DOE/RL-2007-02
Revision 0
Volume II

Supplemental Remedial Investigation/Feasibility Study Work Plan for the 200 Areas Central Plateau Operable Units

Volume II: Site-Specific Field-Sampling Plan Addenda

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

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J. D. Aardal 11/09/2007
Release Approval Date

VOLUME II ADDENDA

(Each addendum consists of one or more site-specific field-sampling plans)

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ADDENDUM 1

SITE-SPECIFIC FIELD-SAMPLING PLANS FOR THE 216-S-5, 216-S-6, 216-T-36, 216-B-55, 216-A-37-2, AND 216-A-30 CRIBS IN THE 200-SC-1 OPERABLE UNIT

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APPROVAL PAGE

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

Addendum 1 – Site-Specific Field Sampling Plans for the 216-S-5, 216-S-6, 216-T-36, 216-B-55, 216-A-37-2, and 216-A-30 Cribs in the 200-SC-1 Operable Unit

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

David A Bradburn 11/30/07

Signature Date

Lead Regulatory Agency:

☒ U.S. Environmental Protection Agency

☐ Washington State Department of Ecology

Craig E. Cameron 12/4/07

Signature Date

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FIGURES

TABLES

TERMS

bgs	below ground surface
DG	downhole geophysics
GL	geologic log
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)
REDOX	Reduction-Oxidation (Plant or process)
RS	representative site
SIM	Soil Inventory Model
TBD	to be determined
TD	total depth
WIDS	*Waste Information Data System* database

METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If you know	*Multiply by*	*To get*	*If you know*	*Multiply by*	*To get*
Length			**Length**		
Inches	25.40	Millimeters	millimeters	0.0394	inches
Inches	2.54	Centimeters	centimeters	0.394	inches
Feet	0.305	Meters	meters	3.281	feet
Yards	0.914	Meters	meters	1.094	yards
miles (statute)	1.609	Kilometers	kilometers	0.621	miles (statute)
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.0929	sq. meters	sq. meters	10.764	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.591	sq. kilometers	sq. kilometers	0.386	sq. miles
Acres	0.405	Hectares	hectares	2.471	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.349	Grams	grams	0.0353	ounces (avoir)
Pounds	0.454	Kilograms	kilograms	2.205	pounds (avoir)
tons (short)	0.907	Ton (metric)	ton (metric)	1.102	tons (short)
Volume			**Volume**		
Teaspoons	5	Milliliters	milliliters	0.034	ounces (U.S., liquid)
Tablespoons	15	Milliliters	liters	2.113	pints
ounces (U.S., liquid)	29.573	Milliliters	liters	1.057	quarts (U.S., liquid)
Cups	0.24	Liters	liters	0.264	gallons (U.S., liquid)
Pints	0.473	Liters	cubic meters	35.315	cubic feet
quarts (U.S., liquid)	0.946	Liters	cubic meters	1.308	cubic yards
gallons (U.S., liquid)	3.785	Liters			
cubic feet	0.0283	cubic meters			
cubic yards	0.764	cubic meters			
Temperature			**Temperature**		
Fahrenheit	(°F-32)*5/9	Centigrade	Centigrade	(°C*9/5)+32	Fahrenheit
Radioactivity			**Radioactivity**		
Picocurie	37	millibecquerel	millibecquerel	0.027	picocurie

AD1-1.0 INTRODUCTION

Addendum 1 of Work Plan Volume II contains the site-specific field sampling plans for the 216-S-5, 216-S-6, 216-T-36, 216-B-55, 216-A-37-2, and 216-A-30 Cribs in the 200-SC-1 Operable Unit. 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 objectives 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*.[1]

[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.

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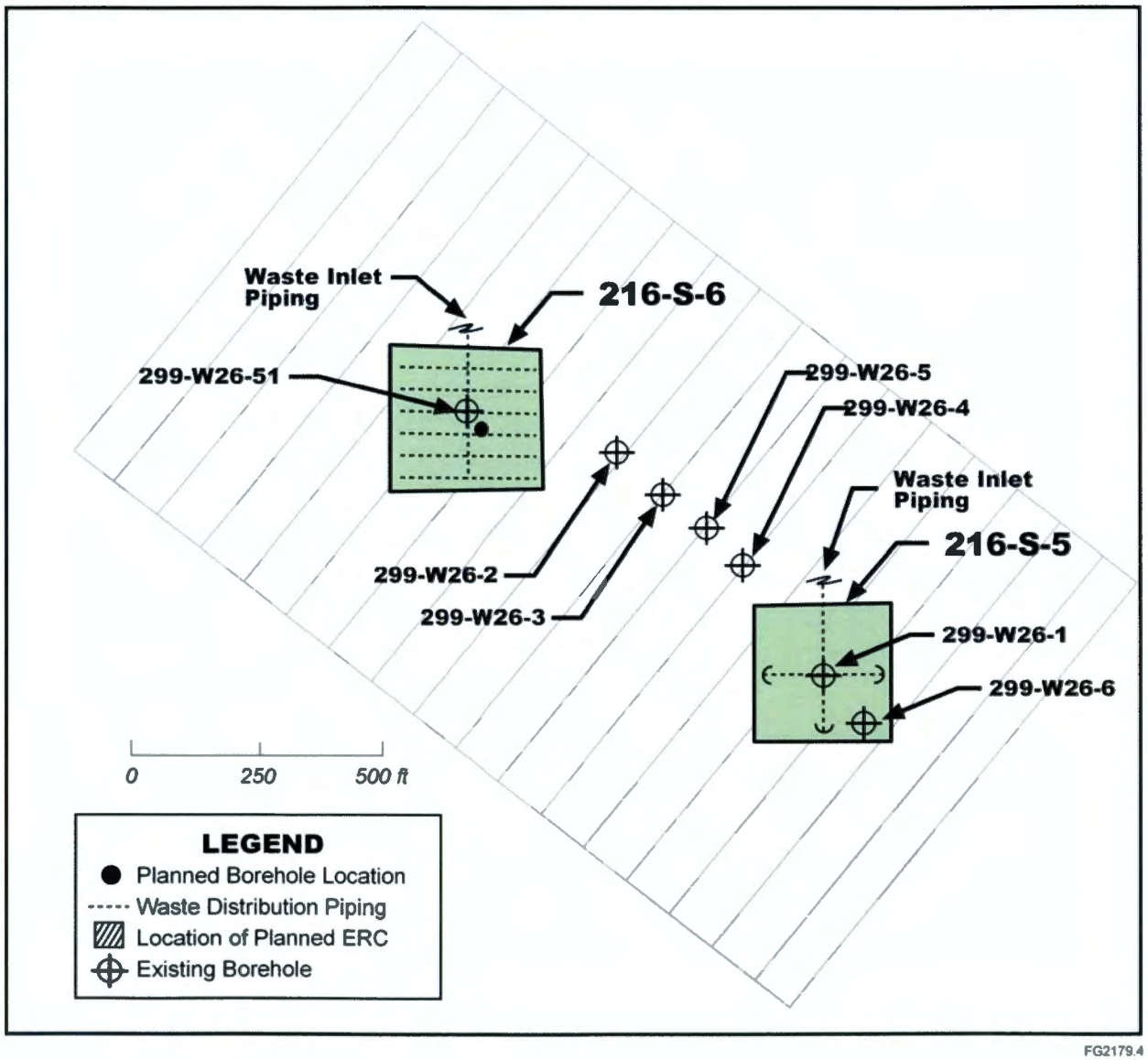
AD1-2.0 216-S-5 AND 216-S-6 CRIBS SITE-SPECIFIC FIELD-SAMPLING PLAN

The following figures and tables provide the site-specific field-sampling plan for the 216-S-5 and 216-S-6 Cribs.

Figure AD1-1. 216-S-5 and 216-S-6 Cribs Data-Collection Locations.



ERC = electrical resistivity characterization.

Figure AD1-2. 216-S-6 Crib Stratigraphy and Sample-Collection Intervals.

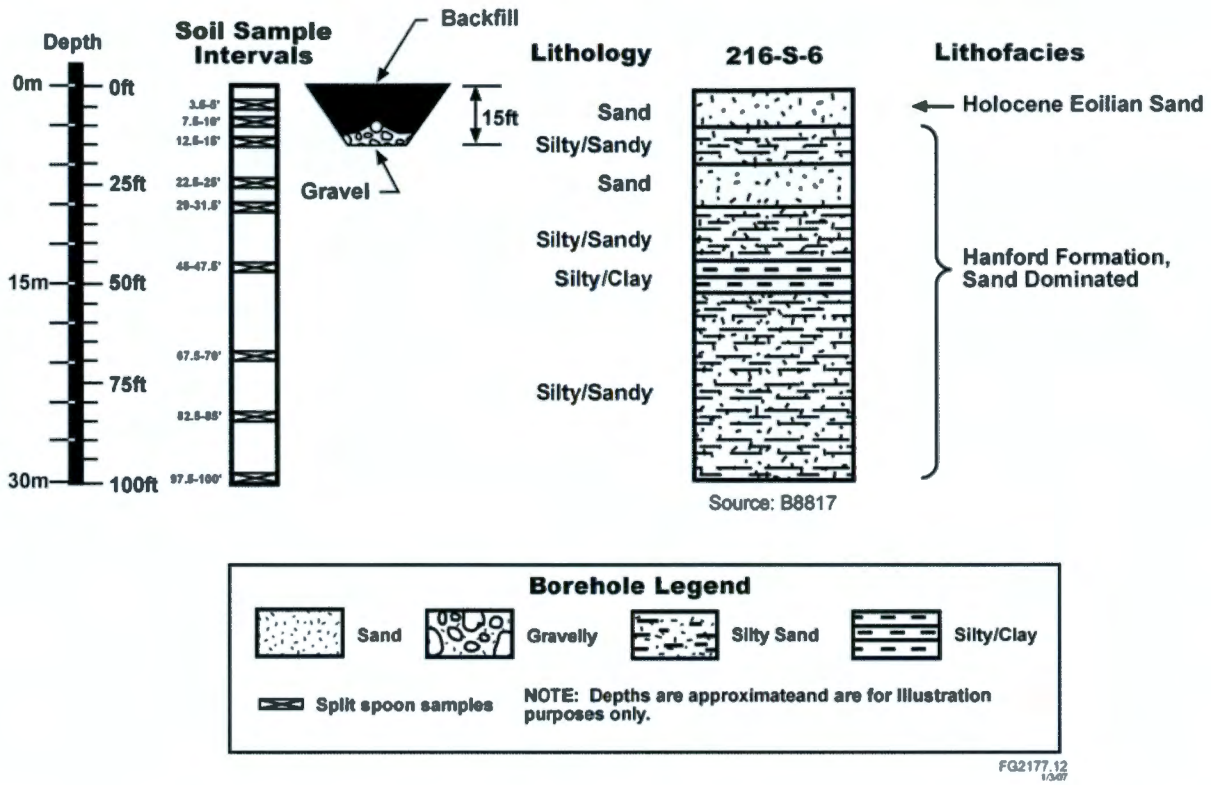


Table AD1-1. 216-S-6 Crib Sampling Plan.

Sample Collection Methodology	Sample Location	Maximum Depth of Investi-gation	Sample Interval Depth (ft bgs) [a]	Analyte List [b]	Physical Properties	
					Sample Interval	Parameters
Shallow borehole and sampling	One shallow borehole to evaluate ERC	100 ft bgs	Sample at depths of: 3.5 – 5 ft bgs 7.5 – 10 ft bgs 12.5 – 15 ft bgs 22.5 – 25 ft bgs 29 – 31.5 ft bgs 45 – 47.5 ft bgs 67.5 – 70 ft bgs 82.5 – 85 ft bgs 97.5 – 100 ft bgs	Analytes are presented in Volume I, Tables A2-3, the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 columns.	One sample at each change in stratigraphy. Sample interval at Hanford formation, sand dominated. Other samples taken at fine-grained intervals.	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	2
Approximate total number of soil samples collected	14
Approximate total number of soil samples analyzed	14

Non-Sample Data Collection	Maximum Depth of Investigation
Electrical resistivity characterization	Not defined (ERC survey of area continuous with the 216-S-5 Crib)

[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, A2-3, 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.

bgs = below ground surface.
ERC = electrical resistivity characterization.

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Figure AD1-3. 216-S-5 Crib
Conceptual Model and Data Summary.

216-S-5 Crib

200-SC-1 Operable Unit
Waste Type: Steam Condensate

Model Group 6
200-W Ponds Zone

History

216-S-5 Crib is a liquid waste disposal site that received process cooling water and REDOX steam condensate from the 202-S Building. The waste water was acidic. The structure was allowed to overflow for some months in 1956 and surrounding contamination ranged from 100 millirad/hr to 17 rad/hr.

CONSTRUCTION: A square pit 210 ft by 210 ft by 15 ft deep, filled with gravel and two corrugated perforated metal pipes that form a cross in the center of the structure.

WASTE VOLUME: 4,100,000,000 liters

DURATION: 1954 to 1957.

ESTIMATED INVENTORY OF SELECTED HIGH-MOBILITY CONSTITUENTS

	WIDS	SIM
Uranium	270 Kg	1098 Kg
Tritium	0 Ci	3.3 Ci
Nitrate	100 Kg	232,600 Kg
Nitrite	--	203,400 Kg
Fluoride	--	5.15 Kg

ESTIMATED INVENTORY OF SELECTED MEDIUM/LOW MOBILITY CONSTITUENTS

	WIDS	SIM
Co-60	0.002 Ci	0.002 Ci
Cs-137	28.8 Ci	56.2 Ci
Sr-90	59.4 Ci	31.4 Ci
Pu-239/240	42 Ci	0.018 Ci
Plutonium (total)	580 g	0.014 Ci
Total Beta Emitters	174 Ci	--

Note: "--" indicates inventory not estimated.

REFERENCES:

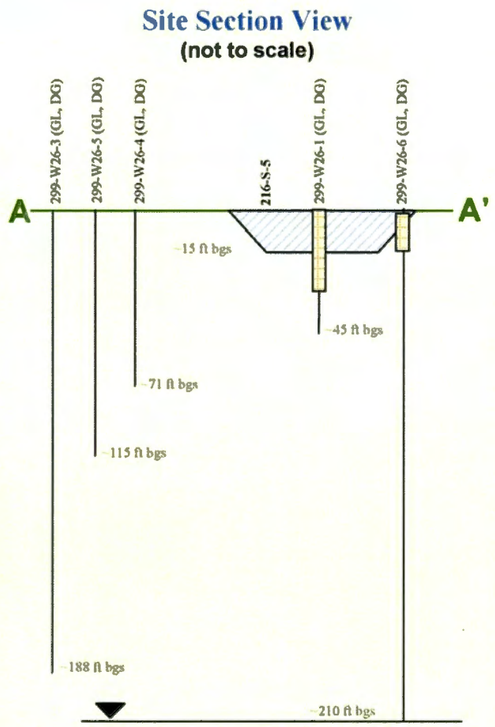
WIDS general summary reports
Hanford Soil Inventory Model, Rev 1 (RPP-26744)

Basis of Knowledge

- Process History (PH)
- Interpretation of Downhole Geophysics (DG)
- Geologic Logs (GL)
- Extrapolation from Representative Site (RS)

Characterization Summary

- Scintillation probe and spectral gamma profiles from wells 299-W26-1, -3, -4, -5, and -6 indicate residual gamma emitters to about 30 feet bgs within the crib footprint.
- Process history including data from discharge stream.
- Assigned to representative site 216-U-10.



Data Needs, Rationale, and Investigation Approach

No additional data are needed for 216-S-5. Decisions will be made using the following information:

- Existing site-specific information
- Information to be collected from 216-S-6 Crib
- Electrical Resistivity Characterization (ERC) survey of 216-S-5 and 216-S-6 combined area to identify potential conductivity plume that may be associated with contamination.

Potential Viable Alternatives

- REMOVE/TREAT/DISPOSE
- PARTIAL REMOVAL/TREATMENT/BARRIER
- MESC/MNA/IC
- BARRIER

Table AD1-2. Data-Needs Priority
Summary – Model Group 6 – 216-S-5 Crib
(200-CW-5/2/4/200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Background	
Site Identification	216-S-5
Site Location	200 West Area; 200 West Ponds Zone, southwest of 207-S Retention Basin west of the 216-S-10 Ditch
Type of Site	Crib
Operating History	The site consists of a gravel-filled crib containing two lengths of corrugated, perforated metal pipe that form a cross. The crib has been surface stabilized. It is marked and posted with Underground Radioactive Material signs. This unit received subsurface liquid disposal for the 202-S Building process vessel cooling water and steam condensate via an underground clay pipeline. The crib was built to replace the 216-S-17 Pond. The site is associated with the 202-S Building, the 207-S Retention Basin, and 216-S-6 Crib. The unit (originally called an underground swamp) was built as a temporary replacement for the grossly contaminated 216-S-17 Pond. In November 1954, the 216-S-6 Crib was built to receive condensate and cooling water with a high potential for contamination. Effluent with a low potential for contamination was sent to the 216-S-5 Crib. In 1957, the site was deactivated by valving out and locking the pipeline to the unit. The effluent was rerouted to the 216-S-16 Pond. The 207-S Retention Basin was bypassed in April 1954 due to being grossly contaminated. The basin later was backfilled with soil to prevent contamination migration. In 1956, the large cooling water discharge volumes made it necessary to cut a hole along the top edge of the crib to discharge overflow cooling water to a trench immediately southwest of the crib structure rather than allowing the crib to flood. The overflow of 50 to 100 gal/min represented approximately 5% of the total flow to the 216-S-5 Crib. The emergency overflow continued throughout the summer of 1956. In September 1956, the REDOX A-2 dissolver and H-4 coils failed. The dose rates along the edge of the crib overflow area increased from 100 millirad/h to 350 millirad/h with some spots reading up to 17 rad/h. The emergency crib overflow pond was used until the 216-S-16 Pond was completed in September 1957. In 1974, action was taken to fill in four cave-in depressions at the 216-S-5 Crib. This site is monitored by groundwater wells 299-W26-1, 299-W26-3, 299-W26-4, 299-W26-5, and 299-W26-6. Visual and radiological surveys are performed at the site. (WIDS) The crib is 64 by 64 m (210 by 210 ft) and 4.6 m (15 ft) deep. The crib operated from 1954 to 1957. (WIDS) Site Inventory Model – 216-S-5 (RPP-26744) (some constituents of interest are highlighted)

Na (kg) 5.331E+04	Al (kg) 2.053E+01	Fe (kg) 1.366E+00	Cr (kg) 3.583E+00	Bi (kg) 0.000E+00	La (kg) 0.000E+00	Hg (kg) 3.987E+00	Zr (kg) 0.000E+00	Pb (kg) 1.160E-03
Ni (kg) 1.526E-01	Ag (kg) 3.107E-03	Mn (kg) 1.682E-01	Ca (kg) 2.116E+02	K (kg) 4.642E+03	NO3 (kg) 2.326E+05	NO2 (kg) 2.034E+05	CO3 (kg) 6.028E-01	PO4 (kg) 5.550E+01
SO4 (kg) 1.342E+00	Si (kg) 9.037E+02	F (kg) 5.154E+00	Cl (kg) 2.419E+00	CCl4 (kg) 0.000E+00	Butanol (kg) 1.043E-03	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 1.859E-01
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 3.297E+00	C-14 (Ci) 1.075E-03	Ni-59 (Ci) 2.888E-04	Ni-63 (Ci) 2.627E-02	Co-60 (Ci) 1.751E-03	Se-79 (Ci) 5.187E-05	Sr-90 (Ci) 3.142E+01	Y-90 (Ci) 3.166E+01
Zr-93 (Ci) 3.109E-03	Nb-93m (Ci) 2.671E-03	Tc-99 (Ci) 2.585E-02	Ru-106 (Ci) 6.351E-10	Cd-113m (Ci) 2.224E-03	Sb-125 (Ci) 1.767E-04	Sn-126 (Ci) 2.103E-04	I-129 (Ci) 3.151E-05	Cs-134 (Ci) 7.226E-06
Cs-137 (Ci) 5.625E+01	Ba-137m (Ci) 5.328E+01	Sm-151 (Ci) 2.086E+00	Eu-152 (Ci) 2.187E-04	Eu-154 (Ci) 1.465E-02	Eu-155 (Ci) 6.065E-03	Ra-226 (Ci) 3.007E-09	Ra-228 (Ci) 1.754E-14	Ac-227 (Ci) 1.285E-08
Pa-231 (Ci) 1.909E-08	Th-229 (Ci) 6.025E-11	Th-232 (Ci) 1.891E-14	U-232 (Ci) 5.476E-06	U-233 (Ci) 4.488E-07	U-234 (Ci) 3.591E-01	U-235 (Ci) 1.589E-02	U-236 (Ci) 4.885E-03	U-238 (Ci) 3.665E-01
U-Total (kg) 1.098E+03	Np-237 (Ci) 1.367E-04	Pu-238 (Ci) 2.783E-04	Pu-239 (Ci) 1.450E-02	Pu-240 (Ci) 2.851E-03	Pu-241 (Ci) 9.832E-03	Pu-242 (Ci) 8.463E-08	Am-241 (Ci) 1.022E-02	Am-243 (Ci) 3.791E-06
Cm-242 (Ci) 7.791E-06	Cm-243 (Ci) 1.503E-07	Cm-244 (Ci) 3.605E-06						

Table AD1-2. Data-Needs Priority
Summary – Model Group 6 – 216-S-5 Crib
(200-CW-5/2/4/200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Vicinity Waste Sites	216-S-6, 216-S-11, and 216-S-17						
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	X		

Data Evaluation and Gaps Analysis			
Data	Knowns	Data Uncertainties	Are supplemental data required to support decision making?
Geophysical Logging 299-W26-06 (209.65 ft) (spectral gamma log 2003) 299-W26-3 (188 ft) (scintillation log 1976) 299-W26-4 (71 ft) (scintillation log 1976) 299-W26-1 (87 ft) (scintillation log 1976) (spectral gamma log 2006) 299-W26-5 (115 ft) (scintillation log 1976)	Located in the southeast corner of the crib. Cesium-137 detected from 3 to 16 ft in concentrations ranging from 0.4 to 2.5 pCi/g. The maximum concentration of Cs-137 was at 8 ft. Cesium-137 also was detected at 53 and 62 ft, with concentrations ~0.4 pCi/g. Located 378 ft northwest of the center of the crib. Scintillation probe profiles show background level radiation. Located 287 ft northwest of the center of the crib. Scintillation probe profiles show background-level radiation. Located in the center of the crib area. Scintillation probe profiles indicate radioactive contaminants from 1.5 to 12.8 m (5 to 42 ft) bgs. The spectral gamma log identified Cs-137 in the same depth range as the scintillation log with a maximum concentration of 12,000 pCi/g at 5.8 m (19 ft) bgs. Located northwest of the center of the crib area between 299-W26-3 and 299-W26-4; scintillation probe profiles show background-level radiation.	Potential for impacts to groundwater	No. Existing information is sufficient for decision making for the shallow zone; ERC would provide information on elevated conductivity that may be associated with deeper contamination; the shallow borehole sampling at 216-S-6 would provide information to correlate the ERC and to evaluate protection of groundwater at 216-S-5 as well.

Proposed Activities and Path Forward:

Conduct ERC surveys to evaluate potential for elevated conductivity plume that may be associated with contamination; use to help evaluate extent of contamination with depth.

Use existing information and information from data collection activities at 216-S-6 to support remedial decision making for 216-S-5.

The following provides a list of the references/bibliography used during this evaluation:

DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units.*
RHO-CD-673, *Handbook 200 Areas Waste Sites.*
RPP-26744, *Hanford Soil Inventory Model, Rev. 1.*
Waste Information Data System Report, Hanford Site database.

bgs = below ground surface.
ERC = electrical resistivity characterization.
MESC/MNA/IC = Maintain Existing Soil Cover, Monitored Natural Attenuation, Institutional Controls.
NPH = normal paraffin hydrocarbon.
TBP = tributyl phosphate.
WIDS = *Waste Information Data System* database.

Figure AD1-4. 216-S-6 Crib
Conceptual Model and Data Summary.

200-SC-1 Operable Unit
Waste Type: Steam Condensate

216-S-6 Crib

Model Group 6
200-W Ponds Zone

History

216-S-6 Crib is a liquid waste disposal site that received process cooling water and REDOX steam condensate from the 202-S Building. The waste stream was neutral to basic.

CONSTRUCTION: A square pit 210 ft by 210 ft by 15 ft deep, filled with gravel and a corrugated perforated metal pipe down the center with six pipes branching off perpendicular to the main pipe at 7 ft below the surface. The site is backfilled with 116,333 cu yd of gravel, 12,000 cu m contaminated soil and 13,000 cu m of "overburden" soils.

WASTE VOLUME: 4,470,000,000 liters

DURATION: 1954 to 1972

ESTIMATED INVENTORY OF SELECTED HIGH-MOBILITY CONSTITUENTS

	WIDS	SIM
Uranium	272 Kg	853 Kg
Tritium	0.00 Ci	3.549 Ci
Nitrate	140 Kg	253,500 Kg
Nitrite	--	221,100 Kg
Fluoride	--	3.9 Kg

ESTIMATED INVENTORY OF SELECTED MEDIUM/LOW MOBILITY CONSTITUENTS

	WIDS	SIM
Co-60	0.258 Ci	0.0008 Ci
Cs-137	125.0 Ci	11.3 Ci
Sr-90	224.0 Ci	5.8 Ci
Pu-239/240	34.3 Ci	0.3 Ci
Plutonium	473 g	--
Total Beta Emitters	901 Ci	--

Note: "--" indicates inventory not estimated

REFERENCES:

WIDS general summary reports
Hanford Soil Inventory Model, Rev 1 (RPP-26744)

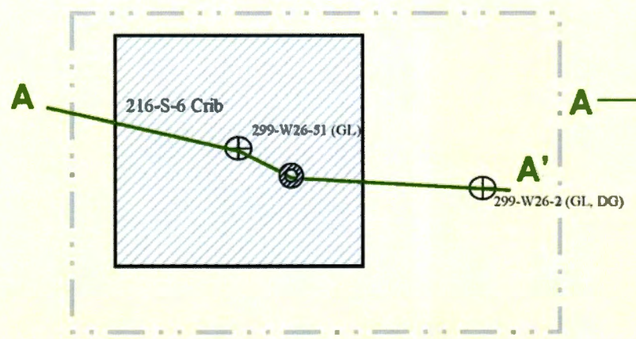
Basis of Knowledge

- Process History (PH)
- Interpretation of Downhole Geophysics (DG)
- Interpretation of Surface Geophysics (SG)
- Geologic Logs (GL)
- Extrapolation from Representative Site (RS)

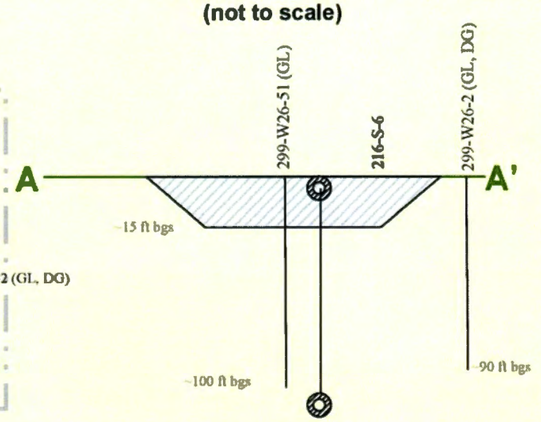
Characterization Summary

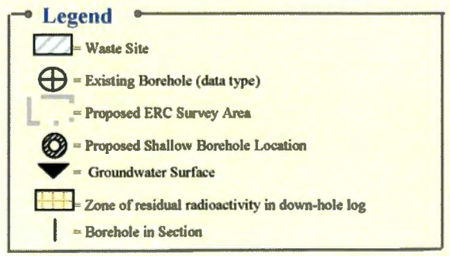
- One scintillation probe profile from well 299-W26-2 to approximately 90 ft bgs indicates no detectable gamma emitters.
- Process history including data from discharge stream.
- Surface scans identified contaminated plants growing on the site.
- Assigned to representative site 216-U-10.

Site Plan View
(not to scale)



Site Section View
(not to scale)





Potential Viable Alternatives

- REMOVE/TREAT/DISPOSE
- PARTIAL REMOVAL/TREATMENT/BARRIER
- MESC/MNA/IC
- BARRIER

Data Needs, Rationale, and Investigation Approach

Additional information is required for the following reasons:

- The analogous relationship to 216-U-10 is uncertain.
- The potential exists for deeper contamination associated with mobile contaminants that may impact groundwater (e.g., nitrate, uranium).

The supplemental investigation strategy incorporates the following elements:

- Electrical Resistivity Characterization (ERC) survey to identify the presence of subsurface conductivity plumes that may indicate subsurface contaminants.
- Install one shallow borehole to a depth of about 100 feet bgs. Collect subsurface soil samples and analyze them as specified.
- Correlate the soil sample analyses to results of ERC survey to obtain site-specific data to reduce the uncertainty between 216-S-6 and the representative site.
- Data collected at 216-S-6 will also be used to support decision making for 216-S-5.

Table AD1-3. Data-Needs Priority Summary – Model Group 6 – 216-S-6 Crib (200-CW-5/2/4/ 200-SC-1) (RL/FH) CPP) (EPA). (2 Pages)

Background	
Site Identification	216-S-6
Site Location	200 West Area, 200-W Ponds, northwest of the 216-S-5 Crib and north of 216-S-17 Pond.
Type of Site	Crib
Operating History	This unit consists of a square pit filled with gravel with corrugated, perforated metal pipe running down the center, and six pipes branching off perpendicular to the main pipe. The site is backfilled and marked with Underground Radioactive Material signs. This unit received subsurface process cooling water and steam condensate from the 202-S Building waste via an underground pipeline. The site is associated with the 202-S Building, the 207-S Retention Basin, the 2904-S-171 Control Structure, and the 215-S-5 Crib. This site operated from November 1954 to July 1972. The crib was constructed as part of the Segregation Project. REDOX effluent with a high potential for contamination was diverted to the 216-S-6 Crib. Effluent with a low potential for contamination was sent to the 216-S-5 Crib. After July 1967, the site received the steam condensate from the D-12 and D-14 Waste Concentrators in the 202-S Building. The waste is low salt, neutral to basic and contains nitrates. In September 1955, both the 216-S-5 and 216-S-6 Cribs were operated at greater-than-capacity levels. Temporary relief was provided by blading off the corner of the 216-S-6 Crib and cutting a run off ditch. The overflow was considered a better option than allowing the crib to flood and damage the roof seal. No contamination problems were noted in the overflow area in 1955. (WIDS) The crib is 64 by 64 m (210 by 210 ft) and 4.6 m (15 ft) deep. The crib operated from 1954 to 1972. (WIDS) Soil Inventory Model – 216-S-6 (RPP-26744) (some constituents of interest are highlighted)

Na (kg) 5.789E+04	Al (kg) 1.346E+01	Fe (kg) 2.525E-02	Cr (kg) 1.837E-01	Bi (kg) 0.000E+00	La (kg) 0.000E+00	Hg (kg) 4.332E+00	Zr (kg) 0.000E+00	Pb (kg) 1.261E-03
Ni (kg) 1.568E-02	Ag (kg) 3.273E-06	Mn (kg) 2.657E-03	Ca (kg) 2.283E+02	K (kg) 4.223E+03	NO3 (kg) 2.535E+05	NO2 (kg) 2.211E+05	CO3 (kg) 1.481E-02	PO4 (kg) 4.242E+01
SO4 (kg) 1.312E-01	Si (kg) 9.821E+02	F (kg) 3.939E+00	Cl (kg) 1.967E-01	CCl4 (kg) 0.000E+00	Butanol (kg) 7.973E-04	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 1.814E-02
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 3.549E+00	C-14 (Ci) 9.230E-05	Ni-59 (Ci) 7.043E-05	Ni-63 (Ci) 6.715E-03	Co-60 (Ci) 8.266E-04	Se-79 (Ci) 1.600E-04	Sr-90 (Ci) 5.831E+00	Y-90 (Ci) 5.838E+00
Zr-93 (Ci) 2.373E-03	Nb-93m (Ci) 3.198E-04	Tc-99 (Ci) 1.600E-02	Ru-106 (Ci) 6.588E-10	Cd-113m (Ci) 3.538E-04	Sb-125 (Ci) 6.437E-05	Sn-126 (Ci) 2.609E-05	I-129 (Ci) 2.804E-03	Cs-134 (Ci) 5.945E-06
Cs-137 (Ci) 1.130E+01	Ba-137m (Ci) 1.067E+01	Sm-151 (Ci) 5.880E-01	Eu-152 (Ci) 1.037E-04	Eu-154 (Ci) 1.175E-02	Eu-155 (Ci) 6.839E-04	Ra-226 (Ci) 3.789E-07	Ra-228 (Ci) 3.186E-12	Ac-227 (Ci) 1.579E-06
Pa-231 (Ci) 2.311E-06	Th-229 (Ci) 2.585E-09	Th-232 (Ci) 3.264E-12	U-232 (Ci) 4.552E-06	U-233 (Ci) 1.508E-06	U-234 (Ci) 2.803E-01	U-235 (Ci) 1.237E-02	U-236 (Ci) 3.877E-03	U-238 (Ci) 2.848E-01
U-Total (kg) 8.529E+02	Np-237 (Ci) 1.740E-03	Pu-238 (Ci) 9.023E-03	Pu-239 (Ci) 2.467E-01	Pu-240 (Ci) 5.135E-02	Pu-241 (Ci) 2.629E-01	Pu-242 (Ci) 2.124E-06	Am-241 (Ci) 5.488E-02	Am-243 (Ci) 2.067E-05
Cm-242 (Ci) 3.471E-05	Cm-243 (Ci) 7.276E-07	Cm-244 (Ci) 1.756E-05						

Table AD1-3. Data-Needs Priority
Summary – Model Group 6 – 216-S-6 Crib
(200-CW-5/2/4/ 200-SC-1) (RL/FH) CPP) (EPA). (2 Pages)

Vicinity Waste Sites	216-S-17; 216-S-16D; 216-S-5						
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	X		

Data Evaluation and Gaps Analysis			
Data	Knowns	Data Uncertainties	Are supplemental data required to support decision making?
Geophysical logging 299-W26-2 (230 ft) (scintillation log 1976) 299-W26-51 (106 ft) (spectral gamma log 2006) (moisture log 2006)	Located east of and outside of the crib. Scintillation probe profiles indicate background radiation levels. Located in center of crib. Cs-137 was detected from 2.1 to 18.9 m (7 to 62 ft) bgs with a maximum concentration of 3,800 pCi/g at 13.7 m (45 ft) bgs. The moisture detected in the well was variable due to the presence of a grout seal from the surface to 6 m (20 ft) bgs. Below this depth, moisture appears to increase at about 11.9, 14, 18, 20.7, 23.8 m (39, 46, 59, 68, 78 ft), and from 28 m (92 ft) to the bottom of the borehole at 32.3 m (106 ft).	Potential for impacts to groundwater from mobile contaminants such as nitrate and uranium	Yes. The analogous relationship between 216-U-10 (representative site) and 216-S-6 is somewhat uncertain. While inventory, geophysical logs, and analogous relationships may support shallow vadose zone decision making, ERC surveys would provide indication of deeper zones of elevated conductivity that may be associated with contamination. A shallow borehole would help correlate with the ERC by providing samples that can be evaluated for pore water contamination (similar to the 216-B-26 borehole drilled in the BC Cribs and Trenches area). These analyses would support the protection of groundwater evaluation for both the 216-S-6 and 216-S-5 Cribs. Supplemental data would provide site-specific information on remaining inventory of mobile contaminants, such as uranium and nitrate, in the soil column that may impact groundwater.

Proposed Activities and Path Forward:

Conduct ERC surveys to evaluate the presence of subsurface conductivity that may be associated with mobile contaminants that could impact groundwater.

Install shallow borehole to correlate results of ERC and to obtain site-specific data needed because of differences between the representative site and 216-S-6.

Data collected at 216-S-6 also would be used to support 216-S-5 decision making because these two sites received similar waste streams, with the higher concentration effluent going to 216-S-6. 216-S-6 is bounding for 216-S-5 decision making.

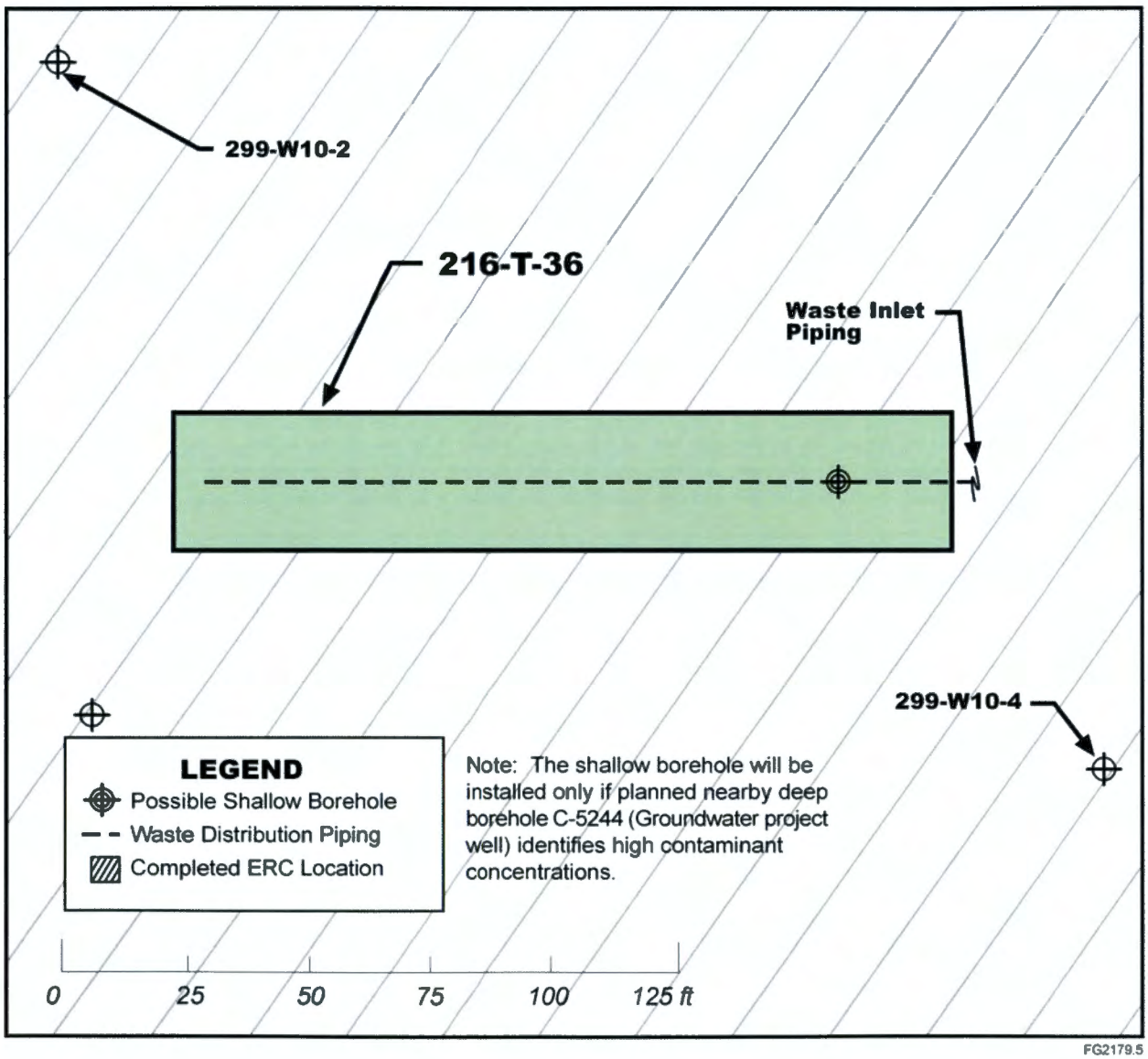
Additional Notes: Soil Inventory Model inventory identifies >800 kg uranium and >200,000 kg each of nitrate and nitrite.
References: The following provides a list of the references/bibliography used during this evaluation:
DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units.*
RHO-CD-673, *Handbook 200 Areas Waste Sites.*
RPP-26744, *Hanford Soil Inventory Model, Rev. 1.*
Waste Information Data System Report, Hanford Site database.

ERC = electrical resistivity characterization.
MESC/MNA/IC = Maintain Existing Soil Cover, Monitored Natural Attenuation, Institutional Controls.
WIDS = *Waste Information Data System* database.

AD1-3.0 216-T-36 CRIB SITE-SPECIFIC FIELD-SAMPLING PLAN

The following figures and tables provide the site-specific field-sampling plan for the 216-T-36 Crib.

Figure AD1-5. 216-T-36 Crib Data-Collection Locations.



ERC = electrical resistivity characterization.

Figure AD1-6. 216-T-36 Crib Stratigraphy and Sample-Collection Intervals.

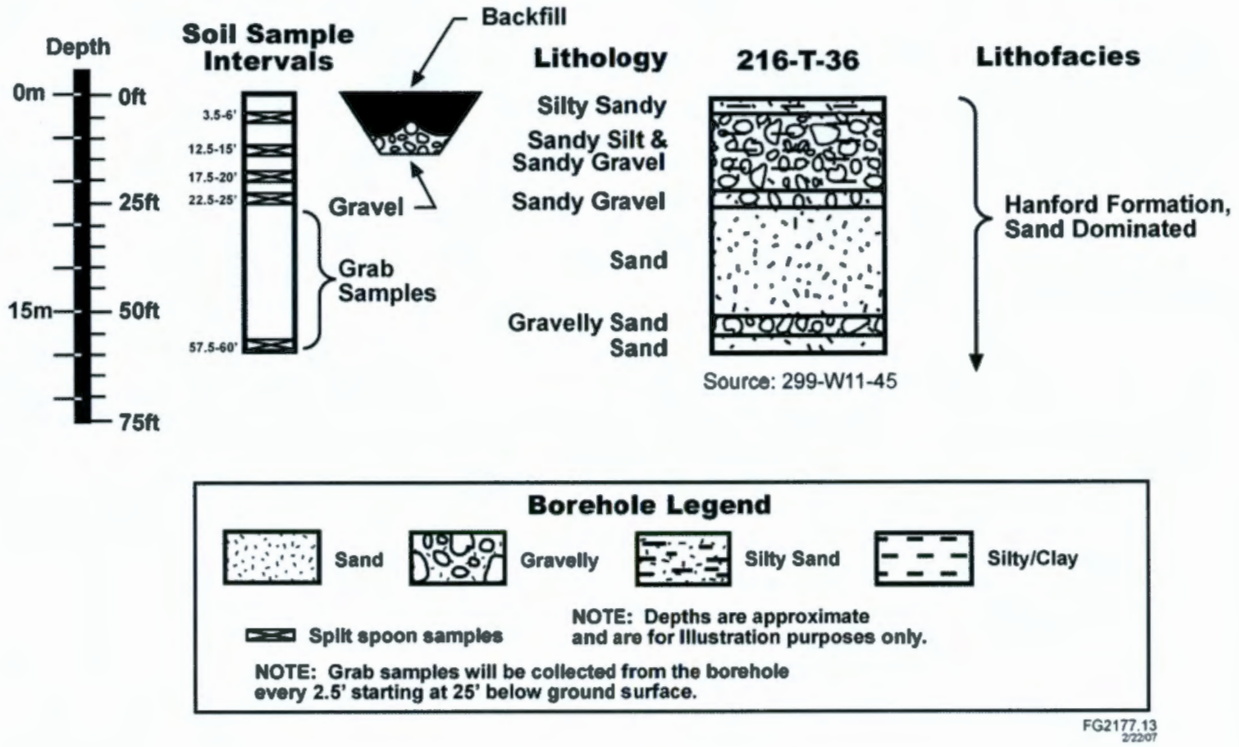


Table AD1-4. 216-T-36 Crib Data Collection Plan.

Sample Collection Methodology	Sample Location	Maximum Depth of Investi-gation	Sample Interval Depth (ft bgs) [a]	Analyte List [b]	Physical Properties	
					Sample Interval	Parameters
Borehole drilling and sampling	One shallow borehole if indicated by monitoring well data	60 ft bgs	Sample at depths of: 3.5 – 6 ft bgs 12.5 – 15 ft bgs 17.5 – 20 ft bgs 22.5 – 25 ft bgs 57.5 – 60 ft bgs	Analytes are presented in Volume I, Table A2-3, the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 columns.	One sample at each change in stratigraphy. Sample interval at Hanford formation, sand dominated. Other samples taken at fine-grained interval(s).	pH, specific conductance, bulk density, moisture, particle size distribution
			Grab sample collected every 2.5 ft starting at 25 ft bgs to TD; initial analysis on 5-ft samples.	See Volume I, Table A2-3.		

Number of split-spoon samples	5
Approximate number of field quality-control samples [c]	3
Approximate number of physical-property samples	2
Approximate number of grab samples	15
Approximate total number of soil samples collected	25
Approximate total number of soil samples initially analyzed [d]	18

[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 I, Appendix A, Tables A2-1, A2-2, A2-3, 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 five split-spoon samples, three field quality-control samples, two physical-property samples, and eight grab samples.

bgs = below ground surface.
TD = total depth.

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Figure AD1-7. 216-T-36 Conceptual Model and Data Summary.

216-T-36 Crib

200-SC-1 Operable Unit
Waste Type: Steam Condensate

Model Group 6
T Farm Zone

History

216-T-36 Crib is a liquid waste disposal site that received process steam condensate, equipment decontamination waste and miscellaneous radioactive waste from 221-T and 221-U buildings and decontamination waste from 2706-T building. The waste stream was an alkaline aqueous waste.

CONSTRUCTION: The 216-T-36 crib consists of a clay distribution pipe placed in a rectangular trench with bottom dimensions of 160 ft by 10 ft by 15 ft deep, filled with gravel and soil.

WASTE VOLUME: 522,000 liters

DURATION: 1967 to 1969 (end of use not clearly identified).

ESTIMATED INVENTORY OF SELECTED HIGH-MOBILITY CONSTITUENTS

	WIDS	SIM
Uranium	1.18 Kg	172 Kg
Tritium	0.00 Ci	0.001 Ci
Nitrate	0.00 Kg	4.950 Kg
Nitrite	0.00 Kg	563 Kg
Fluoride	0.0 Kg	0.0 Kg
Chromium	--	212 Kg

ESTIMATED INVENTORY OF SELECTED MEDIUM/LOW MOBILITY CONSTITUENTS

	WIDS	SIM
Co-60	--	0.00008 Ci
Cs-137	0.06 Ci	0.07 Ci
Sr-90	0.05 Ci	0.6 Ci
Pu-239/240	0.0 Ci	22.8 Ci
Pu-241	0.0 Ci	111 Ci
Plutonium	0.24 Ci	--
Total Beta Emitters	0.72 Ci	--
Total Alpha Emitters	22.7 Ci	--

Note: "--" indicates inventory not estimated.

REFERENCES:

WIDS general summary reports
Hanford Soil Inventory Model, Rev 1 (RPP-26744)

Basis of Knowledge

- Process History (PH)

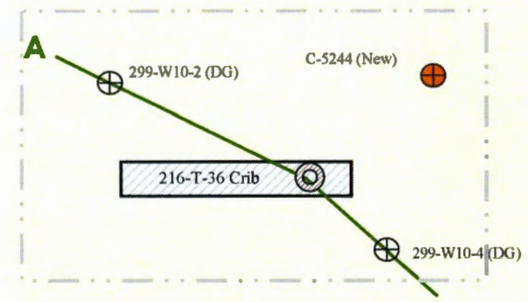
Interpretation of Downhole Geophysics (DG)

- Extrapolation from Representative Site (RS)

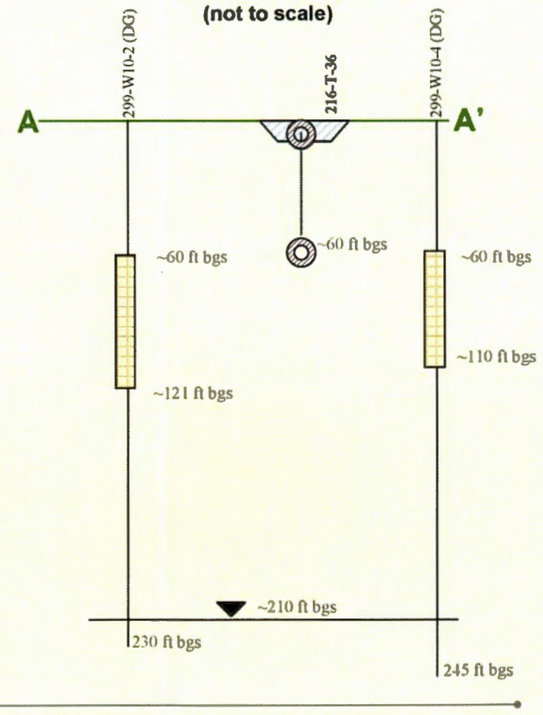
Characterization Summary

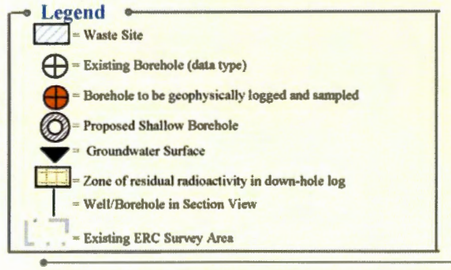
- No site-specific measurements. Process history only.
- Assigned as analogous to representative site 216-T-26.
- Downhole geophysics from two nearby wells (299-W10-2 and 299-W10-4) indicate subsurface contamination by gamma emitting nuclides pre-dating 216-T-36. Tc-99 groundwater plume in this area.
- ERC survey indicates areas of elevated conductivity near the east side of the crib and limited conductivity directly below the crib.

Site Plan View
(not to scale)



Site Section View
(not to scale)





Potential Viable Alternatives

- REMOVE/TREAT/DISPOSE
- PARTIAL REMOVAL/TREATMENT/BARRIER
- MESC/MNA/IC
- BARRIER

Data Needs, Rationale, and Investigation Approach

Additional Information may be required for the following reasons:

- Based on current groundwater conditions (e.g., Tc-99) in the vicinity of this site, the inventory for 216-T-36 may be uncertain.

The supplemental investigation incorporates the following elements:

- A new deep borehole (to be installed by the groundwater program) will be installed and sampled.
- Sampling and analysis results and downhole geophysics from the new borehole will be evaluated.
- If the new borehole indicates soil contamination that suggests contribution from 216-T-36, then a shallow borehole (to about 60 feet bgs) will be placed within the crib footprint and subsurface soil samples will be collected and analyzed as specified.
- The sampling and analysis results from the new borehole(s) will be correlated to existing ERC survey data.

Table AD1-5. Data-Needs Priority Summary – Model Group 6 – 216-T-36 Crib (200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Background	
Site Identification	216-T-36 Crib
Site Location	200 West Area, T Farm Zone, south of 241-T Tank Farm; north of 241-TY Tank Farm
Type of Site	Crib
Operating History	The site consists of an interim stabilized crib posted as Underground Radioactive Material. The site consists of a single vitreous clay distribution pipe resting in a gravel layer that is in a rectangular trench. Backfill covers the pipe and gravel. The crib also has a gage well riser and a filter riser. This site provided subsurface liquid disposal for steam condensate, equipment decontamination waste, and miscellaneous waste from the 221-T and 221-U Buildings. The site also received decontamination waste from the 2706-T Building. Associated structures are the 221-T, 221-U, and 2706-T Buildings and the 200-W-79 Pipeline. The site started operation in May 1967. The end date is unclear. However, a shutdown date between 1970 and 1973 is likely based on available documentation. One WIDS source indicates the 216-T-36 Crib was built to replace the 216-T-28 Crib. (WIDS)

Soil Inventory Model – 216-T-36 (RPP-26744) (some constituents of interest are highlighted)

Na (kg) 2.29E+03	Al (kg) 0.00E+00	Fe (kg) 5.33E+01	Cr (kg) 2.12E+02	Bi (kg) 0.00E+00	La (kg) 0.00E+00	Hg (kg) 0.00E+00	Zr (kg) 0.00E+00	Pb (kg) 0.00E+00
Ni (kg) 9.44E+01	Ag (kg) 0.00E+00	Mn (kg) 0.00E+00	Ca (kg) 2.45E+02	K (kg) 1.38E+01	NO3 (kg) 4.95E+03	NO2 (kg) 5.63E+02	CO3 (kg) 1.52E+02	PO4 (kg) 0.00E+00
SO4 (kg) 2.00E+02	Si (kg) 0.00E+00	F (kg) 0.00E+00	Cl (kg) 5.73E+01	CCl4 (kg) 0.00E+00	Butanol (kg) 0.00E+00	TBP (kg) 0.00E+00	NPH (kg) 0.00E+00	NH3 (kg) 0.00E+00
Fe(CN)6 (kg) 0.00E+00	H-3 (Ci) 1.24E-03	C-14 (Ci) 1.19E-05	Ni-59 (Ci) 1.12E-04	Ni-63 (Ci) 1.08E-02	Co-60 (Ci) 8.02E-05	Se-79 (Ci) 5.04E-07	Sr-90 (Ci) 6.16E-01	Y-90 (Ci) 6.16E-01
Zr-93 (Ci) 2.96E-05	Nb-93m (Ci) 2.23E-05	Tc-99 (Ci) 2.15E-04	Ru-106 (Ci) 2.25E-08	Cd-113m (Ci) 4.41E-05	Sb-125 (Ci) 3.92E-05	Sn-126 (Ci) 2.16E-06	I-129 (Ci) 2.98E-04	Cs-134 (Ci) 5.70E-06
Cs-137 (Ci) 7.26E-01	Ba-137m (Ci) 6.87E-01	Sm-151 (Ci) 1.95E-02	Eu-152 (Ci) 1.24E-05	Eu-154 (Ci) 9.02E-04	Eu-155 (Ci) 3.32E-04	Ra-226 (Ci) 4.31E-11	Ra-228 (Ci) 4.39E-08	Ac-227 (Ci) 1.15E-07
Pa-231 (Ci) 1.78E-07	Th-229 (Ci) 2.69E-08	Th-232 (Ci) 3.46E-08	U-232 (Ci) 1.95E-02	U-233 (Ci) 1.17E+00	U-234 (Ci) 8.54E-02	U-235 (Ci) 3.26E-03	U-236 (Ci) 3.70E-03	U-238 (Ci) 5.73E-02
U-Total (kg) 1.72E+02	Np-237 (Ci) 4.52E-07	Pu-238 (Ci) 1.92E+00	Pu-239 (Ci) 1.69E+01	Pu-240 (Ci) 5.91E+00	Pu-241 (Ci) 1.11E+02	Pu-242 (Ci) 1.03E-03	Am-241 (Ci) 7.96E-04	Am-243 (Ci) 7.59E-07
Cm-242 (Ci) 1.27E-06	Cm-243 (Ci) 1.36E-07	Cm-244 (Ci) 3.41E-06						

Table AD1-5. Data-Needs Priority Summary – Model Group 6 – 216-T-36 Crib (200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Vicinity Waste Sites	200-W-79; 216-T-13; 241-T Tank Farm						
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	X		

Data Evaluation and Gaps Analysis			
Data	Knowns	Data Uncertainties	Are supplemental data required to support decision making?
Scintillation Logs (ARH-ST-156): 299-W10-2 (230 ft) (1976) 299-W10-4 (245 ft) (1976) ERC surveys (2006)	Located 10 m (33 ft) north of the northwest corner of the 216-T-36 Crib. Scintillation log from 1976 indicates minor (10^4 cpm) at ~30 m (100 ft) bgs. ARH-ST-156 implies this contamination is associated with 216-T-7 rather than 216-T-36. Located 10 m (33 ft) south of the southeast corner of the 216-T-36 Crib. Scintillation logs from 1959, 1963, and 1976 indicate minor (10^3 to 10^4 cpm) at ~30 m (100 ft) bgs. ARH-ST-156 implies this contamination is associated with 216-T-7 rather than 216-T-36. The 216-T-36 Crib is located in an area of increasing Tc-99 concentrations in the groundwater. ERC surveys show some areas of higher conductivity near the east side of this crib. The area directly below the crib shows limited conductivity to a depth of >40 m (130 ft) bgs (RPP-RPT-28955)	Based on current groundwater conditions, the inventory for this site may be uncertain.	Potentially. A deep borehole is planned for fiscal year 2007 to evaluate the Tc-99 plume in the groundwater in this area. The borehole will be located to the northeast of the 216-T-36 Crib. Based on the information from the groundwater borehole, a shallow borehole may be needed in the 216-T-36 Crib to resolve uncertainties in the inventory and resulting contaminant concentrations. If the groundwater borehole indicates substantial vadose zone contamination, then a shallow borehole will be drilled in the 216-B-36 Crib to obtain site-specific information to correlate with ERC and to support site-specific risk assessment and the decision making for the 216-T-36 Crib.

Proposed Activities and Path Forward:

Evaluate data from the groundwater borehole to be drilled to the northeast of the 216-T-36 Crib in fiscal year 2007.

Install a contingent shallow borehole if the vadose information from the groundwater well indicates substantial contamination.

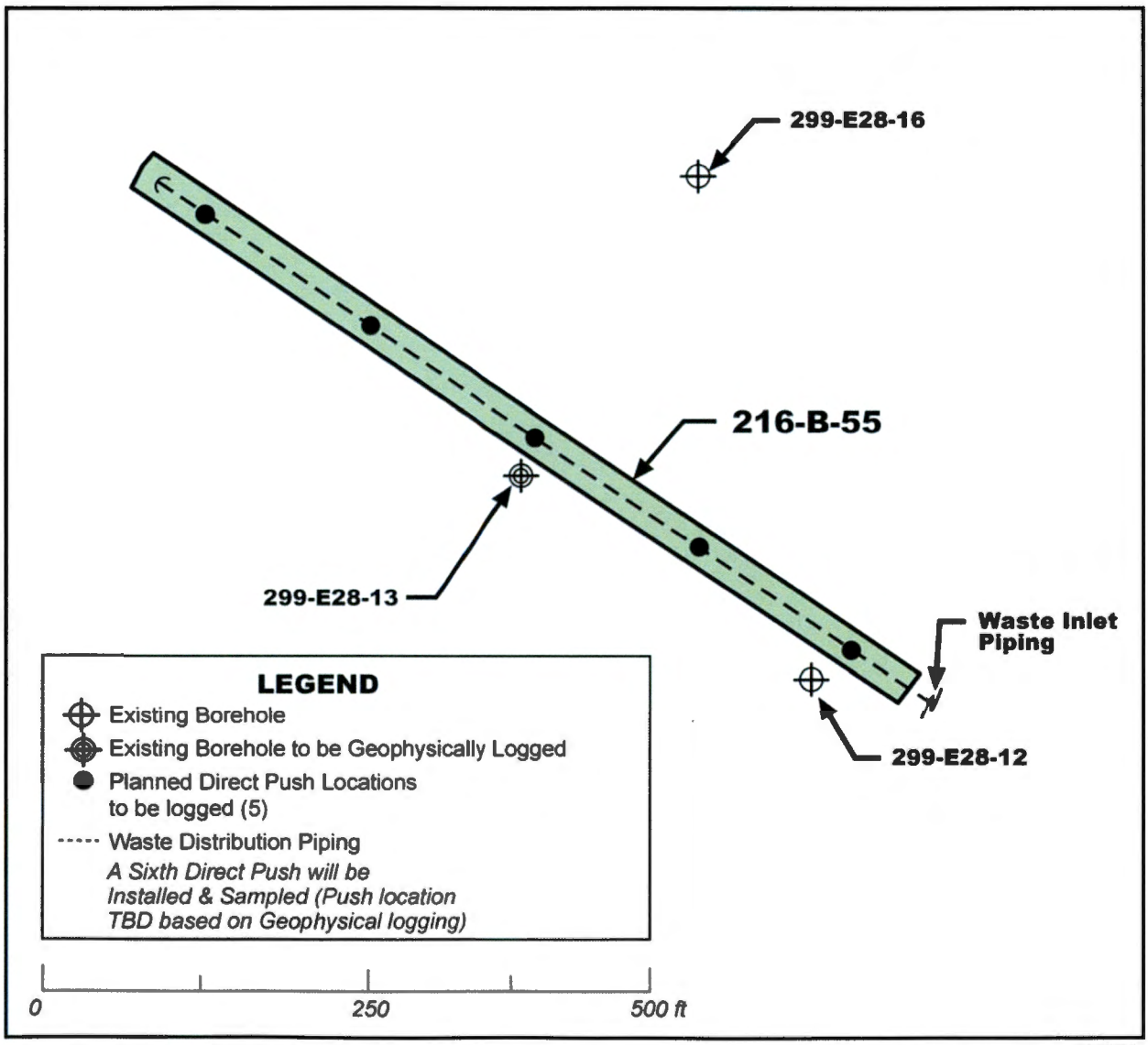
Additional Notes:
The following provides a list of the references/bibliography used during this evaluation:
ARH-ST-156, *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells.*
DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units.*
DOE/RL-2006-46, *Sampling and Analysis Plan for Deep Groundwater Wells 299-W11-48 (C5243) and 299-W10-32 (C5244) Near Waste Management Area T in the 200-ZP-1 Operable Unit, Fiscal Year 2006.*
RPP-26744, *Hanford Soil Inventory Model, Rev. 1.*
RPP-RPT-28955, *Surface Geophysical Exploration of T Tank Farm at the Hanford Site.*
Waste Information Data System Report, Hanford Site database.

bgs = below ground surface.
ERC = electrical resistivity characterization.
MESC/MNA/IC = Maintain Existing Soil Cover, Monitored Natural Attenuation, Institutional Controls.
WIDS = *Waste Information Data System* database.

AD1-4.0 216-B-55 CRIB SITE-SPECIFIC FIELD-SAMPLING PLAN

The following figures and tables provide the site-specific field-sampling plan for the 216-B-55 Crib.

Figure AD1-8. 216-B-55 Crib Data-Collection Locations.



TBD = to be determined.

Figure AD1-9. 216-B-55 Crib Stratigraphy and Sample-Collection Intervals.

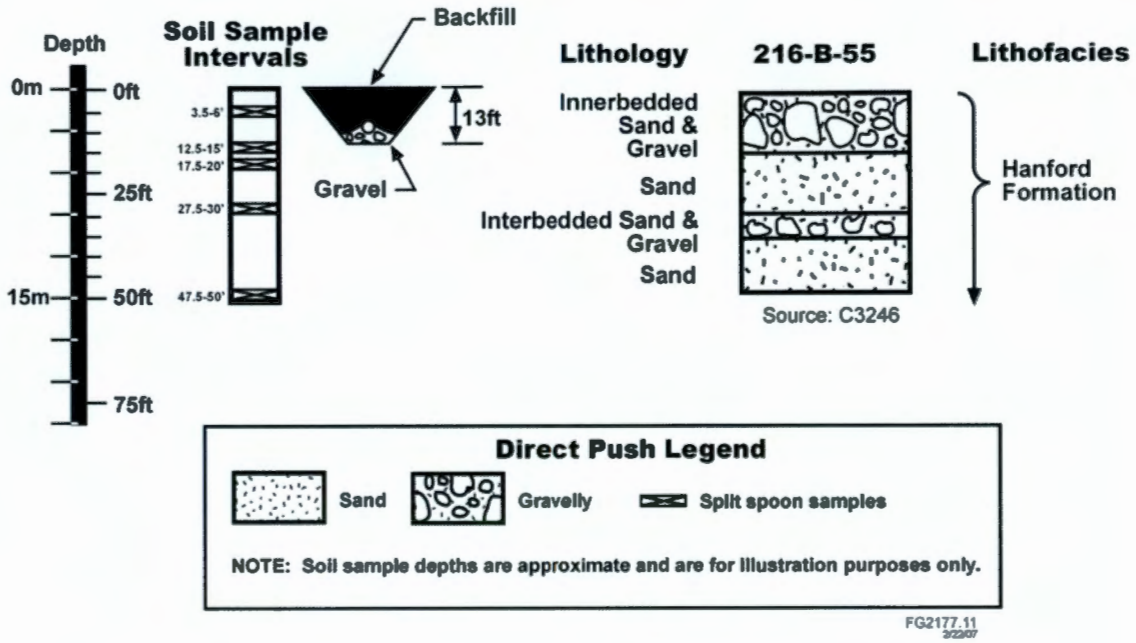


Table AD1-6. 216-B-55 Crib Sampling Plan.

Sample Collection Methodology	Sample Location	Maximum Depth of Investi-gation	Sample Interval Depth (ft bgs) [a]	Analyte List [b]	Physical Properties	
					Sample Interval	Parameters
Direct push with sampling	Five direct-push holes [e]	50 ft bgs	12.5 – 15 ft bgs	Analytes are presented in Volume I, Table A2-3, the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 columns.	N/A	N/A
	One direct-push hole [f]	50 ft bgs	Sample at depths of: 3.5 – 6 ft bgs 12.5 – 15 ft bgs 17.5 – 20 ft bgs 27.5 – 30 ft bgs 47.5 – 50 ft bgs	Analytes are presented in Volume I, Table A2-3, the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 columns.	N/A	N/A

Number of split-spoon samples	10
Approximate number of field quality-control samples [c]	3
Approximate total number of soil samples collected	13
Approximate total number of soil samples initially analyzed [d]	8

Non-Sample Data Collection	Maximum Depth of Investigation
Downhole gamma-spectroscopy log, neutron moisture, passive neutrons	Surface to total depth in five direct-push holes to 50 ft bgs and one existing well E28-13 to 230 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 I, Appendix A, Tables A2-1, A2-2, A2-3, 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 five split-spoon samples and three field quality-control samples. Five additional split spoons associated with five direct pushes will be analyzed in accordance with footnote e.

[e] Analyze these samples only if geophysical logging shows no contamination.

[f] Install sixth direct push at location of highest contamination from the initial five pushes, to collect and analyze soil samples. If the logging results of the first five pushes do not indicate contamination, install sixth direct push at the head end of the ditch and sample throughout the push to obtain vertical distribution of contaminants.

bgs = below ground surface. N/A = not applicable.

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Figure AD1-10. 216-B-55 Crib
Conceptual Model and Data Summary.

200-SC-1 Operable Unit
Waste Type: Steam Condensate

216-B-55 Crib

Model Group 6
B Plant Zone

History

216-B-55 Crib is a liquid waste disposal site that received contaminated steam condensate from the 221-B Building.

CONSTRUCTION: A covered, gravel-filled trench with bottom dimensions of 750 feet long by 10 feet wide and about 13 feet deep. A perforated 30-inch diameter galvanized pipe runs the length of the unit.

WASTE VOLUME: 1,230,000,000 liters

DURATION: 1967 to 1991.

ESTIMATED INVENTORY OF SELECTED HIGH-MOBILITY CONSTITUENTS

	WIDS	SIM
Uranium	<0.54 Kg	0.0003 Kg
Tritium	3.74 Ci	0.0002 Ci
Nitrate	--	604 Kg
Fluoride	--	159 Kg

ESTIMATED INVENTORY OF SELECTED MEDIUM/LOW MOBILITY CONSTITUENTS

	WIDS	SIM
Co-60	0.38 Ci	0.0004 Ci
Cs-137	21.1 Ci	0.14 Ci
Sr-90	<11.1 Ci	0.0002 Ci
Plutonium	<0.46 g	0.00014 Ci
Total Beta Emitters	150 Ci	--

Note: "--" indicates inventory not estimated

REFERENCES:

WIDS general summary reports
Hanford Soil Inventory Model, Rev 1 (RPP-26744)

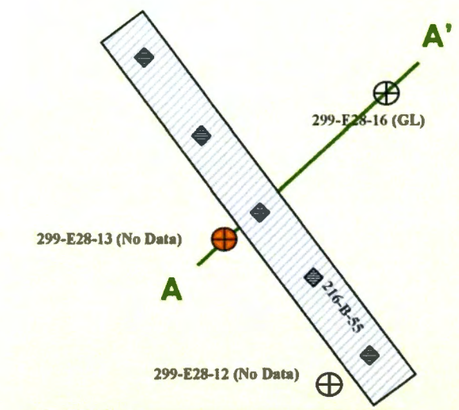
Basis of Knowledge

- Process History (PH)
- Geologic Logs (GL)
- Extrapolation from Representative Site (RS)

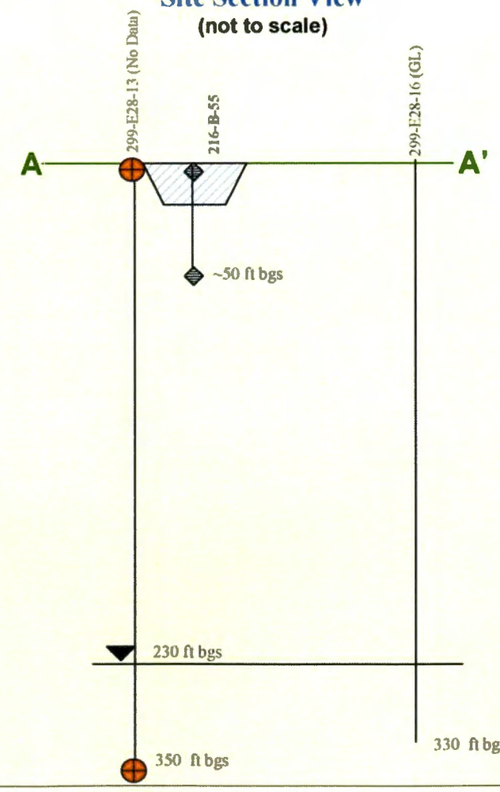
Characterization Summary

- One geologic log from well 299-E28-16
- Process history including data from discharge stream
- Assigned to representative site 216-U-10.

Site Plan View
(not to scale)



Site Section View
(not to scale)



Potential Viable Alternatives

- NO ACTION
- REMOVE/TREAT/DISPOSE
- PARTIAL REMOVAL/TREATMENT/BARRIER
- MESC/MNA/IC
- BARRIER

Data Needs, Rationale, and Investigation Approach

No additional data are required to support a decision based on the analogous relationship; however additional information is useful for the following reasons:

- The analogous relationship with 216-U-10 is expected to be bounding; however, the actual inventory at this facility may be substantially lower, providing the opportunity to support a no action alternative, or other non-intrusive alternatives.
- Supplemental information may also support reducing the scope of intrusive remediation (e.g., partial removal/treatment/barrier).

The supplemental investigation strategy incorporates the following elements:

- Geophysically log existing well 299-E28-13, using gamma spectroscopy, neutron moisture, and passive neutron logging techniques.
- Install 5 direct push holes along the axis of the crib and geophysically-log the holes and collect soil samples at the elevation of the crib bottom. Identify locations of elevated gamma activity.
- Collect subsurface soil samples from one direct push hole located at the point of highest gamma activity identified in the five logged holes. If no gamma response is found in the first five holes, then locate the sixth hole near the head end of the trench, collect soil samples and analyze as specified.

Table AD1-7. Data-Needs Priority
Summary – Model Group 6 – 216-B-55 Crib
(200-CW-5/2/4/200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Background	
Site Identification	216-B-55 Crib
Site Location	200 East Area; B Plant Zone; west of 225-B and north of 7th Street
Type of Site	Crib
Operating History	The site is marked with concrete AC-540 markers and posted with Underground Radioactive Material signs. The unit is filled with approximately 1380 m^3 (1,800 yd^3) of gravel. A perforated 30 cm (30-in.) diameter galvanized pipe runs the length of the unit, 0.9 m (3 ft) above the bottom. The site had two gage wells of 20 cm (8-in.) steel pipe with a galvanized sheet metal cap. Each well extended from the crib bottom to approximately 0.9 m (3 ft) above grade. The crib was constructed with 19,500 ft^2 of membrane barrier. The site received 1.23 billion liters of steam condensate from 221-B. The crib is adjacent to an area of reoccurring, spreading contamination known as UPR-200-E-64. (WIDS) The crib is 228 m long by 3.1 m wide (750 ft by 10 ft) (WIDS). The depth is uncertain, but appears to be approximately 13 ft deep (H-2-60330). The crib operated from 1967 to 1991 (WIDS). Soil Inventory Model – 216-B-55 (RPP-26744).

Na (kg) 2.490E+03	Al (kg) 9.318E-02	Fe (kg) 4.231E+01	Cr (kg) 1.474E-02	Bi (kg) 9.513E-06	La (kg) 0.000E+00	Hg (kg) 2.936E-06	Zr (kg) 1.259E-06	Pb (kg) 6.649E+00
Ni (kg) 9.903E-04	Ag (kg) 0.000E+00	Mn (kg) 6.044E+00	Ca (kg) 2.273E+04	K (kg) 8.958E+02	NO3 (kg) 6.045E+02	NO2 (kg) 3.579E-01	CO3 (kg) 9.067E+04	PO4 (kg) 5.572E-03
SO4 (kg) 1.245E+04	Si (kg) 2.974E+03	F (kg) 1.596E+02	Cl (kg) 1.058E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 1.754E-08	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 3.772E-03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 1.770E-04	C-14 (Ci) 3.399E-05	Ni-59 (Ci) 6.417E-06	Ni-63 (Ci) 6.098E-04	Co-60 (Ci) 3.926E-04	Se-79 (Ci) 4.049E-06	Sr-90 (Ci) 2.197E-04	Y-90 (Ci) 2.197E-04
Zr-93 (Ci) 2.412E-04	Nb-93m (Ci) 1.947E-04	Tc-99 (Ci) 1.291E-03	Ru-106 (Ci) 3.687E-10	Cd-113m (Ci) 2.523E-04	Sb-125 (Ci) 5.996E-05	Sn-126 (Ci) 1.683E-05	I-129 (Ci) 7.634E-07	Cs-134 (Ci) 1.353E-07
Cs-137 (Ci) 1.433E-01	Ba-137m (Ci) 1.354E-01	Sm-151 (Ci) 5.316E-02	Eu-152 (Ci) 9.925E-06	Eu-154 (Ci) 7.391E-04	Eu-155 (Ci) 3.411E-04	Ra-226 (Ci) 1.890E-10	Ra-228 (Ci) 8.757E-09	Ac-227 (Ci) 1.119E-09
Pa-231 (Ci) 3.058E-09	Th-229 (Ci) 4.858E-11	Th-232 (Ci) 1.353E-10	U-232 (Ci) 2.324E-09	U-233 (Ci) 1.434E-07	U-234 (Ci) 9.993E-08	U-235 (Ci) 4.173E-09	U-236 (Ci) 2.723E-09	U-238 (Ci) 9.357E-08
U-Total (kg) 2.805E-04	Np-237 (Ci) 4.206E-06	Pu-238 (Ci) 1.969E-06	Pu-239 (Ci) 4.575E-05	Pu-240 (Ci) 1.061E-05	Pu-241 (Ci) 8.933E-05	Pu-242 (Ci) 7.363E-10	Am-241 (Ci) 6.433E-05	Am-243 (Ci) 3.694E-08
Cm-242 (Ci) 2.269E-07	Cm-243 (Ci) 6.970E-09	Cm-244 (Ci) 1.739E-07						

Table AD1-7. Data-Needs Priority
Summary – Model Group 6 – 216-B-55 Crib
(200-CW-5/2/4/200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Vicinity Waste Sites	216-B-12, UPR-200-E-64						
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	X	X		

Data Evaluation and Gaps Analysis			
Data	Knowns	Data Uncertainties	Are supplemental data required to support decision making?
Well 299-E28-12 (349 ft) (scintillation logs 1968, 1970, and 1976)	Located 4 m (13 ft) from the crib edge on the southeast end. Only background radioactivity was detected	Nature and extent of contamination is uncertain; however, contaminant concentrations are expected to be low based on Soil Inventory Model inventory estimate. Analogous relationship with representative site is a bounding relationship. Site-specific data may indicate no action or MESC/IC/MNA are more appropriate.	No. Analogous relationship and inventory data could be used to support decision making. However, this crib is assigned to 216-U-10, which has a larger inventory of several constituents. While the analogous relationship with 216-U-10 would bound the decision process, supplemental data at 216-B-55 may permit a stronger analysis of the no action and MESC/IC/MNA alternatives and may permit a lesser alternative than the analogous evaluation. Supplemental data would provide site-specific confirmatory information on the nature and extent of contamination; because the crib is large, the supplemental data would allow assessment of partial removal alternative and permit a more accurate evaluation of contaminant volume and cost.

Proposed Activities and Path Forward:

Geophysically log well 299-E28-13.

Install five direct pushes along length of crib; geophysically log the holes; collect soil samples at bottom of crib.

Install sixth direct push at location of highest contamination from the initial five pushes to collect and analyze soil samples. If the logging results of the first five pushes do not indicate contamination, install sixth direct push at the head end of the ditch and sample throughout the push to obtain vertical distribution of contaminants.

Additional Notes:
The following provides a list of the references/bibliography used during this evaluation:

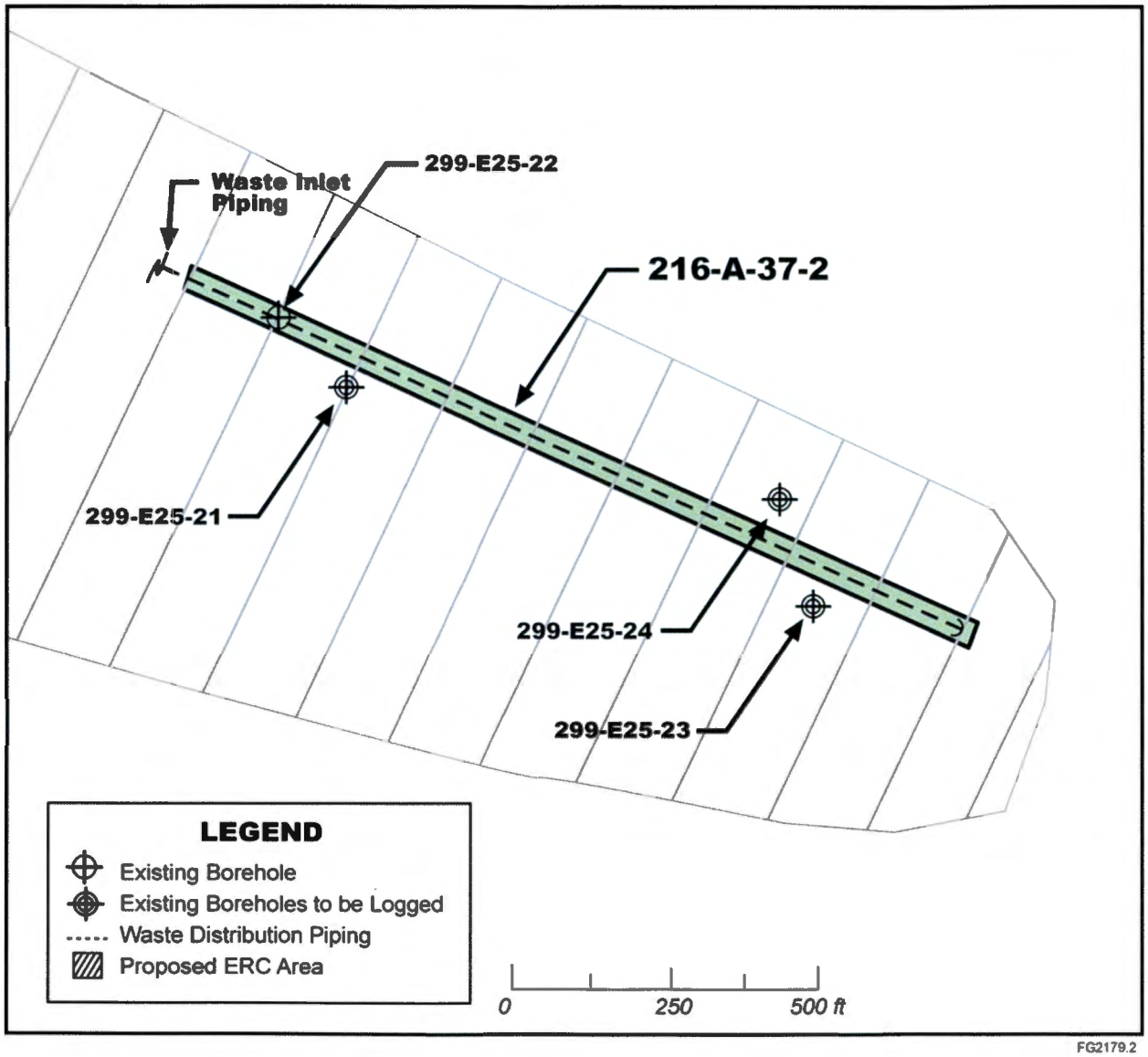
ARH-947, *200 Areas Disposal Sites for Radioactive Liquid Waste.*
ARH-ST-156, *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells.*
BHI-00179, *B Plant Aggregate Area Management Study Technical Baseline Report.*
DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units.*
H-2-60330, *Trench 216-B-55 Cond Waste Lines 221-B to Trench 216-B-55 & B-12 Crib Plan & Profile.*
RHO-CD-673, *Handbook 200 Areas Waste Sites.*
RHO-RE-SR-84-24 P, *Results of the Separations Area Groundwater Monitoring Network for 1983.*
RPP-26744, *Hanford Soil Inventory Model,* Rev. 1.
Waste Information Data System Report, Hanford Site database.

MESC/MNA/IC = Maintain Existing Soil Cover, Monitored Natural Attenuation, Institutional Controls.
WIDS = *Waste Information Data System* database.

AD1-5.0 216-A-37-2 CRIB SITE-SPECIFIC FIELD-SAMPLING PLAN

The following figures and tables provide the site-specific field-sampling plan for the 216-A-37-2 Crib.

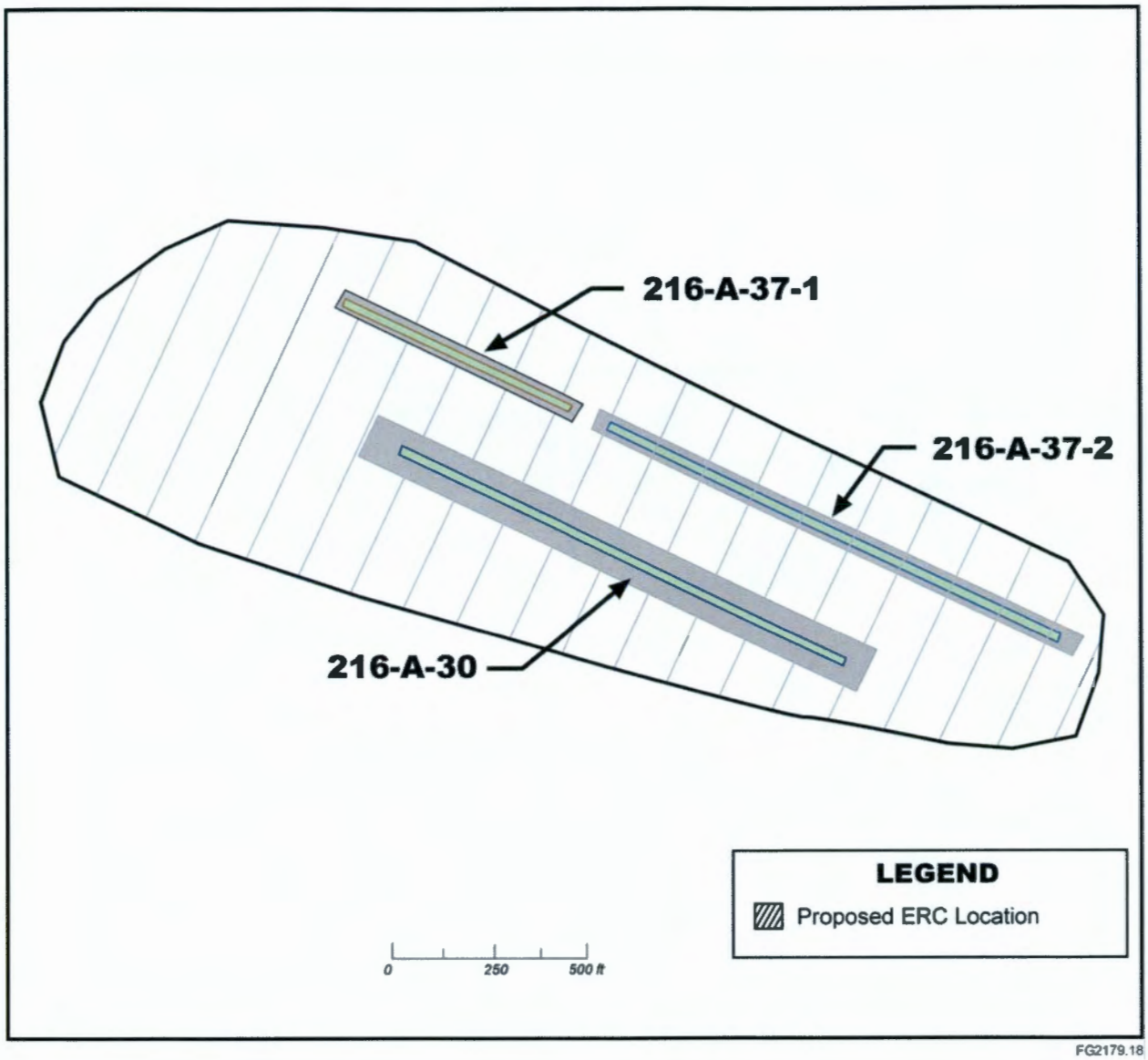
Figure AD1-11. 216-A-37-2 Crib Data-Collection Locations.



ERC=electrical resistivity characterization.

NOTE: Downhole logging from surface to total depth of existing boreholes. Downhole logging includes gamma spectroscopy, neutron moisture, and passive neutron.

Figure AD1-12. East Plutonium-Uranium Extraction Plant Electrical Resistivity Characterization Data-Collection Study Area (including the 216-A-37-2 Crib).



ERC = electrical resistivity characterization.

Figure AD1-13. 216-A-37-2 Crib
Conceptual Model and Data Summary.

200-SC-1 Operable Unit
Waste Type: Steam Condensate

216-A-37-2 Crib

Model Group 6
PUREX Zone

History

216-A-37-2 Crib is a liquid waste disposal site constructed as a replacement for 216-A-30 Crib and received contaminated steam condensate, equipment disposal tunnel floor and water-filled door drainage, and fuel slug storage basin overflow from the 202-A Building (PUREX).

CONSTRUCTION: A covered, gravel-filled trench with bottom dimensions of 1,400 feet long by 10 feet wide and about 16 feet deep. Two perforated galvanized pipes run the length of the unit.

WASTE VOLUME: 1,290,000,000 liters

DURATION: 1983 to 1995.

ESTIMATED INVENTORY OF SELECTED HIGH-MOBILITY CONSTITUENTS

	WIDS	SIM
Uranium	0.005 Ci	47.6 Kg
U-234	--	0.02 Ci
Tritium	5.08 Ci	9.5 Ci
Nitrate	--	617 Kg
Fluoride	--	149 Kg

INVENTORY OF MEDIUM/LOW MOBILITY CONSTITUENTS

	WIDS	SIM
Cs-137	0.102 Ci	--
Sr-90	0.132 Ci	0.06 Ci
Plutonium	--	1.34 Ci
Total Beta Emitters	0.672 Ci	--

Note: "--" indicates inventory not estimated.

REFERENCES:

WIDS general summary reports
Hanford Soil Inventory Model, Rev 1 (RPP-26744)

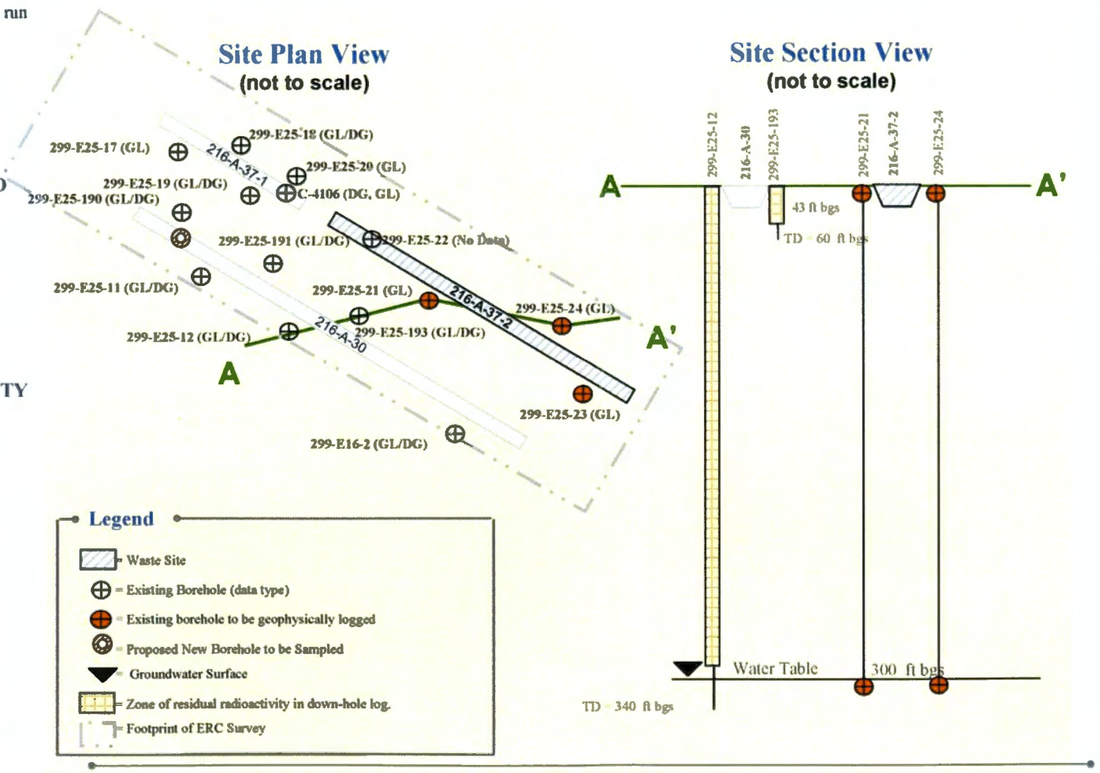
Basis of Knowledge

- Process History (PH)
- Interpretation of Downhole Geophysics (DG)
- Geologic Logs (GL)
- Extrapolation from Representative Site (RS)

Characterization Summary

- Operating history and scintillation log of well 299-E25-12 (adjacent to 216-A-30) suggests potential for deep contamination at relatively low concentrations under 216-A-30.
- Assigned to representative site 216-U-10.

Site Plan View
(not to scale)



Site Section View
(not to scale)

Potential Viable Alternatives

- NO ACTION
- REMOVE/TREAT/DISPOSE
- PARTIAL REMOVAL/TREATMENT/BARRIER
- MESC/MNA/IC
- BARRIER

Data Needs, Rationale, and Investigation Approach

No additional data are needed for 216-A-37-2. Decisions at this site will be made using the following information:

- The estimated inventory for the site is relatively low.
- The site received the same waste stream as 216-A-30 Crib and the information derived from that site can be used to describe conditions at 216-A-37-2. 216-A-30 should provide bounding conditions for 216-A-37-2.
- 216-A-37-2 will be included in the conductivity survey to be conducted at 216-A-30.
- Conduct downhole geophysical logging (gamma spectroscopy, neutron moisture, and passive neutron) at three nearby existing wells to supplement information.
- Results of sampling and analysis of subsurface soil from a new deep borehole to be placed within 216-A-30 Crib will be evaluated in association with 216-A-37-2.

Table AD1-8. Data-Needs Priority
Summary – Model Group 6 – 216-A-37-2 Crib
(200-CW-5/2/4/200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Background	
Site Identification	216-A-37-2 Crib
Site Location	200 East Area; PUREX Zone; outside 200 East Area perimeter fence, east of the 202-A Building
Type of Site	Crib
Operating History	The crib is marked with concrete AC-540 posts and Underground Radioactive Material signs. The crib was built as a replacement for the 216-A-30 crib. The crib received PUREX steam condensate waste. There are two steel drain pipes. One is perforated and runs the length of the unit, and the other is unperforated and runs from west to east only to the center of the unit, 1.5 m (5 ft) above the bottom. Two vents are located at the center and at the east end. Two liquid-level gage wells are located 106 m (350 ft) from the ends of the unit. A bed of gravel on the bottom has been covered with a 20-mil polyvinyl chloride barrier cover. The crib is 1,400 ft long, 10 ft wide at the bottom, and 16 ft deep. The waste site received 1,090,033 m^3 of liquid effluent and operated from 1983 to 1995. Site Inventory Model – 216-A-37-2 Crib (RPP-26744) (some constituents of interest are highlighted)

Na (kg) 2.366E+03	Al (kg) 0.000E+00	Fe (kg) 5.664E+01	Cr (kg) 0.000E+00	Bi (kg) 0.000E+00	La (kg) 0.000E+00	Hg (kg) 1.155E-02	Zr (kg) 0.000E+00	Pb (kg) 5.555E-01
Ni (kg) 0.000E+00	Ag (kg) 0.000E+00	Mn (kg) 7.728E+00	Ca (kg) 1.181E+04	K (kg) 8.178E+02	NO3 (kg) 6.177E+02	NO2 (kg) 0.000E+00	CO3 (kg) 7.469E+04	PO4 (kg) 0.000E+00
SO4 (kg) 1.163E+04	Si (kg) 2.757E+03	F (kg) 1.487E+02	Cl (kg) 1.168E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 1.389E+02	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 0.000E+00
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 9.505E+00	C-14 (Ci) 4.528E-01	Ni-59 (Ci) 0.000E+00	Ni-63 (Ci) 0.000E+00	Co-60 (Ci) 0.000E+00	Se-79 (Ci) 0.000E+00	Sr-90 (Ci) 5.556E-02	Y-90 (Ci) 5.560E-02
Zr-93 (Ci) 0.000E+00	Nb-93m (Ci) 0.000E+00	Tc-99 (Ci) 0.000E+00	Ru-106 (Ci) 0.000E+00	Cd-113m (Ci) 0.000E+00	Sb-125 (Ci) 0.000E+00	Sn-126 (Ci) 0.000E+00	I-129 (Ci) 5.437E-05	Cs-134 (Ci) 0.000E+00
Cs-137 (Ci) 0.000E+00	Ba-137m (Ci) 0.000E+00	Sm-151 (Ci) 0.000E+00	Eu-152 (Ci) 0.000E+00	Eu-154 (Ci) 0.000E+00	Eu-155 (Ci) 0.000E+00	Ra-226 (Ci) 5.406E-07	Ra-228 (Ci) 3.249E-11	Ac-227 (Ci) 2.712E-06
Pa-231 (Ci) 6.243E-06	Th-229 (Ci) 3.566E-09	Th-232 (Ci) 3.729E-11	U-232 (Ci) 7.605E-06	U-233 (Ci) 2.411E-06	U-234 (Ci) 2.300E-02	U-235 (Ci) 8.816E-04	U-236 (Ci) 2.222E-03	U-238 (Ci) 1.586E-02
U-Total (kg) 4.764E+01	Np-237 (Ci) 5.757E-04	Pu-238 (Ci) 1.435E-02	Pu-239 (Ci) 1.386E-01	Pu-240 (Ci) 3.908E-02	Pu-241 (Ci) 1.158E+00	Pu-242 (Ci) 4.931E-06	Am-241 (Ci) 3.599E-02	Am-243 (Ci) 9.959E-06
Cm-242 (Ci) 1.838E-05	Cm-243 (Ci) 2.780E-06	Cm-244 (Ci) 7.111E-05						

Table AD1-8. Data-Needs Priority
Summary – Model Group 6 – 216-A-37-2 Crib
(200-CW-5/2/4/200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Vicinity Waste Sites	216-A-30, 216-A-37-1						
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	X	X		
Data Evaluation and Gaps Analysis							
Data	Knowns	Data Uncertainties	Are supplemental data required to support decision making?				
No site-specific sampling or geophysical logging information Borehole C4106 at 216-A-37-1 was drilled to the water table and provides information on deeper contamination in the area of the 216-A-37-1 and 216-A-37-2 Cribs.		Nature and extent of contamination at 216-A-37-2; inventory indicates minor contamination.	No. Inventory data and data from supplemental investigation activities at 216-A-30 (proposed) will support decision making at the 216-A-37-2 Crib (216-A-37-2 replaced the 216-A-30 Crib). Because existing wells are located within the waste site, geophysical logging is an opportunistic method of collecting site-specific data to help confirm inventory knowledge for gamma-emitting radionuclides and to support decision making. ERC surveys in this area also will provide information on the potential for deeper mobile contaminants.				
Proposed Activities and Path Forward: No supplemental data collection activities are required. Data collected from 216-A-30 will be used to support evaluation of 216-A-37-2. Geophysically log 299-E25-21, -23, and -24 to obtain opportunistic site-specific information. Reevaluate data needs following assessment of the 216-A-30 supplemental investigation data and any additional information collected for 216-A-37-1 (a Washington State Department of Ecology treatment, storage, and/or disposal site).							

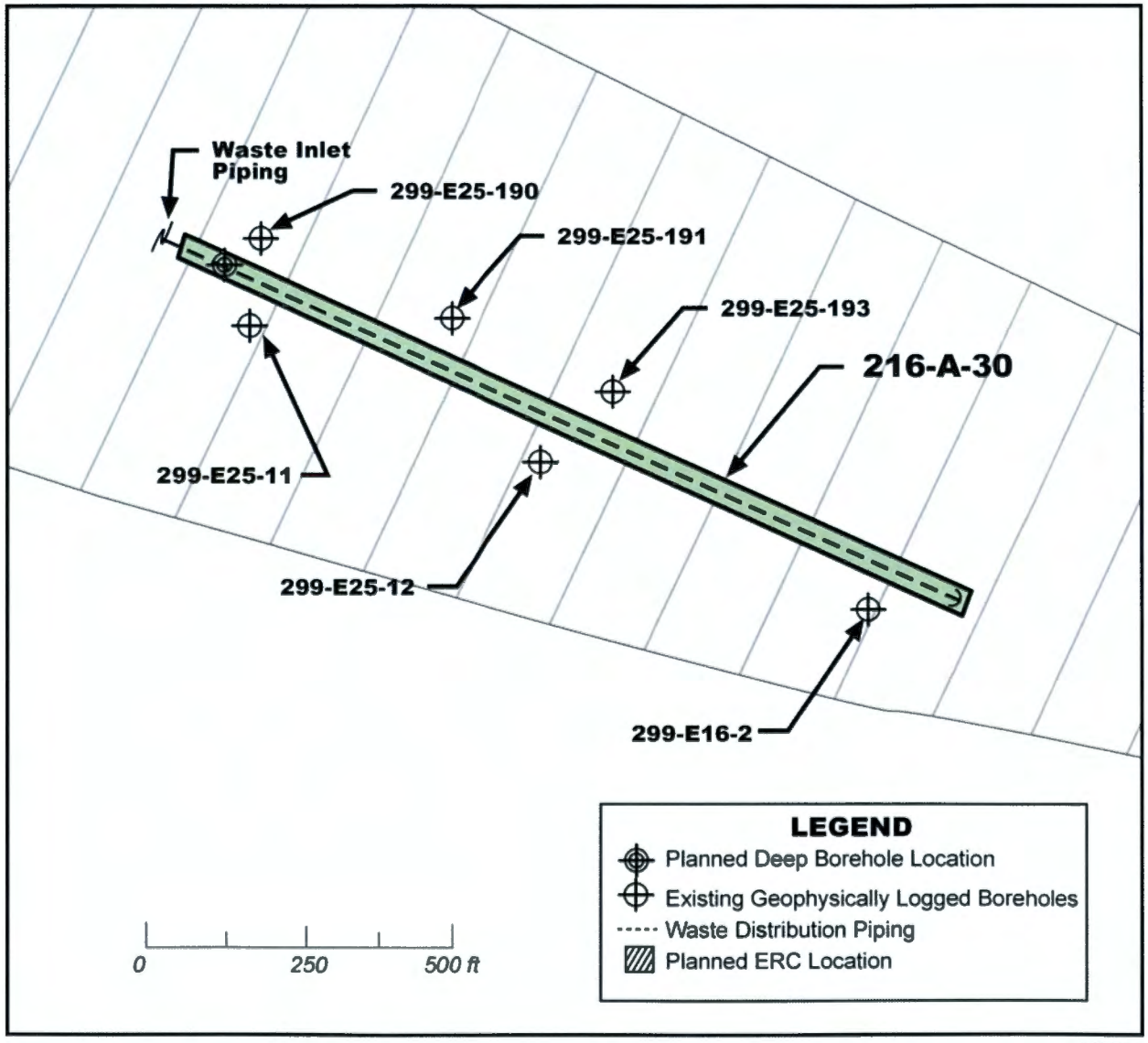
Additional Notes:
The following provides a list of the references/bibliography used during this evaluation:
DOE/RL-2003-11, *Remedial Investigation for the 200-CW-5 U Pond/ Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-CS-1 Steam Condensate Group Operable Units.*
DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units.*
HNF-1744, *Radioactive Inventories of Liquid Waste Disposal Sites on the Hanford Site.*
RHO-CD-673, *Handbook 200 Areas Waste Sites.*
RHO-RE-SR-84-24 P, *Results of the Separation Area Groundwater Monitoring Network for 1983.*
RPP-26744, *Hanford Soil Inventory Model, Rev. 1.*
Waste Information Data System Report, Hanford Site database.

MESC/MNA/IC = Maintain Existing Soil Cover, Monitored Natural Attenuation, Institutional Controls..
PUREX = Plutonium-Uranium Extraction (Plant or process).
WIDS = *Waste Information Data System* database.

AD1-6.0 216-A-30 CRIB SITE-SPECIFIC FIELD-SAMPLING PLAN

The following figures and tables provide the site-specific field-sampling plan for the 216-A-30 Crib.

Figure AD1-14. 216-A-30 Crib Data-Collection Locations.



NOTE: Full extent of electrical resistivity characterization (ERC) shown on Figure AD1-12.

Figure AD1-15. 216-A-30 Crib Stratigraphy and Sample-Collection Intervals.

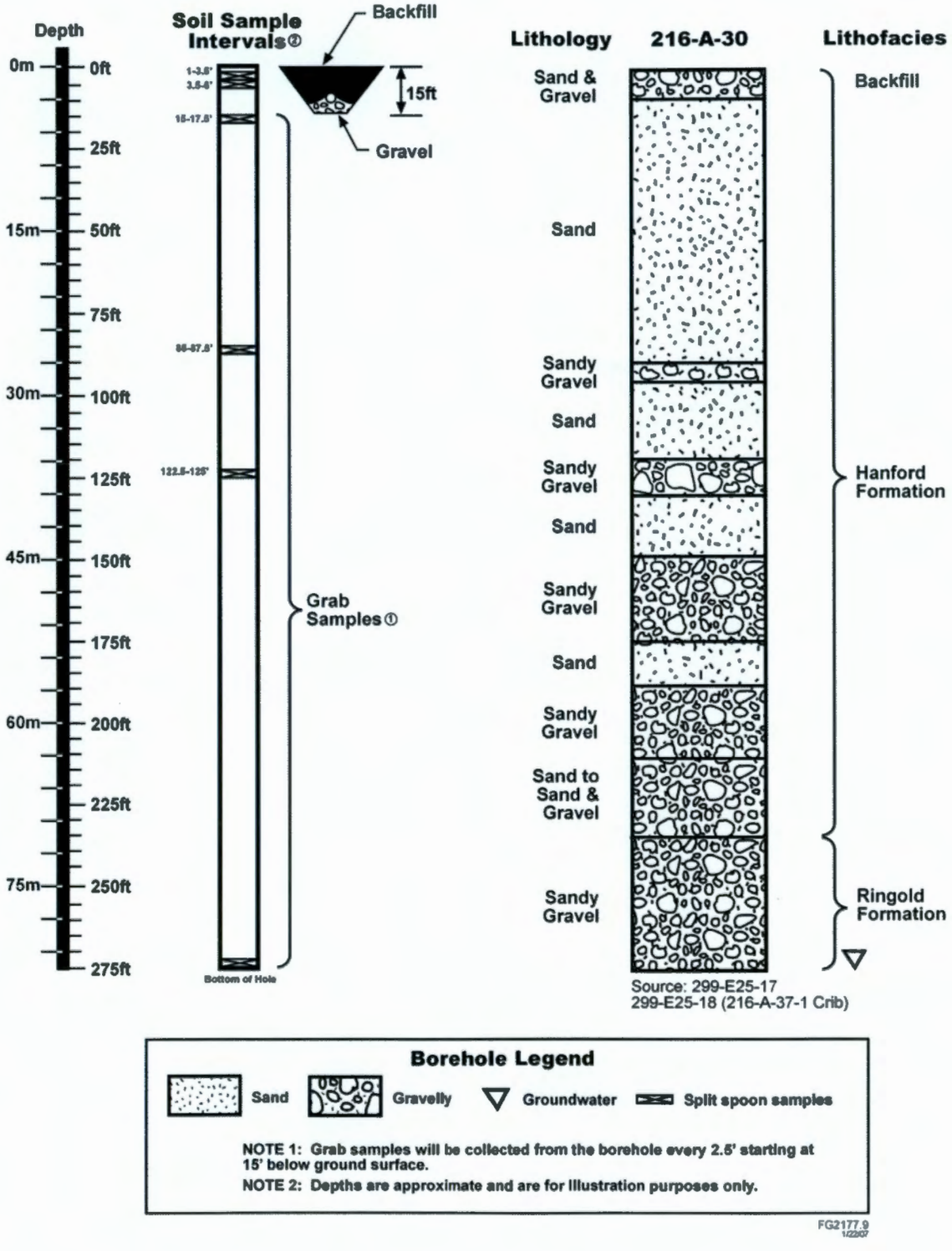


Table AD1-9. 216-A-30 Crib Sampling Plan.

Sample Collection Methodology	Sample Location	Maximum Depth of Investi-gation	Sample Interval Depth (ft bgs) [a]	Analyte List [b]	Physical Properties	
					Sample Interval	Parameters
Borehole drilling and sampling	One new borehole near the inlet end of crib	To water table (~275 ft bgs)	Split-spoon sample intervals: 1 – 3.5 ft bgs 3.5 – 6 ft bgs 15 – 17.5 ft bgs 85 – 87.5 ft bgs 122.5 – 125 ft bgs TD (~272.5 – 275 ft bgs)	Analytes are presented in Volume I, Table A2-3, the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 columns.	All split-spo on samples	pH, specific conductance, bulk density, moisture, particle-size distribution
			Collect grab samples every 2.5 ft from depth 15 ft bgs to TD. Perform extraction analysis on grab samples, starting with samples every 10 ft.	See Volume I, Table A2-3	N/A	N/A
Number of split-spoon samples		6				
Approximate number of field quality-control samples [c]		3				
Approximate number of grab samples		105				
Approximate total number of soil samples collected		113				
Approximate total number of soil samples initially analyzed [d]		36				
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 at ~275 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 I, Appendix A, Tables A2-1, A2-2, A2-3, 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] Samples analyzed include 6 split spoon samples, 27 grab samples, and 3 quality-control samples.
bgs = below ground surface. N/A = not applicable. TD = total depth.

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Figure AD1-16. 216-A-30 Crib
Conceptual Model and Data Summary.

216-A-30 Crib

200-SC-1 Operable Unit
Waste Type: Steam Condensate

Model Group 6
PUREX Plant Zone

History

216-A-30 Crib is a liquid waste disposal site that received contaminated steam condensate, equipment disposal tunnel floor and water-filled door drainage, and fuel slug storage basin overflow from the 202-A Building (PUREX). In 1972, contaminated salt crust formed on the surface of the crib. Contaminated tumbleweeds were subsequently found growing on the crib.

CONSTRUCTION: A covered, gravel-filled trench with bottom dimensions of 1,400 feet long by 10 feet wide and about 15 feet deep. Two perforated galvanized pipes run the length of the unit.

WASTE VOLUME: 7,500,000,000 liters

DURATION: 1961 to 1992.

ESTIMATED INVENTORY OF SELECTED HIGH-MOBILITY CONSTITUENTS

	WIDS	SIM
Uranium	<41 Kg	656 Kg
U-233	<7.48 g	2.05 Ci
Tritium	10.7 Ci	0.02 Ci
Nitrate	--	208,200 Kg
Chromium	--	6,045 Kg
Fluoride	--	1,128 Kg

ESTIMATED INVENTORY OF SELECTED MEDIUM/LOW MOBILITY CONSTITUENTS

	WIDS	SIM
Co-60	16.6 Ci	0.0002 Ci
Cs-137	220 Ci	2.79 Ci
Sr-90	<11.1 Ci	1.10 Ci
Plutonium	<72 g	247.8 Ci
Pu-239/-240	--	41.45 Ci
Pu-241	--	202.7 Ci
Total Beta Emitters	5,440 Ci	--

Note: "--" indicates inventory not estimated.

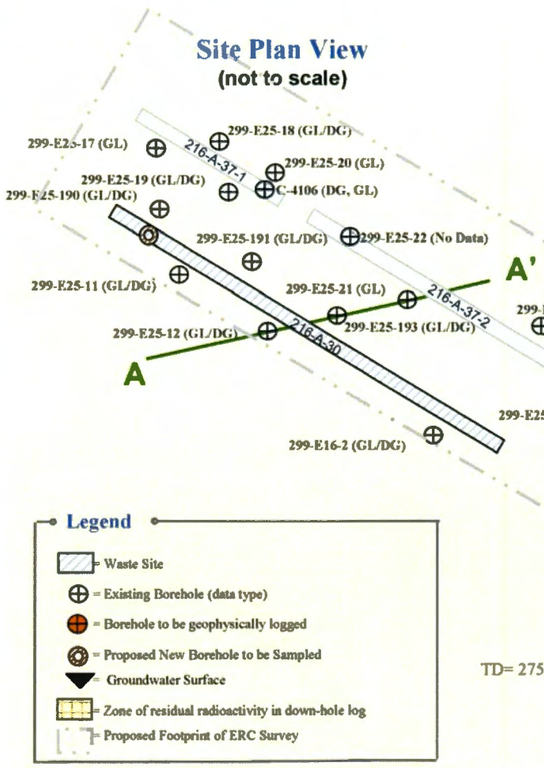
REFERENCES:

WIDS general summary reports
Hanford Soil Inventory Model, Rev 1 (RPP-26744)

Basis of Knowledge

- Process History (PH)
- Interpretation of Downhole Geophysics (DG)
- Geologic Logs (GL)
- Extrapolation from Representative Site (RS)

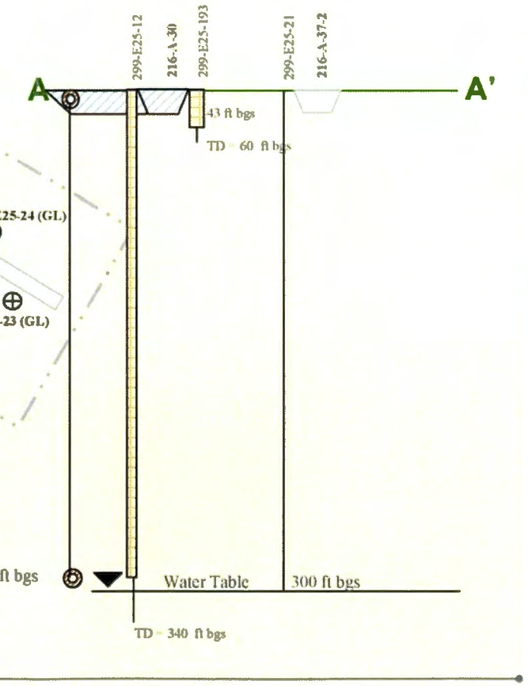
Site Plan View
(not to scale)



Characterization Summary

- Operating history and scintillation log of well 299-E25-12 (adjacent to 216-A-30) suggests potential for deep contamination at relatively low concentrations under 216-A-30.
- Operating history indicates surface contamination along full length of crib.
- Assigned to representative site 216-U-10.

Site Section View
(with proposed borehole projected)
(not to scale)



Potential Viable Alternatives

- REMOVE/TREAT/DISPOSE
- PARTIAL REMOVAL/TREATMENT/BARRIER
- MESC/MNA/IC
- BARRIER

Data Needs, Rationale, and Investigation Approach

Additional information is required for the following reasons:

- There are uncertainties in the relationship to the representative site (216-U-10) based on geology and inventory.
- Groundwater protection could be a concern based on the site-specific inventory: the full nature and extent of contaminants that may impact groundwater are uncertain (e.g., chromium, fluoride, nitrate).

The supplemental investigation strategy incorporates the following elements:

- An Electrical Resistivity Characterization (ERC) survey will support identification of areas of elevated conductivity that may be associated with mobile contaminants.
- One deep borehole will be installed near the head end of the 216-A-30 Crib to collect subsurface soil samples for analysis as specified.
- Data collected from this site will be used to describe expected conditions at 216-A-37-2 and 216-A-6. This is appropriate because these sites all received the same waste; 216-A-6 was replaced by 216-A-30, which was subsequently replaced by 216-A-37-2.

Table AD1-10. Data-Needs Priority
Summary – Model Group 6 – 216-A-30 Crib
(200-CW-5/2/4/200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Background	
Site Identification	216-A-30 Crib
Site Location	200 East; PUREX Zone; south of 202-A Building inside the PUREX Exclusion Fence, immediately east of 216-Z-6 Crib and adjacent to 216-A-37-1 and 216-A-37-2.
Type of Site	Crib
Operating History	The crib is surrounded with concrete AC-540 markers and posted with Underground Radioactive Material signs. The unit includes two distribution pipes: one 15-in (38 cm) corrugated perforated pipe running approximately 4 ft (1.2 m) below grade to the center of the unit, the other a 16-in (41 cm) steel pipe running parallel to the other, 4 ft (1.2 m) below grade to the center of the unit, then angling 45 degrees and changing to a 15-in (38 cm) corrugated, perforated pipe running 7 to 8 ft (2.1 to 2.4 m) below grade to the end of the unit. It is filled with 5 ft (1.5 m) or a total of 123,000 cu ft (3,480 m^3) of gravel, and the site has been backfilled. The side slope is 1.5:1. The crib is associated with PUREX operations. Two 8-inch (20 cm) carbon steel gage wells extending from the bottom to 3 ft (0.9 m) above grade. A 15-inch (38 cm) diameter vent riser extends from the distribution pipe to 3 ft (0.9 m) above grade. Two 16-in. (41 cm) by 16-inch (41 cm) by 8-inch (20 cm) concrete pads support the gage wells. 47,720 square feet (4430 square meters) of polyethylene sheets were added. The site is associated with the 216-A-6 Crib. The site received waste between 1961 and 1992. From 1961 to 1966, the 216-A-6 and 216-A-30 Cribs were used in parallel; in 1970, the 216-A-6 Crib was abandoned and the effluent was routed to the 216-A-30 Crib. The 216-A-37-2 Crib subsequently was constructed to replace 216-A-30. During the winter of 1971 and early 1972, an alkaline deposit formed over the surface of the 216-A-30 Crib. A radiation survey found the residue to have between 4000 to 6000 disintegrations per minute beta/gamma on the surface. A few tumbleweeds were found measuring 12,000 disintegrations per minute beta/gamma. An exploratory excavation was made into the crib in 1972. Dose rates up to 800 mrad/h were encountered at a depth of 1.2 m (4 ft). It appeared to be a salt deposit condensing out of vapors being emitted from the unit through the porous soil. Corrective actions were taken in June 1972, including covering the ground with layers of sand and plastic. This crib has a history of tumbleweed growing on it and becoming contaminated by absorbing the radionuclides from the crib through their roots. In November 2002, an area measuring approximately 12 by 12 m (40 by 40 ft) was found to have growing contaminated tumbleweeds reading up to 120,000 disintegrations per minute. (WIDS) The crib is 1,400 ft long, and 10 ft wide at the bottom. Construction and historical information would suggest contamination as shallow as 4 to 5 ft bgs. The waste site received approximately 7.5 million m^3 of liquid effluent. (WIDS) Soil Inventory Model – 216-A-30 (RPP-26744) – 216-A-30 (some constituents of interest are highlighted).

Na (kg) 8.123E+04	Al (kg) 1.521E+01	Fe (kg) 1.894E+03	Cr (kg) 6.045E+03	Bi (kg) 0.000E+00	La (kg) 0.000E+00	Hg (kg) 7.350E-03	Zr (kg) 1.704E-05	Pb (kg) 3.680E-01
Ni (kg) 1.628E+03	Ag (kg) 2.081E-07	Mn (kg) 4.681E+01	Ca (kg) 8.274E+04	K (kg) 8.285E+04	NO3 (kg) 2.082E+05	NO2 (kg) 1.603E+04	CO3 (kg) 5.583E+05	PO4 (kg) 2.981E+04
SO4 (kg) 9.867E+04	Si (kg) 1.865E+04	F (kg) 1.128E+03	Cl (kg) 9.680E+03	CCl4 (kg) 0.000E+00	Butanol (kg) 2.292E-03	TBP (kg) 0.000E+00	NPH (kg) 0.000E+00	NH3 (kg) 9.615E-03
Fe(CN)6 (kg) 0.000E+00	H-3 (Ci) 1.809E-02	C-14 (Ci) 2.889E-02	Ni-59 (Ci) 2.208E-04	Ni-63 (Ci) 2.124E-02	Co-60 (Ci) 2.517E-04	Se-79 (Ci) 2.044E-06	Sr-90 (Ci) 1.101E+00	Y-90 (Ci) 1.102E+00
Zr-93 (Ci) 1.213E-04	Nb-93m (Ci) 9.425E-05	Tc-99 (Ci) 7.391E-04	Ru-106 (Ci) 1.235E-05	Cd-113m (Ci) 1.528E-04	Sb-125 (Ci) 1.709E-04	Sn-126 (Ci) 8.631E-06	I-129 (Ci) 8.912E-03	Cs-134 (Ci) 1.240E-04
Cs-137 (Ci) 2.795E+00	Ba-137m (Ci) 2.638E+00	Sm-151 (Ci) 5.697E-02	Eu-152 (Ci) 2.628E-05	Eu-154 (Ci) 1.925E-03	Eu-155 (Ci) 7.655E-04	Ra-226 (Ci) 5.643E-06	Ra-228 (Ci) 1.392E-07	Ac-227 (Ci) 2.723E-05
Pa-231 (Ci) 4.887E-05	Th-229 (Ci) 8.803E-08	Th-232 (Ci) 6.180E-08	U-232 (Ci) 3.467E-02	U-233 (Ci) 2.052E+00	U-234 (Ci) 2.997E-01	U-235 (Ci) 1.186E-02	U-236 (Ci) 1.633E-02	U-238 (Ci) 2.185E-01
U-Total (kg) 6.564E+02	Np-237 (Ci) 3.315E-03	Pu-238 (Ci) 3.444E+00	Pu-239 (Ci) 3.072E+01	Pu-240 (Ci) 1.073E+01	Pu-241 (Ci) 2.027E+02	Pu-242 (Ci) 1.812E-03	Am-241 (Ci) 1.469E-03	Am-243 (Ci) 1.359E-06
Cm-242 (Ci) 2.373E-06	Cm-243 (Ci) 2.477E-07	Cm-244 (Ci) 6.057E-06						

Table AD1-10. Data-Needs Priority
Summary – Model Group 6 – 216-A-30 Crib
(200-CW-5/2/4/200-SC-1) (RL/FH) (CPP) (EPA). (2 Pages)

Vicinity Waste Sites	216-A-6 Crib; 216-A-37-1 and 216-A-37-2 Cribs						
Potential Remedial Alternatives							
X for Viable Alternatives	No Action	MESC/MNA/IC	Removal/Disposal	Barrier	Partial Removal/Barrier	In Situ Treatment	Other
	No (inventory suggests contamination that could exceed the no action criteria)	X	X	X	X		

Data Evaluation and Gaps Analysis			
Data	Knowns	Data Uncertainties	Are supplemental data required to support decision making?
Scintillation Logs for Wells: 299-E16-2 (340 ft) (1963, 1968, and 1976) 299-E25-11 (340 ft) (1963, 1968, and 1976) 299-E25-12 (340 ft) (1963, 1976)	All three wells are located along the southern edge of the crib. Low-level radioactive contaminants were detected in wells E25-11 and E25-12 in 1963. In 1976, the scintillation probe profiles showed minor activity in all three wells. (ARH-ST-156)	Relationship with representative site has some uncertainties related to geology and inventory. Protection of groundwater could be a concern based on the inventory; site-specific nature and extent of contaminants that may impact groundwater are uncertain.	Yes. The analogous relationship with 216-U-10 is somewhat uncertain. Inventory information would suggest potential for groundwater impacts associated with chromium, fluoride, and/or nitrate. ERC would support evaluation of the lateral extent of potential elevated conductivity that may be associated with mobile contaminants that could impact groundwater. A deep borehole would provide site-specific data on nature and vertical extent and correlation data for the ERC survey results. The data from the 216-A-30 borehole would be used as analogous for 216-A-37-2 and 216-A-6 and associated unplanned releases (these unplanned releases are associated with spills or overflows at the 216-A-6 Crib) because 216-A-37-2 and 216-A-6 received the same waste as 216-A-30. 216-A-6 ultimately was replaced by 216-A-30 and 216-A-37-2 replaced 216-A-30.
Spectral Gamma Logs for Wells: 299-E25-190 (50 ft) (2006) 299-E25-191 (50 ft) (2006) 299-E25-193 (60 ft) (2006)	All three wells are located along the northern edge of the crib. All three wells had minor amounts of Cs-137, mostly above 20 ft. Each well had total gamma anomalies beginning ~15 ft deep, which do not correlate with the observed Cs-137 concentrations. Assessment of the logging results indicated the potential for Sr-90 concentrations in excess of 500 pCi/g in these wells. Elevated concentrations extended to a maximum depth of ~43 ft bgs. A moisture log in 299-E25-191 shows elevated moisture content associated with the lower interval of Sr-90 contamination in that well. (Stoller 2006)		

Proposed Activities and Path Forward:

- Conduct ERC surveys to evaluate potential for elevated conductivity that may be associated with mobile contaminants and lateral extent of contamination.
- Install deep borehole to obtain site-specific data that will be used to define nature and vertical extent of contamination and to correlate ERC data.
- Use data as analogous for 216-A-37-2 and 216-A-6 and associated unplanned releases at 216-A-6 because 216-A-37-2 and 216-A-6 received the same waste as 216-A-30. 216-A-6 ultimately was replaced by 216-A-30 and 216-A-37-2 replaced 216-A-30.

Additional Notes:
The following provides a list of the references/bibliography used during this evaluation:
ARH-ST-156, *Evaluation of Scintillation Probe Profiles from 200 Area Crib Monitoring Wells.*
BHI-00178, *PUREX Plant Aggregate Area Management Study Technical Baseline Report.*
DOE/RL-99-66, *Steam Condensate/Cooling Water Waste Group Operable Units RI/FS Work Plan; Includes: 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*
DOE/RL-2003-11, *Remedial Investigation for the 200-CW-5 U Pond/ Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-CS-1 Steam Condensate Group Operable Units.*
DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units.*
RHO-CD-673, *Handbook 200 Areas Waste Sites.*
RHO-RE-SR-84-24 P, *Results of the Separations Area Groundwater Monitoring Network for 1983.*
RPP-26744, *Hanford Soil Inventory Model,* Rev 1.
Stoller, 2006, "Contract No. 30475-1, Stoller Geophysical Log Results in the 216-A-30 Trench."
Waste Information Data System Report, Hanford Site database.

bgs = below ground surface.
ERC = electrical resistivity characterization.
MESC/MNA/IC = Maintain Existing Soil Cover, Monitored Natural Attenuation, Institutional Controls.
PUREX = Plutonium-Uranium Extraction (Plant or process).
WIDS = Waste Information Data System database.

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DOE/RL-2004-24, 2004, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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.

H-2-60330, *Trench 216-B-55 Cond Waste Lines 221-B to Trench 216-B-55 & B-12 Crib Plan & Profile*, Hanford Site Drawing.

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