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CVP-2015-00001
Rev. 0

Cleanup Verification Package for the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site

Prepared for the U.S. Department of Energy by Washington Closure Hanford

July 2015

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EXECUTIVE SUMMARY

This cleanup verification package documents completion of remedial action for the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground site. The 300-7 waste site is located in the 300-FF-2 Operable Unit in the 300 Area of the Hanford Site in southeastern Washington State.

The 300-7 waste site was identified as an undocumented burial ground when contamination was discovered during installation of utility poles by the Bonneville Power Administration in 1952 and 1980. Remedial action was determined to be necessary when confirmatory sampling unearthed soil and potential asbestos-containing material with elevated gamma/beta and alpha contamination (WCH 2006).

Remediation of the 300-7 waste site, performed from July 8 through July 31, 2014, consisted of removal and disposal of contaminated soil, gravel, wood, steel, wire, concrete, and one truck battery. The excavation reached a depth of approximately 2.0 m (6.6 ft), resulting in approximately 7,870 bank cubic meters (10,293 bank cubic yards) of contaminated soil and debris being disposed at the Environmental Restoration Disposal Facility. No overburden soil was salvaged from the 300-7 waste site excavation and no staging pile areas were utilized.

Verification sampling within the 300-7 excavation was performed on September 30, 2014. An evaluation of the resulting data found that the waste removal action achieved compliance with the residential scenario remedial action objectives for the 300-7 waste site. A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 300-7 waste site in accordance with the *Tri-Party Agreement Handbook Management Procedures,* TPA-MP-14 (DOE-RL 2011b) procedure.

Table ES-1. Summary of Cleanup Verification Results for the 300-7 Waste Site. (2 Pages)

Regulatory Requirement	Cleanup Levels	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain individual radionuclide cleanup levels (CULs) and attain radionuclide total excess cancer risk of <1 x 10^{-4} over 1,000 years or a dose of 15 mrem//yr, whichever is lower.	Residual radionuclide activities were all below individual CULs. The total radionuclide excess cancer risk calculated using a sum-of-fractions evaluation is 1.12 x 10^{-5}; therefore, the <1 x 10^{-4} requirement is met.	Yes
Direct Exposure – Nonradionuclides	Attain individual contaminant of concern (COC) direct exposure CULs.	All individual COC concentrations are below the residential direct exposure CULs.	Yes
Nonradionuclide Risk Requirements	Attain hazard quotient of <1 for noncarcinogens.	All hazard quotients for individual nonradionuclide COCs are <1.	Yes
	Attain cumulative hazard quotient of <1 for noncarcinogens.	The residential cumulative hazard quotient for the 300-7 waste site COCs is 2.89 x 10^{-1}, which is <1.	
	Attain an excess cancer risk of <1 x 10^{-6} for individual carcinogens in the residential scenario.	The excess cancer risk for individual carcinogens is <1 x 10^{-6}.	
	Attain a total excess cancer risk of <1 x 10^{-5} for carcinogens.	The total excess carcinogenic risk for all sampling areas is 2.8 x 10^{-7}, and thus is <1 x 10^{-5}.	
Groundwater/River Protection – Radionuclides	Attain single COC groundwater and river protection CULs.	Radionuclide COCs identified for the 300-7 waste site are not predicted to migrate to groundwater or the river within 1,000 years.	Yes
	Attain National Primary Drinking Water Standards: 4 mrem/yr (beta/gamma) dose rate to target receptors/organs [a].		
	Meet drinking water standards for nonuranium alpha emitters: the more stringent of the 15 pCi/L MCL or 1/25th of the derived concentration guide per DOE Order 5400.5 [b].		
	Meet total uranium drinking water standard of 21.2 pCi/L [c].		

Table ES-1. Summary of Cleanup Verification Results for the 300-7 Waste Site. (2 Pages)

Regulatory Requirement	Cleanup Levels	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	All individual COC concentrations are below the groundwater and/or Columbia River protection criteria.	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and the Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the Hanford Site background, the 30 µg/L uranium MCL (40 *Code of Federal Regulations* 141.66) corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038 (BHI 2001).
COC = contaminant concern
CUL = cleanup level
MCL = maximum contaminant level (drinking water standard)

The current site conditions achieve the remedial action objectives and the corresponding cleanup levels for industrial land use established in the *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils* (DOE-RL 2015) and the *Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington* (300 Area ROD) (EPA 2013). The 300-7 site has met the requirements for unlimited use and unrestricted exposure. The results of verification sampling show that residual contaminant concentrations also meet human health direct exposure cleanup levels for residential land use in the shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The waste site contamination does not extend into the deep zone soils. Since the waste site remediation achieved cleanup levels for residential land use, institutional controls to maintain industrial land use are not required.

The site meets cleanup standards and has been reclassified as Final Closed Out in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) and the Waste Site Reclassification Guideline TPA-MP-14 (RL-TPA-90-0001) (DOE-RL 2011). A copy of the stand-alone waste site reclassification form is included as part of the Executive Summary of this document.

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 300-FF-2 **Control No.:** 2014-109

Waste Site Code(s)/Subsite Code(s): 300-7

Reclassification Category: Interim ☐ Final ☒

Reclassification Status: Closed Out ☒ No Action ☐ Rejected ☐
RCRA Postclosure ☐ Consolidated ☐ None ☐

Approvals Needed: DOE ☒ Ecology ☐ EPA ☒

Description of current waste site condition:

The 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site, part of the 300-FF-2 Operable Unit, was identified as a waste site requiring remediation in the *Hanford Site 300 Area, Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington* (300 Area ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2013). The 300-7 waste site was previously included as a "plug-in" site in the Tri-Party Agreement Administrative Record *Fact Sheet: 300 Area "Plug-In" Waste Sites for Fiscal Year 2011*, U.S. Department of Energy, Richland, Washington (DOE-RL 2011) in accordance with the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site, Benton County, Washington* (300-FF-2 ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2001), and the *Explanation of Significant Differences for the 300-FF-2 Operable Unit Interim Remedial Action Record of Decision* (2009 ESD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2009).

The site was identified as an undocumented burial ground when contamination was discovered during installation of utility poles by the Bonneville Power Administration in 1952. Confirmatory sampling of the site was conducted on March 27, 2006. Sampling results indicated that the 300-7 waste site failed to meet cleanup levels for isotopic uranium and asbestos-containing material. In addition, unearthed debris consisted of an orange rock, potential uranium ore, and other potentially hazardous materials at the site. Based on the confirmatory sampling results and the nature of material found, the 300-7 waste site was recommended for remediation.

Remediation of the 300-7 waste site was performed from July 8 through July 31, 2014. Approximately 7,870 bank cubic meters (10,293 bank cubic yards) of excavated materials were removed and direct loaded for disposal at the Environmental Restoration Disposal Facility (ERDF).

Cleanup verification soil samples were collected from the 300-7 waste site on September 30, 2014, per the *Work Instruction for Verification Sampling of the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site*, 0300X-WI-G0049, Rev. 0, Washington Closure Hanford, Richland, Washington (WCH 2014). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at ERDF in the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Final Closed Out.

Basis for reclassification:

The verification sampling results were evaluated in comparison to the cleanup levels (CULs) and remedial action objectives (RAOs) from the 300 Area ROD (EPA 2013) and the *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils* (300 Area RDR/RAWP), DOE/RL-2014-13-ADD1, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2015). In accordance with this evaluation, the verification sampling results support a reclassification of the 300-7 waste site to Final Closed Out. The current site conditions achieve the CULs and RAOs established by the 300 Area ROD (EPA 2013) and the 300 Area RDR/RAWP (DOE-RL 2015). The waste site was remediated to achieve cleanup levels for a residential land-use scenario and to protect groundwater and the Columbia River. The 300-7 site has met the requirements for unlimited use and unrestricted exposure. The results of verification sampling show that residual contaminant concentrations meet human health direct exposure cleanup levels for residential land use and applicable standards for groundwater and river protection in the shallow zone (i.e., surface to 4.6 m [15 ft] deep). The waste site contamination does not extend into the deep zone soils. Since the waste site remediation achieved cleanup levels for residential land use, institutional controls to maintain industrial land use are not required for the 300-7 waste site. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site.*

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 300-FF-2 **Control No.:** 2014-109

Waste Site Code(s)/Subsite Code(s): 300-7

Regulator comments:

Waste Site Controls:

Engineered Controls: ☐ Yes ☒ No Institutional Controls: ☐ Yes ☒ No O&M Requirements: ☐ Yes ☒ No

If any of the Waste Site Controls are checked Yes, specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents:

M. French	M. French	6/15/15
DOE Federal Project Director (printed)	Signature	Date
NA		
Ecology Project Manager (printed)	Signature	Date
B. Simes		6/29/15
EPA Project Manager (printed)	Signature	Date

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ACRONYMS AND ABBREVIATIONS

COC	contaminant of concern
CUL	cleanup level
CVP	cleanup verification package
DQA	data quality assessment
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
RAO	remedial action objective
RDR/RAWP	remedial design report/remedial action work plan
ROD	record of decision
SAP	sampling and analysis plan
UCL	upper confidence limit
WAC	*Washington Administrative Code*

1.0 INTRODUCTION

This cleanup verification package (CVP) documents that the 300-7 Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site was remediated in accordance with the *Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington* (300 Area ROD) (EPA 2013). Remedial action objectives (RAOs) and associated cleanup levels (CULs) for this site are documented in the 300 Area ROD (EPA 2013) and the *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils* (300 Area RDR/RAWP) (DOE-RL 2015). The 300 Area ROD provides the U.S. Department of Energy, Richland Operations Office, the authority, guidance, and objectives to conduct this remedial action.

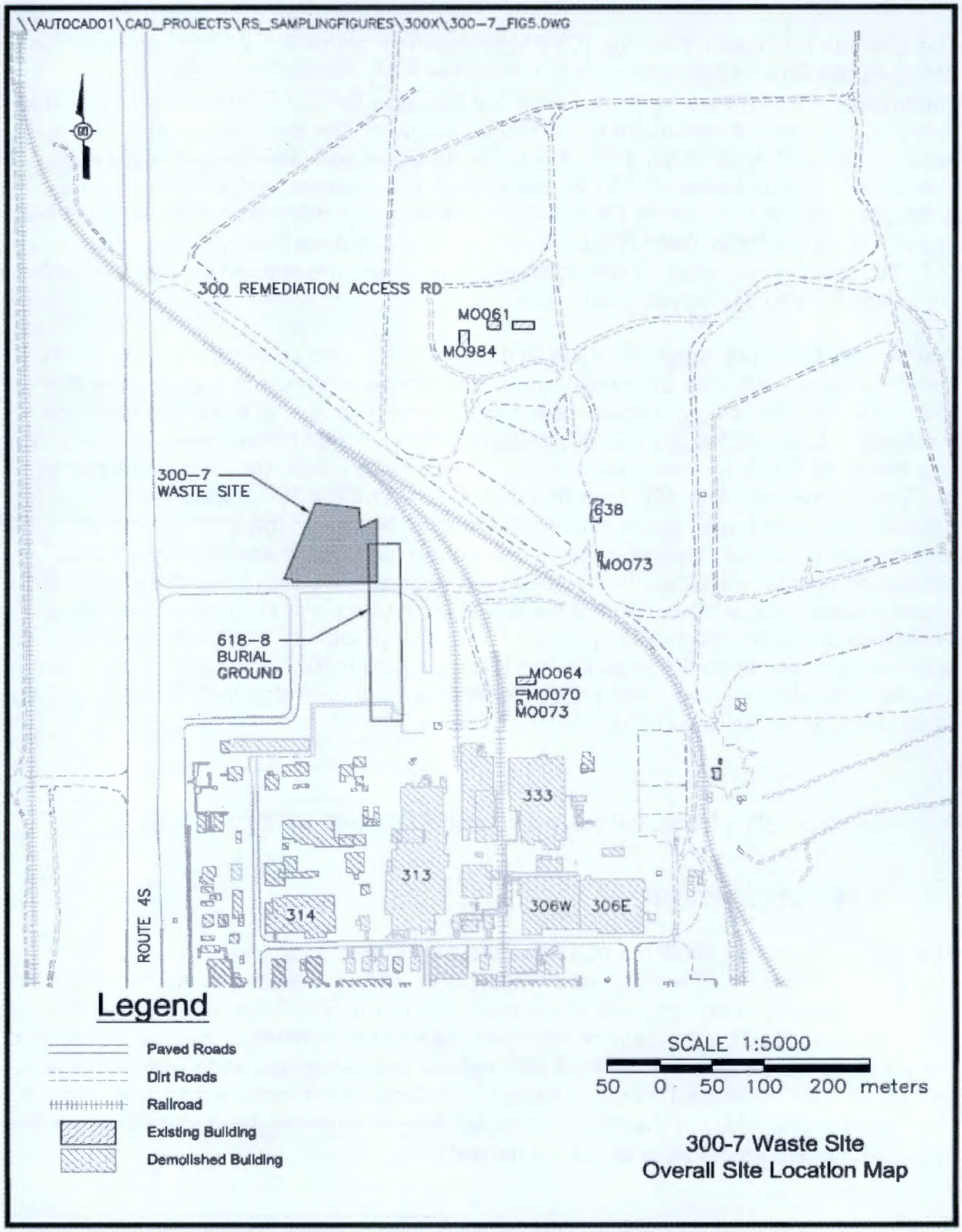
The remedy specified in the 300 Area ROD (EPA 2013) and conducted for the 300-7 waste site included excavating the site to the extent required to meet specified soil CULs and disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility (ERDF) in the 200 Area of the Hanford Site. Excavation was driven by RAOs for direct exposure, protection of groundwater, and protection of the Columbia River. The 300 Area ROD (EPA 2013) for the 300-7 waste site established RAOs based on an industrial land use. However, the 300-7 waste site remediation achieved cleanup levels for residential land use; therefore, institutional controls to maintain industrial land use are not required. Observations of the type and quantity of material removed from the site and associated characterization sampling performed during the excavation process were used to identify final COCs for the verification sampling as discussed in the *Work Instruction for Verification Sampling of the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site* (WCH 2014).

2.0 SITE DESCRIPTION AND SUPPORTING INFORMATION

2.1 SITE DESCRIPTION

The 300-7 waste site consisted of a mound-covered area of approximately 2,205 m^2 (7,234 ft^2) (Figure 1). The 300-7 waste site extended to the north and west from the 300 Area North Parking Lot, west of the north end of the 618-8 Burial Ground. It formed an irregular-shaped polygon where the north edge of the parking lot is the south edge of the waste site. The site was covered with natural vegetation and some visible surface debris, such as concrete, trash, and cables. The area of subsurface anomalies was not marked. The boundary of the 300-7 waste site was enlarged in 1998 to include the area of visible surface debris adjacent to the mound.

Figure 1. The 300-7 Waste Site Location Map.



2.2 HISTORY

The burial of solid radioactive wastes in the vicinity of the 300 Area began in 1944 and consisted mostly of uranium metal, uranium oxides, and other miscellaneous uranium-bearing materials from the production of uranium slugs. The location for this burial ground was not documented. It was identified as an undocumented burial ground when contamination was discovered during installation of utility poles by the Bonneville Power Administration in 1952 and 1980. Remedial action was determined to be necessary when confirmatory sampling unearthed soil and potential asbestos-containing material with elevated gamma/beta and alpha contamination (WCH 2006).

Contamination levels of 12,000 disintegrations per minute beta-gamma and 1,200 disintegrations per minute alpha were noted west of the north end of 618-8, along with 1 mR/hr subsurface contamination found adjacent to the east side of the north end of the 618-8 waste site. Laboratory samples taken from test pits in 1980 indicated 550 pCi/g of uranium and 90 pCi/g of uranium. In 1987, Battelle Northwest performed geophysical surveys in this area. Geophysical surveys revealed a concentration of disturbances adjacent to the north end of 618-8. Seven more excavations were made in 1987. Miscellaneous metal scrap was found in two of the excavations. Contamination levels of 300 to 1,500 counts per minute were found on the debris in one of the pits. Similar contaminated scrap metal was found in another test pit. Additional geophysical surveys were done in December 2001 (Figure 2). The area under the parking lot did not appear to be a burial ground, with only scattered, isolated anomalies. The area north of the parking lot seemed to be much more complex with elevated contaminant concentrations of buried materials.

A historic aerial photograph taken in October 1952 (Figure 3) shows the 300-7 waste site and surrounding areas as relatively undisturbed with no earth-scraping scars. A photograph from December 1953 shows extensive earth moving at the 618-8 Burial Ground, with a small portion in the southeast corner of 300-7 being affected.

Most activity at the 300-7 waste site occurred in the spring and early summer of 1954. A photograph taken in May 1954 (Figure 4) shows that a large portion of the site had been disturbed in a fan shape with the apex at the southeast corner. Large piles of soil had been placed in the area that is now the mound (although they do not appear to coincide in size). The large concrete blocks that remain at the site are visible in the photograph.

No significant changes to the 300-7 waste site were identified in aerial photographs taken after 1954. The site appears to have naturally revegetated over time.

Figure 2. 300-7 Waste Site Geophysical Interpretation Map.

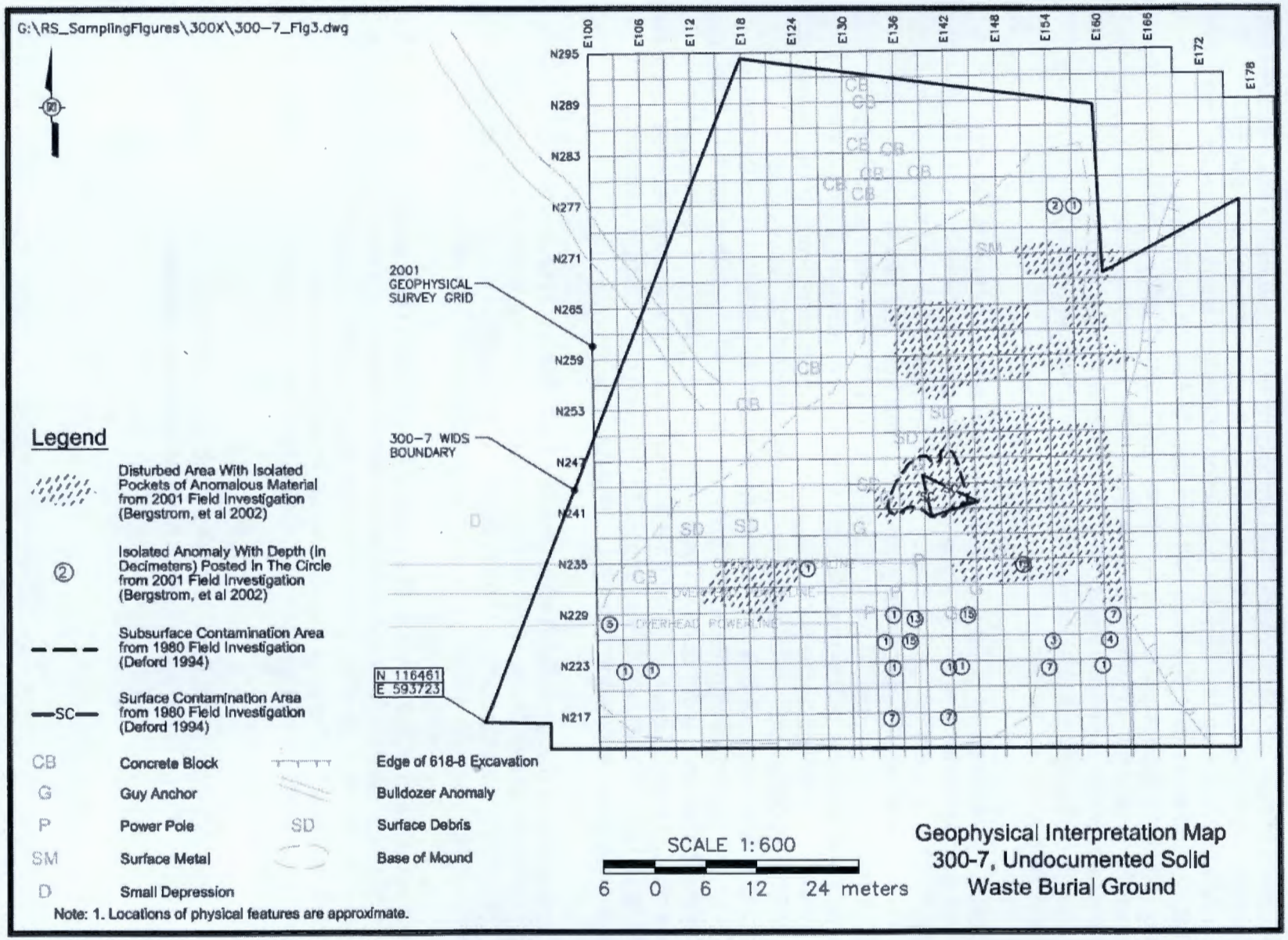
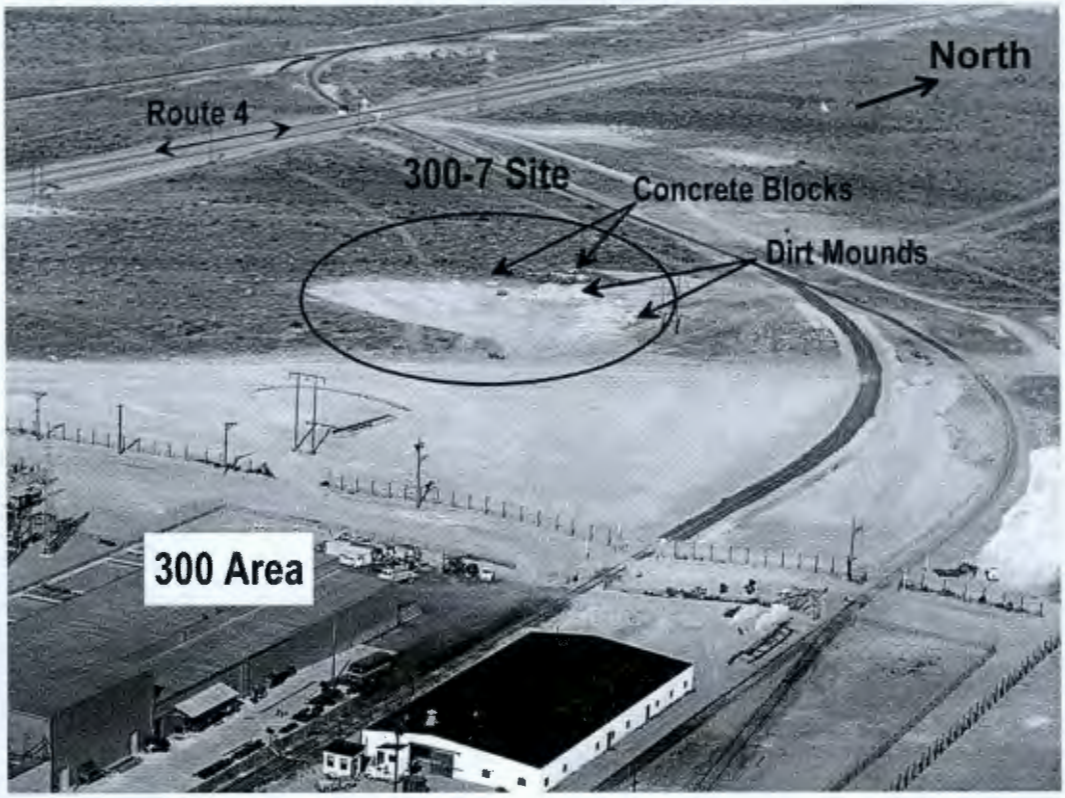


Figure 3. 300-7 Waste Site, October 1952 (Negative 484).

Figure 4. 300-7 Waste Site, May 1954 (Negative 2836).



3.0 REMEDIAL ACTION FIELD ACTIVITIES

3.1 EXCAVATION AND DISPOSAL

Remediation of the 300-7 waste site was performed from July 8 through July 31, 2014. Approximately 7,870 bank cubic meters (10,293 bank cubic yards) of excavated materials were removed and loaded for direct disposal at the Environmental Restoration Disposal Facility (ERDF). According to the post-excavation civil survey the maximum depth of the waste site excavation was approximately 2.0 m (6.6 ft). However, due to the mounded nature of the waste site surface, some areas of the 300-7 waste site excavation extended to a depth of 3.8 m (12.5 ft), below the original ground surface. Excavated materials consisted of soil, gravel, wood, steel, wire, and concrete debris. In addition, one truck battery, two old steel cart wheels, and two metal pails were removed from the 300-7 excavation and disposed at ERDF.

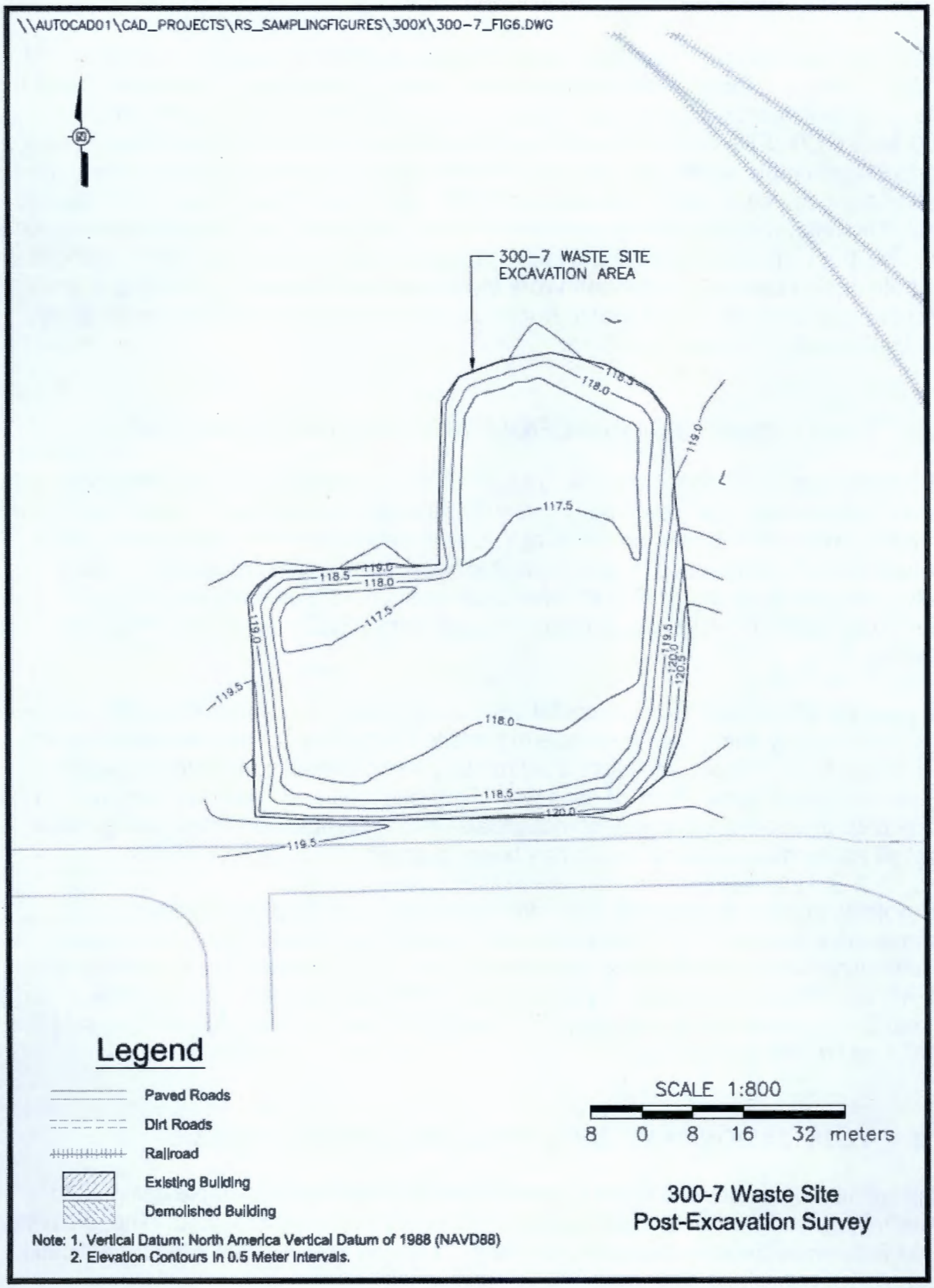
No overburden materials were salvaged from the 300-7 waste site excavation; therefore, there is no overburden pile associated with the 300-7 waste site. No staging pile areas were utilized during 300-7 waste site remediation.

Screening for volatile organics was performed during and immediately following remediation. No volatile organic compounds were detected within the 300-7 excavation area. Radiological monitoring was performed during the duration of the 300-7 waste site excavation; however, radiological activity was not detected in the field during remediation activities.

3.2 POST-EXCAVATION TOPOGRAPHIC SURVEY

A post-excavation civil survey was performed at the 300-7 waste site at the completion of remedial action activities. The area associated with the 300-7 waste site remediation is shown in Figure 5.

Figure 5. 300-7 Waste Site Post-Excavation Civil Survey (2014).



4.0 VERIFICATION SAMPLING ACTIVITIES

Verification sampling for the 300-7 waste site was performed on September 30, 2014 (WCH 2014), to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the RDR/RAWP (DOE-RL 2015) and the 300 Area ROD (EPA 2013). The 95% upper confidence limit (UCL) calculations for the verification sample results are provided in Appendix A. These indicate that the remedial action achieved compliance with the applicable RAOs and CULs for the 300-7 waste site. The following subsections provide additional discussion of the information used to develop the verification sampling design. A more detailed discussion of the verification sample design can be found in the *Work Instruction for Verification Sampling of the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site* (WCH 2014).

4.1 CONTAMINANTS OF CONCERN FOR VERIFICATION SAMPLING

The contaminants of concern (COCs) for the 300-7 waste site were identified based on the process knowledge, confirmatory sampling results, and COCs for the proximal burial ground waste sites. Based on the available information, the 300-7 waste site COCs include arsenic, barium, cadmium, total chromium, lead, selenium, silver, mercury, polychlorinated biphenyls (PCBs), americium, cesium-137, plutonium-238, plutonium-239/240, nickel-63, strontium-90, uranium-233/234, uranium-235, and uranium-238.

Several small pieces of transite-containing debris were found during the 300-7 waste site confirmatory sampling. A sample of transite-containing debris was collected and submitted for laboratory analysis. Confirmatory sample results indicated presence of 5% to 10% of chrysotile form of asbestos. For verification purposes, the excavation was inspected by asbestos-competent individuals prior to sample collection, to visually verify that all asbestos-containing debris has been removed.

No volatile organic compounds were detected during confirmatory sampling or immediately following the 300-7 waste site remediation; therefore, volatile organic compounds were excluded from the list of COCs. The total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH) were not site COCs for the proximal burial ground waste sites; therefore, TPH and PAH were not included on the list of the 300-7 waste site COCs.

4.2 VERIFICATION SAMPLING DESIGN SELECTION AND BASIS

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples that were collected. The excavation area footprint is the only decision unit identified for the 300-7 waste site for verification sampling.

4.2.1 Statistical Verification Sampling Design

Figure 6 presents the statistical verification sample design for the shallow zone within the excavation. A discrete soil sample was collected at each designated sample point (0 to 0.15 m [0 to 6 in.]) below the surface of the excavated waste site) and analyzed using the methods identified in Table 1. The soil sampling locations were global positional surveyed and staked prior to sample collection using the coordinate pairs provided in Table 2.

Figure 6. Verification Sample Locations for the 300-7 Waste Site Excavation.

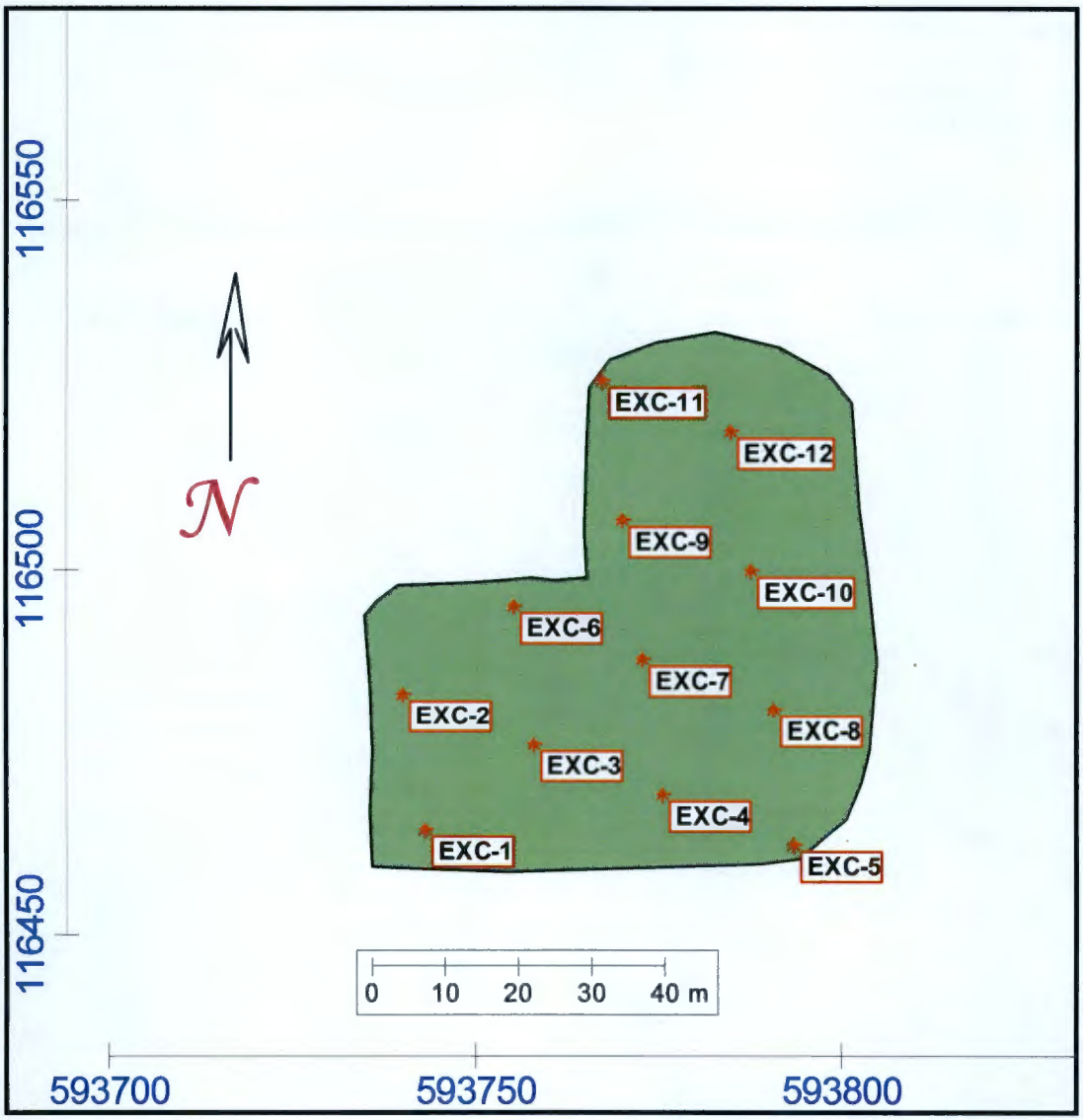


Table 1. Laboratory Analytical Methods.

Analytical Method	Contaminants of Concern
ICP metals [a] – EPA Method 6010	Arsenic, barium, cadmium, total chromium, lead, selenium, silver
Mercury – EPA Method 7471	Mercury
PCB – EPA Method 8082	Polychlorinated biphenyls
GEA – Gamma spectroscopy	Cesium-137
Total beta radiostrontium	Strontium-90
Total uranium – KPA	Total uranium
Isotopic uranium	Uranium-233/234, uranium-235, uranium-238
Isotopic plutonium	Plutonium-238, plutonium-239/240
Americium	Americium-241

[a] The expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc in the analytical results package.

EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
ICP = inductively coupled plasma
KPA = kinetic phosphorescence analysis
PCB = polychlorinated biphenyl

Table 2. Sample Summary Table for the 300-7 Waste Site. (2 Pages)

Sample Location	HEIS Sample Number	Washington State Plane Coordinate Locations (m)		Sample Analysis [a]
		Northing	Easting	
EXC-1	J1V0N3	116464.2	593743.0	ICP metals [b], mercury, PCBs, GEA, total beta radiostrontium, total uranium, isotopic uranium, isotopic plutonium, americium
EXC-2	J1V0N4	116483.1	593740.1	
EXC-3	J1V0N5	116476.1	593757.9	
EXC-4	J1V0N6	116469.1	593775.6	
EXC-5	J1V0N7	116462.2	593793.3	
EXC-6	J1V0N8	116495.0	593755.0	
EXC-7	J1V0N9	116488.0	593772.8	
EXC-8	J1V0P0	116481.0	593790.5	
EXC-9	J1V0P1	116506.8	593769.9	
EXC-10	J1V0P2	116499.9	593787.7	
EXC-11	J1V0P3	116525.7	593767.1	
EXC-12	J1V0P4	116518.7	593784.8	
Duplicate of J1V0N4	J1V0P5	116483.1	593740.1	
Split of J1V0N4	J1V0P7	116483.1	593740.1	

Table 2. Sample Summary Table for the 300-7 Waste Site. (2 Pages)

Sample Location	HEIS Sample Number	Washington State Plane Coordinate Locations (m)		Sample Analysis [a]
		Northing	Easting	
Equipment blank	J1V0P6	NA	NA	ICP metals [a], mercury

[a] Grab samples were collected at each location and sample analysis were performed as defined in Table 1, Laboratory Analytical Methods. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management* consistent with the SAP (DOE-RL 2014a) requirements.
[b] The expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc in the analytical results package.

GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PCB = polychlorinated biphenyl
SAP = sampling and analysis plan

The decision rule for demonstrating compliance with the cleanup criteria requires comparison of the true population mean, as estimated by the 95% UCL on the sample mean, with the CUL. Therefore, a statistical sampling design is the preferred verification sampling approach for this site because the distribution of potential residual soil contamination over the site is uncertain. The Washington State Department of Ecology (Ecology) publication *Guidance on Sampling and Data Analysis Methods* (Ecology 1995) recommends that systematic sampling with sample locations distributed over the entire study area be used. This sampling approach is referred to by Ecology as "area-wide sampling." Therefore, sampling locations were distributed over the footprint of the excavation area using a random-start systematic grid in an effort to determine the potential presence of residual contamination. Statistical parameters (i.e., standard deviation within the populations) for residual contaminant levels following remediation at the 300-7 waste site were estimated based on assumptions of residual contamination after remediation. These assumptions were verified using the resulting verification sampling data and considered in the data quality assessment (DQA) for the data set.

The excavation area footprint of the 300-7 waste site was delineated in Visual Sample Plan[1] and used as the basis for the location of a random-start systematic grid for verification soil sampling. Twelve soil sample locations were identified. A triangular grid was selected for this investigation based on studies that indicate triangular grids are superior to square grids (Gilbert 1987).

The soil sample locations were surveyed and staked prior to sample collection and one discrete sample was collected at each location (WCH 2014). All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *300 Area Remedial Action Sampling and Analysis Plan* (300 Area SAP) (DOE-RL 2014a).

[1] Visual Sample Plan is a site map-based user-interface program that may be downloaded at http://vsp.pnnl.gov.

Field quality control samples consisted of one equipment blank sample, one field duplicate, and one split sample. All samples were submitted for full protocol laboratory analysis.

5.0 SAMPLING RESULTS

This section presents the evaluation of the 300-7 waste site cleanup verification data for comparison with the data quality criteria and CULs. The verification samples were submitted to offsite laboratories for analysis using approved U.S. Environmental Protection Agency (EPA) analytical methods as required per the 300 Area SAP (DOE-RL 2014a).

5.1 STATISTICAL SAMPLE RESULTS

The laboratory-reported verification data results for all constituents are stored in the Environmental Restoration project-specific database prior to archival in the Hanford Environmental Information System (HEIS) and are presented as Attachment 1 of the 95% UCL calculation (Appendix A).

The 300-7 waste site consisted of one decision unit (the excavation footprint) for verification sampling. The verification data from the excavation footprint were evaluated using ProUCL to calculate a 95% UCL on the true population mean for residual concentrations of COCs as specified by the RDR/RAWP (DOE-RL 2015). These calculations are provided in Appendix A. If there are five or more detections of a given COC, and the COC is detected in 25% or more of the total samples, a UCL is calculated. If there are less than five detections of a given COC within a data set, a UCL is not calculated and the maximum concentration is used. If no detections for a given COC were reported in the data set, then no statistical or maximum concentrations were reported for that COC.

Comparisons of the statistical and maximum results for COCs against the residential site CULs for the footprint of the 300-7 waste site excavation are summarized in Table 3. Contaminants that were not detected by laboratory analysis are excluded from this table, but are reported in Appendix A.

Table 3. Comparison of Contaminant Concentrations to Residential Cleanup Levels for the 300-7 Waste Site Verification Sampling.

COC	Statistical or Maximum Result [a,b] (pCi/g)	Radionuclide Direct Exposure CULs [c] (pCi/g)	Radionuclide Groundwater and River Protection CULs [c] (pCi/g)	Does the Result Exceed CULs?
Europium-152	0.242	3.3	--	No
Europium-154	0.102	3.0	--	No
Plutonium-238	0.180	39	--	No
Uranium-233/234	0.990 (<BG)	27.2	--	No
Uranium-235	0.102 (<BG)	2.7	--	No
Uranium-238	0.912 (<BG)	26.2	--	No
Uranium (KPA)	1.69 (<BG)	56.1	--	No
COC	**Statistical or Maximum Result [a,b] (mg/kg)**	**Nonradionuclide Direct Exposure CULs [c] (mg/kg)**	**Nonradionuclide Groundwater and River Protection CULs [c] (mg/kg)**	**Does the Result Exceed CULs?**
Arsenic	2.96 (<BG)	20	20	No
Barium	90.1 (<BG)	16,000	--	No
Beryllium	1.39 (<BG)	160	--	No
Cadmium	0.483 (<BG)	80	176	No
Chromium (total)	11.4 (<BG)	120,000	--	No
Cobalt	10.5 (<BG)	24	--	No
Copper	16.7 (<BG)	3,200	3,400	No
Lead	5.25 (<BG)	250	1,480	No
Lithium	9.42 (<BG)	160	--	No
Manganese	369 (<BG)	11,200	--	No
Mercury	0.00502 (<BG)	24	8.5	No
Nickel	12.8 (<BG)	1,600	--	No
Selenium	1.73	400	302	No
Silver	0.168 (<BG)	400	--	No
Strontium	32.3	48,000	--	No
Uranium (total)	2.84 (<BG)	81	102	No
Vanadium	90.0	400	--	No
Zinc	54.5 (<BG)	24,000	64,100	No
Aroclor-1254	0.094	0.5	--	No
Aroclor-1260	0.048	0.5	--	No

[a] 95% upper confidence limit value from verification sample results (Appendix A).
[b] Background values from DOE-RL 1996, 2001, and 2014b.
[c] CULs obtained from Appendix D, Table D-1 of the RDR/RAWP (DOE-RL 2015).

-- = not applicable
(<BG) = less than background value specified in Table D-3 of the RDR/RAWP (DOE-RL 2015)
COC = contaminant of concern
CUL = cleanup level
KPA = kinetic phosphorescence analysis
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan

Contaminants of concern for the 300 Area were selected in the 300 Area ROD (EPA 2013). In the event that contaminants are discovered during remediation for which CULs were not established in the ROD, the information will be presented to the

U.S. Department of Energy and EPA project managers for determination of a path forward. While not identified as COCs, boron and molybdenum were detected above background levels in the 300-7 waste site cleanup verification samples. These detections were below risk-based CULs calculated during development of the 300 Area ROD (EPA 2013). Therefore, the detected boron and molybdenum concentrations do not require further discussion.

5.2 DATA QUALITY ASSESSMENT PROCESS

A DQA is performed to compare the verification sampling approach and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 300-7 waste site determined that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. All analytical data were found to be acceptable for decision-making purposes. The evaluation also verified that the sample design was sufficient to support clean site verification. The cleanup verification sample analytical data are stored in the Washington Closure Hanford project-specific database prior to archiving in HEIS and are presented as attachments to the 95% UCL calculations in Appendix A. The detailed DQA is presented in Appendix B.

6.0 CLEANUP VERIFICATION DATA EVALUATION

This section describes the evaluation of the sampling data in terms of comparison to the CULs, the radionuclide risk requirements, and the nonradionuclide risk requirements.

Although the 300-7 waste site is in the industrial portion of the 300 Area, the residual COC concentrations for the 300-7 waste site meet residential land use criteria. Therefore, the 300-7 waste site was evaluated against the residential land use scenario.

6.1 COMPARISON OF SAMPLE DATA TO CULS

Evaluation of the results listed in Table 3 from the verification sampling at the 300-7 waste site indicates that all radionuclide and nonradionuclide COCs were undetected and/or quantified below the residential direct exposure, groundwater protection, and river protection CULs. Residential and industrial soil CULs to be protective of groundwater and the river were calculated based on federal drinking water standards as described in Section 8.2 of the 300 Area ROD (EPA 2013).

The ecological risk evaluations discussed in Section 7.2 of the 300 Area ROD (EPA 2013) concluded that 300-FF-2 Operable Unit interim remedial actions that achieved

interim action ROD CULs to protect human health were also protective of ecological receptors. No further evaluation or screening of potential ecological risk is necessary to be performed in CVPs or other supporting documents for waste site reclassification.

6.2 EVALUATION OF ATTAINMENT OF RADIONUCLIDE AND NONRADIONUCLIDE RISK REQUIREMENTS

This section discusses how the verification sampling data are used in demonstrating attainment of radionuclide and nonradionuclide risk requirements.

6.2.1 Radionuclide Evaluation of Risk and Dose

The cleanup levels (CULs) for soil radionuclide COCs in the 300 Area ROD (EPA 2013) were set at a 1×10^{-4} risk limit or 15 mrem/yr dose limit, whichever is more conservative for residential and industrial land use. In addition to meeting these individual CULs, a comparison of the radionuclide verification sample results for the statistical data set to the cumulative direct exposure radionuclide excess cancer risk limit of 1×10^{-4} and the radiological dose limit of 15 mrem/yr was conducted using sum of fractions calculations (Appendix A). The sum of fractions were conservatively calculated for the 300-7 waste site data set using the greater of the statistical or maximum value for each COC detected above background. The calculations were performed using the soil concentrations corresponding to a 1×10^{-4} risk and a 15 mrem/yr dose for residential land use from Table 8-3 of the 300 Area RI/FS (DOE-RL 2013).

The sum of fractions shown in the 300-7 Waste Site Radionuclide Sum of Fractions Calculation in Appendix A determined that the cumulative excess cancer risk value for radionuclides is 8.9×10^{-6} and the total radiological dose is 1.6 mrem/yr. Comparing these values to the risk and dose limits of $<1 \times 10^{-4}$ and <15 mrem/yr the risk and dose requirements are met.

6.2.2 Attainment of Nonradionuclide Noncarcinogenic and Carcinogenic Risk Standards.

For COCs with noncarcinogenic effects, *Washington Administrative Code* (WAC) 173-340 specified the evaluation of the hazard quotient, which is given as daily intake divided by a reference dose (WAC 173-340-200). The solutions and details of the hazard quotient calculations for 300-7 waste site are provided in Appendix A.

Nonradionuclide risk requirements for the residential scenario include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. Hazard quotient and excess carcinogenic risk calculations were performed for the 300-7 waste site using the 95% UCL statistical values from the cleanup verification samples. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients

are below 1.0, and all individual excess carcinogenic risk values are below 1×10^{-6}. The cumulative hazard quotient for the 300-7 waste site is 2.89×10^{-1}, satisfying the criteria of less than 1.0. The cumulative excess cancer risk for the 300-7 waste site is 2.8×10^{-7}, satisfying the criteria of less than 1×10^{-5}.

7.0 STATEMENT OF PROTECTIVENESS

This CVP demonstrates that remedial action at the 300-7 waste site achieved the RAOs and corresponding CULs established for the residential land-use scenario in the 300 Area ROD (EPA 2013) and the RDR/RAWP (DOE-RL 2015). The contaminated materials from the site have been excavated and disposed of at ERDF. The remaining soil at the 300-7 waste site has been sampled, analyzed, and evaluated. Results indicate that the site supports future land uses that can be represented (or bounded) by the residential land-use scenario and poses no threat to groundwater or the Columbia River. The waste site contamination does not extend into the deep zone soils. Although the 300-7 waste site is in the industrial portion of the 300 Area, the waste site remediation achieved cleanup levels for residential land use. Therefore, the site meets the requirements for unlimited use and unrestricted exposure, and institutional controls to maintain industrial land use are not required. The 300-7 waste site is verified to be remediated in accordance with the 300 Area ROD (EPA 2013) and may be reclassified to a status of Final Closed Out.

8.0 REFERENCES

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Gilbert, R. O., 1987, *Statistical Methods for Environmental Pollution Monitoring*, Wiley & Sons, Inc., New York, New York.

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WCH, 2014, *Work Instruction for Verification Sampling of the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site*, 0300X-WI-G0049, Rev. 0, Washington Closure Hanford, Richland, Washington.

APPENDIX A

CALCULATIONS

APPENDIX A

CALCULATIONS

The calculations in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the files will be stored in a U.S. Department of Energy, Richland Operations Office, repository. These calculations have been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculations," Washington Closure Hanford, Richland, Washington. The following calculations are provided in this appendix:

300-7 Waste Site Cleanup Verification 95% UCL Calculations, 0300X-CA-V0193, Rev. 1, Washington Closure Hanford, Richland, Washington A-3

300-7 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0300X-CA-V0194, Rev. 1, Washington Closure Hanford, Richland, Washington.....A-23

300-7 Waste Site Radionuclide Sum of Fractions Calculations, 0300X-CA-V0195, Rev. 1, Washington Closure Hanford, Richland, Washington A-29

DISCLAIMER FOR CALCULATIONS

The calculations provided in this appendix have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents.

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 300 Area Closure Operations **Job No. 14655**

Area: 300

Discipline: Environmental *Calculation No: 0300X-CA-V0193

Subject: 300-7 Waste Site Cleanup Verification 95% UCL Calculations

Computer Program: Excel Program No: Excel 2010

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 9 Attm. 1 = 8 Total = 18	I. B. Berezovskiy	J. D. Skoglie	R. J. Nielson	S. G. Wilkinson	Signed on 12/8/14
1	Cover = 1 Sheets = 9 Attm. 1 = 8 Total = 18	J. D. Skoglie	I. B. Berezovskiy	NA	S. G. Wilkinson	6/30/15

SUMMARY OF REVISION

1	Sheets 1 and 2: references "DOE-RL, 2014a" and "DOE-RL, 2014b" revised to "DOE-RL, 2014" and "DOE-RL, 2015", respectively.
WCH-DE-018 (05/08/2007)	*Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie	**Date** 05/07/15	**Calc. No.** 0300X-CA-V0193	**Rev. No.** 1
Project 300 Area Closure Operations	**Job No.** 14655	**Checked** I. B. Berezovskiy	**Date** 05/07/15
Subject 300-7 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 1 of 9

Summary

Purpose:
The calculation provides documentation to support the calculation of the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for waste sites included in the 300 Area Final ROD (EPA 2013). ProUCL 4.1 (EPA 2010) software was used for all calculations.

Table of Contents:
Sheets 1 to 4 - Calculation Sheet Summary
Sheets 5 to 7 - Calculation Sheet Verification Data - Excavation Area
Sheets 8 to 9 - Calculation Sheet Split-Duplicate Analysis Excavation Area
Attachment 1 - 300-7, Verification Sampling Results (8 sheets)

Given/References:
1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2015), DOE-RL (2001), and Ecology (1996).
3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2014, *300 Area Remedial Action Sampling and Analysis Plan (SAP)*, DOE/RL-2001-48, Rev. 4, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) DOE-RL, 2015, *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils*, DOE/RL-2014-13-ADD1, Rev. 0., U.S. Department of Energy, Richland Operations Office, Richland, Washington.
6) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets)*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
7) Ecology, 1996, *Model Toxic Control Act Cleanup Levels and Risk Calculations (CLARC II)*, Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
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11) EPA, 2010, ProUCL, Version 4.1, U.S. Environmental Protection Agency, Washington, D.C. <http://www.epa.gov/osp/hstl/tsc/software.htm>.
12) EPA, 2013, *Record of Decision for the 300-FF-2 Operable Unit and 300-FF-5, and Record of Decision Amendment for 300-FF-1*, Rev. 0., Hanford Site, Benton County, Washington, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.
13) WCH, 2014, *300-7 Waste Site General UCL Statistics*, ProUCL Calculation Details, CCN 178055, Washington Closure Hanford, Richland, Washington.

Solution:
The subject calculations were performed on statistical verification sample data. Calculations were performed using ProUCL 4.1 (EPA 2010) software with the data presented on each calculation worksheet. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Cleanup Verification Package (CVP).

Calculation Description:
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 300-7 waste site. The data were entered into an EXCEL 2010 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2015) is documented by this calculation. Duplicate/Split RPD results are used in evaluation of data quality within the CVP for this site.

Methodology:
The excavation area of the 300-7 waste site underwent statistical sampling at 12 locations. One split and one duplicate were also taken. Analytical data for all sampling locations is provided in the summary tables on sheets 3 and 4.

The primary statistical calculation to support cleanup verification is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. In accordance with the RDR/RAWP (DOE-RL 2015), the 95% UCL values for detected COCs in statistical data sets are calculated for each decision unit according to the following:

If there are 5 or more detections of a given COC, and the COC is detected in 25% or more of the total samples, a UCL is calculated. A detection in either or both of the primary/duplicate sample pair is considered a single detection.

Summary (continued)

Methodology (continued):

If there are less than 5 detections of a given COC within a data set, a UCL is not calculated and the maximum concentration is used. A detection in either or both of the primary/duplicate sample pair is considered a single detection. Direct comparison of the maximum value against site cleanup levels (CULs) is used as the compliance basis. For convenience, these maximum detected values are included in the summary tables that follow.

If a given COC is detected in 5 or more samples, but is detected in 25% or less of the total samples, a UCL is not calculated and the maximum concentration is used. A detection in either or both of the primary/duplicate sample pair is considered a single detection.

If there are no detections of a COC, then there is no calculation or further evaluation performed for the COC.

For the statistical evaluation of primary/duplicate sample pairs, the following is applied to determine the value to be used in the UCL calculation:

- If detections are reported for both the primary and duplicate, the maximum concentration is used.
- If one detection and one nondetection are reported, the detected concentration is used.
- If both the primary and duplicate are reported as nondetects, the higher detection limit is used.

For sample results that are non-detects (e.g., "U" or "UJ" flagged), the full reported minimum detectable activity (radionuclides) or practical quantitation limit (nonradionuclides) value is used as the concentration. Data are then identified as detected (1) or non-detected (0) in the ProUCL data input file. The 95% UCL is computed by ProUCL using the identified detection status and all available data distributions. In cases that ProUCL output identifies more than one potential UCL for a given data set, the UCL with the highest value is chosen.

For focused sampling, no statistical evaluation is performed and the maximum detected value is used for comparison with the CULs. For convenience, these maximum detected values are included with the 95% UCL results in the summary tables that follow.

Calculated cleanup levels are not available in Ecology (2011) for calcium, magnesium, potassium, silicon, and sodium. The EPA's Risk Assessment Guidance for Superfund (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COCs and are also not included in these calculations. The 95% UCL values were not calculated for potassium-40, radium-226, radium-228, thorium-228, and thorium-232 based on natural occurrence at the Hanford Site.

ProUCL output from UCL analysis is presented in the 300-7 General UCL Statistics for Data Sets with Non-Detects (WCH 2014). In addition to identifying the 95% UCL for each data set, the ProUCL output includes additional statistical information.

ProUCL analysis may result in a potential UCL with a confidence limit greater than 95% (e.g., 97.5%, 99%). In such cases, the identified potential UCL is used and reported with the associated confidence limit. In cases that ProUCL output recommends more than one potential UCL for a given data set, the UCL with the highest value is chosen.. Arrangement of the ProUCL data output into formatted tables was performed to optimize data presentation in Attachment 1 for each sample set.

The RPD is calculated when both the primary value and the duplicate/split value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed in Table II-1 of the SAP (DOE-RL 2014) for certain constituents with cleanup levels or shown in laboratory-specific documents; all other constituents will have their own pre-determined TDL's based on the laboratory and method used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate/split sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

$$RPD = [\,|M-S|/((M+S)/2)]*100$$

where, M = Main Sample Value S = Split (or duplicate) Sample Value

For quality assurance/quality control (QA/QC) split and duplicate RPD calculations, a value less than 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. To assist in the identification of anomalous sample pairs, when an analyte is detected in the primary or duplicate/split sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate/split results exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. Regulatory split samples were collected for cleanup verification of the subject site.

Washington Closure Hanford **CALCULATION SHEET**

Originator	I. B. Berezovskiy	**Date**	11/20/14	**Calc. No.**	0300X-CA-V0193	**Rev. No.**	0
Project	300 Area Closure Operations	**Job No.**	14655	**Checked**	J. D. Skoglie	**Date**	11/20/14
Subject	300-7 Waste Site Cleanup Verification 95% UCL Calculations					**Sheet No.**	3 of 9

Summary (continued)

Qualifiers

* Indicates that a quality control parameter was not within specifications
B = Estimated result. Result is less than the RL, but greater than MDL.
D = dilution
J = estimate
M = sample duplicate precision not met
N = recovery is outside the control limits
P = aroclor target analyte with greater than 25% difference between column analyses
U = undetected
X (metals) = more than 40% difference between the primary and confirmation detector results

Acronyms

CUL = cleanup limit
CVP = cleanup verification package
DE = direct exposure
DS = detected sample
EXC = excavation
GW = groundwater
MDA = minimum detectable activity
MDL = method detection limit
PCB = polychlorinated biphenyls
PQL = practical quantitation limit
Q = qualifier
QA/QC = quality assurance/quality control
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
SAP = sampling and analysis plan
TDL = target detection limit
UCL = upper confidence limit
WAC = Washington Administrative Code

Washington Closure Hanford **CALCULATION SHEET**

Originator	I. B. Berezovskiy	**Date**	12/02/14	**Calc. No.**	0300X-CA-V0193	**Rev. No.**	0
Project	300 Area Closure Operations	**Job No.**	14655	**Checked**	J. D. Skoglie	**Date**	12/02/14
Subject	300-7 Waste Site Cleanup Verification 95% UCL Calculations					**Sheet No.**	4 of 9

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the maximum and 95% UCL calculations for the excavation, the WAC 173-340-740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the CVP for this waste site.

Results Summary - Excavation

Analyte	95% UCL Result	Maximum Result	Units
Europium-152	–	0.242	pCi/g
Europium-154	–	0.102	pCi/g
Plutonium-238	–	0.180	pCi/g
Uranium-233/234 (AEA)	0.990	–	pCi/g
Uranium-235 (AEA)	–	0.102	pCi/g
Uranium-238 (AEA)	0.912	–	pCi/g
Uranium (KPA)	1.69	–	pCi/g
Arsenic	2.96	–	mg/kg
Barium	90.1	–	mg/kg
Beryllium	1.39	–	mg/kg
Cadmium	0.483	–	mg/kg
Chromium	11.4	–	mg/kg
Cobalt	10.5	–	mg/kg
Copper	16.7	–	mg/kg
Lead	5.25	–	mg/kg
Lithium	9.42	–	mg/kg
Manganese	369	–	mg/kg
Mercury	0.00502	–	mg/kg
Molybdenum	0.338	–	mg/kg
Nickel	12.8	–	mg/kg
Selenium	1.73	–	mg/kg
Silver	0.168	–	mg/kg
Strontium	32.3	–	mg/kg
Uranium	2.84	–	mg/kg
Vanadium	90.0	–	mg/kg
Zinc	54.5	–	mg/kg
Aroclor-1254	0.094	–	mg/kg
Aroclor-1260	–	0.048	mg/kg

Relative Percent Difference Results and QA/QC Analysis[a]

Analyte	Excavation	
	Duplicate	Split Analysis
Ptassium-40	–	1.5%
Aluminum	13.5%	17.7%
Barium	6.8%	9.5%
Calcium	14.5%	29.4%
Chromium	7.4%	18.8%
Copper	6.6%	21.1%
Iron	10.8%	26.6%
Magnesium	14.4%	22.7%
Manganese	5.8%	11.3%
Silicon	***46.8%***	***116.4%***
Sodium	1.1%	***36.0%***
Strontium	14.2%	13.8%
Vanadium	0.3%	23.2%
Zinc	6.2%	27.4%
Zirconium	12.3%	20.4%

[a]RPD listed where result produced, based on criteria. If RPD not required, no value is listed. The significance of the reported RPD values, including values greater than 30% (35% for split data), is addressed in the data quality assessment section of the CVP.

CALCULATION SHEET

Washington Closure Hanford

Originator I. B. Berezovskiy	**Date** 11/20/14	**Calc. No.** 0300X-CA-V0193	**Rev. No.** 0
Project 300 Area Closure Operations	**Job No.** 14655	**Checked** J. D. Skoglie	**Date** 11/20/14
Subject 300-7 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 5 of 9

300-7 Statistical Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Uranium-233/234			Uranium-238			Uranium - KPA			Arsenic			Barium			Beryllium			Cadmium			Chromium			Cobalt		
			pCi/g	Q	MDA	pCi/g	Q	MDA	ug/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	0.550	J	0.050	0.732	J	0.050	0.595		0.100	2.68	B	0.501	88.1	NJ	0.100	1.19		0.100	0.409	B	0.100	9.11	*J	0.150	9.98	DJ	1.50
Duplicate of J1V0N4	J1V0P5	9/30/14	0.526	J	0.070	0.519	J	0.080	0.657		0.100	2.69	B	0.499	82.3	NJ	0.0999	1.18		0.0999	0.337	B	0.0999	9.81	*J	0.150	8.91	DJ	1.50
EXC-1	J1V0N3	9/30/14	0.668	J	0.080	0.452	J	0.080	0.528		0.100	1.95	B	0.501	84.4	NJ	0.100	1.17		0.100	0.431	B	0.100	8.01	*J	0.150	6.80	DJ	1.50
EXC-3	J1V0N5	9/30/14	0.420	J	0.060	0.569	J	0.050	0.493		0.100	3.65		0.486	92.3	NJ	0.0973	1.01		0.0973	0.282	B	0.0973	14.5	*J	0.146	8.35	DJ	1.46
EXC-4	J1V0N6	9/30/14	1.04	J	0.060	1.166	J	0.070	1.933		0.100	3.20		0.517	83.0	NJ	0.103	1.06		0.103	0.317	B	0.103	9.24	*J	0.155	7.73	DJ	1.55
EXC-5	J1V0N7	9/30/14	0.461	J	0.070	0.510	J	0.050	0.418		0.070	2.47	B	0.494	81.9	NJ	0.0988	1.31		0.0988	0.456	B	0.0988	9.71	*J	0.148	9.92	DJ	1.48
EXC-6	J1V0N8	9/30/14	0.853	J	0.070	0.708	J	0.050	0.509		0.100	2.72	B	0.506	80.1	NJ	0.101	1.07		0.101	0.341	B	0.101	10.6	*J	0.152	7.61	DJ	1.52
EXC-7	J1V0N9	9/30/14	1.99		0.140	1.629		0.190	2.538		0.100	3.55		0.500	96.6		0.100	1.11		0.100	0.131	B	0.100	13.0		0.150	12.2	D	1.50
EXC-8	J1V0P0	9/30/14	0.510	J	0.050	0.613	J	0.060	0.852		0.100	3.10		0.507	77.9	NJ	0.101	1.18		0.101	0.437	B	0.101	12.4	*J	0.152	8.94	DJ	1.52
EXC-9	J1V0P1	9/30/14	0.596	J	0.070	0.479	J	0.050	0.509		0.100	1.71	B	0.493	74.1	NJ	0.0986	1.55		0.0986	0.617		0.0986	9.12	*J	0.148	10.9	DJ	1.48
EXC-10	J1V0P2	9/30/14	0.483	J	0.060	0.447	J	0.050	0.542		0.090	1.92	B	0.501	106.0	NJ	0.100	1.64		0.100	0.618		0.100	9.67	*J	0.150	11.5	DJ	1.50
EXC-11	J1V0P3	9/30/14	0.670	J	0.070	0.507	J	0.060	0.619		0.100	2.55	B	0.497	84.3	NJ	0.0994	1.02		0.0994	0.331	B	0.0994	10.1	*J	0.149	7.92	DJ	1.49
EXC-12	J1V0P4	9/30/14	0.389	J	0.080	0.452	J	0.060	0.353		0.080	1.99	B	0.494	75.5	NJ	0.0988	1.61		0.0988	0.545		0.0988	8.89	*J	0.148	12.0	DJ	1.48

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Uranium-233/234			Uranium-238			Uranium - KPA			Arsenic			Barium			Beryllium			Cadmium			Chromium			Cobalt		
			pCi/g	DS		pCi/g	DS		mg/kg	DS		mg/kg	DS		mg/kg	DS		mg/kg	DS		mg/kg	DS		mg/kg	DS		mg/kg	DS	
EXC-2	J1V0N4/ J1V0P5	9/30/14	0.550	1		0.732	1		0.66	1		2.69	1		88.1	1		1.19	1		0.409	1		9.81	1		10.0	1	
EXC-1	J1V0N3	9/30/14	0.668	1		0.452	1		0.53	1		1.95	1		84.4	1		1.17	1		0.431	1		8.01	1		6.80	1	
EXC-3	J1V0N5	9/30/14	0.420	1		0.569	1		0.49	1		3.65	1		92.3	1		1.01	1		0.282	1		14.5	1		8.35	1	
EXC-4	J1V0N6	9/30/14	1.04	1		1.17	1		1.93	1		3.20	1		83.0	1		1.06	1		0.317	1		9.24	1		7.73	1	
EXC-5	J1V0N7	9/30/14	0.461	1		0.510	1		0.42	1		2.47	1		81.9	1		1.31	1		0.456	1		9.71	1		9.92	1	
EXC-6	J1V0N8	9/30/14	0.853	1		0.708	1		0.51	1		2.72	1		80.1	1		1.07	1		0.341	1		10.6	1		7.61	1	
EXC-7	J1V0N9	9/30/14	1.99	1		1.629	1		2.54	1		3.55	1		96.6	1		1.11	1		0.131	1		13.0	1		12.2	1	
EXC-8	J1V0P0	9/30/14	0.510	1		0.613	1		0.85	1		3.10	1		77.9	1		1.18	1		0.437	1		12.4	1		8.94	1	
EXC-9	J1V0P1	9/30/14	0.596	1		0.479	1		0.51	1		1.71	1		74.1	1		1.55	1		0.617	1		9.12	1		10.9	1	
EXC-10	J1V0P2	9/30/14	0.483	1		0.447	1		0.54	1		1.92	1		106	1		1.64	1		0.618	1		9.67	1		11.5	1	
EXC-11	J1V0P3	9/30/14	0.670	1		0.507	1		0.62	1		2.55	1		84.3	1		1.02	1		0.331	1		10.1	1		7.92	1	
EXC-12	J1V0P4	9/30/14	0.389	1		0.452	1		0.35	1		1.99	1		75.5	1		1.61	1		0.545	1		8.89	1		12.0	1	

Statistical Computations

	Uranium-233/234	Uranium-238	Uranium - KPA	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt
95% UCL based on	Use 95% Approximate Gamma UCL	Use 95% Approximate Gamma UCL	Use 95% Chebyshev UCL	Use 95% Student's-t UCL	Use 95% Student's-t UCL	Use 95% Approximate Gamma UCL	Use 95% Student's-t UCL	Use 95% Student's-t UCL	Use 95% Student's-t UCL
N	12	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mean	1.68	0.689	0.829	2.63	85.4	1.24	0.410	10.4	9.49
Standard deviation	1.55	0.358	0.681	0.654	9.22	0.231	0.142	1.91	1.86
95% UCL on mean	0.990	0.912	1.69	2.96	90.1	1.39	0.483	11.4	10.5
Maximum value	5.30	1.63	2.54	3.65	106	1.64	0.618	14.5	12.2

CALCULATION SHEET

Washington Closure Hanford

Originator I. B. Berezovskiy	**Date** 11/20/14	**Calc. No.** 0300X-CA-V0193	**Rev. No.** 0
Project 300 Area Closure Operations	**Job No.** 14655	**Checked** J. D. Skoglie	**Date** 11/20/14
Subject 300-7 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 6 of 9

300-7 Statistical Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Copper			Lead			Lithium			Manganese			Mercury			Molybdenum			Nickel			Selenium			Silver		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	15.7	*	0.301	3.31	DU	3.31	8.28	DN	0.398	373	*J	0.201	0.00373	U	0.00373	0.318	B	0.201	13.9	*	0.150	1.59	DN	0.328	0.105	B	0.100
Duplicate of J1V0N4	J1V0P5	9/30/14	14.7	*	0.30	3.80	BD	3.30	9.11	DN	0.401	352	*J	0.200	0.00389	U	0.00389	0.283	B	0.200	11.8	*	0.150	1.43	DN	0.331	0.211	B	0.100
EXC-1	J1V0N3	9/30/14	12.9	*	0.30	5.44	BD	3.30	10.7	DN	0.400	276	*J	0.200	0.00568	B	0.00405	0.316	B	0.200	8.57	*	0.150	1.69	DN	0.330	0.100	U	0.100
EXC-3	J1V0N5	9/30/14	17.6	*	0.292	3.34	BD	3.21	9.60	DN	0.404	323	*J	0.195	0.00444	B	0.00363	0.229	B	0.195	13.4	*	0.146	1.25	DN	0.333	0.0973	U	0.0973
EXC-4	J1V0N6	9/30/14	11.5	*	0.310	3.41	DU	3.41	8.42	DN	0.412	332	*J	0.207	0.00418	U	0.00418	0.270	B	0.207	9.94	*	0.155	1.30	DN	0.340	0.103	U	0.103
EXC-5	J1V0N7	9/30/14	15.2	*	0.296	6.77	BD	3.26	9.05	DN	0.386	376	*J	0.198	0.00396	U	0.00396	0.331	B	0.198	11.0	*	0.148	1.47	DN	0.319	0.139	B	0.0988
EXC-6	J1V0N8	9/30/14	12.3	*	0.304	4.51	BD	3.34	8.40	DN	0.408	330	*J	0.202	0.00345	U	0.00345	0.247	B	0.202	10.4	*	0.152	1.47	DN	0.337	0.157	B	0.101
EXC-7	J1V0N9	9/30/14	19.3		0.300	3.30	DU	3.30	8.88	DNJ	0.396	384		0.200	0.00381	B	0.00360	0.200	U	0.200	13.8		0.150	1.21	DN	0.327	0.100	U	0.100
EXC-8	J1V0P0	9/30/14	12.7	*	0.304	6.53	BD	3.35	8.56	DN	0.410	368	*J	0.203	0.00378	U	0.00378	0.415	B	0.203	13.5	*	0.152	1.66	DN	0.339	0.101	U	0.101
EXC-9	J1V0P1	9/30/14	16.2	*	0.296	3.25	DU	3.25	6.52	DN	0.393	353	*J	0.197	0.00375	U	0.00375	0.315	B	0.197	13.0	*	0.148	1.81	DN	0.324	0.0986	U	0.0986
EXC-10	J1V0P2	9/30/14	19.8	*	0.301	4.37	BD	3.31	10.3	DN	0.400	398	*J	0.200	0.00443	B	0.00362	0.370	B	0.200	12.6	*	0.150	2.42	DN	0.330	0.209	B	0.100
EXC-11	J1V0P3	9/30/14	11.5	*	0.298	6.33	BD	3.28	8.91	DN	0.398	348	*J	0.199	0.00802	B	0.00376	0.290	B	0.199	11.3	*	0.149	1.28	DN	0.329	0.161	B	0.0994
EXC-12	J1V0P4	9/30/14	17.4	*	0.296	3.26	DU	3.26	7.74	DN	0.402	365	*J	0.198	0.00400	B	0.00394	0.364	B	0.198	11.6	*	0.148	1.59	DN	0.332	0.226	B	0.0988

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Copper		Lead		Lithium		Manganese		Mercury		Molybdenum		Nickel		Selenium		Silver	
			mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS
EXC-2	J1V0N4/ J1V0P5	9/30/14	15.7	1	3.80	1	9.11	1	373	1	0.00389	0	0.318	1	13.9	1	1.59	1	0.211	1
EXC-1	J1V0N3	9/30/14	12.9	1	5.44	1	10.7	1	276	1	0.00568	1	0.316	1	8.57	1	1.69	1	0.100	0
EXC-3	J1V0N5	9/30/14	17.6	1	3.34	1	9.60	1	323	1	0.00444	1	0.229	1	13.4	1	1.25	1	0.0973	0
EXC-4	J1V0N6	9/30/14	11.5	1	3.41	0	8.42	1	332	1	0.00418	0	0.270	1	9.94	1	1.30	1	0.103	0
EXC-5	J1V0N7	9/30/14	15.2	1	6.77	1	9.05	1	376	1	0.00396	0	0.331	1	11.0	1	1.47	1	0.139	1
EXC-6	J1V0N8	9/30/14	12.3	1	4.51	1	8.40	1	330	1	0.00345	0	0.247	1	10.4	1	1.47	1	0.157	1
EXC-7	J1V0N9	9/30/14	19.3	1	3.30	0	8.88	1	384	1	0.00381	1	0.200	0	13.8	1	1.21	1	0.100	0
EXC-8	J1V0P0	9/30/14	12.7	1	6.53	1	8.56	1	368	1	0.00378	0	0.415	1	13.5	1	1.66	1	0.101	0
EXC-9	J1V0P1	9/30/14	16.2	1	3.25	0	6.52	1	353	1	0.00375	0	0.315	1	13.0	1	1.81	1	0.0986	0
EXC-10	J1V0P2	9/30/14	19.8	1	4.37	1	10.3	1	398	1	0.00443	1	0.370	1	12.6	1	2.42	1	0.209	1
EXC-11	J1V0P3	9/30/14	11.5	1	6.33	1	8.91	1	348	1	0.00802	1	0.290	1	11.3	1	1.28	1	0.161	1
EXC-12	J1V0P4	9/30/14	17.4	1	3.26	0	7.74	1	365	1	0.00400	1	0.364	1	11.6	1	1.59	1	0.226	1

Statistical Computations

	Copper	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver
95% UCL based on	Use 95% Student's-t UCL	Use 95% KM (t) UCL	Use 95% Student's-t UCL	Use 95% Student's-t UCL	Use 95% KM (t) UCL	Use 95% KM (t) UCL	Use 95% Student's-t UCL	Use 95% Student's-t UCL	Use 95% KM (t) UCL
N	12	12	12	12	12	12	12	12	12
% < Detection limit	0%	33%	0%	0%	50%	8%	0%	0%	50%
Mean	15.2	4.53	8.85	352	0.00445	0.305	11.9	1.56	0.142
Standard deviation	2.97	1.38	1.10	33.2	0.00126	0.0621	1.72	0.332	0.0500
95% UCL on mean	16.7	5.25	9.42	369	0.00502	0.338	12.8	1.73	0.168
Maximum value	19.8	6.77	10.7	398	0.00802	0.415	13.9	2.42	0.226

CALCULATION SHEET

Washington Closure Hanford

Originator I. B. Berezovskiy
Project 300 Area Closure Operations
Subject 300-7 Waste Site Cleanup Verification 95% UCL Calculations

Date 11/20/14
Job No. 14655

Calc. No. 0300X-CA-V0193
Checked J. D. Skoglie

Rev. No. 0
Date 11/20/14
Sheet No. 7 of 9

300-7 Statistical Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Strontium			Uranium			Vanadium			Zinc			Aroclor-1254		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	27.9		0.100	0.937	*DMN	0.0131	71.1	DN	1.00	51.5	*DNJ	4.01	1.12	U	1.12
Duplicate of J1V0N4	J1V0P5	9/30/14	24.2		0.0999	1.07	*DMN	0.0132	71.3	DN	0.999	48.4	*DNJ	3.99	1.14	U	1.14
EXC-1	J1V0N3	9/30/14	32.1		0.100	1.33	*DMN	0.0132	64.4	DN	1.00	37.8	*DNJ	4.01	1.12	U	1.12
EXC-3	J1V0N5	9/30/14	39.0		0.0973	1.60	*DMN	0.0133	62.6	DN	0.973	44.0	*DNJ	3.89	2.25	DU	2.25
EXC-4	J1V0N6	9/30/14	28.5		0.103	4.34	*DMN	0.0136	67.1	DN	1.03	43.2	*DNJ	4.14	8.72		1.16
EXC-5	J1V0N7	9/30/14	25.0		0.0988	0.939	*DMN	0.0127	81.8	DN	0.988	52.1	*DNJ	3.95	124	D	5.61
EXC-6	J1V0N8	9/30/14	25.8		0.101	2.10	*DMN	0.0135	64.5	DN	1.01	43.5	*DNJ	4.05	18.0		1.13
EXC-7	J1V0N9	9/30/14	34.9		0.100	5.30	*DMNJ	0.0131	73.7	DN	1.00	54.9	*DN	4.00	1.12	U	1.12
EXC-8	J1V0P0	9/30/14	32.7		0.101	1.04	*DMN	0.0135	80.8	DN	1.01	45.6	*DNJ	4.06	6.39		1.17
EXC-9	J1V0P1	9/30/14	34.0		0.0986	0.496	*DMN	0.0130	109	DN	0.986	57.1	*DNJ	3.94	1.12	U	1.12
EXC-10	J1V0P2	9/30/14	30.2		0.100	0.624	*DMN	0.0132	98.9	DN	1.00	61.5	*DNJ	4.01	1.12	U	1.12
EXC-11	J1V0P3	9/30/14	20.9		0.0994	0.797	*DMN	0.0132	61.3	DN	0.994	48.8	*DNJ	3.98	6.64	P	1.12
EXC-12	J1V0P4	9/30/14	24.5		0.0988	0.479	*DMN	0.0133	121	DN	0.988	64.0	*DNJ	3.95	1.12	U	1.12

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Strontium		Uranium		Vanadium		Zinc		Aroclor-1254	
			mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS
EXC-2	J1V0N4/ J1V0P5	9/30/14	27.9	1	1.07	1	71.3	1	51.5	1	1.14	0
EXC-1	J1V0N3	9/30/14	32.1	1	1.33	1	64.4	1	37.8	1	1.12	0
EXC-3	J1V0N5	9/30/14	39.0	1	1.60	1	62.6	1	44.0	1	2.25	0
EXC-4	J1V0N6	9/30/14	28.5	1	4.34	1	67.1	1	43.2	1	8.72	1
EXC-5	J1V0N7	9/30/14	25.0	1	0.939	1	81.8	1	52.1	1	124	1
EXC-6	J1V0N8	9/30/14	25.8	1	2.10	1	64.5	1	43.5	1	18.0	1
EXC-7	J1V0N9	9/30/14	34.9	1	5.30	1	73.7	1	54.9	1	1.12	0
EXC-8	J1V0P0	9/30/14	32.7	1	1.04	1	80.8	1	45.6	1	6.39	1
EXC-9	J1V0P1	9/30/14	34.0	1	0.496	1	109	1	57.1	1	1.12	0
EXC-10	J1V0P2	9/30/14	30.2	1	0.624	1	98.9	1	61.5	1	1.12	0
EXC-11	J1V0P3	9/30/14	20.9	1	0.797	1	61.3	1	48.8	1	6.64	1
EXC-12	J1V0P4	9/30/14	24.5	1	0.479	1	121	1	64.0	1	1.12	0

Statistical Computations

	Strontium	Uranium	Vanadium	Zinc	Aroclor-1254
95% UCL based on	Use 95% Student's-t UCL	Use 95% Approximate Gamma UCL	Use 95% Student's-t UCL	Use 95% Student's-t UCL	Use 95% Approximate Gamma KM UCL
N	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	58%
Mean	29.6	1.68	79.7	50.3	14.4
Standard deviation	5.16	1.55	19.8	7.99	34.9
95% UCL on mean	32.3	2.84	90.0	54.5	93.5
Maximum value	39.0	5.30	121	64.0	124

CALCULATION SHEET

Washington Closure Hanford

Originator I. B. Berezovskiy
Project 300 Area Closure Operations
Subject 300-7 Waste Site Cleanup Verification 95% UCL Calculations

Date 12/02/14
Job No. 14655

Calc. No. 0300X-CA-V0193
Checked J. D. Skoglie

Rev. No. 0
Date 12/02/14
Sheet No. 8 of 9

Duplicate/Split Analysis - 300-7 Excavation Samples

Sampling Area	Sample Number	Sample Date	Lead-212 pCi/g	Q	MDA	Lead-214 pCi/g	Q	MDA	Potassium-40 ug/g	Q	MDA	Radium-226 pCi/g	Q	MDA	Radium-228 pCi/g	Q	MDA	Thallium-208 ug/g	Q	MDA	Uranium-233/234 - AEA pCi/g	Q	MDA	Uranium-238 - AEA pCi/g	Q	MDA	Uranium - KPA ug/g	Q	MDA
EXC-2	J1V0N4	9/30/14	0.818		0.290	0.487		0.280	14.1		1.21	0.642		0.320	0.750		0.550	0.575		0.530	0.550		0.050	0.732		0.050	0.595		0.100
Duplicate of J1V0N4	J1V0P5	9/30/14	0.628		0.180	0.485		0.140	14.3		0.910	0.518		0.280	0.683		0.300	0.537		0.250	0.526		0.070	0.519		0.080	0.657		0.100
Split of J1V0N4	J1V0P7	9/30/14							13.9		0.237	0.426		0.037	0.644		0.087				0.424		0.076	0.452		0.080	1.44		0.131

Analysis:

		Lead-212	Lead-214	Potassium-40	Radium-226	Radium-228	Thallium-208	Uranium-233/234 - AEA	Uranium-238 - AEA	Uranium - KPA
TDL		1	1	1	1	1	1	1	1	1
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD			1.3%						
	Difference > 2 TDL?	**No - acceptable**	No - acceptable	**No - acceptable**	**No - acceptable**	No - acceptable	**No - acceptable**	**No - acceptable**	No - acceptable	**No - acceptable**
Split Analysis	Both > PQL?	**No-Stop (acceptable)**	**No-Stop (acceptable)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**No-Stop (acceptable)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?			**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)		No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD			1.5%						
	Difference > 2 TDL?	**No - acceptable**	No - acceptable	No - acceptable	**No - acceptable**	No - acceptable	No - acceptable	**No - acceptable**	No - acceptable	No - acceptable

Duplicate/Split Analysis - 300-7 Excavation Samples

Sampling Area	Sample Number	Sample Date	Aluminum mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	6850	*J	6.82	2.68	B	0.501	88.1	NJ	0.100	1.19		0.100	0.409	B	0.100	7330	*	8.02	9.11	*J	0.150	9.98	DJ	1.50	15.7	*	0.301
Duplicate of J1V0N4	J1V0P5	9/30/14	7840	*J	6.79	2.69	B	0.499	82.3	NJ	0.100	1.18		0.100	0.337	B	0.0999	6340	*	7.99	9.81	*J	0.150	8.91	DJ	1.50	14.7	*	0.300
Split of J1V0N4	J1V0P7	9/30/14	8180		1.60	2.70		0.670	80.1		0.0770	0.0330	U	0.0330	0.110	B	0.0410	5450	X	14.2	11.0	X	0.0590	7.90	X	0.100	12.7	X	0.220

Analysis:

		Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper
TDL		5	10	2	0.5	0.5	100	1	2	1
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD	13.5%		6.8%			14.5%	7.4%		6.6%
	Difference > 2 TDL?	**Yes - assess further**	No - acceptable	**Yes - assess further**	No - acceptable	No - acceptable	Yes - assess further	No - acceptable	No - acceptable	No - acceptable
Split Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	No-Stop (acceptable)	Yes (continue)	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**		No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD	17.7%		9.5%			29.4%	18.8%		21.1%
	Difference > 2 TDL?	**Yes - assess further**	No - acceptable	Yes - assess further	Yes - assess further	No - acceptable	Yes - assess further	No - acceptable	No - acceptable	Yes - assess further

CALCULATION SHEET

Washington Closure Hanford

Originator I. B. Berezovskiy
Project 300 Area Closure Operations
Subject 300-7 Waste Site Cleanup Verification 95% UCL Calculations

Date 11/20/14
Job No. 14655

Calc. No. 0300X-CA-V0193
Checked J. D. Skoglie

Rev. No. 0
Date 11/20/14
Sheet No. 9 of 9

Duplicate/Split Analysis - 300-7 Excavation Samples

Sampling Area	Sample Number	Sample Date	Iron			Lithium			Magnesium			Manganese			Molybdenum			Nickel			Potassium			Selenium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	27300	*J	8.02	8.28	DN	0.398	5750	*J	8.52	373	*J	0.201	0.318	B	0.201	13.9	*	0.150	1150	*NJ	6.42	1.59	DN	0.328	931	*N	1.50
Duplicate of J1V0N4	J1V0P5	9/30/14	24500	*J	7.99	9.11	DN	0.401	4980	*J	8.49	352	*J	0.200	0.283	B	0.200	11.8	*	0.150	1350	*NJ	6.39	1.43	DN	0.331	1500	*N	1.50
Split of J1V0N4	J1V0P7	9/30/14	20900	X	3.80	7.90		0.300	4580	X	3.70	333	X	0.100	0.260	U	0.260	13.5	X	0.120	1230		41.4	24.3	X	0.036	246	N	5.70

Analysis:

TDL		5	2.5	75	5	20	4	400	10	2
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD	10.8%		14.4%	5.8%					*46.8%*
	Difference > 2 TDL?	**Yes - assess further**	No - acceptable	Yes - assess further	**Yes - assess further**	**No - acceptable**	No - acceptable	No - acceptable	No - acceptable	**Yes - assess further**
Split Analysis	Both > PQL?	**Yes (continue)**	Yes (continue)	**Yes (continue)**	**Yes (continue)**	**No-Stop (acceptable)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**		No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD	26.6%		22.7%	11.3%					*116.4%*
	Difference > 2 TDL?	**Yes - assess further**	No - acceptable	Yes - assess further	**Yes - assess further**	**No - acceptable**	**No - acceptable**	No - acceptable	Yes - assess further	**Yes - assess further**

Duplicate/Split Analysis - 300-7 Excavation Samples

Sampling Area	Sample Number	Sample Date	Silver			Sodium			Strontium			Uranium			Vanadium			Zinc			Zirconium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	0.105	B	0.100	264	NJ	7.02	27.9		0.100	0.937	*DMN	0.0131	71.1	DN	1.00	51.5	*DNJ	4.01	30.3	DM	0.0995
Duplicate of J1V0N4	J1V0P5	9/30/14	0.211	B	0.0999	267	NJ	6.99	24.2		0.0999	1.07	*DMN	0.0132	71.3	DN	0.999	48.4	*DNJ	3.99	26.8	DM	0.100
Split of J1V0N4	J1V0P7	9/30/14	0.160	U	0.160	380	M	59.6	24.3	X	0.0360	0.940		0.00150	56.3		0.0950	39.1	X	0.400	24.7	X	0.360

Analysis:

TDL		50	50	0.1	1	2.5	1.0	2.5
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD		1.1%	14.2%		0.3%	6.2%	12.3%
	Difference > 2 TDL?	No - acceptable	No - acceptable	**Yes - assess further**	**No - acceptable**	No - acceptable	Yes - assess further	No - acceptable
Split Analysis	Both > PQL?	**No-Stop (acceptable)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?		**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD		*36.0%*	13.8%		23.2%	27.4%	20.4%
	Difference > 2 TDL?	No - acceptable	Yes - assess further	**Yes - assess further**	**No - acceptable**	Yes - assess further	**Yes - assess further**	Yes - assess further

Attachment 1. 300-7 Waste Site Verification Sample Results (Radionuclides).

Location	HEIS Number	Date	Americium-241			Antimony-125			Cerium-144			Cesium-134			Cesium-137		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-2	J1V0N4	9/30/14	-0.011	U	0.180	0.064	U	0.310	-0.058	U	0.540	0.021	U	0.140	0.019	U	0.140
Duplicate of J1V0N4	J1V0P5	9/30/14	0.044	U	0.090	0.059	U	0.130	0.150	U	0.330	0.015	U	0.050	-0.003	U	0.060
EXC-1	J1V0N3	9/30/14	0.018	U	0.090	-0.003	U	0.130	-0.034	U	0.330	0.004	U	0.050	-0.037	U	0.060
EXC-3	J1V0N5	9/30/14	-0.145	U	0.150	0.045	U	0.180	-0.169	U	0.410	0.010	U	0.070	0.025	U	0.080
EXC-4	J1V0N6	9/30/14	0.016	U	0.100	0.066	U	0.140	0.115	U	0.370	0.007	U	0.050	-0.013	U	0.060
EXC-5	J1V0N7	9/30/14	-0.056	U	0.140	0.110	U	0.170	-0.160	U	0.400	-0.005	U	0.060	0.015	U	0.070
EXC-6	J1V0N8	9/30/14	0.023	U	0.090	0.016	U	0.130	0.149	U	0.360	-0.048	U	0.050	0.011	U	0.060
EXC-7	J1V0N9	9/30/14	-0.002	U	0.150	0.019	U	0.180	-0.052	U	0.430	-0.004	U	0.070	0.008	U	0.070
EXC-8	J1V0P0	9/30/14	-0.122	U	0.120	-0.019	U	0.140	0.161	U	0.330	-0.004	U	0.050	0.014	U	0.060
EXC-9	J1V0P1	9/30/14	-0.055	U	0.080	0.007	U	0.120	0.183	U	0.320	0.008	U	0.050	0.001	U	0.050
EXC-10	J1V0P2	9/30/14	-0.222	U	0.130	-0.024	U	0.160	-0.246	U	0.390	-0.007	U	0.060	0.019	U	0.060
EXC-11	J1V0P3	9/30/14	0.110	U	0.200	-0.169	U	0.330	0.035	U	0.610	-0.008	U	0.150	0.078	U	0.150
EXC-12	J1V0P4	9/30/14	-0.052	U	0.100	-0.079	U	0.120	0.094	U	0.300	-0.007	U	0.050	-0.006	U	0.050
Split of J1V0N4	J1V0P7	9/30/14	0.0118	U	0.0299	0.0111	U	0.0474	-0.0604	U	0.0823	0.0262	U	0.0292	-0.00454	U	0.0211

Location	HEIS Number	Date	Cobalt-60			Europium-152			Europium-154			Europium-155			Lead-212		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-2	J1V0N4	9/30/14	-0.015	U	0.150	0.128	U	0.290	-0.098	U	0.150	0.056	U	0.220	0.818		0.290
Duplicate of J1V0N4	J1V0P5	9/30/14	0.011	U	0.060	0.040	U	0.170	0.037	U	0.090	-0.092	U	0.140	0.628		0.180
EXC-1	J1V0N3	9/30/14	-0.0004	U	0.060	-0.163	U	0.180	-0.018	U	0.090	0.140	U	0.180	0.669		0.140
EXC-3	J1V0N5	9/30/14	0.019	U	0.090	0.001	U	0.210	0.032	U	0.110	0.114	U	0.170	0.755		0.200
EXC-4	J1V0N6	9/30/14	0.030	U	0.050	0.181	U	0.180	-0.012	U	0.090	0.043	U	0.150	0.618		0.190
EXC-5	J1V0N7	9/30/14	-0.00003	U	0.080	0.155	U	0.200	-0.017	U	0.110	-0.027	U	0.160	0.651		0.180
EXC-6	J1V0N8	9/30/14	-0.009	U	0.060	0.242		0.170	-0.021	U	0.090	0.036	U	0.150	0.672		0.160
EXC-7	J1V0N9	9/30/14	-0.011	U	0.080	-0.073	U	0.220	0.025	U	0.110	0.051	U	0.170	0.943		0.190
EXC-8	J1V0P0	9/30/14	0.012	U	0.050	0.057	U	0.170	0.025	U	0.080	-0.011	U	0.150	0.773		0.180
EXC-9	J1V0P1	9/30/14	0.004	U	0.050	-0.024	U	0.160	0.009	U	0.080	0.086	U	0.140	0.552		0.140
EXC-10	J1V0P2	9/30/14	0.004	U	0.080	0.090	U	0.210	-0.086	U	0.100	0.018	U	0.160	0.728		0.150
EXC-11	J1V0P3	9/30/14	0.052	U	0.140	-0.047	U	0.300	0.112	U	0.150	0.058	U	0.240	1.053		0.370
EXC-12	J1V0P4	9/30/14	-0.013	U	0.040	0.002	U	0.140	0.102		0.070	0.041	U	0.120	0.579		0.150
Split of J1V0N4	J1V0P7	9/30/14	0.00327	U	0.0261	-0.00896	U	0.0453	0.0280	U	0.0846	0.0391	U	0.0436			

Acronyms and notes apply to all of the tables in this attachment.

Gray cells indicate not applicable.

* Indicates that a quality control parameter was not within specifications

Note: Data qualified with B, C, D, J, N and/or X are considered acceptable values.

B = Estimated result. Result is less than the RL, but greater than MDL.

D = dilution

EXC = excavation

HEIS = Hanford Environmental Information System

J = estimated

MDA = minimal detectable activity

MDL = method detection limit

M = sample duplicate precision not met

N = recovery is outside the control limits

P = aroclor target analyte with greater than 25% difference between column analyses

PCB = polychlorinated biphenyls

PQL = practical quantitation limit

Q = qualifier

U = undetected

X = more than 40% difference between the primary and confirmation detector results.

Attachment	1	Sheet No.	1 of 8
Originator	I. B. Berezovskiy	Date	11/20/14
Checked	J. D. Skoglie	Date	11/20/14
Calc. No.	0300X-CA-V0193	Rev. No.	0

Attachment 1. 300-7 Waste Site Verification Sample Results (Radionuclides).

Location	HEIS Number	Date	Lead-214			Potassium-40			Protactinium-234m			Radium-226			Radium-228		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-2	J1V0N4	9/30/14	0.487		0.280	14.1		1.21	4.42	U	14.1	0.642		0.320	0.750		0.550
Duplicate of J1V0N4	J1V0P5	9/30/14	0.485		0.140	14.3		0.910	-2.36	U	5.27	0.518		0.280	0.683		0.300
EXC-1	J1V0N3	9/30/14	0.558		0.140	14.3		0.460	0.467	U	6.46	0.712		0.160	0.795		0.480
EXC-3	J1V0N5	9/30/14	0.569		0.160	14.2		0.710	2.25	U	8.40	0.537		0.200	0.793		0.540
EXC-4	J1V0N6	9/30/14	0.475		0.180	16.4		0.620	0.096	U	6.10	0.553		0.150	0.660		0.450
EXC-5	J1V0N7	9/30/14	0.505		0.160	13.7		0.830	0.318	U	7.16	0.443		0.270	0.577		0.380
EXC-6	J1V0N8	9/30/14	0.509		0.140	15.5		0.720	1.54	U	6.32	0.527		0.140	0.649		0.290
EXC-7	J1V0N9	9/30/14	0.686		0.200	13.1		0.670	3.51	U	8.85	0.566		0.150	0.803		0.330
EXC-8	J1V0P0	9/30/14	0.655		0.180	14.5		0.810	2.92	U	6.18	0.655		0.130	0.851		0.280
EXC-9	J1V0P1	9/30/14	0.479		0.130	12.6		0.410	-1.88	U	5.22	0.458		0.140	0.497		0.330
EXC-10	J1V0P2	9/30/14	0.477		0.180	13.1		0.760	5.02	U	8.26	0.470		0.300	0.762		0.540
EXC-11	J1V0P3	9/30/14	0.663		0.280	17.0		1.79	-4.66	U	13.0	0.720		0.430	0.867		0.550
EXC-12	J1V0P4	9/30/14	0.452		0.160	11.8		0.640	0.620	U	5.25	0.458		0.160	0.542		0.230
Split of J1V0N4	J1V0P7	9/30/14				13.9		0.237				0.426		0.0367	0.644		0.0868

Location	HEIS Number	Date	Ruthenium-106			Thallium-208			Thorium-234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-2	J1V0N4	9/30/14	-0.693	U	1.01	0.575		0.530	1.44	U	2.25	0.072	U	0.640	1.44	U	2.25
Duplicate of J1V0N4	J1V0P5	9/30/14	-0.090	U	0.510	0.537		0.250	0.515	U	0.910	0.025	U	0.350	0.515	U	0.910
EXC-1	J1V0N3	9/30/14	-0.073	U	0.500	0.690		0.190	1.42	U	1.67	-0.134	U	0.360	1.42	U	1.67
EXC-3	J1V0N5	9/30/14	-0.188	U	0.500	0.558		0.100	0.963	U	1.48	0.074	U	0.430	0.963	U	1.48
EXC-4	J1V0N6	9/30/14	-0.158	U	0.450	0.620		0.110	1.01	U	1.65	0.052	U	0.380	1.01	U	1.65
EXC-5	J1V0N7	9/30/14	0.152	U	0.580	0.458		0.190	0.819	U	1.40	-0.009	U	0.420	0.819	U	1.40
EXC-6	J1V0N8	9/30/14	0.093	U	0.530	0.553		0.100	1.17	U	1.71	0.276	U	0.350	1.17	U	1.71
EXC-7	J1V0N9	9/30/14	-0.114	U	0.560	0.661		0.210	3.48		2.12	0.408	U	0.490	3.48		2.12
EXC-8	J1V0P0	9/30/14	0.042	U	0.480	0.713		0.120	1.36		1.26	0.208	U	0.350	1.36		1.26
EXC-9	J1V0P1	9/30/14	-0.052	U	0.460	0.530		0.100	0.988	U	1.17	0.135	U	0.310	0.988	U	1.17
EXC-10	J1V0P2	9/30/14	0.131	U	0.590	0.510		0.100	0.791	U	1.38	0.223	U	0.410	0.791	U	1.38
EXC-11	J1V0P3	9/30/14	0.173	U	1.16	0.765		0.510	1.13	U	2.05	-0.064	U	0.670	1.13	U	2.05
EXC-12	J1V0P4	9/30/14	0.373	U	0.480	0.486		0.130	1.45		1.08	0.316		0.310	1.45		1.08
Split of J1V0N4	J1V0P7	9/30/14	0.0839	U	0.179							0.00917	U	0.0866	0.610		0.282

Attachment	1	Sheet No.	2 of 8
Originator	I. B. Berezovskiy	Date	11/20/14
Checked	J. D. Skoglie	Date	11/20/14
Calc. No.	0300X-CA-V0193	Rev. No.	0

Attachment 1. 300-7 Waste Site Verification Sample Results (Radionuclides).

Location	HEIS Number	Date	Zinc-65			Americium-241 - AEA			Curium-243/244 - AEA			Plutonium-238 - AEA			Plutonium-239/240 - AEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-2	J1V0N4	9/30/14	0.018	U	0.300	-0.026	U	0.190	0.033	U	0.140	0.008	U	0.120	-0.011	U	0.090
Duplicate of J1V0N4	J1V0P5	9/30/14	0.026	U	0.120	0.064	U	0.150	0.064	U	0.150	0.180		0.080	0.280	U	0.070
EXC-1	J1V0N3	9/30/14	-0.005	U	0.120	0.042	U	0.140	0.031	U	0.110	0.145	U	0.190	0.067	U	0.140
EXC-3	J1V0N5	9/30/14	-0.001	U	0.160	-0.025	U	0.220	0.072	U	0.160	0.025	U	0.120	0.025	U	0.090
EXC-4	J1V0N6	9/30/14	-0.034	U	0.130	0.007	U	0.260	0.073	U	0.210	0.003	U	0.110	-0.013	U	0.110
EXC-5	J1V0N7	9/30/14	-0.025	U	0.130	0.161	U	0.170	0.075	U	0.160	0.014	U	0.070	0.030	U	0.070
EXC-6	J1V0N8	9/30/14	-0.004	U	0.120	0.006	U	0.100	0.003	U	0.110	0.037	U	0.050	0.013	UJ	0.080
EXC-7	J1V0N9	9/30/14	-0.030	U	0.150	0.052	U	0.120	0.037	U	0.120	0.053	U	0.080	0.013	UJ	0.080
EXC-8	J1V0P0	9/30/14	0.025	U	0.120	0.027	U	0.090	0.015	U	0.070	0.047	U	0.110	-0.003	U	0.080
EXC-9	J1V0P1	9/30/14	-0.010	U	0.120	0.064	U	0.180	0.051	U	0.220	0.028	U	0.100	-0.006	U	0.090
EXC-10	J1V0P2	9/30/14	0.022	U	0.150	0.017	U	0.080	0.027	U	0.110	0.108	J	0.080	0.070	UJ	0.050
EXC-11	J1V0P3	9/30/14	-0.090	U	0.290	0.066	U	0.090	0.015	U	0.090	0.074	U	0.090	-0.002	U	0.060
EXC-12	J1V0P4	9/30/14	-0.030	U	0.120	0.060	U	0.150	0.068	U	0.120	0.006	U	0.110	0.020	U	0.120
Split of J1V0N4	J1V0P7	9/30/14	0.0262	U	0.0562	0.0364	U	0.0922	-0.00537	U	0.0821	-0.00486	U	0.0897	-0.00139	U	0.0698

Location	HEIS Number	Date	Uranium-233/234 - AEA			Uranium-235 - AEA			Uranium-238 - AEA			Total beta radiostrontium			Uranium - KPA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	ug/g	Q	MDA
EXC-2	J1V0N4	9/30/14	0.550	J	0.050	0.054	UJ	0.080	0.732	J	0.050	0.329	U	0.340	0.595		0.100
Duplicate of J1V0N4	J1V0P5	9/30/14	0.526	J	0.070	0.076	J	0.070	0.519	J	0.080	0.336	U	0.350	0.657		0.100
EXC-1	J1V0N3	9/30/14	0.668	J	0.080	0	UJ	0.100	0.452	J	0.080	0.058	U	0.350	0.528		0.100
EXC-3	J1V0N5	9/30/14	0.420	J	0.060	0.046	UJ	0.090	0.569	J	0.050	0.350	U	0.370	0.493		0.100
EXC-4	J1V0N6	9/30/14	1.04	J	0.060	0.088	J	0.080	1.166	J	0.070	0.588		0.380	1.933		0.100
EXC-5	J1V0N7	9/30/14	0.461	J	0.070	0.009	UJ	0.070	0.510	J	0.050	0.104	U	0.440	0.418		0.070
EXC-6	J1V0N8	9/30/14	0.853	J	0.070	0.071	UJ	0.070	0.708	J	0.050	0.047	U	0.410	0.509		0.100
EXC-7	J1V0N9	9/30/14	1.99		0.140	0.065	UJ	0.160	1.629		0.190	0.789		0.390	2.538		0.100
EXC-8	J1V0P0	9/30/14	0.510	J	0.050	0.025	UJ	0.070	0.613	J	0.060	0.684		0.340	0.852		0.100
EXC-9	J1V0P1	9/30/14	0.596	J	0.070	0.102	J	0.060	0.479	J	0.050	0.041	U	0.370	0.509		0.100
EXC-10	J1V0P2	9/30/14	0.483	J	0.060	0.029	UJ	0.090	0.447	J	0.050	0.269	U	0.310	0.542		0.090
EXC-11	J1V0P3	9/30/14	0.670	J	0.070	0.046	UJ	0.090	0.507	J	0.060	0.281	U	0.420	0.619		0.100
EXC-12	J1V0P4	9/30/14	0.389	J	0.080	0.066	UJ	0.100	0.452	J	0.060	0.320		0.310	0.353		0.080
Split of J1V0N4	J1V0P7	9/30/14	0.424		0.0760	0.0265	U	0.0556	0.482		0.0632	0.105	U	0.266	1.44		0.131

Attachment	1	Sheet No.	3 of 8
Originator	I. B. Berezovskiy	Date	11/20/14
Checked	J. D. Skoglie	Date	11/20/14
Calc. No.	0300X-CA-V0193	Rev. No.	0

Attachment 1. 300-7 Waste Site Verification Sample Results (Metals).

LOCATION	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	6850	*J	6.82	3.31	DNU	3.31	2.68	B	0.501	88.1	NJ	0.100
Duplicate of J1V0N4	J1V0P5	9/30/14	7840	*J	6.79	3.30	DNU	3.30	2.69	B	0.499	82.3	NJ	0.100
EXC-1	J1V0N3	9/30/14	5700	*J	6.81	3.30	DNU	3.30	1.95	B	0.501	84.4	NJ	0.100
EXC-3	J1V0N5	9/30/14	8680	*J	6.62	3.21	DNU	3.21	3.65		0.486	92.3	NJ	0.097
EXC-4	J1V0N6	9/30/14	6610	*J	7.04	3.41	DNU	3.41	3.20		0.517	83.0	NJ	0.103
EXC-5	J1V0N7	9/30/14	7560	*J	6.72	3.26	DNU	3.26	2.47	B	0.494	81.9	NJ	0.099
EXC-6	J1V0N8	9/30/14	7110	*J	6.88	3.34	DNU	3.34	2.72	B	0.506	80.1	NJ	0.101
EXC-7	J1V0N9	9/30/14	8390		6.80	3.30	DU	3.30	3.55		0.500	96.6		0.100
EXC-8	J1V0P0	9/30/14	7230	*J	6.90	3.35	DNU	3.35	3.10		0.507	77.9	NJ	0.101
EXC-9	J1V0P1	9/30/14	7050	*J	6.70	3.25	DNU	3.25	1.71	B	0.493	74.1	NJ	0.099
EXC-10	J1V0P2	9/30/14	8610	*J	6.81	3.31	DNU	3.31	1.92	B	0.501	106	NJ	0.100
EXC-11	J1V0P3	9/30/14	7690	*J	6.76	3.28	DNU	3.28	2.55	B	0.497	84.3	NJ	0.099
EXC-12	J1V0P4	9/30/14	7560	*J	6.72	3.26	DNU	3.26	1.99	B	0.494	75.5	NJ	0.099
Split of J1V0N4	J1V0P7	9/30/14	8180		1.60	0.380	U	0.380	2.70		0.670	80.1		0.077
Equipment blank	J1V0P6	9/30/14	89.1	*J	6.71	0.326	NU	0.326	0.493	U	0.493	1.37	NJ	0.099

LOCATION	HEIS Number	Sample Date	Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	1.19		0.100	1.00	U	1.00	0.409	B	0.100	7330	*	8.02
Duplicate of J1V0N4	J1V0P5	9/30/14	1.18		0.0999	0.999	U	0.999	0.337	B	0.0999	6340	*	7.99
EXC-1	J1V0N3	9/30/14	1.17		0.100	1.00	U	1.00	0.431	B	0.100	12700	*	8.01
EXC-3	J1V0N5	9/30/14	1.01		0.0973	0.973	U	0.973	0.282	B	0.0973	16900	*	7.78
EXC-4	J1V0N6	9/30/14	1.06		0.103	1.03	U	1.03	0.317	B	0.103	9470	*	8.28
EXC-5	J1V0N7	9/30/14	1.31		0.0988	0.988	U	0.988	0.456	B	0.0988	6490	*	7.90
EXC-6	J1V0N8	9/30/14	1.07		0.101	1.01	U	1.01	0.341	B	0.101	6900	*	8.10
EXC-7	J1V0N9	9/30/14	1.11		0.100	1.16	B	1.00	0.131	B	0.100	11800		8.00
EXC-8	J1V0P0	9/30/14	1.18		0.101	1.01	U	1.01	0.437	B	0.101	11400	*	8.11
EXC-9	J1V0P1	9/30/14	1.55		0.0986	0.986	U	0.986	0.617		0.0986	9080	*	7.89
EXC-10	J1V0P2	9/30/14	1.64		0.100	1.00	U	1.00	0.618		0.100	6380	*	8.02
EXC-11	J1V0P3	9/30/14	1.02		0.0994	0.994	U	0.994	0.331	B	0.0994	3730	*	7.95
EXC-12	J1V0P4	9/30/14	1.61		0.0988	0.988	U	0.988	0.545		0.0988	6130	*	7.91
Split of J1V0N4	J1V0P7	9/30/14	0.033	U	0.033	0.990	U	0.990	0.110	B	0.0410	5450	X	14.2
Equipment blank	J1V0P6	9/30/14	0.0987	U	0.0987	0.987	U	0.987	0.0987	U	0.0987	21.6	*B	7.89

Attachment	1	Sheet No.	4 of 8
Originator	I. B. Berezovskiy	Date	11/20/14
Checked	J. D. Skoglie	Date	11/20/14
Calc. No.	0300X-CA-V0193	Rev. No.	0

Attachment 1. 300-7 Waste Site Verification Sample Results (Metals).

LOCATION	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	9.11	*J	0.150	9.98	DJ	1.50	15.7	*	0.301	27300	*J	8.02
Duplicate of J1V0N4	J1V0P5	9/30/14	9.81	*J	0.150	8.91	DJ	1.50	14.7	*	0.300	24500	*J	7.99
EXC-1	J1V0N3	9/30/14	8.01	*J	0.150	6.80	DJ	1.50	12.9	*	0.300	19900	*J	8.01
EXC-3	J1V0N5	9/30/14	14.5	*J	0.146	8.35	DJ	1.46	17.6	*	0.292	22500	*J	7.78
EXC-4	J1V0N6	9/30/14	9.24	*J	0.155	7.73	DJ	1.55	11.5	*	0.310	23000	*J	8.28
EXC-5	J1V0N7	9/30/14	9.71	*J	0.148	9.92	DJ	1.48	15.2	*	0.296	25200	*J	7.90
EXC-6	J1V0N8	9/30/14	10.6	*J	0.152	7.61	DJ	1.52	12.3	*	0.304	22800	*J	8.10
EXC-7	J1V0N9	9/30/14	13.0		0.150	12.2	D	1.50	19.3		0.300	23600		8.00
EXC-8	J1V0P0	9/30/14	12.4	*J	0.152	8.94	DJ	1.52	12.7	*	0.304	26900	*J	8.11
EXC-9	J1V0P1	9/30/14	9.12	*J	0.148	10.9	DJ	1.48	16.2	*	0.296	30200	*J	7.89
EXC-10	J1V0P2	9/30/14	9.67	*J	0.150	11.5	DJ	1.50	19.8	*	0.301	31000	*J	8.02
EXC-11	J1V0P3	9/30/14	10.1	*J	0.149	7.92	DJ	1.49	11.5	*	0.298	22200	*J	7.95
EXC-12	J1V0P4	9/30/14	8.89	*J	0.148	12.0	DJ	1.48	17.4	*	0.296	31200	*J	7.91
Split of J1V0N4	J1V0P7	9/30/14	11.0	X	0.059	7.90	X	0.100	12.7	X	0.220	20900	X	3.80
Equipment blank	J1V0P6	9/30/14	0.148	*UJ	0.148	0.148	UJ	0.148	0.296	*U	0.296	161	*J	7.89

LOCATION	HEIS Number	Sample Date	Lead			Lithium			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	3.31	DU	3.31	8.28	DN	0.398	5750	*J	8.52	373	*J	0.201
Duplicate of J1V0N4	J1V0P5	9/30/14	3.80	BD	3.30	9.11	DN	0.401	4980	*J	8.49	352	*J	0.200
EXC-1	J1V0N3	9/30/14	5.44	BD	3.30	10.7	DN	0.400	3940	*J	8.51	276	*J	0.200
EXC-3	J1V0N5	9/30/14	3.34	BD	3.21	9.60	DN	0.404	5950	*J	8.27	323	*J	0.195
EXC-4	J1V0N6	9/30/14	3.41	DU	3.41	8.42	DN	0.412	4550	*J	8.79	332	*J	0.207
EXC-5	J1V0N7	9/30/14	6.77	BD	3.26	9.05	DN	0.386	4860	*J	8.40	376	*J	0.198
EXC-6	J1V0N8	9/30/14	4.51	BD	3.34	8.40	DN	0.408	4760	*J	8.60	330	*J	0.202
EXC-7	J1V0N9	9/30/14	3.30	DU	3.30	8.88	DNJ	0.396	5700		8.50	384		0.200
EXC-8	J1V0P0	9/30/14	6.53	BD	3.35	8.56	DN	0.410	5180	*J	8.62	368	*J	0.203
EXC-9	J1V0P1	9/30/14	3.25	DU	3.25	6.52	DN	0.393	5730	*J	8.38	353	*J	0.197
EXC-10	J1V0P2	9/30/14	4.37	BD	3.31	10.3	DN	0.400	5830	*J	8.52	398	*J	0.200
EXC-11	J1V0P3	9/30/14	6.33	BD	3.28	8.91	DN	0.398	4330	*J	8.45	348	*J	0.199
EXC-12	J1V0P4	9/30/14	3.26	DU	3.26	7.74	DN	0.402	5530	*J	8.40	365	*J	0.198
Split of J1V0N4	J1V0P7	9/30/14	4.10		0.270	7.90		0.300	4580	X	3.70	333	X	0.100
Equipment blank	J1V0P6	9/30/14	0.426	B	0.326	0.382	DNU	0.382	12.5	*BJ	8.39	2.95	*J	0.197

Attachment	1	Sheet No.	5 of 8
Originator	I. B. Berezovskiy	Date	11/20/14
Checked	J. D. Skoglie	Date	11/20/14
Calc. No.	0300X-CA-V0193	Rev. No.	0

Attachment 1. 300-7 Waste Site Verification Sample Results (Metals).

LOCATION	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	0.00373	U	0.00373	0.318	B	0.201	13.9	*	0.150	1150	*NJ	6.42
Duplicate of J1V0N4	J1V0P5	9/30/14	0.00389	U	0.00389	0.283	B	0.200	11.8	*	0.150	1350	*NJ	6.39
EXC-1	J1V0N3	9/30/14	0.00568	B	0.00405	0.316	B	0.200	8.57	*	0.150	922	*NJ	6.41
EXC-3	J1V0N5	9/30/14	0.00444	B	0.00363	0.229	B	0.195	13.4	*	0.146	1200	*NJ	6.23
EXC-4	J1V0N6	9/30/14	0.00418	U	0.00418	0.270	B	0.207	9.94	*	0.155	1140	*NJ	6.62
EXC-5	J1V0N7	9/30/14	0.00396	U	0.00396	0.331	B	0.198	11.0	*	0.148	1140	*NJ	6.32
EXC-6	J1V0N8	9/30/14	0.00345	U	0.00345	0.247	B	0.202	10.4	*	0.152	1340	*NJ	6.48
EXC-7	J1V0N9	9/30/14	0.00381	B	0.00360	0.200	U	0.200	13.8		0.150	1250		6.40
EXC-8	J1V0P0	9/30/14	0.00378	U	0.00378	0.415	B	0.203	13.5	*	0.152	1050	*NJ	6.49
EXC-9	J1V0P1	9/30/14	0.00375	U	0.00375	0.315	B	0.197	13.0	*	0.148	805	*NJ	6.31
EXC-10	J1V0P2	9/30/14	0.00443	B	0.00362	0.370	B	0.200	12.6	*	0.150	1000	*NJ	6.41
EXC-11	J1V0P3	9/30/14	0.00802	B	0.00376	0.290	B	0.199	11.3	*	0.149	1820	*NJ	6.36
EXC-12	J1V0P4	9/30/14	0.00400	B	0.00394	0.364	B	0.198	11.6	*	0.148	948	*NJ	6.32
Split of J1V0N4	J1V0P7	9/30/14	0.0120	BN	0.00620	0.260	U	0.260	13.5	X	0.120	1230		41.4
Equipment blank	J1V0P6	9/30/14	0.00373	U	0.00373	0.197	U	0.197	0.148	*U	0.148	36.4	*NJ	6.31

LOCATION	HEIS Number	Sample Date	Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	1.59	DN	0.328	931	*N	1.50	0.105	B	0.100	264	NJ	7.02
Duplicate of J1V0N4	J1V0P5	9/30/14	1.43	DN	0.331	1500	*N	1.50	0.211	B	0.0999	267	NJ	6.99
EXC-1	J1V0N3	9/30/14	1.69	DN	0.330	1100	*N	1.50	0.100	U	0.100	286	NJ	7.01
EXC-3	J1V0N5	9/30/14	1.25	DN	0.333	1580	*N	1.46	0.0973	U	0.0973	280	NJ	6.81
EXC-4	J1V0N6	9/30/14	1.30	DN	0.340	1450	*N	1.55	0.103	U	0.103	246	NJ	7.24
EXC-5	J1V0N7	9/30/14	1.47	DN	0.319	1460	*N	1.48	0.139	B	0.0988	307	NJ	6.91
EXC-6	J1V0N8	9/30/14	1.47	DN	0.337	1490	*N	1.52	0.157	B	0.101	254	NJ	7.08
EXC-7	J1V0N9	9/30/14	1.21	DN	0.327	584	NJ	1.50	0.100	U	0.100	206		7.00
EXC-8	J1V0P0	9/30/14	1.66	DN	0.339	1460	*N	1.52	0.101	U	0.101	268	NJ	7.10
EXC-9	J1V0P1	9/30/14	1.81	DN	0.324	1370	*N	1.48	0.0986	U	0.0986	463	NJ	6.90
EXC-10	J1V0P2	9/30/14	2.42	DN	0.330	1450	*N	1.50	0.209	B	0.100	394	NJ	7.01
EXC-11	J1V0P3	9/30/14	1.28	DN	0.329	1550	*N	1.49	0.161	B	0.0994	193	NJ	6.96
EXC-12	J1V0P4	9/30/14	1.59	DN	0.332	1300	*N	1.48	0.226	B	0.0988	429	NJ	6.92
Split of J1V0N4	J1V0P7	9/30/14	0.870	U	0.870	246	N	5.70	0.160	U	0.160	380	M	59.6
Equipment blank	J1V0P6	9/30/14	0.315	DNU	0.315	142	*N	1.48	0.0987	U	0.0987	6.91	NUJ	6.91

Attachment	1	Sheet No.	6 of 8
Originator	I. B. Berezovskiy	Date	11/20/14
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Attachment 1. 300-7 Waste Site Verification Sample Results (Metals).

LOCATION	HEIS Number	Sample Date	Strontium			Tin			Uranium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-2	J1V0N4	9/30/14	27.9		0.100	3.01	DU	3.01	0.937	*DMN	0.0131	71.1	DN	1.00
Duplicate of J1V0N4	J1V0P5	9/30/14	24.2		0.0999	3.00	DU	3.00	1.07	*DMN	0.0132	71.3	DN	0.999
EXC-1	J1V0N3	9/30/14	32.1		0.100	3.00	DU	3.00	1.33	*DMN	0.0132	64.4	DN	1.00
EXC-3	J1V0N5	9/30/14	39.0		0.0973	2.92	DU	2.92	1.60	*DMN	0.0133	62.6	DN	0.973
EXC-4	J1V0N6	9/30/14	28.5		0.103	3.10	DU	3.10	4.34	*DMN	0.0136	67.1	DN	1.03
EXC-5	J1V0N7	9/30/14	25.0		0.0988	2.96	DU	2.96	0.939	*DMN	0.0127	81.8	DN	0.988
EXC-6	J1V0N8	9/30/14	25.8		0.101	3.04	DU	3.04	2.10	*DMN	0.0135	64.5	DN	1.01
EXC-7	J1V0N9	9/30/14	34.9		0.100	3.00	DU	3.00	5.30	*DMNJ	0.0131	73.7	DN	1.00
EXC-8	J1V0P0	9/30/14	32.7		0.101	3.04	DU	3.04	1.04	*DMN	0.0135	80.8	DN	1.01
EXC-9	J1V0P1	9/30/14	34.0		0.0986	2.96	DU	2.96	0.496	*DMN	0.0130	109	DN	0.986
EXC-10	J1V0P2	9/30/14	30.2		0.100	3.01	DU	3.01	0.624	*DMN	0.0132	98.9	DN	1.00
EXC-11	J1V0P3	9/30/14	20.9		0.0994	2.98	DU	2.98	0.797	*DMN	0.0132	61.3	DN	0.994
EXC-12	J1V0P4	9/30/14	24.5		0.0988	2.96	DU	2.96	0.479	*DMN	0.0133	121	DN	0.988
Split of J1V0N4	J1V0P7	9/30/14	24.3	X	0.0360	0.920	U	0.920	0.940		0.0015	56.3		0.0950
Equipment blank	J1V0P6	9/30/14	0.550		0.0987	0.296	U	0.296	0.116	*DMN	0.0126	0.212	BN	0.0987

LOCATION	HEIS Number	Sample Date	Zinc			Zirconium			Percent moisture (wet sample)		
			mg/kg	Q	PQL	mg/kg	Q	PQL	%	Q	PQL
EXC-2	J1V0N4	9/30/14	51.5	*DNJ	4.01	30.3	DM	0.0995			
Duplicate of J1V0N4	J1V0P5	9/30/14	48.4	*DNJ	3.99	26.8	DM	0.100			
EXC-1	J1V0N3	9/30/14	37.8	*DNJ	4.01	26.6	DM	0.0999			
EXC-3	J1V0N5	9/30/14	44.0	*DNJ	3.89	21.2	DM	0.101			
EXC-4	J1V0N6	9/30/14	43.2	*DNJ	4.14	20.7	DM	0.103			
EXC-5	J1V0N7	9/30/14	52.1	*DNJ	3.95	29.6	DM	0.0965			
EXC-6	J1V0N8	9/30/14	43.5	*DNJ	4.05	21.9	DM	0.102			
EXC-7	J1V0N9	9/30/14	54.9	*DN	4.00	23.7	DM	0.099			
EXC-8	J1V0P0	9/30/14	45.6	*DNJ	4.06	24.3	DM	0.103			
EXC-9	J1V0P1	9/30/14	57.1	*DNJ	3.94	36.0	DM	0.0982			
EXC-10	J1V0P2	9/30/14	61.5	*DNJ	4.01	45.4	DM	0.100			
EXC-11	J1V0P3	9/30/14	48.8	*DNJ	3.98	23.8	DM	0.0996			
EXC-12	J1V0P4	9/30/14	64.0	*DNJ	3.95	39.7	DM	0.101			
Split of J1V0N4	J1V0P7	9/30/14	39.1	X	0.400	24.7	X	0.360	1.00		0.10
Equipment blank	J1V0P6	9/30/14	0.889	*BNJ	0.395	0.613	BDM	0.0955			

Attachment	1	Sheet No.	7 of 8
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Calc. No.	0300X-CA-V0193	Rev. No.	0

Attachment 1. 300-7 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	J1V0N4, EXC-2			J1V0P5, Duplicate of J1V0N4			J1V0N3, EXC-1			J1V0N5, EXC-3			J1V0N6, EXC-4		
		09/30/14			09/30/14			09/30/14			09/30/14			09/30/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB.	1.12	U	1.12	1.14	U	1.14	1.12	U	1.12	2.25	DU	2.25	1.16	U	1.16
Aroclor-1221	PCB	1.12	U	1.12	1.14	U	1.14	1.12	U	1.12	2.25	DU	2.25	1.16	U	1.16
Aroclor-1232	PCB	1.12	U	1.12	1.14	U	1.14	1.12	U	1.12	2.25	DU	2.25	1.16	U	1.16
Aroclor-1242	PCB	1.12	U	1.12	1.14	U	1.14	1.12	U	1.12	2.25	DU	2.25	1.16	U	1.16
Aroclor-1248	PCB	1.12	U	1.12	1.14	U	1.14	1.12	U	1.12	2.25	DU	2.25	1.16	U	1.16
Aroclor-1254	PCB	1.12	U	1.12	1.14	U	1.14	1.12	U	1.12	2.25	DU	2.25	8.72		1.16
Aroclor-1260	PCB	1.12	U	1.12	1.14	U	1.14	1.12	U	1.12	2.25	DU	2.25	1.16	U	1.16
Aroclor-1262	PCB	1.12	U	1.12	1.14	U	1.14	1.12	U	1.12	2.25	DU	2.25	1.16	U	1.16
Aroclor-1268	PCB	1.12	U	1.12	1.14	U	1.14	1.12	U	1.12	2.25	DU	2.25	1.16	U	1.16

CONSTITUENT	CLASS	J1V0N7, EXC-5			J1V0N8, EXC-6			J1V0N9, EXC-7			J1V0P0, EXC-8			J1V0P1, EXC-7		
		09/30/14			09/30/14			09/30/14			09/30/14			09/30/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	5.61	DU	5.61	1.13	U	1.13	1.12	U	1.12	1.17	U	1.17	1.12	U	1.12
Aroclor-1221	PCB	5.61	DU	5.61	1.13	U	1.13	1.12	U	1.12	1.17	U	1.17	1.12	U	1.12
Aroclor-1232	PCB	5.61	DU	5.61	1.13	U	1.13	1.12	U	1.12	1.17	U	1.17	1.12	U	1.12
Aroclor-1242	PCB	5.61	DU	5.61	1.13	U	1.13	1.12	U	1.12	1.17	U	1.17	1.12	U	1.12
Aroclor-1248	PCB	5.61	DU	5.61	1.13	U	1.13	1.12	U	1.12	1.17	U	1.17	1.12	U	1.12
Aroclor-1254	PCB	124	D	5.61	18.0		1.13	1.12	U	1.12	6.39		1.17	1.12	U	1.12
Aroclor-1260	PCB	47.6	D	5.61	6.89		1.13	1.12	U	1.12	2.45	J	1.17	1.12	U	1.12
Aroclor-1262	PCB	5.61	DU	5.61	1.13	U	1.13	1.12	U	1.12	1.17	U	1.17	1.12	U	1.12
Aroclor-1268	PCB	5.61	DU	5.61	1.13	U	1.13	1.12	U	1.12	1.17	U	1.17	1.12	U	1.12

CONSTITUENT	CLASS	J1V0P2, EXC-10			J1V0P3, EXC-11			J1V0P4, EXC-12			J1V0P7, Split of J1V0N4		
		09/30/14			09/30/14			09/30/14			09/30/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	1.12	U	1.12	1.12	U	1.12	1.12	U	1.12	2.7	U	2.7
Aroclor-1221	PCB	1.12	U	1.12	1.12	U	1.12	1.12	U	1.12	7.9	U	7.9
Aroclor-1232	PCB	1.12	U	1.12	1.12	U	1.12	1.12	U	1.12	2.0	U	2.0
Aroclor-1242	PCB	1.12	U	1.12	1.12	U	1.12	1.12	U	1.12	4.6	U	4.6
Aroclor-1248	PCB	1.12	U	1.12	1.12	U	1.12	1.12	U	1.12	4.6	U	4.6
Aroclor-1254	PCB	1.12	U	1.12	6.64	P	1.12	1.12	U	1.12	2.6	U	2.6
Aroclor-1260	PCB	1.12	U	1.12	7.26		1.12	1.12	U	1.12	2.6	U	2.6
Aroclor-1262	PCB	1.12	U	1.12	1.12	U	1.12	1.12	U	1.12			
Aroclor-1268	PCB	1.12	U	1.12	1.12	U	1.12	1.12	U	1.12			

Attachment	1	Sheet No.	8 of 8
Originator	I. B. Berezovskiy	Date	11/20/14
Checked	J. D. Skoglie	Date	11/20/14
Calc. No.	0300X-CA-V0193	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 300 Area Closure Operations **Job No. 14655**

Area: 300

Discipline: Environmental *Calculation No: 0300X-CA-V0194

Subject: 300-7 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2010

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 4 Total = 5	I. B. Berezovskiy	J. D. Skoglie	R. J. Nielson	S. G. Wilkinson	Signed on 12/4/14
1	Cover = 1 Summary = 4 Total = 5	J. D. Skoglie /	I. B. Berezovskiy	NA	S. G. Wilkinson	6/30/15

SUMMARY OF REVISION

1	All sheets: change reference from "DOE-RL, 2014" to DOE-RL, 2015".

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	05/11/15	Calc. No.:	0300X-CA-V0194	Rev.:	1
Project:	300 Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	05/11/15
Subject:	300-7 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 4

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk of contaminants of concern (COCs) for waste sites identified as requiring remove, treat, and dispose in Table 1 of the 300 Area Final ROD (EPA 2013). In accordance with the nonradionuclides evaluation of risk standards in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2015), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ (residential) or $<1 \times 10^{-5}$ (industrial) for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 2015, *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils*, DOE/RL-2014-13-ADD1, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) Ecology, 2007, WAC 173-340, "Model Toxics Control Act -- Cleanup," Washington Administrative Code, November 2007 Revision.

3) EPA, 2013, *Record of Decision for the 300-FF-2 Operable Unit and 300-FF-5, and Record of Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

4) WCH, 2014a, *300 -7 Waste Site 95% UCL Calculations*, 0300X-CA-V0193, Rev. 0, Washington Closure Hanford, Richland, Washington.

5) WCH, 2014b, *Cleanup Verification Package for the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Waste Site*, Attachment to Waste Site Reclassification Form 2014-109, Rev. 0, Washington Closure Hanford, Richland, Washington.

SOLUTION:

Hazard Quotient and Excess Carcinogenic Risk Calculations

Where residential land use cleanup and risk standards cannot be met in the industrial land use areas of the 300 Area, the industrial hazard quotient and cancer risk must be calculated. The residential and industrial hazard quotient and cancer risk values are calculated by substituting the appropriate residential and industrial daily intake factors, calculated as described in Appendix D of the RDR/RAWP (DOE-RL 2015), into the Appendix D equations for the hazard quotient and cancer risk. Values of the reference doses (RfDs) and cancer potency factors (CPFs) for use in calculating the hazard quotient and cancer risk are also provided in Appendix D of the RDR/RAWP (DOE-RL 2015).

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	05/11/15	Calc. No.:	0300X-CA-V0194	Rev.:	1
Project:	300 Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	05/11/15
Subject:	300-7 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	2 of 4

1) Generate an HQ for each constituent with noncarcinogenic effects detected above background and compare it to the individual HQ of <1.0. The calculation is performed as necessary for residential land use as described in the RDR/RAWP (DOE-RL 2015) and presented in Table 1.

2) Sum the HQs and compare this value to the cumulative HQ of <1.0.

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background and compare it to the excess cancer risk of $<1 \times 10^{-6}$ for residential land use calculation or $<1 \times 10^{-5}$ for industrial land use calculation (DOE-RL 2015). The calculation is performed for residential use as described in the RDR/RAWP (DOE-RL 2015) and presented in Table 1.

4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.

METHODOLOGY:

Hazard Quotient and Excess Carcinogenic Risk Calculations

The 300-7 waste site underwent statistical sampling for the excavation area. One duplicate sample was also collected. The direct contact hazard quotient and carcinogenic risk calculations for the 300-7 waste site were performed for the entire waste site using the statistical value for each COC detected above background from the excavation area decision unit, as described in the referenced cleanup verification package document (WCH 2014b), and/or the 95% upper confidence limit (UCL) calculation (WCH 2014a). Vanadium and selenium are the 300-7 waste site COCs that were detected above Hanford Site background levels and require direct contact hazard quotient and carcinogenic risk calculations. Aroclor-1254, aroclor-1260, and strontium are included because they were detected and a Hanford Site background value is not available.

The 300-7 waste site data set was evaluated against the residential cumulative direct contact hazard quotient standards (Table 1).

Calculations for the 300-7 waste site were performed using parameters and equations for residential land use from the RDR/RAWP (DOE-RL 2015). An example of the HQ and risk calculations of COCs for industrial land use using data for the 300-7 waste site is presented below:

1) To calculate the HQ, the statistical value for vanadium is 90.0 mg/kg, multiplied by the daily intake factor (1.25×10^{-5}) and divided by the reference dose (RfD) of 0.005 mg/kg-day, resulting in an HQ of 2.25×10^{-1}. Comparing this value, and all other individual values for the 300-7 calculation, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate COCs, the cumulative HQ is obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 2.89×10^{-1} for the 300-7 waste site COCs only calculation. Comparing this value to the requirement of <1.0, this criterion is met.

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	05/11/15	Calc. No.:	0300X-CA-V0194	Rev.:	1
Project:	300 Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	05/11/15
Subject:	300-7 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 4

3) To calculate the excess cancer risk, the statistical value for aroclor-1254, 0.094 mg/kg, is multiplied by the daily intake factor (1.0×10^{-6}) and the cancer potency factor of 2.0 mg/kg-day, with a resulting value of 1.88×10^{-7}. Comparing this value, and all other individual values for the 300-7 calculation, to the threshold of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk is obtained by summing the individual values. The sum of the cumulative cancer risk values is 2.8×10^{-7} for the 300-7 calculation. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

Hazard Quotient and Excess Carcinogenic Risk Calculations - 300-7 COCs

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk $>1 \times 10^{-6}$: None
4) List the cumulative excess cancer risk for carcinogens $>1 \times 10^{-5}$: None

Table 1 shows the results of the residential direct contact calculations. Because the residential direct contact criteria are all met the industrial hazard quotient and excess cancer risk calculations were not performed.

Table 1. Residential Direct Contact Hazard Quotient and Excess Cancer Risk Results for 300-7 Waste Site.

COCs	Statistical Value[a] (mg/kg)	Oral Reference Dose (RfD)[b] (mg/kg-day)	Hazard Quotient	Cancer Potency (Slope) Factor[b] (mg/kg-day) -1	Cancer Risk
Metals (mg/kg)					
Selenium	1.73	5.00E-03	4.33E-03	--	--
Strontium	32.3	6.00E-01	6.73E-04	--	--
Vanadium	90.0	5.00E-03	2.25E-01	--	--
Polychlorinated Biphenyls (mg/kg)					
PCB Aroclor 1254	0.094	2.00E-05	5.88E-02	2.00E+00	1.88E-07
PCB Aroclor 1260	0.048	--	--	2.00E+00	9.60E-08
COCs Cumulative Hazard Quotient:			**2.89E-01**		
COCs Cumulative Excess Cancer Risk:					**2.8E-07**

[a] From WCH 2014.
[b] = Value obtained from the RDR/RAWP (DOE-RL 2015)
COC = contaminant of concern

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	05/11/15	Calc. No.:	0300X-CA-V0194	Rev.:	1
Project:	300 Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	05/11/15
Subject:	300-7 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	4 of 4

CONCLUSION:

The calculations for residential land use summarized in Table 1 demonstrate that the 300-7 waste site identified as requiring remove, treat, and dispose in Table 1 of the 300 Area Final ROD (EPA 2013) meets the requirements for the industrial direct contact hazard quotient and excess carcinogenic risk, respectively, as identified in the RDR/RAWP (DOE-RL 2015). The hazard quotient and carcinogenic (excess cancer) risk calculations are for use in the CVP for this site.

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 300 Area Closure Operations **Job No. 14655**

Area: 300 Area

Discipline: Environmental *Calculation No: 0300X-CA-V0195

Subject: 300-7 Waste Site Radionuclide Sum of Fractions Calculations

Computer Program: Excel Program No: Excel 2010

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 3 Total = 4	I. B. Berezovskiy	J. D. Skoglie	R. J. Nielson	S. G. Wilkinson	Signed on 12/8/14
1	Cover = 1 Sheets = 3 Total = 4	J. D. Skoglie	I. B. Berezovskiy	NA	S. G. Wilkinson	6/30/15

SUMMARY OF REVISION

1	All sheets: revise reference from "DOE-RL, 2014" to "DOE-RL, 2015". All sheets: include calculations and discussion for radiological dose limit of 15 mrem/yr.

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	05/08/15	Calc. No.:	0300X-CA-V0195	Rev.:	1
Project:	300 Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	05/08/15
Subject:	300-7 Waste Site Radionuclide Sum of Fractions Calculations					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the sum of fractions evaluation for radionuclide direct exposure excess cancer risk and radiological dose for waste sites identified as requiring remove, treat, and dispose in Table 1 of the 300 Area Final ROD (EPA 2013). The calculation is prepared for waste site data sets with applicable radiological contaminants of concern (COCs) in accordance with Section B4 of the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2015).

GIVEN/REFERENCES:

1) DOE-RL, 1996, *Hanford Site Background: Part 2, Soil Background for Radioactive Analytes,* DOE/RL-96-12, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2013, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*, DOE/RL-2010-99, Rev 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

3) DOE-RL, 2015, *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils,* DOE/RL-2014-13-ADD1, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

4) EPA, 2013, *Record of Decision for the 300-FF-2 Operable Unit and 300-FF-5, and Record of Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

5) WCH, 2014a, *300 -7 Waste Site 95% UCL Calculations*, 0300X-CA-V0193, Rev. 0, Washington Closure Hanford, Richland, Washington.

6) WCH, 2014b, *Cleanup Verification Package for the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Waste Site*, Attachment to Waste Site Reclassification Form 2014-109, Rev. 0, Washington Closure Hanford, Richland, Washington.

SOLUTION:

As discussed in section B4 of the RDR/RAWP (DOE-RL 2015), the cleanup levels (CULs) for soil radionuclide COCs in the 300 Area Final Action ROD (EPA 2013) were set at a 1×10^{-4} risk limit or 15 mrem/yr dose limit for isotopes where the latter is more conservative. Soil radionuclide CULs must also meet the multi-contaminant total cancer risk limit of 1×10^{-4} and the radiological dose limit of 15 mrem/yr. These soil risk limits are applied to both the industrial and residential scenarios.

For waste sites with few radionuclide COCs at concentrations well below the individual radionuclide cleanup levels (CULs) provided in the 300 Area Final ROD (EPA 2013), a sum of fractions evaluation is performed for direct exposure single radionuclide 1×10^{-4} cancer risk and 15 mrem/yr dose values as shown in Table 1. The first column of Table 1 presents the COCs and the second column presents

statistical or maximum value (depending on the data set). Where applicable, background values (DOE-RL 1996) are presented in the third column. Uranium background is subtracted from the analyses for all soil samples but background for other radionuclides is only subtracted from the overburden soil analysis. This accounts for anthropogenic and naturally occurring radionuclide background in surface soils. Only uranium background concentrations are accounted for in shallow and deep zone soils by subtracting uranium isotope concentrations from the statistical or maximum values. The fourth column presents the background subtracted value. The fifth column presents the single radionuclide 1×10^{-4} cancer risk equivalence activity, and the sixth column presents the statistical or maximum value divided by the cancer risk equivalence activity.

The values in the sixth column are summed and presented as the sum of fractions. This value is multiplied by 0.0001 to determine the cancer risk value of 8.93×10^{-6}. A cancer risk value of more than 1×10^{-4} indicates additional evaluation is required.

The seventh column presents the single radionuclide 15 mrem/yr dose equivalence activity, and the last column presents the statistical or maximum value divided by the dose equivalence activity. The values in the last column are summed and presented as the sum of fractions. This value is multiplied by 15 mrem/yr to determine the total radiological dose of 1.68 mrem/yr. A total dose of more than 15 mrem/yr indicates additional evaluation is required.

METHODOLOGY:

The 300-7 waste site excavation area underwent statistical verification sampling. One duplicate sample was also collected. The sum of fractions were conservatively calculated for the 300-7 waste site data set, using the greater of the statistical or maximum value (depending on the data set) for each COC detected above background from amongst all applicable decision units, as described in the cleanup verification package for 300-7 (WCH 2014b), and/or the 95% upper confidence limit (UCL) calculation (WCH 2014a).

Calculations for the 300-7 waste site were performed using CULs for residential land use. The sum of fractions calculation of COCs for residential land use using data from the 300-7 waste site is presented below:

1) To calculate the cancer risk fraction for europium-152, the background value of 0 pCi/g is subtracted from the maximum value from the data set, 0.242 pCi/g. The background corrected maximum value is 0.242 pCi/g. The background corrected value is divided by the activity equivalent to 1×10^{-4} cancer risk of 3.7 pCi/g, resulting in a fraction of 0.0654 for europium-152.

2) The cancer risk fractions for the remaining COCs are determined and summed. The sum of these fractions equals 0.0893. The sum of fractions is then multiplied by 1×10^{-4} to determine the cumulative cancer risk value of 8.93×10^{-6} for the 300-7 waste site. Comparing this value to the cancer risk limit of $<1 \times 10^{-4}$, the requirement is met.

3) To calculate the radiological dose fraction for europium-152, the background corrected maximum value of 0.242 pCi/g is divided by the activity equivalent to a 15 mrem/yr dose of 3.3 pCi/g, resulting in a fraction of 0.0733 for europium-152.

4) The radiological dose fractions for the remaining COCs are determined and summed. The sum of these fractions equals 0.112. The sum of fractions is then multiplied by 15 mrem/yr to determine the total radiological dose of 1.68 mrem/yr for the 300-7 waste site. Comparing this value to the radiological dose limit of 15 mrem/yr, the requirement is met.

RESULTS:

Table 1 presents the results of the direct contact sum of fractions calculations for 300-7 for residential land use.

Table 1. 300-7 Waste Site Residential Sum of Fractions Evaluation of Radionuclide Direct Exposure Excess Cancer Risk and Dose.

COC	Statistical or Maximum Activity [a] (pCi/g)	Back-ground (pCi/g)	Back-ground Corrected Activity [b] (pCi/g)	Activity Equivalent to Residential 10^{-4} Cancer Risk [c] (pCi/g)	Fraction for 10^{-4} Cancer Risk [b]	Activity Equivalent to Residential 15 mrem/yr Dose [d] (pCi/g)	Fraction for 15 mrem/yr Dose [b]
Europium-152	0.242	0	0.242	3.7	0.0654	3.3	0.0733
Europium-154	0.102	0	0.102	4.4	0.0232	3.0	0.0340
Plutonium-238	0.180	0	0.180	236	0.000763	39	0.00462
Uranium-233/234	0.990	1.1	0	133	0	27.2	0
Uranium-235	0.102	0.11	0	16	0	2.7	0
Uranium-238	0.912	1.1	0	54	0	26.2	0
				Sum of Fractions	**0.0893**	**Sum of Fractions**	**0.112**
				Residential Excess Cancer Risk	**8.93E-06**	**Dose, mrem/yr**	**1.68**

[a] From (WCH 2014a).
[b] Correct decimal places and correct all negative values to be zero.
[c] From Table 8-3 of the 300 Area RI/FS, DOE/RL-2010-99, Rev. 0 (DOE-RL 2013).
[d] From Table D-1 of the RDR/RAWP for the 300-FF-2 Soils, DOE/RL-2014-13-ADD1, Rev. 0 (DOE-RL 2015)
COC = Contaminant of Concern.

CONCLUSION:

The calculations summarized in Table 1 provide the sum of fraction calculations for the 300-7 waste site with residential land use radionuclide COCs that were identified as requiring remove, treat, and dispose in Table 1 of the 300 Area Final ROD (EPA 2013). The direct contact sum of fractions calculations are for use in the CVP for this waste site (WCH 2014b).

APPENDIX B

DATA QUALITY ASSESSMENT

APPENDIX B

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2014b). This DQA was performed in accordance with site-specific data quality objectives found in the *300 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2014).

A review of the sample design (WCH 2014b), the field logbook (WCH 2014a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 300-7 waste site were provided by the laboratories in two sample delivery groups (SDGs), SDG X0081 and SDG J02160. SDG X0081 was submitted for third-party validation. No major deficiencies were noted in the data results. Minor deficiencies are discussed for 300-7 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

MINOR DEFICIENCIES

SDG X0081

This SDG comprises 12 statistical soil samples (J1V0N3 through J1V0N9, J1V0P0 through J1V0P4) from the excavation area. This SDG includes one field duplicate pair (J1V0N4/J1V0P5). All samples were analyzed for inductively coupled plasma (ICP) metals, mercury, polychlorinated biphenyls (PCBs), gamma energy analysis, strontium-90, total uranium, isotopic uranium, isotopic plutonium, and americium-241. In addition, one field equipment blank sample (J1V0P6) was collected and analyzed for ICP metals and mercury. SDG X0081 was submitted for third-party validation. Minor deficiencies are as follows:

In the isotopic plutonium analysis, due to method blank (MB) contamination, third-party validation qualified plutonium-239/240 results in samples J1V0P2 and J1V0P5 as undetected with "U" flags. Data are usable for decision-making purposes.

In the isotopic uranium analysis, due to the lack of laboratory control sample analysis, third-party validation qualified all uranium-235 results as estimates, with "J" flags. Estimated data are usable for decision-making purposes.

In the isotopic uranium analysis, due to tracer recoveries outside the quality control (QC) limits, third-party validation qualified all detected uranium-233/234, uranium-238, and uranium-235 sampling results (with the exception of J1V0N9) as estimates with "J" flags. Estimated data are usable for decision-making purposes.

In the isotopic plutonium analysis, due to laboratory tracer recoveries outside the QC limits, third-party validation qualified all detected plutonium-238 and plutonium-239 results in samples J1V0N8, J1V0N9, and J1V0P2 as estimates with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, matrix spike (MS) recoveries were outside the QC limits for silicon (29.9%), lithium (149%), and uranium (171%). The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the samples. Due to MS recoveries outside QC limits, third-party validation qualified silicon, lithium, and uranium results in sample J1V0N9 as estimates with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, MS recoveries were outside the QC limits for barium (133%), potassium (143%), sodium (143%), and zinc (134%). The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the samples. Due to MS recoveries outside quality control (QC) limits, third-party validation qualified all barium, potassium, sodium, and zinc results (with the exception of J1V0N9) as estimates with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory duplicate relative percent differences (RPDs) for aluminum (39.5%), chromium (34.9%), cobalt (48.1%), iron (31.7%), magnesium (45.6%), manganese (43.9%), and zinc (36.1%) are above the acceptance criteria of 30%. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. Third-party validation qualified all aluminum, chromium, cobalt, iron, magnesium, manganese, and zinc results (with the exception of J1V0N9) as estimates with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory duplicate RPD for uranium (34.6%) is above the acceptance criteria of 30%. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. Third-party validation qualified all uranium results in sample J1V0N9 as estimates with "J" flags.

Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

Relative percent difference evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations are reported by SDG in the previous sections.

Field quality assurance (QA) measurements are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2014), are shown in Table B-1. The main and QA/QC sample results are presented in Appendix A.

Table B-1. Field Quality Assurance/Quality Control Samples.

Sample Area	Main Sample	Duplicate Sample	Split Sample
Excavation area	J1V0N4	J1V0P5	J1V0P7

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern (COPC). Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the target detection limit (TLD). Relative percent differences of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The calculation brief in Appendix A provides details on duplicate pair evaluation and RPD calculation.

Field split samples are used to determine systematic differences (bias) between laboratories. A statistical determination of systematic differences would require larger data sets than are presented here. Such a determination is complicated by variability introduced by the natural heterogeneities inherent in field soil samples and the analytical variability that each individual laboratory experiences. Therefore, when evaluating limited field split data relatively large RPDs are expected. No major deficiencies in the RPD calculations were found for the split sample. Minor deficiencies for the field duplicates and split samples are as follows:

In the duplicate evaluation, the RPD calculated for silicon (46.8%) is above the duplicate acceptance criteria of 30%. In the split evaluation, the RPDs calculated for silicon (116.4%) and sodium (36.0%) are above the field split acceptance criteria (less than 35%). Elevated RPDs in environmental samples are generally attributed to

natural heterogeneity in the sample matrix. The data are usable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the TDL. In these cases, a control limit of ±2 times the TDL is used (Appendix A) to indicate that a visual check of the data is required by the reviewer. In the duplicate analysis, barium, calcium, iron, magnesium, manganese, silicon, strontium, and zinc required this check. In the split analysis, aluminum, barium, beryllium, calcium, copper, iron, magnesium, manganese, selenium, silicon, sodium, strontium, vanadium, zinc, and zirconium required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

SUMMARY

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 300-7 waste site verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 300-7 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes.

The verification sample analytical data are stored in the Washington Closure Hanford project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix B.

REFERENCES

BHI, 2000, *Data Validation Procedure for Chemical Analysis*, BHI-01435, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 2014, *300 Area Remedial Action Sampling and Analysis Plan*, DOE/RL 2001-48, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 2006, *Guidance on Systematic Planning using the Data Quality Objectives Process*, EPA QA/G-4, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2014a, *D4 Waste Site Miscellaneous Sampling*, Logbook EL-1663-06, pp. 43-45, Washington Closure Hanford, Richland, Washington.

WCH, 2014b, *Work Instruction for Verification Sampling of the 300-7, Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site,* 0300X-WI-G0049, Rev. 0, Washington Closure Hanford, Richland, Washington.

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