0076588

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAR 25 2008

08-AMCP-0128

Mr. N. Ceto, Program Manager
Office of Environmental Cleanup
Hanford Project Office
U.S. Environmental Protection Agency
309 Bradley Blvd., Suite 115
Richland, Washington 99352

Dear Mr. Ceto:

SITE-SPECIFIC FIELD-SAMPLING PLANS FOR THE 216-B-42 TRENCH, 216-S-13 CRIB, 216-S-21 CRIB, 216-T-18 CRIB, AND 216-T-19 CRIB AND TILE FIELD IN THE 200-TW-1/200-PW-5 OPERABLE UNITS, ADDENDUM 3, DOE/RL-2007-02, VOLUME II, DRAFT A

The purpose of this letter is to submit the Addendum 3 Site-Specific Field-Sampling Plans for the 216-B-42 Trench, 216-S-13 Crib, 216-S-21 Crib, 216-T-18 Crib, and 216-T-19 Crib and Tile Field in the 200-TW-1/200-PW-5 Operable Units of Supplemental Remedial Investigation/ Feasibility Study Work Plan for the 200 Areas Central Plateau Operable Units, DOE/RL-2007-02, Volume II, Draft A for your review and approval.

The site-specific field sampling plans in this addendum provide site-specific information regarding the waste sites conceptual model, data needs, data collection strategy and associated analytical and quality control requirements arrived at during the agency data quality objective process as documented in the data needs priority summary tables (Volume I, Appendix C). Together with the elements of the overall sampling and analysis plan (Volume I, Appendix A), the site-specific field sampling plans presented in Chapters 2.0 through 6.0 of this addendum complete the sampling and analysis plan for these waste sites. This Addendum is part of the supplemental work plan and is considered a component of that primary document under the Hanford Federal Facility Agreement and Consent Order.

If you have any questions, please contact me, or your staff may contact Matt McCormick, Assistant Manager for the Central Plateau, on (509) 373-9971.

Sincerely,

FOR David A. Brockman
Manager

AMCP:RDH

Attachment

cc w/attach:
G. Bohnee, NPT
L. Buck, Wanapum
C. E. Cameron, EPA
S. Harris, CTUIR
J. A. Hedges, Ecology
R. Jim, YN
S. L. Leckband, HAB
K. Niles, ODOE
J. B. Price, Ecology
R. Skinnarland, Ecology
Administrative Record
Environmental Portal

cc w/o attach:
R. H. Engelmann, EFSH
R. E. Piippo, FHI
J. G. Vance, FFS

DOE/RL-2007-02-VOL II
DRAFT A

Site-Specific Field-Sampling Plans for the 216-B-42 Trench, 216-S-13 Crib, 216-S-21 Crib, 216-T-18 Crib and 216-T-19 Crib and Tile Field in the 200-TW-1/200-PW-5 Operable Units

ADDENDUM 3

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

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

DOE/RL-2007-02-VOL II
DRAFT A

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ADDENDUM 3

Date Published
February 2008

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Assistant Secretary for Environmental Management

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

J. D. Aardal 02/29/2008
Release Approval Date

ADDENDUM 3

SITE-SPECIFIC FIELD-SAMPLING PLANS FOR THE 216-B-42 TRENCH, 216-S-13 CRIB, 216-S-21 CRIB, 216-T-18 CRIB AND 216-T-19 CRIB AND TILE FIELD IN THE 200-TW-1/200-PW-5 OPERABLE UNITS

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APPROVAL PAGE

Title: Supplemental Remedial Investigation Work Plan for the 200 Areas Central Plateau Operable Units, Volume II, Addenda

Addendum 3 – Site-Specific Field-Sampling Plans for 216-B-42 Trench, 216-S-13 Crib, 216-S-21 Crib, 216-T-18 Crib And 216-T-19 Crib and Tile Field in the 200-TW-1/200-PW-5 Operable Units

Approval: U.S. Department of Energy, Richland Operations Office

Signature ______________________ Date 3/24/08

Lead Regulatory Agency:

☒ U.S. Environmental Protection Agency

☐ Washington State Department of Ecology

Signature ______________________ Date ____________

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

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CONTENTS

FIGURES

TABLES

TERMS

bgs	below ground surface
COPC	contaminants of potential concern
DOE	U.S. Department of Energy
DG	downhole geophysics
DQO	data quality objectives
EPA	U.S. Environmental Protection Agency
ERC	electrical resistivity characterization
GL	geologic log
HRLS	high resolution logging system
HRR	high resolution resistivity
IPT	integrated project team
KUT	natural occurring potassium, uranium, and thorium logs
MDL	method detection limit
MESC/MNA/IC	maintain existing soil cover, monitored natural attenuation, institutional controls
N/A	not applicable
OU	operable unit
PH	process history
PUREX	plutonium-uranium extraction (plant or process)
QAPjP	quality assurance project plan
QA/QC	quality assurance/quality control
REDOX	reduction-oxidation (plant or process)
RLS	radionuclide logging system
RS	representative site
SGE	surface geophysical exploration
SGLS	spectral gamma logging system
SIM	*Soil Inventory Model, Rev.1*
SSSP	site-specific field-sampling plan
TBD	to be determined
TD	total depth
WIDS	*Waste Information Data System* database

METRIC CONVERSION CHART

Into Metric Units

If you know	*Multiply by*	*To get*
Length		
inches	25.4	millimeters
inches	2.54	centimeters
feet	0.305	meters
yards	0.914	meters
miles	1.609	kilometers
Area		
sq. inches	6.452	sq. centimeters
sq. feet	0.0929	sq. meters
sq. yards	0.836	sq. meters
sq. miles	2.591	sq. kilometers
acres	0.405	hectares
Mass (weight)		
ounces	28.349	grams
pounds	0.454	kilograms
ton	0.907	metric ton
Volume		
teaspoons	5	milliliters
tablespoons	15	milliliters
fluid ounces	29.573	milliliters
cups	0.24	liters
pints	0.473	liters
quarts	0.946	liters
gallons	3.785	liters
cubic feet	0.0283	cubic meters
cubic yards	0.764	cubic meters
Temperature		
Fahrenheit	(°F-32)*5/9	Celsius
Radioactivity		
picocuries	37	millibecquerels

Out of Metric Units

If you know	*Multiply by*	*To get*
Length		
millimeters	0.0394	inches
centimeters	0.394	inches
meters	3.281	feet
meters	1.094	yards
kilometers	0.621	miles
Area		
sq. centimeters	0.155	sq. inches
sq. meters	10.764	sq. feet
sq. meters	1.196	sq. yards
sq. kilometers	0.386	sq. miles
hectares	2.471	acres
Mass (weight)		
grams	0.0353	ounces
kilograms	2.205	pounds
metric ton	1.102	tons
Volume		
milliliters	0.034	fluid ounces
liters	2.113	pints
liters	1.057	quarts
liters	0.264	gallons
cubic meters	35.315	cubic feet
cubic meters	1.308	cubic yards
Temperature		
Celsius	(°C*9/5)+32	Fahrenheit
Radioactivity		
millibecquerel	0.027	picocuries

AD3-1.0 INTRODUCTION

Addendum 3 of Work Plan Volume II contains the site-specific field-sampling plans (SSSP) for the 216-B-42 Trench, 216-S-13 Crib, 216-S-21 Crib, 216-T-18 Crib and 216-T-19 Crib and Tile Field in the 200-PW-5/200-TW-1 Operable Units. The SSSPs in this addendum provide site-specific information regarding the waste sites including detailed sampling location maps, conceptual models, and the detailed sampling strategy for each site (i.e., number and location of samples, analytes, and sampling and analytical methods). These requirements have been determined by the Tri-Parties (U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology) and documented via the data quality objectives (DQO) process in the data-needs priority summary tables (Volume 1, Appendix C).

Volume 1 of the supplemental work plan also includes the Overarching Supplemental Sampling and Analysis Plan (SAP) which supports the RI/FS process for all of the supplemental waste sites (DOE/RL-2007-02 Rev. 0, Vol. I, Appendix A). Data collected under the overarching SAP will be used to support completion of the RI/FS process for the 216-B-42 Trench, 216-S-13 Crib, 216-S-21 Crib, 216-T-18 Crib and 216-T-19 Crib and Tile Field in the 200-PW-5/200-TW-1 Operable Units. The overarching SAP includes the field-sampling plan which includes investigative strategies for a range of sampling techniques, the health and safety plan, and the quality assurance project plan (QAPjP) which establishes quality requirements for the supplemental investigation activities. For radioactive samples, ALARA principles may limit the amount of sample the laboratory can process for analysis. This may result in elevated levels of detection (greater than the Required Detection Limits listed in Tables A2-1 and A2-2 of DOE/RL-2007-02, Vol. I) and provide limitations on the analytical batch quality control analyses that can be completed. The overarching SAP also includes the list of contaminants of potential concern (COPC) identified for each of the supplemental waste sites (Vol. I, Appendix A, Table A2-3). Cyanide will be added to the list of COPC, as it was used extensively in the scavenging and recovery processes. The overarching SAP was approved by the Tri-Parties to support all supplemental waste site sampling activities.

Together with the elements of the overarching sampling and analysis plan (Volume I, Appendix A), the SSSPs presented in Chapters 2.0 through 6.0 of this addendum complete the sampling and analysis plan for these waste sites. This addendum is part of the supplemental work plan and is considered a component of that primary document under the *Hanford Federal Facility Agreement and Consent Order.* [1]

Activities associated with surface geophysical exploration (SGE) or high resolution resistivity (HRR), now referred to as electrical resistivity characterization (ERC), as identified in Volume I, Appendix C has been (is currently) completed and will not be discussed further in this SSSP. ERC results will be reported as follows: waste site in the

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[1] Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, as amended.

surrounding area of the B, BX, and BY Tank Farms are included in RPP-34690, provided by CH2M Hill Hanford Group, Inc.; waste sites in the surrounding area of the TX and TY Tank Farms are to be included in a report issued by CH2M Hill Hanford Group, Inc., expected October 2008; remaining waste sites are to be included in a report issued by Pacific Northwest National Laboratory, expected March 2008. ERC areas are not included in the figures of this SSSP, as they extend well beyond the waste site boundaries, but can be accessed from their corresponding reports.

The conceptual contamination distribution model graphics in the conceptual model and data summary figures were developed using historical data including, but not limited to: geophysical logs of existing boreholes, waste discharge volume, waste contaminant inventories and electrical resistivity characterization reports. These graphics may be updated as additional information becomes available from planned characterization or other support activities. The potential remedial alternatives section in the data needs priority summary tables were derived from DOE/RL-2003-64 and are presented for reference only; this is not the final regulator approved list of remedies.

AD3-2.0 216-B-42 TRENCH SITE-SPECIFIC FIELD-SAMPLING PLAN

The characterization planned for the 216-B-42 Trench includes drilling a deep borehole to groundwater, approximately 276 ft, and geophysical logging of this same borehole. The drilling and logging efforts are planned to reduce the uncertainty associated with the differences in waste streams between the 216-B-42 Trench and the other trenches located within close geographical proximity, especially the 216-B-38 Trench. The 216-B-42 Trench received scavenged waste from the Uranium Recovery Process (tributyl phosphate solvent extraction) in the 221-U Canyon Facility, whereas the 216-B-35 through 216-B-41 Trenches received dissolved cladding and 1st cycle wastes from the 221-B Plant Canyon Building. The planned characterization would provide information to accurately assign the 216-B-42 Trench to the appropriate representative site; the 216-B-46 Crib received a similar waste stream, while its current representative site, 216-B-38 Trench, is geographically similar.

Split-spoon samples will be collected at the bottom of the trench and at changes in lithology as indicated in Figure AD3 2-2; the samples will be analyzed for analytes presented in Volume I, Table A2-3, the 200-TW-1 column. Documentation for groundwater samples, if requested by an operable unit manager, will be provided by the requesting party. The sample analysis will provide information for decision-making on assignment of a representative site. The grab samples to be analyzed will be determined by the field geologist and technical lead, utilizing characterization data; such as geophysical logs, lithology (driller's logs), and split-spoon sample analyses.

The 299-E33-10 well, which monitors this waste site, is too far removed from the contaminant source to accurately describe the contamination distribution below the trench. The location of the planned deep borehole, at the eastern end of the trench, was determined by evaluation of current geophysical logs and surface geophysical exploration conducted by CH2M Hill Hanford Group, Inc. utilizing their quality assurance/quality control (QA/QC) procedures (RPP-34690). The location was chosen to address the zone of highest contamination; it is believed that the inlet to the trench was also located at this end. Analysis of the characterization could serve to verify the surface geophysical exploration.

The following figures and tables provide the site-specific field-sampling plan for the 216-B-42 Trench.

Figure AD3 2-1. 216-B-42 Trench Data-Collection Locations

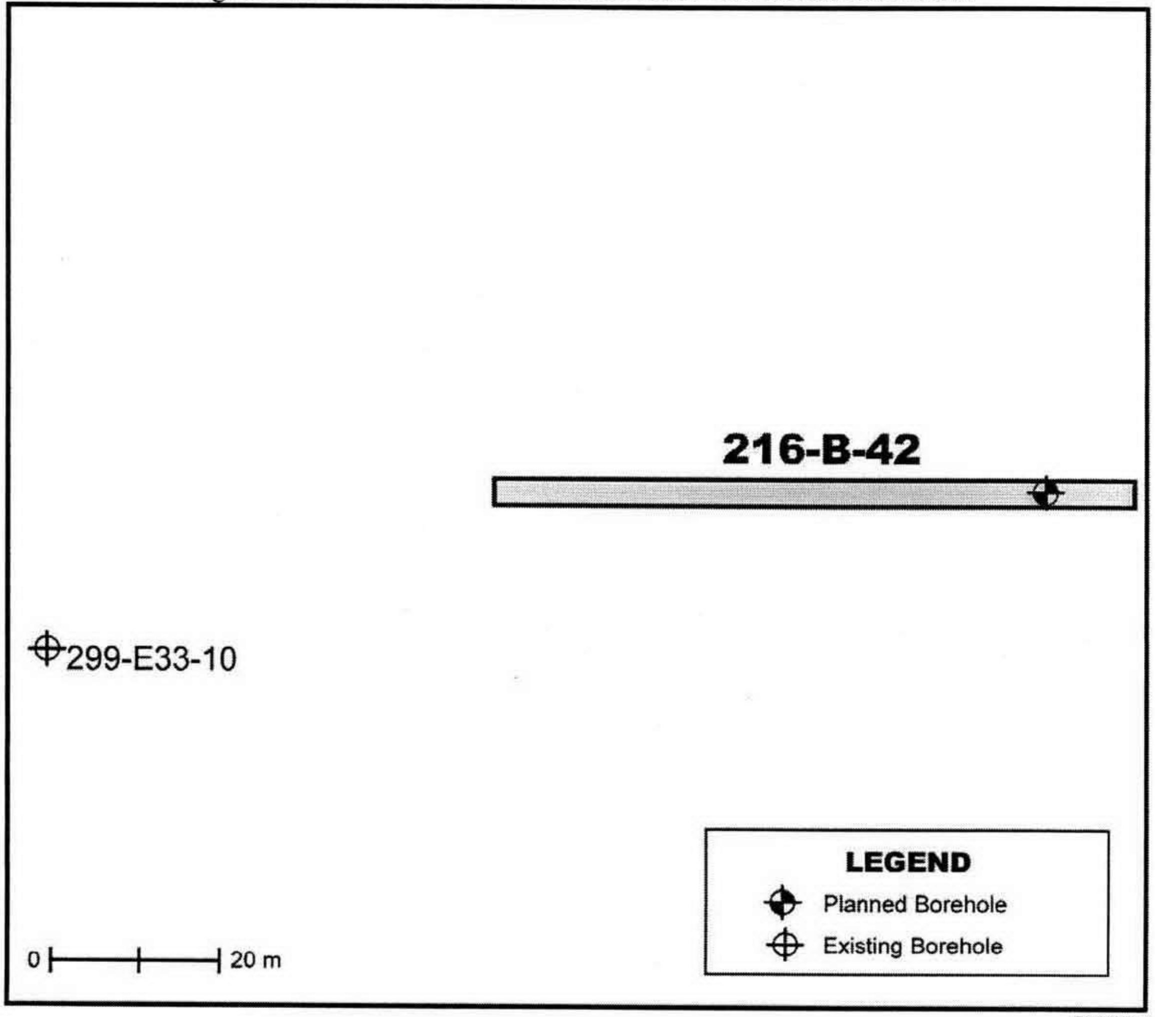


Figure AD3 2-2. 216-B-42 Trench Stratigraphy and Sample-Collection Intervals

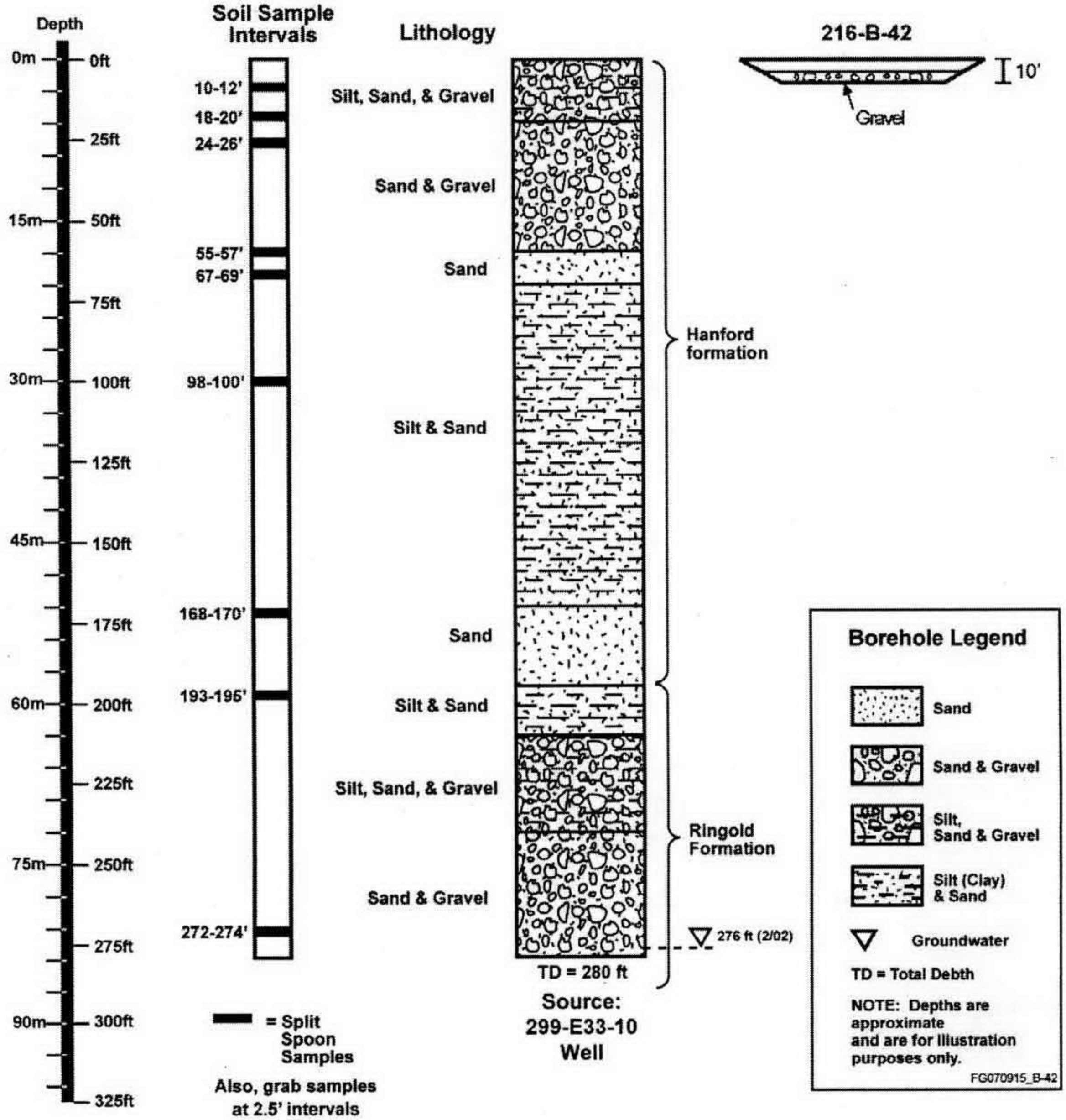


Table AD3 2-1. 216-B-42 Trench Sampling Plan.

Sample Collection Methodology	Sample Location	Maximum Depth of Investigation	Sample Interval Depth (ft bgs) [a]	Analyte List [b]	Physical Properties	
					Sample Interval	Parameters
Deep borehole with split spoon and grab samples	One deep borehole near head end of trench (eastern end)	To groundwater (approximately 276 ft bgs)	Split-spoon sample at depths: 10 – 12 ft bgs 18 – 20 ft bgs 24 – 26 ft bgs 55 – 57 ft bgs 67 – 69 ft bgs 98 – 100 ft bgs 168 – 170 ft bgs 193 – 195 ft bgs 272 – 274 ft bgs Also, grab samples at 2.5 ft intervals throughout borehole	Analytes are presented in Volume I, Table A2-3, the 200-TW-1 column. Grab samples will be analyzed for contaminants within the pore volume.	One sample at each change in lithology or fine-grained intervals (same as split-spoon sample intervals, between 15-200 ft bgs). As indicated in Figure AD3 2-2.	pH, specific conductance, bulk density, moisture, particle size distribution

Number of split-spoon samples	9
Approximate number of field quality-control samples [c]	3
Approximate number of physical-property samples	7
Approximate number of grab samples	110
Approximate total number of soil samples collected	129
Approximate total number of soil samples analyzed [d]	72

Non-Sample Data Collection	Maximum Depth of Investigation
Downhole gamma-spectroscopy log, neutron moisture, and passive neutron logs	Surface to TD in new borehole ~276 ft bgs

[a] Actual sampling depths may vary depending on the amount of backfill/overburden used in interim-stabilization activities at the waste site, field screening results, and varying subsurface conditions.

[b] See Volume 1, Appendix A, Tables A2-1, A2-2, A2-4, A2-5, and A3-2 for detection limits and other analytical parameters.

[c] One duplicate, one split*, and one equipment blank.

[d] Number of samples analyzed includes nine split-spoon samples, three field quality-control samples, seven physical-property samples and 53 grab samples.

* Optional (Volume I, p. A2-17)

Figure AD3 2-3. 216-B-42 Trench Conceptual Model and Data Summary

200-TW-1 Operable Unit
Waste Type: Process Effluent

216-B-42 Trench

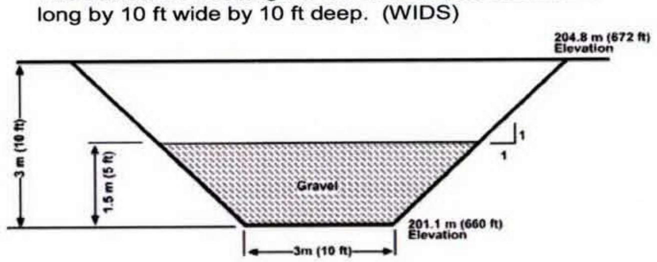
B Farm Zone

History

216-B-42 Trench is a subsurface liquid waste disposal site that operated during 1955 receiving Uranium Recovery Process and tributyl phosphate solvent extraction process waste from the 221-U building via 241-BY Tank Farm. It is marked and posted with Underground Radioactive Material signs. (WIDS)

CONSTRUCTION:

The trench is a rectangular excavation that was 252 ft long by 10 ft wide by 10 ft deep. (WIDS)



WASTE VOLUME: 1,500,000 L (400,000 gal) (WIDS)

DURATION: January 1955 to February 1955 (WIDS)

ESTIMATED DISCHARGED INVENTORY (DOE/RL-2003-64, RHO-CD-673, RPP-26744):

Contaminant	Historical	2008%	SIM
Plutonium	10 g	---	---
Nitrate	210,000 kg	---	297,921 kg
Sr-90	1100 Ci	306 Ci	200.9 Ci
Tc-99	7.3 Ci	7.3 Ci	5.70 Ci
Cs-137	96 Ci	28.3 Ci	52.66 Ci
Uranium	680 kg	---	46.52 kg
Total beta	5800 Ci	---	---
Co-60	10 Ci	0.009 Ci	0.28 Ci
Ferrocyanide	0.8 kg	---	0 kg

%Values decayed from RHO-CD-673 to 6/30/2008

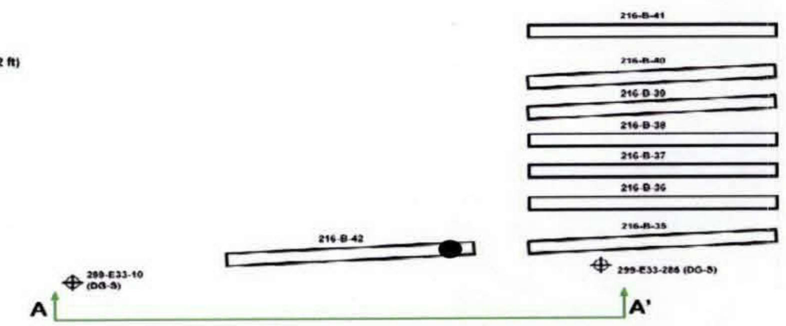
REFERENCES:
- WIDS general summary reports
- RPP-26744
- RHO-CD-673
- DOE/RL-2000-38
- DOE/RL-2003-64
- RPP-34690

Basis of Knowledge (Data Types)

- Process History (PH)
- Downhole Geophysics – Spectral (DG-S)
- Geologic Logs (GL)

Site Plan View

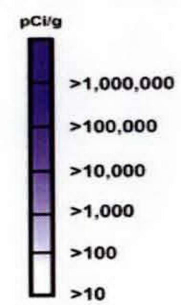
(not to scale)



Legend

- ⊕ = Existing Borehole (data type)
- ▼ = Groundwater Surface
- ● = Planned Deep Borehole
- bgs = Below Ground Surface
- WIDS = *Waste Information Data System* database
- SIM = *Soil Inventory Model, Rev.1*

Cesium-137 Concentration



Characterization Summary

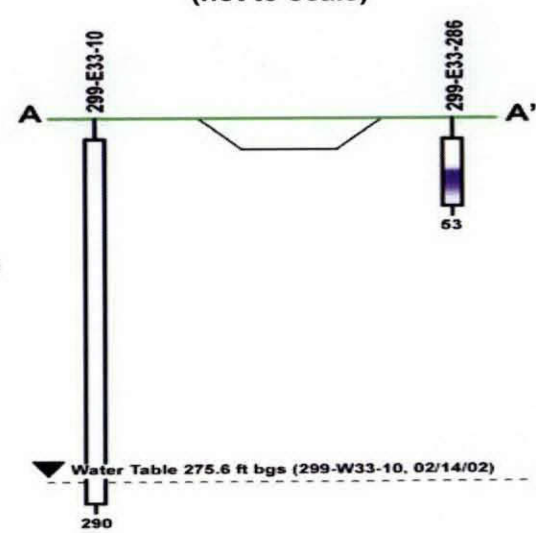
216-B-42 was investigated under DOE/RL-2000-38. The maximum cesium-137 detected in well 299-E33-10 was 0.9 pCi/g at 4 ft bgs. This small amount of cesium-137 is insufficient to explain the increase in total gamma in this well using spectral gamma logging, which suggests a remote gamma source or a strong beta emitter may be present in the trench.

Summarized Well Information

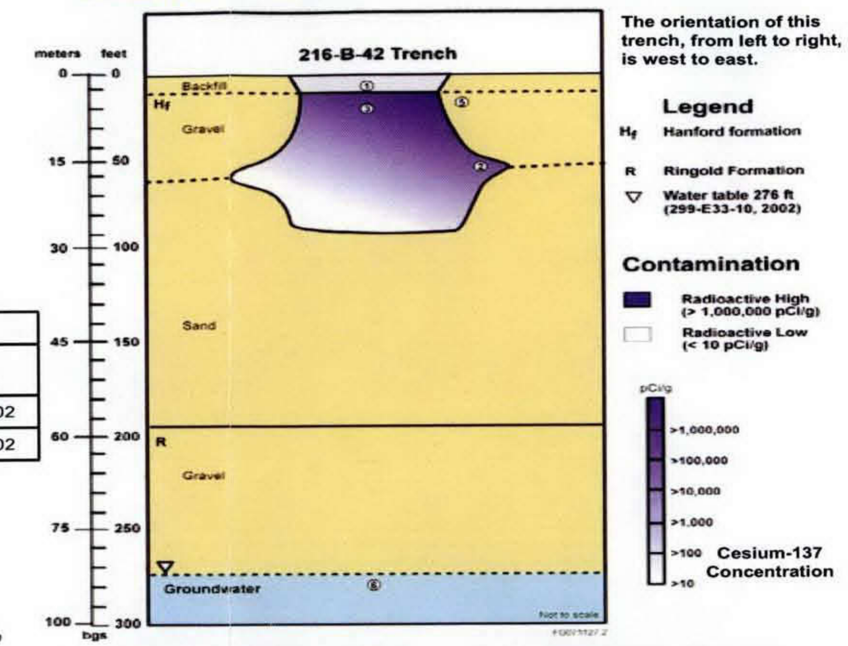
Well ID	Maximum Cs-137 (pCi/g)	Depth (ft bgs)	Date
299-E33-10	0.9	4	2/25/2002
299-E33-286	50,000	38	2/20/2002

Site Section View

(not to scale)



Conceptual Contaminant Distribution Model



1. High salt, neutral/basic, radioactive scavenged waste containing cesium-137, plutonium, uranium, strontium-90 and cobalt-60 from the Uranium Recovery Process and tributyl phosphate solvent extraction process at 221-U was released to this trench. The trench received a total volume of 1,500,000 L (400,000 gal) of wastewater between January and February 1955.
2. The wetting front and contaminants move vertically beneath the trench. Lateral spreading of liquids is associated mainly with the Hanford gravel and sand contact and at intersections with other finely grained lenses. As the effluent traveled downward after discharge, contaminants may have been deposited along the upper contact of these zones.
3. Constituents with large distribution coefficients (e.g., cesium-137, strontium-90 and plutonium) sorb to soils resulting in higher concentrations near the bottom of the trench. Concentrations generally decrease with depth.
4. The highest concentration of cesium-137 was only 0.9 pCi/g at 4 ft bgs in well 299-E33-10.
5. Electronic resistivity characterization conducted in 2007 (RPP-34690), shows the majority of the contamination is associated with the inlet to the trench (eastern side).
6. The effluent volume discharged to the trench suggests that groundwater may not have been directly impacted by the wetting front unless a preferential pathway is present.

Table AD3 2-2. Data Needs Priority Summary – Model Group 6 – 216-B-42 Trench (200-TW-1)(RL/FH)(CPP)(EPA). (13 Pages)

Background	
Site Identification	216-B-35, 216-B-36, 216-B-37, 216-B-38, 216-B-39, 216-B-40, 216-B-41 and 216-B-42
Site Location	B Farm Zone
Type of Site	Trenches
Operating History	The 216-B-35 through 216-B-42 trenches were surface stabilized, as a unit, with 2 ft. of top soil in October 1982. The area is marked with concrete AC-540 posts and Underground Radioactive Material signs. The surface has been planted with wheat grass. In order to provide the tank space needed to support the fuel separations operations in 200 East and West Areas, first cycle supernate stored in the single shell tanks was intentionally discharged to specific retention trenches during 1953 and 1955. Specific retention disposal utilized the moisture retention capacity of the relatively dry soils above the regional ground water table. The volume of liquid disposed to each trench was limited to ten percent of the soil volume between the bottom of the trench and the groundwater table. B Plant and T Plant used the bismuth phosphate process to separate plutonium from irradiated fuel from 1944 through 1956. The first step in the process was to dissolve the metal coating from the fuel rods. The next step dissolved the uranium and extracted the plutonium. The uranium waste was known as the metal waste stream. It contained the bulk of the uranium and 97.5 and 93.6 % of the cesium-137 and strontium-90, respectively (PNNL-14120). The plutonium stream went through two additional decontamination cycles to purify it, producing the first and second cycle waste streams. The first cycle waste stream contained approximately 2% of the long lived fission products and <1% of the plutonium (PNNL-14120). The coating waste was combined with the first cycle waste. The liquid waste from these processes was initially stored in the single shell tanks in tank farms. By 1948, limited space in the tank farms resulted in the decision to discharge the second cycle waste to cribs. In 1951, the 242-B and 242-T Evaporators began to concentrate the first cycle waste to reduce the volume of waste stored in the tank farms. By 1953, the need for tank space resulted in the first cycle waste that was being stored in the single shell tanks, to be discharged via overground pipelines to specific retention trenches. Some specific retention trenches received the waste from the bottoms of the 242-B and 242-T Evaporator tank or tributyl phosphate waste from the Uranium Recovery Process. The trenches are associated with the 221-B facility and 241-BX Tank Farm and are confined within a 2 hectare area.
	The 216-B-38 trench is 10 ft deep by 10 ft wide and 252 ft long and received a known discharge quantity of 1,430,000 L first cycle supernatant waste from 221-B. The waste was high-salt, neutral/basic and had the following radionuclide content: 1.2 g total plutonium, 5800 Ci total beta, 1900 Ci strontium-90, 560 Ci ruthenium-106, 510 Ci cesium-137, < 0.06 Ci cobalt-60, and 42 kg uranium. The trench was active in July & August 1954. The overground pipeline to the unit was removed and the site was backfilled when the specific retention capacity was reached.
	The 216-B-36 trench is 10 ft deep by 10 ft wide and 252 ft long and received a known discharge quantity of 1,940,000 L first cycle supernatant waste from 221-B. The waste was high-salt, neutral/basic and had the following radionuclide content: 0.8 g total plutonium, 3500 Ci total beta, 490 Ci strontium-90, 470 Ci ruthenium-106, 770 Ci cesium-137, <0.07 Ci cobalt-60, and 16 kg uranium. Chemical constituent inventory: nitrates 160 kg, phosphates 40 kg, sulfates 8 kg, sodium (ion) 120 kg, nitrites 18 kg, fluorides 5 kg, sodium hydroxide 3.8 kg, sodium metasilicate 10 kg and sodium meta aluminate 24 kg. The trench was active in March & April 1954.
	The 216-B-42 trench is 10 ft deep by 10 ft wide and 252 ft long and received a known discharge quantity of 1,500,000 L of scavenged waste from uranium recovery (tributyl phosphate solvent extraction) process in 221-U. The waste was high-salt, neutral/basic and had the following radionuclide content: 10 g total plutonium, 5800 Ci total beta, 1100 Ci strontium-90, 1500 Ci ruthenium-106, 96 Ci cesium-137, 10 Ci cobalt-60, and 680 kg uranium. Chemical constituent inventory: nitrates 210 kg, phosphates 11 kg, sulfates 15 kg, sodium (ion) 90 kg & ferrocyanide 0.8 kg. The trench was active in January & February 1955.
	The 216-B-40 trench is 10 ft deep by 10 ft wide and 252 ft long and received a known discharge quantity of 1,640,000 L of first cycle supernatant waste from 221-B. The waste was high-salt, neutral/basic and had the following radionuclide content: 1 g total plutonium, 1800 Ci total beta, 280 Ci strontium-90, 240 Ci ruthenium-106, 350 Ci cesium-137, <0.020 Ci cobalt-60, and 35 kg uranium. The trench was active between April & July 1954.

Table AD3 2-2. Data Needs Priority Summary – Model Group 6 – 216-B-42 Trench (200-TW-1)(RL/FH)(CPP)(EPA). (13 Pages)

The 216-B-41 trench is 10 ft deep by 10 ft wide and 252 ft long and received a known discharge quantity of 1,440,000 L of first cycle supernatant waste from 221-B. The waste was high-salt, neutral/basic and had the following radionuclide content: 0.3 g total plutonium, 2100 Ci total beta, 47 Ci strontium-90, 130 Ci ruthenium-106, 890 Ci cesium-137, <0.10 Ci cobalt-60, 7.5 kg uranium, and 0.00462 Ci plutonium-240. Chemical constituent inventory: nitrates 120 kg, phosphates 27 kg, sulfates 6 kg, sodium (ion) 90 kg, nitrites 13 kg, fluorides 4 kg, sodium hydroxide 28 kg, sodium metasilicate 8 kg & sodium meta aluminate 18 kg. The trench was active in November 1954.

The 216-B-39 trench is 10 ft deep by 10 ft wide and 252 ft long and received a known discharge quantity of 1,470,000 L of first cycle supernatant waste from 221-B. The waste was high-salt, neutral/basic and had the following calculated radionuclide contents: 1.5 g total plutonium, 110 Ci total beta, 23 Ci strontium-90, 65 Ci ruthenium-106, 450 Ci cesium-137, <0.10 Ci cobalt-60, 5.8 kg uranium, and 0.00462 Ci plutonium-240. Chemical constituent inventory: nitrates 120 kg, phosphates 29 kg, sulfates 6 kg, sodium (ion) 90 kg, nitrites 14 kg, fluorides 4 kg, sodium hydroxide 2.8 kg, sodium metasilicate 8 kg & sodium meta aluminate 18 kg. The trench was active in December 1953 and January 1954.

The 216-B-37 trench is 10 ft deep by 10 ft wide and 252 ft long and received a known discharge quantity of 4,320,000 L of first cycle bottoms waste from the waste evaporator in 242-B. The waste was high-salt, neutral/basic and had the following radionuclide content: 2 g total plutonium, 7000 Ci total beta, 16 Ci strontium-90, 500 Ci ruthenium-240, 3100 Ci cesium-137, 1 Ci cobalt-60, and 3.6 kg uranium. Chemical constituent inventory: nitrates 1700 kg, phosphates 400 kg, sulfates 90 kg, sodium (ion) 1300 kg, nitrites 200 kg, fluorides 4 kg, sodium hydroxide 50 kg, sodium metasilicate 100 kg & sodium meta aluminate 250 kg. The trench was active in August 1954.

The 216-B-35 trench is 10 ft deep by 10 ft wide and 252 ft long and received a known discharge quantity of 1,060,000 L of first cycle supernatant waste from 221-B. The waste was high-salt, neutral/basic and had the following radionuclide contents: 1.2 g total plutonium, 1800 Ci total beta, 240 Ci strontium-90, 230 Ci ruthenium-106, 430 Ci cesium-137, <0.30 Ci cobalt-60, and 17 kg uranium. Chemical constituent inventory: nitrates 90 kg, phosphates 20 kg, sulfates 4 kg, sodium (ion) 600 kg, nitrites 10 kg, fluorides 2.6 kg, sodium hydroxide 20 kg, sodium metasilicate 5.5 kg & sodium meta aluminate 10 kg. The trench was active in February and March 1954.

Some of the historical contaminant values presented above do not fall within the uncertainty ranges of the SIM model results (presented in the tables below). The model may need some refining to more accurately reflect the historical data. The following tables represent the mean values, for each site, as determined by the SIM model.

Soil Inventory Model - 216-B-35 Trench (RPP-26744)

Na (kg) 5.996E+04	Al (kg) 2.903E+01	Fe (kg) 1.575E+02	Cr (kg) 3.798E+02	Bi (kg) 1.427E+02	La (kg) 0.000E+00	Hg (kg) 3.788E-01	Zr (kg) 2.852E+01	Pb (kg) 0.000E+00
Ni (kg) 1.055E+02	Ag (kg) 2.896E-01	Mn (kg) 0.000E+00	Ca (kg) 1.695E+02	K (kg) 4.172E+02	NO3 (kg) 1.136E+05	NO2 (kg) 2.456E+03	CO3 (kg) 2.537E+02	PO4 (kg) 7.469E+03
SO4 (kg) 7.511E+03	Si (kg) 3.344E+02	F (kg) 3.970E+03	Cl (kg) 1.739E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 1.528E+03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 6.462E+00	C-14 (Ci) 8.569E-02	Ni-59 (Ci) 2.818E-02	Ni-63 (Ci) 3.900E+00	Co-60 (Ci) 3.366E-01	Se-79 (Ci) 2.818E-03	Sr-90 (Ci) 7.623E+01	Y-90 (Ci) 7.627E+01
Zr-93 (Ci) 1.310E+00	Nb-93m (Ci) 1.153E+00	Tc-99 (Ci) 2.143E-01	Ru-106 (Ci) 1.397E-09	Cd-113m (Ci) 1.709E-01	Sb-125 (Ci) 4.916E-03	Sn-126 (Ci) 1.098E-02	I-129 (Ci) 1.870E-03	Cs-134 (Ci) 5.735E-06
Cs-137 (Ci) 4.849E+02	Ba-137m (Ci) 4.578E+02	Sm-151 (Ci) 2.245E+02	Eu-152 (Ci) 1.231E-02	Eu-154 (Ci) 8.604E-01	Eu-155 (Ci) 3.908E-01	Ra-226 (Ci) 9.280E-06	Ra-228 (Ci) 6.026E-11	Ac-227 (Ci) 2.811E-05
Pa-231 (Ci) 6.141E-04	Th-229 (Ci) 4.175E-08	Th-232 (Ci) 3.522E-10	U-232 (Ci) 2.148E-07	U-233 (Ci) 1.623E-08	U-234 (Ci) 1.185E-02	U-235 (Ci) 5.222E-04	U-236 (Ci) 1.757E-04	U-238 (Ci) 1.211E-02
U-Total (kg) 3.628E+01	Np-237 (Ci) 4.928E-03	Pu-238 (Ci) 4.368E-03	Pu-239 (Ci) 4.277E-01	Pu-240 (Ci) 6.103E-02	Pu-241 (Ci) 1.403E-01	Pu-242 (Ci) 1.065E-06	Am-241 (Ci) 5.509E-01	Am-243 (Ci) 6.335E-05
Cm-242 (Ci) 1.091E-04	Cm-243 (Ci) 1.326E-06	Cm-244 (Ci) 3.112E-05						

216-B-36 Trench (RPP-26744)

Na (kg) 1.097E+05	Al (kg) 5.300E+01	Fe (kg) 2.884E+02	Cr (kg) 6.950E+02	Bi (kg) 2.611E+02	La (kg) 0.000E+00	Hg (kg) 6.934E-01	Zr (kg) 5.219E+01	Pb (kg) 0.000E+00
Ni (kg) 1.931E+02	Ag (kg) 5.300E-01	Mn (kg) 0.000E+00	Ca (kg) 3.102E+02	K (kg) 7.637E+02	NO3 (kg) 2.078E+05	NO2 (kg) 4.496E+03	CO3 (kg) 4.643E+02	PO4 (kg) 1.367E+04
SO4 (kg) 1.375E+04	Si (kg) 6.119E+02	F (kg) 7.266E+03	Cl (kg) 3.183E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 2.796E+03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 1.183E+01	C-14 (Ci) 1.568E-01	Ni-59 (Ci) 5.157E-02	Ni-63 (Ci) 7.139E+00	Co-60 (Ci) 6.158E-01	Se-79 (Ci) 5.159E-03	Sr-90 (Ci) 1.396E+02	Y-90 (Ci) 1.396E+02
Zr-93 (Ci) 2.398E+00	Nb-93m (Ci) 2.109E+00	Tc-99 (Ci) 3.923E-01	Ru-106 (Ci) 2.558E-09	Cd-113m (Ci) 3.127E-01	Sb-125 (Ci) 9.002E-03	Sn-126 (Ci) 2.010E-02	I-129 (Ci) 3.424E-03	Cs-134 (Ci) 1.050E-05
Cs-137 (Ci) 8.873E+02	Ba-137m (Ci) 8.381E+02	Sm-151 (Ci) 4.110E+02	Eu-152 (Ci) 2.251E-02	Eu-154 (Ci) 1.575E+00	Eu-155 (Ci) 7.152E-01	Ra-226 (Ci) 1.699E-05	Ra-228 (Ci) 1.103E-10	Ac-227 (Ci) 5.142E-05
Pa-231 (Ci) 1.124E-03	Th-229 (Ci) 7.642E-08	Th-232 (Ci) 6.445E-10	U-232 (Ci) 3.930E-07	U-233 (Ci) 2.968E-08	U-234 (Ci) 2.170E-02	U-235 (Ci) 9.555E-04	U-236 (Ci) 3.216E-04	U-238 (Ci) 2.215E-02
U-Total (kg) 6.637E+01	Np-237 (Ci) 9.021E-03	Pu-238 (Ci) 7.995E-03	Pu-239 (Ci) 7.853E-01	Pu-240 (Ci) 1.113E-01	Pu-241 (Ci) 2.562E-01	Pu-242 (Ci) 1.932E-06	Am-241 (Ci) 1.008E+00	Am-243 (Ci) 1.159E-04
Cm-242 (Ci) 1.996E-04	Cm-243 (Ci) 2.426E-06	Cm-244 (Ci) 5.698E-05						

216-B-37 Trench (RPP-26744)

Na (kg) 2.444E+05	Al (kg) 1.180E+02	Fe (kg) 6.416E+02	Cr (kg) 1.547E+03	Bi (kg) 5.816E+02	La (kg) 0.000E+00	Hg (kg) 1.544E+00	Zr (kg) 1.162E+02	Pb (kg) 0.000E+00
Ni (kg) 4.301E+02	Ag (kg) 1.180E+00	Mn (kg) 0.000E+00	Ca (kg) 6.906E+02	K (kg) 1.701E+03	NO3 (kg) 4.628E+05	NO2 (kg) 1.001E+04	CO3 (kg) 1.034E+03	PO4 (kg) 3.044E+04
SO4 (kg) 3.061E+04	Si (kg) 1.362E+03	F (kg) 1.618E+04	Cl (kg) 7.088E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 6.225E+03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 2.634E+01	C-14 (Ci) 3.492E-01	Ni-59 (Ci) 1.149E-01	Ni-63 (Ci) 1.589E+01	Co-60 (Ci) 1.371E+00	Se-79 (Ci) 1.149E-02	Sr-90 (Ci) 3.107E+02	Y-90 (Ci) 3.108E+02
Zr-93 (Ci) 5.339E+00	Nb-93m (Ci) 4.695E+00	Tc-99 (Ci) 8.734E-01	Ru-106 (Ci) 5.693E-09	Cd-113m (Ci) 6.965E-01	Sb-125 (Ci) 2.004E-02	Sn-126 (Ci) 4.476E-02	I-129 (Ci) 7.622E-03	Cs-134 (Ci) 2.337E-05
Cs-137 (Ci) 1.976E+03	Ba-137m (Ci) 1.865E+03	Sm-151 (Ci) 9.152E+02	Eu-152 (Ci) 5.016E-02	Eu-154 (Ci) 3.507E+00	Eu-155 (Ci) 1.593E+00	Ra-226 (Ci) 3.781E-05	Ra-228 (Ci) 2.456E-10	Ac-227 (Ci) 1.146E-04
Pa-231 (Ci) 2.502E-03	Th-229 (Ci) 1.702E-07	Th-232 (Ci) 1.435E-09	U-232 (Ci) 8.751E-07	U-233 (Ci) 6.609E-08	U-234 (Ci) 4.826E-02	U-235 (Ci) 2.129E-03	U-236 (Ci) 7.161E-04	U-238 (Ci) 4.933E-02
U-Total (kg) 1.478E+02	Np-237 (Ci) 2.009E-02	Pu-238 (Ci) 1.782E-02	Pu-239 (Ci) 1.746E+00	Pu-240 (Ci) 2.474E-01	Pu-241 (Ci) 5.703E-01	Pu-242 (Ci) 4.317E-06	Am-241 (Ci) 2.244E+00	Am-243 (Ci) 2.582E-04
Cm-242 (Ci) 4.445E-04	Cm-243 (Ci) 5.400E-06	Cm-244 (Ci) 1.269E-04						

Table AD3 2-2. Data Needs Priority Summary – Model Group 6 – 216-B-42 Trench (200-TW-1)(RL/FH)(CPP)(EPA). (13 Pages)

216-B-38 Trench (RPP-26744)

Na (kg) 8.090E+04	Al (kg) 3.907E+01	Fe (kg) 2.126E+02	Cr (kg) 5.121E+02	Bi (kg) 1.924E+02	La (kg) 0.000E+00	Hg (kg) 5.111E-01	Zr (kg) 3.847E+01	Pb (kg) 0.000E+00
Ni (kg) 1.423E+02	Ag (kg) 3.907E-01	Mn (kg) 0.000E+00	Ca (kg) 2.286E+02	K (kg) 5.628E+02	NO3 (kg) 1.532E+05	NO2 (kg) 3.314E+03	CO3 (kg) 3.423E+02	PO4 (kg) 1.008E+04
SO4 (kg) 1.013E+04	Si (kg) 4.510E+02	F (kg) 5.355E+03	Cl (kg) 2.346E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 2.061E+03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 8.719E+00	C-14 (Ci) 1.156E-01	Ni-59 (Ci) 3.803E-02	Ni-63 (Ci) 5.260E+00	Co-60 (Ci) 4.542E-01	Se-79 (Ci) 3.802E-03	Sr-90 (Ci) 1.028E+02	Y-90 (Ci) 1.029E+02
Zr-93 (Ci) 1.768E+00	Nb-93m (Ci) 1.555E+00	Tc-99 (Ci) 2.891E-01	Ru-106 (Ci) 1.885E-09	Cd-113m (Ci) 2.305E-01	Sb-125 (Ci) 6.633E-03	Sn-126 (Ci) 1.482E-02	I-129 (Ci) 2.523E-03	Cs-134 (Ci) 7.738E-06
Cs-137 (Ci) 6.541E+02	Ba-137m (Ci) 6.178E+02	Sm-151 (Ci) 3.030E+02	Eu-152 (Ci) 1.660E-02	Eu-154 (Ci) 1.161E+00	Eu-155 (Ci) 5.273E-01	Ra-226 (Ci) 1.252E-05	Ra-228 (Ci) 8.132E-11	Ac-227 (Ci) 3.794E-05
Pa-231 (Ci) 8.287E-04	Th-229 (Ci) 5.634E-08	Th-232 (Ci) 4.751E-10	U-232 (Ci) 2.898E-07	U-233 (Ci) 2.187E-08	U-234 (Ci) 1.599E-02	U-235 (Ci) 7.040E-04	U-236 (Ci) 2.370E-04	U-238 (Ci) 1.633E-02
U-Total (kg) 4.896E+01	Np-237 (Ci) 6.650E-03	Pu-238 (Ci) 5.909E-03	Pu-239 (Ci) 5.789E-01	Pu-240 (Ci) 8.191E-02	Pu-241 (Ci) 1.889E-01	Pu-242 (Ci) 1.435E-06	Am-241 (Ci) 7.433E-01	Am-243 (Ci) 8.544E-05
Cm-242 (Ci) 1.471E-04	Cm-243 (Ci) 1.788E-06	Cm-244 (Ci) 4.200E-05						

216-B-39 Trench (RPP-26744)

Na (kg) 8.712E+04	Al (kg) 4.201E+01	Fe (kg) 2.288E+02	Cr (kg) 5.516E+02	Bi (kg) 2.073E+02	La (kg) 0.000E+00	Hg (kg) 5.504E-01	Zr (kg) 4.143E+01	Pb (kg) 0.000E+00
Ni (kg) 1.533E+02	Ag (kg) 4.207E-01	Mn (kg) 0.000E+00	Ca (kg) 2.462E+02	K (kg) 6.063E+02	NO3 (kg) 1.650E+05	NO2 (kg) 3.569E+03	CO3 (kg) 3.686E+02	PO4 (kg) 1.085E+04
SO4 (kg) 1.091E+04	Si (kg) 4.858E+02	F (kg) 5.767E+03	Cl (kg) 2.527E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 2.220E+03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 9.387E+00	C-14 (Ci) 1.245E-01	Ni-59 (Ci) 4.095E-02	Ni-63 (Ci) 5.665E+00	Co-60 (Ci) 4.890E-01	Se-79 (Ci) 4.095E-03	Sr-90 (Ci) 1.108E+02	Y-90 (Ci) 1.108E+02
Zr-93 (Ci) 1.903E+00	Nb-93m (Ci) 1.675E+00	Tc-99 (Ci) 3.114E-01	Ru-106 (Ci) 2.031E-09	Cd-113m (Ci) 2.482E-01	Sb-125 (Ci) 7.145E-03	Sn-126 (Ci) 1.595E-02	I-129 (Ci) 2.717E-03	Cs-134 (Ci) 8.331E-06
Cs-137 (Ci) 7.044E+02	Ba-137m (Ci) 6.652E+02	Sm-151 (Ci) 3.263E+02	Eu-152 (Ci) 1.788E-02	Eu-154 (Ci) 1.250E+00	Eu-155 (Ci) 5.678E-01	Ra-226 (Ci) 1.348E-05	Ra-228 (Ci) 8.755E-11	Ac-227 (Ci) 4.084E-05
Pa-231 (Ci) 8.921E-04	Th-229 (Ci) 6.067E-08	Th-232 (Ci) 5.116E-10	U-232 (Ci) 3.120E-07	U-233 (Ci) 2.357E-08	U-234 (Ci) 1.722E-02	U-235 (Ci) 7.584E-04	U-236 (Ci) 2.552E-04	U-238 (Ci) 1.759E-02
U-Total (kg) 5.271E+01	Np-237 (Ci) 7.160E-03	Pu-238 (Ci) 6.322E-03	Pu-239 (Ci) 6.224E-01	Pu-240 (Ci) 8.822E-02	Pu-241 (Ci) 2.045E-01	Pu-242 (Ci) 1.542E-06	Am-241 (Ci) 8.003E-01	Am-243 (Ci) 9.208E-05
Cm-242 (Ci) 1.584E-04	Cm-243 (Ci) 1.926E-06	Cm-244 (Ci) 4.521E-05						

Table AD3 2-2. Data Needs Priority Summary – Model Group 6 – 216-B-42 Trench (200-TW-1)(RL/FH)(CPP)(EPA). (13 Pages)

216-B-40 Trench (RPP-26744)

Na (kg) 9.277E+04	Al (kg) 4.484E+01	Fe (kg) 2.438E+02	Cr (kg) 5.874E+02	Bi (kg) 2.208E+02	La (kg) 0.000E+00	Hg (kg) 5.859E-01	Zr (kg) 4.412E+01	Pb (kg) 0.000E+00
Ni (kg) 1.633E+02	Ag (kg) 4.480E-01	Mn (kg) 0.000E+00	Ca (kg) 2.621E+02	K (kg) 6.454E+02	NO3 (kg) 1.757E+05	NO2 (kg) 3.800E+03	CO3 (kg) 3.926E+02	PO4 (kg) 1.156E+04
SO4 (kg) 1.162E+04	Si (kg) 5.173E+02	F (kg) 6.142E+03	Cl (kg) 2.691E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 2.364E+03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 9.996E+00	C-14 (Ci) 1.326E-01	Ni-59 (Ci) 4.360E-02	Ni-63 (Ci) 6.033E+00	Co-60 (Ci) 5.206E-01	Se-79 (Ci) 4.362E-03	Sr-90 (Ci) 1.180E+02	Y-90 (Ci) 1.179E+02
Zr-93 (Ci) 2.027E+00	Nb-93m (Ci) 1.783E+00	Tc-99 (Ci) 3.316E-01	Ru-106 (Ci) 2.164E-09	Cd-113m (Ci) 2.644E-01	Sb-125 (Ci) 7.603E-03	Sn-126 (Ci) 1.699E-02	I-129 (Ci) 2.894E-03	Cs-134 (Ci) 8.873E-06
Cs-137 (Ci) 7.501E+02	Ba-137m (Ci) 7.084E+02	Sm-151 (Ci) 3.474E+02	Eu-152 (Ci) 1.905E-02	Eu-154 (Ci) 1.331E+00	Eu-155 (Ci) 6.047E-01	Ra-226 (Ci) 1.436E-05	Ra-228 (Ci) 9.322E-11	Ac-227 (Ci) 4.348E-05
Pa-231 (Ci) 9.501E-04	Th-229 (Ci) 6.461E-08	Th-232 (Ci) 5.449E-10	U-232 (Ci) 3.322E-07	U-233 (Ci) 2.510E-08	U-234 (Ci) 1.833E-02	U-235 (Ci) 8.081E-04	U-236 (Ci) 2.718E-04	U-238 (Ci) 1.873E-02
U-Total (kg) 5.615E+01	Np-237 (Ci) 7.625E-03	Pu-238 (Ci) 6.762E-03	Pu-239 (Ci) 6.632E-01	Pu-240 (Ci) 9.372E-02	Pu-241 (Ci) 2.178E-01	Pu-242 (Ci) 1.636E-06	Am-241 (Ci) 8.520E-01	Am-243 (Ci) 9.800E-05
Cm-242 (Ci) 1.688E-04	Cm-243 (Ci) 2.050E-06	Cm-244 (Ci) 4.811E-05						

216-B-41 Trench (RPP-26744)

Na (kg) 8.146E+04	Al (kg) 3.919E+01	Fe (kg) 2.139E+02	Cr (kg) 5.157E+02	Bi (kg) 1.940E+02	La (kg) 0.000E+00	Hg (kg) 5.147E-01	Zr (kg) 3.874E+01	Pb (kg) 0.000E+00
Ni (kg) 1.434E+02	Ag (kg) 3.934E-01	Mn (kg) 0.000E+00	Ca (kg) 2.302E+02	K (kg) 5.668E+02	NO3 (kg) 1.543E+05	NO2 (kg) 3.337E+03	CO3 (kg) 3.447E+02	PO4 (kg) 1.015E+04
SO4 (kg) 1.020E+04	Si (kg) 4.542E+02	F (kg) 5.393E+03	Cl (kg) 2.362E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 2.075E+03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 8.781E+00	C-14 (Ci) 1.164E-01	Ni-59 (Ci) 3.829E-02	Ni-63 (Ci) 5.299E+00	Co-60 (Ci) 4.571E-01	Se-79 (Ci) 3.828E-03	Sr-90 (Ci) 1.036E+02	Y-90 (Ci) 1.036E+02
Zr-93 (Ci) 1.780E+00	Nb-93m (Ci) 1.566E+00	Tc-99 (Ci) 2.912E-01	Ru-106 (Ci) 1.897E-09	Cd-113m (Ci) 2.321E-01	Sb-125 (Ci) 6.682E-03	Sn-126 (Ci) 1.492E-02	I-129 (Ci) 2.541E-03	Cs-134 (Ci) 7.790E-06
Cs-137 (Ci) 6.586E+02	Ba-137m (Ci) 6.220E+02	Sm-151 (Ci) 3.051E+02	Eu-152 (Ci) 1.672E-02	Eu-154 (Ci) 1.169E+00	Eu-155 (Ci) 5.308E-01	Ra-226 (Ci) 1.261E-05	Ra-228 (Ci) 8.187E-11	Ac-227 (Ci) 3.821E-05
Pa-231 (Ci) 8.341E-04	Th-229 (Ci) 5.672E-08	Th-232 (Ci) 4.784E-10	U-232 (Ci) 2.918E-07	U-233 (Ci) 2.204E-08	U-234 (Ci) 1.609E-02	U-235 (Ci) 7.095E-04	U-236 (Ci) 2.386E-04	U-238 (Ci) 1.645E-02
U-Total (kg) 4.928E+01	Np-237 (Ci) 6.697E-03	Pu-238 (Ci) 5.908E-03	Pu-239 (Ci) 5.818E-01	Pu-240 (Ci) 8.230E-02	Pu-241 (Ci) 1.905E-01	Pu-242 (Ci) 1.453E-06	Am-241 (Ci) 7.483E-01	Am-243 (Ci) 8.609E-05
Cm-242 (Ci) 1.482E-04	Cm-243 (Ci) 1.802E-06	Cm-244 (Ci) 4.229E-05						

Table AD3 2-2. Data Needs Priority Summary – Model Group 6 – 216-B-42 Trench (200-TW-1)(RL/FH)(CPP)(EPA). (13 Pages)

	216-B-42 Trench (RPP-26744)

Na (kg) 1.338E+05	Al (kg) 0.000E+00	Fe (kg) 1.570E+02	Cr (kg) 2.580E+02	Bi (kg) 5.789E+01	La (kg) 0.000E+00	Hg (kg) 4.777E-01	Zr (kg) 0.000E+00	Pb (kg) 0.000E+00
Ni (kg) 1.577E+02	Ag (kg) 4.496E-03	Mn (kg) 0.000E+00	Ca (kg) 2.213E+02	K (kg) 9.853E+02	NO3 (kg) 2.979E+05	NO2 (kg) 1.421E+02	CO3 (kg) 3.314E+02	PO4 (kg) 1.005E+04
SO4 (kg) 1.764E+04	Si (kg) 4.359E+02	F (kg) 6.075E+03	Cl (kg) 4.108E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 1.704E-03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 9.348E+00	C-14 (Ci) 3.624E-01	Ni-59 (Ci) 6.132E-03	Ni-63 (Ci) 5.358E-01	Co-60 (Ci) 2.819E-01	Se-79 (Ci) 1.636E-02	Sr-90 (Ci) 2.009E+02	Y-90 (Ci) 2.010E+02
Zr-93 (Ci) 4.395E-03	Nb-93m (Ci) 3.884E-03	Tc-99 (Ci) 5.697E+00	Ru-106 (Ci) 4.840E-12	Cd-113m (Ci) 4.910E-01	Sb-125 (Ci) 1.461E-02	Sn-126 (Ci) 6.173E-02	I-129 (Ci) 7.309E-03	Cs-134 (Ci) 4.677E-07
Cs-137 (Ci) 5.266E+01	Ba-137m (Ci) 4.971E+01	Sm-151 (Ci) 6.063E+02	Eu-152 (Ci) 2.216E-02	Eu-154 (Ci) 1.682E+00	Eu-155 (Ci) 9.858E-01	Ra-226 (Ci) 7.806E-05	Ra-228 (Ci) 3.650E-10	Ac-227 (Ci) 3.780E-04
Pa-231 (Ci) 3.252E-06	Th-229 (Ci) 1.742E-08	Th-232 (Ci) 1.475E-10	U-232 (Ci) 1.900E-07	U-233 (Ci) 1.548E-08	U-234 (Ci) 1.524E-02	U-235 (Ci) 6.796E-04	U-236 (Ci) 1.742E-04	U-238 (Ci) 1.552E-02
U-Total (kg) 4.652E+01	Np-237 (Ci) 4.521E-02	Pu-238 (Ci) 8.517E-03	Pu-239 (Ci) 1.194E+00	Pu-240 (Ci) 1.286E-01	Pu-241 (Ci) 2.509E-01	Pu-242 (Ci) 1.758E-06	Am-241 (Ci) 2.498E+00	Am-243 (Ci) 3.524E-04
Cm-242 (Ci) 6.074E-04	Cm-243 (Ci) 7.177E-06	Cm-244 (Ci) 1.692E-04						

Vicinity Waste Sites	216-B-35, 216-B-36, 216-B-37, 216-B-38, 216-B-39, 216-B-40, and 216-B-41
Current Status	216-B-38: representative site; investigated under 200-TW-1/2 Work Plan (DOE/RL-2000-38) with 1 deep borehole and 5 direct pushes; reported in 200-TW-1/2 Remedial Investigation (RI) Report (DOE/RL-2002-42); evaluated in 200-TW-1/2/200-PW-5 Feasibility Study (FS) (DOE/RL-2003-64); capping identified as preferred alternative in FS. 216-B-42: analogous to 216-B-46; reported in 200-TW1/2 RI Report (DOE/RL-2002-42); evaluated in 200-TW1/2 and 200-PW-5 FS (DOE/RL-2003-64); capping identified as preferred alternative in FS.

Potential Remedial Alternatives (as investigated in the 200-TW-1/2 and 200-PW-5 FS [DOE/RL-2003-64])

X for viable alternatives	**No Action**	**MESC/MNA/IC**	**Removal/Disposal**	**Barrier**	**Partial Removal / Barrier**	**In Situ Treatment**	**Other**
		X	X	X	X		

Table AD3 2-2. Data Needs Priority Summary – Model Group 6 – 216-B-42 Trench (200-TW-1)(RL/FH)(CPP)(EPA). (13 Pages)

Data Evaluation and Gaps Analysis			
Data	**Knowns**	**Data Uncertainties**	**Are supplemental data required to support decision making?**
1 Deep Borehole at 216-B-38: C3104 (259.6 ft) (Spectral, 2001) Geophysical logging with spectral gamma and neutron moisture instruments at representative site 216-B-38:	Borehole C3104: Located within the eastern end of the 216-B-38 Trench; twelve soil samples were collected from the trench surface to a depth of 80.9 m (265.5 ft) ; samples were analyzed for radionuclides, inorganics (metals), general chemistry anions, and herbicides. The following 19 constituents exceeded the initial screening in the soil column beneath the 216-B-38 Trench: • americium-241 • cesium-137 • cobalt-60 • plutonium-238 • plutonium-239/240 • potassium-40 • strontium-90 • technetium-99 • tritium • total uranium • uranium-233/234 • uranium-238 • ammonia • fluoride • nitrate • nitrite • phosphate • sulfate • sodium Radiological contaminants were detected between 1.1 and 61 m (3.5 and 200 ft) bgs. Cesium-137 was detected at low levels from 1.1 to 3.8 m (3.5 to 12.5 ft) bgs with a maximum activity of 1.82 pCi/g. The major zone of radiological contamination extends from 4.4 to 12 m (14.5 to 40 ft) bgs. The maximum concentrations of cesium-137 (226,000 pCi/g), plutonium-238 (7.85 pCi/g), plutonium-239/240 (159 pCi/g), potassium-40 (273 pCi/g), strontium-90 (2,050 pCi/g), and uranium (32.5 µg/g) were detected in this zone. From 12 to 61 m (40 to 200 ft) bgs, radionuclide concentrations were less than 2.0 pCi/g, with the exception of tritium. Tritium was detected at a maximum concentration of 28.7 pCi/g at a depth of 16.6 m (54.5 ft) and decreased to less than 1 pCi/g at the groundwater/vadose zone interface. Sodium, the only metal that exceeded the initial screening, was detected from 4.4 to 6.3 m (14.5 to 20.5 ft) bgs (i.e., the bottom of the trench) at a maximum concentration of 848 mg/kg. Ammonia, fluoride, nitrate, nitrite, phosphate, and sulfate exceeded the initial screening at the trench. Nitrate and nitrite were distributed deep in the vadose zone to a maximum depth of 61 m (200 ft) bgs. Ammonium, fluoride, and phosphate were not detected deeper than 16.6 m (54.5 ft) bgs. Maximum concentrations were 65.2 mg/kg for ammonia	216-B-37 received approximately three times higher effluent volume than 216-B-38 or any other trench in this group. Pipelines in the area may have contributed additional sources of water to the trenches. 216-B-42 received scavenged waste from the uranium recovery process, which represents a different waste stream than that received by 216-B-35 through 216-B-41 (1st cycle supernatant). The 299-E33-10 borehole is approximately 180 ft west of the 216-B-42 Trench, which is not close enough to adequately represent the contamination problem at this trench.	216-B-35 through 216-B-41: No – existing data provide information for the nature of contamination and the lateral extent in the shallow zone; ERC reported contamination to depths about 175 ft bgs, but suggested groundwater would not be immediately impacted by this contamination zone. Information and lessons learned from activities being planned for the BC Cribs and Trenches area will be useful to the evaluation of remedial actions for this series of waste sites. 216-B-42: Yes – a deep borehole at this site would reduce the uncertainty associated with differences in waste streams between 216-B-42 and 216-B-38; depth of borehole was determined by geophysical resistivity characterization results; the source OUs in the area will also use this data.

	(as ammonia), 33.4 mg/kg for fluoride, 3,180 mg/kg for nitrate (as nitrate), 41.2 mg/kg for nitrite (as nitrite), and 149 mg/kg for phosphate. Sulfate was detected throughout the borehole with a maximum concentration of 248 mg/kg in the 2.9 to 3.7 m (9.5 to 12 ft) sample.		
C3340 (60 ft) (Spectral, 2001)	Cesium-137 and cobalt-60 were the only man-made radionuclide detected in all five drive casings (C3340 – C3344). In drive casing C3340, cesium-137 was detected from 15 to 32 ft (4.6 to 9.8 m) bgs with the maximum of 180,000 pCi/g occurring at 23.5 ft (7.2 m) bgs.		
C3341 (60 ft) (Spectral, 2001)	In drive casing C3341, the highest concentrations of cesium-137 occurred between 12.5 and 28 ft (3.8 and 8.5 m) bgs with a maximum concentration of 56,186 pCi/g at 17 ft (5.2 m) bgs. A second interval of cesium-137 contamination was encountered from 29.5 to 33 ft (9.0 to 10.0 m) bgs with a maximum concentration of 6,356 pCi/g at 31.5 ft (9.6 m). Minor cesium-137 contamination was noted from 4 to 5.5 ft (1.2 to 1.7 m) with a maximum concentration of 2.57 pCi/g. Cobalt-60 was detected from 33 to 57 ft (10.0 to 17.4 m) with a maximum concentration of 0.16 pCi/g at 53 ft (16 m). The moisture content increased slightly between 15 and 35 ft (4.6 and 10.7 m) bgs. This corresponds to the area of high cesium-137, but also may be a result of interference from the high gamma radiation.		
C3342 (59.5 ft) (Spectral, 2001)	In drive casing C3342, the highest concentrations of cesium-137 occurred between 13 and 33.5 ft (4.0 and 10.2 m) with a maximum concentration of 195,000 pCi/g at 16.5 ft (5.0 m) bgs. From 17.5 to 28.5 ft (5.3 to 8.7 m) bgs, the concentrations decreased to the 20,000 to 100,000 pCi/g range. From 33.5 ft (10.2 m) to the total depth of 59.5 ft (18.1 m), the concentrations decreased from over 2,000 pCi/g to about 15 pCi/g. Cobalt-60 was detected from 34 to 42 ft (10.4 to 12.8 m) bgs with a maximum concentration of 0.29 pCi/g. The moisture content increased slightly in the zone of high cesium-137.		
C3343 (60 ft) (Spectral, 2001)	In C3343, only minor cesium-137 concentrations were detected from 4.5 to 5.5 ft (1.4 to 1.7 m) bgs with a maximum of 1.2 pCi/g. Moisture increased slightly from 22 to 29 ft (6.7 to 8.8 m) bgs and below 35 ft (10.7 m) bgs. These increases correspond to an increase in concentration of naturally occurring radionuclides and may indicate a stratigraphic change to a zone with a higher percentage of finer grained particles.		
C3344 (60 ft) (Spectral, 2001)	In C3344, only minor cesium-137 concentrations were detected from 4.5 to 5.0 ft (1.4 to 1.5 m) bgs with a maximum of 0.8 pCi/g. Moisture increased slightly from 38 to 39 ft (11.6 to 11.9 m) bgs. This increase		

	corresponds to an increase in concentration of naturally occurring radionuclides and may indicate a stratigraphic change to a zone with a higher percentage of finer grained particles.		
299-E33-289 (50 ft) (Spectral, 2002); (Moisture, 1999)	299-E33-289: located 5 m (16 ft) south of the midpoint of the 216-B-38 Trench. Except for the upper 3 ft of the borehole, cesium-137 was detected throughout the length of this borehole. A zone of cesium-137 contamination was detected near the ground surface (log depth 5.0 through 8.5 ft) with a maximum concentration of about 40 pCi/g. A second zone between 18 and 31 ft had a maximum cesium-137 concentration of about 70,000 pCi/g. Concentrations at the bottom of the borehole exceeded 200 pCi/g, suggesting the borehole did not penetrate all of the contamination. Moisture measurements collected in 1999 indicate the high contamination zone is generally higher in moisture than the remainder of the vadose zone measured in this borehole. Above the zone of cesium-137, apparent potassium-40 activities are about 12 pCi/g. The increase in potassium-40 activity to about 18 pCi/g at 34 ft may represent the transition from the coarser-grained sediments of the gravel-dominated Hanford formation to the finer-grained sediments of the sand-dominated Hanford formation.		
299-E33-290 (50 ft) (Spectral, 2001)	299-E33-290: located 4 m (13 ft) north of the midpoint of the 216-B-38 Trench. Man-made radionuclides cesium-137 and cobalt-60 were detected in this borehole. A zone of cesium-137 contamination was detected near the ground surface (log depth 1.5 through 9.5 ft) with activities ranging from 0.2 to 17.5 pCi/g. Cobalt-60 was detected with an activity of about 0.2 pCi/g at 44.0 and 44.5 ft near the detection limit (0.16 pCi/g) of the Spectral Gamma Logging System (SGLS). A second zone of contamination between about 22 ft and the total depth of the borehole required High Resolution Logging System (HRLS) measurements where the SGLS dead time exceeded 40 percent. The maximum concentration of cesium-137 measured with the HRLS was about 70,000 pCi/g at 28 ft. Cesium-137 concentrations at the bottom of the borehole remained in excess of 6,000 pCi/g, suggesting the borehole did not penetrate all of the contamination. Comparison of existing logs from 1992 through 2002 shows good agreement and indicates no changes in the cesium-137 profile since 1992. In 1992, cobalt-60 was detected over the interval of 35 to 45 ft at less than 0.5 pCi/g; whereas cobalt-60 was detected at 0.2 pCi/g in 2001. Moisture measurements collected in 1999 indicate relatively higher		

	moisture content in the sediments at the top of the zones of higher gamma flux. Above the zone of intense gamma-ray activity (24 to 36 ft), apparent potassium-40 activities are about 12 pCi/g. The increase in potassium-40 activity to about 18 pCi/g at 36 ft may represent the transition from the coarse-grained sediments of the gravel-dominated Hanford formation to the finer-grained sediments of the sand-dominated Hanford formation.		
Geophysical logging at 216-B-37: 299-E33-288 (52.41 ft) (Spectral, 2001)	299-E33-288: located 3 m (10 ft) north of the midpoint of the 216-B-37 Trench. The man-made radionuclide detected in this borehole is cesium-137. Cesium-137 was detected almost continuously from near the ground surface to the total depth of the borehole. The maximum concentrations approach 10^5 pCi/g between about 28 and 36 ft. The concentration at total depth is about 10,000 pCi/g, suggesting the borehole was not deep enough to penetrate the entire contamination zone. The Radionuclide Logging System (RLS) cesium-137 concentration data compare favorably with the SGLS and HRLS concentrations. The cesium-137 contaminant profile does not appear to have changed significantly since 1999. The moisture data were collected in 1999. The two high moisture zones at about 6 ft and between 20 and 28 ft appear to occur at depth intervals just above the high cesium-137 concentration zone at 9.5 ft and in the top 8 ft of a high cesium-137 concentration zone that extends from about 20 ft to the total depth of the borehole. The logs of naturally occurring potassium, uranium, and thorium (KUT) do not delineate any definitive lithologic units. Changes in the potassium-40 concentrations from near 10 pCi/g at 20 ft to 17 pCi/g at about 42 ft suggest a lithologic change occurs in this interval. This change is likely the transition from the coarser-grained sediments of the gravel-dominated Hanford formation to the finer-grained sediments of the sand-dominated Hanford formation. Cesium-137 contamination extends more than 38 m (125 ft) from the east end of the ditch (i.e., half of the ditch) and 6.1 to 7.6 m (20 to 25 ft) on either side of the ditch. The conceptual contaminant distribution model in the Work Plan did not indicate the head end of the ditch, because the historical information was not sufficient to determine the discharge point in the trench. The geophysical logging conducted during the RI clarified the head end and provided information on the distribution of contamination along the length of the trench.		

299-E33-287 (52.71 ft) (Spectral, 2001); (Moisture, 1999) Geophysical logging at 216-B-41: 299-E33-08 (257 ft) (Spectral, 2002); (Moisture, 1999); Scintillation logs for 216-B-41 were collected in 1959 and 1976	299-E33-287: located 8 m (25 ft) south of the 216-B-37 Trench. Cesium-137 was detected in this borehole between about 4 and 9 feet in depth and between about 26 ft and the total depth. The maximum cesium-137 concentrations exist between about 37 and 40 ft at about 10^5 pCi/g. The RLS cesium-137 concentration data compare favorably with the SGLS and HRLS data. The contaminant profile does not appear to have changed significantly since 1999. The moisture data were collected in 1999. Relatively high moisture exists at about 6 ft and coincides with the high cesium-137 concentration zone between 4 and 9 ft. A second high moisture zone exists between 18 and 25 ft and occurs just above the zone of high gamma flux that exists between 26 ft and total depth of the borehole. The KUT logs do not delineate any definitive lithologic units. Changes in the potassium-40 concentrations from near 10 pCi/g at 25 ft to 17 pCi/g at about 52 ft suggest a lithologic change occurs in this interval; this change could be at 26 ft where the potassium-40 concentrations appear to be increasing. This change is likely the transition from the coarser-grained sediments of the gravel-dominated Hanford formation unit to the finer-grained sediments of the sand-dominated Hanford formation. 299-E33-08: located approximately 16 m (52 ft) north of the east end of the 216-B-41 Trench. Cesium-137, cobalt-60, and antimony-125 were detected in this borehole using spectral gamma logging in 2002. A zone of cesium-137 contamination was detected near the ground surface (log depths 4.0 and 4.5 ft) with activities ranging from 0.7 to 1.25 pCi/g. Between 30 and 43 ft, cesium-137 was detected at activities ranging from 0.3 to 7.3 pCi/g. Cesium-137 was detected at activities ranging from 0.3 to 3.5 pCi/g in the interval from 227.5 to 250.5 ft. In addition, cesium-137 contamination was detected near the method detection limit (MDL) (about 0.3 pCi/g) at log depths 9.0, 56.0, and 163.5 ft. Cobalt-60 was detected at activities ranging from 0.1 to 0.3 pCi/g in the interval from 251.5 to 258.5 ft and below the 2002 groundwater depth (252.7 ft). Between 31 and 61.5 ft, cobalt-60 was detected at activities ranging from 0.1 to 0.6 pCi/g. Antimony-125 was detected in the zone between 32 and 34 ft at activities ranging from near the MDL (1 pCi/g) to 2.5 pCi/g. A moisture spike at 34 ft corresponds with an increase in thorium-232, which is likely indicative of the transition from the coarser-grained sediments of the gravel-dominated Hanford formation to the finer-grained sediments of the sand-dominated Hanford formation. Gross gamma profiles indicate that significant amounts of gamma-emitting contamination were present below 200 ft as early as May 1959 (ARH-ST-156). Scintillation logs show elevated gamma activity from about 7 to 20		

	m (23 to 65 ft) in 1959 and in 1976 (ARH-ST-156). Decay between 1959 and 1976 reduced concentrations of shorter-lived gamma emitting radionuclides, leaving a maximum concentration in 1976 of about 3 x 10^5 counts per minute.		
Geophysical logging at 216-B-42: 299-E33-10 (290 ft) (Spectral, 2002)	299-E33-10: located 200 ft west of the 216-B-42 Trench. Cesium-137 was detected near the ground surface (log depth 4.0 ft) with an activity of 0.9 pCi/g. It was detected at 24 and 25 ft at a concentration of 0.6 pCi/g. This small amount of cesium-137 is insufficient to explain the increase in total gamma in this interval, which suggests a remote gamma source or a strong beta emitter. Also cesium-137 contamination was detected near the MDL (about 3.0 pCi/g) at log depths 267 and 268 ft. Cobalt-60 was detected at activities ranging from 0.1 to 0.2 pCi/g in the interval from 277 to 281 ft and below the 2002 groundwater depth (275.5 ft.)		
Geophyscial logging at 216-B-36: 299-E33-21 (284 ft) (Spectral, 2002) Scintillation logs for 216-B-36 were dated 1959, 1963, 1970 and 1976	299-E33-21: located at the eastern end of the 216-B-36 Trench. Cesium-137 was detected almost continuously throughout this borehole. Cesium-137 activities exceeded 1000 pCi/g in the intervals between 12.5 and 44.0 ft. The maximum cesium-137 measured was about 48,000 pCi/g at 14.5 ft. Recognizable changes in the KUT logs occurred in this borehole. Gross gamma profiles indicate that significant amounts of gamma-emitting contamination were present below 250 ft as early as May 1959 (ARH-ST-156). The gamma contamination appears to start at about 80 m (262 ft) in 1959 versus about 83 m (273 ft) in the 1963, 1970, and 1976 log runs. Because cobalt-60 contamination is essentially only detected below groundwater in this borehole, it is speculated that the cobalt-60 and associated cesium-137 detected at depth may have been transported in the groundwater to this location.		
Geophysical logging at 216-B-35: 299-E33-286 (53 ft) (Spectral, 2002); (Mositure, 1999)	299-E33-286: located 4 m (13 ft) south of the 216-B-35 Trench. Cesium-137 was detected between about 4 and 10 ft in depth and between 26 ft and the total depth of the borehole. The maximum measured cesium-137 concentration was about 50,000 pCi/g between about 37 and 40 ft. The moisture data were collected in 1999. Relatively high moisture exists between 23 and 26 ft and occurs just above the zone of high gamma flux that exists between 26 ft and total depth of the borehole.		

References:

- WIDS, *Waste Information Data System* database
- ARH-ST-156, *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells*
- BHI-01607, *Borehole Summary Report for the 216-B-38 Trench & the 216-B-7A Crib, 200-TW-2 Tank Waste Group OU;*
- DOE/RL-2002-42, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 OU)*
- WHC-MR-0227, *Tank Wastes Discharged Directly to the Soil at the Hanford Site*
- DOE/RL-2003-64, *Feasibility Study for the 200-TW-1 Scavenged Waste Group & the 200-TW-2 Tank Waste Group & the 200-PW-5 Fission-Product Rich Waste Group OU*
- GJO-2002-322-TAR, *Hanford 200 Areas Spectral Gamma Baseline Characterization Project 216-B-35 to -42 Trenches Waste Site Summary Report*
- DOE/RL-2004-10, *Proposed Plan for the 200-TW-1 Scavenged Waste Group & the 200-TW-2 Tank Waste Group & the 200-PW-5 Fission-Product Rich Waste Group OU*
- DOE/RL-2000-38, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan.*
- PNNL-14120, *Laboratory-Scale Bismuth Phosphate Extraction Process Simulation to Track Fate of Fission Products*
- RPP-26744, *Hanford Soil Inventory Model, Rev. 1*

AD3-3.0 216-S-13 CRIB SITE-SPECIFIC FIELD-SAMPLING PLAN

The characterization planned for the 216-S-13 Crib includes drilling a deep borehole to groundwater, approximately 221 ft, and geophysical logging of this same borehole. The drilling and logging efforts are planned to reduce the uncertainty associated with differences in chromium data between the current SIM model and historical estimates and to address analogous relationships with other sites. The 216-S-13 Crib received liquid waste from the 203-S Decontamination Metal Storage Facility, 204-S Uranium Nitrate Hexahydrate Lag Storage Facility, and 276-S Organic-Solvent Make-up Facility; the waste site was recently transferred from the 200-PW-3 OU to the 200-PW-5 OU so no analogous relationship has been established.

Split-spoon samples will be collected at the bottom of the crib and at changes in lithology as indicated in Figure AD3 3-2; the samples will be analyzed for analytes presented in Volume I, Table A2-3, the 200-TW-1 and 200-PW-3 columns. This waste site was recently transferred to the 200-PW-5 OU from 200-PW-3 when it was concluded that waste was more representative of the 200-PW-5 OU during the development of the 200-PW-1/3/6 feasibility study (FS) and proposed plan (PP). Analysis of contaminants in both columns will address all COPC for this site. Documentation for groundwater samples, if requested by an operable unit manager, will be provided by the requesting party. The sample analysis will provide information for decision-making on representative/analogous relationships and due to similar hexone contamination, support decision-making for the hexone release at 216-S-14 Crib. The grab samples to be analyzed will be determined by the field geologist and technical lead, utilizing characterization data; such as geophysical logs, lithology (driller's logs), and split-spoon sample analyses.

The 299-W22-21 well, which monitors this waste site, is too far removed from the contaminant source to accurately describe the contamination distribution below the crib. The location of the planned deep borehole, at the center of the crib, was determined from construction drawings to address the zone of highest contamination. ERC data is to be included in a report issued by Pacific Northwest National Laboratory, expected March 2008, following their QA/QC procedures.

The following figures and tables provide the site-specific field-sampling plan for the 216-S-13 Crib.

Figure AD3 3-1. 216-S-13 Crib Data-Collection Locations

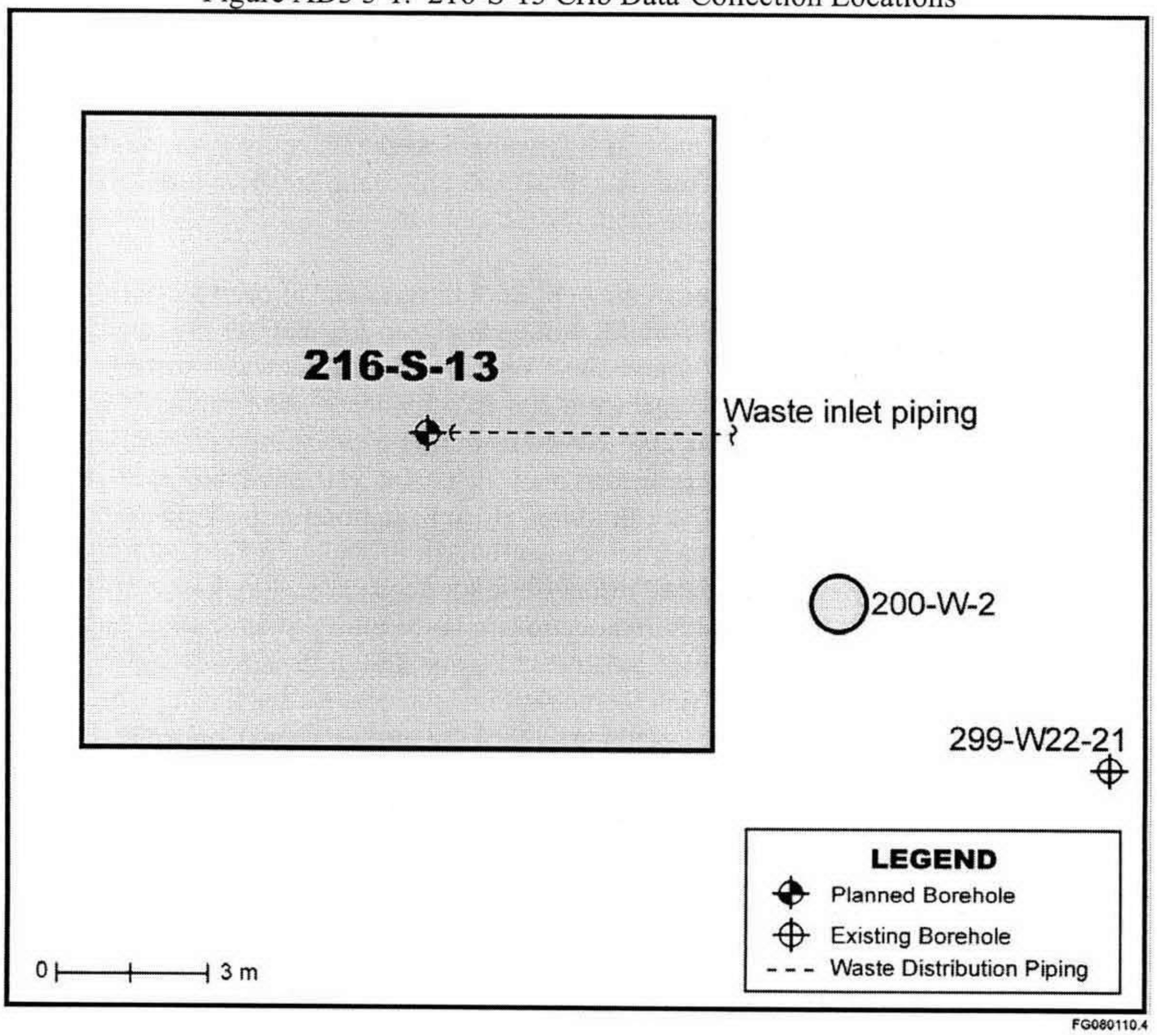


Figure AD3 3-2. 216-S-13 Crib Stratigraphy and Sample-Collection Intervals.

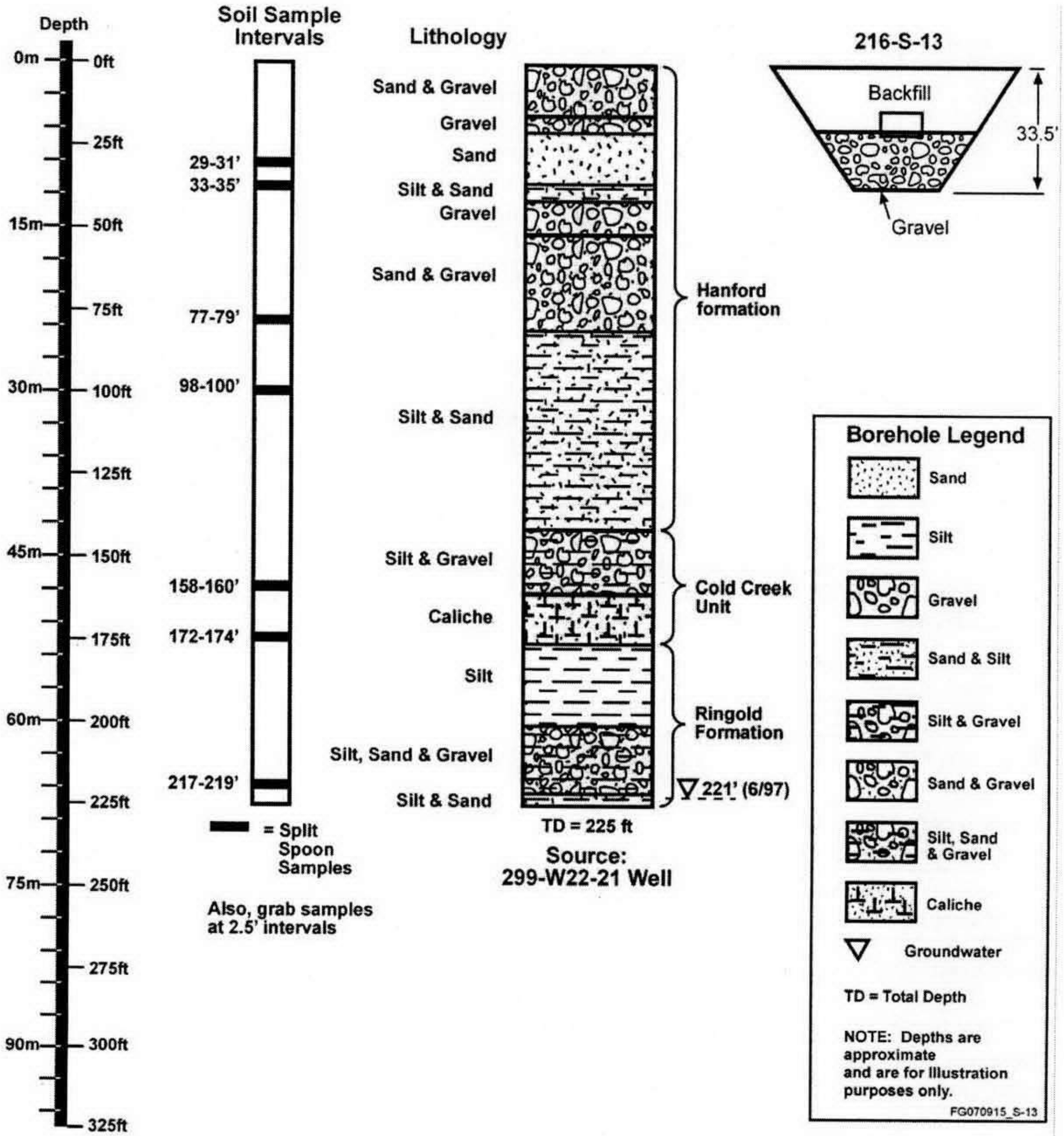


Table AD3 3-1. 216-S-13 Crib Sampling Plan.

Sample	Sample	Maximum	Sample Interval	Analyte List [b]	Physical Properties

Collection Methodology	Location	Depth of Investi-gation	Depth (ft bgs) [a]		Sample Interval	Parameters
Deep borehole with split spoon and grab samples	One deep borehole near center of crib	To groundwater (approximately 221 ft)	Split-spoon sample at depths: 29 – 31 ft bgs 33 – 35 ft bgs 77 – 79 ft bgs 98 – 100 ft bgs 158 – 160 ft bgs 172 – 174 ft bgs 217 – 219 ft bgs Also, grab samples at 2.5 ft intervals throughout borehole	Analytes are presented in Volume I, Tables A2-3, the 200-PW-3 and 200-TW-1 columns. Grab samples will be analyzed for contaminants within the pore volume.	One sample at each change in lithology or fine-grained intervals (same as split-spoon sample intervals after 32 bgs). As indicated in Figure AD3 3-2.	pH, specific conductance, bulk density, moisture, particle size distribution

Number of split-spoon samples	7
Approximate number of field quality-control samples [c]	3
Approximate number of physical-property samples	6
Approximate number of grab samples	89
Approximate total number of soil samples collected	105
Approximate total number of soil samples analyzed [d]	59

Non-Sample Data Collection	Maximum Depth of Investigation
Electrical resistivity characterization	Not defined
Downhole gamma-spectroscopy log, neutron moisture, and passive neutron logs	Surface to TD in new borehole ~221 ft bgs

[a] Actual sampling depths may vary depending on the amount of backfill/overburden used in interim-stabilization activities at the waste site, field screening results, and varying subsurface conditions.

[b] See Volume 1, Appendix A, Tables A2-1, A2-2, A2-4, A2-5, and A3-2 for detection limits and other analytical parameters.

[c] One duplicate, one split*, and one equipment blank. Field blanks also will be collected for volatile organic analysis, but are not included here.

[d] Number of samples analyzed includes seven split-spoon samples, three field quality-control samples, six physical-property samples and 43 grab samples.

* Optional (Volume I, p. A2-17)

Figure AD3 3-3. 216-S-13 Crib
Conceptual Model and Data Summary

200-PW-5 Operable Unit
Waste Type: Process Effluent

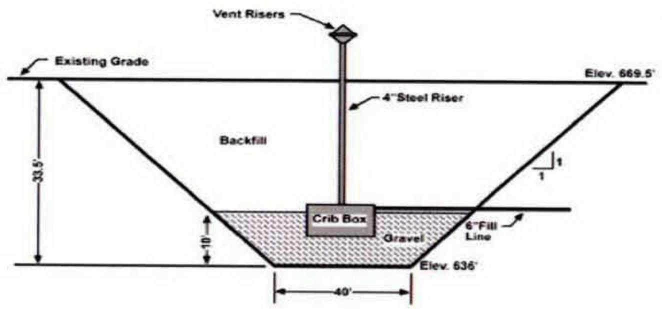
216-S-13 Crib

REDOX Zone

History

216-S-13 Crib is a subsurface liquid waste disposal site that operated from 1952 to 1971 receiving process waste from the 203-S Decontaminated Metal Storage Facility, the 204-S Uranium Nitrate Hexahydrate Lag Storage Facility and the 276-S Organic-Solvent Make-up Facility. It also received sump waste from the 204-S Facility. (WIDS)

CONSTRUCTION:
A square wooden crib, with open bottom enclosed on four sides with sheathing. The 12 ft by 12 ft by 9 ft deep crib box has a riser vent, and one inlet pipe near the top of the box. The base on which the box sits is 40 ft by 40 ft by 33.5 ft deep. (WIDS)



WASTE VOLUME: 5,000,000 L (1,320,000 gal) (WIDS)

DURATION: January 1952 to July 1972 (WIDS)

ESTIMATED DISCHARGED INVENTORY (RHO-CD-673, WIDS, RPP-26744):

Contaminant	Historical	2008%	SIM
Plutonium	8 g	---	---
Sr-90	0.04 Ci	0.013 Ci	0.42 Ci
Tc-99	0.0515 Ci	0.0515 Ci	0.44 Ci
Cs-137	5 Ci	1.84 Ci	144.8 Ci
Uranium	91 kg	---	3.05 kg
Hexone	10,000 kg	---	---
Nitrate	10,000 kg	---	---
Sodium Dichromate	10,000 kg	---	12.08 kg

% Values decayed from RHO-CD-673 to 6/30/2008

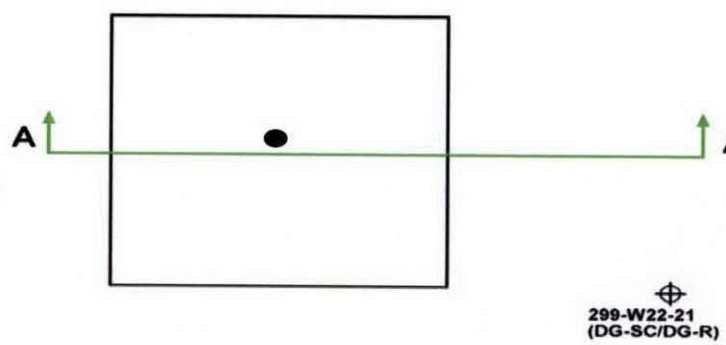
REFERENCES:

- WIDS general summary reports
- RPP-26744
- RHO-CD-673
- DOE/RL-2001-01

Basis of Knowledge (Data Types)

- Process History (PH)
- Downhole Geophysics – Scintillation (DG-SC)
- Downhole Geophysics – Radionuclide Logging System (DG-R)

Site Plan View
(not to scale)



Legend

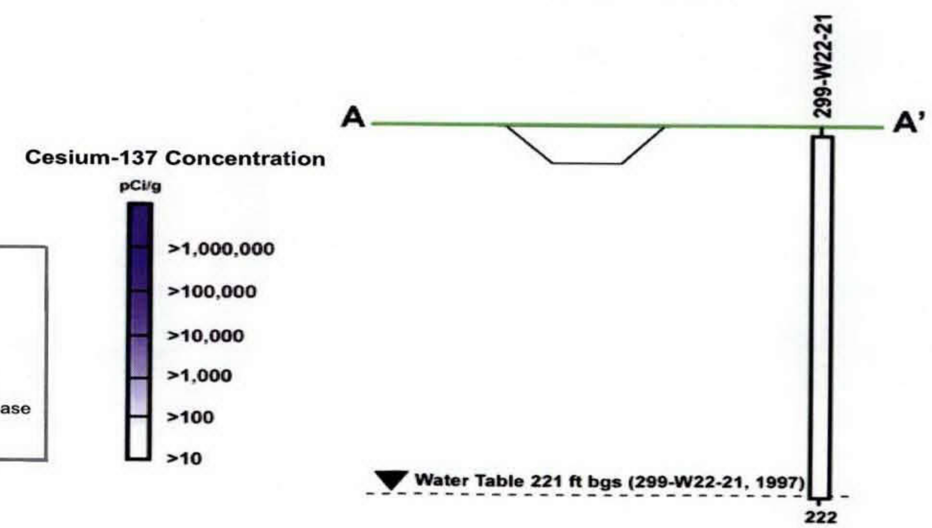
- ⊕ = Existing Borehole (data type)
- ▼ = Groundwater Surface
- ● = Planned Deep Borehole
- bgs = Below Ground Surface
- WIDS = *Waste Information Data System* database
- SIM = *Soil Inventory Model, Rev.1*

Characterization Summary

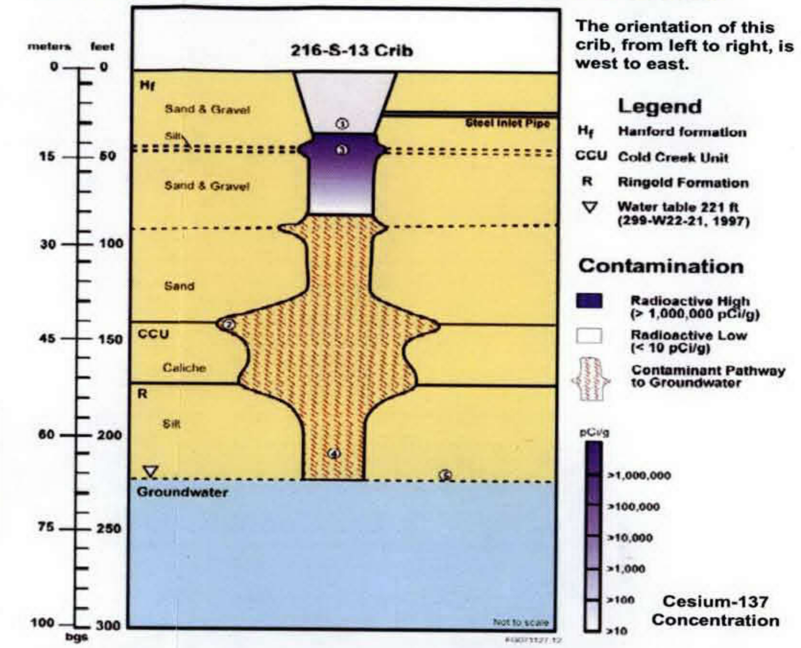
216-S-13 was recently moved to the PW-5 OU; therefore, no analogous/representative relationship has been established. Maximum Cs-137 detected was 1 pCi/g at 7 feet as noted in the RLS log for 299-W22-21. Maximum U-238 detected was 300 pCi/g at 206 feet.

Summarized Well Information			
Well ID	Maximum Cs-137 (pCi/g)	Depth (ft bgs)	Date
299-W22-21	1	7	1992

Site Section View
(not to scale)



Conceptual Contaminant Distribution Model



1. Low salt, neutral/basic, radioactive liquid waste containing plutonium, uranium, hexone, sodium dichromate and tritium from the 203-S decontaminated metal storage facility, 204-S uranium nitrate hexahydrate lag storage facility, 276-S organic-solvent make-up facility and sump waste from 204-S were discharged to the crib. The crib received a total volume of 5,000,000 L (1,320,000 gal) of wastewater between January 1952 and July 1972.

2. The wetting front and contaminants moved vertically beneath the crib. Lateral spreading of liquids is associated mainly with the Hanford gravel and sand contact, and at the intersection with the Cold Creek Unit or other fine grained lenses. As the effluent traveled downward after discharge, contaminants may have been deposited along the upper contact of these zones.

3. Constituents with large distribution coefficients (e.g., plutonium) sorb to soils resulting in higher concentrations near the bottom of the crib. Concentrations generally decrease with depth. The volatile contaminant, hexone, is not expected to remain in the soil for more than a couple of years after discharge.

4. The highest concentration of uranium-238 detected at 206 ft bgs was 300 pCi/g in well 299-W22-21. Cesium-137 concentration of 1 pCi/g was detected at 7 ft bgs in the same well.

5. Not enough information is known below 220 ft to accurately locate the depth to groundwater (the historical depth was 221 ft in 1997), but mobile contaminants (chromium, uranium-238 and nitrate) are believed to have impacted groundwater.

Table AD3 3-2. Data-Needs Priority Summary – Model Group 2 – 216-S-13 Crib (200-PW-5)(RL/FH)(CPP)(EPA). (2 Pages)

Background	
Site Identification	216-S-13
Site Location	200 West Area, REDOX Zone, west of 202-S Building
Type of Site	Crib
Operating History	The unit is a square wooden crib box, with open bottom enclosed on four sides with sheathing. The 12 ft x 12 ft x 9 ft crib box has a riser vent, and one inlet pipe near the top of the box. The top of the box sits 17.5 ft bgs. The base of the excavation in which the box sits is 40 ft x 40 ft and 33.5 ft in depth. From January 1952 to June 1967 the unit received liquid waste from the 203-S Decontaminated Metal Storage Facility, the 204-S Uranium Nitrate Hexahydrate Lag Storage Facility, and the 276-S Organic-Solvent Make-up Facility. From June 1967 to July 1972 the unit received occasional sump waste from the 204-S Facility. The crib received 5 million liters of waste containing 89.2 kg of uranium, 8 g of plutonium, 2.77 Ci of Cs-137, 0.02 Ci of Sr-90, and 10,000 kg each of hexone, nitrate, and sodium dichromate. The site is reported to have received 25,000 gallons of hexone over a three month period in 1966. Although these historical values differ from those presented in the SIM table below, they still fall within the range of the model's uncertainty. The following table represents the mean values as determined by the SIM model. Soil Inventory Model – 216-S-13 Crib (RPP-26744)

Na (kg) 4.955E+03	Al (kg) 8.822E-01	Fe (kg) 6.761E-01	Cr (kg) 1.208E+01	Bi (kg) 0.000E+00	La (kg) 0.000E+00	Hg (kg) 5.616E-03	Zr (kg) 0.000E+00	Pb (kg) 0.000E+00
Ni (kg) 5.688E-01	Ag (kg) 0.000E+00	Mn (kg) 1.755E-02	Ca (kg) 3.907E+01	K (kg) 2.384E+04	NO3 (kg) 3.484E+04	NO2 (kg) 1.391E+03	CO3 (kg) 9.705E-01	PO4 (kg) 5.187E+02
SO4 (kg) 8.128E+00	Si (kg) 0.000E+00	F (kg) 4.788E+01	Cl (kg) 1.299E+02	CCl4 (kg) 0.000E+00	Butanol (kg) 9.753E-03	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 7.722E-01
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 4.312E+01	C-14 (Ci) 1.855E-04	Ni-59 (Ci) 6.307E-05	Ni-63 (Ci) 5.936E-03	Co-60 (Ci) 1.853E-03	Se-79 (Ci) 0.000E+00	Sr-90 (Ci) 4.204E-01	Y-90 (Ci) 4.206E-01
Zr-93 (Ci) 6.472E-02	Nb-93m (Ci) 5.246E-02	Tc-99 (Ci) 4.400E-01	Ru-106 (Ci) 1.907E-07	Cd-113m (Ci) 0.000E+00	Sb-125 (Ci) 0.000E+00	Sn-126 (Ci) 0.000E+00	I-129 (Ci) 0.000E+00	Cs-134 (Ci) 1.404E-04
Cs-137 (Ci) 1.448E+02	Ba-137m (Ci) 1.367E+02	Sm-151 (Ci) 1.751E+00	Eu-152 (Ci) 4.054E-04	Eu-154 (Ci) 2.697E-02	Eu-155 (Ci) 1.126E-02	Ra-226 (Ci) 4.695E-09	Ra-228 (Ci) 3.979E-14	Ac-227 (Ci) 1.828E-07
Pa-231 (Ci) 2.671E-07	Th-229 (Ci) 2.932E-10	Th-232 (Ci) 3.796E-13	U-232 (Ci) 4.406E-08	U-233 (Ci) 2.051E-07	U-234 (Ci) 1.018E-03	U-235 (Ci) 4.342E-05	U-236 (Ci) 2.167E-05	U-238 (Ci) 1.018E-03
U-Total (kg) 3.050E+00	Np-237 (Ci) 1.244E-02	Pu-238 (Ci) 4.034E-02	Pu-239 (Ci) 7.042E-01	Pu-240 (Ci) 1.585E-01	Pu-241 (Ci) 1.074E+00	Pu-242 (Ci) 8.316E-06	Am-241 (Ci) 9.361E-01	Am-243 (Ci) 7.047E-04
Cm-242 (Ci) 1.549E-03	Cm-243 (Ci) 1.002E-04	Cm-244 (Ci) 2.229E-03						

Vicinity Waste Sites	200-W-2 (soil disturbance area)
Current Status	Site recently transferred from the 200-PW-3 OU to the 200-PW-5 OU; No representative/analogous relationship yet established

Table AD3 3-2. Data-Needs Priority Summary – Model Group 2 – 216-S-13 Crib (200-PW-5)(RL/FH)(CPP)(EPA). (2 Pages)

Potential Remedial Alternatives							
X for viable alternatives	**No Action**	**MESC/MNA/IC**	**Removal/Disposal**	**Barrier**	**Partial Removal / Barrier**	**In Situ Treatment**	**Other**
		X		X			

Data Evaluation and Gaps Analysis			
Data	**Knowns**	**Data Uncertainties**	**Are supplemental data required to support decision making?**
Geophysical logging at 216-S-13: 299-W22-21 (222 ft); (RLS, 1992) Scintillation logs dated 1963, 1968 & 1976	Site is reported to have received sodium dichromate; chromium is a potential risk to groundwater. Site also received hexone. 299-W22-21: located 9 m (30 ft) east of the southeastern corner of the 216-S-13 Crib. Cesium-137 was detected from 7 to 14 ft and from 200 to 214 ft. The maximum activity encountered was 1 pCi/g at 7 ft. Uranium-238 was detected from 196 to 213 ft. The maximum detected was 300 pCi/g at 206 ft.	Nature of contaminants in crib and extent of contamination with depth. Protection of groundwater.	Yes –inventory data would support decision making; however, uncertainty exists in the chromium data between current SIM inventory and inventory data from past estimates. Supplemental data could help alleviate the uncertainty and would be used to support a better evaluation of protection of groundwater, especially for the chromium.

References :

WIDS, *Waste Information Data System* database

DOE/RL-2001-01, *Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit RI/FS Work Plan; Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*

PNNL-14120, *Laboratory-Scale Bismuth Phosphate Extraction Process Simulation to Track Fate of Fission Products*

RPP-26744, *Hanford Soil Inventory Model, Rev. 1*

Proposed Activities and Path Forward:

- Conduct ERC to evaluate potential zones of elevated conductivity that may be indicative of contamination associated with chromium.
- Log 299-W22-21 to gain site-specific data for gamma emitters (not required for decision making, but opportunity for site-specific data).
- Deep borehole to evaluate chromium and nitrate remaining in vadose zone; may be opportunity to coordinate with Groundwater Project.
- Data on hexone would be used as representative for other hexone sites (such as 216-S-14 - Model Group 6)

AD3-4.0 216-S-21 CRIB SITE-SPECIFIC FIELD-SAMPLING PLAN

The characterization planned for the 216-S-21 Crib includes drilling a drive point, approximately 30 ft, and obtaining two sample barrel samples at the bottom of the crib (22 to 25 ft). The 216-S-21 Crib received tank condensate waste from the 241-SX-401 condenser.

Sample barrel samples will be collected at the bottom of the crib and will be analyzed for analytes presented in Volume I, Table A2-3, the 200-TW-1 column. The sample analysis will provide information regarding contaminant concentrations and will allow for comparison with geophysical logging results from the nearby 299-W23-63 well.

The 299-W23-63 well, which monitors this waste site, was geophysically logged in December 2006 and detected cesium-137 concentrations >45,000,000 pCi/g. The samples obtained from this drive point will validate or refute the previous logging data. For this reason, the location of the drive point is to be 3 ft east of 299-W23-63 (near the center of the crib).

The following figures and tables provide the site-specific field-sampling plan for the 216-S-21 Crib.

Figure AD3 4-1. 216-S-21 Crib Data-Collection Locations.

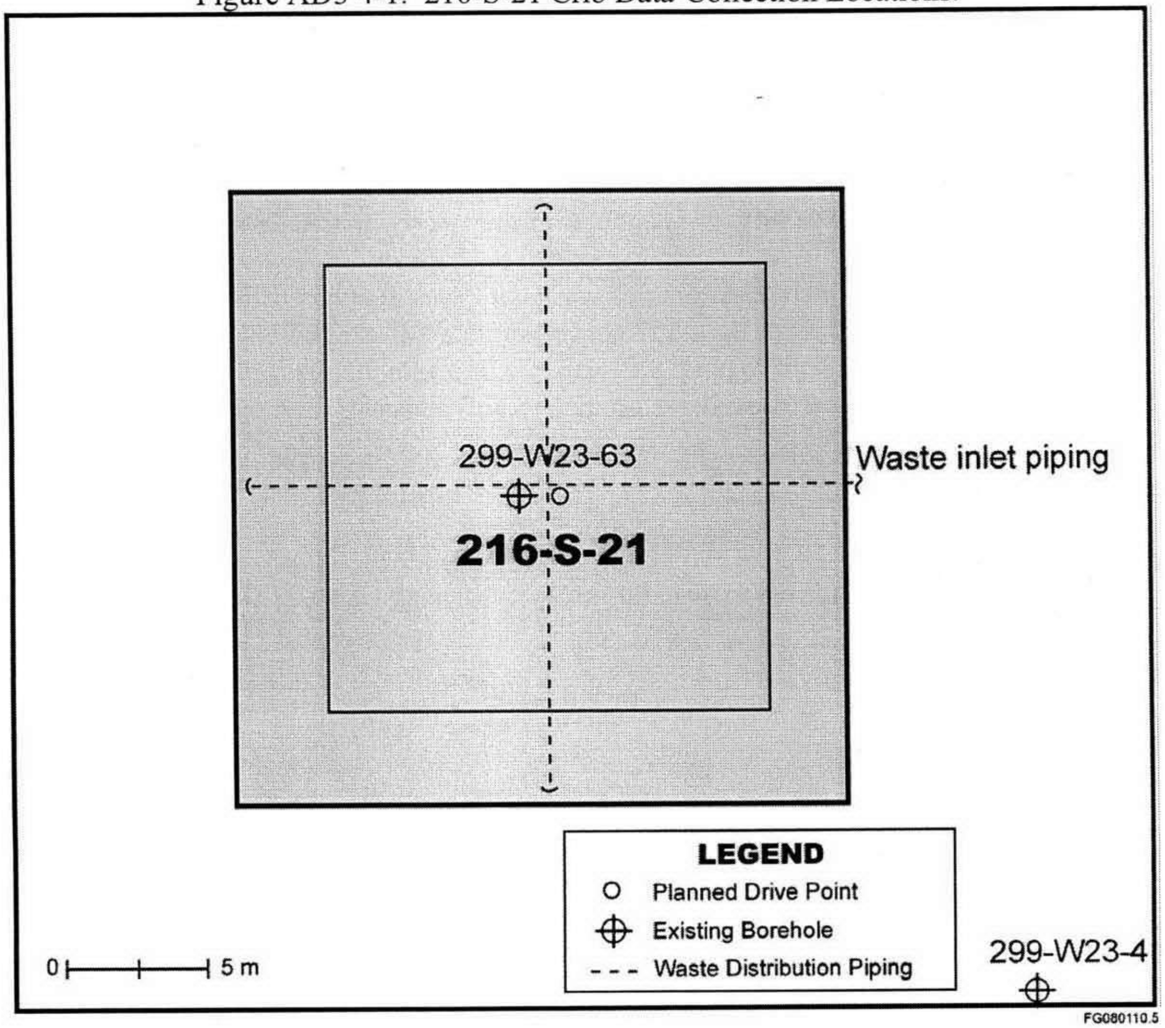


Figure AD3 4-2. 216-S-21 Crib Stratigraphy and Sample-Collection Intervals.

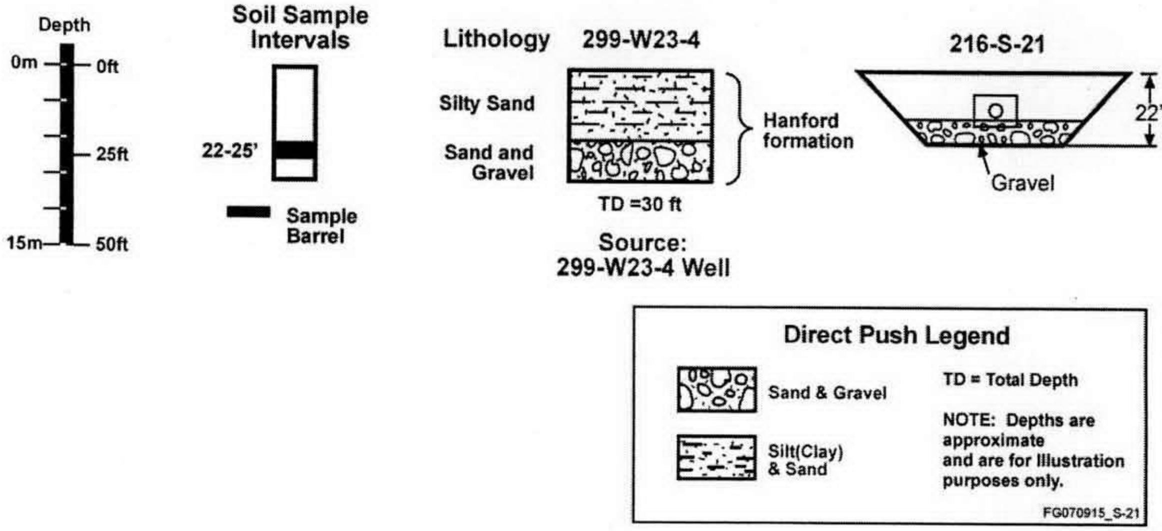


Table AD3 4-1. 216-S-21 Crib Sampling Plan.

Sample Collection Methodology	Sample Location	Maximum Depth of Investi-gation	Sample Interval Depth (ft bgs) [a]	Analyte List [b]	Physical Properties	
					Sample Interval	Parameters
Drive point with sampling	One drive point near center of crib (within 3 ft of 299-W23-63)	30 ft bgs	Sample barrel at depth: 22 – 25 ft bgs	Analytes are presented in Volume I, Table A2-3, the 200-TW-1 column.	One sample just below the bottom of the crib.	pH, specific conductance, bulk density, moisture, particle size distribution

Number of sample barrels	1
Approximate number of field quality-control samples [c]	3
Approximate number of physical-property samples	1
Approximate total number of soil samples collected	5
Approximate total number of soil samples analyzed [d]	5

[a] Actual sampling depths may vary depending on the amount of backfill/overburden used in interim-stabilization activities at the waste site, field screening results, and varying subsurface conditions.
[b] See Volume 1, Appendix A, Tables A2-1, A2-2, and A2-5 for detection limits and other analytical parameters.
[c] One duplicate, one split*, and one equipment blank (if possible and plausible).
[d] Number of samples analyzed includes one sample barrel, three field quality-control samples, and one physical-property samples.

* Optional (Volume I, p. A2-17)

Figure AD3 4-3. 216-S-21 Crib Conceptual Model and Data Summary.

200-PW-5 Operable Unit
Waste Type: Process Effluent

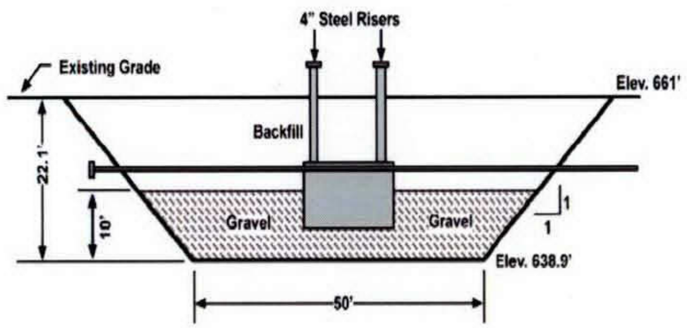
216-S-21 Crib

200-W Ponds Zone

History

216-S-21 Crib is a subsurface liquid waste disposal site that operated from 1954 to 1970 receiving waste from the 241-SX-401 Condenser Facility via Tank 241-SX-206. It was interim stabilized in 1991. (WIDS)

CONSTRUCTION:
The crib consists of one wooden box, 16 ft by 16 ft by 10 ft high, sitting in a gravel layer of a square 50 ft by 50 ft by 22.10 ft deep excavation. (WIDS)



WASTE VOLUME: 87,100,000 L (23,000,000 gal) (WIDS)

DURATION: November 1954 to December 1970 (WIDS)

ESTIMATED DISCHARGED INVENTORY (DOE/RL-2003-64, RHO-CD-673, RPP-26744):

Contaminant	Historical	2008%	SIM
Plutonium	2.1 g	---	---
Sr-90	43 Ci	14.4 Ci	6.63 Ci
Tc-99	0.0156 Ci	0.0156 Ci	0.21 Ci
Cs-137	160 Ci	56.7 Ci	628 Ci
Sn-126	---	---	0.0023 Ci
Eu-154	---	---	0.11 Ci
Co-60	---	---	0.034 Ci
Uranium	4.2 kg	---	0.11 kg

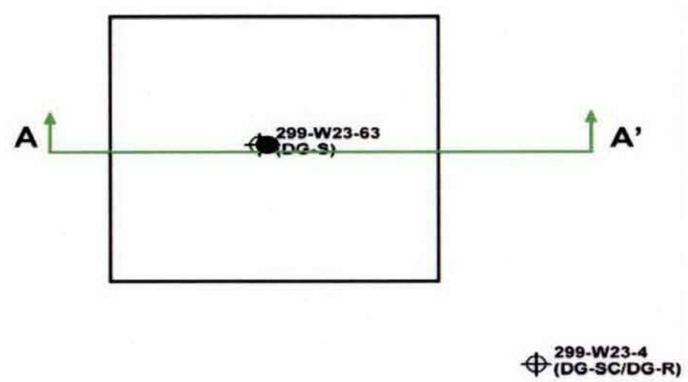
% Values decayed from RHO-CD-673 to 6/30/2008

REFERENCES:
- WIDS general summary reports
- RPP-26744
- RHO-CD-673
- DOE/RL-2000-38
- DOE/RL-2002-42
- DOE/RL-2003-64

Basis of Knowledge (Data Types)

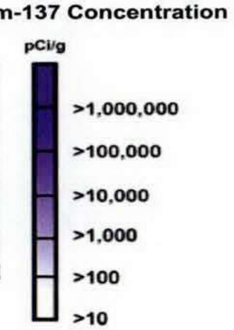
- Process History (PH)
- Downhole Geophysics – Spectral (DG-S)
- Downhole Geophysics – Scintillation (DG-SC)
- Downhole Geophysics – Radionuclide Logging System (DG-R)
- Geologic Logs (GL)

Site Plan View
(not to scale)



Legend

- ⊕ = Existing Borehole (data type)
- ▼ = Groundwater Surface
- ● = Planned Drive Point
- bgs = Below Ground Surface
- WIDS = *Waste Information Data System* database
- SIM = *Soil Inventory Model, Rev.1*

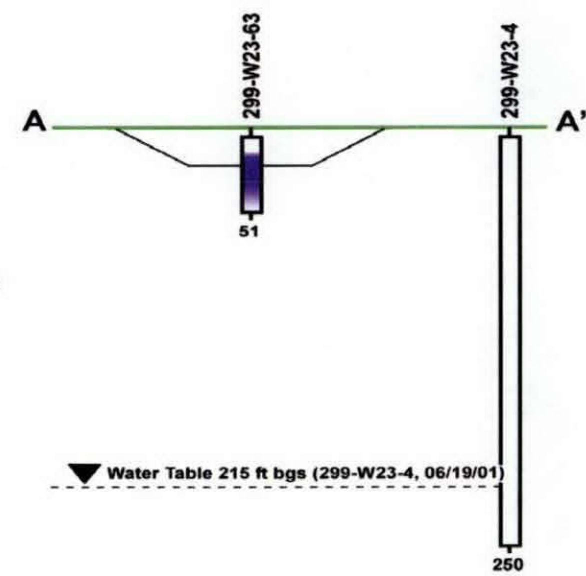


Characterization Summary

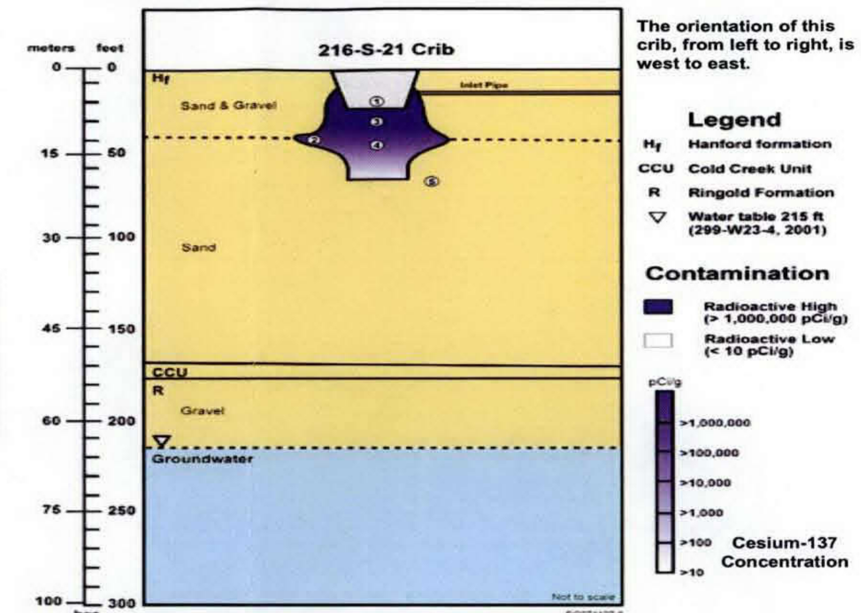
216-S-21 is analogous to 216-B-57 and was evaluated in DOE/RL-2003-64. 45,000,000 pCi/g of Cs-137 was detected in borehole 299-W23-63 at 24.5 feet based on geophysical logging.

Summarized Well Information			
Well ID	Maximum Cs-137 (pCi/g)	Depth (ft bgs)	Date
299-W23-4	Scintillation	38	1995
299-W23-63	45,000,000	24.5	1/3/2007

Site Section View
(not to scale)



Conceptual Contaminant Distribution Model



1. Low salt, neutral/basic, radioactive tank condensate waste containing plutonium, uranium, strontium-90 and cesium-137 from 241-SX-401 condenser via 241-SX-206 tank was discharged to this crib. The crib received a total volume of 87,100,000 L (23,000,000 gal) of wastewater between November 1954 and December 1970.

2. The wetting front and contaminants move vertically beneath the crib. Lateral spreading of liquids is associated mainly with the Hanford gravel and sand contact, and at intersections with other fine grained lenses. As the effluent traveled downward after discharge, contaminants may have been deposited along the upper contact of these zones.

3. Constituents with large distribution coefficients (e.g., plutonium, strontium-90 and cesium-137) sorb to soils resulting in higher concentrations near the bottom of the crib. Concentrations generally decrease with depth.

4. The highest concentrations reported from well 299-W23-63 are as follows:
   Cesium-137: 45,000,000 pCi/g at 24.5 ft bgs
   Europium-154: 6 pCi/g at 44 ft bgs
   Cobalt-60: 6 pCi/g at 44 ft bgs
   Sn-126: 45 pCi/g at 44 ft

5. Not enough information is known below 60' to accurately describe the zone of high contamination, but mobile contaminants are not believed to have impacted groundwater.

Table AD3 4-2. Data-Needs Priority Summary – Model Group 2 – 216-S-21 Crib (200-PW-5)(RL/FH)(CPP)(EPA). (3 pages)

Background	
Site Identification	216-S-21
Site Location	200 West Area, 200-W Ponds Zone, west of 202-S Building
Type of Site	Crib
Operating History	The site consists of one wooden crib box with two vent risers and one test well (299-W23-63) through the center of the box. The 16 ft by 16 ft by 10 ft high crib box sits in a gravel layer in a 50 ft by 50 ft square excavation that is 22.10 ft deep. The top of the crib box sits 8.25 ft below grade. The site provided subsurface liquid disposal for the 241-SX-401 Condenser Facility. The site operated from November 1954 to December 1970. The site was interim stabilized in 1991. The waste was low in salt and neutral to basic, and contained sodium and ammonium nitrate. The site received 87.1 million liters of condensate. Historical data suggests that the following contamination was discharged to the crib: 2.1 g total plutonium, 1300 Ci total beta, 43 Ci strontium-90, 160 Ci cesium-137, 4.2 kg uranium. Although these values may differ than those presented in the SIM table below, they still fall within the model's uncertainty. The follwoing table represents the mean values as determined by the SIM model. Soil Inventory Model – 216-S-21 Crib (RPP-26744):

Na (kg) 7.126E+02	Al (kg) 9.711E+01	Fe (kg) 4.132E+00	Cr (kg) 5.084E+01	Bi (kg) 1.216E-04	La (kg) 0.000E+00	Hg (kg) 1.747E+00	Zr (kg) 1.646E-05	Pb (kg) 5.102E-01
Ni (kg) 2.784E-01	Ag (kg) 1.280E-04	Mn (kg) 7.479E-02	Ca (kg) 1.690E+03	K (kg) 6.893E+01	NO3 (kg) 4.914E+02	NO2 (kg) 2.072E+02	CO3 (kg) 3.044E+00	PO4 (kg) 1.030E-01
SO4 (kg) 1.249E+03	Si (kg) 1.911E+02	F (kg) 2.191E+01	Cl (kg) 3.422E+02	CCl4 (kg) 0.000E+00	Butanol (kg) 1.039E+00	TBP (kg) 0.000E+00	NPH (kg) 1.222E+03	NH3 (kg) 1.471E+00
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 2.542E+03	C-14 (Ci) 8.949E-03	Ni-59 (Ci) 1.488E-03	Ni-63 (Ci) 1.418E-01	Co-60 (Ci) 3.363E-02	Se-79 (Ci) 5.645E-04	Sr-90 (Ci) 6.626E+00	Y-90 (Ci) 6.661E+00
Zr-93 (Ci) 3.382E-02	Nb-93m (Ci) 2.768E-02	Tc-99 (Ci) 2.108E-01	Ru-106 (Ci) 6.753E-08	Cd-113m (Ci) 3.146E-02	Sb-125 (Ci) 6.544E-03	Sn-126 (Ci) 2.298E-03	I-129 (Ci) 3.233E-04	Cs-134 (Ci) 4.788E-04
Cs-137 (Ci) 6.279E+02	Ba-137m (Ci) 5.928E+02	Sm-151 (Ci) 9.322E+00	Eu-152 (Ci) 1.575E-03	Eu-154 (Ci) 1.065E-01	Eu-155 (Ci) 4.435E-02	Ra-226 (Ci) 3.463E-08	Ra-228 (Ci) 1.339E-06	Ac-227 (Ci) 1.681E-07
Pa-231 (Ci) 2.534E-06	Th-229 (Ci) 3.844E-09	Th-232 (Ci) 1.363E-08	U-232 (Ci) 2.487E-07	U-233 (Ci) 1.463E-05	U-234 (Ci) 4.302E-05	U-235 (Ci) 1.722E-06	U-236 (Ci) 1.117E-06	U-238 (Ci) 3.554E-05
U-Total (kg) 1.064E-01	Np-237 (Ci) 1.160E-03	Pu-238 (Ci) 3.305E-03	Pu-239 (Ci) 5.990E-02	Pu-240 (Ci) 1.343E-02	Pu-241 (Ci) 9.081E-02	Pu-242 (Ci) 7.061E-07	Am-241 (Ci) 1.788E-02	Am-243 (Ci) 1.008E-05
Cm-242 (Ci) 4.200E-05	Cm-243 (Ci) 1.791E-06	Cm-244 (Ci) 4.067E-05						

Vicinity Waste Sites	Adjacent to 216-U-10 Pond to the west, and 216-S-25 Crib to the south, and S Tank Farm to the east.
Current Status	Analogous site; assigned to 216-B-57; evaluated in 200-TW-1/2 &200-PW-5 Feasibility Study (DOE/RL-2003-64); capping identified as preferred alternative

Table AD3 4-2. Data-Needs Priority Summary – Model Group 2 – 216-S-21 Crib (200-PW-5)(RL/FH)(CPP)(EPA). (3 pages)

Potential Remedial Alternatives (as investigated in 200-TW-1/2 and 200-PW-5 FS [DOE/RL-2003-64])							
X for viable alternatives	**No Action**	**MESC/MNA/IC**	**Removal/Disposal**	**Barrier**	**Partial Removal / Barrier**	**In Situ Treatment**	**Other**
		X	X	X	X		

Data Evaluation and Gaps Analysis

Data	**Knowns**	**Data Uncertainties**	**Are supplemental data required to support decision making?**
Well construction log, 1957 Geophysical logging at 216-S-21: 299-W23-4 (250 ft) (Spectral, 1992) Historical gamma logs dated 1991 & 1995	299-W23-4 – located 21 m southeast of the crib center and 8 m from the southeast corner of the crib. Well construction log indicates elevated beta-gamma activity from 40 to 75 ft during drilling in 1957. Historic logs indicate contamination between 32 and 140 ft with maximum concentration at 38 ft. Most recent log (1995) indicates high gross gamma zone from 40 to 50 ft. A 1992 spectral gamma survey also indicated cobalt-60 between 37 and 60 ft with a maximum concentration of 11 pCi/g at 39 ft. Note - cesium-137 was not encountered in this log.	Nature of contaminants and extent of contamination with depth below the crib.	Yes – the analogous relationship and inventory data are sufficient to support decision making; however, supplemental data may support a lesser alternative (such as MESC/MNA/IC). Soil samples collected at the bottom of the waste site (e.g., discharge point) will provide site-specific data to support a stronger evaluation of a broader range of alternatives. The data from soil samples and geophysical logging of 299-W23-63will also address uncertainties between the representative site and the 216-S-21 Crib, such as differences in inventory and effluent volumes. The 216-S-21 inventory data do not suggest groundwater protection issues.
299-W23-63 (51 ft) (Spectral, 2006)	299-W23-63 - located in the center of the 216-S-21 Crib. Cesium-137 was detected from 4 to 45 ft in depth. The maximum concentration is approximately 45 million pCi/g at 24.5 ft. in depth. Europium-154 detected from 41 to 47 ft. Maximum concentration is approximately 6 pCi/g at 44 ft. Cobalt-60 is detected from 43 to 51 ft. The maximum concentration is approximately 6 pCi/g at 44 ft. It is probable cobalt-60 also exists in the high cesium-137 interval from 15 to 40 ft at higher concentrations. Tin-126 detected from 40 to 45 ft. The maximum concentration is approximately 45 pCi/g at 44 ft.		

Additional Notes: Small waste site footprint. Remedial alternatives should consider the selected remedial action for 216-U-10 Pond due to the close proximity.

Table AD3 4-2. Data-Needs Priority Summary – Model Group 2 – 216-S-21 Crib (200-PW-5)(RL/FH)(CPP)(EPA). (3 pages)

References : • BHI-00174, *U Plant Aggregate Area Management Study Technical Baseline Report* • DOE/RL-2000-38, *200-TW-1 Scavenged Waste Group OU & 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan* • DOE/RL-2002-42, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 Operable Unit)* • DOE/RL-2003-64, *Feasibility Study for the 200-TW-1 Scavenged Waste Group & the 200-TW-2 Tank Waste Group & the 200-PW-5 Fission-Product Rich Waste Group OU* • RPP-26744, *Hanford Soil Inventory Model, Rev. 1*
Proposed Activities and Path Forward: • Direct push through high contamination zone (approximately 30 ft), a soil sample should be obtained at the bottom of waste site for analysis to support a stronger evaluation of MESC/MNA/IC, to permit site-specific evaluation of a broader range of alternatives, and to reduce uncertainty in the relationship between the representative waste site (216-B-57) and the 216-S-21 Crib.

AD3-5.0 216-T-18 CRIB SITE-SPECIFIC FIELD-SAMPLING PLAN

The characterization planned for the 216-T-18 Crib includes drilling four drive points, approximately 100 ft. The first three will be geophysically logged with the location of the fourth drive point being adjacent to the drive point with the highest contamination. The drilling and logging efforts are planned to reduce the uncertainty associated with plutonium released to the concrete culverts, indicated by the shaded circles in Figure AD3 5-1, within the crib. The 216-T-18 Crib received scavenged waste test effluent from the Uranium Recovery Process (tributyl phosphate solvent extraction) in the 221-U Canyon Facility.

A sample(s) will be collected from the fourth drive point, at a depth(s) determined by the initial logging efforts, and analyzed for contaminants presented in Volume I, Table A2-3, the 200-TW-1 column. Geologic logs will be generated during drilling providing additional information on the lithology below the crib.

The locations of the four drive points, three on the edges of the crib and one at a selected culvert, were chosen to characterize the entire crib. The three drive points at the edges will provide information on lateral extent of plutonium contamination, while the one drive point at the culvert will provide information on a source. The location of these drive points may change as information becomes available on the surface geophysical exploration (SGE) of the TX and TY Tank Farm surrounding area currently being investigated under a work plan of CH2M Hill Hanford Group, Inc., utilizing their QA/QC procedures.

The following figures and tables provide the site-specific field-sampling plan for the 216-T-18 Crib.

Figure AD3 5-1. 216-T-18 Crib Data-Collection Locations.

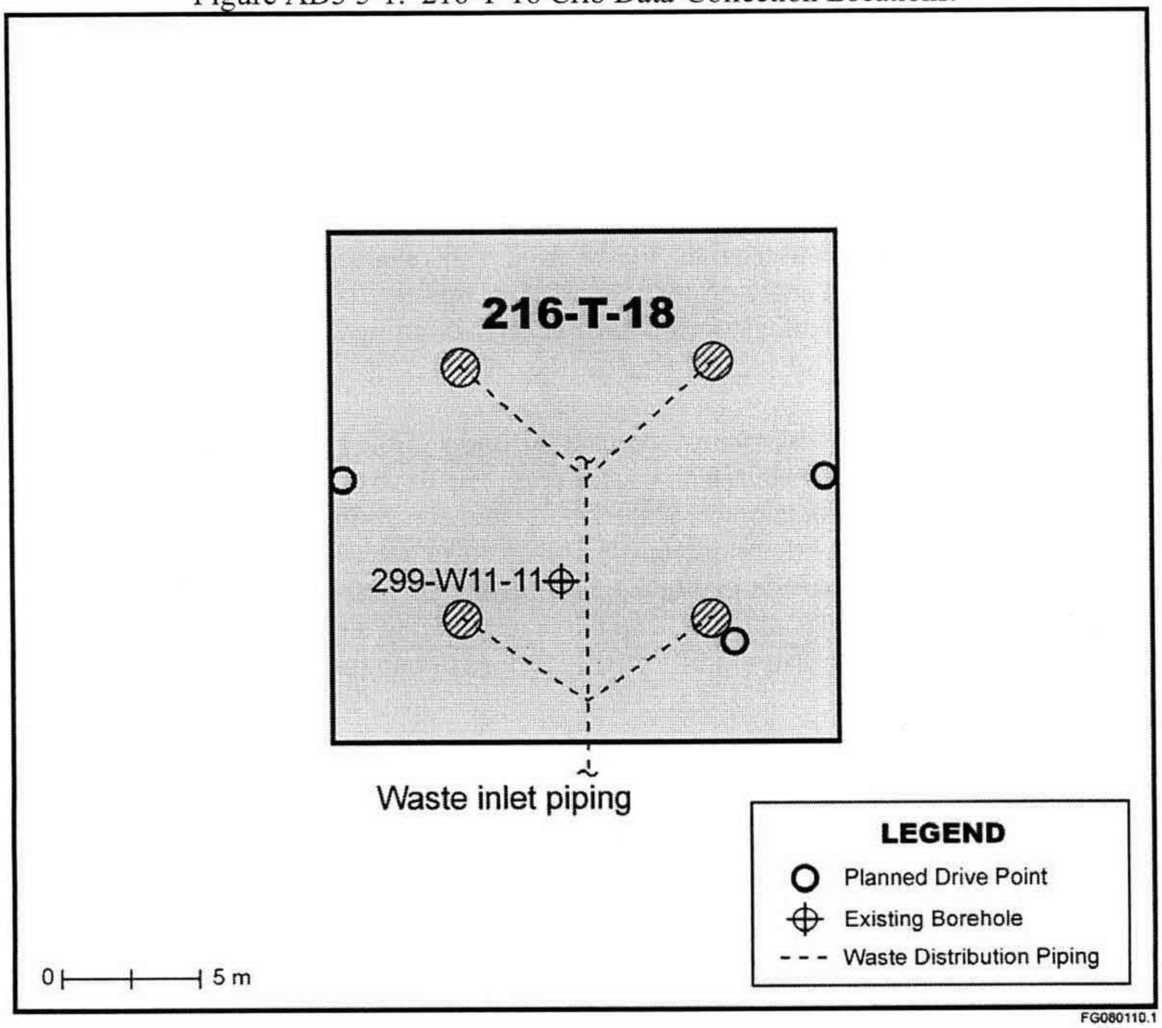


Table AD3 5-1. 216-T-18 Crib Sampling Plan.

Sample Collection Methodology	Sample Location	Maximum Depth of Investi-gation	Sample Interval Depth (ft bgs)	Analyte List	Physical Properties	
					Sample Interval	Parameters
Four drive points (one with sampling)	One on east edge, one on west edge, and one near culvert as indicated on Figure AD3 5-1. Fourth drive point installed adjacent to drive point of interest	100 ft bgs	To be determined by geophysical logging activities.	Analytes are presented in Volume I, Table A2-3, the 200-TW-1 column.	N/A	N/A

Non-Sample Data Collection	Maximum Depth of Investigation
Downhole gamma-spectroscopy log, neutron moisture, and passive neutron logs	Surface to TD in new drive point ~100 ft bgs

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Figure AD3 5-2. 216-T-18 Crib Conceptual Model and Data Summary.

200-TW-1 Operable Unit
Waste Type: Process Effluent

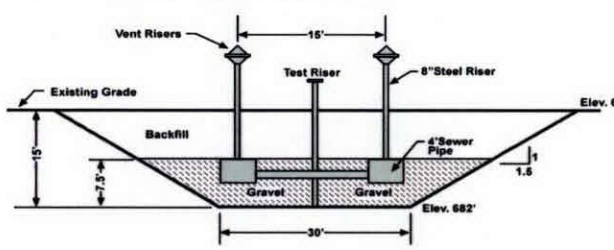
216-T-18 Crib

T Farm Zone

History

216-T-18 Crib is a subsurface liquid waste disposal site that operated during 1953 receiving tributyl phosphate test effluent from the 221-U Building via 241-T Tank Farm. It is marked and posted with Underground Radioactive Material signs. The above ground pipe was removed and the unit backfilled. (WIDS)

CONSTRUCTION:
The crib was constructed of four 4 ft diameter by 4 ft long concrete culverts buried vertically on a bed of gravel. The culverts are arranged in a square with the centers spaced 15 ft apart in a 30 ft by 30 ft by 15 ft deep excavation. The culverts were fed by a steel pipe coming from a main inlet pipe. These structures lie in an excavation with side slope 1:1.5, with a gravel fill covered by earth backfill. (WIDS)



WASTE VOLUME: 972,800 L (257,000 gal) (WIDS)

DURATION: December 1953 (WIDS)

ESTIMATED DISCHARGED INVENTORY (DOE/RL-2003-64, RHO-CD-673, RPP-26744):

Contaminant	Historical	2008*	SIM
Plutonium	1800 g	---	---
Nitrate	80,000 kg	---	32,820 kg
Sr-90	7 Ci	1.85 Ci	39.6 Ci
Tc-99	1.26 Ci	1.26 Ci	0.15 Ci
Cs-137	57 Ci	16 Ci	42.2 Ci
Uranium	27.2 kg	---	55.2 kg

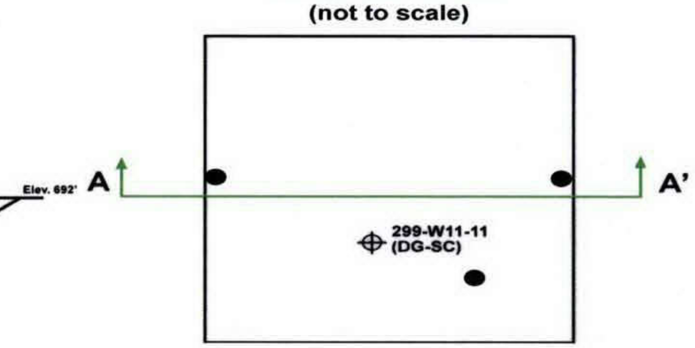
* Values decayed from RHO-CD-673 to 6/30/2008

REFERENCES:
- WIDS general summary reports
- RPP-26744
- RHO-CD-673
- DOE/RL-2000-38
- DOE/RL-2002-42
- DOE/RL-2003-64

Basis of Knowledge (Data Types)

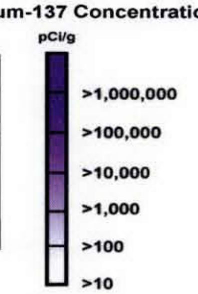
- Process History (PH)
- Downhole Geophysics – Scintillation (DG-SC)
- Geologic Logs (GL)

Site Plan View
(not to scale)



Legend

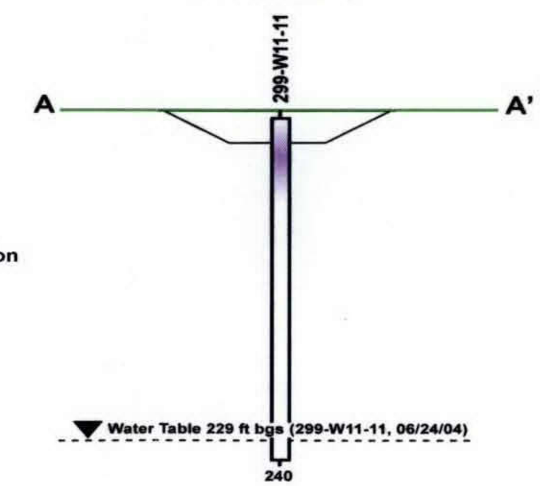
- ⊕ = Existing Borehole (data type)
- ▼ = Groundwater Surface
- ● = Planned Drive Point
- bgs = Below Ground Surface
- WIDS = *Waste Information Data System* database
- SIM = *Soil Inventory Model, Rev.1*



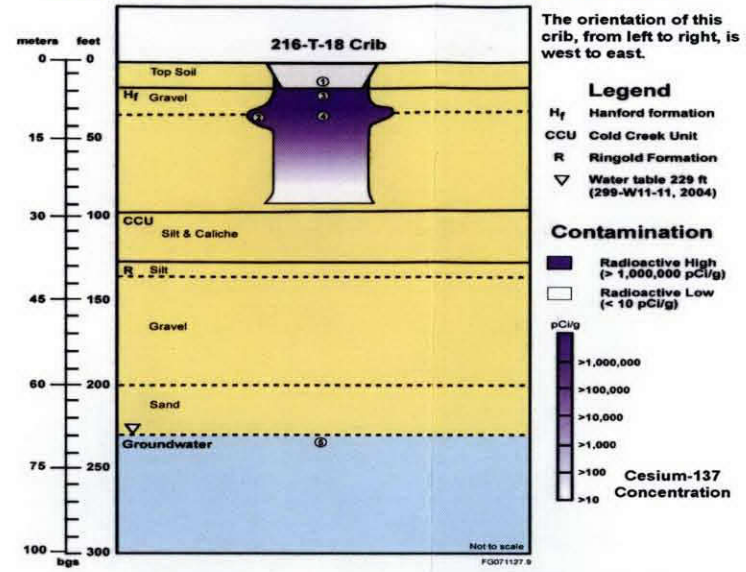
Characterization Summary

216-T-18 is analogous to 216-T-26 and was evaluated in DOE/RL-2003-64. Gross gamma logs from 1976 show approximately 2.5 X 10^6 counts per minute (cpm) at about 33 ft, which decreased quickly to between 10^4 and 10^5 cpm between 33 ft and 100 ft. Waste released would indicate the likelihood for cesium-137 and strontium-90 to be the main contaminants.

Site Section View
(not to scale)



Conceptual Contaminant Distribution Model



1. High salt, neutral/basic, radioactive scavenged waste test effluent from the Uranium Recovery Process, tributyl phosphate solvent extraction, in 221-U via 241-T-101 settling tank containing plutonium, uranium and cesium-137 was discharged to the crib in December 1953. The crib received a total volume of 972,800 L (257,000 gal) of wastewater.

2. The wetting front and contaminants move vertically beneath the cribs. Lateral spreading of liquids is associated mainly with the Hanford gravel and sand contact, and at intersections with silt layers or other fine grained lenses. As the effluent traveled downward after discharge, contaminants may have been deposited along the upper contact of these zones.

3. Constituents with large distribution coefficients (e.g., plutonium and cesium-137) sorb to soils resulting in higher concentrations near the bottom of the cribs. Concentrations generally decrease with depth.

4. The highest contamination was found at 33 ft bgs based on scintillation logs from 1976.

5. The effluent volume discharged to the cribs suggests that groundwater may not have been directly impacted by the wetting front unless a preferential pathway is present.

Table AD3 5-2. Data-Needs Priority Summary – Model Group 4 – 216-T-18 Crib (200-TW-1)(RL/FH)(CPP)(EPA). (3 Pages)

Background	
Site Identification	216-T-18 Crib
Site Location	200 West Area, T Farm Zone, northeast of TY-Tank Farm
Type of Site	Crib
Operating History	The site is marked with concrete AC-540 markers. The site is posted as an "Underground Radioactive Material" area. The surface is covered with gravel. Although many references state the crib received scavenged tributyl phosphate waste from 221-T (T Plant), it is believed that the reference to T Plant was a typographical error that was carried into subsequent documentation. The correct reference should have been to the 241-T Tank Farm. WHC-MR-0227, *Tank Wastes Discharged Directly to the Soil at Hanford*, states that the ferrocyanide scavenging process was tested in U Plant in October 1953. Ferrocyanide and nickel were added to the uranium recovery waste to remove cesium-137 from the waste stream so it could be discharged to the ground instead of requiring tank storage. The treated test waste was pumped to a single shell tank for settling (241-T-101) in October 1953. Because of poor pH control during the test, only half of the resultant scavenged waste was discharged to the 216-T-18 crib in December 1953. The other half remained stored in the single shell tank. The site was deactivated when the discharge of waste was completed in 1953. The total amount of effluent discharged was 972, 800 liters. The above-ground piping from 241-T Tank Farm to 216-T-18 was removed and the unit backfilled. The unit consists of a steel inlet pipe reducing to another steel pipe, that branches into four steel pipes, each one extending to a 4 ft in diameter by 4 ft long concrete open-end culvert. The top of these culverts sit 7.5 ft below grade and lie in an excavation with a side slope of 1:1.5. The gravel fill in the excavation is covered by earth backfill. The waste site is 30 ft by 30 ft and about 15 ft deep with the centers of the culverts spaced 15 ft apart. Historical data has been presented as follows: 1800 g total plutonium, 840 Ci total beta, 7 Ci strontium-90, 57 Ci cesium-137, 10 Ci cobalt-60 and 27.2 kg uranium. Although these values may differ than those presented in the SIM table below, they still fall within the range of the model's uncertainty. The following table represents the mean values as determined by the SIM model. Soil Inventory Model – 216-T-18 Crib (RPP-26744)

Na (kg) 2.963E+04	Al (kg) 0.000E+00	Fe (kg) 1.309E+02	Cr (kg) 1.012E+02	Bi (kg) 3.915E+02	La (kg) 0.000E+00	Hg (kg) 6.649E-01	Zr (kg) 6.120E+01	Pb (kg) 0.000E+00
Ni (kg) 1.691E+02	Ag (kg) 0.000E+00	Mn (kg) 0.000E+00	Ca (kg) 2.143E+02	K (kg) 1.597E+02	NO3 (kg) 3.282E+04	NO2 (kg) 7.614E+03	CO3 (kg) 4.232E+02	PO4 (kg) 6.639E+03
SO4 (kg) 1.995E+03	Si (kg) 3.681E+02	F (kg) 4.214E+03	Cl (kg) 6.659E+02	CCl4 (kg) 0.000E+00	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 2.171E-02
Fe(CN)6 (kg) 1.436E+02	H-3 (Ci) 2.362E-01	C-14 (Ci) 2.671E-01	Ni-59 (Ci) 2.386E-03	Ni-63 (Ci) 2.144E-01	Co-60 (Ci) 6.141E-02	Se-79 (Ci) 2.146E-03	Sr-90 (Ci) 3.963E+01	Y-90 (Ci) 3.971E+01
Zr-93 (Ci) 2.067E-01	Nb-93m (Ci) 1.781E-01	Tc-99 (Ci) 1.539E-01	Ru-106 (Ci) 5.587E-09	Cd-113m (Ci) 7.344E-02	Sb-125 (Ci) 4.272E-03	Sn-126 (Ci) 7.750E-03	I-129 (Ci) 1.484E-03	Cs-134 (Ci) 5.224E-07
Cs-137 (Ci) 4.220E+01	Ba-137m (Ci) 3.976E+01	Sm-151 (Ci) 1.911E+02	Eu-152 (Ci) 3.184E-03	Eu-154 (Ci) 3.982E-01	Eu-155 (Ci) 5.268E-01	Ra-226 (Ci) 1.096E-05	Ra-228 (Ci) 4.392E-11	Ac-227 (Ci) 3.464E-05
Pa-231 (Ci) 7.994E-04	Th-229 (Ci) 2.933E-08	Th-232 (Ci) 2.624E-10	U-232 (Ci) 1.805E-07	U-233 (Ci) 1.344E-08	U-234 (Ci) 1.816E-02	U-235 (Ci) 8.158E-04	U-236 (Ci) 1.631E-04	U-238 (Ci) 1.843E-02
U-Total (kg) 5.523E+01	Np-237 (Ci) 3.643E-03	Pu-238 (Ci) 1.164E-02	Pu-239 (Ci) 3.240E+00	Pu-240 (Ci) 2.186E-01	Pu-241 (Ci) 2.823E-01	Pu-242 (Ci) 8.081E-07	Am-241 (Ci) 9.495E-02	Am-243 (Ci) 2.325E-06
Cm-242 (Ci) 4.261E-06	Cm-243 (Ci) 1.936E-08	Cm-244 (Ci) 5.437E-07						

Table AD3 5-2. Data-Needs Priority Summary – Model Group 4 – 216-T-18 Crib (200-TW-1)(RL/FH)(CPP)(EPA). (3 Pages)

Vicinity Waste Sites	216-T-26, 216-T-27, and 216-T-28 Cribs						
Current Status	Analogous site; assigned to 216-T-26; evaluated in 200-TW-1/2 & 200-PW-5 FS (DOE/RL-2003-64) Draft A to EPA and Ecology March 2004; capping identified as preferred alternative in FS						
Potential Remedial Alternatives (as investigated in 200-TW-1/2 & 200-PW-5 FS [DOE/RL-2003-64])							
X for viable alternatives	**No Action**	**MESC/MNA/IC**	**Removal/Disposal**	**Barrier**	**Partial Removal / Barrier**	**In Situ Treatment**	**Other**
		X		X	X		

Data Evaluation and Gaps Analysis			
Data	**Knowns**	**Data Uncertainties**	**Are supplemental data required to support decision making?**
Data analysis at 216-T-18: 299-W11-11 (246 ft); Scintillation logs dated 1954 & 1976	299-W11-11: located near the center of the 216-T-18 Crib. A zone of elevated radioactivity between 7 ft and 86 ft associated with gamma emitters exists. Log from 1954 shows counts per minute at levels as high as 10^7. Log from 1976 shows radioactivity in same depth range, but concentrations maximums are lower due to decay of the shorter lived radionuclides. 1976 counts per minute were about 2.5×10^6 at about 33 ft and quickly fell to between 10^4 and 10^5 between 33 ft and 100 ft. The nature of the waste released would indicate the likelihood for cesium-137 and strontium-90 to be the main contaminants.	Contamination with depth is somewhat uncertain; however, inventory and volume are not reflective of significant deep contamination	The analogous relationship with 216-T-26 is sufficient to support decision making. Inventory does not imply significant groundwater risks; however, the opportunity to extend the ERC proposed for 216-T-26, 216-T-27, and 216-T-28 to cover 216-T-18 was accomplished. A draft of this report will soon be available. In addition, 216-T-18 only received a small volume, which would not indicate a substantial threat to groundwater. Yes - supplemental information on the nature and extent of plutonium may provide a stronger evaluation of protectiveness, disposal options, and cost. These data may also permit selection of a lesser or different alternative. These data collection activities would constitute accelerated confirmatory sampling activities.

Table AD3 5-2. Data-Needs Priority Summary – Model Group 4 – 216-T-18 Crib (200-TW-1)(RL/FH)(CPP)(EPA). (3 Pages)

References:
DOE/RL-2000-38, *200-TW-1 Scavenged Waste Group OU & 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan*
DOE/RL-2002-42, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 Operable Unit)*
DOE/RL-2003-64, *Feasibility Study for the 200-TW-1 Scavenged Waste Group and the 200-TW-2 Tank Waste Group & the 200-PW-5 Fission-Product Rich Waste Group OU*
RPP-26744, *Hanford Soil Inventory Model, Rev. 1*
Proposed activities:
• Install four (4) shallow drive points to evaluate nature and extent of plutonium contamination, utilizing current logging techniques as indicator of plutonium contamination.

AD3-6.0 216-T-19 CRIB AND TILE FIELD SITE-SPECIFIC FIELD-SAMPLING PLAN

The characterization planned for the 216-T-19 Crib and Tile Field includes drilling a deep borehole to groundwater, approximately 221 ft, and geophysical logging of this same borehole. The drilling and logging efforts are planned to reduce uncertainty in the nature and extent of contamination associated with protection of groundwater. The 216-T-19 Crib and Tile Field received varying waste streams including cell drainage from Tank 5-6 and 2nd cycle supernatant waste from the 221-T Plant Canyon Building, liquid waste from the 224-T Waste Storage Facility, and condensate from the 242-T evaporator.

Split-spoon samples will be collected at the bottom of the trench and at changes in lithology as indicated in Figure AD3 6-2; the samples will be analyzed for analytes presented in Volume I, Table A2-3, the 200-TW-1 and 200-PW-1 columns. This waste site was recently transferred to the 200-TW-1 OU from 200-PW-1 when it was concluded that this waste site was more representative of the 200-TW-1 OU during the development of the 200-PW-1/3/6 feasibility study (FS) and proposed plan (PP). Analysis of contaminants in both columns will address all COPC for this site. Documentation for groundwater samples, if requested by an operable unit manager, will be provided by the requesting party. The sample analysis will provide information on contaminant inventory and issues facing groundwater protection. The grab samples to be analyzed will be determined by the field geologist and technical lead, utilizing characterization data; such as geophysical logs, lithology (driller's logs), and split-spoon sample analyses.

The location of the planned deep borehole, at the northern end of the waste site near the connection of the crib to the tile field, was selected to address the zone of highest contamination. The location of this deep borehole may change as information becomes available on the surface geophysical exploration (SGE) of the TX and TY Tank Farm area currently being investigated under RPP-PLAN-35244.

During construction of the 299-W15-762, in November 2000, the drillers encountered contamination at 35 ft bgs and abandoned drilling activities at this location. A new well, 299-W15-763, was drilled an additional 50 ft west of the abandoned well and monitors groundwater at the 216-T-19 Crib and Tile Field.

The following figures and tables provide the site-specific field sampling plan for the 216-T-19 Crib and Tile Field.

Figure AD3 6-1. 216-T-19 Crib and Tile Field Data-Collection Locations.

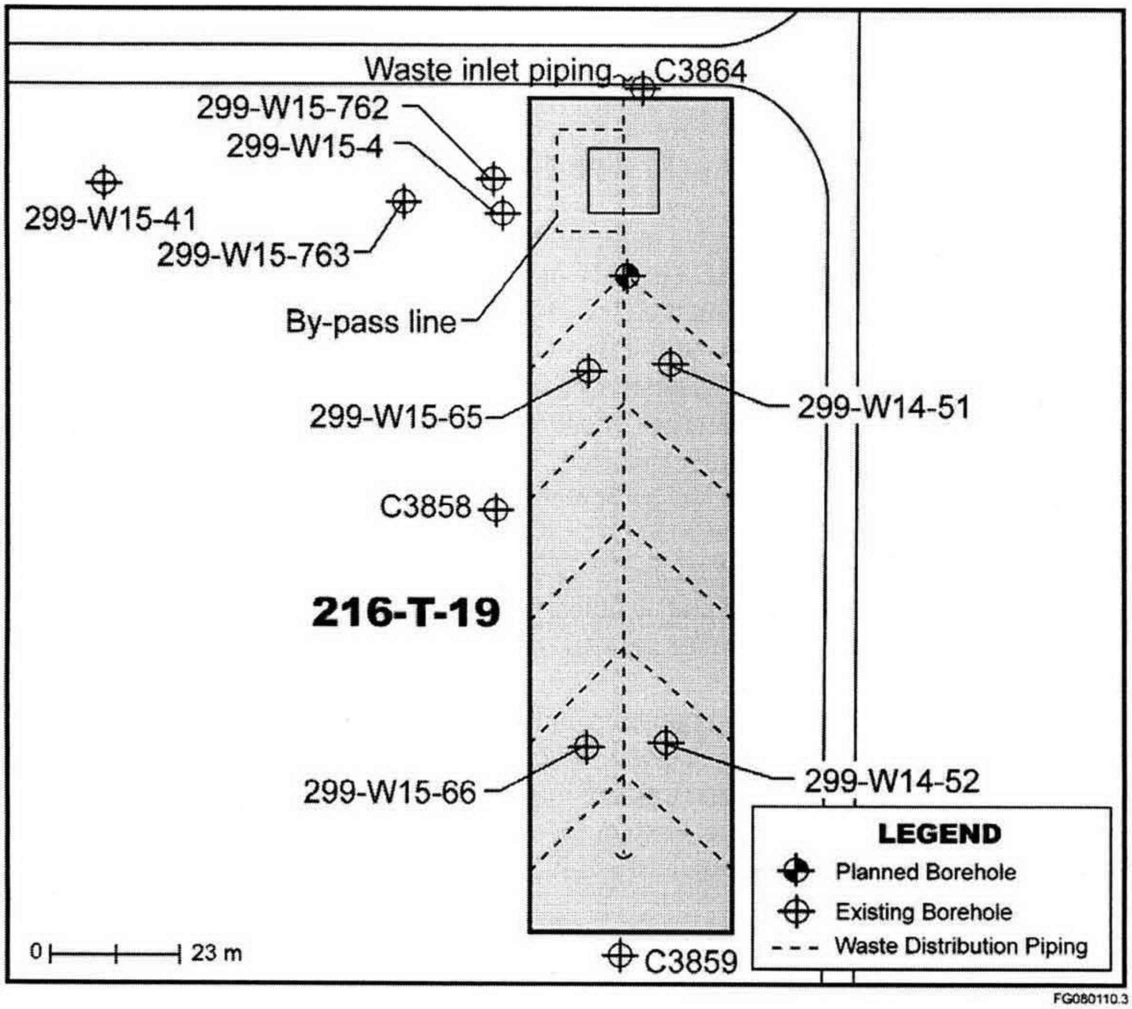


Figure AD3 6-2. 216-T-19 Crib and Tile Field Stratigraphy and Sample-Collection Intervals.

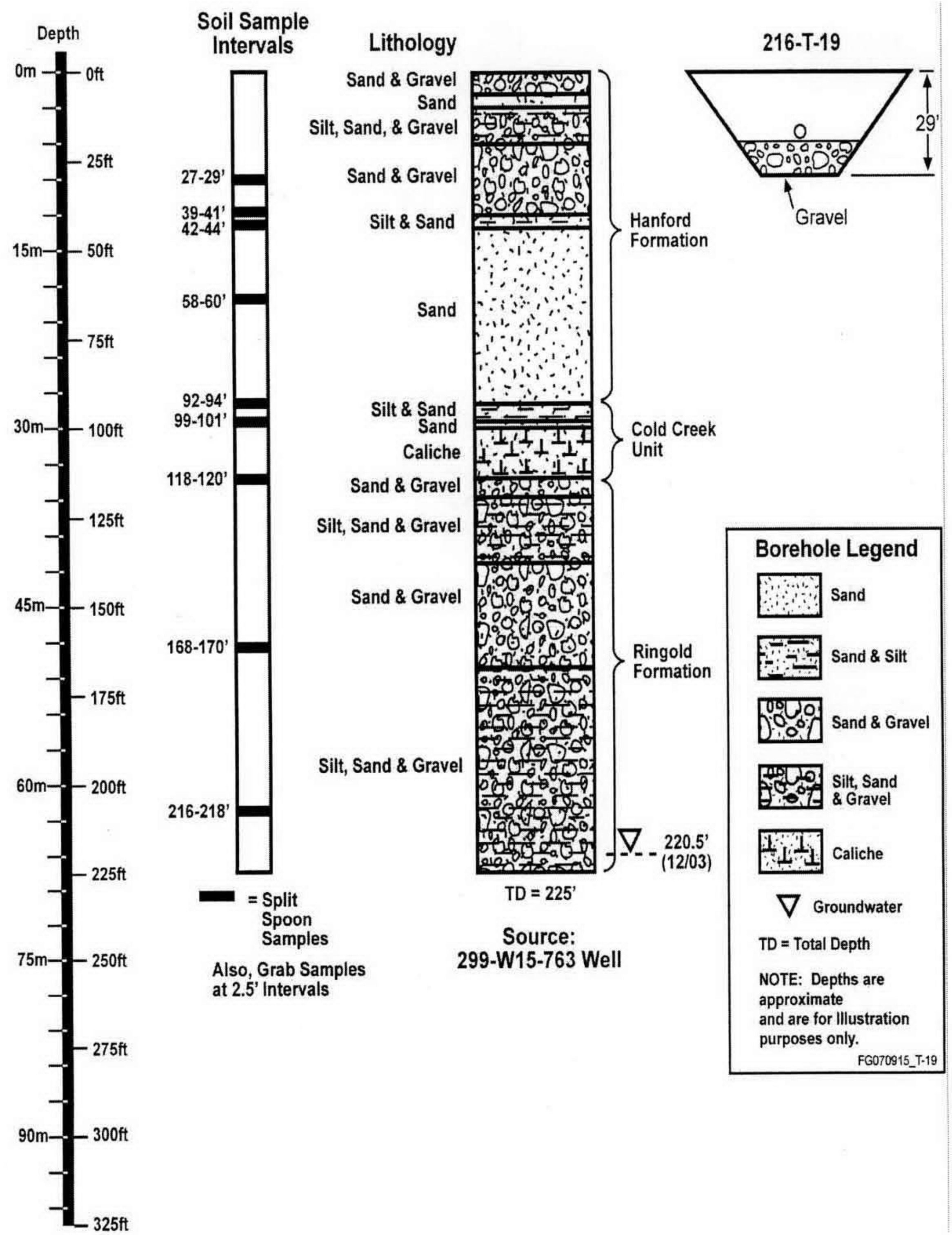


Table AD3 6-1. 216-T-19 Crib and Tile Field Sampling Plan.

Sample Collection Methodology	Sample Location	Maximum Depth of Investi-gation	Sample Interval Depth (ft bgs) [a]	Analyte List [b]	Physical Properties	
					Sample Interval	Parameters
Deep borehole with split spoon and grab samples	One deep borehole near connection between crib and tile field	To groundwater (approximately 221 ft)	Split-spoon sample at depths: 27 – 29 ft bgs 39 – 41 ft bgs 42 – 44 ft bgs 58 – 60 ft bgs 92 – 94 ft bgs 99 – 101 ft bgs 118 – 120 ft bgs 168 – 170 ft bgs 216 – 218 ft bgs Also, grab samples at 2.5 ft intervals throughout borehole	Analytes are presented in Volume I, Table A2-3, the 200-PW-1 and 200-TW-1 columns. Grab samples will be analyzed for contaminants within the pore volume.	One sample at each change in lithology or fine-grained intervals (same as split-spoon sample intervals between 35-200 ft bgs). As shown in Figure AD3 6-2.	pH, specific conductance, bulk density, moisture, particle size distribution

Number of split-spoon samples	9
Approximate number of field quality-control samples [c]	3
Approximate number of physical-property samples	7
Approximate number of grab samples	89
Approximate total number of soil samples collected	108
Approximate total number of soil samples analyzed [d]	62

Non-Sample Data Collection	Maximum Depth of Investigation
Downhole gamma-spectroscopy log, neutron moisture, and passive neutron logs	Surface to TD in new borehole ~221 ft bgs

[a] Actual sampling depths may vary depending on the amount of backfill/overburden used in interim-stabilization activities at the waste site, field screening results, and varying subsurface conditions.

[b] See Volume 1, Appendix A, Tables A2-1, A2-2, A2-4, A2-5, and A3-2 for detection limits and other analytical parameters.

[c] One duplicate, one split*, and one equipment blank. Field blanks also will be collected for volatile organic analysis, but are not included here.

[d] Number of samples analyzed includes nine split-spoon samples, three field quality-control samples, seven physical-property samples and 43 grab samples.

* Optional (Volume I, p. A2-17)

Figure AD3 6-3. 216-T-19 Crib and Tile Field Conceptual Model and Data Summary.

200-TW-1 Operable Unit
Waste Type: Process Effluent

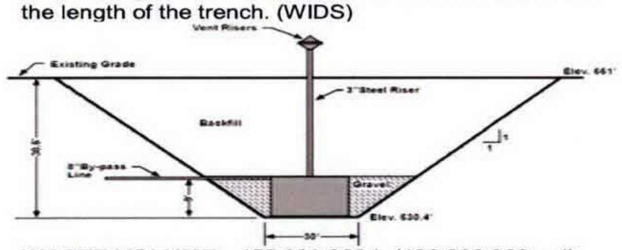
216-T-19 Crib and Tile Field

T Farm Zone

History

The 216-T-19 Crib is enclosed within a chain barricade that is posted with Cave-In Potential signs. The outer chain is posted with Underground Radioactive Material signs. The site provided subsurface liquid disposal for process condensate from the waste evaporator in 242-T, cell drainage from Tank 5-6, second-cycle supernatant waste from 221-T, and waste from the 224-T Building. The crib and tile field are associated with the 242-T Building, 221-T Building, the 224-T Building and the 241-TX-153 Diversion Box. A cave-in occurred in 1956 that resulted in the abandonment of the wooden crib. (WIDS)

CONSTRUCTION:
The site construction is wooden crib box with a riser set into a square bottom pit with sloping sides. The outlet pipe connects to a tile field. The tile field consists of a central pipe running the length of a rectangular trench with sloping sides. Pipes branch off the main pipe over the length of the trench. (WIDS)



WASTE VOLUME: 455,000,000 L (120,200,000 gal) (WIDS)

DURATION: September 1951 to December 1980 (WIDS)

ESTIMATED DISCHARGED INVENTORY (RHO-CD-673, RPP-26744):

Contaminant	Historical	2008%	SIM
Plutonium	14 g	---	---
Nitrate	---	---	241,213 kg
Sr-90	62 Ci	18.4 Ci	24.6 Ci
Cs-137	370 Ci	116 Ci	19.2 Ci
Uranium	9.5 kg	---	12.8kg
Carbon tetrachloride	---	---	1663 kg
Total beta	4500 Ci	---	---

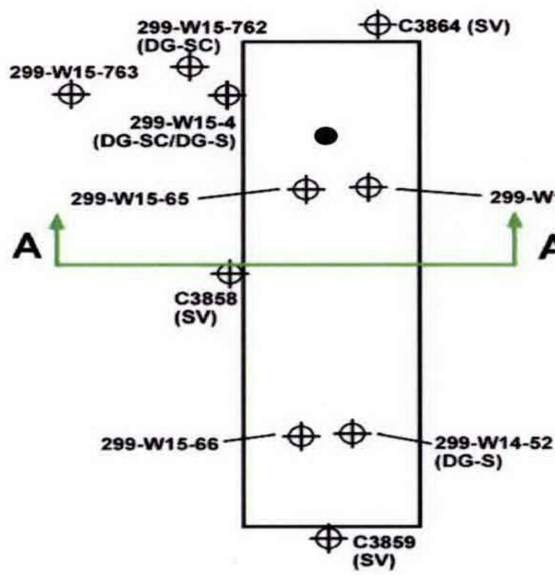
% Values decayed from RHO-CD-673 to 6/30/2008

REFERENCES:
- WIDS general summary reports
- RPP-26744
- RHO-CD-673
- BHI-00177
- DOE/RL-91-61

Basis of Knowledge (Data Types)

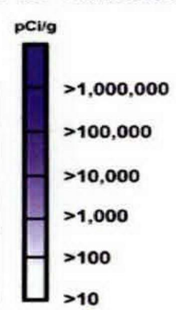
- Process History (PH)
- Downhole Geophysics - Spectral (DG-S)
- Downhole Geophysics – Scintillation (DG-SC)

Site Plan View
(not to scale)



Legend
- ⊕ = Existing Borehole (data type)
- ▼ = Groundwater Surface
- ● = Planned Deep Borehole
- bgs = Below Ground Surface
- WIDS = *Waste Information Data System database*
- SIM = *Soil Inventory Model, Rev.1*

Cesium-137 Concentration

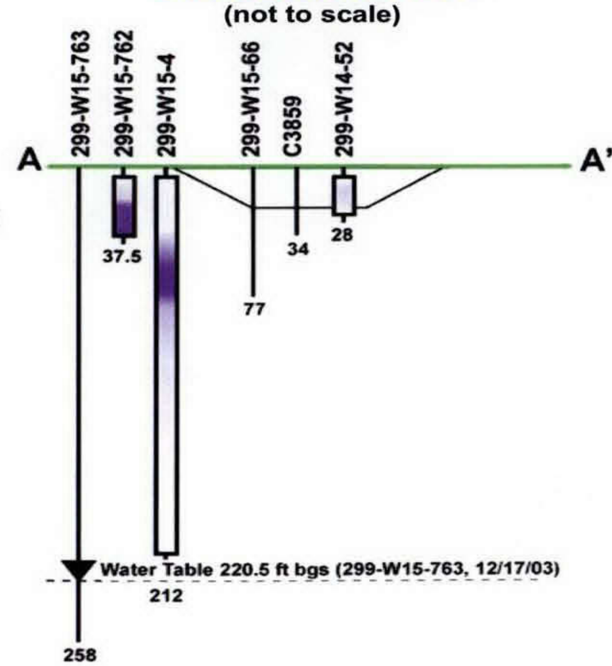


Characterization Summary

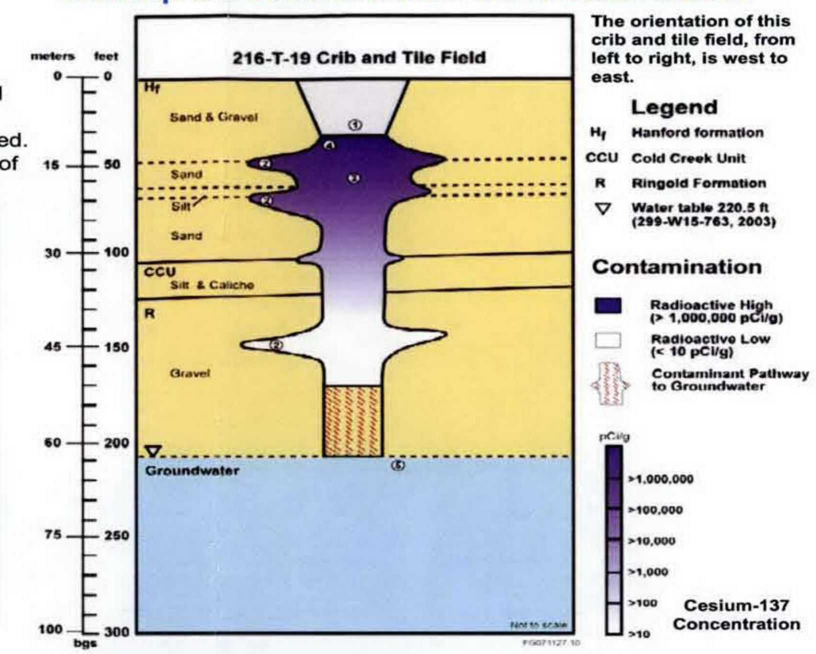
216-T-19 is analogous to 216-Z-9 and was evaluated in DOE/RL-2001-01. When the 299-W15-4 well was drilled in January 1956, contamination readings of 40,000 cpm were encountered at 47 ft bgs. A new ground water monitoring well was drilled a few feet west of 299-W15-4 in November 2000, but encountered contamination at the 35 ft and was abandoned. Soil sample results showed 6800 pCi/g of Cs-137, 240 pCi/g of gross alpha and 5300 pCi/g gross beta activity.

Summarized Well Information			
Well ID	Maximum Cs-137 (pCi/g)	Depth (ft bgs)	Date
299-W14-51	1	45	5/25/2006
299-W14-52	1	1	5/11/2006
299-W15-4	Scintillation	47	1956
299-W15-65	1312	51.5	10/15/2004
299-W15-66	1	1	1/24/2008
299-W15-762	Scintillation	35	2000
299-W15-763	No data		
C3858	No data		
C3859	No data		
C3864	No data		

Site Section View
(not to scale)



Conceptual Contaminant Distribution Model



1. Low salt, neutral/basic, radioactive liquid waste from cell drainage of Tank 5-6, 2nd cycle supernatant from 221-T, 224-T and process condensate from 242-T waste evaporator containing plutonium, uranium, strontium-90 and cesium-137 were discharged to this crib and tile between September 1951 and December 1980. The crib and tile field received a total volume of 455,000,000 L (120,200,000 gal) of wastewater.

2. The wetting front and contaminants move vertically beneath the crib and tile field. Lateral spreading of liquids is associated mainly with the Hanford gravel and sand contact, and at the intersection with the Cold Creek Unit, silt layers or other finely grained lenses. As the effluent traveled downward after discharge, contaminants may have been deposited along the top of these zones.

3. Constituents with large distribution coefficients (e.g., plutonium, strontium-90 and cesium-137) sorb to soils resulting in higher concentrations near the bottom of the crib and tile field. Concentrations generally decrease with depth.

4. The highest cesium-137 concentration was 6800 pCi/g at 35 ft bgs in well 299-W15-762.

5. Wastewater and mobile contaminants (e.g., nitrate, tritium and technium-99) from the crib impact groundwater.

Table AD3 6-2. Data-Needs Priority Summary – Model Group 6 – 216-T-19 Crib and Tile Field (200-TW-1)(RL/FH)(CPP)(EPA). (3 pages)

Background	
Site Identification	216-T-19
Site Location	200 West Area, T Farm Zone
Type of Site	Crib & Tile Field
Operating History	The crib and tile field are enclosed within a chain barricade. The crib is enclosed within a second chain barricade that is posted with "Cave-In Potential" signs. The outer chain is posted with "Underground Radioactive Material" signs. The site construction is a wooden crib box (12 ft by 12 ft by 9 ft deep) with a riser set into a square bottom pit (14 ft wide by 14 ft long by 30 ft deep) with sloping sides. The crib has an inlet and outlet pipe. The outlet pipe connects to a tile field. The tile field consists of a central pipe running the length of a rectangular trench (85 ft wide by 390 ft long by 30 ft deep) with sloping sides. Lateral pipes branch off the main pipe over the length of the trench. After construction the crib and tile field were backfilled to grade. The site provided subsurface liquid disposal for process condensate from the waste evaporator in 242-T, cell drainage from Tank 5-6, second-cycle supernatant waste from 221-T, and waste from the 224-T Building. The crib and tile field are associated with the 242-T Building, 221-T Building, the 224-T Building and the 241-TX-153 Diversion Box. The crib operated from September 1951 until August 1956. A cave-in occurred in 1956 that resulted in the abandonment of the wooden crib. The site was inactive from August 1956 to December 1965 because T Plant production was shutdown and discharges of second-cycle wastes were completed. The pipeline to the crib was blanked. In December 1965, a by-pass line was installed to reroute the effluent around the crib directly into the tile field. The tile field continued to be active until 1980. The total effluent volume discharged was 455,000,000 liters. On November 10, 2000, unexpected contamination was found in spoils being removed from a well being drilled west of 216-T-19, 3 meters [10 feet] from well 299-W15-4 that became dry in early 2000. The contamination levels reported in the field were 1.8 million dpm beta/gamma, direct; 10,400 dpm, alpha, direct, and 25 milliRem per hour (mR/hour) at contact with 1.5 mR/hour at 30 centimeters. Further sample analysis at the Radiological Counting Facility determined no alpha contamination was present and the actual dose rate was 8 mR/hour at contact. The contamination appeared to be matrixed in discolored soil being removed at about the 10.7 m (35 foot) depth. Later that day the site was posted as a Contamination Area. When well 299-W15-4 was being drilled in 1956, radioactive contamination of 40,000 counts per minute was encountered at 14.3 meters (47 feet) below ground surface. In 1992, a spectral gamma log from 299-W15-4 showed levels of gamma activity between 10,000 and 33,000 pCi/g at 11.9 and 14.9 m (39 and 49 feet). Visual and radiological surveys are performed annually at this site. Well 299-W15-4, located adjacent to the northwest corner of the crib, monitored the site groundwater until it went dry in early 2000. A new ground water monitoring well 299-W15-762 (C3122) was drilled a few feet west of 299-W15-4 in November 2000. This well encountered contamination at the 35 ft. level. Soil sample results showed 6800pCi/g of Cs-137, 240 pCi/g of gross alpha and 5300 pCi/g gross beta activity. The drilling of this well was abandoned. The location of the new well 299-W15-763 (C3339) was moved an additional 50 ft. west. Historical data suggests that the crib and tile field received the following contamination: 14 g total plutonium, 4500 Ci total beta, 62 Ci strontium-90, 370 Ci cesium-137 and 9.5 kg uranium. Some of these historical contaminant values do not fall within the uncertainty ranges of the SIM model (presented in the table below). The model may need some refining to more accurately reflect historical data. The following table represents the mean values as determined by the SIM model.

Table AD3 6-2. Data-Needs Priority Summary – Model Group 6 – 216-T-19 Crib and Tile Field (200-TW-1)(RL/FH)(CPP)(EPA). (3 pages)

Soil Inventory Model - 216-T-19 Crib and Tile Field (RPP-26744)

Na (kg) 1.206E+05	Al (kg) 0.000E+00	Fe (kg) 3.533E+02	Cr (kg) 1.131E+03	Bi (kg) 3.067E+02	La (kg) 1.849E-01	Hg (kg) 4.085E+00	Zr (kg) 0.000E+00	Pb (kg) 5.503E+00
Ni (kg) 2.798E+02	Ag (kg) 7.763E-01	Mn (kg) 4.315E+01	Ca (kg) 3.955E+03	K (kg) 1.261E+04	NO3 (kg) 2.412E+05	NO2 (kg) 8.171E+00	CO3 (kg) 6.675E+02	PO4 (kg) 1.492E+04
SO4 (kg) 9.293E+03	Si (kg) 5.929E+02	F (kg) 1.373E+04	Cl (kg) 3.376E+03	CCl4 (kg) 1.663E+03	Butanol (kg) 0.000E+00	TBP (kg) 0.000E+00	NPH (kg) 7.733E+02	NH3 (kg) 1.283E-05
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 5.122E+03	C-14 (Ci) 1.529E-02	Ni-59 (Ci) 3.989E-03	Ni-63 (Ci) 3.523E-01	Co-60 (Ci) 1.406E-02	Se-79 (Ci) 6.932E-04	Sr-90 (Ci) 2.458E+01	Y-90 (Ci) 2.458E+01
Zr-93 (Ci) 3.944E-01	Nb-93m (Ci) 3.456E-01	Tc-99 (Ci) 7.906E-03	Ru-106 (Ci) 5.723E-10	Cd-113m (Ci) 2.284E-02	Sb-125 (Ci) 8.014E-04	Sn-126 (Ci) 2.667E-03	I-129 (Ci) 0.000E+00	Cs-134 (Ci) 2.157E-07
Cs-137 (Ci) 1.917E+01	Ba-137m (Ci) 1.810E+01	Sm-151 (Ci) 1.594E+02	Eu-152 (Ci) 7.611E-03	Eu-154 (Ci) 5.592E-01	Eu-155 (Ci) 3.073E-01	Ra-226 (Ci) 2.505E-06	Ra-228 (Ci) 1.479E-11	Ac-227 (Ci) 2.655E-05
Pa-231 (Ci) 5.943E-04	Th-229 (Ci) 3.561E-08	Th-232 (Ci) 3.030E-10	U-232 (Ci) 6.867E-08	U-233 (Ci) 2.034E-08	U-234 (Ci) 4.221E-03	U-235 (Ci) 1.864E-04	U-236 (Ci) 5.841E-05	U-238 (Ci) 4.285E-03
U-Total (kg) 1.284E+01	Np-237 (Ci) 4.485E-03	Pu-238 (Ci) 7.668E-02	Pu-239 (Ci) 8.350E+00	Pu-240 (Ci) 1.063E+00	Pu-241 (Ci) 2.390E+00	Pu-242 (Ci) 1.742E-05	Am-241 (Ci) 2.926E-01	Am-243 (Ci) 4.530E-05
Cm-242 (Ci) 7.801E-05	Cm-243 (Ci) 9.414E-07	Cm-244 (Ci) 2.214E-05						

Vicinity Waste Sites	216-Z-7, UPR-200-W-99
Current Status	Site recently transferred from the 200-PW-1 OU to the 200-TW-1 OU; analogous site; assigned to 216-T-26 Crib.

Potential Remedial Alternatives

X for viable alternatives	No Action	MESC/MNA/IC	Removal/Disposal	Barrier	Partial Removal / Barrier	In Situ Treatment	Other
		X		X	X		

Table AD3 6-2. Data-Needs Priority Summary – Model Group 6 – 216-T-19 Crib and Tile Field (200-TW-1)(RL/FH)(CPP)(EPA). (3 pages)

Data Evaluation and Gaps Analysis

Data	**Knowns**	**Data Uncertainties**	**Are supplemental data required to support decision making?**
299-W15-762 (37.5 ft) 299-W15-4 (212 ft) Scintillation logs dated 1959, 1963, 1968, 1970, and 1976 299-W14-52 (28 ft) (Spectral, 2006)	299-W15-762: located near the northwest edge of the crib. Soil samples taken from this borehole show a peak cesium-137 concentration of 15,600 pCi/g at 35 ft bgs. 299-W15-4: located near the northwest edge of the crib. Groundwater data indicated a cesium-137 concentration of 1900 pCi/L, Cobalt-60 concentration of 3400 pCi/L, technetium-99 concentration of 982 pCi/L. 299-W14-52: located within the southeastern end of the tile field in 216-T-19 Crib and Tile Field. Cesium-137 is the only man-made radionuclide detected in this borehole. It was detected near the ground surface at approximately 1 pCi/g.	Uncertainty in nature and extent of contamination associated with unexpected contamination in a nearby borehole that was located adjacent to but outside the boundary of the waste site.	Yes – supplemental data on the nature and extent of contamination are needed to address uncertainties associated with protection of groundwater and with unexpected contamination from a nearby borehole (found during drilling at a location to the west of the waste site boundary); ERC will provide extent of elevated conductivity and borehole will provide information on nature of contamination in the crib and in the pore water.

References:

- WIDS, *Waste Information Data System* database
- RHO-CD-673, *Handbook for 200 Area Waste Sites*
- Internal Letter (Rockwell International # 72710-83-205 from J.S. Wilbur to M.J. Graham dated January 13, 1983 subject: Separations Area Ground Water Monitoring Network Fourth Quarter Report (October-December 1982)
- 083777 Critique Report for Unexpected Contamination Discovered During Well C-3122 Drilling
- RPP-26744, *Hanford Soil Inventory Model, Rev. 1*

Proposed Activities and Path Forward:

- Install a deep borehole to groundwater to evaluate the nature and vertical extent of contamination.

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