref pt)	U-238 concentration (pCi/g)	Converted U (mg/kg)
C4201	216-U-1/216-U-2	44.5	50.6520	150.9
C4201	216-U-1/216-U-2	43.5	155.1551	462.4
C4201	216-U-1/216-U-2	42.5	47.4529	141.4
C4201	216-U-1/216-U-2	41.5	126.3634	376.6
C4201	216-U-1/216-U-2	39.5	147.1574	438.5
C4201	216-U-1/216-U-2	38.5	59.7160	178.0
C4201	216-U-1/216-U-2	36.5	31.9907	95.3
C4201	216-U-1/216-U-2	35.5	21.8603	65.1
C4203	216-U-1/216-U-2	46	33.7480	100.6
C4203	216-U-1/216-U-2	45	33.7480	100.6
C4203	216-U-1/216-U-2	44	25.9223	77.2
C4203	216-U-1/216-U-2	40	65.8253	196.2
C4203	216-U-1/216-U-2	39	119.2324	355.3
C4203	216-U-1/216-U-2	38	388.6901	1158.3
C4203	216-U-1/216-U-2	36	63.1903	188.3

Table E-5. List of U-238 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Depth (ft below ref pt)	U-238 concentration (pCi/g)	Converted U (mg/kg)
C4203	216-U-1/216-U-2	35	29.8352	88.9
C4203	216-U-1/216-U-2	34	30.3243	90.4
C4203	216-U-1/216-U-2	33	20.0531	59.8
C4203	216-U-1/216-U-2	32	102.2221	304.6
C4203	216-U-1/216-U-2	31	31.7916	94.7
C4204	216-U-1/216-U-2	46	26.6590	79.4
C4204	216-U-1/216-U-2	26	34.1235	101.7
C4204	216-U-1/216-U-2	44	27.1921	81.0
C4204	216-U-1/216-U-2	43	26.6590	79.4
C4205	216-U-1/216-U-2	42.5	33.8599	100.9
C4205	216-U-1/216-U-2	41.5	21.9094	65.3
C4207	216-U-1/216-U-2	42.5	25.0594	74.7
C4207	216-U-1/216-U-2	41.5	31.9907	95.3
C4207	216-U-1/216-U-2	31.5	23.9931	71.5
C4548	216-U-1/216-U-2	53	51.9723	154.9
C4548	216-U-1/216-U-2	52	30.5055	90.9
A4947 (299-W19-15)	216-U-1/216-U-2	59	18.7187	55.8
A4947 (299-W19-15)	216-U-1/216-U-2	71	23.7104	70.7
A7772 (299-W19-72)	216-U-1/216-U-2	13	55.1938	164.5
A7772 (299-W19-72)	216-U-1/216-U-2	37	21091.2079	62851.8
A7772 (299-W19-72)	216-U-1/216-U-2	38	23620.8341	70390.1
A7772 (299-W19-72)	216-U-1/216-U-2	39	24875.9295	74130.3
A7772 (299-W19-72)	216-U-1/216-U-2	40	26862.2471	80049.5
A7772 (299-W19-72)	216-U-1/216-U-2	41	25028.3789	74584.6
A7772 (299-W19-72)	216-U-1/216-U-2	42	12147.0339	36198.2
A7772 (299-W19-72)	216-U-1/216-U-2	43	16424.9202	48946.3
A7772 (299-W19-72)	216-U-1/216-U-2	44	9082.7257	27066.5
A7772 (299-W19-72)	216-U-1/216-U-2	45	1934.6419	5765.2
A7772 (299-W19-72)	216-U-1/216-U-2	46	1565.7075	4665.8

Table E-5. List of U-238 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Depth (ft below ref pt)	U-238 concentration (pCi/g)	Converted U (mg/kg)
A7772 (299-W19-72)	216-U-1/216-U-2	47	1304.7186	3888.1
A7772 (299-W19-72)	216-U-1/216-U-2	48	1026.0355	3057.6
A7772 (299-W19-72)	216-U-1/216-U-2	49	1350.7994	4025.4
A7772 (299-W19-72)	216-U-1/216-U-2	50	976.1876	2909.0
A7772 (299-W19-72)	216-U-1/216-U-2	55	202.5786	603.7
A7772 (299-W19-72)	216-U-1/216-U-2	56	78.0933	232.7
A7772 (299-W19-72)	216-U-1/216-U-2	57	35.9538	107.1
A7772 (299-W19-72)	216-U-1/216-U-2	58	22.4228	66.8
A7772 (299-W19-72)	216-U-1/216-U-2	59	35.5672	106.0
A7772 (299-W19-72)	216-U-1/216-U-2	60	32.4744	96.8
A7772 (299-W19-72)	216-U-1/216-U-2	61	34.7940	103.7
A7772 (299-W19-72)	216-U-1/216-U-2	62	22.0362	65.7
A7772 (299-W19-72)	216-U-1/216-U-2	63	13.1444	39.2
A7772 (299-W19-72)	216-U-1/216-U-2	65	23.1960	69.1
A7772 (299-W19-72)	216-U-1/216-U-2	66	13.5310	40.3
A7772 (299-W19-72)	216-U-1/216-U-2	67	14.6908	43.8
A7772 (299-W19-72)	216-U-1/216-U-2	69	22.0362	65.7
A7772 (299-W19-72)	216-U-1/216-U-2	70	39.4332	117.5
A7772 (299-W19-72)	216-U-1/216-U-2	71	33.6342	100.2
A7772 (299-W19-72)	216-U-1/216-U-2	72	13.5310	40.3
A7772 (299-W19-72)	216-U-1/216-U-2	73	19.3300	57.6
A7772 (299-W19-72)	216-U-1/216-U-2	74	14.3042	42.6
A7772 (299-W19-72)	216-U-1/216-U-2	54.67	202.5786	603.7
A7772 (299-W19-72)	216-U-1/216-U-2	54	459.2813	1368.7

Table E-5. List of U-238 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Depth (ft below ref pt)	U-238 concentration (pCi/g)	Converted U (mg/kg)
A7772 (299-W19-72)	216-U-1/216-U-2	53	1533.1248	4568.7
A7772 (299-W19-72)	216-U-1/216-U-2	52	1068.1771	3183.2
A7772 (299-W19-72)	216-U-1/216-U-2	51	964.1815	2873.3
A7773 (299-W19-73)	216-U-1/216-U-2	43	87.7583	261.5
A7773 (299-W19-73)	216-U-1/216-U-2	44	46.0055	137.1
A7773 (299-W19-73)	216-U-1/216-U-2	45	37.1136	110.6
A7773 (299-W19-73)	216-U-1/216-U-2	46	28.6084	85.3
A7773 (299-W19-73)	216-U-1/216-U-2	47	29.3816	87.6
A7773 (299-W19-73)	216-U-1/216-U-2	48	20.4898	61.1
A7773 (299-W19-73)	216-U-1/216-U-2	49	13.5310	40.3
A7773 (299-W19-73)	216-U-1/216-U-2	50	15.8506	47.2
A7773 (299-W19-73)	216-U-1/216-U-2	51	20.4898	61.1
A7773 (299-W19-73)	216-U-1/216-U-2	52	22.8094	68.0
A7773 (299-W19-73)	216-U-1/216-U-2	53	18.9434	56.5
A7773 (299-W19-73)	216-U-1/216-U-2	54	15.8506	47.2
A7773 (299-W19-73)	216-U-1/216-U-2	55	17.7836	53.0
A7773 (299-W19-73)	216-U-1/216-U-2	56	23.5826	70.3
A7773 (299-W19-73)	216-U-1/216-U-2	57	30.5414	91.0
A7773 (299-W19-73)	216-U-1/216-U-2	58	11.9846	35.7
A7773 (299-W19-73)	216-U-1/216-U-2	59	15.8506	47.2
A7773 (299-W19-73)	216-U-1/216-U-2	64	15.0774	44.9
A7773 (299-W19-73)	216-U-1/216-U-2	68	15.0774	44.9
A7773 (299-W19-73)	216-U-1/216-U-2	70	12.3712	36.9
A7773 (299-W19-73)	216-U-1/216-U-2	71	14.6908	43.8

Table E-5. List of U-238 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Depth (ft below ref pt)	U-238 concentration (pCi/g)	Converted U (mg/kg)
A7773 (299-W19-73)	216-U-1/216-U-2	72	20.1032	59.9
A7773 (299-W19-73)	216-U-1/216-U-2	73	13.1444	39.2
A7773 (299-W19-73)	216-U-1/216-U-2	74	15.4640	46.1
A7773 (299-W19-73)	216-U-1/216-U-2	75	12.7578	38.0
C4219	216-U-8	45.5	167.5956	499.4
C4219	216-U-8	44.5	283.2494	844.1
C4219	216-U-8	43.5	3137.4647	9349.6
C4219	216-U-8	42.5	870.2153	2593.2
C4219	216-U-8	41.5	1127.5777	3360.2
C4219	216-U-8	40.5	1809.2408	5391.5
C4223	216-U-8	41	229.1244	682.8
A7770 (299-W19-70)	216-U-8	90.17	38.5267	114.8
A7770 (299-W19-70)	216-U-8	90	48.9610	145.9
A7770 (299-W19-70)	216-U-8	89	36.1188	107.6
A7770 (299-W19-70)	216-U-8	88	29.6977	88.5
A7770 (299-W19-70)	216-U-8	86	18.4607	55.0
A7770 (299-W19-70)	216-U-8	84	21.6713	64.6
A7770 (299-W19-70)	216-U-8	83	21.6713	64.6
A7770 (299-W19-70)	216-U-8	82	24.8818	74.1
A7770 (299-W19-70)	216-U-8	80	39.3293	117.2
A7770 (299-W19-70)	216-U-8	78	24.0792	71.8
A7770 (299-W19-70)	216-U-8	76	19.2633	57.4
A7770 (299-W19-70)	216-U-8	74	17.9471	53.5
A7770 (299-W19-70)	216-U-8	73	28.0924	83.7
A7770 (299-W19-70)	216-U-8	71	23.2765	69.4
A7770 (299-W19-70)	216-U-8	70	27.2897	81.3
A7770 (299-W19-70)	216-U-8	69	18.4607	55.0
A7770 (299-W19-70)	216-U-8	64	19.2633	57.4
A7770 (299-W19-70)	216-U-8	63	16.0528	47.8
A7770 (299-W19-70)	216-U-8	49	49.1277	146.4
A7770 (299-W19-70)	216-U-8	46	645.0120	1922.1
A7770 (299-W19-70)	216-U-8	44.99	1392.0593	4148.3

Table E-5. List of U-238 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Depth (ft below ref pt)	U-238 concentration (pCi/g)	Converted U (mg/kg)
A7771 (299-W19-71)	216-U-8	87.5	24.8818	74.1
A7771 (299-W19-71)	216-U-8	86.5	43.3425	129.2
A7771 (299-W19-71)	216-U-8	85.5	65.0138	193.7
A7771 (299-W19-71)	216-U-8	84.5	53.7769	160.3
A7771 (299-W19-71)	216-U-8	83.5	90.6983	270.3
A7771 (299-W19-71)	216-U-8	82.5	110.7643	330.1
A7771 (299-W19-71)	216-U-8	81.5	56.9874	169.8
A7771 (299-W19-71)	216-U-8	80.5	24.8818	74.1
A7771 (299-W19-71)	216-U-8	79.5	25.6845	76.5
A7771 (299-W19-71)	216-U-8	68.5	24.0792	71.8
A7771 (299-W19-71)	216-U-8	67.5	28.0924	83.7
A7771 (299-W19-71)	216-U-8	65.5	23.2765	69.4
A7771 (299-W19-71)	216-U-8	59.5	52.1716	155.5
A7771 (299-W19-71)	216-U-8	58.5	34.5135	102.9
A7771 (299-W19-71)	216-U-8	57.5	114.7775	342.0
A7771 (299-W19-71)	216-U-8	56.5	235.1734	700.8
A7771 (299-W19-71)	216-U-8	55.5	28.0924	83.7
A7771 (299-W19-71)	216-U-8	54.5	64.2112	191.3
A7771 (299-W19-71)	216-U-8	53.5	49.6119	147.8
A7771 (299-W19-71)	216-U-8	52.5	85.6420	255.2
A7771 (299-W19-71)	216-U-8	51.5	150.8490	449.5
A7771 (299-W19-71)	216-U-8	47.5	124.4625	370.9
A7771 (299-W19-71)	216-U-8	46.5	183.8993	548.0
C4217	216-U-8	34.5	44.0191	131.2
C4217	216-U-8	33.5	341.8815	1018.8
C4217	216-U-8	32.5	39.1281	116.6
C4217	216-U-8	31.5	34.2371	102.0
C4218	216-U-8	37.5	34.2371	102.0
C4224	216-U-8	50.5	18.1359	54.0
C4547	216-U-8	35.5	31.7916	94.7
C4547	216-U-8	34.5	156.5285	466.5
C4553	216-U-8	48	16.5828	49.4
C4553	216-U-8	46	9.3279	27.8
A7775 (299-W22-75)	216-U-12	81	49.9839	149.0

Table E-5. List of U-238 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Depth (ft below ref pt)	U-238 concentration (pCi/g)	Converted U (mg/kg)
A7775 (299-W22-75)	216-U-12	80	80.9657	241.3
A7775 (299-W22-75)	216-U-12	79	114.8390	342.2
A7775 (299-W22-75)	216-U-12	78	231.7435	690.6
A7775 (299-W22-75)	216-U-12	77	317.6663	946.6
A7775 (299-W22-75)	216-U-12	76	334.6030	997.1
A7775 (299-W22-75)	216-U-12	75	332.9506	992.2
A7775 (299-W22-75)	216-U-12	74	254.0504	757.1
A7775 (299-W22-75)	216-U-12	73	28.0901	83.7
A7775 (299-W22-75)	216-U-12	72	30.1556	89.9
A7775 (299-W22-75)	216-U-12	71	37.1781	110.8
A7775 (299-W22-75)	216-U-12	70	34.2865	102.2
A7775 (299-W22-75)	216-U-12	69	40.4828	120.6
A7775 (299-W22-75)	216-U-12	68	42.5483	126.8
A7775 (299-W22-75)	216-U-12	66	48.7446	145.3
A7775 (299-W22-75)	216-U-12	65	29.7425	88.6
A7775 (299-W22-75)	216-U-12	61	16.5236	49.2
A7775 (299-W22-75)	216-U-12	53	67.7218	201.8
A7775 (299-W22-75)	216-U-12	52	69.9863	208.6
A7775 (299-W22-75)	216-U-12	51	71.7168	213.7
A7775 (299-W22-75)	216-U-12	50	76.4479	227.8
A7775 (299-W22-75)	216-U-12	49	58.7949	175.2
A7775 (299-W22-75)	216-U-12	48	39.3047	117.1
A7775 (299-W22-75)	216-U-12	47	41.8820	124.8
A7775 (299-W22-75)	216-U-12	46	68.2999	203.5
A7775 (299-W22-75)	216-U-12	45	45.7480	136.3
A7775 (299-W22-75)	216-U-12	44	63.1452	188.2
A7775 (299-W22-75)	216-U-12	43	63.1452	188.2
A7775 (299-W22-75)	216-U-12	44	61.8565	184.3
A7775 (299-W22-75)	216-U-12	43	63.1452	188.2
A7775 (299-W22-75)	216-U-12	42	39.9490	119.0
A7775 (299-W22-75)	216-U-12	41	42.5264	126.7
A7775 (299-W22-75)	216-U-12	40	21.9075	65.3
A7775 (299-W22-75)	216-U-12	39	27.0622	80.6
A7775 (299-W22-75)	216-U-12	38	30.2839	90.2

Table E-5. List of U-238 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Depth (ft below ref pt)	U-238 concentration (pCi/g)	Converted U (mg/kg)
A7775 (299-W22-75)	216-U-12	37	16.7528	49.9
A7775 (299-W22-75)	216-U-12	31	32.2169	96.0
A7775 (299-W22-75)	216-U-12	30	18.0415	53.8
A7775 (299-W22-75)	216-U-12	29	23.2461	69.3
A7775 (299-W22-75)	216-U-12	20	328.6368	979.3
A7775 (299-W22-75)	216-U-12	19	324.7467	967.7
A7775 (299-W22-75)	216-U-12	18	191.3686	570.3
A7775 (299-W22-75)	216-U-12	17	54.7688	163.2
A7775 (299-W22-75)	216-U-12	81	41.3090	123.1
A7775 (299-W22-75)	216-U-12	80	87.5751	261.0
A7775 (299-W22-75)	216-U-12	79	119.3830	355.8
A7775 (299-W22-75)	216-U-12	78	236.7006	705.4
A7775 (299-W22-75)	216-U-12	77	308.5783	919.6
A7775 (299-W22-75)	216-U-12	76	301.5558	898.6
A7775 (299-W22-75)	216-U-12	75	319.7317	952.8
A7775 (299-W22-75)	216-U-12	74	261.8991	780.5
A7775 (299-W22-75)	216-U-12	73	44.6137	132.9
A7775 (299-W22-75)	216-U-12	72	28.5032	84.9
A7775 (299-W22-75)	216-U-12	71	33.8734	100.9
A7775 (299-W22-75)	216-U-12	70	25.1985	75.1
A7775 (299-W22-75)	216-U-12	69	38.8305	115.7
A7775 (299-W22-75)	216-U-12	68	36.7650	109.6
A7775 (299-W22-75)	216-U-12	67	30.1556	89.9
A7775 (299-W22-75)	216-U-12	66	58.2457	173.6
A7775 (299-W22-75)	216-U-12	65	41.7221	124.3
C4228	216-U-12	41.5	47.4428	141.4
C4228	216-U-12	40.5	60.6485	180.7
C4228	216-U-12	39.5	60.6485	180.7
C4228	216-U-12	38.5	50.8665	151.6
C4228	216-U-12	37.5	39.6172	118.1
C4228	216-U-12	36.5	21.5204	64.1
C4228	216-U-12	34.5	24.4905	73.0
C4228	216-U-12	33.5	56.7357	169.1
C4228	216-U-12	32.5	16.6294	49.6

Table E-5. List of U-238 Conversions.

Well Identification Number (Well Name)	Waste Site	Actual Sample Depth (ft below ref pt)	U-238 concentration (pCi/g)	Converted U (mg/kg)
C4228	216-U-12	24.5	23.4768	70.0
C4232	216-U-12	40	37.4053	111.5
C4232	216-U-12	39	75.9441	226.3
C4232	216-U-12	38	77.0776	229.7
C4232	216-U-12	37.01	31.7378	94.6
C4232	216-U-12	36.01	70.2766	209.4
C4232	216-U-12	35.01	43.0728	128.4
C4232	216-U-12	34	26.0704	77.7
C4232	216-U-12	28	14.7354	43.9
C4232	216-U-12	27	31.7378	94.6

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