WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2014-116

Waste Site Code(s)/Subsite Code(s): 100-D-97

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 100-D-97, 184-DA 500-Gallon Fuel Tank waste site was the former site of the 184-DA underground storage tank (UST), K1-7-1. In addition to the UST and associated underlying soils, the waste site included a fuel oil supply pipeline and a fuel oil return pipeline. It was reported in the Waste Information Data System that the UST and the associated piping were removed in 1985/1986 as part of the 100-DR general demolition efforts; however, sections of piping were discovered during confirmatory sampling activities. The UST was not found during confirmatory sampling. Due to the presence of the fuel oil supply and fuel oil return piping in the confirmatory test trenches, the waste site was designated for remediation. The 100-D-97 waste site was added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999), as a candidate site for confirmatory sampling by the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2009).

Remediation of the 100-D-97 waste site was performed on February 25, 2014. Verification sampling was conducted on August 6, 2014. Remediation, verification sampling, and comparison of residual contaminant concentrations against cleanup levels have been performed in accordance with remedial action objectives and goals established by the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP), DOE/RL-97-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2009b), and the Remaining Sites ROD (EPA 1999). The selected remedy involved (1) excavating the waste site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the waste site for reclassification as Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the remedial action goals. In accordance with this evaluation, the verification sampling results support a reclassification of the 100-D-97 waste site to Interim Closed Out. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The evaluation, which may include fate-and-transport modeling, of all verification sample data collected from the 100-D-97 waste site resulted in a determination that residual contaminant concentrations do not preclude any future uses, as bounded by the rural-residential scenario, and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-D-97, 184-DA 500-Gallon Fuel Tank waste site* (attached). Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2014-116

Waste Site Code(s)/Subsite Code(s): 100-D-97

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:

J. P. Neath		3/26/15
DOE Federal Project Director (printed)	Signature	Date
N. Menard	Nina M. Menard	3/2/15
Ecology Project Manager (printed)	Signature	Date
N/A		
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-97, 184-DA 500-GALLON FUEL TANK WASTE SITE

Attachment to Waste Site Reclassification Form 2014-116

April 2015

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-97, 184-DA 500-GALLON FUEL TANK WASTE SITE

EXECUTIVE SUMMARY

The 100-D-97, 184-DA 500-Gallon Fuel Tank waste site was the former site of the 184-DA underground storage tank (UST), K1-7-1. In addition to the UST and associated soils, the waste site included a fuel oil supply pipeline and a fuel oil return pipeline. Sections of the fuel oil piping were discovered during test trenching for confirmatory sampling; the UST was not encountered. Due to the presence of the fuel oil piping, the site was designated for remedial action (WCH 2010).

Remediation of the 100-D-97 waste site was conducted on February 25, 2014. The fuel tank was previously removed and not found during excavation for remediation. Approximately 70 bank cubic meters (92 bank cubic yards) of soil and piping debris were removed from the 2-m (6.6-ft)-deep excavation and placed in a staging pile area before being disposed to the Environmental Restoration Disposal Facility. No anomalous materials were encountered during the excavation.

Verification sampling was conducted on August 6, 2014, per the *Work Instruction for Verification Sampling of the 100-D-97, 184-DA 500-Gallon Fuel Tank Waste Site* (WCH 2014b). The results indicate that the waste removal action achieved compliance with the remedial action objectives and remedial action goals of the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units* (Remaining Sites ROD) (EPA 1999). A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1.

Table ES-1. Summary of Remedial Action Goals for the 100-D-97 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15 mrem/yr above background for 1,000 years.	Radionuclides were not COPCs for the 100-D-97 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC direct exposure RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for all sampling areas (2.4×10^{-2}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for all individual carcinogens are $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk is 2.7×10^{-7}, and thus is $<1 \times 10^{-5}$.	

Table ES-1. Summary of Remedial Action Goals for the 100-D-97 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river protection RAGs.	Radionuclides were not COPCs for the 100-D-97 waste site.	NA
	Attain national primary drinking water standards[a]: 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.		
	Meet drinking water standards for alpha emitters: the most stringent of 15 pCi/L MCL or 1/25th of the derived concentration guides from DOE Order 5400.5[b].		
	Meet total uranium standard of 30 µg/L (21.2 pCi/L)[c].		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Residual concentrations of aroclor-1254 within the site excavation are above the soil RAGs for river protection. However, RESRAD modeling predicts that aroclor-1254 will not reach groundwater (and, therefore, the Columbia River) within 1,000 years[d].	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and the Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL 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).
[d] Based on the RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of aroclor-1254 is not expected to migrate more than 0.5 m (1.6 ft) vertically in 1,000 years (based on the K_d of 75.6 mL/g for aroclor-1254). The vadose zone underlying the soil below the 100-D-97 excavation is a minimum of 23 m (75 ft) thick; therefore, residual concentrations of aroclor-1254 are predicted to be protective of groundwater and the Columbia River.

COPC = contaminant of potential concern
DOE = U.S. Department of Energy
K_d = distribution coefficient
MCL = maximum contaminant level
NA = not applicable
RAG = remedial action goal
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)

The results of the verification sampling are used to make reclassification decisions for the 100-D-97 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011). In accordance with this evaluation, the verification sampling results support a reclassification of this waste site to Interim Closed Out. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses, as bounded by the rural-residential scenario, and allow for unrestricted use of 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. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in

deep zone soils (i.e., below 4.6 m [15 ft]); therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-97 waste site contaminants of potential concern and other constituents. Those constituents exceeding the ecological screening level in the *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were boron and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, manganese, vanadium, and zinc. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, vanadium, and zinc are below background levels, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for this site. A table showing contaminant concentrations from the 100-D-97 waste site that exceed ecological screening levels is provided in Appendix A.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-97, 184-DA 500-GALLON FUEL TANK WASTE SITE

STATEMENT OF PROTECTIVENESS

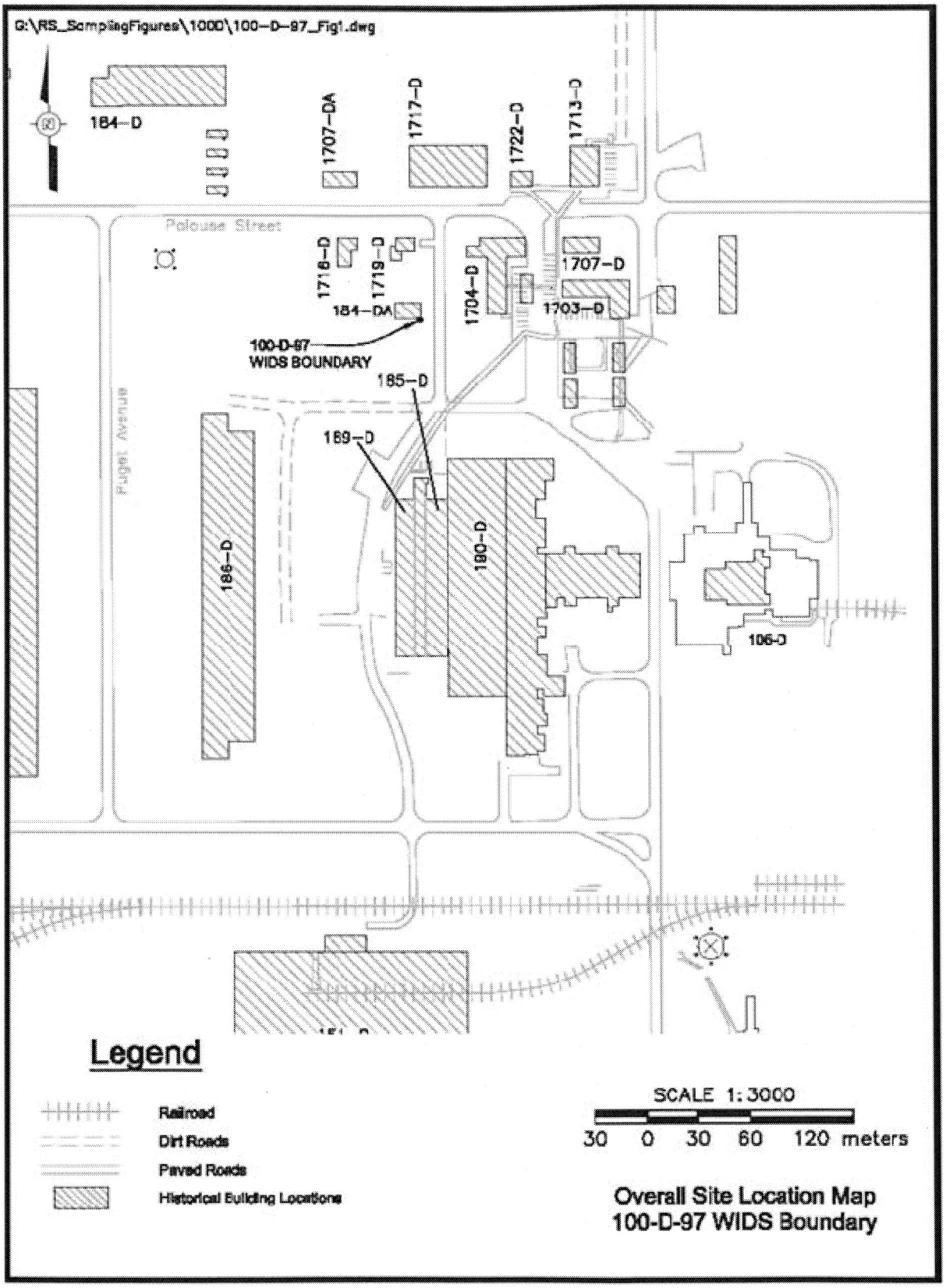
The 100-D-97, 184-DA 500-Gallon Fuel Tank Waste Site verification sampling data, site evaluations, and supporting documentation demonstrate that this site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]) and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-97 waste site contaminants of potential concern (COPCs) and other constituents. Those constituents exceeding the ecological screening level in the *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were boron and vanadium. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, manganese, vanadium, and zinc. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, vanadium, and zinc are below background levels, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for this site. A table showing contaminant concentrations from the 100-D-97 waste site that exceed ecological screening levels is provided in Appendix A.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-D-97 waste site is part of the 100-DR-1 Operable Unit, and is the former site of the 184-DA underground storage tank (UST), K1-7-1 (Figure 1).

Figure 1. 100-D-97 Waste Site Location Map.



In addition to the UST, the waste site included the associated underlying soils, a fuel oil supply pipeline, and a fuel oil return pipeline. It had been reported in the Waste Information Data System that the UST and the associated piping were removed in 1985/1986 as part of the 100-DR general demolition efforts; however, sections of piping were discovered during confirmatory sampling activities. The UST was not found during sampling. Due to the presence of the fuel oil supply and fuel oil return piping in the confirmatory test trenches, the waste site was designated for remediation.

The 100-D-97 UST supplied fuel to the 184-DA Steam Generating Facility, which provided steam to 184-D and other surrounding 100-D facilities. The UST had a capacity of 1,900 L (500 gal), was covered with approximately 0.6 m (2 ft) of overburden, and was located near the southeast corner of the 184-DA Steam Generating Facility. The 100-D-97 waste site is adjacent to the analogous 100-D-9, 185-DA Boiler Oil Tank.

REMEDIATION ACTION SUMMARY

Remediation of the 100-D-97 waste site was conducted on February 25, 2014. The remediation extended to approximately 2 m (6.6 ft) deep, resulting in approximately 70 bank cubic meters (92 bank cubic yards) of soil and piping debris removed and placed in a staging pile area awaiting loadout and disposal to the Environmental Restoration Disposal Facility. Materials staged in the SPA area were disposed to the Environmental Restoration Disposal Facility on June 26, 2014. The steel piping debris that was removed is thought to be boiler fuel oil piping. The fuel tank was not found in the excavation. The soil and debris was later loaded out and disposed at the Environmental Restoration Disposal Facility. No overburden piles are associated with this excavation. There were no anomalies found during the remediation of the 100-D-97 waste site. A large concrete monolith thrust block associated with the 100-D-63 clean water pipelines is visible on the south sidewall of the excavation.

VERIFICATION SAMPLING ACTIVITIES

Verification Sample Design

This section describes the basis for selection of a verification sampling design for the 100-D-97 waste site. One decision unit was identified for the 100-D-97 waste site and consists of the 60 m^2 (646 ft^2) excavation and the 180 m^2 (1940 ft^2) staging pile area (SPA). A combination statistical and focused sample design was used to evaluate the decision unit. No residual staining was identified within the excavated waste site and staging pile area.

Contaminants of Concern for Verification Sampling

The COPCs for the 100-D-97 waste site were determined based on process history and the COPCs previously determined for the 100-D-9 waste site. The adjacent 100-D-9 waste site also consisted of a fuel oil tank associated with the 184-DA Building and is, therefore, analogous to the 100-D-97 waste site.

The COPCs include polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), volatile organic compounds, polychlorinated biphenyls (PCBs), and lead. Although not considered COPCs, analysis for the constituents of the expanded inductively coupled plasma metals analytical list were performed to include arsenic, antimony, barium, beryllium, boron, cadmium, chromium, cobalt, copper, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc. Analysis for mercury was also performed. While also not considered a COPC, analysis for hexavalent chromium was performed to support the effort to identify hexavalent chromium sources across the 100-D Area.

Verification Sampling

Verification sampling was conducted on August 6, 2014, per the *Work Instruction for Verification Sampling of the 100-D-97, 184-DA 500-Gallon Fuel Tank Waste Site* (WCH 2014b). Twelve statistical verification soil samples plus one duplicate were collected. Additionally, a single focused sample was collected from directly below the former location of the fuel tank. All sampling was performed in accordance with ENV-1, *Environmental Monitoring and Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). Sampling was conducted to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The 100-D-97 waste site verification sample locations are shown in Figure 2.

A summary of the verification samples collected and laboratory analyses performed is provided in Table 1. Table 2 identifies the EPA-approved methods for the analyses performed for verification sampling. Additional information related to verification sampling can be found in the field sampling logbook (WCH 2014a).

Verification Sampling Results

All verification samples were collected for full protocol laboratory analysis and analyzed using EPA-approved analytical methods. Evaluation of the verification data from the 100-D-97 waste site was performed by direct comparison of the statistical or maximum sample result for each COPC against cleanup criteria. Evaluation of the focused sample was performed by direct comparison of the results to the cleanup criteria.

The primary statistical calculation to evaluate compliance with cleanup standards is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. The 95% UCL values for each detected COPC are computed for the 100-D-97 waste site decision unit as specified by the 100 Area RDR/RAWP (DOE-RL 2009b). The calculations are provided in Appendix C. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for the decision unit, the maximum detected value was used for comparison to the remedial action goals (RAGs). If no detections for a given COPC were reported in the data set, then no statistical calculation or evaluation was performed for that COPC.

Figure 2. 100-D-97 Waste Site Verification Sample Locations.

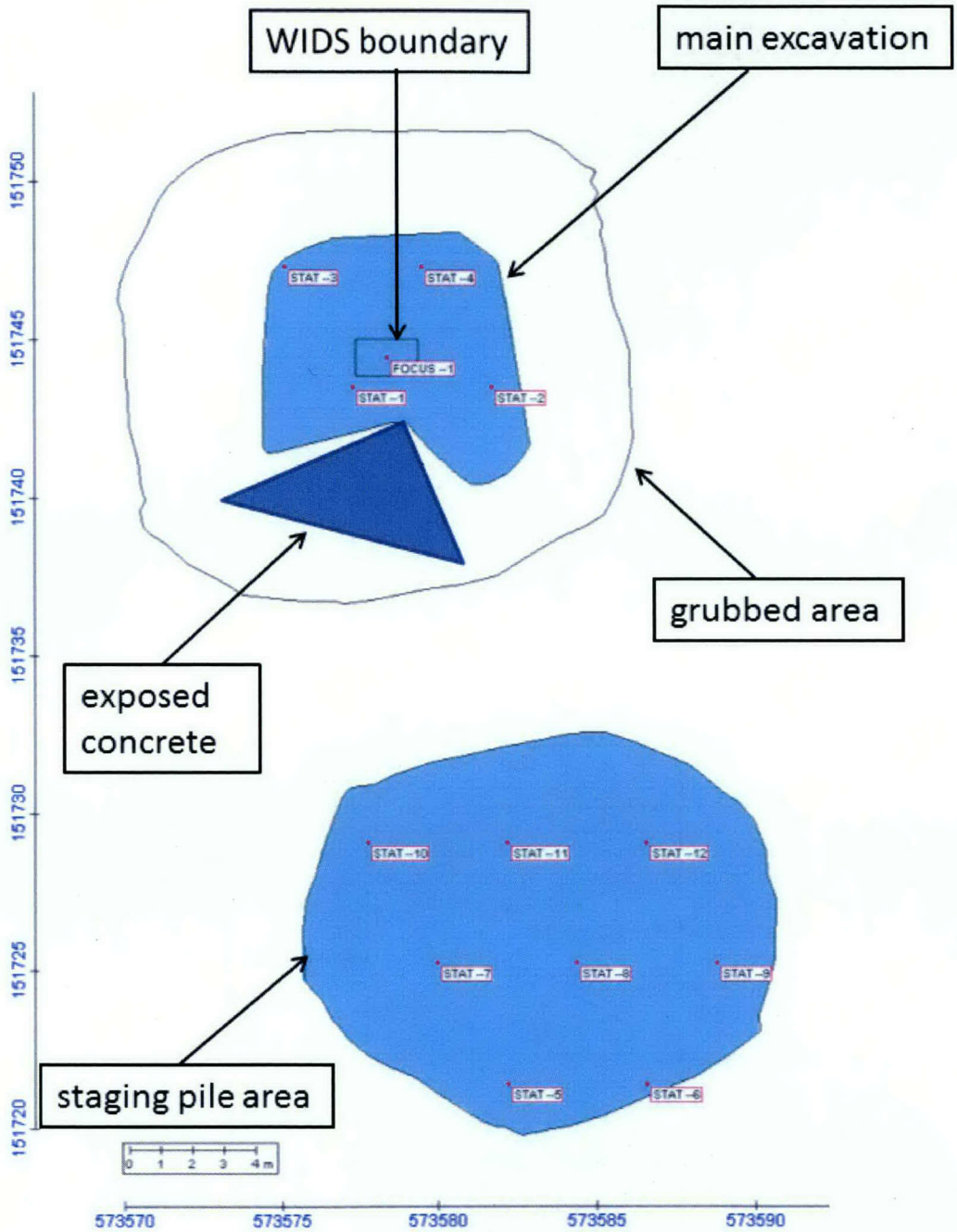


Table 1. 100-D-97 Waste Site Excavation Sample Summary [a].

Sample Location	HEIS Sample Number	Media	bgs	Washington State Plane		Sample Analysis
				Northing	Easting	
100-D-97 Tank Focused Sample						PAH, TPH, VOCs, PCB, ICP metals [b], mercury, hexavalent chromium
FOCUS --1	J1TVW1	Soil	0-6 in.	151744.5	573578.4	
100-D-97 Statistical Samples Excavation						
STAT --1	J1TVW2	Soil	0-6 in.	151743.5	573577.3	
STAT --2	J1TVW3	Soil	0-6 in.	151743.5	573581.7	
STAT --3	J1TVW4	Soil	0-6 in.	151747.3	573575.1	
STAT --4	J1TVW5	Soil	0-6 in.	151747.3	573579.5	
100-D-97 Statistical Samples SPA						
STAT --5	J1TVW6	Soil	0-6 in.	151721.5	573582.2	
STAT --6	J1TVW7	Soil	0-6 in.	151721.5	573586.6	
STAT --7	J1TVW8	Soil	0-6 in.	151725.3	573580.0	
STAT --8	J1TXL0	Soil	0-6 in.	151725.3	573584.4	
STAT --9	J1TVX0	Soil	0-6 in.	151725.3	573588.8	
STAT --10	J1TVX1	Soil	0-6 in.	151729.1	573577.8	
STAT --11	J1TVX2	Soil	0-6 in.	151729.1	573582.2	
STAT --12	J1TVX3	Soil	0-6 in.	151729.1	573586.6	
Duplicate of J1TVX2	J1TVX4	Soil	0-6 in.	151729.1	573582.2	
Equipment blank	J1TVX5	Soil	NA	NA	NA	ICP metals [a], mercury, VOCs
VOC trip blank	J1TVX6	Sand	NA	NA	NA	VOCs

[a] Grab samples were collected at each location and sample analysis performed as defined in Table 3, Laboratory Analytical Methods. All sampling was performed in accordance with ENV-1, *Environmental Monitoring and Management* consistent with the 100 Area SAP (DOE-RL 2009a) requirements.

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

bgs = below ground surface
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
SAP = sampling and analysis plan
SPA = staging pile area
TPH = total petroleum hydrocarbons
VOC = volatile organic compound

Table 2. 100-D-97 Waste Site Laboratory Analytical Methods. (2 Pages)

Analysis	Analytical Method	Analytes
PAH	EPA Method 8310	Polycyclic aromatic hydrocarbons
TPH	NWTPH-Dx	Total petroleum hydrocarbons
VOCs	EPA Method 8260	Volatile organic compounds
PCBs	EPA Method 8082	Polychlorinated biphenyls
ICP metals [a]	EPA Method 6010	Lead
Mercury	EPA Method 7471	Mercury

Table 2. 100-D-97 Waste Site Laboratory Analytical Methods. (2 Pages)

Analysis	Analytical Method	Analytes
Hexavalent chromium	EPA Method 7196	Hexavalent chromium

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

EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma
NWTPH-Dx = Northwest total petroleum hydrocarbons-diesel range
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons
VOC = volatile organic compounds

Comparisons of the focused and statistical sample results to the site RAGs for the 100-D-97 waste site are presented in Table 3. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations database (Ecology 2014) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. The complete laboratory results are stored in a Washington Closure Hanford project-specific database prior to submitting to the Hanford Environmental Information System for archiving and are provided in Appendix C.

Table 3. Comparison of the Contaminant Concentrations to Remedial Action Goals for the 100-D-97 Waste Site Excavation and Staging Pile Area. (3 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Focused Sample Results						
Arsenic	1.3 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	65.5 (<BG)	5,600	200	400	No	--
Cadmium [c]	0.11 (<BG)	13.9 [d]	0.81 [b]	0.81 [b]	No	-
Chromium	7.0 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	8.9 (<BG)	24	15.7 [b]	--	No	--
Copper	16.8 (<BG)	2,960	59.2	22.0 [b]	No	--
Hexavalent chromium [c]	0.221	2.1 [d]	4.8	2	No	--
Lead	3.6 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	337 (<BG)	3,760	512 [b]	512 [b]	No	--
Molybdenum [c]	0.37	400	8	-- [e]	No	--
Nickel	8.4 (<BG)	1,600	19.1 [b]	27.4	No	--
Silver	0.14 (<BG)	400	8	0.73 [b]	No	--
Vanadium	84.5 (<BG)	560	85.1 [b]	-- [e]	No	--
Zinc	58.3 (<BG)	24,000	480	67.8 [b]	No	--
TPH - diesel range	1.3	200	200	200	No	--

Table 3. Comparison of the Contaminant Concentrations to Remedial Action Goals for the 100-D-97 Waste Site Excavation and Staging Pile Area. (3 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
TPH - diesel range extended	3.9	200	200	200	No	--
Chloroform	0.0039	32.3	0.717	1.14	No	--
Methylenechloride	0.0056	480	0.5	0.94	No	--
Toluene	0.0018	6,400	64	1,360	No	--
Statistical Sample Results						
Antimony [c]	0.62 (<BG)	32	5 [b]	5 [b]	No	--
Arsenic	3.2 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	67.9 (<BG)	5,600	200	400	No	--
Beryllium	0.84 (<BG)	10.4 [d]	1.51 [b]	1.51 [b]	No	--
Boron [c]	1.2	7,200	320	-- [e]	No	--
Cadmium [c]	0.096 (<BG)	13.9 [d]	0.81 [b]	0.81 [b]	No	--
Chromium	10.4 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	6.8 (<BG)	24	15.7 [b]	-- [e]	No	--
Copper	15.6 (<BG)	2,960	59.2	22.0 [b]	No	--
Hexavalent chromium	0.389	2.1 [d]	4.8	2	No	--
Lead	6.2 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	313 (<BG)	3,760	512 [b]	512 [b]	No	--
Mercury	0.0084 (<BG)	24	0.33 [b]	0.33 [b]	No	--
Molybdenum [c]	0.52	400	8	-- [e]	No	--
Nickel	11.6 (<BG)	1,600	19.1 [b]	27.4	No	--
Silver	0.22 (<BG)	400	8	0.73 [b]	No	--
Vanadium	56.3 (<BG)	560	85.1 [b]	-- [e]	No	--
Zinc	48.2 (<BG)	24,000	480	67.8 [b]	No	--
TPH - diesel range	10	200	200	200	No	--
TPH - diesel range extended	25	200	200	200	No	--
Acetone	0.031	72,000	720	--	No	--
Chloroform	0.0033	32.3	0.717	1.14	No	--
Benzo(a)anthracene	0.012	1.37	0.015 [f]	0.015 f	No	--
Dibenz[ah]anthracene	0.013	1.37	0.03 [f]	0.03 [f]	No	--
Aroclor-1254	0.033	0.5	0.017 [f]	0.017 [f]	Yes	Yes [g]
2-butanone	0.022	48,000	480	--[e]	No	--
2-hexanone	0.019	400	8	--[e]	No	--
4-methyl 2-pentanone	0.019	6,400	64	--[e]	No	--
Chlorobenzene	0.00071	1,600	16	136	No	--
Methylenechloride	0.0069	480	0.5	0.94	No	--

Table 3. Comparison of the Contaminant Concentrations to Remedial Action Goals for the 100-D-97 Waste Site Excavation and Staging Pile Area. (3 Pages)

COPC	Statistical or Maximum Result[b] (mg/kg)	Remedial Action Goals (mg/kg)[a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Toluene	0.0014	6,400	64	1,360	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[b] Maximum focused sample values; or maximum or 95% UCL values, depending on data censorship, as described in the *100-D-97 Waste Site Cleanup Verification 95% UCL Calculations (Appendix C).*
[b] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[c] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3]) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[d] No Hanford Site-specific or Washington State background value available.
[e] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).
[f] Based on the RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of aroclor-1254 is not expected to migrate more than 0.5 m (1.6 ft) vertically in 1,000 years (based on the K_d of 75.6 mL/g for aroclor-1254). The vadose zone underlying the soil below the 100-D-97 excavation is a minimum of 23m (75 ft) thick. Therefore, residual concentrations of lead and benzo(a)pyrene are predicted to be protective of groundwater and the Columbia River.
[g] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid turnaround analyses. Prior notification and concurrence with the laboratory may be necessary to meet this RDL. Actual detection limits may differ from any RDL.

-- = not applicable
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
K_d = distribution coefficient
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = *Washington Administrative Code*

DATA EVALUATION

This section demonstrates that remedial actions at the 100-D-97 waste site have achieved the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the Remaining Sites ROD (EPA 1999) and documented in the 100 Area RDR/RAWP (DOE-RL 2009b).

Attainment of Nonradionuclide RAGs

Table 3 compares the cleanup verification sample values for the 100-D-97 waste site excavation area and SPA to the applicable soil RAGs for direct exposure, protection of groundwater, and the protection of the Columbia River. All COPCs were quantified below direct exposure RAGs. All COPCs were quantified below groundwater and/or river protection soil RAGs with the exception of aroclor-1254. However, given the soil-partitioning distribution coefficient (K_d) of aroclor-1254 (K_d of 75.6 mL/g), this contaminant would not be expected to migrate more than

0.5 m (1.6 ft) vertically in 1,000 years based on RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b). The vadose zone thickness beneath the excavation is approximately 23 m (75 ft). Therefore, the residual concentration of aroclor-1254 is predicted to be protective of groundwater and, thus, the Columbia River.

Three-Part Test for Nonradionuclides

A RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test, which consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection shall exceed two times the cleanup criteria, and (3) the percentage of samples exceeding the cleanup criteria must be less than 10% of the data set.

The application of the three-part test for the 100-D-97 waste site is included in the statistical calculations, where half or more of the data set was detected (Appendix B). The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs.

An additional application of the three-part test is included for the statistical data sets that default to the maximum because less than half of the data set was detected. The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs with the exception of aroclor-1254. Aroclor-1254 failed the three-part test due to a single result from location STAT-10. All of the other samples were nondetected for aroclor-1254. As previously discussed, with a K_d of 75.6 mL/g, aroclor-1254 is not expected to migrate more than 0.5 m (1.6 ft) vertically in 1,000 years based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b). The depth to groundwater underlying this sample location is approximately 23 m (75 ft); therefore, residual concentrations of COPCs are predicted to be protective of groundwater and the Columbia River.

The WAC 173-340-740(7)(e) three-part test is a statistical evaluation of the data; therefore, the three-part test does not apply to the results of the single focused sample taken at the 100-D-97 waste site.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Nonradionuclide risk requirements 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}. For the 100-D-97 waste site, these risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background. All individual hazard quotients for noncarcinogenic constituents were less than 1.0. The cumulative hazard quotient for those noncarcinogenic constituents above background or detected levels is 2.4×10^{-2}, which is less than 1.0. The individual carcinogenic risk values for the carcinogenic constituents detected above background are less than 1×10^{-6}, and the cumulative carcinogenic risk value is 2.7×10^{-7}, which is less than 1×10^{-5}. Therefore, the 100-D-97 waste site meets the

requirements for the direct contact hazard quotient and excess carcinogenic risk as identified in the 100 Area RDR/RAWP (DOE-RL 2009b).

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 100-D-97 waste site included calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides. The requirements include an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. These risk values were conservatively calculated for the entire waste site using the maximum focused or statistical value for each COPC. Risk values were calculated for constituents that were detected at concentrations above Hanford Site or Washington State background values or for which there is no background value. In addition, the K_d values for these contaminants are less than that necessary to show no migration to groundwater in 1,000 years based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b). Based on this model and a vadose zone of approximately 23 m (75 ft) in thickness at the excavation, a K_d of 3.3 or greater is required to show no predicted migration to groundwater within 1,000 years. All individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the 100-D-97 waste site is 9.0×10^{-2}, which is less than 1.0. The individual excess carcinogenic risk for 100-D-97 constituents are all less than 1×10^{-6}. The cumulative excess carcinogenic risk for the 100-D-97 waste site is 8.6×10^{-9}, which is less than 1.0×10^{-5}; therefore, the criterion for excess cancer risk is met. Nonradionuclide risk requirements related to groundwater are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach, the field logbook (WCH 2014a), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications. The DQA for the 100-D-97 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in the environmental restoration project-specific database for data evaluation prior to archival in the Hanford Environmental Information System and are summarized in Appendix B. The detailed DQA is presented in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 100-D-97 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). Verification sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at this waste site meet the remedial action objectives for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the verification sampling results support a reclassification of the 100-D-97 waste site to Interim Closed Out. Contamination above direct

exposure levels was not observed in the shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

REFERENCES

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WAC 173-340, "Model Toxics Control Act—Cleanup," *Washington Administrative Code*, as amended.

WDOH, 1997, *Hanford Guidance for Radiological Cleanup*, WDOH/320-015, Rev. 1, Washington State Department of Health, Olympia, Washington.

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WCH, 2014a, *100D Field Remediation Miscellaneous Sampling Activities*, Logbook EL-1662-02, pp. 85-89, Washington Closure Hanford, Richland, Washington.

WCH, 2014b, *Work Instruction for Verification Sampling of the 100-D-97, 184-DA 500-Gallon Fuel Tank Waste Site,* 0100D-WI-G0136, Rev. 0, Washington Closure Hanford, Richland, Washington.

APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Contaminants Exceeding Ecological Screening Levels for the 100-D-97 Waste Site [a]

Hazardous Substance		2007 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Waste Site Analyses
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
Metals (mg/kg):									
	Background								
Antimony	5	5	--	--	--	78	--	0.27	0.62 (<BG)
Boron [d]	--	0.5	--	--	--	--	--	--	1.2
Manganese	512	1,100 [e]	--	1,500	220	450	4,300	4,000	337(<BG)
Vanadium	85.1	2	--	--	--	--	7.8	280	84.5(<BG)
Zinc	67.8	86 [e]	200	360	160	120	46	79	58.3(<BG)

NOTE: Shaded cells are exceeded by the maximum or the statistical result.
Blank cells = Values not available.

[a] Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. All exceedances must be evaluated in the context of additional lines of evidence for ecological effects following a baseline risk assessment for the river corridor portion of the Hanford Site, which will include a more complete quantitative ecological risk assessment.

[b] Available on the Internet at www.epa.gov/ecotox/ecossl.

[c] Wildlife.

[d] No Hanford Site-specific or Washington State background available.

[e] Benchmark replaced by Washington State natural background concentration from Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication 94-115, Washington State Department of Ecology, Olympia, Washington.

BG = background
EPA = U.S. Environmental Protection Agency
WAC = *Washington Administrative Code*

APPENDIX B

CALCULATIONS

APPENDIX B

CALCULATION BRIEFS

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

100-D-97 Waste Site Cleanup Verification 95% UCL Calculations, 0100D CA V0559, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-97 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100D-CA-V0560, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-97 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater Hazard, 0100D-CA-V0561, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

The calculations that are 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 in the administrative record.

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CALCULATION COVER SHEET

Project Title: 100-D Area Closure Operations **Job No. 14655**

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0559

Subject: 100-D-97 Waste Site Cleanup Verification 95% UCL Calculations

Computer Program: Excel Program No: Excel 2010

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 12 Attm. 1 = 7 Total = 20	J. D. Skoglie	I. B. Berezovskiy	R. J. Nielson	S. G. Wilkinson	3/10/15

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**	10/28/14	**Calc. No.**	0100D-CA-V0559
Project	100-D Area Closure Operations	**Job No.**	14655	**Checked**	I. B. Berezovskiy
Subject	100-D-97 Waste Site Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 10/28/14
Sheet No. 1 of 12

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 5 - Calculation Sheet Summary
Sheets 6 to 9 - Calculation Sheet Verification Data - Excavation Area
Sheets 10 and 11 - Ecology Software (MTCAStat) Results
Sheet 12 - Calculation Sheet - Duplicate Analysis
Attachment 1 - 100-D-97 Waste Site, Verification Sampling Results (7 pages).

Given/References:
1) Sample Results (Attachment 1).
2) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
3) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
5) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets)*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
6) Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
7) EPA, 1989, *Risk Assessment Guidance for Superfund:* Volume 1, *Human Health Evaluation Manual, Part A; Interim Final,* EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D. C.
8) 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 2009b). 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 Remaining Sites Verification Package (RSVP).

Calculation Description:
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 100-D-97 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 2009b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:
The 100-D-97 waste site underwent statistical sampling at one decision unit; the excavation area. In addition, one focused sample was collected for verifiication sampling purposes.

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie **Date** 10/28/14 **Calc. No.** 0100D-CA-V0559 **Rev. No.** 0
Project 100-D Area Closure Operations **Job No.** 14655 **Checked** I. B. Berezovskiy **Date** 10/28/14
Subject 100-D-97 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 2 of 12

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). 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 radionuclide data, calculation of the statistics is done using the reported value. 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 2009b) 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 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 TDLs are pre-determined values for analytical methods and constituents with cleanup levels as listed in Table 2-1 of the SAP (DOE-RL 2009a). Table 2-1 includes nominal TDLs for identified methods based organic analyses. The nominal TDLs are also used in support of the RPD calculation for the methods based analytes. TDLs not included in Table 2-1 are based on the laboratory and/or methods 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. If the RPD is greater than 30%, 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 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 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 RSVP.

Washington Closure Hanford **CALCULATION SHEET**

Originator	J. D. Skoglie	**Date**	10/28/14	**Calc. No.**	0100D-CA-V0559
Project	100-D Area Closure Operations	**Job No.**	14655	**Checked**	I. B. Berezovskiy
Subject	100-D-97 Waste Site Cleanup Verification 95% UCL Calculations				

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Sheet No. 3 of 12

Summary (continued)

QUALIFIER LIST

B = Estimated result. Result is less than the RL, but greater than MDL.
C = Sample was </= 5X the blank concentration
J = estimate
M = sample duplicate precision not met.
N = recovery is outside control limits
R = rejected
U = undetected
X = > 40% difference between primary and confirmation detector results.

ACRONYM LIST

-- = not applicable
DE = direct exposure
EXC = excavation
FS = fosused sample
GW = groundwater
MDL = method detection limit
MTCA = *Model Toxics Control Act*
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
PQL = practical quantitation limit
Q = qualifier
QA/QC = quality assurance/quality control
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
RSVP = remaining sites verification package
SAP = sampling and analysis plan
TDL = target detection limit
UCL = upper confidence limit
VOA = volatile organic analysis
WAC = Washington Administrative Code

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie **Date** 10/28/14 **Calc. No.** 0100D-CA-V0559 **Rev. No.** 0
Project 100-D Area Closure Operations **Job No.** 14655 **Checked** I. B. Berezovskiy **Date** 10/28/14
Subject 100-D-97 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 4 of 12

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 RSVP for this site.

Results Summary - Excavation [a]

Analyte	EXC 95% UCL Result	EXC Maximum Result	FS Maximum Result	Units
Antimony	--	0.62	--	mg/kg
Arsenic	3.2	--	1.3	mg/kg
Barium	67.9	--	65.5	mg/kg
Beryllium	--	0.84	--	mg/kg
Boron	1.2	--	--	mg/kg
Cadmium	0.096	--	0.11	mg/kg
Chromium	10.4	--	7.0	mg/kg
Cobalt	6.8	--	8.9	mg/kg
Copper	15.6	--	16.8	mg/kg
Hexavalent chromium	0.389	--	0.221	mg/kg
Lead	6.2	--	3.6	mg/kg
Manganese	313	--	337	mg/kg
Mercury	--	0.0084	--	mg/kg
Molybdenum	--	0.52	0.37	mg/kg
Nickel	11.6	--	8.4	mg/kg
Silver	--	0.22	0.14	mg/kg
Vanadium	56.3	--	84.5	mg/kg
Zinc	48.2	--	58.3	mg/kg
TPH - diesel range	10	--	1.3	mg/kg
TPH - diesel range extended	25	--	3.9	mg/kg
Acetone	0.031	--	--	mg/kg
Chloroform	0.0033	--	0.0039	mg/kg
Benzo(a)anthracene	--	0.012	--	mg/kg
Dibenz[ah]anthracene	--	0.013	--	mg/kg
Aroclor-1254	--	0.033	--	mg/kg
2-butanone	--	0.022	--	mg/kg
2-hexanone	--	0.019	--	mg/kg
4-methyl 2-pentanone	--	0.019	--	mg/kg
Chlorobenzene	--	0.00071	--	mg/kg
Methylenechloride	--	0.0069	0.0056	mg/kg
Toluene	--	0.0014	0.0018	mg/kg

3-Part Test Evaluation

		EXC
95% UCL or Maximum > Cleanup Limit?	NO	YES
> 10% above Cleanup Limit?	NO	NO
Any sample > 2x Cleanup Limit?	NO	NO

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

Originator J. D. Skoglie	**Date** 10/29/14	**Calc. No.** 0100D-CA-V0559	**Rev. No.** 0
Project 100-D Area Closure Operations	**Job No.** 14655	**Checked** I. B. Berezovskiy	**Date** 10/29/14
Subject 100-D-97 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 5 of 12

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 RSVP for this site.

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

Analyte	Duplicate Analysis
	Excavation
Aluminum	0.2%
Barium	5.0%
Calcium	0.1%
Chromium	0.0%
Copper	8.5%
Iron	1.0%
Magnesium	0.7%
Manganese	1.0%
Silicon	14.7%
Sodium	6.8%
Vanadium	4.5%
Zinc	2.8%

[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%, is addressed in the data quality assessment section of the RSVP.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Area Closure Operations
Subject 100-D-97 Waste Site Cleanup Verification 95% UCL Calculations

Date 10/28/14
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100-D-97 Waste Site Statistical Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Arsenic			Barium			Boron			Cadmium			Chromium			Cobalt			Copper			Hexavalent Chromium			Lead		
			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
STAT-11	J1TVX2	8/6/14	3.5		0.58	64.8	X	0.067	0.94	B	0.87	0.071	B	0.036	9.8	X	0.051	6.6		0.088	15.9		0.19	0.363		0.155	4.7		0.24
Duplicate of J1TVX2	J1TVX4	8/6/14	3.0		0.56	68.1	X	0.064	1.1	B	0.83	0.078	B	0.035	9.8	X	0.049	6.7		0.085	14.6		0.18	0.322		0.155	4.7		0.23
STAT-1	J1TVW2	8/6/14	2.4		0.59	64.6	X	0.068	1.1	B	0.88	0.048	B	0.037	9.9	X	0.052	6.7		0.090	14.5		0.19	0.342		0.155	5.4		0.24
STAT-2	J1TVW3	8/6/14	3.6		0.58	67.3	X	0.067	0.86	U	0.86	0.082	B	0.036	10.2	X	0.051	6.8		0.088	14.4		0.19	0.322		0.155	4.8		0.24
STAT-3	J1TVW4	8/6/14	2.9		0.59	74.5	X	0.068	1.6	B	0.87	0.16	B	0.037	10.9	X	0.052	6.9		0.089	18.4		0.19	0.403		0.155	7.9		0.24
STAT-4	J1TVW5	8/6/14	3.3		0.65	63.6	X	0.075	1.2	B	0.97	0.054	B	0.040	10.0	X	0.057	6.8		0.099	16.9		0.21	0.281		0.155	4.6		0.27
STAT-5	J1TVW6	8/6/14	2.4		0.59	61.3	X	0.068	1.1	B	0.88	0.079	B	0.037	7.6	X	0.052	6.5		0.090	13.5		0.19	0.441		0.155	4.6		0.24
STAT-6	J1TVW7	8/6/14	2.6		0.60	67.6	X	0.069	1.3	B	0.89	0.072	B	0.037	9.1	X	0.053	7.1		0.091	13.9		0.20	0.342		0.155	4.9		0.24
STAT-7	J1TVW8	8/6/14	3.3		0.59	67.7	X	0.068	0.92	B	0.88	0.10	B	0.037	11.3	X	0.052	6.7		0.090	14.7		0.19	0.363		0.155	4.7		0.24
STAT-8	J1TXL0	8/12/14	3.2	M	0.61	62.3		0.071	0.98	BN	0.91	0.038	U	0.038	8.1		0.054	6.2	X	0.093	13.9	X	0.20	0.319		0.155	4.6		0.25
STAT-9	J1TVX0	8/6/14	3.3		0.63	63.9	X	0.073	0.95	B	0.94	0.050	B	0.039	10.7	X	0.056	6.4		0.096	14.5		0.21	0.343		0.155	4.7		0.26
STAT-10	J1TVX1	8/6/14	2.5		0.64	68.5	X	0.074	0.95	U	0.95	0.10	B	0.040	10.3	X	0.056	6.4		0.097	15.3		0.21	0.361		0.155	5.2		0.26
STAT-12	J1TVX3	8/6/14	1.9		0.56	65.6	X	0.064	0.92	B	0.83	0.094	B	0.035	9.0	X	0.049	6.8		0.085	14.4		0.18	0.464		0.155	9.3		0.23

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Hexavalent Chromium mg/kg	Lead mg/kg
STAT-11	J1TVX2/ J1TVX4	8/6/14	3.3	66.5	1.0	0.075	9.8	6.7	15.3	0.343	4.7
STAT-1	J1TVW2	8/6/14	2.4	64.6	1.1	0.048	9.9	6.7	14.5	0.342	5.4
STAT-2	J1TVW3	8/6/14	3.6	67.3	0.43	0.082	10.2	6.8	14.4	0.322	4.8
STAT-3	J1TVW4	8/6/14	2.9	74.5	1.6	0.16	10.9	6.9	18.4	0.403	7.9
STAT-4	J1TVW5	8/6/14	3.3	63.6	1.2	0.054	10.0	6.8	16.9	0.281	4.6
STAT-5	J1TVW6	8/6/14	2.4	61.3	1.1	0.079	7.6	6.5	13.5	0.441	4.6
STAT-6	J1TVW7	8/6/14	2.6	67.6	1.3	0.072	9.1	7.1	13.9	0.342	4.9
STAT-7	J1TVW8	8/6/14	3.3	67.7	0.92	0.10	11.3	6.7	14.7	0.363	4.7
STAT-8	J1TXL0	8/12/14	3.2	62.3	0.98	0.019	8.1	6.2	13.9	0.319	4.6
STAT-9	J1TVX0	8/6/14	3.3	63.9	0.95	0.050	10.7	6.4	14.5	0.343	4.7
STAT-10	J1TVX1	8/6/14	2.5	68.5	0.48	0.10	10.3	6.4	15.3	0.361	5.2
STAT-12	J1TVX3	8/6/14	1.9	65.6	0.92	0.094	9.0	6.8	14.4	0.464	9.3

Statistical Computations

	Arsenic	Barium	Boron	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), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat normal distribution.	Large data set (n ≥ 10), use MTCAStat normal distribution.	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), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	17%	8%	0%	0%	0%	0%	0%
Mean	2.9	66.1	1.0	0.078	9.7	6.7	15.0	0.360	5.5
Standard deviation	0.52	3.5	0.32	0.035	1.1	0.25	1.4	0.0521	1.5
95% UCL on mean	3.2	67.9	1.2	0.096	10.4	6.8	15.6	0.389	6.2
Maximum value	3.6	74.5	1.6	0.16	11.3	7.1	18.4	0.464	9.3
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW & River Protection	200 GW Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection	2 River Protection	10.2 GW & River Protection
WAC 173-340 3-PART TEST									
95% UCL > Cleanup Limit?	NA	NA	NO	NA	NA	NA	NA	NO	NA
> 10% above Cleanup Limit?	NA	NA	NO	NA	NA	NA	NA	NO	NA
Any sample > 2X Cleanup Limit?	NA	NA	NO	NA	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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 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 100-D Area Closure Operations
Subject 100-D-97 Waste Site Cleanup Verification 95% UCL Calculations

Date 10/28/14
Job No. 14655

Calc. No. 0100D-CA-V0559
Checked I. B. Berezovskiy

Rev. No. 0
Date 10/28/14
Sheet No. 7 of 12

1 **100-D-97 Waste Site Statistical Calculations**
2 **Verification Data - Excavation**

3	Sample	Sample	Sample	Manganese			Nickel			Vanadium			Zinc			TPH - Diesel Range EXT			TPH - Diesel Range			Acetone			Chloroform		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	STAT-11	J1TVX2	8/6/14	301	X	0.088	11.9	X	0.11	52.4	JX	0.083	41.9		0.35	17000		930	6900		630	8.3	U	8.3	3.9	J	0.45
6	Duplicate of J1TVX2	J1TVX4	8/6/14	298	X	0.085	12.9	X	0.10	54.8	JX	0.080	43.1		0.34	21000		970	7800		660	36		9.4	3.7	J	0.51
7	STAT-1	J1TVW2	8/6/14	311	X	0.090	10.7	X	0.11	53.8	JX	0.084	41.8		0.36	36000		960	14000		650	32		6.6	1.3	J	0.36
8	STAT-2	J1TVW3	8/6/14	318	X	0.088	11.2	X	0.11	58.3	JX	0.083	51.6		0.35	10000		950	5100		650	31		6.4	3.3	J	0.34
9	STAT-3	J1TVW4	8/6/14	325	X	0.089	12.0	X	0.11	56.4	JX	0.084	60.6		0.35	25000		950	10000		650	8.5	U	8.5	4.0	J	0.46
10	STAT-4	J1TVW5	8/6/14	300	X	0.099	11.2	X	0.12	58.2	JX	0.093	44.8		0.39	3800	J	1000	1500	J	680	40		7.0	3.6	J	0.38
11	STAT-5	J1TVW6	8/6/14	288	X	0.090	9.4	X	0.11	59.6	JX	0.084	47.2		0.36	11000		970	5300		660	23		5.4	2.4	J	0.29
12	STAT-6	J1TVW7	8/6/14	313	X	0.091	10.3	X	0.11	56.3	JX	0.085	42.9		0.36	10000		940	4200		640	35		9.0	4.2	J	0.49
13	STAT-7	J1TVW8	8/6/14	298	X	0.090	11.3	X	0.11	50.1	JX	0.084	40.9		0.36	11000		980	4600		670	36		8.8	1.8	J	0.47
14	STAT-8	J1TXL0	8/12/14	316		0.093	9.9	X	0.11	53.5		0.087	41.3	X	0.37	26000		980	10000		670	31		3.9	0.79	J	0.21
15	STAT-9	J1TVX0	8/6/14	316	X	0.096	12.4	X	0.12	53.6	JX	0.090	42.0		0.38	16000		940	5600		640	29		6.9	2.9	J	0.37
16	STAT-10	J1TVX1	8/6/14	303	X	0.097	11.8	X	0.12	51.4	JX	0.092	47.3		0.39	17000		980	6300		670	26		6.5	2.8	J	0.35
17	STAT-12	J1TVX3	8/6/14	306	X	0.085	10.5	X	0.10	52.1	JX	0.080	42.2		0.34	9300		920	3800		630	5.4	U	5.4	1.8	J	0.29

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19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Manganese	Nickel	Vanadium	Zinc	TPH - Diesel Range EXT	TPH - Diesel Range	Acetone	Chloroform
21	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg
22	STAT-11	J1TVX2/ J1TVX4	8/6/14	300	12.4	53.6	42.5	19000	7350	20	3.8
23	STAT-1	J1TVW2	8/6/14	311	10.7	53.8	41.8	36000	14000	32	1.3
24	STAT-2	J1TVW3	8/6/14	318	11.2	58.3	51.6	10000	5100	31	3.3
25	STAT-3	J1TVW4	8/6/14	325	12.0	56.4	60.6	25000	10000	4.3	4.0
26	STAT-4	J1TVW5	8/6/14	300	11.2	58.2	44.8	3800	1500	40	3.6
27	STAT-5	J1TVW6	8/6/14	288	9.4	59.6	47.2	11000	5300	23	2.4
28	STAT-6	J1TVW7	8/6/14	313	10.3	56.3	42.9	10000	4200	35	4.2
29	STAT-7	J1TVW8	8/6/14	298	11.3	50.1	40.9	11000	4600	36	1.8
30	STAT-8	J1TXL0	8/12/14	316	9.9	53.5	41.3	26000	10000	31	0.79
31	STAT-9	J1TVX0	8/6/14	316	12.4	53.6	42.0	16000	5600	29	2.9
32	STAT-10	J1TVX1	8/6/14	303	11.8	51.4	47.3	17000	6300	26	2.8
33	STAT-12	J1TVX3	8/6/14	306	10.5	52.1	42.2	9300	3800	2.7	1.8

34 **Statistical Computations**

35		Manganese	Nickel	Vanadium	Zinc	TPH - Diesel Range EXT	TPH - Diesel Range	Acetone	Chloroform
36	95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	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.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat normal distribution.
37	N	12	12	12	12	12	12	12	12
38	% < Detection limit	0%	0%	0%	0%	0%	0%	17%	0%
39	Mean	308	11.1	54.7	45.4	16175	6479	26	2.7
40	Standard deviation	10.5	0.96	3.0	5.7	9077	3397	12	1.1
41	95% UCL on mean	313	11.6	56.3	48.2	25113	9821	31	3.3
42	Maximum value	325	12.9	59.6	60.6	36000	14000	40	4.2
43	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless stated otherwise**	512 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200000 ug/kg GW Protection	200000 ug/kg GW Protection	720000 ug/kg GW Protection	7.17 ug/kg GW Protection
44	**WAC 173-340 3-PART TEST**								
45	95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NO	NO	NO
46	> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NO	NO	NO
47	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NO	NO	NO
48	**WAC 173-340 Compliance?**	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

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MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Area Closure Operations
Subject 100-D-97 Waste Site Cleanup Verification 95% UCL Calculations

Date 10/28/14
Job No. 14655

Calc. No. 0100D-CA-V0559
Checked I. B. Berezovskiy

Rev. No. 0
Date 10/28/14
Sheet No. 8 of 12

1 **100-D-97 Waste Site Maximum Calculations**
2 **Verification Data - Excavation**

3	Sample	Sample	Sample	Antimony			Beryllium			Mercury			Molybdenum			Silver			Benzo(a)anthracene			Dibenz[a,h]anthracene		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	STAT-11	J1TVX2	8/6/14	0.34	UJ	0.34	0.029	UJ	0.029	0.016	UJC	0.0053	0.23	U	0.23	0.14	U	0.14	3.0	U	3.0	10	U	10
6	Duplicate of J1TVX2	J1TVX4	8/6/14	0.52	J	0.32	0.028	UJ	0.028	0.014	UJBC	0.0052	0.22	U	0.22	0.14	U	0.14	3.2	U	3.2	11	U	11
7	STAT-1	J1TVW2	8/6/14	0.34	UJ	0.34	0.030	UJ	0.030	0.0093	UJBC	0.0054	0.25	B	0.23	0.14	U	0.14	3.0	U	3.0	10	U	10
8	STAT-2	J1TVW3	8/6/14	0.53	J	0.33	0.029	UJ	0.029	0.019	UJC	0.0048	0.23	U	0.23	0.14	U	0.14	3.1	U	3.1	11	U	11
9	STAT-3	J1TVW4	8/6/14	0.34	UJ	0.34	0.029	UJ	0.029	0.016	UJBC	0.0056	0.23	U	0.23	0.20		0.14	3.1	U	3.1	11	U	11
10	STAT-4	J1TVW5	8/6/14	0.37	UJ	0.37	0.033	UJ	0.033	0.015	UJBC	0.0051	0.26	U	0.26	0.19	B	0.16	3.4	JX	3.0	13	JX	10
11	STAT-5	J1TVW6	8/6/14	0.34	UJ	0.34	0.030	UJ	0.030	0.020	UJC	0.0063	0.23	U	0.23	0.14	U	0.14	12	JX	3.0	10	U	10
12	STAT-6	J1TVW7	8/6/14	0.57	J	0.34	0.030	UJ	0.030	0.014	UJBC	0.0059	0.24	U	0.24	0.18		0.15	3.0	U	3.0	10	U	10
13	STAT-7	J1TVW8	8/6/14	0.39	JB	0.34	0.030	UJ	0.030	0.014	UJBC	0.0052	0.52	B	0.23	0.14	U	0.14	8.3	JX	2.9	10	U	10
14	STAT-8	J1TXL0	8/12/14	0.62		0.35	0.84		0.031	0.0084	BM	0.0062	0.25	B	0.24	0.15	U	0.15	3.1	U	3.1	11	U	11
15	STAT-9	J1TVX0	8/6/14	0.37	UJ	0.37	0.032	UJ	0.032	0.013	UJBC	0.0047	0.25	U	0.25	0.22		0.15	2.9	U	2.9	10	U	10
16	STAT-10	J1TVX1	8/6/14	0.37	UJ	0.37	0.032	UJ	0.032	0.016	UJC	0.0047	0.25	U	0.25	0.16	U	0.16	3.0	U	3.0	10	U	10
17	STAT-12	J1TVX3	8/6/14	0.32	UJ	0.32	0.028	UJ	0.028	0.014	UJBC	0.0051	0.22	U	0.22	0.16	B	0.14	3.0	U	3.0	10	U	10

18 **Statistical Computations**

19		Antimony	Beryllium	Mercury	Molybdenum	Silver	Benzo(a)anthracene	Dibenz[a,h]anthracene
20	% < Detection limit	54%	85%	85%	69%	54%	69%	85%
21	Maximum value	0.62	0.84	0.0084	0.52	0.22	12	13
22	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	5 GW & River Protection	1.51 GW & River Protection	0.33 GW & River Protection	8 GW Protection	0.73 River Protection	15 ug/kg GW & River Protection	30 GW & River Protection
23	**3-PART TEST**							
24	Maximum > Cleanup Limit?	NA	NA	NA	NO	NA	NO	NO
25	> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NO	NO
26	Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NO	NO
27	**3-Part Test Compliance?**	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the 3-part test is not required.	Because all values are below background (0.33 mg/kg) the 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 (0.73 mg/kg) the 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Area Closure Operations
Subject 100-D-97 Waste Site Cleanup Verification 95% UCL Calculations

Date 10/28/14
Job No. 14655

Calc. No. 0100D-CA-V0559
Checked I. B. Berezovskiy

Rev. No. 0
Date 10/28/14
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1 **100-D-97 Waste Site Maximum Calculations**
2 **Verification Data - Excavation**

3	Sample	Sample	Sample	Aroclor-1254			2-Butanone			2-Hexanone			4-Methyl-2-Pentanone			Chlorobenzene			Methylenechloride			Toluene		
4	Area	Number	Date	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	STAT-11	J1TVX2	8/6/14	2.6	U	2.6	2.8	U	2.8	7.6	U	7.6	6.8	U	6.8	0.84	U	0.84	2.5	U	2.5	1.1	U	1.1
6	Duplicate of J1TVX2	J1TVX4	8/6/14	2.4	U	2.4	3.2	U	3.2	8.6	U	8.6	7.6	U	7.6	0.95	U	0.95	5.3	J	2.8	1.2	U	1.2
7	STAT-1	J1TVW2	8/6/14	2.6	U	2.6	2.2	U	2.2	6.0	U	6.0	5.4	U	5.4	0.66	U	0.66	2.0	U	2.0	0.85	U	0.85
8	STAT-2	J1TVW3	8/6/14	2.6	U	2.6	2.2	U	2.2	5.8	J	5.8	5.1	U	5.1	0.71	J	0.64	1.9	U	1.9	0.81	U	0.81
9	STAT-3	J1TVW4	8/6/14	2.5	U	2.5	2.9	U	2.9	7.7	U	7.7	6.9	U	6.9	0.85	U	0.85	6.9	J	2.5	1.1	U	1.1
10	STAT-4	J1TVW5	8/6/14	2.6	U	2.6	2.4	U	2.4	6.4	U	6.4	5.7	U	5.7	0.71	U	0.71	6.6		2.1	1.4	J	0.90
11	STAT-5	J1TVW6	8/6/14	2.5	U	2.5	1.8	U	1.8	4.9	U	4.9	4.4	U	4.4	0.54	U	0.54	1.6	U	1.6	0.69	U	0.69
12	STAT-6	J1TVW7	8/6/14	2.6	U	2.6	3.1	U	3.1	8.2	U	8.2	7.3	U	7.3	0.91	U	0.91	2.7	U	2.7	1.2	U	1.2
13	STAT-7	J1TVW8	8/6/14	2.5	U	2.5	3.0	U	3.0	8.0	U	8.0	7.1	U	7.1	0.88	U	0.88	2.6	U	2.6	1.1	U	1.1
14	STAT-8	J1TXL0	8/12/14	2.4	U	2.4	22		1.3	19		3.6	19		3.2	0.40	U	0.40	1.2	U	1.2	0.51	U	0.51
15	STAT-9	J1TVX0	8/6/14	2.6	U	2.6	2.4	U	2.4	6.3	U	6.3	5.6	U	5.6	0.70	U	0.70	3.8	J	2.1	0.90	J	0.89
16	STAT-10	J1TVX1	8/6/14	33		2.5	2.2	U	2.2	5.9	U	5.9	5.3	U	5.3	0.65	U	0.65	1.9	U	1.9	0.83	U	0.83
17	STAT-12	J1TVX3	8/6/14	2.5	U	2.5	1.8	U	1.8	4.9	U	4.9	4.4	U	4.4	0.55	U	0.55	6.9		1.6	1.0	J	0.70

18 **Statistical Computations**

19	Aroclor-1254	2-Butanone	2-Hexanone	4-Methyl-2-Pentanone	Chlorobenzene	Methylenechloride	Toluene
20 % < Detection limit	85%	85%	77%	85%	85%	54%	69%
21 Maximum value	33	22	19	19	0.71	6.9	1.4
22 **Most Stringent Cleanup Limit for nonradionuclide and RAG type ug/kg**	17 GW & River Protection	4800 River Protection	80 GW Protection	640 GW Protection	160 GW Protection	500 GW Protection	64000 GW Protection
23 **3-PART TEST**							
24 Maximum > Cleanup Limit?	YES	NO	NO	NO	NO	NO	NO
25 > 10% above Cleanup Limit?	NO	NO	NO	NO	NO	NO	NO
26 Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO	NO	NO
27 **3-Part Test Compliance?**	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

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CALCULATION SHEET

Washington Closure Hanford

Originator	J. D. Skoglie	**Date**	10/28/14	**Calc. No.**	0100D-CA-V0559
Project	100-D Area Closure Operations	**Job No.**	14655	**Checked**	I. B. Berezovskiy
Subject	100-D-97 Waste Site Cleanup Verification 95% UCL Calculations				

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Ecology Software (MTCAStat) Results, 100-D-97 Waste Site

Arsenic 95% UCL Calculation

DATA	ID
3.3	J1TVX2/ J1TVX4
2.4	J1TVW2
3.6	J1TVW3
2.9	J1TVW4
3.3	J1TVW5
2.4	J1TVW6
2.6	J1TVW7
3.3	J1TVW8
3.2	J1TXL0
3.3	J1TVX0
2.5	J1TVX1
1.9	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	2.9
Censored		Lognormal mean	2.9
Detection limit or PQL		Std. devn.	0.52
Method detection limit		Median	3.1
TOTAL	12	Min.	1.9
		Max.	3.6

Lognormal distribution? r-squared is: 0.898
Normal distribution? r-squared is: 0.919
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 3.2

Barium 95% UCL Calculation

DATA	ID
66.5	J1TVX2/ J1TVX4
64.6	J1TVW2
67.3	J1TVW3
74.5	J1TVW4
63.6	J1TVW5
61.3	J1TVW6
67.6	J1TVW7
67.7	J1TVW8
62.3	J1TXL0
63.9	J1TVX0
68.5	J1TVX1
65.6	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	66.1
Censored		Lognormal mean	66.1
Detection limit or PQL		Std. devn.	3.5
Method detection limit		Median	66.0
TOTAL	12	Min.	61.3
		Max.	74.5

Lognormal distribution? r-squared is: 0.925
Normal distribution? r-squared is: 0.909
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 67.9

Boron 95% UCL Calculation

DATA	ID
1.0	J1TVX2/ J1TVX4
1.1	J1TVW2
0.43	J1TVW3
1.6	J1TVW4
1.2	J1TVW5
1.1	J1TVW6
1.3	J1TVW7
0.92	J1TVW8
0.98	J1TXL0
0.95	J1TVX0
0.48	J1TVX1
0.92	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	1.0
Censored		Lognormal mean	1.0
Detection limit or PQL		Std. devn.	0.32
Method detection limit		Median	1.0
TOTAL	12	Min.	0.43
		Max.	1.6

Lognormal distribution? r-squared is: 0.841
Normal distribution? r-squared is: 0.921
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 1.2

Cadmium 95% UCL Calculation

DATA	ID
0.075	J1TVX2/ J1TVX4
0.048	J1TVW2
0.082	J1TVW3
0.16	J1TVW4
0.054	J1TVW5
0.079	J1TVW6
0.072	J1TVW7
0.10	J1TVW8
0.019	J1TXL0
0.050	J1TVX0
0.10	J1TVX1
0.094	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.078
Censored		Lognormal mean	0.080
Detection limit or PQL		Std. devn.	0.035
Method detection limit		Median	0.077
TOTAL	12	Min.	0.019
		Max.	0.16

Lognormal distribution? r-squared is: 0.884
Normal distribution? r-squared is: 0.918
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 0.096

Chromium 95% UCL Calculation

DATA	ID
9.8	J1TVX2/ J1TVX4
9.9	J1TVW2
10.2	J1TVW3
10.9	J1TVW4
10.0	J1TVW5
7.6	J1TVW6
9.1	J1TVW7
11.3	J1TVW8
8.1	J1TXL0
10.7	J1TVX0
10.3	J1TVX1
9.0	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	9.7
Censored		Lognormal mean	9.7
Detection limit or PQL		Std. devn.	1.1
Method detection limit		Median	10.0
TOTAL	12	Min.	7.6
		Max.	11.3

Lognormal distribution? r-squared is: 0.930
Normal distribution? r-squared is: 0.953
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.4

Cobalt 95% UCL Calculation

DATA	ID
6.7	J1TVX2/ J1TVX4
6.7	J1TVW2
6.8	J1TVW3
6.9	J1TVW4
6.8	J1TVW5
6.5	J1TVW6
7.1	J1TVW7
6.7	J1TVW8
6.2	J1TXL0
6.4	J1TVX0
6.4	J1TVX1
6.8	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	6.7
Censored		Lognormal mean	6.7
Detection limit or PQL		Std. devn.	0.25
Method detection limit		Median	6.7
TOTAL	12	Min.	6.2
		Max.	7.1

Lognormal distribution? r-squared is: 0.960
Normal distribution? r-squared is: 0.963
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.8

Copper 95% UCL Calculation

DATA	ID
15.3	J1TVX2/ J1TVX4
14.5	J1TVW2
14.4	J1TVW3
18.4	J1TVW4
16.9	J1TVW5
13.5	J1TVW6
13.9	J1TVW7
14.7	J1TVW8
13.9	J1TXL0
14.5	J1TVX0
15.3	J1TVX1
14.4	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	15.0
Censored		Lognormal mean	15.0
Detection limit or PQL		Std. devn.	1.4
Method detection limit		Median	14.5
TOTAL	12	Min.	13.5
		Max.	18.4

Lognormal distribution? r-squared is: 0.835
Normal distribution? r-squared is: 0.805
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 15.6

Hexavalent Chromium 95% UCL Calculation

DATA	ID
0.343	J1TVX2/ J1TVX4
0.342	J1TVW2
0.322	J1TVW3
0.403	J1TVW4
0.281	J1TVW5
0.441	J1TVW6
0.342	J1TVW7
0.363	J1TVW8
0.319	J1TXL0
0.343	J1TVX0
0.361	J1TVX1
0.464	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.360
Censored		Lognormal mean	0.361
Detection limit or PQL		Std. devn.	0.0521
Method detection limit		Median	0.343
TOTAL	12	Min.	0.281
		Max.	0.464

Lognormal distribution? r-squared is: 0.928
Normal distribution? r-squared is: 0.905
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.389

Lead 95% UCL Calculation

DATA	ID
4.7	J1TVX2/ J1TVX4
5.4	J1TVW2
4.8	J1TVW3
7.9	J1TVW4
4.6	J1TVW5
4.6	J1TVW6
4.9	J1TVW7
4.7	J1TVW8
4.6	J1TXL0
4.7	J1TVX0
5.2	J1TVX1
9.3	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	5.5
Censored		Lognormal mean	5.4
Detection limit or PQL		Std. devn.	1.5
Method detection limit		Median	4.8
TOTAL	12	Min.	4.6
		Max.	9.3

Lognormal distribution? r-squared is: 0.646
Normal distribution? r-squared is: 0.605
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 6.2

CALCULATION SHEET

Washington Closure Hanford

Originator	J. D. Skoglie	**Date**	10/28/14	**Calc. No.**	0100D-CA-V0559
Project	100-D Area Closure Operations	**Job No.**	14655	**Checked**	I. B. Berezovskiy
Subject	100-D-97 Waste Site Cleanup Verification 95% UCL Calculations				

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Ecology Software (MTCAStat) Results, 100-D-97 Waste Site

Manganese 95% UCL Calculation

DATA	ID
300	J1TVX2/ J1TVX4
311	J1TVW2
318	J1TVW3
325	J1TVW4
300	J1TVW5
288	J1TVW6
313	J1TVW7
298	J1TVW8
316	J1TXL0
316	J1TVX0
303	J1TVX1
306	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	308
Censored		Lognormal mean	308
Detection limit or PQL		Std. devn.	11
Method detection limit		Median	309
TOTAL	12	Min.	288
		Max.	325

Lognormal distribution? r-squared is: 0.970
Normal distribution? r-squared is: 0.973
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 313

Nickel 95% UCL Calculation

DATA	ID
12.4	J1TVX2/ J1TVX4
10.7	J1TVW2
11.2	J1TVW3
12.0	J1TVW4
11.2	J1TVW5
9.4	J1TVW6
10.3	J1TVW7
11.3	J1TVW8
9.9	J1TXL0
12.4	J1TVX0
11.8	J1TVX1
10.5	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	11.1
Censored		Lognormal mean	11.1
Detection limit or PQL		Std. devn.	0.96
Method detection limit		Median	11.2
TOTAL	12	Min.	9.4
		Max.	12.4

Lognormal distribution? r-squared is: 0.970
Normal distribution? r-squared is: 0.974
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.6

Vanadium 95% UCL Calculation

DATA	ID
53.6	J1TVX2/ J1TVX4
53.8	J1TVW2
58.3	J1TVW3
56.4	J1TVW4
58.2	J1TVW5
59.6	J1TVW6
56.3	J1TVW7
50.1	J1TVW8
53.5	J1TXL0
53.6	J1TVX0
51.4	J1TVX1
52.1	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	54.7
Censored		Lognormal mean	54.7
Detection limit or PQL		Std. devn.	3.0
Method detection limit		Median	53.7
TOTAL	12	Min.	50.1
		Max.	59.6

Lognormal distribution? r-squared is: 0.961
Normal distribution? r-squared is: 0.958
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 56.3

Zinc 95% UCL Calculation

DATA	ID
42.5	J1TVX2/ J1TVX4
41.8	J1TVW2
51.6	J1TVW3
60.6	J1TVW4
44.8	J1TVW5
47.2	J1TVW6
42.9	J1TVW7
40.9	J1TVW8
41.3	J1TXL0
42.0	J1TVX0
47.3	J1TVX1
42.2	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	45.4
Censored		Lognormal mean	45.4
Detection limit or PQL		Std. devn.	5.7
Method detection limit		Median	42.7
TOTAL	12	Min.	40.9
		Max.	60.6

Lognormal distribution? r-squared is: 0.783
Normal distribution? r-squared is: 0.745
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 48.2

TPH - diesel range EXT 95% UCL Calculation

DATA	ID
19000	J1TVX2/ J1TVX4
36000	J1TVW2
10000	J1TVW3
25000	J1TVW4
3800	J1TVW5
11000	J1TVW6
10000	J1TVW7
11000	J1TVW8
26000	J1TXL0
16000	J1TVX0
17000	J1TVX1
9300	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	16175
Censored		Lognormal mean	16641
Detection limit or PQL		Std. devn.	9077
Method detection limit		Median	13500
TOTAL	12	Min.	3800
		Max.	36000

Lognormal distribution? r-squared is: 0.939
Normal distribution? r-squared is: 0.912
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 25113

TPH - diesel range 95% UCL Calculation

DATA	ID
7350	J1TVX2/ J1TVX4
14000	J1TVW2
5100	J1TVW3
10000	J1TVW4
1500	J1TVW5
5300	J1TVW6
4200	J1TVW7
4600	J1TVW8
10000	J1TXL0
5600	J1TVX0
6300	J1TVX1
3800	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	6479
Censored		Lognormal mean	6671
Detection limit or PQL		Std. devn.	3397
Method detection limit		Median	5450
TOTAL	12	Min.	1500
		Max.	14000

Lognormal distribution? r-squared is: 0.922
Normal distribution? r-squared is: 0.913
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 9821

Acetone 95% UCL Calculation

DATA	ID
20	J1TVX2/ J1TVX4
32	J1TVW2
31	J1TVW3
4.3	J1TVW4
40	J1TVW5
23	J1TVW6
35	J1TVW7
36	J1TVW8
31	J1TXL0
29	J1TVX0
26	J1TVX1
2.7	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	26
Censored		Lognormal mean	30
Detection limit or PQL		Std. devn.	12
Method detection limit		Median	30
TOTAL	12	Min.	2.7
		Max.	40

Lognormal distribution? r-squared is: 0.675
Normal distribution? r-squared is: 0.871
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 31

Chloroform 95% UCL Calculation

DATA	ID
3.8	J1TVX2/ J1TVX4
1.3	J1TVW2
3.3	J1TVW3
4.0	J1TVW4
3.6	J1TVW5
2.4	J1TVW6
4.2	J1TVW7
1.8	J1TVW8
0.79	J1TXL0
2.9	J1TVX0
2.8	J1TVX1
1.8	J1TVX3

Number of samples		Uncensored values	
Uncensored	12	Mean	2.7
Censored		Lognormal mean	2.8
Detection limit or PQL		Std. devn.	1.1
Method detection limit		Median	2.9
TOTAL	12	Min.	0.79
		Max.	4.2

Lognormal distribution? r-squared is: 0.897
Normal distribution? r-squared is: 0.966
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 3.3

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Area Closure Operations
Subject 100-D-97 Waste Site Cleanup Verification 95% UCL Calculations

Date 10/28/14
Job No. 14655

Calc. No. 0100D-CA-V0559
Checked I. B. Berezovskiy

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Date 10/28/14
Sheet No. 12 of 12

Duplicate Analysis - 100-D-97 Waste Site Excavation

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			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	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
STAT-11	J1TVX2	8/6/14	6540	X	1.4	3.5		0.58	64.8	X	0.067	0.94	B	0.87	0.071	B	0.036	7170	JX	12.5	9.8	X	0.051	6.6		0.088
Duplicate of J1TVX2	J1TVX4	8/6/14	6550	X	1.3	3.0		0.56	68.1	X	0.064	1.1	B	0.83	0.078	B	0.035	7180	JX	12.0	9.8	X	0.049	6.7		0.085

Analysis:

TDL		5	10	2	2	0.2	100	1	2
Duplicate Analysis	Both > PQL?	**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)
	RPD	0.2%		5.0%			0.1%	0.0%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Duplicate Analysis - 100-D-97 Waste Site Excavation

Sampling Area	HEIS Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Magnesium			Manganese			Nickel			Potassium		
			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
STAT-11	J1TVX2	8/6/14	15.9		0.19	0.363		0.155	20500	X	3.4	4.7		0.24	4630	X	3.3	301	X	0.088	11.9	X	0.11	1090		36.2
Duplicate of J1TVX2	J1TVX4	8/6/14	14.6		0.18	0.322		0.155	20700	X	3.2	4.7		0.23	4600	X	3.1	298	X	0.085	12.9	X	0.10	1070		34.8

Analysis:

TDL		1	0.5	5	5	75	5	4	400
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	8.5%		1.0%		0.7%	1.0%		
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

Duplicate Analysis - 100-D-97 Waste Site Excavation

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc			TPH - Diesel Range EXT			TPH - Diesel Range			Chloroform		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
STAT-11	J1TVX2	8/6/14	284	JN	5.0	368		52.1	52.4	JX	0.083	41.9		0.35	17000		930	6900		630	3.9	J	0.45
Duplicate of J1TVX2	J1TVX4	8/6/14	245	JN	4.8	394		50.0	54.8	JX	0.080	43.1		0.34	21000		970	7800		660	3.7	J	0.51

Analysis:

TDL		2	50	2.5	1	5000	5000	10
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	14.7%	6.8%	4.5%	2.8%			
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Attachment 1. 100-D-97 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
STAT-11	J1TVX2	8/6/14	6540	X	1.4	0.34	UJ	0.34	3.5		0.58	64.8	X	0.067	0.029	UJ	0.029
Duplicate of J1TVX2	J1TVX4	8/6/14	6550	X	1.3	0.52	J	0.32	3.0		0.56	68.1	X	0.064	0.028	UJ	0.028
STAT-1	J1TVW2	8/6/14	7360	X	1.4	0.34	UJ	0.34	2.4		0.59	64.6	X	0.068	0.030	UJ	0.030
STAT-2	J1TVW3	8/6/14	6930	X	1.4	0.53	J	0.33	3.6		0.58	67.3	X	0.067	0.029	UJ	0.029
STAT-3	J1TVW4	8/6/14	6920	X	1.4	0.34	UJ	0.34	2.9		0.59	74.5	X	0.068	0.029	UJ	0.029
STAT-4	J1TVW5	8/6/14	6680	X	1.5	0.37	UJ	0.37	3.3		0.65	63.6	X	0.075	0.033	UJ	0.033
STAT-5	J1TVW6	8/6/14	5840	X	1.4	0.34	UJ	0.34	2.4		0.59	61.3	X	0.068	0.030	UJ	0.030
STAT-6	J1TVW7	8/6/14	7040	X	1.4	0.57	J	0.34	2.6		0.60	67.6	X	0.069	0.030	UJ	0.030
STAT-7	J1TVW8	8/6/14	6870	X	1.4	0.39	JB	0.34	3.3		0.59	67.7	X	0.068	0.030	UJ	0.030
STAT-8	J1TXL0	8/12/14	6650		1.4	0.62		0.35	3.2	M	0.61	62.3		0.071	0.84		0.031
STAT-9	J1TVX0	8/6/14	7480	X	1.5	0.37	UJ	0.37	3.3		0.63	63.9	X	0.073	0.032	UJ	0.032
STAT-10	J1TVX1	8/6/14	6700	X	1.5	0.37	UJ	0.37	2.5		0.64	68.5	X	0.074	0.032	UJ	0.032
STAT-12	J1TVX3	8/6/14	6410	X	1.3	0.32	UJ	0.32	1.9		0.56	65.6	X	0.064	0.028	UJ	0.028
FOCUS-1	J1TVW1	8/6/14	4760	X	1.4	1.7	UJ	1.7	1.3		0.58	65.5	X	0.066	0.14	UJN	0.14
Equipment Blank	J1TVX5	8/6/14	115	X	1.5	0.37	UJ	0.37	0.81	B	0.65	1.5	X	0.075	0.032	UJ	0.032

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
STAT-11	J1TVX2	8/6/14	0.94	B	0.87	0.071	B	0.036	7170	JX	12.5	9.8	X	0.051	6.6		0.088
Duplicate of J1TVX2	J1TVX4	8/6/14	1.1	B	0.83	0.078	B	0.035	7180	JX	12.0	9.8	X	0.049	6.7		0.085
STAT-1	J1TVW2	8/6/14	1.1	B	0.88	0.048	B	0.037	6380	JX	12.7	9.9	X	0.052	6.7		0.090
STAT-2	J1TVW3	8/6/14	0.86	U	0.86	0.082	B	0.036	8090	JX	12.4	10.2	X	0.051	6.8		0.088
STAT-3	J1TVW4	8/6/14	1.6	B	0.87	0.16	B	0.037	9590	JX	12.6	10.9	X	0.052	6.9		0.089
STAT-4	J1TVW5	8/6/14	1.2	B	0.97	0.054	B	0.040	12600	JX	13.9	10.0	X	0.057	6.8		0.099
STAT-5	J1TVW6	8/6/14	1.1	B	0.88	0.079	B	0.037	7220	JX	12.7	7.6	X	0.052	6.5		0.090
STAT-6	J1TVW7	8/6/14	1.3	B	0.89	0.072	B	0.037	7170	JX	12.8	9.1	X	0.053	7.1		0.091
STAT-7	J1TVW8	8/6/14	0.92	B	0.88	0.10	B	0.037	7410	JX	12.7	11.3	X	0.052	6.7		0.090
STAT-8	J1TXL0	8/12/14	0.98	BN	0.91	0.038	U	0.038	7310	N	13.1	8.1		0.054	6.2	X	0.093
STAT-9	J1TVX0	8/6/14	0.95	B	0.94	0.050	B	0.039	7230	JX	13.6	10.7	X	0.056	6.4		0.096
STAT-10	J1TVX1	8/6/14	0.95	U	0.95	0.10	B	0.040	7760	JX	13.7	10.3	X	0.056	6.4		0.097
STAT-12	J1TVX3	8/6/14	0.92	B	0.83	0.094	B	0.035	7230	JX	11.9	9.0	X	0.049	6.8		0.085
FOCUS-1	J1TVW1	8/6/14	0.86	U	0.86	0.11	BM	0.036	6080	JX	12.3	7.0	X	0.051	8.9		0.44
Equipment Blank	J1TVX5	8/6/14	0.96	U	0.96	0.040	U	0.040	27.7	JBX	13.9	0.14	BX	0.057	0.098	U	0.098

Grey cells indicate not applicable or data will not be used.

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

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

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

C = detected in both the sample and the associated QC blank, and the sample concentration was </=5X the blank concentration.

FOCUS = focused sample

HEIS = Hanford Environmental Information System

J = estimate

M = sample duplicate precision not met.

MDL = method detection limit

N = recovery exceeds upper or lower control limits.

PAH = polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

PQL = practical quantitation limit

Q = qualifier

RAG = remedial action goal

STAT = statisitcal sample

U = undetected

VOA = volatile organic analysis

X (metals) = Serial dilution in the analytical batch indicates that physical and chemical interferences are present.

X (organics) = MS, MSD: recovery exceeds upper or lower control limits.

Attachment	1	Sheet No.	1 of 7
Originator	J. D. Skoglie	Date	10/28/14
Checked	I. B. Berezovskiy	Date	10/28/14
Calc. No.	0100D-CA-V0559	Rev. No.	0

Attachment 1. 100-D-97 Waste Site Verification Sample Results (Metals, TPH, and Physical).

Sample Location	HEIS Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
STAT-11	J1TVX2	8/6/14	15.9		0.19	0.363		0.155	20500	X	3.4	4.7		0.24	4630	X	3.3
Duplicate of J1TVX2	J1TVX4	8/6/14	14.6		0.18	0.322		0.155	20700	X	3.2	4.7		0.23	4600	X	3.1
STAT-1	J1TVW2	8/6/14	14.5		0.19	0.342		0.155	21300	X	3.4	5.4		0.24	4520	X	3.3
STAT-2	J1TVW3	8/6/14	14.4		0.19	0.322		0.155	21600	X	3.3	4.8		0.24	4690	X	3.3
STAT-3	J1TVW4	8/6/14	18.4		0.19	0.403		0.155	21000	X	3.4	7.9		0.24	4940	X	3.3
STAT-4	J1TVW5	8/6/14	16.9		0.21	0.281		0.155	21300	X	3.7	4.6		0.27	4850	X	3.6
STAT-5	J1TVW6	8/6/14	13.5		0.19	0.441		0.155	21600	X	3.4	4.6		0.24	4240	X	3.3
STAT-6	J1TVW7	8/6/14	13.9		0.20	0.342		0.155	21800	X	3.4	4.9		0.24	4560	X	3.4
STAT-7	J1TVW8	8/6/14	14.7		0.19	0.363		0.155	19800	X	3.4	4.7		0.24	4540	X	3.3
STAT-8	J1TXL0	8/12/14	13.9	X	0.20	0.319		0.155	20700		3.5	4.6		0.25	4370		3.4
STAT-9	J1TVX0	8/6/14	14.5		0.21	0.343		0.155	21100	X	3.7	4.7		0.26	4660	X	3.6
STAT-10	J1TVX1	8/6/14	15.3		0.21	0.361		0.155	20000	X	3.7	5.2		0.26	4630	X	3.6
STAT-12	J1TVX3	8/6/14	14.4		0.18	0.464		0.155	21100	X	3.2	9.3		0.23	4690	X	3.1
STAT-8	J1TVW9	8/6/14				0.342		0.155									
FOCUS-1	J1TVW1	8/6/14	16.8		0.95	0.221		0.155	25300	X	3.3	3.6		1.2	5040	X	16.2
Equipment Blank	J1TVX5	8/6/14	0.28	B	0.21				173	X	3.7	0.27	B	0.27	19.2	BX	3.6

Sample Location	HEIS Number	Sample Date	Manganese			Mercury			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
STAT-11	J1TVX2	8/6/14	301	X	0.088	0.016	UJC	0.0053	0.23	U	0.23	11.9	X	0.11	1090		36.2
Duplicate of J1TVX2	J1TVX4	8/6/14	298	X	0.085	0.014	UJBC	0.0052	0.22	U	0.22	12.9	X	0.10	1070		34.8
STAT-1	J1TVW2	8/6/14	311	X	0.090	0.0093	UJBC	0.0054	0.25	B	0.23	10.7	X	0.11	1300		36.8
STAT-2	J1TVW3	8/6/14	318	X	0.088	0.019	UJC	0.0048	0.23	U	0.23	11.2	X	0.11	1130		36.1
STAT-3	J1TVW4	8/6/14	325	X	0.089	0.016	UJBC	0.0056	0.23	U	0.23	12.0	X	0.11	999		36.5
STAT-4	J1TVW5	8/6/14	300	X	0.099	0.015	UJBC	0.0051	0.26	U	0.26	11.2	X	0.12	840		40.4
STAT-5	J1TVW6	8/6/14	288	X	0.090	0.020	UJC	0.0063	0.23	U	0.23	9.4	X	0.11	1040		36.8
STAT-6	J1TVW7	8/6/14	313	X	0.091	0.014	UJBC	0.0059	0.24	U	0.24	10.3	X	0.11	1180		37.2
STAT-7	J1TVW8	8/6/14	298	X	0.090	0.014	UJBC	0.0052	0.52	B	0.23	11.3	X	0.11	1150		36.8
STAT-8	J1TXL0	8/12/14	316		0.093	0.0084	BM	0.0062	0.25	B	0.24	9.9	X	0.11	1090		38.1
STAT-9	J1TVX0	8/6/14	316	X	0.096	0.013	UJBC	0.0047	0.25	U	0.25	12.4	X	0.12	1210		39.4
STAT-10	J1TVX1	8/6/14	303	X	0.097	0.016	UJC	0.0047	0.25	U	0.25	11.8	X	0.12	1130		39.9
STAT-12	J1TVX3	8/6/14	306	X	0.085	0.014	UJBC	0.0051	0.22	U	0.22	10.5	X	0.10	1060		34.7
FOCUS-1	J1TVW1	8/6/14	337	X	0.087	0.0083	UJBMC	0.0049	0.37	BM	0.23	8.4	X	0.11	744		35.8
Equipment Blank	J1TVX5	8/6/14	3.1	X	0.098	0.0076	UJBC	0.0062	0.26	U	0.26	0.12	UX	0.12	40.3	U	40.3

Attachment	1	Sheet No.	2 of 7
Originator	J. D. Skoglie	Date	10/28/14
Checked	I. B. Berezovskiy	Date	10/28/14
Calc. No.	0100D-CA-V0559	Rev. No.	0

Attachment 1. 100-D-97 Waste Site Verification Sample Results (Metals, TPH, and Physical).

Sample Location	HEIS Number	Sample Date	Selenium			Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
STAT-11	J1TVX2	8/6/14	0.76	U	0.76	284	JN	5.0	0.14	U	0.14	368		52.1	52.4	JX	0.083
Duplicate of J1TVX2	J1TVX4	8/6/14	0.73	U	0.73	245	JN	4.8	0.14	U	0.14	394		50.0	54.8	JX	0.080
STAT-1	J1TVW2	8/6/14	0.77	U	0.77	281	JN	5.1	0.14	U	0.14	242		53.0	53.8	JX	0.084
STAT-2	J1TVW3	8/6/14	0.76	U	0.76	272	JN	5.0	0.14	U	0.14	324		51.9	58.3	JX	0.083
STAT-3	J1TVW4	8/6/14	0.77	U	0.77	288	JN	5.0	0.20		0.14	263		52.6	56.4	JX	0.084
STAT-4	J1TVW5	8/6/14	0.85	U	0.85	268	JN	5.6	0.19	B	0.16	323		58.2	58.2	JX	0.093
STAT-5	J1TVW6	8/6/14	0.77	U	0.77	242	JN	5.1	0.14	U	0.14	320		52.9	59.6	JX	0.084
STAT-6	J1TVW7	8/6/14	0.78	U	0.78	297	JN	5.1	0.18		0.15	269		53.5	56.3	JX	0.085
STAT-7	J1TVW8	8/6/14	0.77	U	0.77	323	JN	5.1	0.14	U	0.14	373		52.9	50.1	JX	0.084
STAT-8	J1TXL0	8/12/14	0.80	U	0.80	221	N	5.3	0.15	U	0.15	363		54.8	53.5		0.087
STAT-9	J1TVX0	8/6/14	0.83	U	0.83	283	JN	5.4	0.22		0.15	213		56.7	53.6	JX	0.090
STAT-10	J1TVX1	8/6/14	0.84	U	0.84	298	JN	5.5	0.16	U	0.16	306		57.4	51.4	JX	0.092
STAT-12	J1TVX3	8/6/14	0.73	U	0.73	252	JN	4.8	0.16	B	0.14	397		50.0	52.1	JX	0.080
FOCUS-1	J1TVW1	8/6/14	0.75	U	0.75	186	JN	4.9	0.14	B	0.14	382		51.5	84.5	JX	0.41
Equipment Blank	J1TVX5	8/6/14	0.85	U	0.85	87.3	JN	5.6	0.16	U	0.16	58.1	U	58.1	0.21	JBX	0.092

Sample Location	HEIS Number	Sample Date	Zinc			TPH - Diesel Range EXT			TPH - Diesel Range			Percent moisture (wet sample)		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	%	Q	PQL
STAT-11	J1TVX2	8/6/14	41.9		0.35	17000		930	6900		630	0.72		0.10
Duplicate of J1TVX2	J1TVX4	8/6/14	43.1		0.34	21000		970	7800		660	0.92		0.10
STAT-1	J1TVW2	8/6/14	41.8		0.36	36000		960	14000		650	0.58		0.10
STAT-2	J1TVW3	8/6/14	51.6		0.35	10000		950	5100		650	0.35		0.10
STAT-3	J1TVW4	8/6/14	60.6		0.35	25000		950	10000		650	0.69		0.10
STAT-4	J1TVW5	8/6/14	44.8		0.39	3800	J	1000	1500	J	680	0.57		0.10
STAT-5	J1TVW6	8/6/14	47.2		0.36	11000		970	5300		660	0.49		0.10
STAT-6	J1TVW7	8/6/14	42.9		0.36	10000		940	4200		640	0.64		0.10
STAT-7	J1TVW8	8/6/14	40.9		0.36	11000		980	4600		670	0.48		0.10
STAT-8	J1TXL0	8/12/14	41.3	X	0.37	26000		980	10000		670	0.26		0.10
STAT-9	J1TVX0	8/6/14	42.0		0.38	16000		940	5600		640	0.91		0.10
STAT-10	J1TVX1	8/6/14	47.3		0.39	17000		980	6300		670	0.27		0.10
STAT-12	J1TVX3	8/6/14	42.2		0.34	9300		920	3800		630	0.79		0.10
FOCUS-1	J1TVW1	8/6/14	58.3		1.7	3900		960	1300	J	650	0.43		0.10
Trip Blank of J1TVX2	J1TVX6	8/6/14										1.9		0.10
Equipment Blank	J1TVX5	8/6/14	1.3		0.39							0.36		0.10

Attachment	1	Sheet No.	3 of 7
Originator	J. D. Skoglie	Date	10/28/14
Checked	I. B. Berezovskiy	Date	10/28/14
Calc. No.	0100D-CA-V0559	Rev. No.	0

Attachment 1. 100-D-97 Waste Site Verification Sample Results (Metals, TPH, and Physical).

CONSTITUENT	CLASS	STAT-11 - J1TVX2			Duplicate of J1TVX2 - J1TVX4			STAT-1 - J1TVW2			STAT-2 - J1TVW3			STAT-3 - J1TVW4		
		8/6/14			8/6/14			8/6/14			8/6/14			8/6/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.5	U	9.5	10	U	10	9.3	U	9.3	9.8	U	9.8	9.7	U	9.7
Acenaphthylene	PAH	8.5	U	8.5	9.0	U	9.0	8.4	U	8.4	8.9	U	8.9	8.8	U	8.8
Anthracene	PAH	2.9	U	2.9	3.0	U	3.0	2.8	U	2.8	3.0	U	3.0	3.0	U	3.0
Benzo(a)anthracene	PAH	3.0	U	3.0	3.2	U	3.2	3.0	U	3.0	3.1	U	3.1	3.1	U	3.1
Benzo(a)pyrene	PAH	6.1	U	6.1	6.4	U	6.4	6.0	U	6.0	6.3	U	6.3	6.2	U	6.2
Benzo(b)fluoranthene	PAH	4.0	U	4.0	4.2	U	4.2	3.9	U	3.9	4.1	U	4.1	4.1	U	4.1
Benzo(ghi)perylene	PAH	6.8	U	6.8	7.2	U	7.2	6.7	U	6.7	7.1	U	7.1	7.0	U	7.0
Benzo(k)fluoranthene	PAH	3.7	U	3.7	3.9	U	3.9	3.7	U	3.7	3.9	U	3.9	3.8	U	3.8
Chrysene	PAH	4.6	U	4.6	4.8	U	4.8	4.5	U	4.5	4.8	U	4.8	4.7	U	4.7
Dibenz[a,h]anthracene	PAH	10	U	10	11	U	11	10	U	10	11	U	11	11	U	11
Fluoranthene	PAH	12	U	12	13	U	13	12	U	12	13	U	13	13	U	13
Fluorene	PAH	5.0	U	5.0	5.3	U	5.3	4.9	U	4.9	5.2	U	5.2	5.1	U	5.1
Indeno(1,2,3-cd)pyrene	PAH	11	U	11	12	U	12	11	U	11	12	U	12	12	U	12
Naphthalene	PAH	11	U	11	12	U	12	11	U	11	12	U	12	12	U	12
Phenanthrene	PAH	11	U	11	12	U	12	11	U	11	12	U	12	12	U	12
Pyrene	PAH	11	U	11	12	U	12	11	U	11	12	U	12	12	U	12
Aroclor-1016	PCB	2.8	U	2.8	2.6	U	2.6	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7
Aroclor-1221	PCB	8.0	U	8.0	7.5	U	7.5	8.1	U	8.1	8.0	U	8.0	7.9	U	7.9
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.7	U	4.7	4.4	U	4.4	4.7	U	4.7	4.6	U	4.6	4.6	U	4.6
Aroclor-1248	PCB	4.7	U	4.7	4.4	U	4.4	4.7	U	4.7	4.6	U	4.6	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5
Aroclor-1260	PCB	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5
1,1,1-Trichloroethane	VOA	0.81	U	0.81	0.91	U	0.91	0.64	UJ	0.64	0.61	U	0.61	0.82	U	0.82
1,1,2,2-Tetrachloroethane	VOA	0.95	U	0.95	1.1	U	1.1	0.75	UJ	0.75	0.72	U	0.72	0.96	U	0.96
1,1,2-Trichloroethane	VOA	1.4	U	1.4	1.5	U	1.5	1.1	UJ	1.1	1.0	U	1.0	1.4	U	1.4
1,1-Dichloroethane	VOA	0.33	U	0.33	0.37	U	0.37	0.26	UJ	0.26	0.25	U	0.25	0.33	U	0.33
1,1-Dichloroethene	VOA	0.91	U	0.91	1.0	U	1.0	0.72	UJ	0.72	0.70	U	0.70	0.93	U	0.93
1,2-Dichloroethane	VOA	1.1	U	1.1	1.2	U	1.2	0.86	UJ	0.86	0.83	U	0.83	1.1	U	1.1
1,2-Dichloroethene(Total)	VOA	0.60	U	0.60	0.68	U	0.68	0.48	UJ	0.48	0.46	U	0.46	0.62	U	0.62
1,2-Dichloropropane	VOA	0.85	U	0.85	0.96	U	0.96	0.68	UJ	0.68	0.65	U	0.65	0.87	U	0.87
2-Butanone	VOA	2.8	U	2.8	3.2	U	3.2	2.2	UJ	2.2	2.2	U	2.2	2.9	U	2.9
2-Hexanone	VOA	7.6	U	7.6	8.6	U	8.6	6.0	UJ	6.0	5.8	J	5.8	7.7	U	7.7
4-Methyl-2-Pentanone	VOA	6.8	U	6.8	7.6	U	7.6	5.4	UJ	5.4	5.1	U	5.1	6.9	U	6.9
Acetone	VOA	8.3	U	8.3	36		9.4	32	J	6.6	31		6.4	8.5	U	8.5
Benzene	VOA	0.73	U	0.73	0.82	U	0.82	0.58	UJ	0.58	0.55	U	0.55	0.74	U	0.74
Bromodichloromethane	VOA	0.34	U	0.34	0.39	U	0.39	0.27	UJ	0.27	0.26	U	0.26	0.35	U	0.35
Bromoform	VOA	0.36	U	0.36	0.40	U	0.40	0.28	UJ	0.28	0.27	U	0.27	0.36	U	0.36
Bromomethane	VOA	0.78	U	0.78	0.88	U	0.88	0.61	UJ	0.61	0.59	U	0.59	0.79	U	0.79
Carbon disulfide	VOA	0.65	U	0.65	0.74	U	0.74	0.52	UJ	0.52	0.50	U	0.50	0.66	U	0.66
Carbon tetrachloride	VOA	0.98	U	0.98	1.1	U	1.1	0.77	UJ	0.77	0.74	U	0.74	1.0	U	1.0
Chlorobenzene	VOA	0.84	U	0.84	0.95	U	0.95	0.66	UJ	0.66	0.71	J	0.64	0.85	U	0.85
Chloroethane	VOA	1.4	U	1.4	1.6	U	1.6	1.1	UJ	1.1	1.1	U	1.1	1.4	U	1.4
Chloroform	VOA	3.9	J	0.45	3.7	J	0.51	1.3	J	0.36	3.3	J	0.34	4	J	0.46
Chloromethane	VOA	1.2	U	1.2	1.3	U	1.3	0.95	UJ	0.95	0.91	U	0.91	1.2	U	1.2
cis-1,3-Dichloropropene	VOA	2.0	U	2.0	2.3	U	2.3	1.6	UJ	1.6	1.5	U	1.5	2.0	U	2.0
Dibromochloromethane	VOA	0.88	U	0.88	1.0	U	1.0	0.70	UJ	0.70	0.67	U	0.67	0.90	U	0.90
Ethylbenzene	VOA	1.0	U	1.0	1.2	U	1.2	0.82	UJ	0.82	0.79	U	0.79	1.1	U	1.1
Methylenechloride	VOA	2.5	U	2.5	5.3	J	2.8	2.0	UJ	2.0	1.9	U	1.9	6.9	J	2.5
Styrene	VOA	0.98	U	0.98	1.1	U	1.1	0.77	UJ	0.77	0.74	U	0.74	1.0	U	1.0
Tetrachloroethene	VOA	0.91	U	0.91	1.0	U	1.0	0.72	UJ	0.72	0.70	U	0.70	0.93	U	0.93
Toluene	VOA	1.1	U	1.1	1.2	U	1.2	0.85	UJ	0.85	0.81	U	0.81	1.1	U	1.1
trans-1,3-Dichloropropene	VOA	1.0	U	1.0	1.2	U	1.2	0.82	UJ	0.82	0.79	U	0.79	1.1	U	1.1
Trichloroethene	VOA	0.36	U	0.36	0.40	U	0.40	0.28	UJ	0.28	0.27	U	0.27	0.36	U	0.36
Vinyl chloride	VOA	2.1	U	2.1	2.3	U	2.3	1.6	UJ	1.6	1.6	U	1.6	2.1	U	2.1
Xylenes (total)	VOA	0.95	U	0.95	1.1	U	1.1	0.75	UJ	0.75	0.72	U	0.72	0.96	U	0.96

Attachment	1	Sheet No.	4 of 7
Originator	J. D. Skoglie	Date	10/28/14
Checked	I. B. Berezovskiy	Date	10/28/14
Calc. No.	0100D-CA-V0559	Rev. No.	0

Attachment 1. 100-D-97 Waste Site Verification Sample Results (Metals, TPH, and Physical).

CONSTITUENT	CLASS	STAT-4 - J1TVW5			STAT-5 - J1TVW6			STAT-6 - J1TVW7			STAT-7 - J1TVW8			STAT-8 - J1TXL0		
		8/6/14			8/6/14			8/6/14			8/6/14			8/12/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.5	U	9.5	9.4	U	9.4	9.4	U	9.4	9.2	U	9.2	9.7	U	9.7
Acenaphthylene	PAH	8.6	U	8.6	8.5	U	8.5	8.5	U	8.5	8.2	U	8.2	8.7	U	8.7
Anthracene	PAH	2.9	U	2.9	2.9	U	2.9	2.9	U	2.9	2.8	U	2.8	2.9	U	2.9
Benzo(a)anthracene	PAH	3.4	JX	3.0	12	JX	3.0	3.0	U	3.0	8.3	JX	2.9	3.1	U	3.1
Benzo(a)pyrene	PAH	6.1	U	6.1	6.0	U	6.0	6.0	U	6.0	5.9	U	5.9	6.2	U	6.2
Benzo(b)fluoranthene	PAH	4.0	U	4.0	3.9	U	3.9	4.0	U	4.0	3.8	U	3.8	4.1	U	4.1
Benzo(ghi)perylene	PAH	6.9	U	6.9	6.8	U	6.8	6.8	U	6.8	6.6	U	6.6	7.0	U	7.0
Benzo(k)fluoranthene	PAH	3.8	U	3.8	3.7	U	3.7	3.7	U	3.7	3.6	U	3.6	3.8	U	3.8
Chrysene	PAH	4.6	U	4.6	4.5	U	4.5	4.6	U	4.6	4.4	U	4.4	4.7	U	4.7
Dibenz[a,h]anthracene	PAH	13	JX	10	10	U	10	10	U	10	10	U	10	11	U	11
Fluoranthene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	13	U	13
Fluorene	PAH	5.0	U	5.0	5.0	U	5.0	5.0	U	5.0	4.8	U	4.8	5.1	U	5.1
Indeno(1,2,3-cd)pyrene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	12	U	12
Naphthalene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	12	U	12
Phenanthrene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	12	U	12
Pyrene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	12	U	12
Aroclor-1016	PCB	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.6	U	2.6
Aroclor-1221	PCB	7.9	U	7.9	7.7	U	7.7	7.9	U	7.9	7.7	U	7.7	7.4	U	7.4
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9
Aroclor-1242	PCB	4.6	U	4.6	4.5	U	4.5	4.6	U	4.6	4.5	U	4.5	4.3	U	4.3
Aroclor-1248	PCB	4.6	U	4.6	4.5	U	4.5	4.6	U	4.6	4.5	U	4.5	4.3	U	4.3
Aroclor-1254	PCB	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5	2.4	U	2.4
Aroclor-1260	PCB	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5	2.4	U	2.4
1,1,1-Trichloroethane	VOA	0.68	U	0.68	0.52	U	0.52	0.87	U	0.87	0.85	UJ	0.85	0.38	U	0.38
1,1,2,2-Tetrachloroethane	VOA	0.8	U	0.8	0.61	U	0.61	1.0	U	1.0	1.0	UJ	1.0	0.45	U	0.45
1,1,2-Trichloroethane	VOA	1.2	U	1.2	0.88	U	0.88	1.5	U	1.5	1.4	UJ	1.4	0.65	U	0.65
1,1-Dichloroethane	VOA	0.27	U	0.27	0.21	U	0.21	0.35	U	0.35	0.34	UJ	0.34	0.15	U	0.15
1,1-Dichloroethene	VOA	0.77	U	0.77	0.59	U	0.59	0.99	U	0.99	0.96	UJ	0.96	0.43	U	0.43
1,2-Dichloroethane	VOA	0.92	U	0.92	0.70	U	0.70	1.2	U	1.2	1.1	UJ	1.1	0.51	U	0.51
1,2-Dichloroethene(Total)	VOA	0.51	U	0.51	0.39	U	0.39	0.65	U	0.65	0.64	UJ	0.64	0.29	U	0.29
1,2-Dichloropropane	VOA	0.72	U	0.72	0.55	U	0.55	0.92	U	0.92	0.90	UJ	0.90	0.40	U	0.40
2-Butanone	VOA	2.4	U	2.4	1.8	U	1.8	3.1	U	3.1	3.0	UJ	3.0	22		1.3
2-Hexanone	VOA	6.4	U	6.4	4.9	U	4.9	8.2	U	8.2	8.0	UJ	8.0	19		3.6
4-Methyl-2-Pentanone	VOA	5.7	U	5.7	4.4	U	4.4	7.3	U	7.3	7.1	UJ	7.1	19		3.2
Acetone	VOA	40		7.0	23		5.4	35		9.0	36	J	8.8	31		3.9
Benzene	VOA	0.61	U	0.61	0.47	U	0.47	0.79	U	0.79	0.77	UJ	0.77	0.34	U	0.34
Bromodichloromethane	VOA	0.29	U	0.29	0.22	U	0.22	0.37	U	0.37	0.36	UJ	0.36	0.16	U	0.16
Bromoform	VOA	0.30	U	0.30	0.23	U	0.23	0.39	U	0.39	0.38	UJ	0.38	0.17	U	0.17
Bromomethane	VOA	0.65	U	0.65	0.50	U	0.50	0.84	U	0.84	0.82	UJ	0.82	0.37	U	0.37
Carbon disulfide	VOA	0.55	U	0.55	0.42	U	0.42	0.70	U	0.70	0.69	UJ	0.69	0.31	U	0.31
Carbon tetrachloride	VOA	0.82	U	0.82	0.63	U	0.63	1.1	U	1.1	1.0	UJ	1.0	0.46	U	0.46
Chlorobenzene	VOA	0.71	U	0.71	0.54	U	0.54	0.91	U	0.91	0.88	UJ	0.88	0.40	U	0.40
Chloroethane	VOA	1.2	U	1.2	0.89	U	0.89	1.5	U	1.5	1.5	UJ	1.5	0.65	U	0.65
Chloroform	VOA	3.6	J	0.38	2.4	J	0.29	4.2	J	0.49	1.8	J	0.47	0.79	J	0.21
Chloromethane	VOA	1.0	U	1.0	0.77	U	0.77	1.3	U	1.3	1.3	UJ	1.3	0.56	U	0.56
cis-1,3-Dichloropropene	VOA	1.7	U	1.7	1.3	U	1.3	2.2	U	2.2	2.1	UJ	2.1	0.95	U	0.95
Dibromochloromethane	VOA	0.75	U	0.75	0.57	U	0.57	0.96	U	0.96	0.93	UJ	0.93	0.42	U	0.42
Ethylbenzene	VOA	0.88	U	0.88	0.67	U	0.67	1.1	U	1.1	1.1	UJ	1.1	0.49	U	0.49
Methylenechloride	VOA	6.6		2.1	1.6	U	1.6	2.7	U	2.7	2.6	UJ	2.6	1.2	U	1.2
Styrene	VOA	0.82	U	0.82	0.63	U	0.63	1.1	U	1.1	1.0	UJ	1.0	0.46	U	0.46
Tetrachloroethene	VOA	0.77	U	0.77	0.59	U	0.59	0.99	U	0.99	0.96	UJ	0.96	0.43	U	0.43
Toluene	VOA	1.4	J	0.9	0.69	U	0.69	1.2	U	1.2	1.1	UJ	1.1	0.51	U	0.51
trans-1,3-Dichloropropene	VOA	0.88	U	0.88	0.67	U	0.67	1.1	U	1.1	1.1	UJ	1.1	0.49	U	0.49
Trichloroethene	VOA	0.30	U	0.30	0.23	U	0.23	0.39	U	0.39	0.38	UJ	0.38	0.17	U	0.17
Vinyl chloride	VOA	1.8	U	1.8	1.3	U	1.3	2.2	U	2.2	2.2	UJ	2.2	0.98	U	0.98
Xylenes (total)	VOA	0.80	U	0.80	0.61	U	0.61	1.0	U	1.0	1.0	UJ	1.0	0.45	U	0.45

Attachment	1	Sheet No.	5 of 7
Originator	J. D. Skoglie	Date	10/28/14
Checked	I. B. Berezovskiy	Date	10/28/14
Calc. No.	0100D-CA-V0559	Rev. No.	0

Attachment 1. 100-D-97 Waste Site Verification Sample Results (Metals, TPH, and Physical).

CONSTITUENT	CLASS	STAT-9 - J1TVX0			STAT-10 - J1TVX1			STAT-12 - J1TVX3			FOCUS-1 - J1TVW1			Equipment Blank - J1TVX5		
		8/6/14			8/6/14			8/6/14			8/6/14			8/6/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.2	U	9.2	9.3	U	9.3	9.3	U	9.3	9.7	UN	9.7			
Acenaphthylene	PAH	8.3	U	8.3	8.4	U	8.4	8.4	U	8.4	8.7	UN	8.7			
Anthracene	PAH	2.8	U	2.8	2.8	U	2.8	2.8	U	2.8	3.0	U	3.0			
Benzo(a)anthracene	PAH	2.9	U	2.9	3.0	U	3.0	3.0	U	3.0	3.1	U	3.1			
Benzo(a)pyrene	PAH	5.9	U	5.9	6.0	U	6.0	6.0	U	6.0	6.2	U	6.2			
Benzo(b)fluoranthene	PAH	3.9	U	3.9	3.9	U	3.9	3.9	U	3.9	4.1	UN	4.1			
Benzo(ghi)perylene	PAH	6.6	U	6.6	6.7	U	6.7	6.7	U	6.7	7.0	U	7.0			
Benzo(k)fluoranthene	PAH	3.6	U	3.6	3.7	U	3.7	3.7	U	3.7	3.8	U	3.8			
Chrysene	PAH	4.4	U	4.4	4.5	U	4.5	4.5	U	4.5	4.7	U	4.7			
Dibenz[a,h]anthracene	PAH	10	U	10	10	U	10	10	U	10	11	U	11			
Fluoranthene	PAH	12	U	12	12	U	12	12	U	12	13	UN	13			
Fluorene	PAH	4.8	U	4.8	4.9	U	4.9	4.9	U	4.9	5.1	UN	5.1			
Indeno(1,2,3-cd)pyrene	PAH	11	U	11	11	U	11	11	U	11	12	U	12			
Naphthalene	PAH	11	U	11	11	U	11	11	U	11	12	UN	12			
Phenanthrene	PAH	11	U	11	11	U	11	11	U	11	12	UN	12			
Pyrene	PAH	11	U	11	11	U	11	11	U	11	12	U	12			
Aroclor-1016	PCB	2.8	U	2.8	2.7	U	2.7	2.7	U	2.7	2.6	U	2.6			
Aroclor-1221	PCB	8.0	U	8.0	7.8	U	7.8	7.8	U	7.8	7.6	U	7.6			
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	2.0	U	2	1.9	U	1.9			
Aroclor-1242	PCB	4.7	U	4.7	4.5	U	4.5	4.5	U	4.5	4.4	U	4.4			
Aroclor-1248	PCB	4.7	U	4.7	4.5	U	4.5	4.5	U	4.5	4.4	U	4.4			
Aroclor-1254	PCB	2.6	U	2.6	33		2.5	2.5	U	2.5	2.5	U	2.5			
Aroclor-1260	PCB	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5			
1,1,1-Trichloroethane	VOA	0.67	U	0.67	0.63	U	0.63	0.53	U	0.53	0.69	U	0.69	0.83	U	0.83
1,1,2,2-Tetrachloroethane	VOA	0.79	U	0.79	0.74	U	0.74	0.62	U	0.62	0.81	U	0.81	0.98	U	0.98
1,1,2-Trichloroethane	VOA	1.1	U	1.1	1.1	U	1.1	0.89	U	0.89	1.2	U	1.2	1.4	U	1.4
1,1-Dichloroethane	VOA	0.27	U	0.27	0.25	U	0.25	0.21	U	0.21	0.28	U	0.28	0.34	U	0.34
1,1-Dichloroethene	VOA	0.76	U	0.76	0.71	U	0.71	0.60	U	0.60	0.78	U	0.78	0.95	U	0.95
1,2-Dichloroethane	VOA	0.90	U	0.90	0.84	U	0.84	0.71	U	0.71	0.93	U	0.93	1.1	U	1.1
1,2-Dichloroethene(Total)	VOA	0.50	U	0.50	0.47	U	0.47	0.39	U	0.39	0.52	U	0.52	0.63	U	0.63
1,2-Dichloropropane	VOA	0.71	U	0.71	0.66	U	0.66	0.56	U	0.56	0.73	U	0.73	0.88	U	0.88
2-Butanone	VOA	2.4	U	2.4	2.2	U	2.2	1.8	U	1.8	2.4	UX	2.4	2.9	U	2.9
2-Hexanone	VOA	6.3	U	6.3	5.9	U	5.9	4.9	U	4.9	6.5	U	6.5	7.8	U	7.8
4-Methyl-2-Pentanone	VOA	5.6	U	5.6	5.3	U	5.3	4.4	U	4.4	5.8	UX	5.8	7.0	U	7.0
Acetone	VOA	29		6.9	26		6.5	5.4	U	5.4	7.2	U	7.2	15	J	8.6
Benzene	VOA	0.61	U	0.61	0.57	U	0.57	0.47	U	0.47	0.63	U	0.63	0.75	U	0.75
Bromodichloromethane	VOA	0.28	U	0.28	0.27	U	0.27	0.22	U	0.22	0.29	U	0.29	0.35	U	0.35
Bromoform	VOA	0.30	U	0.30	0.28	U	0.28	0.23	U	0.23	0.31	U	0.31	0.37	U	0.37
Bromomethane	VOA	0.65	U	0.65	0.60	U	0.60	0.51	U	0.51	0.66	U	0.66	0.80	U	0.80
Carbon disulfide	VOA	0.54	U	0.54	0.51	U	0.51	0.42	U	0.42	0.56	U	0.56	0.67	U	0.67
Carbon tetrachloride	VOA	0.81	U	0.81	0.76	U	0.76	0.64	U	0.64	0.84	U	0.84	1.0	U	1.0
Chlorobenzene	VOA	0.70	U	0.70	0.65	U	0.65	0.55	U	0.55	0.72	U	0.72	0.87	U	0.87
Chloroethane	VOA	1.1	U	1.1	1.1	U	1.1	0.90	U	0.90	1.2	U	1.2	1.4	U	1.4
Chloroform	VOA	2.9	J	0.37	2.8	J	0.35	1.8	J	0.29	3.9	J	0.39	3.2	J	0.47
Chloromethane	VOA	0.99	U	0.99	0.93	U	0.93	0.78	U	0.78	1.0	U	1.0	1.2	U	1.2
cis-1,3-Dichloropropene	VOA	1.7	U	1.7	1.6	U	1.6	1.3	U	1.3	1.7	U	1.7	2.1	U	2.1
Dibromochloromethane	VOA	0.74	U	0.74	0.69	U	0.69	0.58	U	0.58	0.76	U	0.76	0.91	U	0.91
Ethylbenzene	VOA	0.86	U	0.86	0.81	U	0.81	0.68	U	0.68	0.89	U	0.89	1.1	U	1.1
Methylenechloride	VOA	3.8	J	2.1	1.9	U	1.9	6.9		1.6	5.6	J	2.1	2.6	U	2.6
Styrene	VOA	0.81	U	0.81	0.76	U	0.76	0.64	U	0.64	0.84	U	0.84	1.0	U	1.0
Tetrachloroethene	VOA	0.76	U	0.76	0.71	U	0.71	0.60	U	0.60	0.78	U	0.78	0.95	U	0.95
Toluene	VOA	0.90	J	0.89	0.83	U	0.83	1.0	J	0.7	1.8	J	0.92	1.1	U	1.1
trans-1,3-Dichloropropene	VOA	0.86	U	0.86	0.81	U	0.81	0.68	U	0.68	0.89	U	0.89	1.1	U	1.1
Trichloroethene	VOA	0.30	U	0.30	0.28	U	0.28	0.23	U	0.23	0.31	U	0.31	0.37	U	0.37
Vinyl chloride	VOA	1.7	U	1.7	1.6	U	1.6	1.4	U	1.4	1.8	U	1.8	2.1	U	2.1
Xylenes (total)	VOA	0.79	U	0.79	0.74	U	0.74	0.62	U	0.62	0.81	U	0.81	0.98	U	0.98

Attachment	1	Sheet No.	6 of 7
Originator	J. D. Skoglie	Date	10/28/14
Checked	I. B. Berezovskiy	Date	10/28/14
Calc. No.	0100D-CA-V0559	Rev. No.	0

Attachment 1. 100-D-97 Waste Site Verification Sample Results (Metals, TPH, and Physical).

CONSTITUENT	CLASS	Trip Blank - J1TVX6		
		8/6/14		
		ug/kg	Q	PQL
Acenaphthene	PAH			
Acenaphthylene	PAH			
Anthracene	PAH			
Benzo(a)anthracene	PAH			
Benzo(a)pyrene	PAH			
Benzo(b)fluoranthene	PAH			
Benzo(ghi)perylene	PAH			
Benzo(k)fluoranthene	PAH			
Chrysene	PAH			
Dibenz[a,h]anthracene	PAH			
Fluoranthene	PAH			
Fluorene	PAH			
Indeno(1,2,3-cd)pyrene	PAH			
Naphthalene	PAH			
Phenanthrene	PAH			
Pyrene	PAH			
Aroclor-1016	PCB			
Aroclor-1221	PCB			
Aroclor-1232	PCB			
Aroclor-1242	PCB			
Aroclor-1248	PCB			
Aroclor-1254	PCB			
Aroclor-1260	PCB			
1,1,1-Trichloroethane	VOA	0.86	U	0.86
1,1,2,2-Tetrachloroethane	VOA	1.0	U	1.0
1,1,2-Trichloroethane	VOA	1.5	U	1.5
1,1-Dichloroethane	VOA	0.35	U	0.35
1,1-Dichloroethene	VOA	0.98	U	0.98
1,2-Dichloroethane	VOA	1.2	U	1.2
1,2-Dichloroethene(Total)	VOA	0.64	U	0.64
1,2-Dichloropropane	VOA	0.91	U	0.91
2-Butanone	VOA	3.0	U	3.0
2-Hexanone	VOA	8.1	U	8.1
4-Methyl-2-Pentanone	VOA	7.2	U	7.2
Acetone	VOA	17	J	8.9
Benzene	VOA	0.78	U	0.78
Bromodichloromethane	VOA	0.36	U	0.36
Bromoform	VOA	0.38	U	0.38
Bromomethane	VOA	0.83	U	0.83
Carbon disulfide	VOA	0.69	U	0.69
Carbon tetrachloride	VOA	1.0	U	1.0
Chlorobenzene	VOA	0.89	U	0.89
Chloroethane	VOA	1.5	U	1.5
Chloroform	VOA	3.4	J	0.48
Chloromethane	VOA	1.3	U	1.3
cis-1,3-Dichloropropene	VOA	2.1	U	2.1
Dibromochloromethane	VOA	0.94	U	0.94
Ethylbenzene	VOA	1.1	U	1.1
Methylenechloride	VOA	2.6	U	2.6
Styrene	VOA	1.0	U	1.0
Tetrachloroethene	VOA	0.98	U	0.98
Toluene	VOA	1.1	U	1.1
trans-1,3-Dichloropropene	VOA	1.1	U	1.1
Trichloroethene	VOA	0.38	U	0.38
Vinyl chloride	VOA	2.2	U	2.2
Xylenes (total)	VOA	1.0	U	1.0

Attachment	1	Sheet No.	7 of 7
Originator	J. D. Skoglie	Date	10/28/14
Checked	I. B. Berezovskiy	Date	10/28/14
Calc. No.	0100D-CA-V0559	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-D Area Closure Operations **Job No. 14655**

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0560

Subject: 100-D-97 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation

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. Skoglie	I. B. Berezovskiy	R. J. Nielson	S. G. Wilkinson	3/10/15

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:	10/28/14	Calc. No.:	0100D-CA-V0560	Rev.:	0
Project:	100-D Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	10/28/14
Subject:	100-D-97 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					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 100-D-97 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009a), the following criteria must be met:

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

GIVEN/REFERENCES:

1) DOE-RL, 2009a, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas,* DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2009b, 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

4) WCH, 2014, *100-D-97 Waste Site Cleanup Verification 95% UCL Calculation,* 0100D-CA-V0559, Rev. 0, Washington Closure Hanford, 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 2009a).

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

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

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

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	10/28/14	Calc. No.:	0100D-CA-V0560	Rev.:	0
Project:	100-D Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	10/28/14
Subject:	100-D-97 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	2 of 3

METHODOLOGY:

The 100-D-97 waste site is comprised of one decision unit for verification sampling; the excavation area. In addition, one focused sample was collected from the excavation area. The direct contact hazard quotient and carcinogenic risk calculations for the 100-D-97 waste site were conservatively calculated for the entire waste site using the greater of the statistical or maximum value for each analyte in all decision units from WCH (2014). Of the contaminants of potential concern (COPCs) for this site, boron, hexavalent chromium, molybdenum, the detected polycyclic aromatic hydrocarbons, the detected volatiles, and aroclor-1254 require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Although total petroleum hydrocarbons (diesel range extended) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. All other site nonradionuclide COPCs 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 boron is 1.2 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 1.7×10^{-4}. 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 2.4×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the statistical value for hexavalent chromium is 0.389 mg/kg; divided by 2.1 mg/kg, and multiplied as indicated, is 1.9×10^{-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 is obtained by summing the individual values. The excess cancer risk for the carcinogenic constituents detected is 2.7×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

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 $>1 \times 10^{-6}$: None
4) List the cumulative excess cancer risk for carcinogens $>1 \times 10^{-5}$: None

Table 1 shows the results of the calculations.

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	12/18/14	Calc. No.:	0100D-CA-V0560	Rev.:	0
Project:	100-D Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	12/18/14
Subject:	100-D-97 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	3 of 3

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-D-97 Waste Site.

Contaminants of Potential Concern	Maximum or Statistical Value [a] (mg/kg)	Noncarcinogen RAG [b] (mg/kg)	Hazard Quotient	Carcinogen RAG [b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.2	7,200	1.7E-04	--	--
Chromium, hexavalent [c]	0.389	240	1.6E-03	2.1	1.9E-07
Molybdenum	0.52	400	1.3E-03	--	--
Polycyclic Aromatic Hydrocarbons					
Benzo(a)anthracene	0.012	--	--	1.37	8.8E-09
Dibenz(a,h)anthracene	0.013	--	--	1.37	9.5E-09
Polychlorinated Biphenyls					
Aroclor-1254	0.033	1.6	2.1E-02	0.5	6.6E-08
Volatiles					
2-Butanone	0.022	48,000	4.6E-07	--	--
2-Hexanone	0.019	400	4.8E-05	--	--
4-methyl 2-pentanone	0.019	6,400	3.0E-06	--	--
Acetone	0.031	72,000	4.3E-07	--	--
Chlorobenzene	0.00071	1,600	4.4E-07	--	--
Chloroform	0.0039	800	4.9E-06	164	2.4E-11
Methylene chloride	0.0069	480	1.4E-05	500	1.4E-11
Toluene	0.0018	6,400	2.8E-07	--	--
Total Petroleum Hydrocarbons					
TPH - diesel range extended [d]	25	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**2.4E-02**		
Cumulative Excess Cancer Risk:					**2.7E-07**

Notes:

[a] = From WCH (2014).

[b] = Value obtained from the RDR/RAWP (DOE-RL 2009b) or *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

[c] = Value for the carcinogen RAG calculated based on the inhalation exposure pathway (WAC) 173-340-750(3), 1996.

[d] = The risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation.

-- = not applicable

RAG = remedial action goal

CONCLUSION:

The calculations in Table 1 demonstrate that the 100-D-97 waste site meets the requirements for the direct contact hazard quotient and carcinogenic (excess cancer) risk, respectively, as identified in the RDR/RAWP (DOE-RL 2009a) and SAP (DOE-RL 2009b). The direct contact hazard quotient and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-D Area Closure Operations **Job No. 14655**

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0561

Subject: 100-D-97 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater

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. Skoglie	I. B. Berezovskiy	R. J. Nielson	S. G. Wilkinson	3/10/15

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:	10/29/2014	Calc. No.:	0100D-CA-V0561	Rev.:	0
Project:	100-D Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	10/29/2014
Subject:	100-D-97 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 1 of 3	

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for the 100-D-97 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009), the following criteria must be met:

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

GIVEN/REFERENCES:

1) BHI, 2005, *100 Area Analogous Sites RESRAD Evaluation*, Calculation No. 0100X-CA-V0050 Rev 0, Bechtel Hanford, Inc., Richland, Washington.

2) DOE-RL, 2009, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas,* DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

4) WCH, 2014, *100-D-97 Waste Site Cleanup Verification 95% UCL Calculations*, 0100D-CA-V0561, Rev. 0, Washington Closure Hanford, Richland, Washington.

SOLUTION:

1) Generate a HQ for each noncarcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

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

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

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

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	12/18/2014	Calc. No.:	0100D-CA-V0561	Rev.:	0
Project:	100-D Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	12/18/2014
Subject:	100-D-97 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 2 of 3	

METHODOLOGY:

The 100-D-97 waste site is comprised of one decision unit for verification sampling; the excavation area. In addition, one focused sample was collected from the excavation area. Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at the 100-D-97 waste site were conservatively calculated for the entire waste site using the greater of the statistical or maximum value for each analyte in all decision units from the 95% UCL calculation (WCH 2014). Based on this model and a vadose zone of approximately 23 m (75.5 ft) thick, a K_d of 3.3 or greater is required to show no predicted migration to groundwater in 1,000 years. Of the contaminants of potential concern (COPCs) for this site, boron, hexavalent chromium, and the detected volatiles are included because no Washington State or Hanford background value has been established and the distribution coefficients are less than that necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (BHI 2005). All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than or equal to 3.3. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (mg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720(3)(a)(ii)(A), 1996) x 100 x 1 mg/1000 mg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii)(A) (1996). For example, the statistical value for boron of 1.2 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg is 3.8×10^{-3}. Comparing this value 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 cumulative HQ for the 100-D-97 waste site is 9.0×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value. For example, the maximum value for chloroform of 0.0039 mg/kg, divided by 0.717 mg/kg, is 5.4×10^{-9}. Comparing this value, and all other individual values, 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 cumulative excess cancer risk for the 100-D-97 waste site is 8.6×10^{-9}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

5) WAC 173-340-740(3)(a)(ii)(A) (1996) provides the "100 times rule" but also states "unless it can be demonstrated that a higher soil concentration is protective of ground water at the site." When the "100 times rule" values are exceeded, RESRAD was used to demonstrate that higher soil concentrations may be protective of groundwater."

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	12/18/2014	Calc. No.:	0100D-CA-V0561	Rev.:	0
Project:	100-D Area Closure Operations	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	12/18/2014
Subject:	100-D-97 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					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. Hazard Quotient and Excess Cancer Risk Results for the 100-D-97 Waste Site.

Contaminants of Potential Concern[a]	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.2	320	3.8E-03	--	--
Chromium, hexavalent	0.389	4.8	8.1E-02	--	--
Volatiles					
2-Butanone	0.022	480	4.6E-05	--	--
2-Hexanone	0.019	8	2.4E-03	--	--
4-methyl 2-pentanone	0.019	64	3.0E-04	--	--
Acetone	0.031	720	4.3E-05	--	--
Chlorobenzene	0.00071	16	4.4E-05	--	--
Chloroform	0.0039	8	4.9E-04	0.717	5.4E-09
Methylene chloride	0.0069	4.8	1.4E-03	2.19	3.2E-09
Toluene	0.0018	64	2.8E-05	--	--
Totals					
Cumulative Hazard Quotient:			**9.0E-02**		
Cumulative Excess Cancer Risk:					**8.6E-09**

Notes:

[a] = From WCH (2014).

[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.

-- = not applicable

RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 100-D-97 waste site meets the requirements for the hazard quotient and excess carcinogenic risk for protection of groundwater as identified in the RDR/RAWP (DOE-RL 2009).

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 2014b). This DQA was performed in accordance with site-specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009).

A review of the sample design (WCH 2014b), the field logbook (WCH 2014a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design, with minimal alterations, as warranted by field conditions.

To ensure quality data, the 100 Area SAP (DOE-RL 2009) data assurance requirements and the data validation procedures for chemical analysis (BHI 2000) is 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 data from samples collected at the 100-D-97 waste site were provided by the laboratories in two sample delivery group (SDG): SDG JP0846 and JP0848. SDG JP0846 was submitted for third-party validation. No major deficiencies were identified in the 100-D-97 data set. Minor deficiencies are discussed for the data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

MINOR DEFICIENCIES

SDG JP0846

This SDG comprises sixteen total samples (J1TVX1 through J1TVX6, J1TVW1 through J1TVW9, J1TVX0). One focused soil sample (J1TVW1) from the excavation is included in this data set. This SDG includes one field duplicate pair (J1TVX2/J1TVX4). All field samples were analyzed for inductively coupled plasma (ICP) metals, mercury, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), hexavalent chromium, and polycyclic aromatic hydrocarbons (PAH). The field equipment blank sample (J1TVX5) was collected and analyzed for ICP metals, mercury, and VOCs. Additionally, a VOC trip blank (J1TVX6) was analyzed for VOCs. SDG JP0846 was submitted for third-party validation. Minor deficiencies are as follows.

In the VOC analysis, the common laboratory contaminants acetone and chloroform were detected in the equipment blank (J1TVX5) and in the VOC trip blank (J1TVX6) at low concentrations. There is no impact on the field sample results. The data are usable for decision-making purposes.

In the VOC analysis, samples J1TVW2 and J1TVW6 were analyzed without associated matrix spike (MS) or matrix spike duplicate analyses due to insufficient sample volume to prepare these spikes. Third-party validation has qualified all VOC results in samples J1TVW2 and J1TVW6 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the VOC analysis, the MS/ matrix spike duplicate recoveries were outside the laboratory quality control (QC) limits for several compounds. Acceptable laboratory control samples (LCSs) indicate that the analytical system was operating within control. However, the laboratory has qualified the associated data with "T" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the mercury analysis, mercury was detected in the MB and in the field samples at similar low concentrations. Third-party validation qualified all mercury results in SDG JP0846 as estimated and non-detected with "UJ" flags. Estimated and non-detected data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for antimony (59%), beryllium (68%), calcium (148%), silicon (23%), and vanadium (131 %) are outside the QC limits. Third-party validation qualified all antimony, beryllium, calcium, silicon, and vanadium results in SDG JP0846 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, serial dilutions indicate physical and chemical interferences are present for several analytes. The laboratory has qualified the associated data with "X" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, high concentrations of titanium in sample J1TVW1 necessitated a5 times dilution in order to minimize interference with antimony, beryllium, cobalt, copper, lead, magnesium, vanadium, and zinc. The reporting limits have been adjusted as needed. These data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon is outside the laboratory QC limits. The laboratory has qualified associated silicon results with "N" flags. Silicon has a history of poor analytical performance. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, the relative percent difference (RPD) between the primary and confirmatory columns exceeded the laboratory QC limit (40%) for some analytes in samples J1TVW5, J1TVW6, and J1TVW8. The laboratory has qualified the associated results with "X" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, the MS results exhibited spike compound and surrogate recoveries outside the QC limits. The laboratory has qualified the associated data with "N" flags. Acceptable LCS results indicate that the analytical system was operating within control. These data may be considered estimated. Estimated data are usable for decision-making purposes.

SDG JP0848

This SDG comprises one sample (J1TXL0) collected from the 100-D-97 excavation. This sample was analyzed for ICP metals, mercury, TPH, VOCs, PCBs, hexavalent chromium, and PAH. Minor deficiencies are as follows.

In the ICP metals analysis, serial dilution indicates physical and chemical interferences are present for cobalt, copper, nickel, and zinc. The laboratory has qualified results in sample J1TXL0 for cobalt, copper, nickel, and zinc with "X" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for boron, calcium, and silicon are outside the laboratory QC limits. The laboratory has qualified the associated sample data with 'N" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance (QA)/QC measures 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 2014a) 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
Excavation Area	J1TVX2	J1TVX4

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 to be

indicative of the analytical system performance. The calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation.

In the duplicate evaluation, none of the RPDs calculated for the 100-D-97 data set are above the acceptance criteria of 30%. 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, including undetected analytes. 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. No data required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues, such as those discussed above, are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 100-D-97 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 100-D-97 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes.

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

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