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Rev. 0

Cleanup Verification Package for the 300-289, Stained Soil Area North of 300 Area Waste Site

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

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EXECUTIVE SUMMARY

This cleanup verification package documents completion of remedial action for the 300-289, Stained Soil Area North of 300 Area waste site. The 300-289 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 *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 300-289 waste site consisted of an approximate 5-m (16.4-ft)-diameter area of bare ground located near a dirt road north of the 300 Area. The bare ground area included crusty, dark stained soil with two drum bung plugs. Remedial action was determined to be necessary because confirmatory sampling of the soil detected hexavalent chromium and polychlorinated biphenyls at concentrations exceeding direct exposure cleanup levels.

Remediation of the 300-289 waste site was performed from December 8 through 11, 2014. The excavation extended to an approximate maximum depth of 5.5 m (18 ft) below ground surface, resulting in approximately 1,728 bank cubic meters (2,260 bank cubic yards) of contaminated soil being removed for disposal at the Environmental Restoration Disposal Facility. No overburden soil was salvaged from the 300-289 waste site excavation and no staging pile areas were utilized.

Verification sampling within the 300-289 waste site excavation was performed on February 5, 2015. An evaluation of the resulting data found that the waste removal action achieved compliance with residential scenario remedial action objectives for the 300-289 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 300-289 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011b).

Table ES-1. Summary of Cleanup Verification Results for the 300-289 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 does of <15 mrem/yr, whichever is lower.	Radionuclides were not identified as COCs for the 300-289 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.	The hazard quotients for individual nonradionuclide COCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogenic COCs.	The cumulative hazard quotient (5.8 x 10^{-3}) is <1.	
	Attain an excess cancer risk of <1 x 10^{-6} (residential land use) for individual carcinogenic COCs.	The excess cancer risk for aroclor-1260, the only constituent subject to the excess cancer risk calculation is 5.3 x 10^{-7}, which is <1 x 10^{-6} (residential land use).	
	Attain a total excess cancer risk of <1 x 10^{-5} for carcinogenic COCs.	The excess cancer risk for aroclor-1260, the only constituent subject to the excess cancer risk calculation is 2.12 x 10^{-7}, which is <1 x 10^{-5}.	
Groundwater/River Protection – Radionuclides	Attain single radionuclide COC groundwater and river protection CULs.	Radionuclides were not identified as COCs for the 300-289 waste site.	NA
	Attain National Primary Drinking Water Standards: 4 mrem/yr (beta/gamma) dose rate to target receptors/organs [a].		
	Meet drinking water standards for nonuranium alpha emitters: the more stringent of the 15 pCi/L MCL or 1/25th of the derived concentration guide per DOE Order 5400.5 [b].		
	Meet total uranium drinking water standard of 21.2 pCi/L [c].		

Table ES-1. Summary of Cleanup Verification Results for the 300-289 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] *Radiation Protection of the Public and the Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the Hanford Site background, the 30 µg/L uranium MCL (40 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 the 300 Area* (DOE-RL 2009), as modified by TPA-CN-598 (DOE-RL and EPA 2013) to demonstrate attainment of the remedial action objectives and the corresponding cleanup levels (CULs) for industrial land use established in the 300 Area ROD (EPA 2013). Although the 300-289 waste site is in the industrial portion of the 300 Area, the results of verification sampling show that the 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). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Since the waste site remediation achieved cleanup levels for residential land use, institutional controls to maintain industrial land use are not required.

The 300-289 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 (DOE-RL 2011b). 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.:** 2015-017

Waste Site Code(s)/Subsite Code(s): 300-289

Reclassification Category: Interim ☐ Final ☒

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

Approvals Needed: DOE ☒ Ecology ☐ EPA ☒

Description of current waste site condition:

The 300-289, Stained Soil Area North of 300 Area waste site, part of the 300-FF-2 Operable Unit, was identified as a waste site requiring remediation in the *Hanford Site 300 Area, Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1, Hanford Site, Benton County, Washington* (300 Area ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2013). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation material at 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 300-289 waste site was performed from December 8 through 11, 2014. Approximately 1,728 bank cubic meters (2,260 bank cubic yards) of contaminated soil was removed and direct loaded for disposal at the ERDF.

Basis for reclassification:

The verification sampling results were evaluated in comparison to the cleanup levels (CULs) and remedial action objectives (RAOs) from the 300 Area ROD (EPA 2013), as described in the *Remedial Design Report/Remedial Action Work Plan for 300 Area* (300 Area RDR/RAWP), DOE/RL-2001-47, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2009), as modified by TPA-CN-598 (DOE-RL and EPA 2013). In accordance with this evaluation, the verification sampling results support a reclassification of the 300-289 waste site to Final Closed Out. Although the 300-289 waste site is in the industrial portion of the 300 Area, the current site conditions achieve the residential land use CULs and RAOs established by the 300 Area ROD (EPA 2013). The 300-289 site has met the requirements for unlimited use and unrestricted exposure. The results of verification sampling show that residual contaminant concentrations meet human health direct exposure cleanup levels for residential land use and applicable standards for groundwater and river protection in the shallow zone (i.e., surface to 4.6 m [15 ft] deep). Since the waste site remediation achieved cleanup levels for residential land use, institutional controls to maintain industrial land use are not required for the 300-289 waste site. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 300-289, Stained Soil Area North of 300 Area Waste Site.*

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 300-FF-2 **Control No.:** 2015-017

Waste Site Code(s)/Subsite Code(s): 300-289

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		5/12/15
DOE Federal Project Director (printed)	Signature	Date
NA		
Ecology Project Manager (printed)	Signature	Date
B. Simes		5/13/15
EPA Project Manager (printed)	Signature	Date

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ACRONYMS AND ABBREVIATIONS

COC	contaminant of concern
COPC	contaminant of potential 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
ICP	inductively coupled plasma
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
SVOC	semivolatile organic compound
TPH	total petroleum hydrocarbons
UCL	upper confidence limit
VOC	volatile organic compound
WAC	*Washington Administrative Code*

1.0 INTRODUCTION

This cleanup verification package (CVP) documents that the 300-289, Stained Soil Area North of 300 Area waste site was remediated in accordance with the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (300 Area RDR/RAWP) (DOE-RL 2009). 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) and incorporated into the 300 Area RDR/RAWP by TPA-CN-598 (DOE-RL and 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 300-289 waste site included excavating the site to the extent required to meet industrial 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. Although the 300-289 waste site is in the industrial portion of the 300 Area, the waste site remediation achieved cleanup levels for a residential land-use scenario; therefore, institutional controls to maintain industrial land use are not required for the site.

2.0 SITE DESCRIPTION AND SUPPORTING INFORMATION

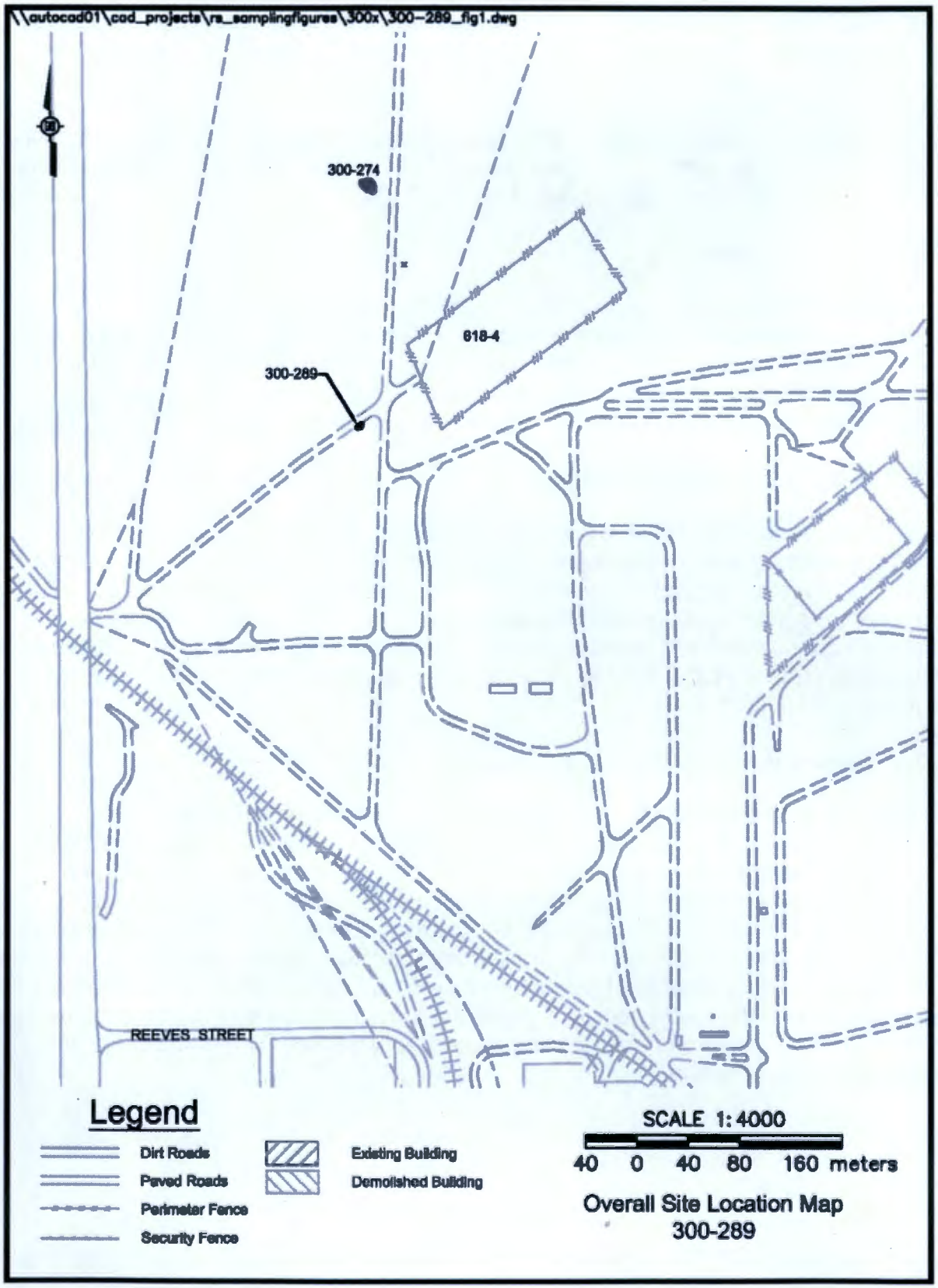
2.1 SITE DESCRIPTION

The 300-289 waste site was described as a 5-m (16.4-ft)-diameter area of bare ground near a dirt road north of the 300 Area (Figure 1). The bare ground area included crusty, dark stained soil partially covered by gravel. Rocks were scattered throughout the site, which borders the partially vegetated dirt road. The *300 Area Orphan Sites Evaluation Report* (WCH 2010) states that two drum bung plugs discovered at the 300-289 waste site may be evidence of "a possible liquid dump site." The waste site was similar in appearance to other dumping areas found north of the 300 Area, including sites where surface debris and organic liquid contamination was removed. The discovery of two bung plugs at the 300-289 waste site suggests that this site may have received a potential release of drummed waste.

Figure 1. Photograph of the 300-289 Waste Site, Looking East Toward the Power Line Road (April 13, 2011).

The 300-289 waste site is located in the 300-FF-2 Operable Unit, approximately 15 m (49 ft) west of a maintained power line road north of the 300 Area (Figure 2). The waste site is adjacent to a road no longer in use that ran northeast from Route 4 South to the 618-4 Burial Ground, intersecting the power line road nearby.

Figure 2. The 300-289 Waste Site Location Map.



2.2 CONFIRMATORY SAMPLING

The 300-289 waste site was previously addressed as a "plug-in" site in accordance with the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site, Benton County, Washington* (300-FF-2 ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2001). In accordance with this approach, the site was evaluated as a candidate site for remedial action using the confirmatory sampling approach described below. The conclusions of this evaluation were incorporated into the decision for the site under the 300 Area ROD.

2.2.1 Site Visit Summary

A walkdown of the 300-289 waste site was conducted on April 13, 2011, to assess existing conditions for confirmatory sampling activities. A ditch was observed in the southern portion of the site ending at the bare-ground area (Figure 3). The bung plugs previously observed were not located at the site, and the crusty stain appeared to be darker than recorded during the 2009 orphan sites walkdown (WCH 2009) (Figure 4).

2.2.2 Geophysical Survey Results

A geophysical survey was performed at the 300-289 waste site in October 2011 to support the confirmatory sampling activities. The results of the survey indicated the presence of a small pocket of shallow anomalies in the vicinity of the surface stain. The geophysical survey indicated that the anomalies were similar in character to the scattered debris observed on the surface and were no more than 0.2 m (0.66 ft) below the ground surface (WCH 2011a). The geophysical interpretation map is provided in Figure 5.

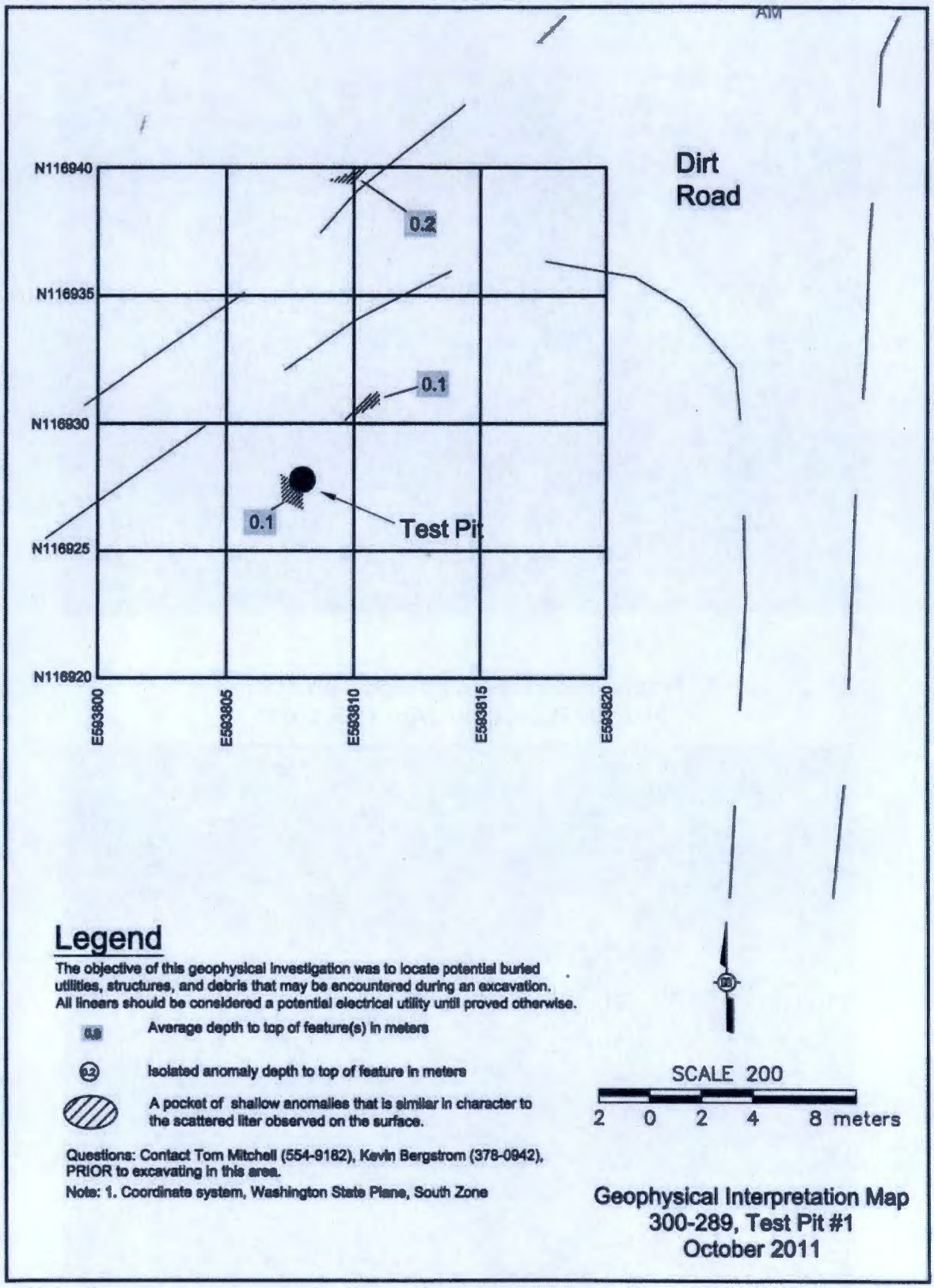
2.2.3 Contaminants of Potential Concern

Contaminants of potential concern (COPCs) for confirmatory sampling at the 300-289 waste site were determined based on the observation of two drum bung plugs and crusty, stained soil found at the site. The COPCs for the 300-289 waste site included the expanded list of inductively coupled plasma (ICP) metals, mercury, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), and semivolatile organic compounds (SVOCs). The preliminary review of the confirmatory sampling data showed elevated levels of total chromium; therefore, hexavalent chromium analysis was requested. No radiological activity or volatile organic compounds (VOCs) were detected in the field during confirmatory sampling; therefore, analyses for radionuclides and VOCs were not requested.

Figure 3. 300-289 Waste Site, Looking North (April 13, 2011).

Figure 4. Close-Up Photograph of the 300-289 Waste Site (April 13, 2011).

Figure 5. 300-289 Waste Site Geophysical Interpretation Map.



2.2.4 Confirmatory Sampling Activities

Confirmatory sampling of the 300-289 was site was performed on April 3, 2012, per the *Work Instruction for Confirmatory Sampling of the 300-289, Stained Soil Area North of 300 Area Waste Site* (WCH 2011b). Two samples were collected on the surface of the waste site and one sample was collected at approximately 1 m (3 ft) below ground surface. A summary of the samples collected is presented in Table 1. The confirmatory sampling locations are provided in Figure 6. No elevated radiological activity or VOCs were detected during the confirmatory sampling.

Table 1. The 300-289 Waste Site Confirmatory Sampling Summary Table.

Sample	Sample Media	Sample Number	Washington State Plane Coordinates		Depth (m bgs)	Sample Analysis
			Northing	Easting		
Surface	Soil	J1N2T1	116927.9	593807.6	NA	ICP metals [a], mercury, TPH, SVOA, PCB, total uranium [b], hexavalent chromium [c]
	Crusty, stained soil	J1N2R8	116928.5	593809.0	NA	
Test Pit	Soil at bottom of test pit	J1N2T0	116928	593808	1	ICP metals [a], mercury, TPH, SVOA, PCB, total uranium [b], hexavalent chromium [c]
Duplicate surface	Crusty, stained soil	J1N2R9	116928.5	593809.0	NA	ICP metals [a], mercury, TPH, SVOA, PCB, total uranium [b], hexavalent chromium [c]
Equipment blank	Silica sand	J1N2R7	NA	NA	NA	ICP metals [a], mercury

Source: *Miscellaneous Sampling*, Logbook EL-1601-6 (WCH 2012).

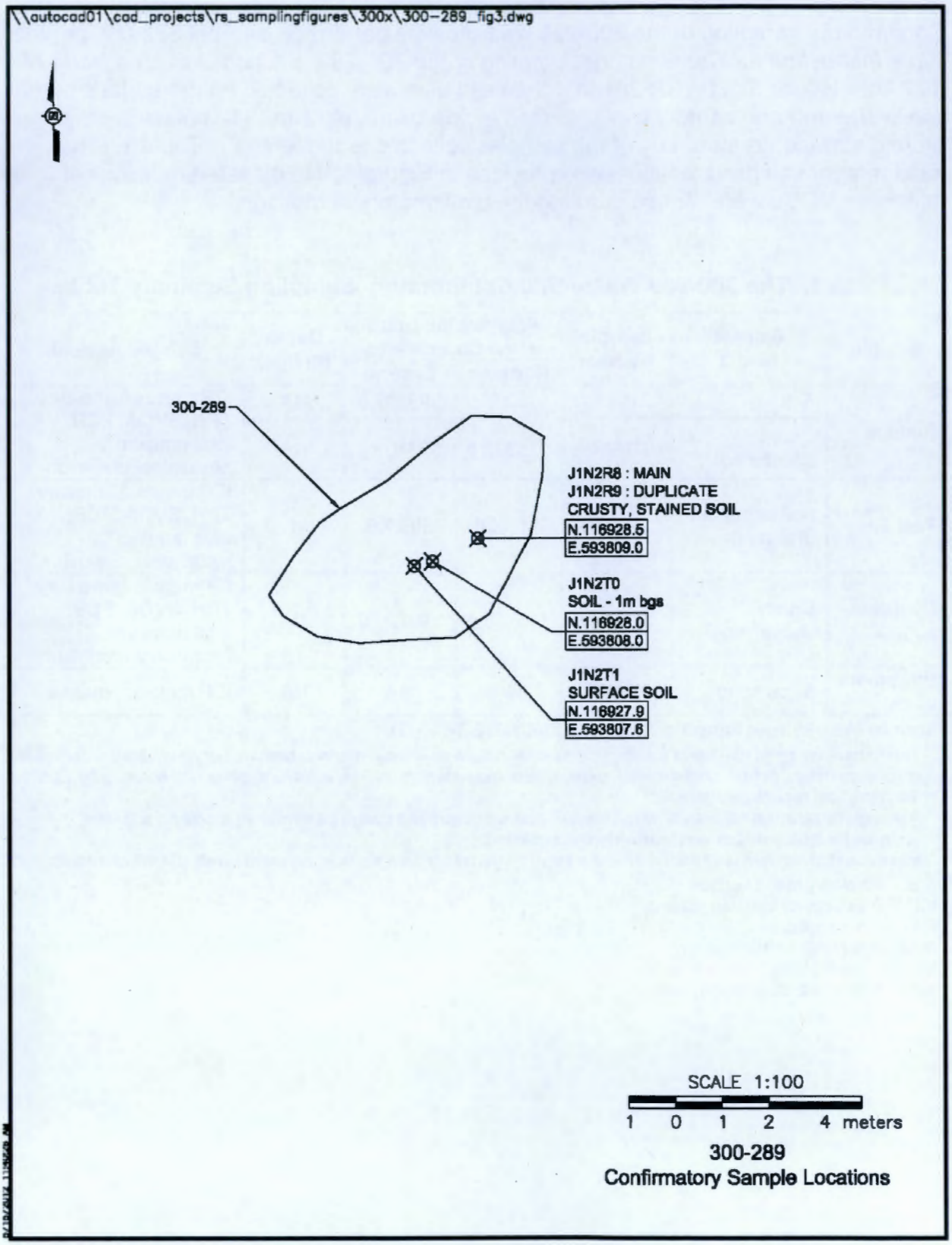
[a] The expanded list of ICP metals was performed to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc in the analytical results package.

[b] Although no radiological activity was detected above background during confirmatory sampling activities, analysis for total uranium was inadvertently requested.

[c] Hexavalent chromium was added after the initial confirmatory data showed elevated levels of total chromium.

bgs = below ground surface
ICP = inductively coupled plasma
NA = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbons

Figure 6. 300-289 Confirmatory Sampling Locations.



3.0 REMEDIAL ACTION FIELD ACTIVITIES

3.1 EXCAVATION AND DISPOSAL

Remediation of the 300-289 waste site was conducted December 8 through 11, 2014. The remediation extended to an approximate maximum depth of 5.5 m (18 ft) below ground surface, resulting in approximately 1,728 bank cubic meters (2,260 bank cubic yards) of soil being removed for disposal at ERDF. All material was direct loaded from the excavation; therefore, no waste staging pile area was generated. Additionally, no overburden material was stockpiled for use as backfill material. Post-excavation photographs taken January 13, 2015, are provided in Figures 7 and 8.

3.2 POST-EXCAVATION TOPOGRAPHIC SURVEY

A post-excavation civil survey was performed at the 300-289 waste site at the completion of remedial action activities. The survey is provided in Figure 9.

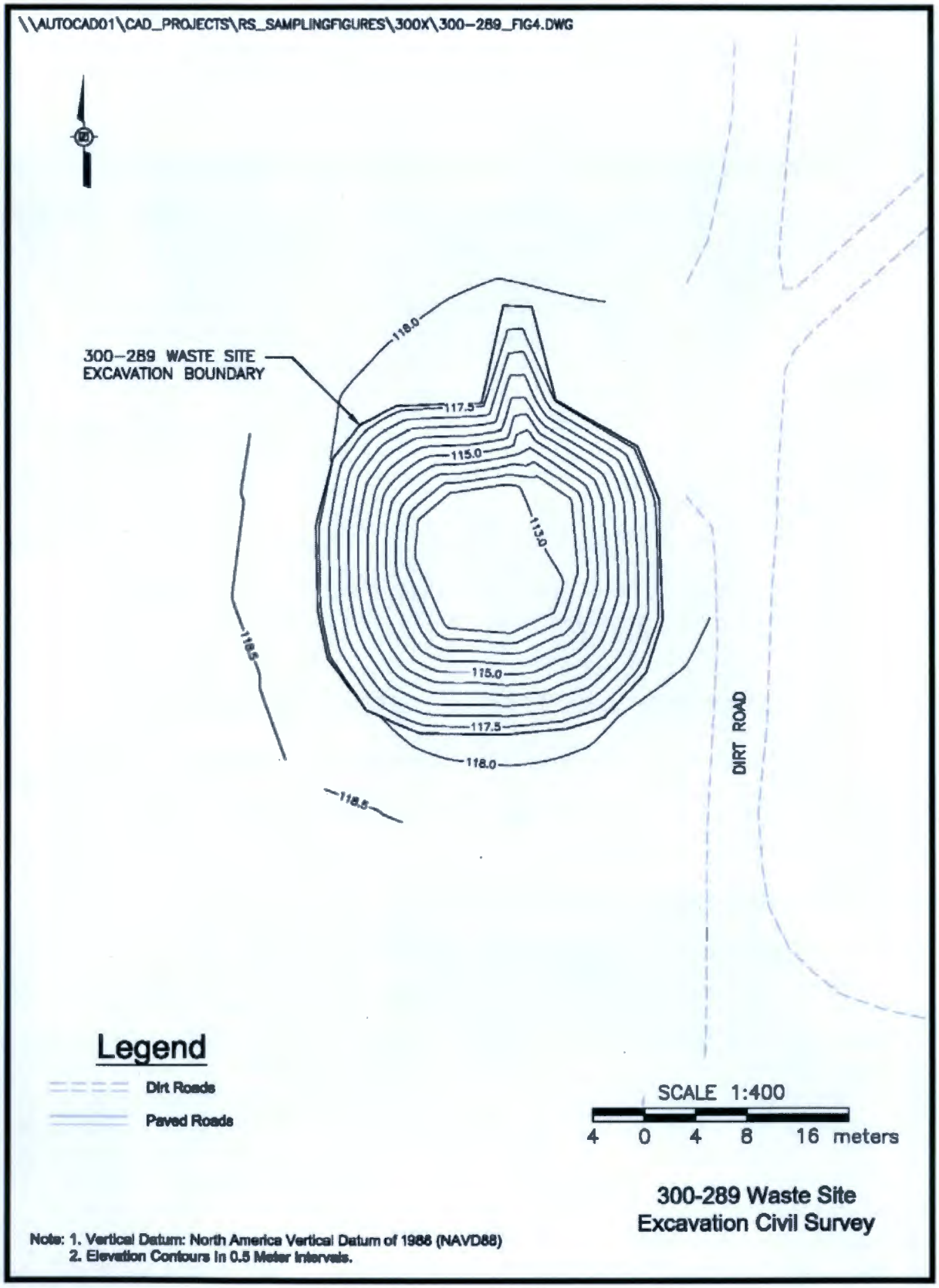
4.0 VERIFICATION SAMPLING ACTIVITIES

Verification sampling for the 300-289 waste site was performed on February 5, 2015, per the *Work Instruction for Verification Sampling of the 300-289, Stained Soil Area North of 300 Area* (WCH 2015). Verification sampling was conducted to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the 300 Area RDR/RAWP (DOE-RL 2009) and the 300 Area ROD (EPA 2013).

Figure 7. Photograph of the Remediated 300-289 Waste Site Looking North, Dated January 13, 2015.

Figure 8. Photograph of the Remediated 300-289 Waste Site Looking North/Northeast Into Excavation, Dated January 13, 2015.

Figure 9. 300-289 Post-Excavation Civil Survey.



The 95% upper confidence limit (UCL) calculations for the verification sample results are provided in Appendix B. The results indicate that the remedial action achieved compliance with the applicable RAOs and CULs for the 300-289 waste site.
The following subsections provide additional discussion of the information used to develop the verification sampling design.

4.1 CONTAMINANTS OF CONCERN FOR VERIFICATION SAMPLING

The contaminants of concern (COCs) for verification sampling at the 300-289 waste site were determined based on the confirmatory sampling results (Appendix A). Hexavalent chromium and PCBs were detected above the direct exposure residential soil CULs; therefore, they were retained as site COCs. Total petroleum hydrocarbons motor oil was detected in the confirmatory samples; therefore, TPH was retained as a COC. Total petroleum hydrocarbons diesel oil range was undetected in all samples; however, because the detection limits were high due to dilution of the sample matrix, diesel oil range was included in the requested analyses. Although carbazole is not a COC for the 300 Area, carbazole was detected in the confirmatory samples; therefore, it was included for verification sampling. Although none were quantified above a CUL, several metals were detected in the confirmatory samples; therefore, the expanded list of ICP metals and mercury was requested.

The final list of analyses for verification sampling at the 300-289 waste site included ICP metals, mercury, hexavalent chromium, PCBs, SVOA, and TPH.

4.2 VERIFICATION SAMPLING DESIGN SELECTION AND BASIS

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples that were collected. The excavation area footprint is the only decision unit identified for the 300-289 waste site for verification sampling.

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% UCL on the sample mean, with the CUL. Therefore, a statistical sampling design is the preferred verification sampling approach for this site because the distribution of potential residual soil contamination over the site is uncertain. The Washington State Department of Ecology (Ecology) publication *Guidance on Sampling and Data Analysis Methods* (Ecology 1995) recommends that systematic sampling with sample locations distributed over the entire study area be used. This sampling approach is referred to by Ecology as "area-wide sampling." Therefore, sampling locations were distributed over the footprint of the excavation area using a random-start systematic grid in an effort to determine the potential presence of residual contamination. Statistical parameters (i.e., standard deviation within the populations) for residual contaminant levels following

remediation at the 300-289 waste site were estimated based on assumptions of residual contamination after remediation. These assumptions were verified using the resulting verification sampling data and considered in the data quality assessment (DQA) for the data set.

The excavation area footprint of the 300-289 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 10).

4.2.2 Verification Sampling

The soil sample locations were global positional surveyed and staked prior to sample collection using the coordinate pairs provided in Table 2. 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 (DOE-RL 2014). The analytical methods are provided in Table 3.

5.0 SAMPLING RESULTS

This section presents the evaluation of the verification sample results for comparison with the data quality criteria and CULs.

5.1 STATISTICAL SAMPLE RESULTS

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).

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

Figure 10. Verification Sample Locations for the 300-289 Waste Site Excavation.

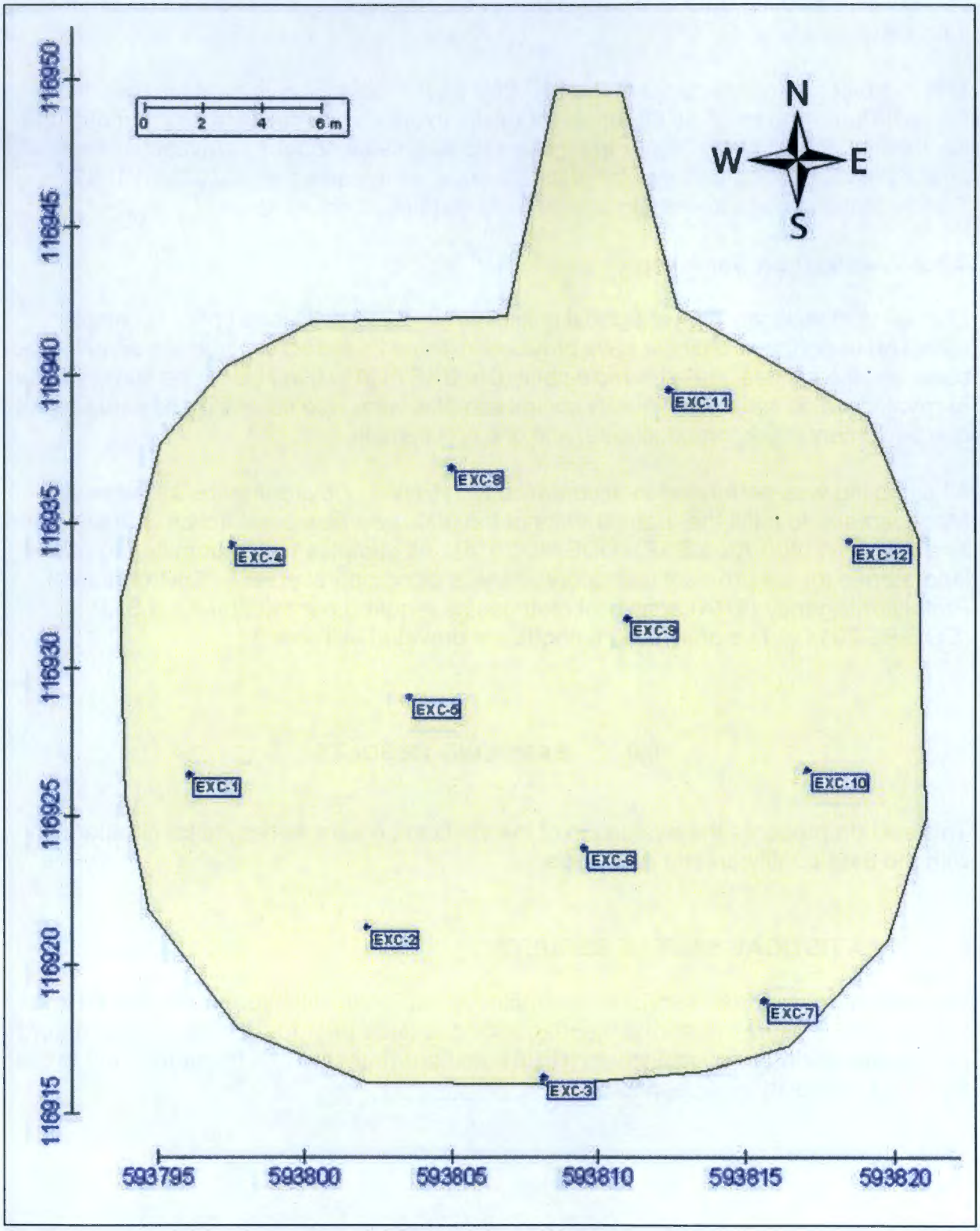


Table 2. Sample Summary Table for the 300-289 Waste Site.

Sample Location	HEIS Sample Number	Washington State Plane Coordinate Locations (m)		Sample Analysis
		Northing	Easting	
EXC-1	J1V468	116926.5	593796.1	ICP metals [a], mercury, hexavalent chromium, PCBs, SVOA, TPH
EXC-2	J1V469	116921.3	593802.1	
EXC-3	J1V470	116916.2	593808.1	
EXC-4	J1V471	116934.3	593797.5	
EXC-5	J1V472	116929.1	593803.5	
EXC-6	J1V473	116924.0	593809.6	
EXC-7	J1V474	116918.8	593815.6	
EXC-8	J1V475	116936.9	593805.0	
EXC-9	J1V476	116931.8	593811.0	
EXC-10	J1V477	116926.6	593817.0	
EXC-11	J1V478	116939.5	593812.5	
EXC-12	J1V479	116934.4	593818.5	
Duplicate of J1V470	J1V480	116916.2	593808.1	
Split of J1V470	J1V482	116916.2	593808.1	
Equipment blank	J1V481	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.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbons

Table 3. 300-289 Waste Site Laboratory Analytical Methods.

Analytical Method	Contaminants of Concern
ICP metals [a] – EPA Method 6010	Metals
Mercury – EPA Method 7471	Mercury
Hexavalent chromium – EPA Method 7196	Hexavalent chromium
PCB – EPA Method 8082	Polychlorinated biphenyls
SVOA – EPA Method 8270	Carbazole
TPH – EPA Method NWTPH-D+	Total petroleum hydrocarbons – diesel range and motor oil
TPH – EPA Method NWTPH-G	Total petroleum hydrocarbons – gasoline range

[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-D+ = Northwest total petroleum hydrocarbons – diesel range and motor oil
NWTPH-G = Northwest total petroleum hydrocarbons – gasoline range
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbons

One decision unit was identified for the 300-289 waste site for verification sampling and consisted of the excavation footprint. Twelve statistical soil samples plus one duplicate and one split sample were collected from the decision unit and submitted to offsite laboratories for analysis. The resulting data were evaluated by performing a 95% UCL on the true population mean for the residual COC concentrations.

The 95% UCLs on the true population means for residual concentrations of COCs were calculated for the excavation decision unit as specified by the RDR/RAWP (DOE-RL 2009), with calculations provided in Appendix A. When a nonradionuclide COC was detected in fewer than 50% of the verification samples collected, the maximum detected value was used for comparison against the RAGs. If no detections for a given COC were reported in the data set, then no statistical evaluation or calculations were performed for that COC.

Comparison of the statistical results for each COC from the 300-289 waste site against the CULs for the excavation area is presented in Table 4. Contaminants that were not detected by laboratory analysis are excluded from the table. Calculated cleanup levels for calcium, magnesium, potassium, silicon, and sodium are not presented in the RDR/RAWP (DOE-RL 2009). Parameters to calculate cleanup levels for these constituents are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2011) under WAC 173-340-740(3) or other reference databases. 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 COPCs and are also not included in the table.

The 300 Area COCs and CULs are provided in the 300 Area ROD (EPA 2013). If a contaminant is discovered during remediation for which a CUL is not established in the ROD, the information will be presented to the U.S. Department of Energy and EPA project managers for determination of a path forward. While not identified as a 300 Area COC, 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 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.

Table 4. Comparison of Contaminant Concentrations to Residential Cleanup Levels for the 300-289 Waste Site 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	2.14 (<BG)	20	20	No
Barium	74.9 (<BG)	16,000	--	No
Beryllium	1.14 (<BG)	160	--	No
Cadmium	0.563	80	176	No
Chromium (total)	8.69 (<BG)	120,000	--	No
Cobalt	9.94 (<BG)	24	--	No
Copper	14.4 (<BG)	3,200	3,400	No
Hexavalent chromium	0.659	2.1	2.0	No
Lead	2.74 (<BG)	250	1,480	No
Manganese	318 (<BG)	11,200	--	No
Mercury	0.0107 (<BG)	24	8.5	No
Nickel	10.0 (<BG)	1,600	--	No
Selenium	1.04	400	302	No
Silver	0.228	400	--	No
Strontium	21.9	48,000	--	No
Uranium (total)	0.498 (<BG)	81	102	No
Vanadium	82.8 (<BG)	400	--	No
Zinc	45.7 (<BG)	24,000	64,100	No
Aroclor-1260	0.106	0.5	--	No

[a] 95% upper confidence level or maximum value, depending on data censorship, as described in Appendix B.
[b] Background values from DOE-RL 2001 and 2013.
[c] CULs obtained from Table 4 of the 300 Area ROD (EPA 2013)

-- = not applicable
BG = background
COC = contaminant of concern
CUL = cleanup level
ROD = record of decision

The DQA for the 300-289 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.

Although the 300-289 waste site is located within the industrial portion of the 300 Area, the residual COC concentrations support residential land use; 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 Table 4 from the verification sampling at the 300-289 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).

The 300 Area RDR/RAWP (DOE-RL 2009) also requires comparison of nonradionuclide results against CULs following the components of the WAC 173-340-740(7)(e) three-part test. The application of the three-part test is included in the 95% UCL calculation (Appendix A). All residual COC concentrations pass the three-part test in comparison against the residential land-use CULs.

The 300 Area RDR/RAWP (DOE-RL 2009) also requires comparison of verification sampling results against ecological screening values. However, as described in Section 7.2 of the 300 Area ROD (EPA 2013), ecological risk evaluations concluded that, once human health CULs are achieved, residual contamination would not be sufficient to adversely impact populations and communities of ecological receptors. Therefore, no further screening of potential ecological risk has been performed for the 300-289 waste site.

6.2 EVALUATION OF ATTAINMENT OF RADIONUCLIDE AND NONRADIONUCLIDE RISK REQUIREMENTS

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

6.2.1 Radionuclide Evaluation of Risk and Dose

Radionuclides were not identified as COCs for the 300-289 waste site; therefore, no risk and dose evaluations were conducted.

6.2.2 Attainment of Nonradionuclide Noncarcinogenic and Carcinogenic Risk Standards

For COCs with noncarcinogenic effects, *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," specified the evaluation of the hazard quotient, which is given as daily intake divided by a reference dose (WAC 173-340-200). The solutions and details of the hazard quotient calculations for 300-289 waste site are provided in Appendix B.

Nonradionuclide risk requirements for the residential scenario include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. Hazard quotient and excess carcinogenic risk calculations were performed for the 300-289 waste site using the 95% UCL statistical values from the cleanup verification samples. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients for the 300-289 waste site are less than 1.0. The cumulative hazard quotient is 5.8×10^{-3}, which is less than 1.0. The individual excess carcinogenic risk value for aroclor-1260, the only constituent subject to the excess cancer risk calculation, is 5.3×10^{-7}, which is less than the individual and cumulative carcinogenic risk of less than 1×10^{-6} and 1×10^{-5}, respectively.

7.0 STATEMENT OF PROTECTIVENESS

Although the 300-289 waste site is in the industrial portion of the 300 Area, remedial action at the 300-289 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 Area RDR/RAWP (DOE-RL 2009), as modified by TPA-CN-598 (DOE-RL and EPA 2013). The contaminated materials from the site have been excavated and disposed of at ERDF. The remaining soil at the 300-289 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 unlimited use and unrestricted exposure as established by the 300 Area ROD (EPA 2013), institutional controls to maintain industrial land use are not required. The 300-289 waste site is verified to be remediated in accordance with the 300 Area ROD (EPA 2013) and has been reclassified to a status of Final Closed Out.

8.0 REFERENCES

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APPENDIX A

CONFIRMATORY SAMPLE DATA

Table A-1. 300-289 Confirmatory Sample Data. (3 Pages)

HEIS Number	Sample Date	Northing	Easting	Aluminum			Antimony			Arsenic			Barium			Beryllium		
				METALS			METALS			METALS			METALS			METALS		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1N2R7	4/3/12 10:15	NA	NA	183		4.03	0.484	U	0.484	0.316	B	0.81	1.74		0.4	0.161	U	0.16
J1N2R8	4/3/12 10:20	116928.5	593809	6320		12.9	1.55	U	1.55	1.6	B	2.58	75.6		1.29	0.191	B	0.52
J1N2R9	4/3/12 10:30	116928.5	593809	5800		13.4	1.61	U	1.61	2.75		2.68	61.7		1.34	0.198	B	0.54
J1N2T0	4/3/12 10:35	116928	593808	5780		11.5	1.38	U	1.38	2.52		2.3	69.8		1.15	0.229	B	0.46
J1N2T1	4/3/12 10:17	116927.9	593808	6100		11.7	1.4	U	1.4	2.34	U	2.34	62.2		1.17	0.215	B	0.47

HEIS Number	Sample Date	Northing	Easting	Boron			Cadmium			Calcium			Chromium			Cobalt		
				METALS			METALS			METALS			METALS			METALS		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1N2R7	4/3/12 10:15	NA	NA	1.61	U	1.61	0.161	U	0.161	35.1	B	80.7	0.244		0.16	1.61	U	1.61
J1N2R8	4/3/12 10:20	116928.5	593809	2	B	5.17	0.286	B	0.517	1630		258	4900		0.52	5.58		5.17
J1N2R9	4/3/12 10:30	116928.5	593809	1.84	B	5.36	0.237	B	0.536	1880		268	4280		0.54	5.24	B	5.36
J1N2T0	4/3/12 10:35	116928	593808	4.61	U	4.61	0.461	U	0.461	3210		230	128		0.46	5.15		4.61
J1N2T1	4/3/12 10:17	116927.9	593808	1.8	B	4.68	0.201	B	0.468	2440		234	5100		0.47	6.39		4.68

HEIS Number	Sample Date	Northing	Easting	Copper			Hexavalent Chromium			Iron			Lead			Magnesium		
				METALS			METALS			METALS			METALS			METALS		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1N2R7	4/3/12 10:15	NA	NA	0.807	U	0.807				303		16.1	0.503		0.4	22.2	B	60.5
J1N2R8	4/3/12 10:20	116928.5	593809	19.6		2.58	144	D	21	20000		51.7	10.8		1.29	2820		194
J1N2R9	4/3/12 10:30	116928.5	593809	15.2		2.68	709	D	41.4	17400		53.6	9.83		1.34	2850		201
J1N2T0	4/3/12 10:35	116928	593808	9.18		2.3	13.9		0.21	17600		46.1	3.18		1.15	3570		173
J1N2T1	4/3/12 10:17	116927.9	593808	14.2		2.34	763	D	41.8	16600		46.8	11.2		1.17	3220		175

HEIS Number	Sample Date	Northing	Easting	Manganese			Mercury			Molybdenum			Nickel			Potassium		
				METALS			METALS			METALS			METALS			METALS		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1N2R7	4/3/12 10:15	NA	NA	4.9		4.03	0.0273	U	0.027	1.61	U	1.61	3.23	U	3.23	41.7	B	323
J1N2R8	4/3/12 10:20	116928.5	593809	231		12.9	0.0263	U	0.026	0.593	B	5.17	7.63	B	10.3	1660		1030
J1N2R9	4/3/12 10:30	116928.5	593809	218		13.4	0.0239	U	0.024	0.684	B	5.36	8.65	B	10.7	1310		1070
J1N2T0	4/3/12 10:35	116928	593808	244		11.5	0.0265	U	0.027	4.61	U	4.61	7.95	B	9.21	1010		921
J1N2T1	4/3/12 10:17	116927.9	593808	261		11.7	0.0254	U	0.025	4.68	U	4.68	10.1		9.35	1160		935

HEIS Number	Sample Date	Northing	Easting	Selenium			Silicon			Silver			Sodium			Vanadium		
				METALS			METALS			METALS			METALS			METALS		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1N2R7	4/3/12 10:15	NA	NA	0.242	U	0.242	87.7		1.61	0.161	U	0.16	40.3	U	40.3	0.284	B	2.02
J1N2R8	4/3/12 10:20	116928.5	593809	0.775	U	0.775	1390		5.17	0.517	U	0.52	175		129	49.4		6.46
J1N2R9	4/3/12 10:30	116928.5	593809	0.804	U	0.804	618		5.36	0.536	U	0.54	142		134	44.1		6.7
J1N2T0	4/3/12 10:35	116928	593808	0.691	U	0.691	555		4.61	0.461	U	0.46	149		115	45		5.76
J1N2T1	4/3/12 10:17	116927.9	593808	0.701	U	0.701	630		4.68	0.468	U	0.47	146		117	41.9		5.85

HEIS Number	Sample Date	Northing	Easting	Zinc			Uranium		
				METALS			KPA		
				mg/kg	Q	PQL	mg/kg	Q	PQL
J1N2R7	4/3/12 10:15	NA	NA	1.08	B	8.07			
J1N2R8	4/3/12 10:20	116928.5	593809	41.1		25.8	1.23		0.23
J1N2R9	4/3/12 10:30	116928.5	593809	42.5		26.8	1.12		0.23
J1N2T0	4/3/12 10:35	116928	593808	33.2		23	1.21		0.23
J1N2T1	4/3/12 10:17	116927.9	593808	54.8		23.4	1.12		0.23

HEIS Number	Sample Date	Northing	Easting	TPH Diesel			TPH - Motor Oil			Percent Solids			pH		
				TPH			TPH			PHYSICAL			PHYSICAL		
				ug/kg	Q	PQL	ug/kg	Q	PQL	%	Q	PQL	pH	Q	PQL
J1N2R7	4/3/12 10:15	NA	NA												
J1N2R8	4/3/12 10:20	116928.5	593809	14000	U	14000	311000		42000	95.1		0.1	6.11		0.1
J1N2R9	4/3/12 10:30	116928.5	593809	27600	UD	27600	396000	D	82700	96.6		0.1	6.17		0.1
J1N2T0	4/3/12 10:35	116928	593808	3380	U	3380	10100	U	10100	97.2		0.1	7.5		0.1
J1N2T1	4/3/12 10:17	116927.9	593808	13400	U	13400	214000		40300	95.8		0.1	6.85		0.1

Table A-1. 300-289 Confirmatory Sample Data. (3 Pages)

CONSTITUENT	CLASS	J1N2R8			J1N2R9			J1N2T0			J1N2T1		
		N116928.5 E593809.0			N116928.5 E593809.0			N116928.0 E593808.0			N116927.9 E593807.6		
		4/3/12 10:20			4/3/12 10:30			4/3/12 10:35			4/3/12 10:17		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	69.8	UD	69.8	68.5	UD	68.5	13.6	U	13.6	54.8	UD	54.8
Aroclor-1221	PCB	69.8	UD	69.8	68.5	UD	68.5	13.6	U	13.6	54.8	UD	54.8
Aroclor-1232	PCB	69.8	UD	69.8	68.5	UD	68.5	13.6	U	13.6	54.8	UD	54.8
Aroclor-1242	PCB	69.8	UD	69.8	68.5	UD	68.5	13.6	U	13.6	54.8	UD	54.8
Aroclor-1248	PCB	69.8	UD	69.8	68.5	UD	68.5	13.6	U	13.6	54.8	UD	54.8
Aroclor-1254	PCB	101	D	69.8	82	D	68.5	13.6	U	13.6	53.7	JD	54.8
Aroclor-1260	PCB	592	D	69.8	534	D	68.5	13.6	U	13.6	331	D	54.8
Aroclor-1262	PCB	69.8	UD	69.8	68.5	UD	68.5	9.63	J	13.6	54.8	UD	54.8
Aroclor-1268	PCB	69.8	UD	69.8	68.5	UD	68.5	13.6	U	13.6	54.8	UD	54.8
1,2,4-Trichlorobenzene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
1,2-Dichlorobenzene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
1,3-Dichlorobenzene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
1,4-Dichlorobenzene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2,4,5-Trichlorophenol	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2,4,6-Trichlorophenol	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2,4-Dichlorophenol	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2,4-Dimethylphenol	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2,4-Dinitrophenol	SVOA	69300	UD	69300	171000	UD	171000	1660	U	1660	67800	UD	67800
2,4-Dinitrotoluene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2,6-Dinitrotoluene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2-Chloronaphthalene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2-Chlorophenol	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2-Methylnaphthalene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2-Methylphenol (cresol, o-)	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
2-Nitroaniline	SVOA	69300	UD	69300	171000	UD	171000	1660	U	1660	67800	UD	67800
2-Nitrophenol	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
3+4 Methylphenol (cresol, m+p)	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
3,3'-Dichlorobenzidine	SVOA	27700	UD	27700	68400	UD	68400	663	U	663	27100	UD	27100
3-Nitroaniline	SVOA	69300	UD	69300	171000	UD	171000	1660	U	1660	67800	UD	67800
4,6-Dinitro-2-methylphenol	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
4-Bromophenylphenyl ether	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
4-Chloro-3-methylphenol	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
4-Chloroaniline	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
4-Chlorophenylphenyl ether	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
4-Nitroaniline	SVOA	69300	UD	69300	171000	UD	171000	1660	U	1660	67800	UD	67800
4-Nitrophenol	SVOA	69300	UD	69300	171000	UD	171000	1660	U	1660	67800	UD	67800
Acenaphthene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Acenaphthylene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Anthracene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Benzo(a)anthracene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Benzo(a)pyrene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Benzo(b)fluoranthene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Benzo(ghi)perylene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Benzo(k)fluoranthene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Bis(2-chloro-1-methylethyl)ether	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Bis(2-Chloroethoxy)methane	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Bis(2-chloroethyl) ether	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Bis(2-ethylhexyl) phthalate	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Butylbenzylphthalate	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600

Table A-1. 300-289 Confirmatory Sample Data. (3 Pages)

CONSTITUENT	CLASS	J1N2R8			J1N2R9			J1N2T0			J1N2T1		
		N116928.5 E593809.0			N116928.5 E593809.0			N116928 E593808			N116927.9 E593807.6		
		4/3/12 10:20			4/3/12 10:30			4/3/12 10:35			4/3/12 10:17		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Carbazole	SVOA	6080	JD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Chrysene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Di-n-butylphthalate	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Di-n-octylphthalate	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Dibenz[a,h]anthracene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Dibenzofuran	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Diethyl phthalate	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Dimethyl phthalate	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Fluoranthene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Fluorene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Hexachlorobenzene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Hexachlorobutadiene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Hexachlorocyclopentadiene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Hexachloroethane	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Indeno(1,2,3-cd)pyrene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Isophorone	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
N-Nitroso-di-n-dipropylamine	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
N-Nitrosodiphenylamine	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Naphthalene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Nitrobenzene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Pentachlorophenol	SVOA	69300	UD	69300	171000	UD	171000	1660	U	1660	67800	UD	67800
Phenanthrene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Phenol	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600
Pyrene	SVOA	13900	UD	13900	34200	UD	34200	332	U	332	13600	UD	13600

APPENDIX B

CALCULATIONS

APPENDIX B

CALCULATIONS

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

300-289 Waste Site Cleanup Verification 95% UCL Calculations, (MTCAStat) 0300X-CA-V0210, Rev. 0, Washington Closure Hanford, Richland, Washington B-3

300-289 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, (MTCAStat) 0300X-CA-V0211, Rev. 0, Washington Closure Hanford, Richland, Washington B-23

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 300

Discipline: Environmental *Calculation No: 0300X-CA-V0210

Subject: 300-289 Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat)

Computer Program: Excel Program No: Excel 2010

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 9 Attm. 1 = 7 Total = 17	J. D. Skoglie	I. B. Berezovskiy	R. J. Nielson	S. G. Wilkinson	5/14/15

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 J. D. Skoglie	**Date** 05/01/15	**Calc. No.** 0300X-CA-V0216	**Rev. No.** 0
Project 300 Area Closure Operations	**Job No.** 14655	**Checked** I. B. Berezovskiy	**Date** 05/01/15
Subject 300-289 Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat)			**Sheet No.** 1 of 9

Summary

Purpose:
Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the subject site. Also, perform the *Washington Administrative Code* (WAC) 173-340-740(7)(e) Model Toxics Control Act (MTCA) 3-part test for nonradionuclide analytes and calculate the relative percent difference (RPD) for primary-duplicate sample pairs for each contaminant of concern (COC) and contaminant of potential concern (COPC), as necessary.

Table of Contents:
Sheets 1 to 4 - Calculation Sheet Summary
Sheet 5 to 6 - Calculation Sheet Verification Data - Excavation
Sheet 7 to 8 - MTCA Results
Sheet 9 - Calculation Sheet Duplicate and Split Analysis
Attachment 1 - 300-289 Waste Site Verification Sampling Results (7 sheets)

Given/References:
1) Sample Results (Attachment 1).
2) Background values and cleanup levels (CULs) are taken from DOE-RL (1996), DOE-RL (2001), and DOE-RL (2014b).
3) DOE-RL, 1996, *Hanford Site Background: Part 2, Soil Background for radioactive Analytes*, DOE/RL-96-12, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) DOE-RL, 2009, *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (RDR/RAWP), DOE/RL-2001-47, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
6) DOE-RL, 2014a, *300 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-2001-48, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
7) DOE-RL, 2014b, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*, DOE/RL-2010-99, Rev. 0, U.S.Department of Energy, Richland Operations Office, Richland, Washington.
8) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication 92-54, Washington State Department of Ecology, Toxics Cleanup Program, Olympia, Washington.
9) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets)*, Publication 92-64, Washington State Department of Ecology, Olympia, Washington.
10) Ecology, 1996, *Model Toxic Control Act Cleanup Levels and Risk Calculations (CLARC II)*, Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
11) Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
12) EPA, 1989, *Risk Assessment Guidance for Superfund* (RAGS), Volume I - Human Health Evaluation Manual (HHEM) (Part A Baseline Risk Assessment), Interim Final, Office of Emergency and Remedial Response, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D.C.
13) 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.
14) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code*.

Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2009). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Cleanup Verification Package (CVP).

Calculation Description:
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 300-289 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 2009) is documented by this calculation. Duplicate and split RPD results are used in evaluation of data quality within the CVP for these sites.

Methodology:
The 300-289 waste site consists of one desicion unit for verification sampling: the excavation. Analytical data for all sampling locations is provided in the summary tables on sheet 4.

Summary (continued)

Methodology (continued):
For nonradioactive analytes with ≤50% of the data below detection limits, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with >50% of the data below detection limits, as determined by direct inspection of the sample results (Attachment 1), the maximum detected value for the data set is used instead of the 95% UCL, and no further calculations are performed for those data sets. For convenience, these maximum detected values are included in the summary tables that follow. The 95% UCL was not calculated for data sets with no reported detections. Calculated cleanup levels are not available in Ecology (2011) under WAC 173-340-740(3) 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/COPCs and are also not included in these calculations.

All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics (Ecology 1993). In cases where the laboratory does not report a value below the minimum detectable activity (MDA), half of the MDA is used in the calculation. For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.

For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets ($n < 10$), the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2009) and MTCAStat coding and due to a limitation in the MTCAStat coding (no direct capability to address variable quantitation limits within a data set), substitutions for censored data are performed before software input and the resulting data set treated as uncensored.

The WAC 173-340-740(7)(e) 3-part test is performed for nonradionuclide analytes only and determines if:
1) the 95% UCL exceeds the most stringent cleanup limit for each COPC/COC,
2) greater than 10% of the raw data exceed the most stringent cleanup limit for each COPC/COC,
3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each COPC/COC.

The WAC 173-340-740(7)(e) 3-part test is not performed for COPCs where the statistical value defaults to the maximum value in the data set. Instead, direct comparison of the maximum value against site CULs (within the CVP) is used as the compliance basis.

The RPD is calculated when both the primary value and the duplicate 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 2-1 of the SAP (DOE-RL 2014a) 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 sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

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

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

Washington Closure Hanford	CALCULATION SHEET				
Originator J. D. Skoglie	Date 04/28/15	Calc. No. 0300X-CA-V0210		Rev. No. 0	
Project 300 Area Closure Operations	Job No. 14655	Checked I. B. Berezovskiy		Date 04/28/15	
Subject 300-289 Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat)				Sheet No. 3 of 9	

Summary (continued)

Qualifiers

* Indicates that a quality control parameter was not within specifications
B = Estimated result. Result is less than the RL, but greater than MDL.
C = Target analyte was detected in the sample and the associated blank
D = dilution
J = estimate
M = sample duplicate precision not met
N = recovery is outside the control limits
U = undetected

Acronyms

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

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie **Date** 05/06/15 **Calc. No.** 0300X-CA-V0210 **Rev. No.** 0
Project 300 Area Closure Operations **Job No.** 14655 **Checked** I. B. Berezovskiy **Date** 05/06/15
Subject 300-289 Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat) **Sheet No.** 4 of 9

Summary (continued)

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

Results Summary - Excavation[a]

Analyte	EXC		Units
	95% UCL Result	Maximum Result	
Arsenic	2.14	--	mg/kg
Barium	74.9	--	mg/kg
Beryllium	1.14	--	mg/kg
Cadmium	0.563	--	mg/kg
Chromium	8.69	--	mg/kg
Cobalt	9.94	--	mg/kg
Copper	14.4	--	mg/kg
Hexavalent chromium	0.659	--	mg/kg
Lead	2.74	--	mg/kg
Manganese	318	--	mg/kg
Molybdenum	0.304	--	mg/kg
Mercury	--	0.0107	mg/kg
Nickel	10.0	--	mg/kg
Selenium	1.04	--	mg/kg
Silver	--	0.228	mg/kg
Strontium	21.9	--	mg/kg
Uranium	0.498	--	mg/kg
Vanadium	82.8	--	mg/kg
Zinc	45.7	--	mg/kg
Aroclor-1260	--	0.106	mg/kg

WAC 173-340-740(7)(e) Evaluation:

WAC 173-340 3-Part Test for most stringent RAG:

95% UCL > Cleanup Limit?	NO
> 10% above Cleanup Limit?	NO
Any sample > 2x Cleanup Limit?	NO

[a]The 95% UCL result or maximum value, depending on data censorship, as described in the methodology section.

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

Analyte	Excavation	
	Duplicate	Split
Aluminum	2.1%	9.0%
Barium	1.1%	2.0%
Calcium	3.3%	2.9%
Chromium	8.6%	20.7%
Copper	2.8%	0.8%
Iron	1.0%	14.3%
Magnesium	2.7%	6.6%
Manganese	4.5%	2.4%
Silicon	3.5%	***100.7%***
Strontium	13.2%	11.3%
Vanadium	1.0%	25.0%
Zinc	1.3%	14.0%
Zirconium	7.2%	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 regulatory split data), is addressed in the data quality assessment section of the CVP.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 300 Area Closure Operations
Subject 300-289 Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat)

Date 05/06/15
Job No. 14655

Calc. No. 0300X-CA-V0210
Checked I. B. Berezovskiy

Rev. No. 0
Date 05/06/15
Sheet No. 5 of 9

300-289 Statistical Calculations - EXC

Verification Data - Statistical

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Arsenic Q	Arsenic PQL	Barium mg/kg	Barium Q	Barium PQL	Beryllium mg/kg	Beryllium Q	Beryllium PQL	Cadmium mg/kg	Cadmium Q	Cadmium PQL	Chromium mg/kg	Chromium Q	Chromium PQL	Cobalt mg/kg	Cobalt Q	Cobalt PQL	Copper mg/kg	Copper Q	Copper PQL	Hexavalent Chromium mg/kg	Hexavalent Chromium Q	Hexavalent Chromium PQL	Lead mg/kg	Lead Q	Lead PQL
EXC-3	J1V470	2/5/15	2.70	B	0.521	65.6		0.104	0.786		0.104	0.304	B	0.104	9.60		0.156	7.11	D	0.781	9.42	M	0.312	2.07		0.128	2.37		0.344
Duplicate of J1V470	J1V480	2/5/15	2.09	B	0.517	66.3		0.103	0.798		0.103	0.420	B	0.103	8.81		0.155	7.32	D	0.776	9.69	M	0.310	0.126	U	0.126	2.51		0.341
EXC-1	J1V468	2/5/15	2.91	B	0.537	107		0.107	1.19		0.107	0.569		0.107	10.0		0.161	9.71	D	0.805	16.3	M	0.322	0.308	B	0.127	3.38		0.354
EXC-2	J1V469	2/5/15	1.97	B	0.532	68.9		0.106	1.16		0.106	0.422	B	0.106	6.12		0.160	10.5	D	0.798	16.1	M	0.319	0.128	U	0.128	2.15		0.351
EXC-4	J1V471	2/5/15	1.18	B	0.519	67.4		0.104	1.28		0.104	0.657		0.104	7.18		0.156	11.3	D	0.778	15.2	M	0.311	0.306	B	0.126	1.29		0.342
EXC-5	J1V472	2/5/15	1.04	B	0.511	61.8		0.102	1.22		0.102	0.582		0.102	5.85		0.153	10.5	D	0.766	12.7	M	0.307	0.307	B	0.126	0.971	B	0.337
EXC-6	J1V473	2/5/15	0.662	B	0.509	59.8		0.102	1.21		0.102	0.545		0.102	9.01		0.153	9.78	D	0.763	13.2	M	0.305	0.527		0.125	0.968	B	0.336
EXC-7	J1V474	2/5/15	2.36	B	0.503	75.6		0.101	0.833		0.101	0.387	B	0.101	9.11		0.151	7.37	D	0.755	10.4	M	0.302	1.48		0.121	2.88		0.332
EXC-8	J1V475	2/5/15	0.522	B	0.510	42.8		0.102	0.842		0.102	0.429	B	0.102	3.24		0.153	7.45	D	0.765	10.9	M	0.306	0.126	U	0.126	0.988	B	0.336
EXC-9	J1V476	2/5/15	2.35	B	0.525	56.6		0.105	0.987		0.105	0.447	B	0.105	6.38		0.157	9.43	D	0.787	13.7	M	0.315	0.124	U	0.124	1.94		0.346
EXC-10	J1V477	2/5/15	0.992	B	0.499	68.8		0.0998	1.29		0.0998	0.665		0.0998	6.32		0.150	10.7	D	0.748	15.0	M	0.299	0.627		0.123	1.34		0.329
EXC-11	J1V478	2/5/15	2.03	B	0.519	66.2		0.104	0.886		0.104	0.468	B	0.104	10.0		0.156	7.45	D	0.779	11.5	M	0.311	0.129	U	0.129	2.72		0.343
EXC-12	J1V479	2/5/15	2.30	B	0.509	72.2		0.102	0.919		0.102	0.501	B	0.102	9.65		0.153	8.57	D	0.764	12.4	M	0.305	0.522		0.124	2.90		0.336

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Hexavalent Chromium mg/kg	Lead mg/kg
EXC-3	J1V470/ J1V480	2/5/15	2.40	66.0	0.792	0.362	9.21	7.22	9.56	1.07	2.44
EXC-1	J1V468	2/5/15	2.91	107	1.19	0.569	10.0	9.71	16.3	0.308	3.38
EXC-2	J1V469	2/5/15	1.97	68.9	1.16	0.422	6.12	10.5	16.1	0.064	2.15
EXC-4	J1V471	2/5/15	1.18	67.4	1.28	0.657	7.18	11.3	15.2	0.306	1.29
EXC-5	J1V472	2/5/15	1.04	61.8	1.22	0.582	5.85	10.5	12.7	0.307	0.971
EXC-6	J1V473	2/5/15	0.662	59.8	1.21	0.545	9.01	9.78	13.2	0.527	0.968
EXC-7	J1V474	2/5/15	2.36	75.6	0.833	0.387	9.11	7.37	10.4	1.48	2.88
EXC-8	J1V475	2/5/15	0.522	42.8	0.842	0.429	3.24	7.45	10.9	0.063	0.988
EXC-9	J1V476	2/5/15	2.35	56.6	0.987	0.447	6.38	9.43	13.7	0.062	1.94
EXC-10	J1V477	2/5/15	0.992	68.8	1.29	0.665	6.32	10.7	15.0	0.627	1.34
EXC-11	J1V478	2/5/15	2.03	66.2	0.886	0.468	10.0	7.45	11.5	0.065	2.72
EXC-12	J1V479	2/5/15	2.30	72.2	0.919	0.501	9.65	8.57	12.4	0.522	2.90

Statistical Computations

	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Hexavalent Chromium	Lead
95% UCL based on	Large data set (n≥ 10), use MTCAStat normal distribution.	Large data set (n≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n≥ 10), use MTCAStat lognormal distribution.	Large data set (n≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n≥ 10), use MTCAStat normal distribution.	Large data set (n≥ 10), use MTCAStat lognormal distribution.	Large data set (n≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n≥ 10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%	0%	42%	0%
mean	1.73	67.8	1.05	0.503	7.67	9.16	13.1	0.450	2.00
st. dev.	0.798	15.0	0.191	0.101	2.13	1.49	2.25	0.441	0.869
95% UCL on mean	2.14	74.9	1.14	0.563	8.69	9.94	14.4	0.659	2.74
max value	2.91	107	1.29	0.665	10.0	11.3	16.3	2.07	3.38
Most Stringent Cleanup Limit for nonradionuclide and CUL type (mg/kg)	20 DE, GW & SW Protection	16,000 DE Protection	160 DE Protection	80 DE Protection	120,000 DE Protection	24 DE Protection	3,200 DE Protection	2.0 GW & SW Protection	250 DE Protection
WAC 173-340 3-PART TEST									
95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NO	NA
> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NO	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NO	NA
WAC 173-340 Compliance?	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (19 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (16 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (22 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 300 Area Closure Operations
Subject 300-289 Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat)

Date 05/06/15
Job No. 14655

Calc. No. 0300X-CA-V0210
Checked I. B. Berezovskiy

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Date 05/06/15
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1 **300-289 Statistical Calculations - EXC**
2 **Verification Data - Statistical**

3	Sample	Sample	Sample	Manganese			Molybdenum			Nickel			Selenium			Strontium			Uranium			Vanadium			Zinc		
4	Area	Number	Date	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
5	EXC-3	J1V470	2/5/15	283		0.208	0.208	U	0.208	8.54		0.156	0.551	BD	0.340	14.2		0.104	0.434	D	0.0136	52.6	D	0.521	37.4	D	2.08
6	Duplicate of J1V470	J1V480	2/5/15	296		0.207	0.233	B	0.207	9.12		0.155	0.593	BD	0.355	16.2		0.103	0.369	D	0.0142	52.1	D	0.517	37.9	D	2.07
7	EXC-1	J1V468	2/5/15	358		0.215	0.324	B	0.215	12.0		0.161	0.686	BD	0.359	25.8		0.107	0.503	D	0.0144	72.9	D	0.537	47.1	D	2.15
8	EXC-2	J1V469	2/5/15	308		0.213	0.316	B	0.213	9.18		0.160	0.999	BD	0.336	21.3		0.106	0.430	D	0.0134	80.9	D	0.532	45.4	D	2.13
9	EXC-4	J1V471	2/5/15	316		0.207	0.320	B	0.207	11.0		0.156	0.993	BD	0.342	18.8		0.104	0.393	D	0.0137	92.7	D	0.519	51.2	D	2.07
10	EXC-5	J1V472	2/5/15	316		0.204	0.277	B	0.204	8.74		0.153	0.859	BD	0.337	20.7		0.102	0.344	D	0.0135	92.3	D	0.511	45.1	D	2.04
11	EXC-6	J1V473	2/5/15	291		0.203	0.311	B	0.203	11.3		0.153	0.961	BD	0.342	17.2		0.102	0.371	D	0.0137	87.0	D	0.509	44.9	D	2.03
12	EXC-7	J1V474	2/5/15	335		0.201	0.304	B	0.201	8.28		0.151	0.632	BD	0.337	19.3		0.101	0.512	D	0.0135	56.7	D	0.503	37.8	D	2.01
13	EXC-8	J1V475	2/5/15	187		0.204	0.204	U	0.204	5.62		0.153	1.07	D	0.348	15.2		0.102	0.405	D	0.0139	57.4	D	0.51	30.8	D	2.04
14	EXC-9	J1V476	2/5/15	289		0.210	0.310	B	0.210	8.55		0.157	1.34	D	0.340	24.0		0.105	0.423	D	0.0136	67.6	D	0.525	39.4	D	2.10
15	EXC-10	J1V477	2/5/15	308		0.200	0.347	B	0.200	9.58		0.150	1.05	D	0.318	23.2		0.0998	0.422	D	0.0127	93.3	D	0.499	48.0	D	2.00
16	EXC-11	J1V478	2/5/15	272		0.208	0.233	B	0.208	9.05		0.156	0.812	BD	0.346	17.9		0.104	0.410	D	0.0138	60.0	D	0.519	38.5	D	2.08
17	EXC-12	J1V479	2/5/15	310		0.204	0.207	B	0.204	8.64		0.153	0.820	BD	0.343	20.6		0.102	0.752	D	0.0137	67.6	D	0.509	41.6	D	2.04

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19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Manganese	Molybdenum	Nickel	Selenium	Strontium	Uranium	Vanadium	Zinc
21	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
22	EXC-3	J1V470/ J1V480	2/5/15	290	0.169	8.83	0.572	15.2	0.402	52.4	37.7
23	EXC-1	J1V468	2/5/15	358	0.324	12.0	0.686	25.8	0.503	72.9	47.1
24	EXC-2	J1V469	2/5/15	308	0.316	9.18	1.00	21.3	0.430	80.9	45.4
25	EXC-4	J1V471	2/5/15	316	0.320	11.0	0.993	18.8	0.393	92.7	51.2
26	EXC-5	J1V472	2/5/15	316	0.277	8.74	0.859	20.7	0.344	92.3	45.1
27	EXC-6	J1V473	2/5/15	291	0.311	11.3	0.961	17.2	0.371	87.0	44.9
28	EXC-7	J1V474	2/5/15	335	0.304	8.28	0.632	19.3	0.512	56.7	37.8
29	EXC-8	J1V475	2/5/15	187	0.102	5.62	1.07	15.2	0.405	57.4	30.8
30	EXC-9	J1V476	2/5/15	289	0.310	8.55	1.34	24.0	0.423	67.6	39.4
31	EXC-10	J1V477	2/5/15	308	0.347	9.58	1.05	23.2	0.422	93.3	48.0
32	EXC-11	J1V478	2/5/15	272	0.233	9.05	0.812	17.9	0.410	60.0	38.5
33	EXC-12	J1V479	2/5/15	310	0.207	8.64	0.820	20.6	0.752	67.6	41.6

34 **Statistical Computations**

35		Manganese	Molybdenum	Nickel	Selenium	Strontium	Uranium	Vanadium	Zinc
36	95% UCL based on	Large data set (n≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n≥ 10), use MTCAStat lognormal distribution.	Large data set (n≥ 10), use MTCAStat lognormal distribution.	Large data set (n≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n≥ 10), use MTCAStat lognormal distribution.	Large data set (n≥ 10), use MTCAStat lognormal distribution.
37	N	12	12	12	12	12	12	12	12
38	% < Detection limit	0%	8%	0%	0%	0%	0%	0%	0%
39	mean	298	0.268	9.23	0.900	19.9	0.447	73.4	42.3
40	st. dev.	41.7	0.075	1.66	0.215	3.34	0.107	15.4	5.69
41	95% UCL on mean	318	0.304	10.0	1.04	21.9	0.498	82.8	45.7
42	max value	358	0.347	12.0	1.34	25.8	0.752	93.3	51.2
43	**Most Stringent Cleanup Limit for nonradionuclide and CUL type (mg/kg)**	11,200 DE Protection		1,600 DE Protection	302 GW and SW Protection	48,000 DE Protection	81 DE Protection	400 DE Protection	24,000 DE Protection
44	**WAC 173-340 3-PART TEST**								
45	95% UCL > Cleanup Limit?	NA		NA	NO	NO	NA	NO	NA
46	> 10% above Cleanup Limit?	NA		NA	NO	NO	NA	NO	NA
47	Any sample > 2X Cleanup Limit?	NA		NA	NO	NO	NA	NO	NA
48	**WAC 173-340 Compliance?**	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Statistical calculation shown; however, no CUL's are available for this non-COC.	Because all values are below background (19 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent CUL.	The data set meets the 3-part test criteria when compared to the most stringent CUL.	Because all values are below background (3.21 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent CUL.	Because all values are below background (68 mg/kg) the WAC 173-340 3-part test is not required.

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CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 300 Area Closure Operations
Subject 300-289 Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat)

Date 04/28/15
Job No. 14655

Calc. No. 0300X-CA-V0210
Checked I. B. Berezovskiy

Rev. No. 0
Date 04/28/15
Sheet No. 7 of 9

Ecology Software (MTCAStat) Results, 300-289 Waste Site Statistical Samples - Excavation

Arsenic 95% UCL Calculation

DATA	ID
2.40	J1V470/ J1V480
2.91	J1V468
1.97	J1V469
1.18	J1V471
1.04	J1V472
0.662	J1V473
2.36	J1V474
0.522	J1V475
2.35	J1V476
0.992	J1V477
2.03	J1V478
2.30	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	1.73
Censored		Lognormal mean	1.78
Detection limit or PQL		Std. devn.	0.798
Method detection limit		Median	2.00
TOTAL	12	Min.	0.522
		Max.	2.91

Lognormal distribution? r-squared is: 0.885
Normal distribution? r-squared is: 0.919
Recommendations:
Use normal distribution.

UCL (t-statistic) is 2.14

Barium 95% UCL Calculation

DATA	ID
66.0	J1V470/ J1V480
107	J1V468
68.9	J1V469
67.4	J1V471
61.8	J1V472
59.8	J1V473
75.6	J1V474
42.8	J1V475
56.6	J1V476
68.8	J1V477
66.2	J1V478
72.2	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	67.8
Censored		Lognormal mean	67.9
Detection limit or PQL		Std. devn.	15.0
Method detection limit		Median	66.8
TOTAL	12	Min.	42.8
		Max.	107

Lognormal distribution? r-squared is: 0.865
Normal distribution? r-squared is: 0.811
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 74.9

Beryllium 95% UCL Calculation

DATA	ID
0.792	J1V470/ J1V480
1.19	J1V468
1.16	J1V469
1.28	J1V471
1.22	J1V472
1.21	J1V473
0.833	J1V474
0.842	J1V475
0.987	J1V476
1.29	J1V477
0.886	J1V478
0.919	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	1.05
Censored		Lognormal mean	1.05
Detection limit or PQL		Std. devn.	0.191
Method detection limit		Median	1.07
TOTAL	12	Min.	0.792
		Max.	1.29

Lognormal distribution? r-squared is: 0.898
Normal distribution? r-squared is: 0.898
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 1.14

Cadmium 95% UCL Calculation

DATA	ID
0.362	J1V470/ J1V480
0.569	J1V468
0.422	J1V469
0.657	J1V471
0.582	J1V472
0.545	J1V473
0.387	J1V474
0.429	J1V475
0.447	J1V476
0.665	J1V477
0.468	J1V478
0.501	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	0.503
Censored		Lognormal mean	0.504
Detection limit or PQL		Std. devn.	0.101
Method detection limit		Median	0.485
TOTAL	12	Min.	0.362
		Max.	0.665

Lognormal distribution? r-squared is: 0.975
Normal distribution? r-squared is: 0.962
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.563

Chromium 95% UCL Calculation

DATA	ID
9.21	J1V470/ J1V480
10.0	J1V468
6.12	J1V469
7.18	J1V471
5.85	J1V472
9.01	J1V473
9.11	J1V474
3.24	J1V475
6.38	J1V476
6.32	J1V477
10.0	J1V478
9.65	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	7.67
Censored		Lognormal mean	7.75
Detection limit or PQL		Std. devn.	2.13
Method detection limit		Median	8.10
TOTAL	12	Min.	3.24
		Max.	10.0

Lognormal distribution? r-squared is: 0.829
Normal distribution? r-squared is: 0.897
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 8.69

Cobalt 95% UCL Calculation

DATA	ID
7.22	J1V470/ J1V480
9.71	J1V468
10.5	J1V469
11.3	J1V471
10.5	J1V472
9.78	J1V473
7.37	J1V474
7.45	J1V475
9.43	J1V476
10.7	J1V477
7.45	J1V478
8.57	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	9.16
Censored		Lognormal mean	9.18
Detection limit or PQL		Std. devn.	1.49
Method detection limit		Median	9.57
TOTAL	12	Min.	7.22
		Max.	11.3

Lognormal distribution? r-squared is: 0.899
Normal distribution? r-squared is: 0.912
Recommendations:
Use normal distribution.

UCL (t-statistic) is 9.94

Copper 95% UCL Calculation

DATA	ID
9.56	J1V470/ J1V480
16.3	J1V468
16.1	J1V469
15.2	J1V471
12.7	J1V472
13.2	J1V473
10.4	J1V474
10.9	J1V475
13.7	J1V476
15.0	J1V477
11.5	J1V478
12.4	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	13.1
Censored		Lognormal mean	13.1
Detection limit or PQL		Std. devn.	2.25
Method detection limit		Median	13.0
TOTAL	12	Min.	9.56
		Max.	16.3

Lognormal distribution? r-squared is: 0.973
Normal distribution? r-squared is: 0.975
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 14.4

Hexavalent Chromium 95% UCL Calculation

DATA	ID
1.07	J1V470/ J1V480
0.308	J1V468
0.064	J1V469
0.306	J1V471
0.307	J1V472
0.527	J1V473
1.48	J1V474
0.063	J1V475
0.062	J1V476
0.627	J1V477
0.065	J1V478
0.522	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	0.450
Censored		Lognormal mean	0.522
Detection limit or PQL		Std. devn.	0.441
Method detection limit		Median	0.308
TOTAL	12	Min.	0.062
		Max.	1.48

Lognormal distribution? r-squared is: 0.894
Normal distribution? r-squared is: 0.833
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.659

Lead 95% UCL Calculation

DATA	ID
2.44	J1V470/ J1V480
3.38	J1V468
2.15	J1V469
1.29	J1V471
0.971	J1V472
0.968	J1V473
2.88	J1V474
0.988	J1V475
1.94	J1V476
1.34	J1V477
2.72	J1V478
2.90	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	2.00
Censored		Lognormal mean	2.03
Detection limit or PQL		Std. devn.	0.869
Method detection limit		Median	2.05
TOTAL	12	Min.	0.968
		Max.	3.38

Lognormal distribution? r-squared is: 0.909
Normal distribution? r-squared is: 0.927
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.74

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
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Subject 300-289 Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat)

Date 05/06/15
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Ecology Software (MTCAStat) Results, 300-289 Waste Site Statistical Samples - Excavation

Manganese 95% UCL Calculation

DATA	ID
290	J1V470/ J1V480
358	J1V468
308	J1V469
316	J1V471
316	J1V472
291	J1V473
335	J1V474
187	J1V475
289	J1V476
308	J1V477
272	J1V478
310	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	298
Censored		Lognormal mean	299
Detection limit or PQL		Std. devn.	41.7
Method detection limit		Median	308
TOTAL	12	Min.	187
		Max.	358

Lognormal distribution? r-squared is: 0.729
Normal distribution? r-squared is: 0.809
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 318

Molybdenum 95% UCL Calculation

DATA	ID
0.169	J1V470/ J1V480
0.324	J1V468
0.316	J1V469
0.320	J1V471
0.277	J1V472
0.311	J1V473
0.304	J1V474
0.102	J1V475
0.310	J1V476
0.347	J1V477
0.233	J1V478
0.207	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	0.268
Censored		Lognormal mean	0.272
Detection limit or PQL		Std. devn.	0.075
Method detection limit		Median	0.307
TOTAL	12	Min.	0.102
		Max.	0.347

Lognormal distribution? r-squared is: 0.762
Normal distribution? r-squared is: 0.842
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.304

Nickel 95% UCL Calculation

DATA	ID
8.83	J1V470/ J1V480
12.0	J1V468
9.18	J1V469
11.0	J1V471
8.74	J1V472
11.3	J1V473
8.28	J1V474
5.62	J1V475
8.55	J1V476
9.58	J1V477
9.05	J1V478
8.64	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	9.23
Censored		Lognormal mean	9.25
Detection limit or PQL		Std. devn.	1.66
Method detection limit		Median	8.94
TOTAL	12	Min.	5.62
		Max.	12.0

Lognormal distribution? r-squared is: 0.849
Normal distribution? r-squared is: 0.896
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 10.0

Selenium 95% UCL Calculation

DATA	ID
0.572	J1V470/ J1V480
0.686	J1V468
0.999	J1V469
0.993	J1V471
0.859	J1V472
0.961	J1V473
0.632	J1V474
1.07	J1V475
1.34	J1V476
1.05	J1V477
0.812	J1V478
0.820	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	0.900
Censored		Lognormal mean	0.902
Detection limit or PQL		Std. devn.	0.215
Method detection limit		Median	0.910
TOTAL	12	Min.	0.572
		Max.	1.34

Lognormal distribution? r-squared is: 0.967
Normal distribution? r-squared is: 0.962
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1.04

Strontium 95% UCL Calculation

DATA	ID
15.2	J1V470/ J1V480
25.8	J1V468
21.3	J1V469
18.8	J1V471
20.7	J1V472
17.2	J1V473
19.3	J1V474
15.2	J1V475
24.0	J1V476
23.2	J1V477
17.9	J1V478
20.6	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	19.9
Censored		Lognormal mean	20.0
Detection limit or PQL		Std. devn.	3.34
Method detection limit		Median	20.0
TOTAL	12	Min.	15.2
		Max.	25.8

Lognormal distribution? r-squared is: 0.978
Normal distribution? r-squared is: 0.979
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 21.9

Uranium 95% UCL Calculation

DATA	ID
0.402	J1V470/ J1V480
0.503	J1V468
0.430	J1V469
0.393	J1V471
0.344	J1V472
0.371	J1V473
0.512	J1V474
0.405	J1V475
0.423	J1V476
0.422	J1V477
0.410	J1V478
0.752	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	0.447
Censored		Lognormal mean	0.447
Detection limit or PQL		Std. devn.	0.107
Method detection limit		Median	0.416
TOTAL	12	Min.	0.344
		Max.	0.752

Lognormal distribution? r-squared is: 0.793
Normal distribution? r-squared is: 0.698
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.498

Vanadium 95% UCL Calculation

DATA	ID
52.4	J1V470/ J1V480
72.9	J1V468
80.9	J1V469
92.7	J1V471
92.3	J1V472
87.0	J1V473
56.7	J1V474
57.4	J1V475
67.6	J1V476
93.3	J1V477
60.0	J1V478
67.6	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	73.4
Censored		Lognormal mean	73.5
Detection limit or PQL		Std. devn.	15.4
Method detection limit		Median	70.3
TOTAL	12	Min.	52.4
		Max.	93.3

Lognormal distribution? r-squared is: 0.933
Normal distribution? r-squared is: 0.925
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 82.8

Zinc 95% UCL Calculation

DATA	ID
37.7	J1V470/ J1V480
47.1	J1V468
45.4	J1V469
51.2	J1V471
45.1	J1V472
44.9	J1V473
37.8	J1V474
30.8	J1V475
39.4	J1V476
48.0	J1V477
38.5	J1V478
41.6	J1V479

Number of samples		Uncensored values	
Uncensored	12	Mean	42.3
Censored		Lognormal mean	42.3
Detection limit or PQL		Std. devn.	5.69
Method detection limit		Median	43.3
TOTAL	12	Min.	30.8
		Max.	51.2

Lognormal distribution? r-squared is: 0.934
Normal distribution? r-squared is: 0.958
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 45.7

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie **Date** 04/28/15 **Calc. No.** 0300X-CA-V0210 **Rev. No.** 0
Project 300 Area Closure Operations **Job No.** 14655 **Checked** I. B. Berezovskiy **Date** 04/28/15
Subject 300-289 Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat) **Sheet No.** 9 of 9

Duplicate/Split Analysis - 300-289 Excavation

Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium			Cobalt			Copper		
			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-3	J1V470	2/5/15	5720		7.08	2.70	B	0.521	65.6		0.104	0.786		0.104	0.304	B	0.104	2800		8.33	9.60		0.156	7.11	D	0.781	9.42	M	0.312
Duplicate of J1V470	J1V480	2/5/15	5840		7.04	2.09	B	0.517	66.3		0.103	0.798		0.103	0.420	B	0.103	2710		8.28	8.81		0.155	7.32	D	0.776	9.69	M	0.310
Split of J1V470	J1V482	2/5/15	6260		1.5	2.2		0.62	66.9		0.071	0.80		0.031	0.097	B	0.039	2720		13.2	7.8		0.054	5.9		0.094	9.5		0.20

Analysis:

TDL		5	10	2	0.5	0.5	100	1	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	2.1%		1.1%			3.3%	8.6%		2.8%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable
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)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	9.0%		2.0%			2.9%	20.7%		0.8%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Duplicate/Split Analysis - 300-289 Excavation

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Iron			Lead			Lithium			Magnesium			Manganese			Nickel			Potassium			Selenium		
			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-3	J1V470	2/5/15	2.07		0.128	19500		8.33	2.37		0.344	7.55	D	0.413	3730		8.85	283		0.208	8.54		0.156	1350		6.66	0.551	BD	0.340
Duplicate of J1V470	J1V480	2/5/15	0.126	U	0.126	19300		8.28	2.51		0.341	8.08	D	0.430	3630		8.79	296		0.207	9.12		0.155	1330		6.62	0.593	BD	0.355
Split of J1V470	J1V482	2/5/15	0.248		0.155	16900		3.6	2.8		0.25	6.5		0.28	3490		3.5	290		0.094	11.2		0.12	1360		38.5	0.81	U	0.81

Analysis:

TDL		0.5	5	5	2.5	75	5	4	400	10
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?		Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD		1.0%			2.7%	4.5%			
	Difference > 2 TDL?	Yes - assess further	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable
Split Analysis	Both > PQL?		Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	
	RPD		14.3%			6.6%	2.4%			
	Difference > 2 TDL?	Yes - assess further	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Duplicate/Split Analysis - 300-289 Excavation

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Strontium			Uranium			Vanadium			Zinc			Zirconium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-3	J1V470	2/5/15	645	JN	1.56	162	C	7.29	14.2		0.104	0.434	D	0.0136	52.6	D	0.521	37.4	D	2.08	18.8	D	0.103
Duplicate of J1V470	J1V480	2/5/15	668	JN	1.55	165	C	7.24	16.2		0.103	0.369	D	0.0142	52.1	D	0.517	37.9	D	2.07	20.2	D	0.108
Split of J1V470	J1V482	2/5/15	213	N	5.3	150		55.4	15.9		0.034	0.37		0.0016	40.9		0.088	32.5		0.37	16.6		0.33

Analysis:

TDL		2	50	1	1	2.5	1	2.5
Duplicate Analysis	Both > PQL?	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)	Yes (calc RPD)	Yes (calc RPD)
	RPD	3.5%		13.2%		1.0%	1.3%	7.2%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable
Split Analysis	Both > PQL?	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)	Yes (calc RPD)	Yes (calc RPD)
	RPD	*100.7%*		11.3%		25.0%	14.0%	12.4%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable

Attachment 1. 300-289 Waste Site Verification Sample Results (Metals, TPH, and Physical).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-3	J1V470	2/5/15	5720		7.08	1.72	UD	1.72	2.70	B	0.521	65.6		0.104	0.786		0.104
Duplicate of J1V470	J1V480	2/5/15	5840		7.04	1.71	UD	1.71	2.09	B	0.517	66.3		0.103	0.798		0.103
EXC-1	J1V468	2/5/15	7630		7.30	1.77	UD	1.77	2.91	B	0.537	107		0.107	1.19		0.107
EXC-2	J1V469	2/5/15	5460		7.24	1.76	UD	1.76	1.97	B	0.532	68.9		0.106	1.16		0.106
EXC-4	J1V471	2/5/15	4670		7.05	1.71	UD	1.71	1.18	B	0.519	67.4		0.104	1.28		0.104
EXC-5	J1V472	2/5/15	3810		6.95	1.69	UD	1.69	1.04	B	0.511	61.8		0.102	1.22		0.102
EXC-6	J1V473	2/5/15	4300		6.92	1.68	UD	1.68	0.662	B	0.509	59.8		0.102	1.21		0.102
EXC-7	J1V474	2/5/15	5420		6.84	1.66	UD	1.66	2.36	B	0.503	75.6		0.101	0.833		0.101
EXC-8	J1V475	2/5/15	2860		6.93	1.68	UD	1.68	0.522	B	0.51	42.8		0.102	0.842		0.102
EXC-9	J1V476	2/5/15	4660		7.14	1.73	UD	1.73	2.35	B	0.525	56.6		0.105	0.987		0.105
EXC-10	J1V477	2/5/15	4670		6.78	1.65	UD	1.65	0.992	B	0.499	68.8		0.0998	1.29		0.0998
EXC-11	J1V478	2/5/15	5520		7.06	1.71	UD	1.71	2.03	B	0.519	66.2		0.104	0.886		0.104
EXC-12	J1V479	2/5/15	5960		6.92	1.68	UD	1.68	2.30	B	0.509	72.2		0.102	0.919		0.102
Split of J1V470	J1V482	2/5/15	6260		1.5	0.36	U	0.36	2.2		0.62	66.9		0.071	0.80		0.031
Equipment Blank	J1V481	2/5/15	251		6.68	0.324	U	0.324	0.794	B	0.491	2.52		0.0983	0.219	B	0.0983

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-3	J1V470	2/5/15	1.04	U	1.04	0.304	B	0.104	2800		8.33	9.60		0.156	7.11	D	0.781
Duplicate of J1V470	J1V480	2/5/15	1.03	U	1.03	0.420	B	0.103	2710		8.28	8.81		0.155	7.32	D	0.776
EXC-1	J1V468	2/5/15	1.07	U	1.07	0.569		0.107	5980		8.59	10.0		0.161	9.71	D	0.805
EXC-2	J1V469	2/5/15	1.06	U	1.06	0.422	B	0.106	5690		8.51	6.12		0.160	10.5	D	0.798
EXC-4	J1V471	2/5/15	1.04	U	1.04	0.657		0.104	4870		8.30	7.18		0.156	11.3	D	0.778
EXC-5	J1V472	2/5/15	1.02	U	1.02	0.582		0.102	4130		8.18	5.85		0.153	10.5	D	0.766
EXC-6	J1V473	2/5/15	1.02	U	1.02	0.545		0.102	4380		8.14	9.01		0.153	9.78	D	0.763
EXC-7	J1V474	2/5/15	1.01	U	1.01	0.387	B	0.101	4550		8.05	9.11		0.151	7.37	D	0.755
EXC-8	J1V475	2/5/15	1.02	U	1.02	0.429	B	0.102	3090		8.15	3.24		0.153	7.45	D	0.765
EXC-9	J1V476	2/5/15	1.05	U	1.05	0.447	B	0.105	3950		8.40	6.38		0.157	9.43	D	0.787
EXC-10	J1V477	2/5/15	0.998	U	0.998	0.665		0.0998	4980		7.98	6.32		0.150	10.7	D	0.748
EXC-11	J1V478	2/5/15	1.04	U	1.04	0.468	B	0.104	3550		8.31	10.0		0.156	7.45	D	0.779
EXC-12	J1V479	2/5/15	1.02	U	1.02	0.501	B	0.102	3180		8.14	9.65		0.153	8.57	D	0.764
Split of J1V470	J1V482	2/5/15	1.2	B	0.92	0.097	B	0.039	2720		13.2	7.8		0.054	5.9		0.094
Equipment Blank	J1V481	2/5/15	0.983	U	0.983	0.0983	U	0.0983	60.0		7.86	0.932		0.147	0.998		0.147

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

Gray cells indicate not applicable.

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

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

C = Target analyte was detected in the sample and the associated blank.

D = dilution

EXC = excavation

HEIS = Hanford Environmental Information System

J = estimate

M = sample duplicate precision not met

MDA = minimal detectable activity

MDL = method detection limit

N = recovery is outside the control limits

PCB = polychlorinated biphenyls

PQL = practical quantitation limit

Q = qualifier

SVOA = semivolatile organic analysis

U = undetected

Attachment	1	Sheet No.	1 of 7
Originator	J. D. Skoglie	Date	5/1/15
Checked	I. B. Berezovskiy	Date	5/1/15
Calc. No.	0300X-CA-V0210	Rev. No.	0
		Job No.	14655

Attachment 1. 300-289 Waste Site Verification Sample Results (Metals, TPH, and Physical).

Sample Location	HEIS Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Lithium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-3	J1V470	2/5/15	9.42	M	0.312	2.07		0.128	19500		8.33	2.37		0.344	7.55	D	0.413
Duplicate of J1V470	J1V480	2/5/15	9.69	M	0.310	0.126	U	0.126	19300		8.28	2.51		0.341	8.08	D	0.430
EXC-1	J1V468	2/5/15	16.3	M	0.322	0.308	B	0.127	26200		8.59	3.38		0.354	9.68	D	0.435
EXC-2	J1V469	2/5/15	16.1	M	0.319	0.128	U	0.128	26800		8.51	2.15		0.351	6.83	D	0.407
EXC-4	J1V471	2/5/15	15.2	M	0.311	0.306	B	0.126	27900		8.30	1.29		0.342	5.56	D	0.414
EXC-5	J1V472	2/5/15	12.7	M	0.307	0.307	B	0.126	27200		8.18	0.971	B	0.337	4.25	D	0.409
EXC-6	J1V473	2/5/15	13.2	M	0.305	0.527		0.125	26100		8.14	0.968	B	0.336	4.08	D	0.414
EXC-7	J1V474	2/5/15	10.4	M	0.302	1.48		0.121	20500		8.05	2.88		0.332	7.14	D	0.408
EXC-8	J1V475	2/5/15	10.9	M	0.306	0.126	U	0.126	17600		8.15	0.988	B	0.336	5.00	D	0.421
EXC-9	J1V476	2/5/15	13.7	M	0.315	0.124	U	0.124	21700		8.40	1.94		0.346	5.28	D	0.412
EXC-10	J1V477	2/5/15	15.0	M	0.299	0.627		0.123	27500		7.98	1.34		0.329	5.44	D	0.386
EXC-11	J1V478	2/5/15	11.5	M	0.311	0.129	U	0.129	20300		8.31	2.72		0.343	7.94	D	0.419
EXC-12	J1V479	2/5/15	12.4	M	0.305	0.522		0.124	23200		8.14	2.90		0.336	8.10	D	0.416
Split of J1V470	J1V482	2/5/15	9.5		0.20	0.248		0.155	16900		3.6	2.8		0.25	6.5		0.28
Equipment Blank	J1V481	2/5/15	2.05	M	0.295				2340		7.86	0.386	B	0.324	0.398	DU	0.398

Sample Location	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-3	J1V470	2/5/15	3730		8.85	283		0.208	0.0041	U	0.0041	0.208	U	0.208	8.54		0.156
Duplicate of J1V470	J1V480	2/5/15	3630		8.79	296		0.207	0.004	U	0.004	0.233	B	0.207	9.12		0.155
EXC-1	J1V468	2/5/15	5060		9.13	358		0.215	0.0058	B	0.00430	0.324	B	0.215	12.0		0.161
EXC-2	J1V469	2/5/15	4710		9.04	308		0.213	0.0043	U	0.0043	0.316	B	0.213	9.18		0.160
EXC-4	J1V471	2/5/15	4920		8.82	316		0.207	0.0039	U	0.0039	0.320	B	0.207	11.0		0.156
EXC-5	J1V472	2/5/15	4320		8.69	316		0.204	0.0042	U	0.0042	0.277	B	0.204	8.74		0.153
EXC-6	J1V473	2/5/15	4550		8.65	291		0.203	0.0041	U	0.0041	0.311	B	0.203	11.3		0.153
EXC-7	J1V474	2/5/15	3900		8.55	335		0.201	0.004	U	0.004	0.304	B	0.201	8.28		0.151
EXC-8	J1V475	2/5/15	2880		8.66	187		0.204	0.0039	U	0.0039	0.204	U	0.204	5.62		0.153
EXC-9	J1V476	2/5/15	3820		8.92	289		0.210	0.0039	U	0.0039	0.310	B	0.210	8.55		0.157
EXC-10	J1V477	2/5/15	4540		8.48	308		0.200	0.0042	U	0.0042	0.347	B	0.200	9.58		0.150
EXC-11	J1V478	2/5/15	3690		8.82	272		0.208	0.0107	B	0.0043	0.233	B	0.208	9.05		0.156
EXC-12	J1V479	2/5/15	4140		8.65	310		0.204	0.0039	U	0.0039	0.207	B	0.204	8.64		0.153
Split of J1V470	J1V482	2/5/15	3490		3.5	290		0.094	0.0053	U	0.0053	0.24	U	0.24	11.2		0.12
Equipment Blank	J1V481	2/5/15	74.9		8.35	10.8		0.197	0.004	U	0.004	0.197	U	0.197	1.26		0.147

Sample Location	HEIS Number	Sample Date	Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-3	J1V470	2/5/15	1350		6.66	0.551	BD	0.340	645	JN	1.56	0.170	B	0.104	162	C	7.29
Duplicate of J1V470	J1V480	2/5/15	1330		6.62	0.593	BD	0.355	668	JN	1.55	0.103	U	0.103	165	C	7.24
EXC-1	J1V468	2/5/15	1240		6.87	0.686	BD	0.359	862	JN	1.61	0.107	U	0.107	288		7.52
EXC-2	J1V469	2/5/15	710		6.81	0.999	BD	0.336	591	JN	1.60	0.228	B	0.106	303		7.45
EXC-4	J1V471	2/5/15	481		6.64	0.993	BD	0.342	503	JN	1.56	0.104	U	0.104	334		7.26
EXC-5	J1V472	2/5/15	413		6.54	0.859	BD	0.337	481	JN	1.53	0.102	U	0.102	322		7.15
EXC-6	J1V473	2/5/15	476		6.51	0.961	BD	0.342	467	JN	1.53	0.102	U	0.102	314		7.12
EXC-7	J1V474	2/5/15	1080		6.44	0.632	BD	0.337	620	JN	1.51	0.101	U	0.101	179	C	7.04
EXC-8	J1V475	2/5/15	369		6.52	1.07	D	0.348	370	JN	1.53	0.102	U	0.102	255		7.14
EXC-9	J1V476	2/5/15	652		6.72	1.34	D	0.340	460	JN	1.57	0.105	U	0.105	263		7.35
EXC-10	J1V477	2/5/15	539		6.38	1.05	D	0.318	473	JN	1.50	0.0998	U	0.0998	321		6.98
EXC-11	J1V478	2/5/15	1120		6.64	0.812	BD	0.346	641	JN	1.56	0.104	U	0.104	204	C	7.27
EXC-12	J1V479	2/5/15	1150		6.52	0.820	BD	0.343	677	JN	1.53	0.102	U	0.102	216	C	7.13
Split of J1V470	J1V482	2/5/15	1360		38.5	0.81	U	0.81	213	N	5.3	0.15	U	0.15	150		55.4
Equipment Blank	J1V481	2/5/15	83.5		6.29	0.328	DU	0.328	112	JN	1.47	0.0983	U	0.0983	15.5	UJBC	6.88

Attachment	1	Sheet No.	2 of 7
Originator	J. D. Skoglie	Date	5/1/15
Checked	I. B. Berezovskiy	Date	5/1/15
Calc. No.	0300X-CA-V0210	Rev. No.	0
		Job No.	14655

Attachment 1. 300-289 Waste Site Verification Sample Results (Metals, TPH, and Physical).

Sample Location	HEIS Number	Sample Date	Strontium			Tin			Uranium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-3	J1V470	2/5/15	14.2		0.104	1.56	UD	1.56	0.434	D	0.0136	52.6	D	0.521	37.4	D	2.08
Duplicate of J1V470	J1V480	2/5/15	16.2		0.103	1.55	UD	1.55	0.369	D	0.0142	52.1	D	0.517	37.9	D	2.07
EXC-1	J1V468	2/5/15	25.8		0.107	1.61	UD	1.61	0.503	D	0.0144	72.9	D	0.537	47.1	D	2.15
EXC-2	J1V469	2/5/15	21.3		0.106	1.60	UD	1.60	0.430	D	0.0134	80.9	D	0.532	45.4	D	2.13
EXC-4	J1V471	2/5/15	18.8		0.104	1.56	UD	1.56	0.393	D	0.0137	92.7	D	0.519	51.2	D	2.07
EXC-5	J1V472	2/5/15	20.7		0.102	1.53	UD	1.53	0.344	D	0.0135	92.3	D	0.511	45.1	D	2.04
EXC-6	J1V473	2/5/15	17.2		0.102	1.53	UD	1.53	0.371	D	0.0137	87.0	D	0.509	44.9	D	2.03
EXC-7	J1V474	2/5/15	19.3		0.101	1.51	UD	1.51	0.512	D	0.0135	56.7	D	0.503	37.8	D	2.01
EXC-8	J1V475	2/5/15	15.2		0.102	1.53	UD	1.53	0.405	D	0.0139	57.4	D	0.51	30.8	D	2.04
EXC-9	J1V476	2/5/15	24.0		0.105	1.57	UD	1.57	0.423	D	0.0136	67.6	D	0.525	39.4	D	2.10
EXC-10	J1V477	2/5/15	23.2		0.0998	1.50	UD	1.50	0.422	D	0.0127	93.3	D	0.499	48.0	D	2.00
EXC-11	J1V478	2/5/15	17.9		0.104	1.56	UD	1.56	0.410	D	0.0138	60.0	D	0.519	38.5	D	2.08
EXC-12	J1V479	2/5/15	20.6		0.102	1.53	UD	1.53	0.752	D	0.0137	67.6	D	0.509	41.6	D	2.04
Split of J1V470	J1V482	2/5/15	15.9		0.034	1.3	B	0.86	0.37		0.0016	40.9		0.088	32.5		0.37
Equipment Blank	J1V481	2/5/15	0.903		0.0983	0.295	U	0.295	0.0808	D	0.0131	2.21		0.0983	1.92		0.393

Sample Location	HEIS Number	Sample Date	Zirconium			TPH - Diesel Range EXT			TPH- Diesel Range			TPH - Gasoline Range			TPH - motor oil (high boiling)		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC-3	J1V470	2/5/15	18.8	D	0.103				2320	U	2320	1780	UD	1780	2320	U	2320
Duplicate of J1V470	J1V480	2/5/15	20.2	D	0.108				2330	U	2330	1790	UD	1790	2330	U	2330
EXC-1	J1V468	2/5/15	34.9	D	0.109				2360	U	2360	1820	UD	1820	2360	U	2360
EXC-2	J1V469	2/5/15	27.8	D	0.102				2320	U	2320	1780	UD	1780	2320	U	2320
EXC-4	J1V471	2/5/15	33.1	D	0.104				2280	U	2280	1760	UD	1760	2280	U	2280
EXC-5	J1V472	2/5/15	25.2	D	0.102				2290	U	2290	1770	UD	1770	2290	U	2290
EXC-6	J1V473	2/5/15	28.6	D	0.104				2300	U	2300	1770	UD	1770	2300	U	2300
EXC-7	J1V474	2/5/15	16.2	D	0.102				2280	U	2280	1760	UD	1760	2280	U	2280
EXC-8	J1V475	2/5/15	29.6	D	0.105				2300	U	2300	1770	UD	1770	2300	U	2300
EXC-9	J1V476	2/5/15	28.0	D	0.103				2320	U	2320	1790	UD	1790	2320	U	2320
EXC-10	J1V477	2/5/15	31.0	D	0.0965				2280	U	2280	1760	UD	1760	2280	U	2280
EXC-11	J1V478	2/5/15	21.8	D	0.105				2330	U	2330	1800	UD	1800	2330	U	2330
EXC-12	J1V479	2/5/15	20.6	D	0.104				2330	U	2330	1800	UD	1800	2330	U	2330
Split of J1V470	J1V482	2/5/15	16.6		0.33	1000	U	1000	830	J	690	340	UN	340			
Equipment Blank	J1V481	2/5/15	0.498	BD	0.0995												

Sample Location	HEIS Number	Sample Date	Percent moisture (wet sample)		
			%	Q	PQL
EXC-3	J1V470	2/5/15			
Duplicate of J1V470	J1V480	2/5/15			
EXC-1	J1V468	2/5/15			
EXC-2	J1V469	2/5/15			
EXC-4	J1V471	2/5/15			
EXC-5	J1V472	2/5/15			
EXC-6	J1V473	2/5/15			
EXC-7	J1V474	2/5/15			
EXC-8	J1V475	2/5/15			
EXC-9	J1V476	2/5/15			
EXC-10	J1V477	2/5/15			
EXC-11	J1V478	2/5/15			
EXC-12	J1V479	2/5/15			
Split of J1V470	J1V482	2/5/15	6.6		0.10
Equipment Blank	J1V481	2/5/15			

Attachment	1	Sheet No.	3 of 7
Originator	J. D. Skoglie	Date	5/1/15
Checked	I. B. Berezovskiy	Date	5/1/15
Calc. No.	0300X-CA-V0210	Rev. No.	0
		Job No.	14655

Attachment 1. 300-289 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-3 - J1V470			Duplicate of J1V470 - J1V480			EXC-1 - J1V468			EXC-2 - J1V469			EXC-4 - J1V471		
		2/5/15			2/5/15			2/5/15			2/5/15			2/5/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	1.19	U	1.19	1.19	U	1.19	1.21	U	1.21	1.19	U	1.19	1.17	U	1.17
Aroclor-1221	PCB	1.19	U	1.19	1.19	U	1.19	1.21	U	1.21	1.19	U	1.19	1.17	U	1.17
Aroclor-1232	PCB	1.19	U	1.19	1.19	U	1.19	1.21	U	1.21	1.19	U	1.19	1.17	U	1.17
Aroclor-1242	PCB	1.19	U	1.19	1.19	U	1.19	1.21	U	1.21	1.19	U	1.19	1.17	U	1.17
Aroclor-1248	PCB	1.19	U	1.19	1.19	U	1.19	1.21	U	1.21	1.19	U	1.19	1.17	U	1.17
Aroclor-1254	PCB	1.19	U	1.19	1.19	U	1.19	1.21	U	1.21	1.19	U	1.19	1.17	U	1.17
Aroclor-1260	PCB	1.19	U	1.19	1.19	U	1.19	6.37		1.21	1.19	U	1.19	1.17	U	1.17
Aroclor-1262	PCB	1.19	U	1.19	1.19	U	1.19	1.21	U	1.21	1.19	U	1.19	1.17	U	1.17
Aroclor-1268	PCB	1.19	U	1.19	1.19	U	1.19	1.21	U	1.21	1.19	U	1.19	1.17	U	1.17

CONSTITUENT	CLASS	EXC-5 - J1V472			EXC-6 - J1V473			EXC-7 - J1V474			EXC-8 - J1V475			EXC-9 - J1V476		
		2/5/15			2/5/15			2/5/15			2/5/15			2/5/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	1.17	U	1.17	1.18	U	1.18	1.17	U	1.17	1.18	U	1.18	1.19	U	1.19
Aroclor-1221	PCB	1.17	U	1.17	1.18	U	1.18	1.17	U	1.17	1.18	U	1.18	1.19	U	1.19
Aroclor-1232	PCB	1.17	U	1.17	1.18	U	1.18	1.17	U	1.17	1.18	U	1.18	1.19	U	1.19
Aroclor-1242	PCB	1.17	U	1.17	1.18	U	1.18	1.17	U	1.17	1.18	U	1.18	1.19	U	1.19
Aroclor-1248	PCB	1.17	U	1.17	1.18	U	1.18	1.17	U	1.17	1.18	U	1.18	1.19	U	1.19
Aroclor-1254	PCB	1.17	U	1.17	1.18	U	1.18	1.17	U	1.17	1.18	U	1.18	1.19	U	1.19
Aroclor-1260	PCB	1.17	U	1.17	1.18	U	1.18	1.17	U	1.17	1.18	U	1.18	1.19	U	1.19
Aroclor-1262	PCB	1.17	U	1.17	1.18	U	1.18	1.17	U	1.17	1.18	U	1.18	1.19	U	1.19
Aroclor-1268	PCB	1.17	U	1.17	1.18	U	1.18	1.17	U	1.17	1.18	U	1.18	1.19	U	1.19

CONSTITUENT	CLASS	EXC-10 - J1V477			EXC-11 - J1V478			EXC-12 - J1V479			Split of J1V470 - J1V482		
		2/5/15			2/5/15			2/5/15			2/5/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	1.17	U	1.17	1.19	U	1.19	1.19	U	1.19	2.8	U	2.8
Aroclor-1221	PCB	1.17	U	1.17	1.19	U	1.19	1.19	U	1.19	8.1	U	8.1
Aroclor-1232	PCB	1.17	U	1.17	1.19	U	1.19	1.19	U	1.19	2.0	U	2.0
Aroclor-1242	PCB	1.17	U	1.17	1.19	U	1.19	1.19	U	1.19	4.7	U	4.7
Aroclor-1248	PCB	1.17	U	1.17	1.19	U	1.19	1.19	U	1.19	4.7	U	4.7
Aroclor-1254	PCB	1.17	U	1.17	1.19	U	1.19	1.19	U	1.19	2.6	U	2.6
Aroclor-1260	PCB	1.17	U	1.17	106		1.19	4.04		1.19	2.6	U	2.6
Aroclor-1262	PCB	1.17	U	1.17	1.19	U	1.19	1.19	U	1.19			
Aroclor-1268	PCB	1.17	U	1.17	1.19	U	1.19	1.19	U	1.19			

Attachment	1	Sheet No.	4 of 7
Originator	J. D. Skoglie	Date	4/28/15
Checked	I. B. Berezovskiy	Date	4/28/15
Calc. No.	0300X-CA-V0210	Rev. No.	0
		Job No.	14655

Attachment 1. 300-289 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-3 - J1V470			Duplicate of J1V470 - J1V480			EXC-1 - J1V468			EXC-2 - J1V469			EXC-4 - J1V471		
		2/5/15			2/5/15			2/5/15			2/5/15			2/5/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
1,2-Dichlorobenzene	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
1,3-Dichlorobenzene	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
1,4-Dichlorobenzene	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
2,4,5-Trichlorophenol	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
2,4,6-Trichlorophenol	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
2,4-Dichlorophenol	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
2,4-Dimethylphenol	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
2,4-Dinitrophenol	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
2,4-Dinitrotoluene	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
2,6-Dinitrotoluene	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
2-Chloronaphthalene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
2-Chlorophenol	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
2-Methylnaphthalene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
2-Methylphenol (cresol, o-)	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
2-Nitroaniline	SVOA	118	U	118	118	U	118	120	U	120	118	U	118	116	U	116
2-Nitrophenol	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
3,3'-Dichlorobenzidine	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
3+4 Methylphenol (cresol, m+p)	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
3-Nitroaniline	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
4,6-Dinitro-2-methylpheno	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
4-Bromophenylphenyl ether	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
4-Chloro-3-methylpheno	SVOA	143	UJ	143	143	UJ	143	145	UJ	145	143	UJ	143	141	UJ	141
4-Chloroaniline	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
4-Chlorophenylphenyl ether	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
4-Nitroaniline	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
4-Nitrophenol	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Acenaphthene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Acenaphthylene	SVOA	10.7	U	10.7	10.8	U	10.8	10.9	U	10.9	10.7	U	10.7	10.5	U	10.5
Anthracene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Benzo(a)anthracene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Benzo(a)pyrene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Benzo(b)fluoranthene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Benzo(ghi)perylene	SVOA	10.7	U	10.7	10.8	U	10.8	10.9	U	10.9	10.7	U	10.7	10.5	U	10.5
Benzo(k)fluoranthene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Bis(2-chloro-1-methylethyl)ether	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
Bis(2-Chloroethoxy)methane	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
Bis(2-chloroethyl) ether	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
Bis(2-ethylhexyl) phthalate	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
Butylbenzylphthalate	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
Carbazole	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Chrysene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Dibenz[a,h]anthracene	SVOA	10.7	U	10.7	10.8	U	10.8	10.9	U	10.9	10.7	U	10.7	10.5	U	10.5
Dibenzofuran	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Diethyl phthalate	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Dimethyl phthalate	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Di-n-butylphthalate	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Di-n-octylphthalate	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Diphenylamine	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
Fluoranthene	SVOA	10.7	U	10.7	10.8	U	10.8	10.9	U	10.9	10.7	U	10.7	10.5	U	10.5
Fluorene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Hexachlorobenzene	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Hexachlorobutadiene	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Hexachlorocyclopentadiene	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Hexachloroethane	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
Indeno(1,2,3-cd)pyrene	SVOA	10.7	U	10.7	10.8	U	10.8	10.9	U	10.9	10.7	U	10.7	10.5	U	10.5
Isophorone	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
Naphthalene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Nitrobenzene	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
N-Nitroso-di-n-dipropylamine	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
N-Nitrosodiphenylamine	SVOA															
Pentachlorophenol	SVOA	107	U	107	108	U	108	109	U	109	107	U	107	105	U	105
Phenanthrene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Phenol	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105
Pyrene	SVOA	10.7	UJ	10.7	10.8	UJ	10.8	10.9	UJ	10.9	10.7	UJ	10.7	10.5	UJ	10.5
Tributyl phosphate	SVOA	107	UJ	107	108	UJ	108	109	UJ	109	107	UJ	107	105	UJ	105

Attachment	1	Sheet No.	5 of 7
Originator	J. D. Skoglie	Date	4/28/15
Checked	I. B. Berezovskiy	Date	4/28/15
Calc. No.	0300X-CA-V0210	Rev. No.	0
		Job No.	14655

Attachment 1. 300-289 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-5 - J1V472			EXC-6 - J1V473			EXC-7 - J1V474			EXC-8 - J1V475			EXC-9 - J1V476		
		2/5/15			2/5/15			2/5/15			2/5/15			2/5/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
1,2-Dichlorobenzene	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
1,3-Dichlorobenzene	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
1,4-Dichlorobenzene	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
2,4,5-Trichlorophenol	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
2,4,6-Trichlorophenol	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
2,4-Dichlorophenol	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
2,4-Dimethylphenol	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
2,4-Dinitrophenol	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
2,4-Dinitrotoluene	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
2,6-Dinitrotoluene	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
2-Chloronaphthalene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
2-Chlorophenol	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
2-Methylnaphthalene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
2-Methylphenol (cresol, o-)	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
2-Nitroaniline	SVOA	116	U	116	117	U	117	116	U	116	117	U	117	118	U	118
2-Nitrophenol	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
3,3'-Dichlorobenzidine	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
3+4 Methylphenol (cresol, m+p)	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
3-Nitroaniline	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
4,6-Dinitro-2-methylpheno	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
4-Bromophenylphenyl ethe	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
4-Chloro-3-methylpheno	SVOA	141	UJ	141	141	UJ	141	140	UJ	140	141	UJ	141	143	UJ	143
4-Chloroaniline	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
4-Chlorophenylphenyl ethe	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
4-Nitroaniline	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
4-Nitrophenol	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Acenaphthene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Acenaphthylene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.6	U	10.6	10.7	U	10.7
Anthracene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Benzo(a)anthracene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Benzo(a)pyrene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Benzo(b)fluoranthene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Benzo(ghi)perylene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.6	U	10.6	10.7	U	10.7
Benzo(k)fluoranthene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Bis(2-chloro-1-methylethyl)ethe	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
Bis(2-Chloroethoxy)methan	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
Bis(2-chloroethyl) ethe	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
Bis(2-ethylhexyl) phthalat	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
Butylbenzylphthalat	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
Carbazole	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Chrysene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Dibenz[a,h]anthracene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.6	U	10.6	10.7	U	10.7
Dibenzofuran	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Diethyl phthalate	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Dimethyl phthalate	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Di-n-butylphthalate	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Di-n-octylphthalate	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Diphenylamine	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
Fluoranthene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.6	U	10.6	10.7	U	10.7
Fluorene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Hexachlorobenzene	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Hexachlorobutadiene	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Hexachlorocyclopentadiene	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Hexachloroethane	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
Indeno(1,2,3-cd)pyrene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.6	U	10.6	10.7	U	10.7
Isophorone	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
Naphthalene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Nitrobenzene	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
N-Nitroso-di-n-dipropylamine	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
N-Nitrosodiphenylamine	SVOA															
Pentachlorophenol	SVOA	106	U	106	106	U	106	105	U	105	106	U	106	107	U	107
Phenanthrene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Phenol	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107
Pyrene	SVOA	10.6	UJ	10.6	10.6	UJ	10.6	10.5	UJ	10.5	10.6	UJ	10.6	10.7	UJ	10.7
Tributyl phosphate	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	106	UJ	106	107	UJ	107

Attachment	1	Sheet No.	6 of 7
Originator	J. D. Skoglie	Date	4/28/15
Checked	I. B. Berezovskiy	Date	4/28/15
Calc. No.	0300X-CA-V0210	Rev. No.	0
		Job No.	14655

Attachment 1. 300-289 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-10 - J1V477			EXC-11 - J1V478			EXC-12 - J1V479			Split of J1V470 - J1V482		
		2/5/15			2/5/15			2/5/15			2/5/15		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	30	U	30
1,2-Dichlorobenzene	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	23	U	23
1,3-Dichlorobenzene	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	13	U	13
1,4-Dichlorobenzene	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	15	U	15
2,4,5-Trichlorophenol	SVOA	105	U	105	108	U	108	108	U	108	11	U	11
2,4,6-Trichlorophenol	SVOA	105	U	105	108	U	108	108	U	108	11	U	11
2,4-Dichlorophenol	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	11	U	11
2,4-Dimethylphenol	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	70	U	70
2,4-Dinitrophenol	SVOA	105	U	105	108	U	108	108	U	108	360	U	360
2,4-Dinitrotoluene	SVOA	105	U	105	108	U	108	108	U	108	70	U	70
2,6-Dinitrotoluene	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	30	U	30
2-Chloronaphthalene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	11	U	11
2-Chlorophenol	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	22	U	22
2-Methylnaphthalene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	20	U	20
2-Methylphenol (cresol, o-)	SVOA	105	U	105	108	U	108	108	U	108	14	U	14
2-Nitroaniline	SVOA	116	U	116	118	U	118	118	U	118	53	U	53
2-Nitrophenol	SVOA	105	U	105	108	U	108	108	U	108	11	U	11
3,3'-Dichlorobenzidine	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	96	U	96
3+4 Methylphenol (cresol, m+p)	SVOA	105	U	105	108	U	108	108	U	108	35	U	35
3-Nitroaniline	SVOA	105	U	105	108	U	108	108	U	108	78	U	78
4,6-Dinitro-2-methylpheno	SVOA	105	U	105	108	U	108	108	U	108	350	U	350
4-Bromophenylphenyl ethe	SVOA	105	U	105	108	U	108	108	U	108	20	U	20
4-Chloro-3-methylpheno	SVOA	140	UJ	140	144	UJ	144	143	UJ	143	70	U	70
4-Chloroaniline	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	87	U	87
4-Chlorophenylphenyl ethe	SVOA	105	U	105	108	U	108	108	U	108	22	U	22
4-Nitroaniline	SVOA	105	U	105	108	U	108	108	U	108	77	U	77
4-Nitrophenol	SVOA	105	U	105	108	U	108	108	U	108	100	U	100
Acenaphthene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	11	U	11
Acenaphthylene	SVOA	10.5	U	10.5	10.8	U	10.8	10.8	U	10.8	18	U	18
Anthracene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	18	U	18
Benzo(a)anthracene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	21	U	21
Benzo(a)pyrene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	21	U	21
Benzo(b)fluoranthene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	28	U	28
Benzo(ghi)perylene	SVOA	10.5	U	10.5	10.8	U	10.8	10.8	U	10.8	17	U	17
Benzo(k)fluoranthene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	43	U	43
Bis(2-chloro-1-methylethyl)ethe	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	25	U	25
Bis(2-Chloroethoxy)methane	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	25	U	25
Bis(2-chloroethyl) ethe	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	18	U	18
Bis(2-ethylhexyl) phthalate	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	49	U	49
Butylbenzylphthalate	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	46	U	46
Carbazole	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	38	U	38
Chrysene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	29	U	29
Dibenz[a,h]anthracene	SVOA	10.5	U	10.5	10.8	U	10.8	10.8	U	10.8	20	U	20
Dibenzofuran	SVOA	105	U	105	108	U	108	108	U	108	21	U	21
Diethyl phthalate	SVOA	105	U	105	108	U	108	108	U	108	28	U	28
Dimethyl phthalate	SVOA	105	U	105	108	U	108	108	U	108	25	U	25
Di-n-butylphthalate	SVOA	105	U	105	108	U	108	108	U	108	31	U	31
Di-n-octylphthalate	SVOA	105	U	105	108	U	108	108	U	108	15	U	15
Diphenylamine	SVOA	105	UJ	105	108	UJ	108	108	UJ	108			
Fluoranthene	SVOA	10.5	U	10.5	10.8	U	10.8	10.8	U	10.8	38	U	38
Fluorene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	19	U	19
Hexachlorobenzene	SVOA	105	U	105	108	U	108	108	U	108	31	U	31
Hexachlorobutadiene	SVOA	105	U	105	108	U	108	108	U	108	11	U	11
Hexachlorocyclopentadiene	SVOA	105	U	105	108	U	108	108	U	108	53	U	53
Hexachloroethane	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	23	U	23
Indeno(1,2,3-cd)pyrene	SVOA	10.5	U	10.5	10.8	U	10.8	10.8	U	10.8	23	U	23
Isophorone	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	18	U	18
Naphthalene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	33	U	33
Nitrobenzene	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	23	U	23
N-Nitroso-di-n-dipropylamine	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	33	U	33
N-Nitrosodiphenylamine	SVOA										22	U	22
Pentachlorophenol	SVOA	105	U	105	108	U	108	108	U	108	350	U	350
Phenanthrene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	18	U	18
Phenol	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	19	U	19
Pyrene	SVOA	10.5	UJ	10.5	10.8	UJ	10.8	10.8	UJ	10.8	13	U	13
Tributyl phosphate	SVOA	105	UJ	105	108	UJ	108	108	UJ	108	62	U	62

Attachment	1	Sheet No.	7 of 7
Originator	J. D. Skoglie	Date	4/28/15
Checked	I. B. Berezovskiy	Date	4/28/15
Calc. No.	0300X-CA-V0210	Rev. No.	0
		Job No.	14655

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 300

Discipline: Environmental *Calculation No: 0300X-CA-V0211

Subject: 300-289 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations (MTCAStat)

Computer Program: Excel Program No: Excel 2010

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 3 Total = 4	J. D. Shogren	I. B. Berezovskiy	R. J. Nielson	S. G. Wilkinson	5/14/15

SUMMARY OF REVISION

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	05/04/15	Calc. No.:	0300X-CA-V0211	Rev.:	0
Project:	300 Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	05/04/15
Subject:	300-289 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations (MTCAStat)					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 300-289 waste site. In accordance with the cleanup levels (CULs) in the 300 Area Final Action Record of Decision (ROD) (EPA 2013) and the Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units (DOE-RL 2014b), the following criteria must be met from the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009):

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

GIVEN/REFERENCES:

1) DOE-RL, 2009, *Remedial Design Report/Remedial Action Work Plan for the 300 Area,* DOE/RL-2001-47, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2014a, *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, 2014b, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units,* DOE/RL-2010-99, Rev. 0, U.S.Department of Energy, Richland Operations Office, Richland, Washington.

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

5) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

6) WCH, 2015, 300-289 *Waste Site Cleanup Verification 95% UCL Calculations (MTCAStat), 0300X-CA-V0210, Rev. 0*, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate an HQ for each noncarcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the individual HQ of <1.0 (DOE-RL 2009).

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	05/05/15	Calc. No.:	0300X-CA-V0211	Rev.:	0
Project:	300 Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	05/05/15
Subject:	300-289 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations (MTCAStat)					Sheet No.	2 of 3

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the excess cancer risk of $<1 \times 10^{-6}$ (DOE-RL 2009).

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

METHODOLOGY:

The 300-289 waste site is comprised of one decision unit for verification sampling: the excavation. The direct contact hazard quotient and carcinogenic risk calculations for the 300-289 waste site was conservatively calculated for the entire waste site using the greater of the statistical or maximum value for each analyte from the excavation decision unit from WCH (2015). Of the contaminants of concern (COCs) for these sites, hexavalent chromium, strontium, and aroclor-1260 require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Selenium requires an HQ and risk calculations because this analyte was detected above a Washington State or Hanford Site background value. All other site nonradionuclide COCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the statistical value for selenium is 1.04 mg/kg, divided by the noncarcinogenic CUL value of 400 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 2.6×10^{-3}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 5.8×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the statistical value is divided by the carcinogenic CUL value, and then multiplied by 1.0×10^{-6}. For example, the statistical value for hexavalent chromium is 0.659 mg/kg, divided by 2.1 mg/kg, and multiplied as indicated, is 3.1×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 5.3×10^{-7}. Comparing these values to the requirement of $<1 \times 10^{-5}$, this criterion is met.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	05/05/15	Calc. No.:	0300X-CA-V0211	Rev.:	0
Project:	300 Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	05/05/15
Subject:	300-289 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations (MTCAStat)					Sheet No.	3 of 3

RESULTS:

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

Table 1 shows the results of the calculations.

Table 1. Residential Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 300-289 Waste Site.

Contaminants of Potential Concern	Statistical Value[a] (mg/kg)	Residential Noncarcinogen CUL[b] (mg/kg)	Hazard Quotient	Residential Carcinogen CUL[b] (mg/kg)	Carcinogen Risk
Metals					
Chromium, hexavalent[c]	0.659	240	2.7E-03	2.1	3.1E-07
Selenium	1.04	400	2.6E-03	--	--
Strontium	21.9	48,000	4.6E-04	--	--
Polychlorinated Biphenyls					
Aroclor-1260	0.106	--	--	0.5	2.1E-07
Totals					
Cumulative Hazard Quotient:			**5.8E-03**		
Cumulative Excess Cancer Risk:					**5.3E-07**

Notes:
[a] = From (WCH 2015).
[b] = Values obtained from (EPA 2013) and (DOE-RL 2014b).
[c] = Value for the carcinogen RAG calculated based on the inhalation exposure pathway (WAC) 173-340-750(3), 1996.
-- = not applicable
CUL = cleanup level

CONCLUSION:

The calculations in Table 1 demonstrate that the 300-289 waste site meet the requirements for the residential direct contact hazard quotients and carcinogenic (excess cancer) risk, respectively, as identified in the RDR/RAWP (DOE-RL 2009) and SAP (DOE-RL 2014a). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the CVP for this site.

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 site-specific data quality objectives found in the *300 Area Remedial Action Sampling and Analysis Plan* (300 Area SAP) (DOE-RL 2011).

A review of the sample design (WCH 2015b), the field logbook (WCH 2015a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the 300 Area SAP (DOE-RL 2011) data assurance requirements and the data validation procedures for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 300-289 waste site were provided by the laboratories in two sample delivery groups (SDGs) XP0202 and JP0905. SDG XP0202 was submitted for third-party validation. No major deficiencies were noted in the data results. Minor deficiencies are discussed, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

MINOR DEFICIENCIES

SDG XP0202

This SDG comprises 13 statistical soil samples (J1V468, J1V469, J1V470 through J1V479, and J1V480) collected from the excavation area. This SDG includes one field duplicate pair (J1V470/J1V480). All samples were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, polychlorinated biphenyls (PCBs), semivolatile organic compounds (SVOCs), total petroleum hydrocarbons in the ranges of diesel motor oil and gasoline. In addition, one field equipment blank sample (J1V481) was collected and analyzed for ICP metals and mercury. SDG XP0202 was submitted for third-party validation. Minor deficiencies are as follows.

In the SVOC analysis, laboratory control sample recoveries for 41 analytes, within the range of 36.8% to 49.5%, are outside the quality control (QC) range.

Third-party validation qualified the associated data in SDG XP0202 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, matrix spike recoveries for 11 analytes within the range of 44% to 49.8% are outside the QC range. Third-party validation qualified the associated data in SDG XP0202 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC metals analysis, matrix spike duplicate recoveries for five analytes within the range of 47.7% to 49.7% are outside the QC range. Third-party validation qualified the associated data in SDG XP0202 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the analyte sodium was detected in the method blank at low concentrations. Sample J1V481, the equipment blank, had a similar low concentration detection of sodium. Third-party validation qualified the J1V481 sodium result as undetected and estimated with "UJ" flagging. Undetected and estimated data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike recovery for silicon (58.6%) is outside the QC limits. Third-party validation qualified all silicon results in SDG XP0202 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

Relative percent difference (RPD) calculations of the main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in the RPD 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 2015a) 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 area	J1V470	J1V480	J1V482

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of

potential concern. 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.

In the duplicate evaluation, none of the RPDs calculated are above the duplicate acceptance criteria of 30%. In the split evaluation, the RPD calculated for silicon (100.7%) is above the field split acceptance criteria (less than 35%). Elevated RPDs in environmental samples are generally attributed to natural heterogeneity in the sample matrix. The data are usable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the 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 analysis, aluminum, hexavalent chromium, iron, magnesium, silicon, and vanadium were flagged for this evaluation, and in the split analysis, aluminum, hexavalent chromium, iron, magnesium, silicon, and vanadium 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 300-289 waste site verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 300-289 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes.

The verification sample analytical data are stored in 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.

REFERENCES

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

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

EPA, 2006, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2015a, *D4 Waste Site Miscellaneous Sampling*, Logbook EL-1663-07, pp. 51-53, Washington Closure Hanford, Richland, Washington.

WCH, 2015b, *Work Instruction for Verification Sampling of the 300-289, Stained Soil Area North of the 300 Area,* 0300X-WI-G0052, Rev. 0, Washington Closure Hanford, Richland, Washington.

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