1231424

CVP-2015-00017
Rev. 0

Cleanup Verification Package for the 600-367, Burial Pit Near the Geotechnical Engineering and Development Facility (Little Egypt) Waste Site

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

Attached to:
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EXECUTIVE SUMMARY

This cleanup verification package documents completion of remedial action for the 600-367, Burial Pit Near the Geotechnical Engineering and Development Facility (Little Egypt) waste site. The 600-367 waste site is located in the 300-FF-2 Operable Unit in the 300 Area of the Hanford Site in southeastern Washington State. It was identified as a 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) (EPA 2013).

The 600-367 waste site consisted of a pit that was excavated to bury the remains of the equipment and trailer that were destroyed during a Hanford Site range fire in the 1980s. The equipment and temporary trailer were being used in support of the Geotechnical Engineering and Development Facility, which became operational in 1982 to support the development of technology for disposal of low level radioactive waste.

Remediation of the 600-367 waste site was performed between January 23 and February 2, 2015. The excavation extended to an estimated maximum depth of 2.6 m (8.5 ft) below ground surface, resulting in approximately 810 bank cubic meters (1,059 bank cubic yards) of contaminated soil and debris being removed for disposal at the Environmental Restoration Disposal Facility. No overburden soil was salvaged from the 600-367 waste site excavation and no staging pile areas were utilized.

Verification sampling within the 600-367 waste site excavation was performed on April 30, 2015. An evaluation of the resulting data found that the waste removal action achieved compliance with the residential scenario remedial action objectives for the 600-367 waste site. A summary of the cleanup evaluation for the soil sampling 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 600-367 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

Table ES-1. Summary of Cleanup Verification Results for the 600-367 Waste Site. (2 Pages)

Regulatory Requirement	Cleanup Levels	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain individual radionuclide CULs and attain radionuclide total excess cancer risk of <1 x 10^{-4} over 1,000 years or an excess dose of <15 mrem/yr, whichever is lower.	Radionuclides were not identified as COCs for the 600-367 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COC direct exposure CULs.	All individual COC concentrations are below the residential direct exposure CULs.	Yes
Nonradionuclide Risk Requirements	Attain a hazard quotient of <1 for all individual noncarcinogenic COCs.	All nonradionuclide COCs were detected below the Hanford Site or Washington State background values; therefore, no hazard quotient or carcinogenic risk calculations were performed.	NA
	Attain a cumulative hazard quotient of <1 for noncarcinogenic COCs.		
	Attain an excess cancer risk of <1 x 10^{-6} (residential land use) for individual carcinogenic COCs.		
	Attain a total excess cancer risk of <1 x 10^{-5} for carcinogenic COCs.		
Groundwater/River Protection – Radionuclides	Attain single radionuclide COC groundwater and river protection CULs.	Radionuclides were not identified as COCs for the 600-367 waste site.	NA
	Attain National Primary Drinking Water Standards: 4 mrem/yr (beta/gamma) dose rate to target receptors/organs [a].		
	Meet drinking MCL for alpha emitters.		
	Meet total uranium drinking water standard of 21.2 pCi/L [b].		

Table ES-1. Summary of Cleanup Verification Results for the 600-367 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 soil CULs for the protection of groundwater and the Columbia River.	Yes

[a] "National Primary Drinking Water Regulations" (40 CFR 141).
[b] Based on the isotopic distribution of uranium in the Hanford Site background, the 30 µg/L uranium MCL (40 CFR 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* (BHI 2001).

CFR = *Code of Federal Regulations*
COC = contaminant of concern
CUL = cleanup level
DOE = U.S. Department of Energy
MCL = maximum contaminant level (drinking water standard)
NA = not applicable

The current site conditions have been evaluated in accordance with the *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils* (DOE-RL 2015) and the 300 Area ROD (EPA 2013). The verification sampling results show that the residual contaminant concentrations at the 600-367 waste site 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). Therefore, the requirements for unlimited use and unrestricted exposure have been met. The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River.

The 600-367 waste 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 standalone 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.:** 2015-070

Waste Site Code(s)/Subsite Code(s): 600-367

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 600-367, Burial Pit Near the Geotechnical Engineering and Development Facility (Little Egypt), 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 selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels (CULs), (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility (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.

Remediation of the 600-367 waste site was performed from January 23 through February 2, 2015. Approximately 810 bank cubic meters (1,059 bank cubic yards) of excavated materials were removed and direct loaded for disposal at ERDF.

Basis for reclassification:

The verification sampling results were evaluated in comparison to the CULs and remedial action objectives (RAOs) from the 300 Area ROD (EPA 2013), as described in the *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 (DOE-RL 2015). In accordance with this evaluation, the verification sampling results support a reclassification of the 600-367 waste site to Final Closed Out. The current site conditions achieve the residential land use CULs and RAOs established by the 300 Area ROD (EPA 2013). Therefore, the 600-367 site meets the requirements for unlimited use and unrestricted exposure. The results of verification sampling show that residual contaminant concentrations meet human health direct exposure CULs for residential land use in the shallow zone soils (i.e., surface to 4.6 m [15 ft] deep); therefore, institutional controls to maintain industrial land use are not required for the 600-367 waste site. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 600-367, Burial Pit Near the Geotechnical Engineering and Development Facility (Little Egypt) Waste Site.*

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 300-FF-2 **Control No.:** 2015-070

Waste Site Code(s)/Subsite Code(s): 600-367

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	8/27/15
DOE Federal Project Director (printed)	Signature	Date
NA		
Ecology Project Manager (printed)	Signature	Date
B. Simes		8/28/15
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
HEIS	Hanford Environmental Information System
PCB	polychlorinated biphenyl
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 600-367, Burial Pit Near the Geotechnical Engineering and Development Facility (Little Egypt) waste site was remediated in accordance with the *Remedial Design Report/Remedial Action Work Plan for 300-FF-2 Soils* (300-FF-2 RDR/RAWP) (DOE-RL 2015). Remedial action objectives (RAOs) and associated cleanup levels (CULs) for this site are established in 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 Area ROD provides the U.S. Department of Energy, Richland Operations Office with the authority, guidance, and objectives to conduct this remedial action.

The remedy specified in the 300 Area ROD (EPA 2013) and conducted for the 600-367 waste site included excavating the site to the extent required to meet residential land-use CULs and disposing of contaminated excavated 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.

2.0 SITE DESCRIPTION AND SUPPORTING INFORMATION

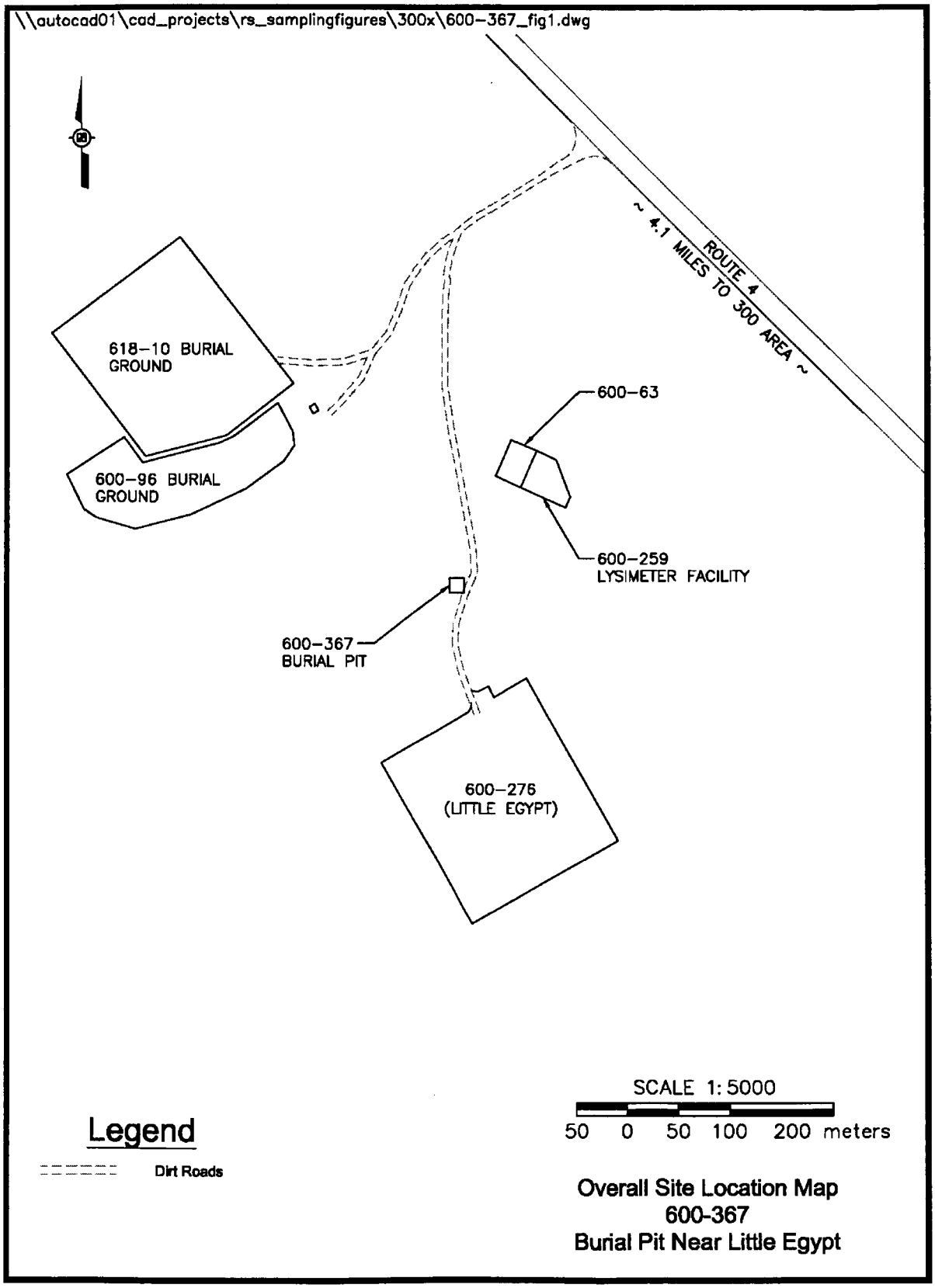
2.1 SITE DESCRIPTION

The 600-367, Burial Pit Near the Geotechnical Engineering and Development Facility (Little Egypt) waste site was located approximately 100 m (328 ft) north of the Hanford Geotechnical Engineering and Development Cold Test Facility (also known as Little Egypt) (Figure 1). The waste site consisted of a pit that was excavated to bury the remains of a trailer and equipment that were destroyed during a Hanford Site range fire in the 1980s. The buried debris was concentrated in an area approximately 7 by 18 m (23 by 59 ft) and was centered at Washington State plane coordinates N 121499, E 591116.

2.2 SITE HISTORY

The 600-367 burial pit was excavated to bury the remains of the equipment and trailer that were destroyed during a Hanford Site range fire in the 1980s. The equipment and temporary trailer were being used in support of the 600-276, Geotechnical Engineering and Development Facility, which became operational in 1982 to support the development of technology for disposal of low level radioactive waste. The site was used to test burial ground subsidence control alternatives, including cold test demonstrations of geotechnical engineering prototype systems for in situ isolation and stabilization of waste disposal structures.

Figure 1. The 600-367 Waste Site Location Map.



The 600-276, Geotechnical Engineering and Development Facility waste site was included as part of the River Corridor Closure contract for confirmatory sampling even though the waste site was classified as "Not Accepted" in the Waste Identification Data System. However, rather than changing the reclassification status, a new waste site (the 600-367, Burial Pit Near Little Egypt) was created (WCH 2011a). The 600-367 waste site was subsequently recommended for remedial action without confirmatory sampling (WCH 2013).

2.3 GEOPHYSICAL SURVEY

A geophysical survey was performed at the 600-367 waste site location in February 2011 for general characterization and delineation of the site (WCH 2011b). The survey identified a well-defined area/pit with debris buried from 1 to 2 m (3.3 to 6.6 ft) below the ground surface. The interpretation map is provided in Figure 2.

3.0 REMEDIAL ACTION FIELD ACTIVITIES

3.1 EXCAVATION AND DISPOSAL

Remedial action at the 600-367 waste site began on January 23 and continued through February 2, 2015. The remediation extended to an estimated maximum depth of 2.6 m (8.5 ft) below ground surface resulting in 810 bank cubic meters (1,059 bank cubic yards) of contaminated soil and debris being removed and disposed at ERDF. The debris consisted of a metal trailer frame, plastic, fiberglass insulation, three empty drums, an empty 19-L (5-gal) bucket, and an empty compressed gas cylinder. The empty cylinder was sent to recycling. Photographs of the remediation are provided in Figures 3 and 4 and the compressed gas cylinder is shown in Figure 5.

One anomaly was found during remediation and is described as blue, soft granular material, and is seen in Figure 6. The anomalous material was sampled on February 20, 2015. The resulting data are provided in Appendix A. Copper and lead exceeded direct exposure CULs. All other metals were either undetected or detected below the CULs. The anomalous material was loaded out and disposed at ERDF.

All waste material was direct loaded from the excavation into ERDF cans for disposal; therefore, no waste staging pile area was created. Additionally, no overburden material was salvaged for use as backfill material.

Several in-process soil samples, one molten metal sample, and one suspect asbestos containing material sample were collected from the 600-367 excavation. A summary of all in-process samples collected is presented in Table 1. The sample results are provided in Appendix A.

Figure 2. The 600-367 Waste Site Geophysical Interpretation Map.

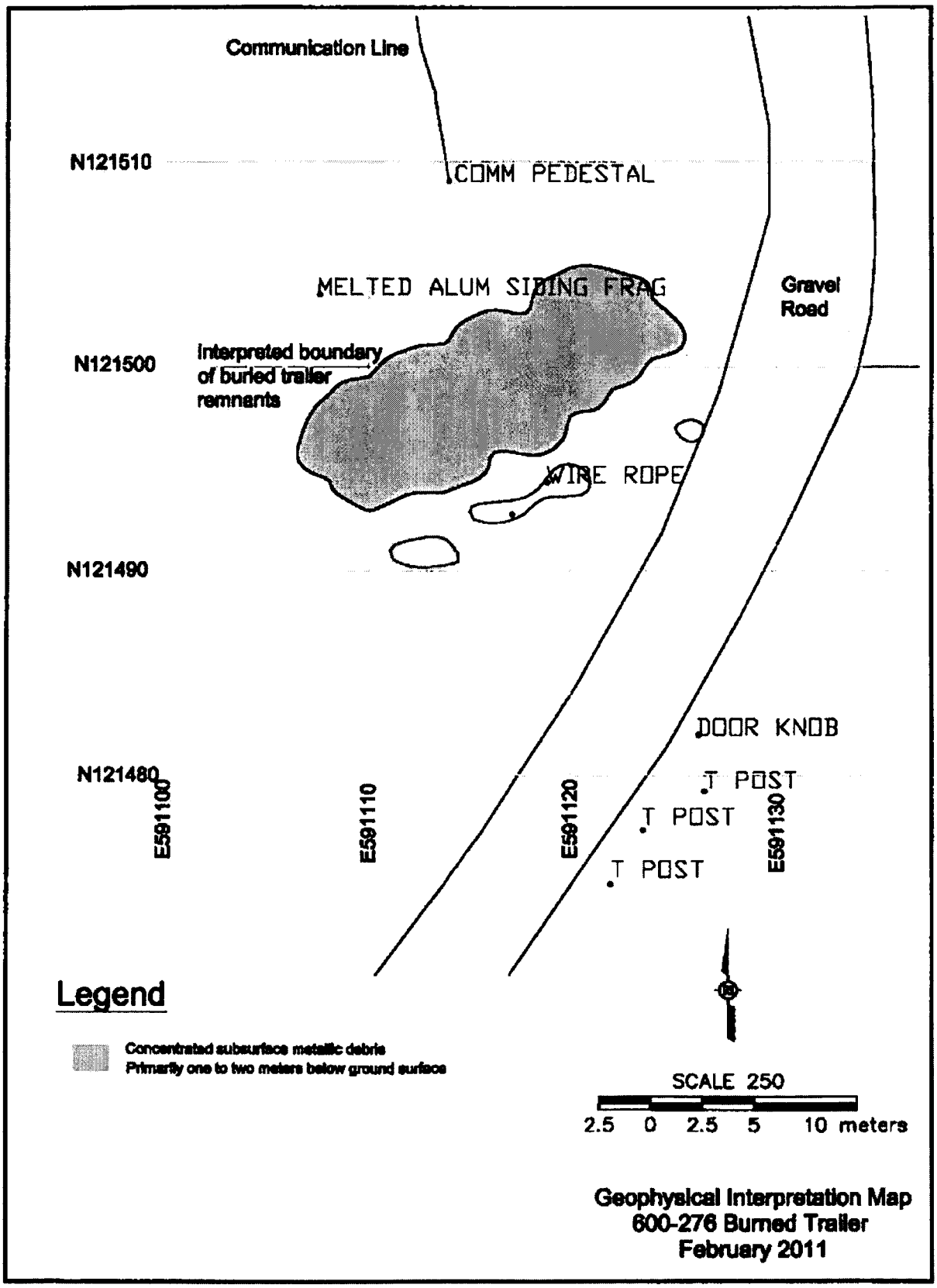


Figure 3. The 600-367 Waste Site Remediation, Dated January 23, 2015.

Figure 4. Metal Debris in 600-367 Excavation, Dated January 30, 2015.

Figure 5. Photograph of Empty Compressed Gas Cylinder Found in 600-367.

Figure 6. Blue Anomalous Material Found in 600-367, Dated January 30, 2015.

Table 1. 600-367 In-Process Sample Summary.

HEIS Sample Number	Sample Date	Sample Description	Washington State Plane Coordinates		Requested Analyses
			Northing	Easting	
J1V0W4	10/8/2015	Soil	121503.4	591119.6	ICP metals [a], mercury, TPH (diesel and kerosene range), PAH, PCB, pesticides
J1V0W5	10/8/2015	Soil	121492.3	591117.6	
J1V0W6	10/8/2015	Soil	121495.1	591108.5	
J1V0X0	10/8/2015	Molten metal	121497.2	591122.5	
J1V0W7	10/8/2015	Soil	121503.4	591119.6	Asbestos
J1V0W8	10/8/2015	Soil	121492.3	591117.6	Asbestos
J1V0W9	10/8/2015	Soil	121495.1	591108.5	Asbestos
J1V0X1	10/8/2015	Suspect ACM	121497.2	591122.5	Asbestos
J1V3X5	2/3/2015	Soil	121493.7	591113.8	ICP metals [a], mercury, TPH (diesel and kerosene range), PAH, PCB, pesticides
J1V3X6	2/3/2015	Soil	121499.9	591118	
J1V3X7	2/3/2015	Soil	121500.4	591126.9	

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

ACM = asbestos containing material
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
TPH = total petroleum hydrocarbons

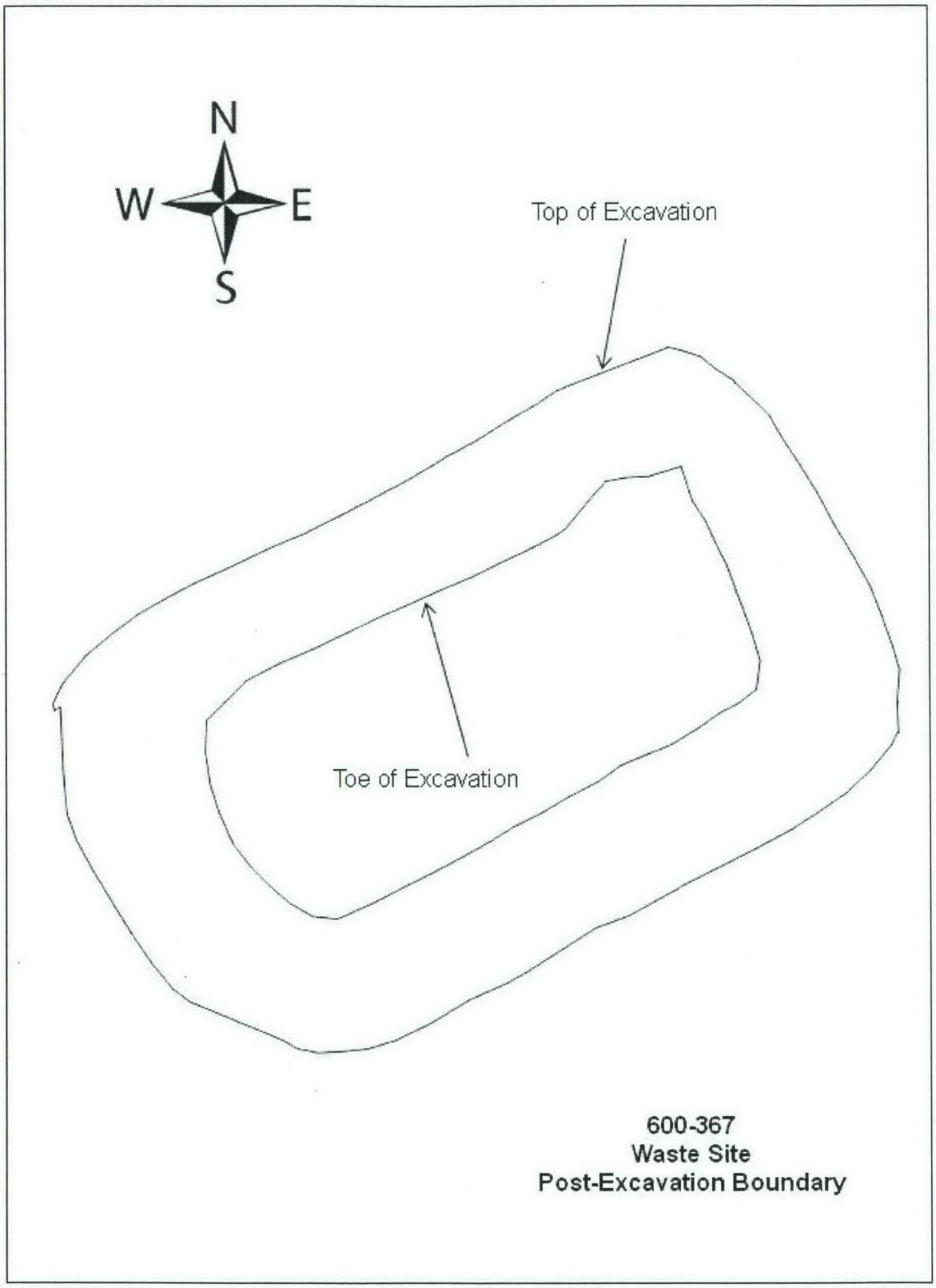
3.2 POST-EXCAVATION TOPOGRAPHIC SURVEY

A post-excavation walkaround boundary survey was conducted and it is provided in Figure 7.

4.0 VERIFICATION SAMPLING ACTIVITIES

Verification sampling at the 600-367 waste site was performed on April 30, 2015, per the *Work Instruction for Verification Sampling of the 600-367, Burial Pit Near Little Egypt* (WCH 2015). Sampling was conducted to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the 300-FF-2 RDR/RAWP (DOE-RL 2015) and the 300 Area ROD (EPA 2013).
The following subsections provide additional discussion of the information used to develop the verification sampling design.

Figure 7. The 600-367 Waste Site Post-Remediation Walkaround Boundary Survey.



4.1 CONTAMINANTS OF CONCERN FOR VERIFICATION SAMPLING

The 600-367, Burial Pit Near Little Egypt waste site was described as a burial pit that was excavated to bury the remains of equipment and a trailer that were destroyed during a Hanford Site range fire in the 1980s.

The contaminants of concern (COCs) for the 600-367 waste site were developed based on historical process knowledge associated with the fire and burned debris and equipment that were present at the site. The COCs include the expanded list of inductively coupled plasma metals, mercury, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons, and polycyclic aromatic hydrocarbons. The analytical methods that were used to evaluate the site COCs are provided in Table 2.

Table 2. 600-367 Waste Site Laboratory Analytical Methods.

Analytical Method	Contaminants of Concern
ICP metals [a] – EPA Method 6010	Metals
Mercury – EPA Method 7471	Mercury
PAH – EPA Method 8310	Polycyclic aromatic hydrocarbons
PCB – EPA Method 8082	Polychlorinated biphenyls
TPH – NWTPH-Dx	Total petroleum hydrocarbons

[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
ICP = inductively coupled plasma
NWTPH-Dx = Northwest total petroleum hydrocarbons – diesel range organics
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

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. One decision unit was identified for the 600-367 waste site. The decision unit is comprised of a combination of statistical and focused verification soil samples.

4.2.1 Statistical Verification Sampling Design

The decision rule for demonstrating compliance with the cleanup criteria requires comparison of the true population mean, as estimated by the 95% upper confidence limit (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 600-367 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 600-367 waste site was delineated in the Visual Sample Plan[1] and used as the basis for the location of a random start systematic grid for verification soil sampling. A triangular grid was selected for this investigation based on studies that indicate triangular grids are superior to square grids (Gilbert 1987). Twelve statistical soil sample locations were identified (Figure 8).

4.2.2 Focused Verification Sampling Design

In addition to the statistical sample locations, one focused sample location was identified at the location where the anomalous material was found (Figure 8). The focused sample point was generated to verify that residual contaminant concentrations exceeding the CULs do not remain.

4.2.3 Verification Sampling

The soil sample locations were global positional surveyed and staked prior to sample collection using the coordinate pairs provided in Table 3. A discrete grab 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). Field quality control samples were also collected and consisted of one equipment blank, one duplicate, and one split sample.

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 2014). All samples were submitted to offsite laboratories for full protocol laboratory analysis using approved U.S. Environmental Protection Agency (EPA) analytical methods as required per the 300 Area SAP.

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

Figure 8. Verification Sample Locations for the 600-367 Waste Site Excavation.

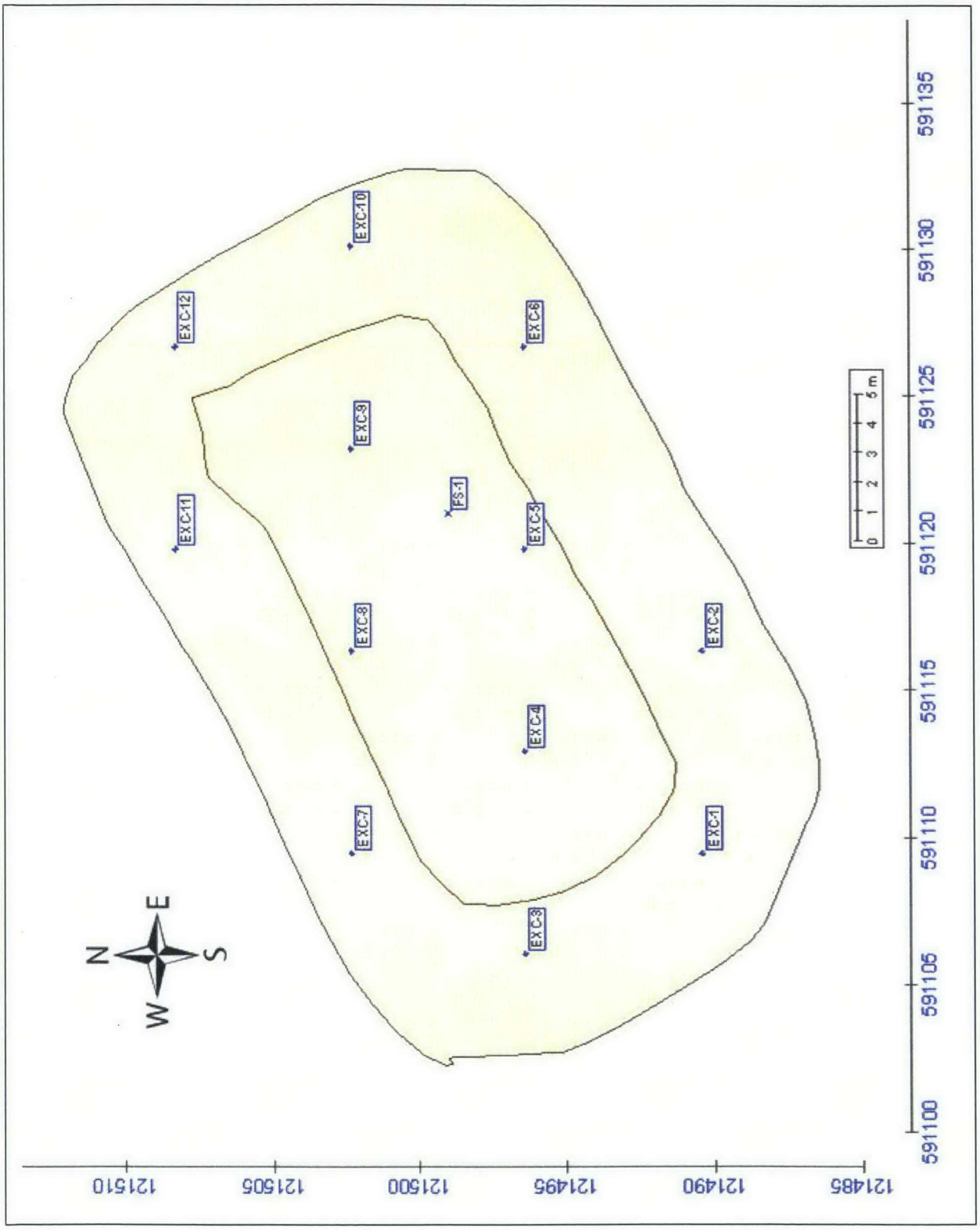


Table 3. Sample Summary Table for the 600-367 Waste Site.

Sample Location	HEIS Sample Number	Washington State Plane Coordinate Locations (m)		Sample Analysis
		Northing	Easting	
EXC-1	J1V720	121490.4	591109.4	ICP metals [a], mercury, PAH, PCBs, TPH
EXC-2	J1V721	121490.4	591116.3	
EXC-3	J1V722	121496.4	591106	
EXC-4	J1V723	121496.4	591112.9	
EXC-5	J1V724	121496.4	591119.8	
EXC-6	J1V725	121496.4	591126.7	
EXC-7	J1V726	121502.4	591109.4	
EXC-8	J1V727	121502.4	591116.3	
EXC-9	J1V728	121502.4	591123.2	
EXC-10	J1V729	121502.4	591130.1	
EXC-11	J1V730	121508.4	591119.8	
EXC-12	J1V731	121508.4	591126.7	
Duplicate of J1V731	J1V732	121508.4	591126.7	
Split of J1V731	J1V733	121508.4	591126.7	
FS-1 [b]	J1V734	121499	591121	
Equipment blank	J1V719	NA	NA	ICP metals [a], mercury

[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.
[b] Focus sample located where the blue granular material was found in the excavation.

EXC = excavation
FS = focused sample
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

5.0 SAMPLING RESULTS

Verification sampling was conducted to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the 300-FF-2 RDR/RAWP (DOE-RL 2015) and the 300 Area ROD (EPA 2013). One decision unit was identified for the 600-367 waste site and it is comprised of a combination of statistical and focused verification soil samples. This section presents the evaluation of the verification sample results for comparison with the data quality criteria and CULs.

The laboratory-reported verification sample results for all constituents are stored in a Washington Closure Hanford project-specific database prior to archival in the Hanford Environmental Information System (HEIS) and are presented as an attachment to the 95% UCL calculation (Appendix B).

5.1 STATISTICAL SAMPLE RESULTS

Twelve statistical soil samples were collected from the decision unit and submitted to offsite laboratories for analysis. The resulting data were evaluated by performing a 95% UCL calculation on the true population mean for the residual COC concentrations.

The 95% UCLs were calculated for the excavation decision unit as specified by the 300-FF-2 RDR/RAWP (DOE-RL 2015); the calculations are presented in Appendix B. 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.

Comparison of the 95% UCL results for each COC against the residential CULs are presented in Table 4. Contaminants that were not detected by laboratory analysis are excluded from the table; however, they are reported in Appendix B. Calculated CULs for calcium, magnesium, potassium, silicon, and sodium are not presented in the 300-FF-2 RDR/RAWP (DOE-RL 2015). Parameters to calculate CULs for these constituents are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2015) under *Washington Administrative Code* (WAC) 173-340-740(3), "Model Toxics Control Act – Cleanup," or other reference databases. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (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 not included in these tables. While not identified as a 300 Area COC in the 300 Area ROD (EPA 2013), molybdenum was detected in the verification samples; however, the detection was below the background value. Therefore, the detected molybdenum concentration does not require further discussion.

5.2 FOCUSED SAMPLE RESULTS

One focused sample was collected from the excavation decision unit. A comparison of the focused sample results for each COC against the residential CULs are presented in Table 5. Statistical analysis (e.g., calculation of a 95% UCL value) is inappropriate to use for evaluation of the focused sample; therefore, the sample results are evaluated using the maximum detected activity for each COC and comparing the value directly to the CULs.

Table 4. Comparison of Contaminant Concentrations to Residential Cleanup Levels for the 600-367 Waste Site Excavation Verification Sampling.

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	2.3 (<BG)	20	20	No
Barium	75.1 (<BG)	16,000	--	No
Beryllium	0.13 (<BG)	160	--	No
Chromium (total)	5.4 (<BG)	120,000	--	No
Cobalt	8.4 (<BG)	24	--	No
Copper	14.4 (<BG)	3,200	3,400	No
Lead	2.9 (<BG)	250	1,480	No
Manganese	305 (<BG)	11,200	--	No
Nickel	10.2 (<BG)	1,600	--	No
Uranium (total)	0.41 (<BG)	81	102	No
Vanadium	63.5 (<BG)	400	--	No
Zinc	39.6 (<BG)	24,000	64,100	No

[a] 95% upper confidence level or maximum value, depending on data censorship, as described in Appendix B.
[b] Background values from DOE-RL (1996, 2001, and 2013).
[c] CULs obtained from 300-FF-2 RDR/RAWP (DOE-RL 2015)

-- = not applicable
BG = background
COC = contaminant of concern
CUL = cleanup level
RDR/RAWP = remedial design report/remedial action work plan

Table 5. Comparison of Contaminant Concentrations to Residential Cleanup Levels for the 600-367 Waste Site Focused Verification Sampling.

COC	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	2.1 (<BG)	20	20	No
Barium	57.1 (<BG)	16,000	--	No
Beryllium	0.077 (<BG)	160	--	No
Chromium (total)	3.9 (<BG)	120,000	--	No
Cobalt	7.4 (<BG)	24	--	No
Copper	12.2 (<BG)	3,200	3,400	No
Lead	2.3 (<BG)	250	1,480	No
Manganese	264 (<BG)	11,200	--	No
Nickel	6.9 (<BG)	1,600	--	No
Uranium (total)	0.34 (<BG)	81	102	No
Vanadium	62.1 (<BG)	400	--	No
Zinc	38.3 (<BG)	24,000	64,100	No

[a] 95% upper confidence level or maximum value, depending on data censorship, as described in Appendix B.
[b] Background values from DOE-RL (1996, 2001, and 2013).
[c] CULs obtained from 300-FF-2 RDR/RAWP (DOE-RL 2015)

-- = not applicable
BG = background
COC = contaminant of concern
CUL = cleanup level
RDR/RAWP= remedial design report/remedial action work plan

5.3 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 600-367 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 a Washington Closure Hanford project-specific database prior to archiving in HEIS and are presented as an attachment to the 95% UCL calculations in Appendix B. The detailed DQA is presented in Appendix C.

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.

The 600-367 waste site is located within the residential portion of the 300 Area; therefore, the site was evaluated against the residential land use CULs.

6.1 COMPARISON OF SAMPLE DATA TO THE CULS

Evaluation of the results listed in Tables 4 and 5 from the verification sampling at the 600-367 waste site indicates that all nonradionuclide COCs were 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).

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 nonradionuclide risk requirements.

6.2.1 Attainment of Nonradionuclide Noncarcinogenic and Carcinogenic Risk Standards

For COCs with noncarcinogenic effects, 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).

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 1.0×10^{-6}, and a cumulative carcinogenic risk of less than 1.0×10^{-5}. The hazard quotient and excess carcinogenic risk calculations are performed using the highest value of either the 95% UCL statistical or the focused sample result 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. For the 600-367 waste site, no constituents were detected above the Hanford Site or Washington State background values; therefore, no hazard quotient and carcinogenic risk calculations were performed.

7.0 STATEMENT OF PROTECTIVENESS

This CVP demonstrates that remedial action at the 600-367 waste site achieved the RAOs and corresponding CULs established for the residential land-use scenario in the 300 Area ROD (EPA 2013) and meets the requirements of the 300-FF-2 RDR/RAWP (DOE-RL 2015). The contaminated materials from the site have been excavated and disposed of at ERDF. The remaining soil at the 600-367 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. Because the waste site was remediated to achieve CULs for residential land use, institutional controls are not required. The 600-367 waste site meets the requirements for unlimited use and unrestricted exposure. The 600-367 waste site is verified to be remediated in accordance with the 300 Area ROD and has been reclassified to a status of Final Closed Out.

8.0 REFERENCES

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APPENDIX A

IN-PROCESS DATA

Table A-1. 600-367 In-Process Sample Data. (5 Pages)

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Aluminum			Antimony			Arsenic		
						mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	6430	X	1.5	1.9	U	1.9	2.5		0.65
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	5930	X	1.4	1.8	U	1.8	1.8		0.61
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	5350	X	1.5	1.9	U	1.9	2		0.66
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5	151000	M	7.7	2.4	B	1.9	3.3	U	3.3
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	7370	X	1.5	3.7	U	3.7	2.9		0.65
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	5150	X	1.5	0.37	U	0.37	1.8		0.64
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	4910	X	1.4	0.35		0.35	2	N	0.61

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Barium			Beryllium			Boron		
						mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	81.4	X	0.075	0.16	U	0.16	0.97	U	0.97
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	76.9	X	0.071	0.15	U	0.15	0.91	U	0.91
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	74.8	XM	0.076	0.16	U	0.16	0.98	U	0.98
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5	92.7		0.075	0.16	U	0.16	19.5	M	0.97
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	83.1	X	0.075	0.32	U	0.32	0.96	U	0.96
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	61.4	X	0.074	0.18	BC	0.032	0.95	U	0.95
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	80.1	X	0.07	0.18	C	0.031	0.91	UN	0.91

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Cadmium			Calcium			Chromium		
						ICP			ICP			ICP		
						mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	0.15	B	0.041	4480	X	13.9	8.3	X	0.057
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	0.14	B	0.038	3690	X	13.1	5.7	X	0.054
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	0.16	B	0.041	5080	X	14	4.5	X	0.058
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5	1.7	M	0.041	3720		14	40.2	N	0.057
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	0.18	B	0.04	10700	X	13.8	7.4	X	0.057
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	0.14	B	0.04	6660	X	13.7	5.3	X	0.057
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	0.15	B	0.038	7220	XN	13	5.9	X	0.054

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Cobalt			Copper			Iron		
						mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	9.6		0.49	15.4		1.1	30100		18.8
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	9.3		0.46	12.6		1	28700		17.6
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	9.5		0.5	15.2		1.1	28200		18.9
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5	6.1	X	0.099	2820	M	0.21	19100	X	3.8
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	8.7	BX	0.98	11.7	X	2.1	23900	X	3.7
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	7	X	0.097	11.6	X	0.21	19000	X	3.7
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	7.7	X	0.092	12	X	0.2	20100	X	3.5

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Lead			Magnesium			Manganese		
						mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	4.8		1.3	4080	X	3.7	360	X	0.099
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	5.1		1.3	3550	X	3.4	372	X	0.093
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	4.3		1.3	3790	X	3.7	363	XM	0.1
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5	22.5		1.3	3260		3.7	1100	M	0.099
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	4.8	B	2.6	5040	X	36.3	280	X	0.098
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	2.9		0.26	3270	X	3.6	263	X	0.097
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	2.6		0.25	3840	X	3.4	242	X	0.092

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Mercury			Molybdenum			Nickel		
						mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	0.0049	U	0.0049	0.26	U	0.26	9.2	X	0.12
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	0.0051	U	0.0051	0.24	U	0.24	7.8	X	0.11
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	0.0054	U	0.0054	0.26	U	0.26	8.8	X	0.12
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5	0.005	U	0.005	0.56	B	0.26	461	M	0.12
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	0.0058	U	0.0058	0.25	U	0.25	9.1	X	0.12
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	0.0055	U	0.0055	0.25	U	0.25	6.3	X	0.12
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	0.0057	U	0.0057	0.24	U	0.24	6.5	X	0.11

Table A-1. 600-367 In-Process Sample Data. (5 Pages)

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Potassium			Selenium			Silicon		
						mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	1360		40.5	0.85	U	0.85	304	N	5.6
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	1250		38.1	1.1		0.8	282	N	5.3
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	829		40.8	0.86	U	0.86	253	N	5.6
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5	914		40.6	4.3	U	4.3	258	N	28
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	953		40.2	0.84	U	0.84	114	N	5.5
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	750		39.9	0.84	U	0.84	65.2	N	5.5
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	624		37.9	0.8	UN	0.8	64.6	N	5.2

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Silver			Sodium			Thallium		
						mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	0.16	U	0.16	230		58.3	3.2	U	3.2
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	0.15	U	0.15	210		54.8	3	U	3
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	0.17	BC	0.16	273		58.8	3.2	U	3.2
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5	0.34		0.16	205		58.4	2.5	N	0.64
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	0.16	U	0.16	286		57.9	6.4	U	6.4
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	0.16	U	0.16	272		57.5	0.63	U	0.63
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	0.15	U	0.15	256		54.6	0.6	U	0.6

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Uranium			Vanadium			Zinc		
						mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	0.36		0.0015	78		0.46	53.8	X	0.39
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	0.41		0.0014	77.5		0.44	55.8	X	0.37
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	0.39		0.0013	76.2		0.47	46.3	X	0.4
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5				65.3		0.093	3170		0.39
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	0.5		0.0016	57.9	X	0.92	48.3	X	3.9
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	0.33		0.0016	50.2	X	0.092	33	X	0.39
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	0.38		0.0015	50.7	X	0.087	35.2	X	0.37

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	Zirconium		
						mg/kg	Q	PQL
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	28.3	X	0.35
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	26.7	X	0.33
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	26.3	X	0.35
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5	23.3		0.35
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	26.9	X	0.35
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	19	X	0.34
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	26.4	X	0.33

Site Code	Sample Number	Sample Date	Sample Type	Northing	Easting	TPH - diesel range			TPH - kerosene range			Percent moisture (wet sample)			Asbestos
						TPH			TPH			PHYSICAL			
						ug/kg	Q	PQL	ug/kg	Q	PQL	%	Q	PQL	
600-367	J1V0W4	10/8/14	In-process	121503.4	591119.6	2400	J	680	1000	U	1000	0.77		0	
600-367	J1V0W5	10/8/14	In-process	121492.3	591117.6	2400	J	670	990	U	990	0.26		0	
600-367	J1V0W6	10/8/14	In-process	121495.1	591108.5	2400	J	660	970	U	970	0.58		0	
600-367	J1V0X0	10/8/14	In-process	121497.2	591122.5										
600-367	J1V0W7	10/8/2014	In-process	121503.4	591119.6										ND
600-367	J1V0W8	10/8/2014	In-process	121492.3	591117.6										ND
600-367	J1V0W9	10/8/2014	In-process	121495.1	591108.5										ND
600-367	J1V0X1	10/8/2014	In-process	121497.2	591122.5										ND
600-367	J1V3X5	2/3/15	In-process	121493.7	591113.8	740	U	740	1100	U	1100	8.9		0	
600-367	J1V3X6	2/3/15	In-process	121499.9	591118	690	U	690	1000	U	1000	5.8		0	
600-367	J1V3X7	2/3/15	In-process	121500.4	591126.9	670	U	670	990	U	990	6		0	

Table A-1. 600-367 In-Process Sample Data. (5 Pages)

Sample Number		J1V0W4			J1V0W5			J1V0W6		
Site Code		600-367			600-367			600-367		
Constituent	Class	10/8/14			10/8/14			10/8/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.7	U	9.7	9.5	U	9.5	10	U	10
Acenaphthylene	PAH	8.7	U	8.7	8.5	U	8.5	9	U	9
Anthracene	PAH	3	U	3	2.9	U	2.9	3	U	3
Benzo(a)anthracene	PAH	3.1	U	3.1	3	UN	3	3.2	U	3.2
Benzo(a)pyrene	PAH	6.2	U	6.2	6.1	U	6.1	6.4	U	6.4
Benzo(b)fluoranthene	PAH	4.1	U	4.1	4	UN	4	4.2	U	4.2
Benzo(ghi)perylene	PAH	7	U	7	6.8	U	6.8	7.2	U	7.2
Benzo(k)fluoranthene	PAH	3.8	U	3.8	3.7	UN	3.7	3.9	U	3.9
Chrysene	PAH	4.7	U	4.7	4.6	U	4.6	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	10	UN	10	11	U	11
Fluoranthene	PAH	13	U	13	12	U	12	13	U	13
Fluorene	PAH	5.1	U	5.1	5	U	5	5.3	U	5.3
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	11	U	11	12	U	12
Naphthalene	PAH	12	U	12	11	U	11	12	U	12
Phenanthrene	PAH	12	U	12	11	U	11	12	U	12
Pyrene	PAH	12	U	12	11	U	11	12	U	12
Aroclor-1016	PCB	2.8	U	2.8	2.7	U	2.7	2.7	U	2.7
Aroclor-1221	PCB	8.1	U	8.1	7.9	U	7.9	7.9	U	7.9
Aroclor-1232	PCB	2	U	2	2	U	2	2	U	2
Aroclor-1242	PCB	4.7	U	4.7	4.6	U	4.6	4.6	U	4.6
Aroclor-1248	PCB	4.7	U	4.7	4.6	U	4.6	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5
Aldrin	PEST	0.25	U	0.25	0.24	U	0.24	0.25	U	0.25
Alpha-BHC	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
alpha-Chlordane	PEST	0.32	U	0.32	0.31	U	0.31	0.32	U	0.32
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.66	U	0.66	0.64	U	0.64	0.65	U	0.65
Delta-BHC	PEST	0.4	U	0.4	0.39	U	0.39	0.4	U	0.4
Dichlorodiphenyldichloroethane	PEST	0.55	U	0.55	0.53	U	0.53	0.54	U	0.54
Dichlorodiphenyldichloroethylene	PEST	0.24	U	0.24	0.23	U	0.23	0.23	U	0.23
Dichlorodiphenyltrichloroethane	PEST	0.59	U	0.59	0.57	U	0.57	0.58	U	0.58
Dieldrin	PEST	0.21	U	0.21	0.2	U	0.2	0.21	U	0.21
Endosulfan I	PEST	0.18	U	0.18	0.17	U	0.17	0.17	U	0.17
Endosulfan II	PEST	0.29	U	0.29	0.28	U	0.28	0.28	U	0.28
Endosulfan sulfate	PEST	0.28	U	0.28	0.27	U	0.27	0.27	U	0.27
Endrin	PEST	0.31	U	0.31	0.3	U	0.3	0.3	U	0.3
Endrin aldehyde	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST	0.49	U	0.49	0.47	U	0.47	0.48	U	0.48
Gamma-BHC (Lindane)	PEST	0.46	U	0.46	0.45	U	0.45	0.46	U	0.46
gamma-Chlordane	PEST	0.27	U	0.27	0.26	U	0.26	0.26	U	0.26
Heptachlor	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
Heptachlor epoxide	PEST	0.43	U	0.43	0.41	U	0.41	0.42	U	0.42
Methoxychlor	PEST	0.45	U	0.45	0.44	U	0.44	0.44	U	0.44
Toxaphene	PEST	16	U	16	15	U	15	16	U	16

Table A-1. 600-367 In-Process Sample Data. (5 Pages)

Sample Number		J1V3X5			J1V3X6			J1V3X7		
Site Code		600-367			600-367			600-367		
Constituent	Class	2/3/15			2/3/15			2/3/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	11	U	11	10	UN	10	10	U	10
Acenaphthylene	PAH	9.7	U	9.7	9.3	U	9.3	9.3	U	9.3
Anthracene	PAH	3.3	U	3.3	3.1	U	3.1	3.2	U	3.2
Benzo(a)anthracene	PAH	3.4	U	3.4	3.3	U	3.3	3.3	U	3.3
Benzo(a)pyrene	PAH	6.9	U	6.9	6.6	U	6.6	6.6	U	6.6
Benzo(b)fluoranthene	PAH	4.5	U	4.5	4.3	U	4.3	4.4	U	4.4
Benzo(ghi)perylene	PAH	7.7	U	7.7	7.4	U	7.4	7.5	U	7.5
Benzo(k)fluoranthene	PAH	4.2	U	4.2	4.1	U	4.1	4.1	U	4.1
Chrysene	PAH	5.2	U	5.2	5	U	5	5	U	5
Dibenz[a,h]anthracene	PAH	12	U	12	11	U	11	11	U	11
Fluoranthene	PAH	14	U	14	13	U	13	13	U	13
Fluorene	PAH	5.7	U	5.7	5.4	U	5.4	5.5	U	5.5
Indeno(1,2,3-cd)pyrene	PAH	13	U	13	12	U	12	12	U	12
Naphthalene	PAH	13	U	13	12	U	12	12	U	12
Phenanthrene	PAH	13	U	13	12	UN	12	12	U	12
Pyrene	PAH	13	U	13	12	U	12	12	U	12
Aroclor-1016	PCB	3	U	3	2.9	U	2.9	2.9	U	2.9
Aroclor-1221	PCB	8.7	U	8.7	8.3	U	8.3	8.5	U	8.5
Aroclor-1232	PCB	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1
Aroclor-1242	PCB	5.1	U	5.1	4.8	U	4.8	5	U	5
Aroclor-1248	PCB	5.1	U	5.1	4.8	U	4.8	5	U	5
Aroclor-1254	PCB	2.8	U	2.8	2.7	U	2.7	2.8	U	2.8
Aroclor-1260	PCB	2.8	U	2.8	2.7	U	2.7	2.8	U	2.8
Aldrin	PEST	0.28	U	0.28	0.26	U	0.26	0.25	U	0.25
Alpha-BHC	PEST	0.24	U	0.24	0.22	U	0.22	0.21	U	0.21
alpha-Chlordane	PEST	0.35	U	0.35	0.33	U	0.33	0.32	U	0.32
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.73	U	0.73	0.69	U	0.69	0.66	UN	0.66
Delta-BHC	PEST	0.44	U	0.44	0.41	U	0.41	0.4	U	0.4
Dichlorodiphenyldichloroethane	PEST	0.6	U	0.6	0.56	U	0.56	0.54	U	0.54
Dichlorodiphenyldichloroethylene	PEST	0.26	U	0.26	0.25	U	0.25	0.24	U	0.24
Dichlorodiphenyltrichloroethane	PEST	0.65	U	0.65	0.61	U	0.61	0.59	U	0.59
Dieldrin	PEST	0.23	U	0.23	0.22	U	0.22	0.21	U	0.21
Endosulfan I	PEST	0.19	U	0.19	0.18	U	0.18	0.18	U	0.18
Endosulfan II	PEST	0.32	U	0.32	0.3	U	0.3	0.29	U	0.29
Endosulfan sulfate	PEST	0.3	U	0.3	0.29	U	0.29	0.28	U	0.28
Endrin	PEST	0.34	U	0.34	0.32	U	0.32	0.31	U	0.31
Endrin aldehyde	PEST	0.19	U	0.19	0.18	U	0.18	0.17	U	0.17
Endrin ketone	PEST	0.54	U	0.54	0.51	U	0.51	0.49	U	0.49
Gamma-BHC (Lindane)	PEST	0.51	U	0.51	0.48	U	0.48	0.46	U	0.46
gamma-Chlordane	PEST	0.29	U	0.29	0.28	U	0.28	0.27	U	0.27
Heptachlor	PEST	0.24	U	0.24	0.22	U	0.22	0.21	U	0.21
Heptachlor epoxide	PEST	0.47	U	0.47	0.44	U	0.44	0.42	U	0.42
Methoxychlor	PEST	0.49	U	0.49	0.47	U	0.47	0.45	U	0.45
Toxaphene	PEST	17	U	17	16	U	16	16	U	16

Table A-1. 600-367 In-Process Sample Data. (5 Pages)

Sample Number	Sample Date	Sample Location	Northing	Easting	Aluminum			Antimony			Arsenic			Barium		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	30100	XM	1.5	0.81	M	0.36	1.9	M	0.63	54.7	X	0.072

Sample Number	Sample Date	Sample Location	Northing	Easting	Beryllium			Boron			Cadmium			Calcium		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	0.23		0.031	11.9	M	0.93	3.7	MN	0.039	3240	X	13.4

Sample Number	Sample Date	Sample Location	Northing	Easting	Chromium			Cobalt			Copper			Iron		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	32.5	MN	0.055	5.6		0.095	4120	M	1	21200		18.1

Sample Number	Sample Date	Sample Location	Northing	Easting	Lead			Mercury			Magnesium			Manganese		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	2860	M	1.3	0.0051	U	0.0051	3600		3.5	337		0.095

Sample Number	Sample Date	Sample Location	Northing	Easting	Molybdenum			Nickel			Potassium			Selenium		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	0.25	U	0.25	10.9	M	0.12	950		39	0.82	U	0.82

Sample Number	Sample Date	Sample Location	Northing	Easting	Silicon			Silver			Sodium			Thallium		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	249		5.4	1.9	MN	0.15	159		56.2	0.62	U	0.62

Sample Number	Sample Date	Sample Location	Northing	Easting	Vanadium			Zinc			Zirconium			Bromide		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	60.9		0.09	6060	M	1.9	22		0.34	0.39	U	0.39

Sample Number	Sample Date	Sample Location	Northing	Easting	Chloride			Cyanide			Fluoride			Nitrogen in Nitrate		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	27.3	C	2	0.1	UN	0.1	0.81	UN	0.81	5		0.31

Sample Number	Sample Date	Sample Location	Northing	Easting	Nitrogen in Nitrite and Nitrate			Nitrogen in Nitrite			Phosphorous in Phosphate			Sulfate		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	4.2	M	0.34	0.7	B	0.33	1.2	UN	1.2	10.8	N	1.7

Sample Number	Sample Date	Sample Location	Northing	Easting	Sulfide			pH Measurement		
					mg/kg	Q	PQL	pH	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	4.7	UN	4.7	8.05		0.1

Sample Number	Sample Date	Sample Location	Northing	Easting	Aluminum			Antimony			Arsenic			Barium		
					TCLP			TCLP			TCLP			TCLP		
					mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	14.3		0.09	0.016	U	0.016	0.022	U	0.022	0.76	B	0.002

Sample Number	Sample Date	Sample Location	Northing	Easting	Beryllium			Cadmium			Chromium			Lead		
					TCLP			TCLP			TCLP			TCLP		
					mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	0.002	U	0.002	0.12		0.002	0.014	B	0.003	226		0.013

Sample Number	Sample Date	Sample Location	Northing	Easting	Mercury			Nickel			Selenium			Silver		
					TCLP			TCLP			TCLP			TCLP		
					mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	3E-05	U	3E-05	0.11	B	0.006	0.024	U	0.024	0.007	B	0.004

Sample Number	Sample Date	Sample Location	Northing	Easting	Sodium			Thallium			Vanadium			Zinc		
					TCLP			TCLP			TCLP			TCLP		
					mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
J1V4H9	2/20/15	B-12 box	121497	591121	1410	CN	0.46	0.024	U	0.024	0.006	U	0.006	131		0.022

APPENDIX B

CALCULATIONS

APPENDIX B

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:

600-367 Waste Site Cleanup Verification 95% UCL Calculations, 0600X-CA-V0196, Rev. 0, Washington Closure Hanford, Richland, Washington B-3

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.

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CALCULATION COVER SHEET

Project Title: 300 Area Field Remediation **Job No. 14655**

Area: 600

Discipline: Environmental *Calculation No: 0600X-CA-V0196

Subject: 600-367 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 = 7 Attm. 1 = 5 Total = 13	R. J. Nielson	I. B. Berezovskiy	T. Q. Howell	S. G. Wilkinson	9/2/15

SUMMARY OF REVISION

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

Washington Closure Hanford **CALCULATION SHEET**

Originator R. J. Nielson		**Date** 07/29/15	**Calc. No.** 0600X-CA-V0196	**Rev. No.**	0
Project 300 Area Closure Operations		**Job No.** 14655	**Checked** I. B. Berezovskiy	**Date**	07/29/15
Subject 600-367 Waste Site Cleanup Verification 95% UCL Calculation				**Sheet No.**	1 of 7

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 Action ROD (EPA 2013a). ProUCL 5.0 (EPA 2013b) software was used for all calculations.

Table of Contents:
Sheets 1 to 4 - Calculation Sheet Summary
Sheets 5 to 6 - Calculation Sheet Verification Data - Excavation
Sheet 7 - Calculation Sheet Split-Duplicate Analysis Excavation
Attachment 1 - 600-367 Waste Site Verification Sampling Results (5 sheets)

Given/References:
1) Sample Results (Attachment 1).
2) 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.
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) Ecology, 2011, *Cleanup Levels and Risk Calculations (CLARC) Database*, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
5) EPA, 1989, *Risk Assessment Guidance for Superfund: Volume 1*, Human Health Evaluation Manual, Part A; Interim Final, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D.C.
6) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013. U.S. Environmental Protection Agency, Washington, D. C.
7) EPA, 2013a, *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*, November 2013, U. S. Environmental Protection Agency, Region 10, Seattle Washington.
8) EPA, 2013b, ProUCL, Version 5.0, U.S. Environmental Protection Agency, Washington, D.C. <http://www.epa.gov/osp/hstl/tsc/software.htm>.
9) WCH, 2015, *600-367 Waste Site General UCL Statistics*, ProUCL Calculation Details, CCN 180219, Washington Closure Hanford, Richland, Washington.

Solution:
The subject calculations were performed on statistical verification sample data. Calculations were performed using ProUCL 5.0 (EPA 2013b) 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 600-367 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 600-367 waste site underwent statistical sampling at 12 locations and included one duplicate and one split sample. Additionally, one focused sample was also collected. Analytical data for the statistical or maximum results are provided in the summary tables on sheet 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.

Washington Closure Hanford **CALCULATION SHEET**

Originator R. J. Nielson	**Date** 07/21/15	**Calc. No.** 0600X-CA-V0196	**Rev. No.** 0
Project 300 Area Closure Operations	**Job No.** 14655	**Checked** I. B. Berezovsky	**Date** 07/21/15
Subject 600-367 Waste Site Cleanup Verification 95% UCL Calculation			**Sheet No.** 2 of 7

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 600-367 General UCL Statistics for Data Sets with Non-Detects (WCH 2015). 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 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. Split samples were collected for cleanup verification of the subject site.

Summary (continued)

Qualifiers

B = estimated result; result is less than the RL but greater than the MDL.
C = the analyte was detected in both the sample and the associated QC blank, and the sample concentration was ≤5x the blank concentration.
D = dilution
J = estimate
M = sample duplicate precision not met.
N = recovery is outside control limits.
Q = qualifier
X = serial dilution in the analytical batch indicates that physical and chemical interferences are present.

Acronyms

CUL = cleanup level
CVP = cleanup verification package
DE = direct exposure
GW = groundwater
MDL = method detection limit
PQL = practical quantitation limit
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
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = Washington Administrative Code

Washington Closure Hanford **CALCULATION SHEET**

Originator	R. J. Nielson	**Date**	07/21/15	**Calc. No.**	0600X-CA-V0196	**Rev. No.**	0
Project	300 Area Closure Operations	**Job No.**	14655	**Checked**	I. B. Berezovskiy	**Date**	07/21/15
Subject	600-367 Waste Site Cleanup Verification 95% UCL Calculation					**Sheet No.**	4 of 7

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, 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	Focused Sample	Units
Arsenic	2.3	--	2.1	mg/kg
Barium	75.1	--	57.1	mg/kg
Beryllium	0.13	--	0.077	mg/kg
Chromium	5.4	--	3.9	mg/kg
Cobalt	8.4	--	7.4	mg/kg
Copper	14.4	--	12.2	mg/kg
Lead	2.9	--	2.3	mg/kg
Manganese	305	--	264	mg/kg
Nickel	10.2	--	6.9	mg/kg
Uranium	0.41	--	0.34	mg/kg
Vanadium	63.5	--	62.1	mg/kg
Zinc	39.6	--	38.3	mg/kg

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

Analyte	Excavation	
	Duplicate Analysis	Split Analysis
Aluminum	4.6%	20.0%
Barium	12.3%	16.2%
Calcium	6.4%	8.3%
Copper	2.5%	32.8%
Iron	7.8%	13.1%
Magnesium	1.0%	8.7%
Manganese	6.1%	23.7%
Silicon	4.7%	***100.4%***
Sodium	2.7%	34.7%
Vanadium	4.5%	33.9%
Zinc	4.1%	17.9%
Zirconium	8.2%	12.4%

[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 R. J. Nielson
Project 300 Area Closure Operations
Subject 600-367 Waste Site Cleanup Verification 95% UCL Calculation

Date 07/21/15
Job No. 14655

Calc. No. 0600X-CA-V0196
Checked I. B. Berezovskiy

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600-367 Statistical Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Arsenic			Barium			Beryllium			Chromium			Cobalt			Copper			Lead			Manganese		
			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-12	J1V731	4/30/15	2.0		0.57	61.8	X	0.066	0.10	B	0.028	5.5	X	0.050	7.4	X	0.086	12.0		0.19	2.7		0.23	272	X	0.086
Duplicate of J1V731	J1V732	4/30/15	2.1		0.62	69.9	X	0.072	0.14	B	0.031	3.9	X	0.055	7.3	X	0.094	12.3		0.20	2.6		0.25	256	X	0.094
EXC-1	J1V720	4/30/15	1.7	N	0.56	71.9	X	0.065	0.091	B	0.028	4.1	X	0.049	6.9	X	0.085	12.6		0.18	2.2		0.23	225	X	0.085
EXC-2	J1V721	4/30/15	2.3		0.58	55.4	X	0.067	0.14	U	0.14	5.0	X	0.051	9.5	X	0.44	16.8		0.95	3.0		1.2	284	X	0.088
EXC-3	J1V722	4/30/15	2.0		0.58	74.4	X	0.067	0.095	B	0.029	5.4	X	0.051	8.0	X	0.088	14.4		0.19	2.6		0.24	322	X	0.088
EXC-4	J1V723	4/30/15	3.2		0.60	93.8	X	0.069	0.19		0.030	6.6	X	0.053	8.8	X	0.091	13.2		0.20	3.2		0.25	362	X	0.091
EXC-5	J1V724	4/30/15	2.0		0.57	55.1	X	0.066	0.11	B	0.028	6.2	X	0.050	6.5	X	0.086	11.8		0.19	2.6		0.23	254	X	0.086
EXC-6	J1V725	4/30/15	2.2		0.57	73.0	X	0.066	0.14	U	0.14	4.3	X	0.050	9.8	X	0.43	15.6		0.94	3.2		1.2	303	X	0.086
EXC-7	J1V726	4/30/15	2.3		0.65	69.0	X	0.075	0.13	B	0.033	4.8	X	0.057	7.8	X	0.099	12.8		0.21	2.9		0.27	306	X	0.099
EXC-8	J1V727	4/30/15	2.1		0.59	58.3	X	0.068	0.087	B	0.029	3.9	X	0.052	7.3	X	0.089	13.0		0.19	2.3		0.24	287	X	0.089
EXC-9	J1V728	4/30/15	2.0		0.60	55.3	X	0.070	0.085	B	0.030	4.0	X	0.053	6.6	X	0.092	12.5		0.20	2.1		0.25	235	X	0.092
EXC-10	J1V729	4/30/15	1.8		0.57	61.1	X	0.065	0.098	B	0.028	5.3	X	0.050	7.3	X	0.086	12.3		0.19	2.7		0.23	286	X	0.086
EXC-11	J1V730	4/30/15	1.5		0.59	86.1	X	0.068	0.14	B	0.029	4.8	X	0.052	8.0	X	0.089	15.1		0.19	3.2		0.24	294	X	0.089

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic		Barium		Beryllium		Chromium		Cobalt		Copper		Lead		Manganese	
			pCi/g	DS	pCi/g	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS	mg/kg	DS
EXC-12	J1V731/ J1V732	4/30/15	2.1	1	69.9	1	0.14	1	5.5	1	7.4	1	12.3	1	2.7	1	272	1
EXC-1	J1V720	4/30/15	1.7	1	71.9	1	0.091	1	4.1	1	6.9	1	12.6	1	2.2	1	225	1
EXC-2	J1V721	4/30/15	2.3	1	55.4	1	0.14	0	5.0	1	9.5	1	16.8	1	3.0	1	284	1
EXC-3	J1V722	4/30/15	2.0	1	74.4	1	0.10	1	5.4	1	8.0	1	14.4	1	2.6	1	322	1
EXC-4	J1V723	4/30/15	3.2	1	93.8	1	0.19	1	6.6	1	8.8	1	13.2	1	3.2	1	362	1
EXC-5	J1V724	4/30/15	2.0	1	55.1	1	0.11	1	6.2	1	6.5	1	11.8	1	2.6	1	254	1
EXC-6	J1V725	4/30/15	2.2	1	73.0	1	0.14	0	4.3	1	9.8	1	15.6	1	3.2	1	303	1
EXC-7	J1V726	4/30/15	2.3	1	69.0	1	0.13	1	4.8	1	7.8	1	12.8	1	2.9	1	306	1
EXC-8	J1V727	4/30/15	2.1	1	58.3	1	0.087	1	3.9	1	7.3	1	13.0	1	2.3	1	287	1
EXC-9	J1V728	4/30/15	2.0	1	55.3	1	0.085	1	4.0	1	6.6	1	12.5	1	2.1	1	235	1
EXC-10	J1V729	4/30/15	1.8	1	61.1	1	0.098	1	5.3	1	7.3	1	12.3	1	2.7	1	286	1
EXC-11	J1V730	4/30/15	1.5	1	86.1	1	0.14	1	4.8	1	8.0	1	15.1	1	3.2	1	294	1

Statistical Computations

	Arsenic	Barium	Beryllium	Chromium	Cobalt	Copper	Lead	Manganese
95% UCL based on	Use 95% Student's-t UCL	Use 95% Student's-t UCL	Use 95% KM (t)	Use 95% Student's-t UCL	Use 95% Student's-t 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
% < Detection limit	0%	0%	17%	0%	0%	0%	0%	0%
Mean	2.1	68.6	0.12	5.0	7.8	13.5	2.7	286
Standard deviation	0.42	12.4	0.033	0.86	1.1	1.6	0.39	37.4
95% UCL on mean	2.3	75.1	0.13	5.4	8.4	14.4	2.9	305
Maximum value	3.2	93.8	0.19	6.6	9.8	16.8	3.2	362

CALCULATION SHEET

Washington Closure Hanford

Originator R. J. Nielson RN
Project 300 Area Closure Operations
Subject 600-367 Waste Site Cleanup Verification 95% UCL Calculation

Date 07/21/15
Job No. 14655

Calc. No. 0600X-CA-V0196
Checked I. B. Berezovskiy

Rev. No. 0
Date 07/21/15
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600-367 Statistical Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Nickel mg/kg	Nickel Q	Nickel PQL	Uranium mg/kg	Uranium Q	Uranium PQL	Vanadium mg/kg	Vanadium Q	Vanadium PQL	Zinc mg/kg	Zinc Q	Zinc PQL
EXC-12	J1V731	4/30/15	11.0	JX	0.11	0.38		0.0015	58.9	X	0.081	38.4	X	0.34
Duplicate of J1V731	J1V732	4/30/15	7.1	JX	0.12	0.42		0.0015	61.6	X	0.089	40.0	X	0.38
EXC-1	J1V720	4/30/15	12.9	JNXM	0.10	0.39		0.0015	52.4	X	0.080	35.3	X	0.34
EXC-2	J1V721	4/30/15	8.9	JX	0.11	0.37		0.0014	70.8	X	0.41	39.3	X	0.35
EXC-3	J1V722	4/30/15	11.1	JX	0.11	0.35		0.0015	62.8	X	0.083	39.4	X	0.35
EXC-4	J1V723	4/30/15	10.2	JX	0.11	0.53		0.0015	59.1	X	0.085	40.7	X	0.36
EXC-5	J1V724	4/30/15	9.4	JX	0.11	0.34		0.0015	52.8	X	0.081	36.2	X	0.34
EXC-6	J1V725	4/30/15	7.4	JX	0.11	0.39		0.0015	72.5	X	0.41	39.1	X	0.34
EXC-7	J1V726	4/30/15	8.4	JX	0.12	0.34		0.0014	61.2	X	0.093	41.1	X	0.39
EXC-8	J1V727	4/30/15	7.6	JX	0.11	0.35		0.0015	58.9	X	0.084	37.3	X	0.36
EXC-9	J1V728	4/30/15	8.0	JX	0.11	0.40		0.0015	53.2	X	0.086	35.0	X	0.36
EXC-10	J1V729	4/30/15	9.2	JX	0.11	0.35		0.0015	55.3	X	0.081	38.7	X	0.34
EXC-11	J1V730	4/30/15	8.3	JX	0.11	0.37		0.0013	61.1	X	0.084	39.7	X	0.36

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Nickel mg/kg	Nickel DS	Uranium mg/kg	Uranium DS	Vanadium mg/kg	Vanadium DS	Zinc ug/kg	Zinc DS
EXC-12	J1V731/ J1V732	4/30/15	11.0	1	0.42	1	61.6	1	40.0	1
EXC-1	J1V720	4/30/15	12.9	1	0.39	1	52.4	1	35.3	1
EXC-2	J1V721	4/30/15	8.9	1	0.37	1	70.8	1	39.3	1
EXC-3	J1V722	4/30/15	11.1	1	0.35	1	62.8	1	39.4	1
EXC-4	J1V723	4/30/15	10.2	1	0.53	1	59.1	1	40.7	1
EXC-5	J1V724	4/30/15	9.4	1	0.34	1	52.8	1	36.2	1
EXC-6	J1V725	4/30/15	7.4	1	0.39	1	72.5	1	39.1	1
EXC-7	J1V726	4/30/15	8.4	1	0.34	1	61.2	1	41.1	1
EXC-8	J1V727	4/30/15	7.6	1	0.35	1	58.9	1	37.3	1
EXC-9	J1V728	4/30/15	8.0	1	0.40	1	53.2	1	35.0	1
EXC-10	J1V729	4/30/15	9.2	1	0.35	1	55.3	1	38.7	1
EXC-11	J1V730	4/30/15	8.3	1	0.37	1	61.1	1	39.7	1

Statistical Computations

	Nickel	Uranium	Vanadium	Zinc
95% UCL based on	Use 95% Student's-t UCL	Use 95% Student's-t UCL	Use 95% Student's-t UCL	Use 95% Student's-t UCL
N	12	12	12	12
% < Detection limit	0%	0%	0%	0%
Mean	9.4	0.38	60.1	38.5
Standard deviation	1.7	0.053	6.5	2.1
95% UCL on mean	10.2	0.41	63.5	39.6
Maximum value	12.9	0.53	72.5	41.1

CALCULATION SHEET

Washington Closure Hanford

Originator R. J. Nielson RN
Project 300 Area Closure Operations
Subject 600-367 Waste Site Cleanup Verification 95% UCL Calculation

Date 07/21/15
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600-367 Waste Site Verification Samples - Excavation

Duplicate/Split Analysis - 600-367 Waste Site

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Calcium			Chromium			Cobalt			Copper			Iron		
			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-12	J1V731	4/30/15	5120	X	1.3	2.0		0.57	61.8	X	0.066	0.10	B	0.028	7860	X	12.2	5.5	X	0.050	7.4	X	0.086	12.0		0.19	22200	X	3.3
Duplicate of J1V731	J1V732	4/30/15	5360	X	1.5	2.1		0.62	69.9	X	0.072	0.14	B	0.031	8380	X	13.3	3.9	X	0.055	7.3	X	0.094	12.3		0.20	24000	X	3.6
Split of J1V731	J1V733	4/30/15	4190		6.37	2.12	B	0.468	72.7		0.0937	1.68		0.0937	8540		7.49	4.34		0.14	10.3	D	0.702	16.7		0.281	25300		7.49

Analysis:

		Aluminum	Arsenic	Barium	Beryllium	Calcium	Chromium	Cobalt	Copper	Iron
TDL		5	10	2	0.5	100	1	2	1	5
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)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	4.6%		12.3%		6.4%			2.5%	7.8%
	Difference > 2 TDL?	**Yes - assess further**	No - acceptable	**Yes - assess further**	No - acceptable	**Yes - assess further**	No - acceptable	No - acceptable	No - acceptable	**Yes - assess further**
Split 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)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	20.0%		16.2%		8.3%			32.8%	13.1%
	Difference > 2 TDL?	**Yes - assess further**	No - acceptable	**Yes - assess further**	**Yes - assess further**	**Yes - assess further**	No - acceptable	No - acceptable	**Yes - assess further**	**Yes - assess further**

Duplicate/Split Analysis - 600-367 Waste Site

Sampling Area	Sample Number	Sample Date	Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium			Uranium			Vanadium		
			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-12	J1V731	4/30/15	2.7		0.23	3830	X	3.2	272	X	0.086	11	JX	0.11	546		35.4	131	JN	4.9	287		51.0	0.38		0.0015	58.9	X	0.081
Duplicate of J1V731	J1V732	4/30/15	2.6		0.25	3790	X	3.5	256	X	0.094	7.1	JX	0.12	554		38.6	125	JN	5.3	295		55.6	0.42		0.0015	61.6	X	0.089
Split of J1V731	J1V733	4/30/15	5.94		0.309	4180		7.96	345		0.187	7.09	J	0.14	563		5.99	395	JN	1.4	152	C	6.56	0.389	D	0.0124	83.6	DN	0.468

Analysis:

		Lead	Magnesium	Manganese	Nickel	Potassium	Silicon	Sodium	Uranium	Vanadium
TDL		5	75	5	4	400	2	50	1	2.5
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)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD		1.0%	6.1%			4.7%	2.7%		4.5%
	Difference > 2 TDL?	No - acceptable	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)**	**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)	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD		8.7%	23.7%			*100.4%*			34.7%
	Difference > 2 TDL?	No - acceptable	**Yes - assess further**	**Yes - assess further**	No - acceptable	No - acceptable	**Yes - assess further**	**Yes - assess further**	No - acceptable	**Yes - assess further**

Duplicate/Split Analysis - 600-367 Waste Site

Sampling Area	Sample Number	Sample Date	Zinc			Zirconium		
			mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-12	J1V731	4/30/15	38.4	X	0.34	26.9		0.31
Duplicate of J1V731	J1V732	4/30/15	40.0	X	0.38	29.2		0.33
Split of J1V731	J1V733	4/30/15	54.1	D	1.87	32.2	D	0.094

Analysis:

		Zinc	Zirconium
TDL		1	2.5
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	4.1%	8.2%
	Difference > 2 TDL?	No - acceptable	No - acceptable
Split Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	33.9%	17.9%
	Difference > 2 TDL?	**Yes - assess further**	**Yes - assess further**

Attachment 1. 600-367 Waste Site Verification Sample Results. (Metals)

Sample 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-12	J1V731	4/30/15	5120	X	1.3	0.33	UJ	0.33	2.0		0.57	61.8	X	0.066
Duplicate of J1V731	J1V732	4/30/15	5360	X	1.5	0.36	UJ	0.36	2.1		0.62	69.9	X	0.072
EXC-1	J1V720	4/30/15	4100	X	1.3	0.32	UJ	0.32	1.7	N	0.56	71.9	X	0.065
EXC-2	J1V721	4/30/15	4670	X	1.4	1.7	UJ	1.7	2.3		0.58	55.4	X	0.067
EXC-3	J1V722	4/30/15	4260	X	1.4	0.34	UJ	0.34	2.0		0.58	74.4	X	0.067
EXC-4	J1V723	4/30/15	6880	X	1.4	0.35	UJ	0.35	3.2		0.60	93.8	X	0.069
EXC-5	J1V724	4/30/15	5050	X	1.3	0.33	UJ	0.33	2.0		0.57	55.1	X	0.066
EXC-6	J1V725	4/30/15	5310	X	1.3	1.6	UJ	1.6	2.2		0.57	73.0	X	0.066
EXC-7	J1V726	4/30/15	5770	X	1.5	0.38	UJ	0.38	2.3		0.65	69.0	X	0.075
EXC-8	J1V727	4/30/15	4590	X	1.4	0.34	UJ	0.34	2.1		0.59	58.3	X	0.068
EXC-9	J1V728	4/30/15	4360	X	1.4	0.35	UJ	0.35	2.0		0.60	55.3	X	0.070
EXC-10	J1V729	4/30/15	5000	X	1.3	0.33	UJ	0.33	1.8		0.57	61.1	X	0.065
EXC-11	J1V730	4/30/15	5590	X	1.4	0.34	UJ	0.34	1.5		0.59	86.1	X	0.068
Split of J1V731	J1V733	4/30/15	4190		6.37	14.9	JD	1.55	2.12	B	0.468	72.7		0.0937
FS-1	J1V734	4/30/15	4090	X	1.3	0.33	UJ	0.33	2.1		0.57	57.1	X	0.065
Euipment Blank	J1V719	4/30/15	106	X	1.6	0.38	UJ	0.38	0.66	U	0.66	1.2	X	0.076

Sample 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-12	J1V731	4/30/15	0.10	B	0.028	0.85	U	0.85	0.035	U	0.035	7860	X	12.2
Duplicate of J1V731	J1V732	4/30/15	0.14	B	0.031	0.92	U	0.92	0.039	U	0.039	8380	X	13.3
EXC-1	J1V720	4/30/15	0.091	B	0.028	0.83	UN	0.83	0.035	U	0.035	5640	X	12.0
EXC-2	J1V721	4/30/15	0.14	U	0.14	0.86	U	0.86	0.036	U	0.036	4480	X	12.4
EXC-3	J1V722	4/30/15	0.095	B	0.029	0.87	U	0.87	0.036	U	0.036	4920	X	12.5
EXC-4	J1V723	4/30/15	0.19		0.030	0.89	U	0.89	0.037	U	0.037	10600	X	12.8
EXC-5	J1V724	4/30/15	0.11	B	0.028	0.84	U	0.84	0.035	U	0.035	7280	X	12.2
EXC-6	J1V725	4/30/15	0.14	U	0.14	0.85	U	0.85	0.035	U	0.035	8320	X	12.2
EXC-7	J1V726	4/30/15	0.13	B	0.033	0.97	U	0.97	0.040	U	0.040	4350	X	13.9
EXC-8	J1V727	4/30/15	0.087	B	0.029	0.87	U	0.87	0.037	U	0.037	6160	X	12.6
EXC-9	J1V728	4/30/15	0.085	B	0.030	0.90	U	0.90	0.038	U	0.038	6120	X	12.9
EXC-10	J1V729	4/30/15	0.098	B	0.028	0.84	U	0.84	0.035	U	0.035	6280	X	12.1
EXC-11	J1V730	4/30/15	0.14	B	0.029	0.88	U	0.88	0.037	U	0.037	4830	X	12.6
Split of J1V731	J1V733	4/30/15	1.68		0.0937	9.51		0.937	0.213	B	0.0937	8540		7.49
FS-1	J1V734	4/30/15	0.077	B	0.028	0.84	U	0.84	0.035	U	0.035	6180	X	12.1
Euipment Blank	J1V719	4/30/15	0.033	U	0.033	0.98	U	0.98	0.041	U	0.041	41.4	BX	14.1

Note: Gray cells indicate not applicable.
Acronyms and notes apply to all of the tables in this attachment.
B = estimated result; result is less than the RL but greater than the MDL.
C = the analyte was detected in both the sample and the associated QC blank, and the sample concentration was ≤5x the blank concentration.
D = dilution
EXC = excavation
FS = focused sample
HEIS = Hanford Environmental Information System
J = estimate
M = sample duplicate precision not met.
N = recovery is outside control limits.
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
PQL = practical quantitation limit
Q = qualifier
TPH = total petroleum hydrocarbons
U = undetected
X = serial dilution in the analytical batch indicates that physical and chemical interferences are present.

Attachment	1	Sheet No.	1 of 5
Originator	R. J. Nielson	Date	7/20/15
Checked	I. B. Berezovskiy	Job No.	48655
Calc. No.	0600X-CA-V0196	Rev. No.	0

Attachment 1. 600-367 Waste Site Verification Sample Results. (Metals)

Sample 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-12	J1V731	4/30/15	5.5	X	0.050	7.4	X	0.086	12.0		0.19	22200	X	3.3
Duplicate of J1V731	J1V732	4/30/15	3.9	X	0.055	7.3	X	0.094	12.3		0.20	24000	X	3.6
EXC-1	J1V720	4/30/15	4.1	X	0.049	6.9	X	0.085	12.6		0.18	20700	X	3.2
EXC-2	J1V721	4/30/15	5.0	X	0.051	9.5	X	0.44	16.8		0.95	23700	X	3.3
EXC-3	J1V722	4/30/15	5.4	X	0.051	8.0	X	0.088	14.4		0.19	23900	X	3.4
EXC-4	J1V723	4/30/15	6.6	X	0.053	8.8	X	0.091	13.2		0.20	25600	X	3.5
EXC-5	J1V724	4/30/15	6.2	X	0.050	6.5	X	0.086	11.8		0.19	20900	X	3.3
EXC-6	J1V725	4/30/15	4.3	X	0.050	9.8	X	0.43	15.6		0.94	24800	X	3.3
EXC-7	J1V726	4/30/15	4.8	X	0.057	7.8	X	0.099	12.8		0.21	24100	X	3.8
EXC-8	J1V727	4/30/15	3.9	X	0.052	7.3	X	0.089	13.0		0.19	22200	X	3.4
EXC-9	J1V728	4/30/15	4.0	X	0.053	6.6	X	0.092	12.5		0.20	20800	X	3.5
EXC-10	J1V729	4/30/15	5.3	X	0.050	7.3	X	0.086	12.3		0.19	21900	X	3.3
EXC-11	J1V730	4/30/15	4.8	X	0.052	8.0	X	0.089	15.1		0.19	24300	X	3.4
Split of J1V731	J1V733	4/30/15	4.34		0.14	10.3	D	0.702	16.7		0.281	25300		7.49
FS-1	J1V734	4/30/15	3.9	X	0.050	7.4	X	0.086	12.2		0.19	24100	X	3.3
Euipment Blank	J1V719	4/30/15	0.11	BX	0.058	0.10	UX	0.10	0.22	U	0.22	165	X	3.8

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-12	J1V731	4/30/15	2.7		0.23	3830	X	3.2	272	X	0.086	0.0057	U	0.0057
Duplicate of J1V731	J1V732	4/30/15	2.6		0.25	3790	X	3.5	256	X	0.094	0.0067	U	0.0067
EXC-1	J1V720	4/30/15	2.2		0.23	4170	X	3.1	225	X	0.085	0.0067	U	0.0067
EXC-2	J1V721	4/30/15	3.0		1.2	4040	X	3.2	284	X	0.088	0.0066	U	0.0066
EXC-3	J1V722	4/30/15	2.6		0.24	4270	X	3.3	322	X	0.088	0.0067	U	0.0067
EXC-4	J1V723	4/30/15	3.2		0.25	4780	X	3.4	362	X	0.091	0.0062	U	0.0062
EXC-5	J1V724	4/30/15	2.6		0.23	3840	X	3.2	254	X	0.086	0.0061	U	0.0061
EXC-6	J1V725	4/30/15	3.2		1.2	3950	X	3.2	303	X	0.086	0.0059	U	0.0059
EXC-7	J1V726	4/30/15	2.9		0.27	3810	X	3.7	306	X	0.099	0.0059	U	0.0059
EXC-8	J1V727	4/30/15	2.3		0.24	3720	X	3.3	287	X	0.089	0.0067	U	0.0067
EXC-9	J1V728	4/30/15	2.1		0.25	3480	X	3.4	235	X	0.092	0.0064	U	0.0064
EXC-10	J1V729	4/30/15	2.7		0.23	3850	X	3.2	286	X	0.086	0.0061	U	0.0061
EXC-11	J1V730	4/30/15	3.2		0.24	3870	X	3.3	294	X	0.089	0.0058	U	0.0058
Split of J1V731	J1V733	4/30/15	5.94		0.309	4180		7.96	345		0.187	0.004	U	0.004
FS-1	J1V734	4/30/15	2.3		0.23	3610	X	3.2	264	X	0.086	0.0057	U	0.0057
Euipment Blank	J1V719	4/30/15	0.27	U	0.27	13.5	UJBXC	3.7	4.7	X	0.10	0.0057	U	0.0057

Sample Location	HEIS Number	Sample Date	Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-12	J1V731	4/30/15	0.22	U	0.22	11	JX	0.11	546		35.4	0.74	U	0.74
Duplicate of J1V731	J1V732	4/30/15	0.25	U	0.25	7.1	JX	0.12	554		38.6	0.81	U	0.81
EXC-1	J1V720	4/30/15	0.22	U	0.22	12.9	JNXM	0.10	573		34.9	0.73	U	0.73
EXC-2	J1V721	4/30/15	0.27	B	0.23	8.9	JX	0.11	599		36.0	0.76	U	0.76
EXC-3	J1V722	4/30/15	0.23	U	0.23	11.1	JX	0.11	642		36.2	0.76	U	0.76
EXC-4	J1V723	4/30/15	0.24	U	0.24	10.2	JX	0.11	903		37.2	0.78	U	0.78
EXC-5	J1V724	4/30/15	0.22	U	0.22	9.4	JX	0.11	619		35.3	0.74	U	0.74
EXC-6	J1V725	4/30/15	0.22	U	0.22	7.4	JX	0.11	508		35.4	0.74	U	0.74
EXC-7	J1V726	4/30/15	0.26	U	0.26	8.4	JX	0.12	969		40.5	0.85	U	0.85
EXC-8	J1V727	4/30/15	0.23	U	0.23	7.6	JX	0.11	560		36.6	0.77	U	0.77
EXC-9	J1V728	4/30/15	0.24	U	0.24	8.0	JX	0.11	463		37.6	0.79	U	0.79
EXC-10	J1V729	4/30/15	0.22	U	0.22	9.2	JX	0.11	760		35.3	0.74	U	0.74
EXC-11	J1V730	4/30/15	0.23	U	0.23	8.3	JX	0.11	676		36.6	0.77	U	0.77
Split of J1V731	J1V733	4/30/15	0.47	B	0.187	7.09	J	0.14	563		5.99	0.31	UD	0.31
FS-1	J1V734	4/30/15	0.22	U	0.22	6.9	JX	0.11	544		35.3	0.74	U	0.74
Euipment Blank	J1V719	4/30/15	0.26	U	0.26	0.12	UJX	0.12	41.0	U	41.0	0.86	U	0.86

Attachment	1	Sheet No.	2 of 5
Originator	R. J. Nielson	Date	7/20/15
Checked	I. B. Berezovskiy	Job No.	48655
Calc. No.	0600X-CA-V0196	Rev. No.	0

Attachment 1. 600-367 Waste Site Verification Sample Results. (Metals and TPH)

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Strontium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-12	J1V731	4/30/15	131	JN	4.9	0.14	U	0.14	287		51.0			
Duplicate of J1V731	J1V732	4/30/15	125	JN	5.3	0.15	U	0.15	295		55.6			
EXC-1	J1V720	4/30/15	90.7	JN	4.8	0.14	U	0.14	241		50.2			
EXC-2	J1V721	4/30/15	139	JN	5.0	0.14	U	0.14	259		51.8			
EXC-3	J1V722	4/30/15	143	JN	5.0	0.14	U	0.14	249		52.1			
EXC-4	J1V723	4/30/15	152	JN	5.1	0.15	U	0.15	254		53.6			
EXC-5	J1V724	4/30/15	151	JN	4.9	0.14	U	0.14	278		50.9			
EXC-6	J1V725	4/30/15	134	JN	4.9	0.14	U	0.14	316		50.9			
EXC-7	J1V726	4/30/15	292	JN	5.6	0.16	U	0.16	238		58.3			
EXC-8	J1V727	4/30/15	136	JN	5.0	0.14	U	0.14	243		52.6			
EXC-9	J1V728	4/30/15	113	JN	5.2	0.15	U	0.15	274		54.1			
EXC-10	J1V729	4/30/15	154	JN	4.9	0.14	U	0.14	238		50.7			
EXC-11	J1V730	4/30/15	245	JN	5.1	0.14	U	0.14	320		52.7			
Split of J1V731	J1V733	4/30/15	395	JN	1.4	0.494		0.0937	152	C	6.56	29.3		0.0937
FS-1	J1V734	4/30/15	144	JN	4.9	0.14	U	0.14	282		50.8			
Euipment Blank	J1V719	4/30/15	84.2	JN	5.7	0.16	U	0.16	59	U	59.0			

Sample Location	HEIS Number	Sample Date	Uranium			Vanadium			Zinc			Zirconium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-12	J1V731	4/30/15	0.38		0.0015	58.9	X	0.081	38.4	X	0.34	26.9		0.31
Duplicate of J1V731	J1V732	4/30/15	0.42		0.0015	61.6	X	0.089	40.0	X	0.38	29.2		0.33
EXC-1	J1V720	4/30/15	0.39		0.0015	52.4	X	0.080	35.3	X	0.34	22.7		0.30
EXC-2	J1V721	4/30/15	0.37		0.0014	70.8	X	0.41	39.3	X	0.35	25.5		0.31
EXC-3	J1V722	4/30/15	0.35		0.0015	62.8	X	0.083	39.4	X	0.35	24.7		0.31
EXC-4	J1V723	4/30/15	0.53		0.0015	59.1	X	0.085	40.7	X	0.36	26.9		0.32
EXC-5	J1V724	4/30/15	0.34		0.0015	52.8	X	0.081	36.2	X	0.34	21.9		0.31
EXC-6	J1V725	4/30/15	0.39		0.0015	72.5	X	0.41	39.1	X	0.34	28.5		0.31
EXC-7	J1V726	4/30/15	0.34		0.0014	61.2	X	0.093	41.1	X	0.39	28.6		0.35
EXC-8	J1V727	4/30/15	0.35		0.0015	58.9	X	0.084	37.3	X	0.36	23.5		0.32
EXC-9	J1V728	4/30/15	0.40		0.0015	53.2	X	0.086	35.0	X	0.36	23.5		0.32
EXC-10	J1V729	4/30/15	0.35		0.0015	55.3	X	0.081	38.7	X	0.34	24.6		0.30
EXC-11	J1V730	4/30/15	0.37		0.0013	61.1	X	0.084	39.7	X	0.36	29.0		0.32
Split of J1V731	J1V733	4/30/15	0.389	D	0.0124	83.6	DN	0.468	54.1	D	1.87	32.2	D	0.094
FS-1	J1V734	4/30/15	0.34		0.0013	62.1	X	0.081	38.3	X	0.34	24.5		0.30
Euipment Blank	J1V719	4/30/15	0.087	B	0.0015	0.094	UX	0.094	0.40	UX	0.40	0.36	B	0.35

Sample Location	HEIS Number	Sample Date	TPH - Diesel Range			TPH - Diesel Range			TPH - Motor Oil (high			Percent moisture (wet		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	%	Q	PQL
EXC-12	J1V731	4/30/15	670	U	670	980	U	980				1.0		0.10
Duplicate of J1V731	J1V732	4/30/15	650	U	650	950	U	950				0.84		0.10
EXC-1	J1V720	4/30/15	630	U	630	930	U	930				1.3	M	0.10
EXC-2	J1V721	4/30/15	670	U	670	980	U	980				1.0		0.10
EXC-3	J1V722	4/30/15	670	U	670	980	U	980				0.68		0.10
EXC-4	J1V723	4/30/15	690	U	690	1000	U	1000				2.6		0.10
EXC-5	J1V724	4/30/15	680	U	680	1000	U	1000				0.85		0.10
EXC-6	J1V725	4/30/15	690	U	690	1000	U	1000				2.6		0.10
EXC-7	J1V726	4/30/15	670	U	670	980	U	980				0.71		0.10
EXC-8	J1V727	4/30/15	650	U	650	950	U	950				0.81		0.10
EXC-9	J1V728	4/30/15	640	U	640	950	U	950				0.82		0.10
EXC-10	J1V729	4/30/15	670	U	670	990	U	990				1.4		0.10
EXC-11	J1V730	4/30/15	680	U	680	1000	U	1000				1.8		0.10
Split of J1V731	J1V733	4/30/15	2180	U	2180				2180	U	2180			0.10
FS-1	J1V734	4/30/15	620	U	620	920	U	920				0.70		0.10
Euipment Blank	J1V719	4/30/15										0.10	U	0.10

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Attachment 1. 600-367 Waste Site Verification Sample Results. (Organics)

CONSTITUENT	CLASS	EXC-12 - J1V731			Duplicate of J1V731 -			EXC-1 - J1V720			EXC-2 - J1V721		
		4/30/15			4/30/15			4/30/15			4/30/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	2.8	U	2.8	2.8	U	2.8	2.6	U	2.6	2.8	U	2.8
Aroclor-1221	PCB	8.1	U	8.1	8.0	U	8.0	7.5	U	7.5	8	U	8
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0
Aroclor-1242	PCB	4.7	U	4.7	4.6	U	4.6	4.3	U	4.3	4.7	U	4.7
Aroclor-1248	PCB	4.7	U	4.7	4.6	U	4.6	4.3	U	4.3	4.7	U	4.7
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6
Acenaphthene	PAH	9.6	U	9.6	9.7	U	9.7	10	U	10	9.9	U	9.9
Acenaphthylene	PAH	8.6	U	8.6	8.8	U	8.8	9.1	U	9.1	8.9	U	8.9
Anthracene	PAH	2.9	U	2.9	3.0	U	3.0	3.1	U	3.1	3.0	U	3.0
Benzo(a)anthracene	PAH	3.1	U	3.1	3.1	U	3.1	3.2	U	3.2	3.2	U	3.2
Benzo(a)pyrene	PAH	6.1	U	6.1	6.2	U	6.2	6.5	U	6.5	6.3	U	6.3
Benzo(b)fluoranthene	PAH	4.0	U	4.0	4.1	U	4.1	4.2	U	4.2	4.2	U	4.2
Benzo(ghi)perylene	PAH	6.9	U	6.9	7.0	U	7.0	7.2	U	7.2	7.1	U	7.1
Benzo(k)fluoranthene	PAH	3.8	U	3.8	3.8	U	3.8	4.0	U	4.0	3.9	U	3.9
Chrysene	PAH	4.6	U	4.6	4.7	U	4.7	4.9	U	4.9	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	12	U	12	13	U	13	13	U	13	13	U	13
Fluorene	PAH	5.0	U	5.0	5.1	U	5.1	5.3	U	5.3	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	11	U	11	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	11	U	11	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	11	U	11	12	U	12	12	U	12	12	U	12
Pyrene	PAH	11	U	11	12	U	12	12	U	12	12	U	12

CONSTITUENT	CLASS	EXC-3 - J1V722			EXC-4 - J1V723			EXC-5 - J1V724			EXC-6 - J1V725		
		4/30/15			4/30/15			4/30/15			4/30/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	2.8	U	2.8
Aroclor-1221	PCB	8.1	U	8.1	8.2	U	8.2	7.8	U	7.8	8.1	U	8.1
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0
Aroclor-1242	PCB	4.7	U	4.7	4.8	U	4.8	4.5	U	4.5	4.7	U	4.7
Aroclor-1248	PCB	4.7	U	4.7	4.8	U	4.8	4.5	U	4.5	4.7	U	4.7
Aroclor-1254	PCB	2.6	U	2.6	2.7	U	2.7	2.5	U	2.5	2.6	U	2.6
Aroclor-1260	PCB	2.6	U	2.6	2.7	U	2.7	2.5	U	2.5	2.6	U	2.6
Acenaphthene	PAH	10	U	10	10	U	10	10	U	10	9.4	U	9.4
Acenaphthylene	PAH	9	U	9	9.1	U	9.1	9.0	U	9.0	8.5	U	8.5
Anthracene	PAH	3.1	U	3.1	3.1	U	3.1	3.0	U	3.0	2.9	U	2.9
Benzo(a)anthracene	PAH	3.2	U	3.2	3.2	U	3.2	3.2	U	3.2	3.0	U	3.0
Benzo(a)pyrene	PAH	6.4	U	6.4	6.5	U	6.5	6.4	U	6.4	6.0	U	6.0
Benzo(b)fluoranthene	PAH	4.2	U	4.2	4.3	U	4.3	4.2	U	4.2	4.0	U	4.0
Benzo(ghi)perylene	PAH	7.2	U	7.2	7.3	U	7.3	7.2	U	7.2	6.8	U	6.8
Benzo(k)fluoranthene	PAH	4.0	U	4.0	4.0	U	4.0	3.9	U	3.9	3.7	U	3.7
Chrysene	PAH	4.9	U	4.9	4.9	U	4.9	4.8	U	4.8	4.6	U	4.6
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	10	U	10
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	12	U	12
Fluorene	PAH	5.3	U	5.3	5.3	U	5.3	5.3	U	5.3	5.0	U	5.0
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	11	U	11
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	11	U	11
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	11	U	11
Pyrene	PAH	12	U	12	12	U	12	12	U	12	11	U	11

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Attachment 1. 600-367 Waste Site Verification Sample Results. (Organics)

CONSTITUENT	CLASS	EXC-7 - J1V726			EXC-8 - J1V727			EXC-9 - J1V728			EXC-10 - J1V729		
		4/30/15			4/30/15			4/30/15			4/30/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	2.8	U	2.8	2.7	U	2.7	2.7	U	2.7	2.6	U	2.6
Aroclor-1221	PCB	8.0	U	8.0	7.9	U	7.9	7.8	U	7.8	7.4	U	7.4
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9
Aroclor-1242	PCB	4.6	U	4.6	4.6	U	4.6	4.5	U	4.5	4.3	U	4.3
Aroclor-1248	PCB	4.6	U	4.6	4.6	U	4.6	4.5	U	4.5	4.3	U	4.3
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.4	U	2.4
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.4	U	2.4
Acenaphthene	PAH	9.6	U	9.6	9.7	U	9.7	9.3	U	9.3	9.2	U	9.2
Acenaphthylene	PAH	8.6	U	8.6	8.8	U	8.8	8.4	U	8.4	8.3	U	8.3
Anthracene	PAH	2.9	U	2.9	3.0	U	3.0	2.8	U	2.8	2.8	U	2.8
Benzo(a)anthracene	PAH	3.1	U	3.1	3.1	U	3.1	3.0	U	3.0	2.9	U	2.9
Benzo(a)pyrene	PAH	6.1	U	6.1	6.2	U	6.2	6.0	U	6.0	5.9	U	5.9
Benzo(b)fluoranthene	PAH	4.0	U	4.0	4.1	U	4.1	3.9	U	3.9	3.9	U	3.9
Benzo(ghi)perylene	PAH	6.9	U	6.9	7.0	U	7.0	6.7	U	6.7	6.6	U	6.6
Benzo(k)fluoranthene	PAH	3.8	U	3.8	3.8	U	3.8	3.7	U	3.7	3.6	U	3.6
Chrysene	PAH	4.6	U	4.6	4.7	U	4.7	4.5	U	4.5	4.5	U	4.5
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	10	U	10	10	U	10
Fluoranthene	PAH	12	U	12	13	U	13	12	U	12	12	U	12
Fluorene	PAH	5.0	U	5.0	5.1	U	5.1	4.9	U	4.9	4.9	U	4.9
Indeno(1,2,3-cd)pyrene	PAH	11	U	11	12	U	12	11	U	11	11	U	11
Naphthalene	PAH	11	U	11	12	U	12	11	U	11	11	U	11
Phenanthrene	PAH	11	U	11	12	U	12	11	U	11	11	U	11
Pyrene	PAH	11	U	11	12	U	12	11	U	11	11	U	11

CONSTITUENT	CLASS	EXC-11 - J1V730			Split of J1V731 -			FS-1 - J1V734		
		4/30/15			4/30/15			4/30/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	2.7	U	2.7	1.12	U	1.12	2.6	U	2.6
Aroclor-1221	PCB	7.9	U	7.9	1.12	U	1.12	7.6	U	7.6
Aroclor-1232	PCB	2.0	U	2.0	1.12	U	1.12	1.9	U	1.9
Aroclor-1242	PCB	4.6	U	4.6	1.12	U	1.12	4.4	U	4.4
Aroclor-1248	PCB	4.6	U	4.6	1.12	U	1.12	4.4	U	4.4
Aroclor-1254	PCB	2.6	U	2.6	1.12	U	1.12	2.5	U	2.5
Aroclor-1260	PCB	2.6	U	2.6	1.12	U	1.12	2.5	U	2.5
Aroclor-1262	PCB				1.12	U	1.12			
Aroclor-1268	PCB				1.12	U	1.12			
Acenaphthene	PAH	10	U	10	5.04	U	5.04	9.4	U	9.4
Acenaphthylene	PAH	9.0	U	9.0	5.04	U	5.04	8.5	U	8.5
Anthracene	PAH	3.0	U	3.0	1.68	U	1.68	2.9	U	2.9
Benzo(a)anthracene	PAH	3.2	U	3.2	0.538	U	0.538	3.0	U	3.0
Benzo(a)pyrene	PAH	6.4	U	6.4	0.538	U	0.538	6.0	U	6.0
Benzo(b)fluoranthene	PAH	4.2	U	4.2	0.538	U	0.538	4.0	U	4.0
Benzo(ghi)perylene	PAH	7.2	U	7.2	0.538	U	0.538	6.8	U	6.8
Benzo(k)fluoranthene	PAH	3.9	U	3.9	0.269	U	0.269	3.7	U	3.7
Chrysene	PAH	4.8	U	4.8	0.538	U	0.538	4.6	U	4.6
Dibenz[a,h]anthracene	PAH	11	U	11	0.538	U	0.538	10	U	10
Fluoranthene	PAH	13	U	13	0.538	U	0.538	12	U	12
Fluorene	PAH	5.3	U	5.3	5.04	U	5.04	5.0	U	5.0
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	0.538	U	0.538	11	U	11
Naphthalene	PAH	12	U	12	5.04	U	5.04	11	U	11
Phenanthrene	PAH	12	U	12	5.04	U	5.04	11	U	11
Pyrene	PAH	12	U	12	0.538	U	0.538	11	U	11

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APPENDIX C

DATA QUALITY ASSESSMENT

APPENDIX C

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 2015b). This DQA was performed in accordance with the site-specific data quality objectives found in the *300 Area Remedial Action Sampling and Analysis Plan* (300 Area SAP) (DOE-RL 2014).

A review of the sample design (WCH 2015b), the field logbook (WCH 2015a), and the 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 300 Area SAP (DOE-RL 2014) 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 from samples collected at the 600-367 waste site were provided by the laboratories in two sample delivery groups (SDGs): J02184 and X0107. SDG J02184 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed 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.

MAJOR DEFICIENCIES

None.

MINOR DEFICIENCIES

SDG J02184

This SDG comprises 14 soil samples (J1V720 through J1V729, J1V730 through J1V732, J1V734) collected from the excavation. Additionally, one equipment blank sample, J1V719, is included in this SDG. Sample J1V732 is a field duplicate of sample J1V731. The split sample (J1V733) associated with this field duplicate pair is in SDG X0107 and is discussed below. The field samples were analyzed for inductively coupled plasma (ICP) metals, mercury, polycyclic aromatic hydrocarbons (PAH),

polychlorinated biphenyls (PCBs), and total diesel range petroleum hydrocarbons (NWTPH-Dx). Minor deficiencies are as follows.

In the ICP metals analysis, low levels of magnesium were detected in the method blank and the equipment blank (J1V719). Third-party validation qualified the J1V719 result as undetected and estimated with "UJ" flags. The data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recoveries for antimony (50%), nickel (60%), and silicon (28%) are outside the quality control (QC) limits. Acceptable matrix spike duplicate (MSD) results indicate that the analytical system was operating within control. Third-party validation qualified the associated data as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory control sample (LCS) recovery for silicon (8%) is outside the QC limits. Third-party validation qualified the associated data as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the relative percent differences (RPDs) calculated for nickel (47%) and silicon (37%) are outside the QC limits. Elevated RPDs in environmental soil samples are generally attributed to natural heterogeneities in the sample matrix. Third-party validation qualified the associated data as estimated with "J" flags. The data are usable for decision-making purposes.

SDG X0107

This SDG comprises one split soil sample (J1V733) collected from the excavation. The field duplicate pair (J1V731/J1V732) in SDG J02184, discussed above, are associated with this split sample. This sample was analyzed for ICP metals, mercury, PCBs, PAHs, and NWTPH-Dx. Minor deficiencies are as follows.

In the NWTPH-Dx analysis, the MS recoveries for the diesel range organics (65.3%) and the motor oil range organics (68.9%) are outside the QC range. Acceptable MSD and LCS recoveries confirm that the analytical system was operating within control. The MS and MSD recoveries are similar enough that the RPDs calculated between them are within the QC range. There is no significant impact on the field sample data. The laboratory has qualified the associated data with "T" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, the RPD calculated between the MS and the MSD for aroclor-1260 is outside the QC range. However, both the MS and MSD recoveries are within the QC range. The LCS recovery is also within the QC range. There is no indication the analytical system was operating out of control. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for vanadium (132%) and silicon (37.5%) are outside the QC range. The post-spike recovery for silicon (154%) confirms physical or chemical interferences are present. The laboratory has qualified the associated silicon and vanadium data with "N" flags. These data may be considered estimated. 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 2015b) are shown in Table C-1. The main and QA/QC sample results are presented in Appendix B.

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

Sample Area	Main Sample	Duplicate Sample	Split Sample
Excavation	J1V731	J1V732	J1V733

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 concern. 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. Relative percent differences of analytes detected at low concentrations (less than five times the detection limit) are not considered indicative of the analytical system performance. The calculation brief in Appendix B 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 duplicate or split samples. Minor deficiencies for the field duplicates and split samples are as follows.

Table C-2. Field Duplicate Relative Percent Differences.

Decision Unit	Duplicate Analyses Over 30%	Split Analyses Over 35%
Shallow Zone (SZ)	None	Silicon (100.4%)

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 target detection limit. In these cases, a control limit of ±2 times the target detection limit is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. In the duplicate and split analyses, multiple analytes were flagged for this evaluation. 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 600-367 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 these sites 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 a 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.

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