Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

14-AMRP-0180 MAY 01 2014

Mr. D. A. Faulk, Program Manager
Office of Environmental Cleanup
Hanford Project Office
U.S. Environmental Protection Agency
309 Bradley Boulevard, Suite 115
Richland, Washington 99352

Dear Mr. Faulk:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 600-279, VEGETATION FREE AREA BETWEEN WHITE BLUFFS AND 100F, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2013-134 and supporting, "Remaining Waste Site Verification Package for the 600-279, Vegetation Free Area Between White Bluffs and 100F," Rev. 0. If you have questions, please contact me or your staff may contact Ellwood Glossbrenner, of my staff, at (509) 376-5828.

Sincerely,

Mark S. French, Director
River Corridor Division

AMRP:ETG

Attachment

cc w/attach:
C. J. Guzzetti, EPA
Administrative Record, H6-08

cc w/o attach:
R. D. Cantwell, WCH
S. L. Feaster, WCH
T. Q. Howell, WCH
D. L. Plung, WCH
J. P. Shearer, CHPRC

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-2 **Control No.:** 2013-134

Waste Site Code(s)/Subsite Code(s):

600-279, Vegetation Free Area between White Bluffs and 100F

Reclassification Category: Interim ☒ Final ☐

Reclassification Status: Closed Out ☒ No Action ☐ Rejected ☐

RCRA Postclosure ☐ Consolidated ☐ None ☐

Approvals Needed: DOE ☒ Ecology ☐ EPA ☒

Description of current waste site condition:

The 600-279, Vegetation Free Area between White Bluffs and 100F waste site, located in the 100-IU-2 Operable Unit of the Hanford Site, consisted of a large area of no vegetation covered with ash and bits of burned debris. The 600-279 waste site is located northwest of the 105-F facility and 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 "plug-in" site for remove, treat, and dispose in the Fact Sheet *100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2012*, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2013). This waste site was remediated as a "plug-in" site in accordance with 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 600-279 waste site was performed over an area of 1,158 m^2 (12,465 ft^2) from September 30 through October 22, 2013. A total of approximately 765 bank cubic meters (1,001 bank cubic yards) of material was removed and direct loaded for disposal at the Environmental Restoration Disposal Facility (ERDF). Cleanup verification sampling was performed on October 23 and November 13, 2013, to determine if the waste site meets remedial action objectives (RAOs) and remedial action goals (RAGs) established by the Remaining Sites ROD (EPA 1999) and 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). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the ERDF at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-279 waste site to Interim Closed Out. The current site conditions achieve the RAOs and RAGs established by the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). The results of verification sampling 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 analytical results and rationale presented in the attached remaining sites verification package also demonstrate that residual contaminant concentrations meet direct exposure cleanup criteria and are protective of groundwater and the Columbia River. Residual contamination above direct exposure levels was not observed in shallow or deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 600-279, Vegetation Free Area Between White Bluffs and 100F* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-2 **Control No.:** 2013-134

Waste Site Code(s)/Subsite Code(s):

600-279, Vegetation Free Area between White Bluffs and 100F

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	JPNeath	4/8/14
DOE Federal Project Director (printed)	Signature	Date
N/A		
Ecology Project Manager (printed)	Signature	Date
C. Guzzetti		4/17/14
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-279, VEGETATION FREE AREA BETWEEN WHITE BLUFFS AND 100F

Attachment to Waste Site Reclassification Form 2013-134

April 2014

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-279, VEGETATION FREE AREA BETWEEN WHITE BLUFFS AND 100F

EXECUTIVE SUMMARY

The 600-279, Vegetation Free Area between White Bluffs and 100F waste site, located in the 100-IU-2 Operable Unit, consisted of a large area having no vegetation and covered with ash and bits of burned debris. The 600-279 waste site is located northwest of the 105-F facility. It is on the west side of the 100-F Area western perimeter road near the northwest corner of the 100-F Area. This 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) (EPA 1999) as a "plug-in" site for remove, treat, and dispose in the Fact Sheet *100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2012* (DOE-RL 2013). This waste site was recommended for remove, treat, and dispose based on the observed presence of stained soils, no vegetation, and a strong odor of sulfur. It was remediated as a "plug-in" site in accordance with the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington* (EPA 2009).

Remediation of the 600-279 waste site was performed from September 30 through October 22, 2013. All materials (stained and affected soil, surface debris such as wood, metal, and bricks) were directly loaded for disposal at the Environmental Restoration Disposal Facility. The approximate volume of material removed from the 600-279 waste site is 765 bank cubic meters (1,001 bank cubic yards). No overburden soil was stockpiled to be used as backfill.

Following remediation, verification sampling was conducted for the 600-279 waste site on October 23 and November 13, 2013. These results indicated that residual contaminant concentrations met the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 600-279 waste site. Verification sampling results support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The results indicated that the waste removal action achieved compliance with the RAOs and RAGs for the 600-279 waste site.

A summary of the cleanup evaluation for the soil results compared to the applicable cleanup criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

Table ES-1. Summary of Remedial Action Goals for the 600-279 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15 mrem/yr above background over 1,000 years.	Radionuclides were not COPCs for the 600-279 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC 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 (2.6×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk values for individual nonradionuclide COPCs are all $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The cumulative excess cancer risk (3.6×10^{-7}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COC groundwater and river RAGs.	Radionuclides were not COPCs for the 600-279 waste site.	NA
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [a].		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 21.2 pCi/L [c].		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are present at concentrations exceeding soil RAGs for groundwater and/or Columbia River protection. However, an evaluation based upon RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b) shows that residual concentrations of these constituents are predicted to be protective of groundwater and the river [d].	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).

[b] *Radiation Protection of the Public and 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 RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years (based on the contaminant with the lowest distribution coefficient, lead, with a value of 30 mL/g). The vadose zone underlying the soil below the site is approximately 6.2 m (20.3 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

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

In accordance with this evaluation, the verification sampling results support a reclassification of this site to interim closed out. The current site conditions achieve the RAOs and the corresponding RAGs established in the 100 Area RDR/RAWP (DOE-RL 2009b) and the 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 contaminant levels remaining in the soil are protective of groundwater and the Columbia River. The 600-279 waste site was excavated to a depth of approximately 3.7 to 6.1 m (12 to 20 ft) below ground surface. Residual contamination above direct exposure levels was not observed in shallow or deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part 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 site contaminants of concern, contaminants of potential concern, and other constituents. Those constituents exceeding the ecological screening level in *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were arsenic, boron, and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for lead, manganese, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of manganese and vanadium are below Hanford Site background levels, it is believed that the presence of manganese 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 the Columbia River corridor portion of the Hanford Site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-279, VEGETATION FREE AREA BETWEEN WHITE BLUFFS AND 100F

STATEMENT OF PROTECTIVENESS

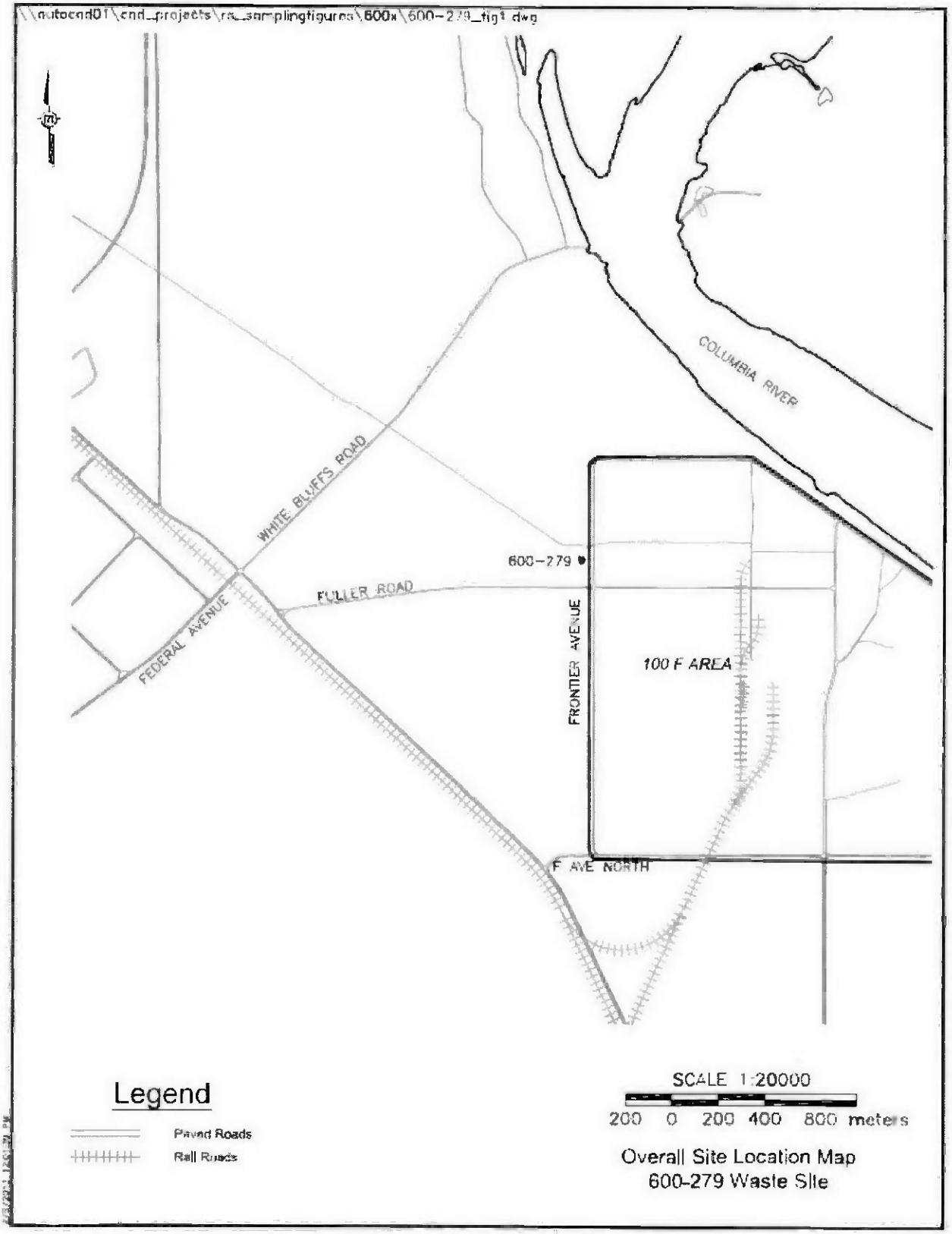
The 600-279, Vegetation Free Area between White Bluffs and 100F waste site verification sampling data, site evaluations, and supporting documentation demonstrate that this waste site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area 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. Residual contamination above direct exposure levels at the 600-279 waste site was not observed in shallow or deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part 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 site contaminants of concern, contaminants of potential concern (COPCs), and other constituents. Those constituents exceeding the ecological screening level in *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were arsenic, boron, and vanadium. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for lead, manganese, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of manganese and vanadium are below Hanford Site background levels, it is believed that the presence of manganese 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 the Columbia River corridor portion of the Hanford Site.

GENERAL SITE INFORMATION AND BACKGROUND

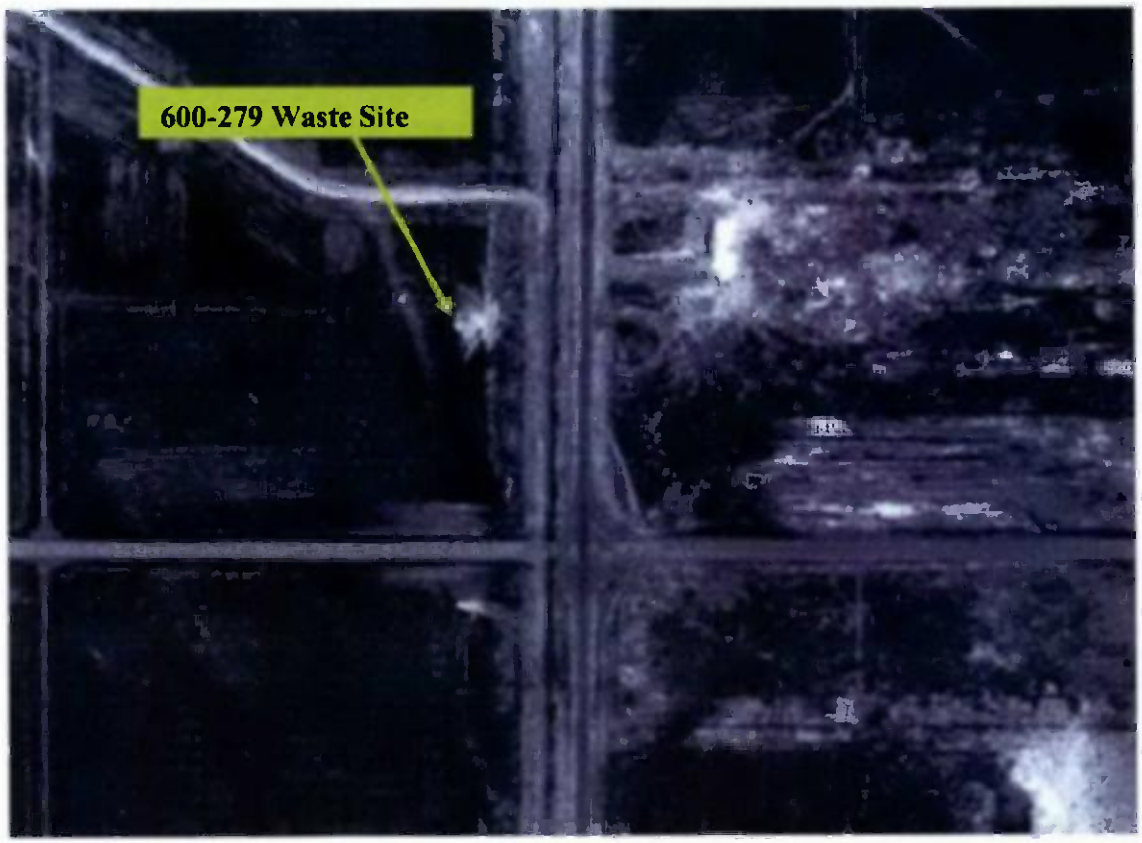
The 600-279 waste site consists of a large area of no vegetation covered with ash and bits of burned debris located northwest of the 105-F facility within the 100-IU-2 Operable Unit. The waste site is on the west side of the 100-F Area western perimeter road near the northwest corner of the 100-F Area (Figure 1). The Washington State Plane coordinates for this waste site are N 148089.2, E 579584.2.

Figure 1. The 600-279 Waste Site Location Map.



There is no process history associated with the 600-279 waste site. The 600-279 waste site is likely related to pre-Hanford orchard activities where pesticides were routinely sprayed to control pests on orchard crops. An aerial photograph from 1948 shows the 600-279 waste site located in the northeast corner of an abandoned pre-Hanford orchard (Figure 2). According to *Pre-Hanford Agricultural History: 1900-1943* (BHI 1999), apples, apricots, pears, peaches, and prunes were produced in those areas during the pre-Hanford era. Apples were the leading crops in the pre-Hanford orchards although many were replaced with soft fruits such as grapes, peaches, and apricots in the early 1930s when apple production declined due to the increased costs to control codling moth (apple pest). Lead-arsenate compounds were used to control codling moth, and lime sulfur was used to control a variety of pests such as scale, red spiders, mold, and mildew.

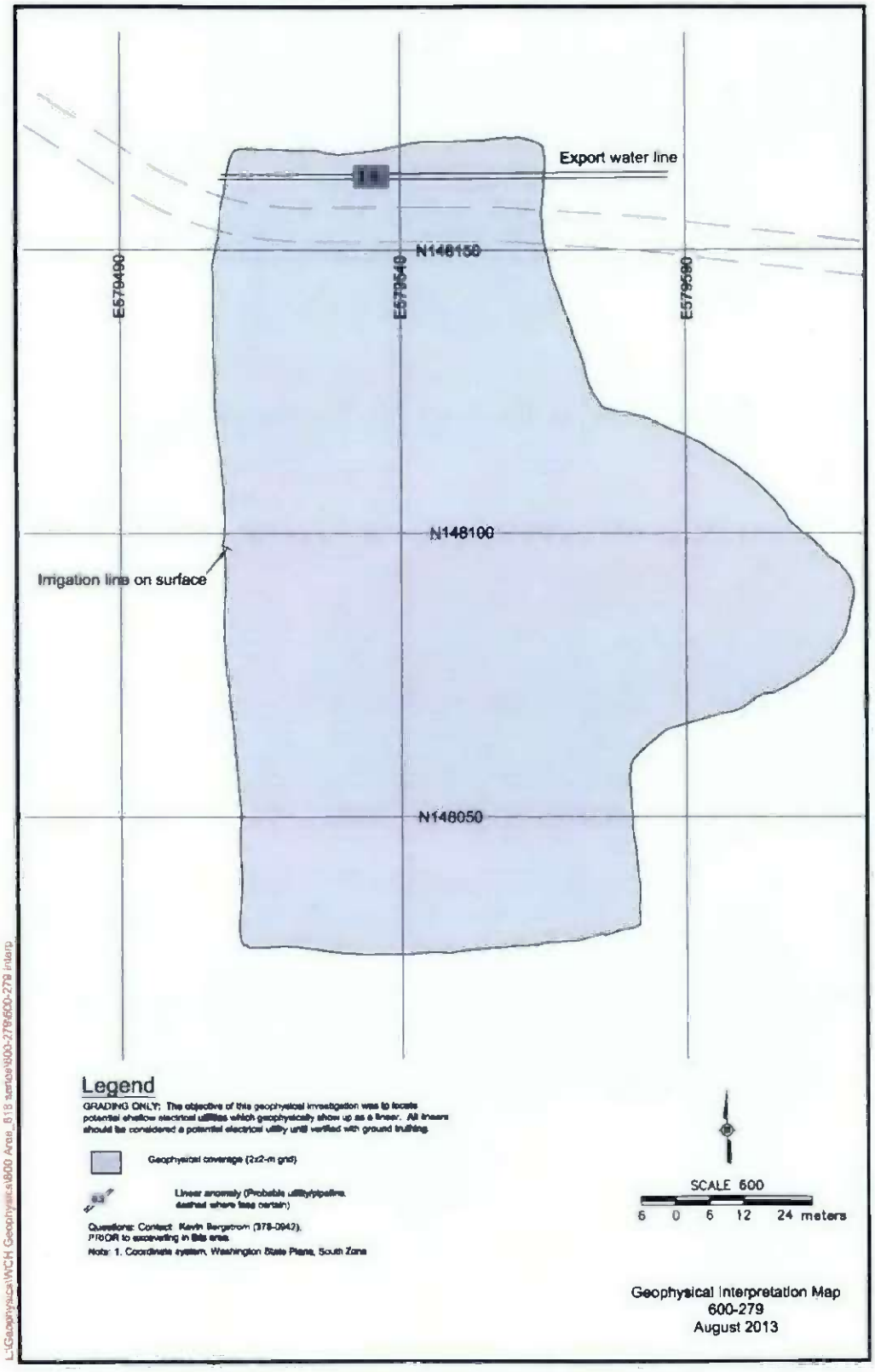
Figure 2. Aerial Photograph of the 600-279 Waste Site (1948).



Geophysical Survey

The objective of the geophysical survey was to determine if any utilities were located in the area of the 600-279 waste site. The geophysical interpretation map is included in Figure 3. No anomalies or utility lines were identified by the geophysical investigation.

Figure 3. Geophysical Interpretation Map for the 600-279 Waste Site.



In-Process/Waste Characterization Sampling

In-process and/or waste characterization sampling was performed to determine the COPCs for each waste site, determine waste disposal practices, and guide remedial actions. In-process sampling at the 600-279 waste site for the purpose of waste management consisted of two composite samples: J1RWK4 collected August 19, 2013, and J1T3J3 collected on October 8, 2013. A portion of the site was observed to be covered with ash, burned debris (pieces of brick, metal, and wood), and yellow stained soil with a sulfur odor in both waste management sampling events. All contaminated soil, ash, and debris was subsequently removed during the waste site remedial actions.

Sample J1RWK4 was analyzed for inductively coupled plasma (ICP) metals, mercury, ion chromatography, anions, sulfide, herbicides, pesticides, semi-volatile organic compounds (SVOCs), volatile organic compounds, and pH. The sample results indicated exceedances of the direct exposure remedial action goal (RAG) for arsenic and exceedances of groundwater and river protection RAGs for lead and multiple SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene). Also indicated in the result was a low soil pH value, pH 2.88.

Sample J1T3J3 was analyzed for ICP metals, pesticides, and pH. The sample results were detected well below RAGs. The pH was 4.0.

The results of the in-process sampling are summarized in Table 1 and the sample results are included in Appendix A.

Table 1. 600-279 In-Process Sample Summary (WCH 2013a).

HEIS Sample Number	Sample Date	Northing[a]	Easting[a]	Sample Depth	Sample Analysis
J1RWK4	8/19/2013	148089	579584	0 ft bgs	ICP metals, mercury, SVOA, VOA, IC anions, sulfide, pesticides, herbicides, pH
J1T3J3	10/8/2013	148087	579578	10-12 ft bgs (from west)	ICP metals, mercury, pesticides, pH

[a] Northing and easting are approximate due to the nature of composite sampling.

bgs = below ground surface
HEIS = Hanford Environmental Information System
IC = ion chromatography
ICP = inductively coupled plasma
SVOA = semivolatile organic analysis
VOA = volatile organic analysis

REMEDIAL ACTION SUMMARY

The 600-279 waste site was recommended as a "plug-in" site for remove, treat, and dispose in the fact sheet *100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2012 - Annual Listing of Waste Sites Plugged into the Remove, Treat and Dispose Remedy in the 1999 Interim Action Record of Decision for the 100 Area* (DOE-RL 2013) based on the observed presence of stained soils, no vegetation, and strong odor of sulfur at this site (WCH 2013a).

Remedial Action

Remediation of the 600-279 waste site was performed over an area of 1,158 m^2 (12,465 ft^2) from September 30 through October 22, 2013. The 600-279 waste site is situated on a sloped area of land that inclines toward the southeast. Therefore, the maximum excavation depth is approximately 6.1 m (20 ft) from the west side of the waste site and 3.7 to 4.6 m (12 to 15 ft) from the east side. All material (stained and affected soil; surface debris such as wood, metal, and bricks) was directly loaded from the excavation into Environmental Restoration Disposal Facility (ERDF) containers for disposal at ERDF. The approximate volume of material removed from the 600-279 waste site was 765 bank cubic meters (1,001 bank cubic yards).

No anomalous materials were encountered during the excavation. There are no overburden piles or waste staging pile areas associated with the 600-279 waste site.

Figure 4 is a photograph of the 600-279 waste site prior to remediation. Figures 5 and 6 are post remediation photographs of the 600-279 waste site.

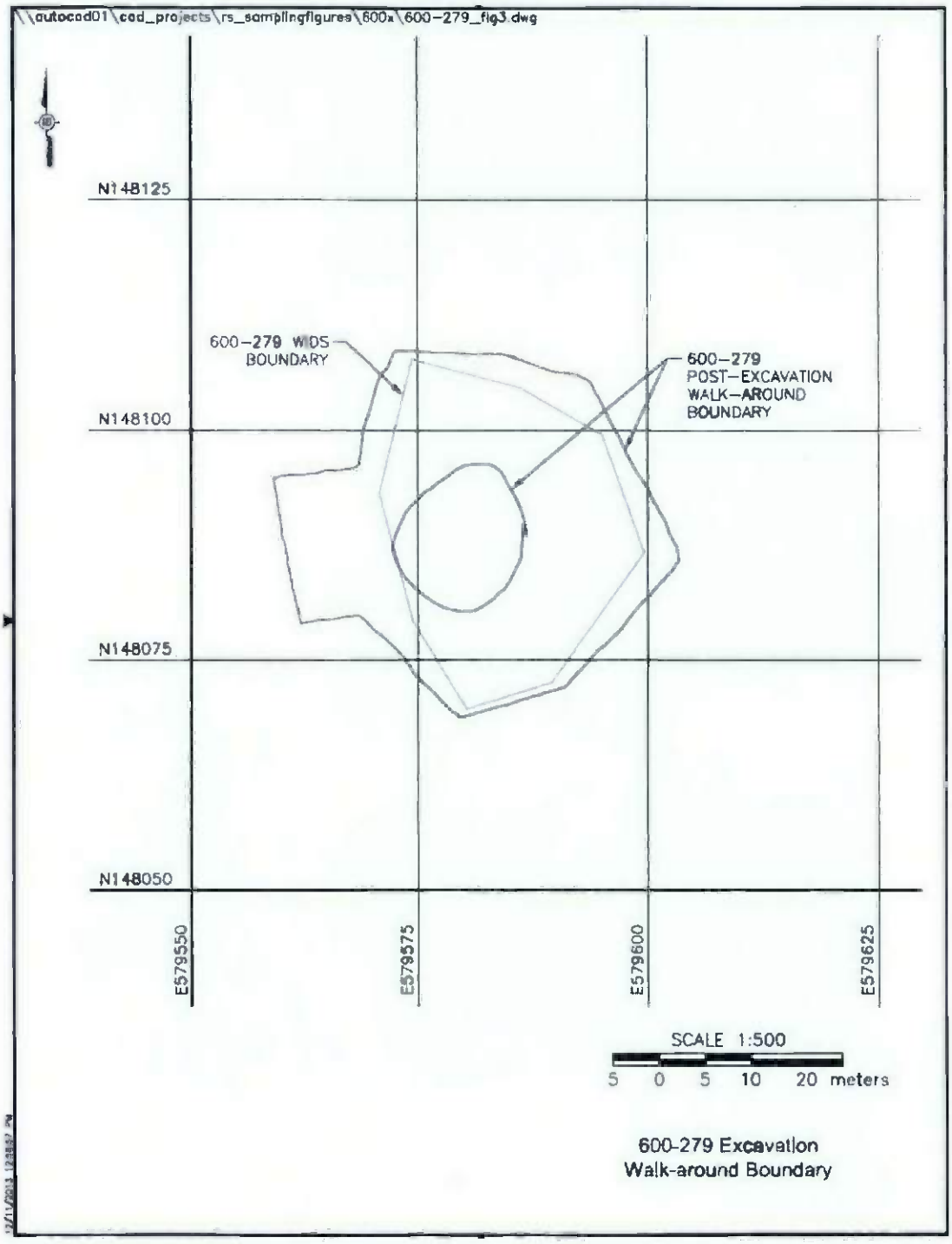
Figure 4. The 600-279 Waste Site Prior to Remediation (August 19, 2013).

Figure 5. The 600-279 Waste Site Post-Remediation Photograph, Looking West (October 23, 2013).

Figure 6. The 600-279 Post-Remediation Photograph - Deepest Part of Excavation, Looking West (October 23, 2013).

Figure 7 shows walkaround boundary of the excavation performed following remediation of the 600-279 waste site. The inner line in the Figure 7 is the top of the slope for the deepest hole, approximately 0.9 to 1.2 m (3 to 4 ft) below ground surface from the east side.

Figure 7. 600-279 Waste Site Excavation Walkaround Boundary.



VERIFICATION SAMPLING ACTIVITIES

Cleanup verification sampling was performed at the 600-279 waste site on October 23 and November 13, 2013. 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 verification sample results are provided in Appendix B and indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and RAGs for the 600-279 waste site. The following subsections provide additional discussion of the information used to develop the verification sampling design. The statistical and maximum results of verification sampling are summarized to support interim closure of the site. A more detailed discussion of the verification sampling can be found in the *Work Instruction for Verification Sampling of the 600-279 Waste Site, Vegetation Free Area Between White Bluffs and 100F Waste Site* (WCH 2013b).

Contaminants of Potential Concern

The COPCs for the 600-279 waste site were based on existing historical information, field observation, and the results of in-process sampling data. The 600-279 COPCs included ICP metals (arsenic and lead), mercury, sulfate, sulfide, SVOCs, herbicides, and pesticides. Soil pH was analyzed to support waste characterization and monitor soil acidity at the 600-279 waste site. The COPCs for verification sampling and the laboratory analytical methods are identified in Table 2.

Table 2. 600-279 Laboratory Analytical Methods and Contaminants of Potential Concern.

Analysis	Analytical Method	Contaminant of Potential Concern
ICP metals [a]	EPA Method 6010	Arsenic and lead
Mercury	EPA Method 7471	Mercury
IC anions [b]	EPA Method 300.0	Sulfate
SVOA	EPA Method 8270	Semivolatile organic compounds
Sulfide	EPA Method 9030	Sulfide
Herbicides	EPA Method 8151	Herbicides
Pesticides	EPA Method 8081	Pesticides
pH	EPA Method 9045C	None

[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.

[b] Analysis was performed for the expanded list of IC anions to include bromide, chloride, fluoride, nitrate, nitrite, phosphate, and sulfate.

EPA = U.S. Environmental Protection Agency
IC = ion chromatography
ICP = inductively coupled plasma
SVOA = semivolatile organic analysis

Verification Sample Design

One decision unit, the excavation footprint, was identified for the 600-279 waste site. A total of 12 statistical verification soil samples were collected from the excavation footprint. In addition, one focused sample was collected to evaluate yellow stained soil found at the bottom of the deepest part of the excavation.

A discrete soil sample was collected at each designated sample point (0 to 0.15 m [0 to 6 in.] below the surface of the excavated waste site) and analyzed using the methods identified in Table 2. The soil sampling locations were global positional surveyed and staked prior to sample collection using the coordinate pairs provided in Table 3. Figure 8 shows the waste site footprint and the sampling locations.

Table 3. 600-279 Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates		Sample Analysis
		Northing	Easting	
EXC-1	J1T469	148073.7	579576.0	ICP metals[a], mercury, IC anions[b], sulfide, SVOA, herbicides, pesticides, pH
EXC-2	J1T470	148073.7	579586.6	
EXC-3	J1T471	148082.9	579570.8	
EXC-4	J1T472	148082.9	579581.3	
EXC-5	J1T473	148082.9	579591.9	
EXC-6	J1T474	148092.0	579565.5	
EXC-7	J1T475	148092.0	579576.0	
EXC-8	J1T476	148092.0	579586.6	
EXC-9	J1T477	148092.0	579597.2	
EXC-10	J1T478	148101.1	579570.8	
EXC-11	J1T479	148101.1	579581.3	
EXC-12	J1T480	148101.1	579591.9	
Duplicate[c]	J1T481	148073.7	579576.0	
FS-1[d]	J1T461	148087.0	579578.0	ICP metals[a], mercury, IC anions[b], cyanide, sulfide, SVOA, herbicides, pesticides, pH
Equipment blank	J1T482	NA	NA	ICP metals[a], mercury

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

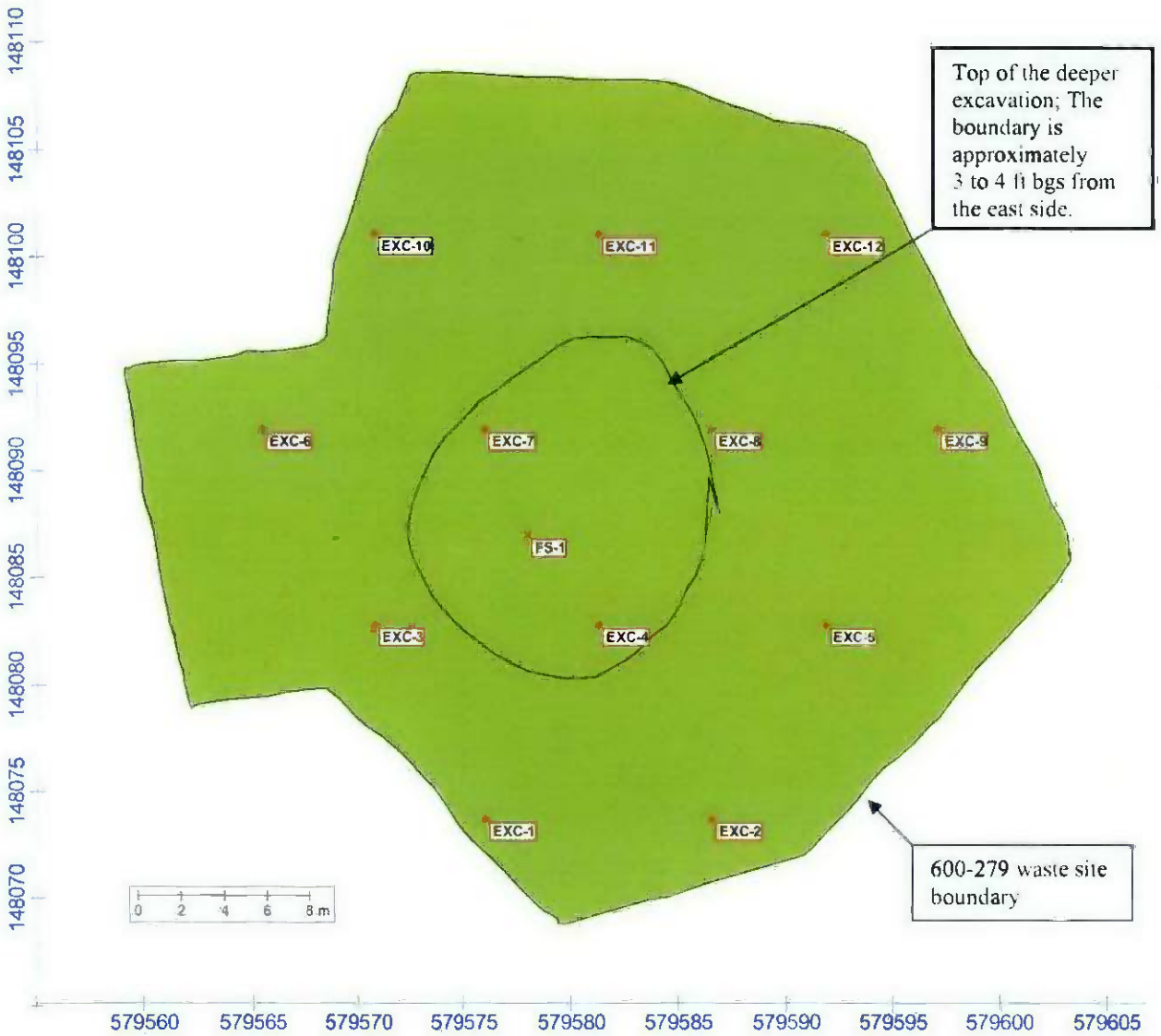
[b] The expanded list of IC anions included bromide, chloride, fluoride, nitrate, nitrite, phosphate, and sulfate in the analytical results package.

[c] One duplicate soil sample was collected from the 600-279 waste site at a location selected at the project analytical lead's discretion.

[d] One focused soil sample was collected from a yellow stained soil found at the bottom of the deeper excavation.

EXC = excavation
FS = focused
HEIS = Hanford Environmental Information System
IC = ion chromatography
ICP = inductively coupled plasma
NA = not applicable
SVOA = semivolatile organic analyses

Figure 8. 600-279 Waste Site Verification Sample Locations.



All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). Additional information related to verification sampling can be found in the field sampling logbooks (WCH 2013a).

Verification Sample Results

All verification samples were analyzed using analytical methods approved by EPA (DOE-RL 2009b). Evaluation of the verification data from the 600-279 waste site was performed by direct comparison of the statistical or maximum sample results for each COPC

against cleanup criteria. If no detections for a given COPC were reported in the data set, then no evaluations or calculations were performed for that COPC.

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 600-279 decision unit as specified by the 100 Area RDR/RAWP (DOE-RL 2009b). The calculations are provided in Appendix B. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for a decision unit, the maximum detected value was used for comparison to 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.

Comparisons of the results for site COPCs with the RAGs for the 600-279 waste site are listed in Tables 4 and 5. 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 2013) 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* (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 laboratory-reported data results for all constituents are stored in the Washington Closure Hanford (WCH) project-specific database prior to archival in the Hanford Environmental Information System, and are presented in Attachment 1 of the 95% UCL calculations (Appendix B).

Table 4. Comparison of Contaminant Concentrations to Action Levels for the 600-279 Excavation Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	13.9	20 [c]	20 [c]	20 [c]	No	--
Barium	73.4 (<BG)	5,600	200	400	No	--
Beryllium	0.605 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.42	7,200	320	-- [f]	No	--
Cadmium [g]	0.280 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium	12.3 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	6.96 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	14.7 (<BG)	2,960	59.2	22.0 [c]	No	--
Lead	28.3	353	10.2 [c]	10.2 [c]	Yes	Yes [h]
Manganese	301 (<BG)	3,760	512 [c]	512 [c]	No	--
Mercury	0.00451 (<BG)	24	0.33 [c]	0.33 [c]	No	--
Molybdenum [e]	0.332	400 [d]	8	-- [f]	No	--
Nickel	10.5 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	48.0 (<BG)	560	85.1 [c]	-- [f]	No	--

Table 4. Comparison of Contaminant Concentrations to Action Levels for the 600-279 Excavation Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Zinc	39.8 (<BG)	24,000	480	67.8 [c]	No	--
Chloride	2.38 (<BG)	--	25,000	-- [f]	No	--
Fluoride	1.63 (<BG)	4,800	96	400	No	--
Nitrogen in nitrate	2.36 (<BG)	128,000	1,000	2,000	No	--
Nitrogen in nitrate and nitrite	6.00 (<BG)	128,000	1,000	2,000	No	--
Sulfate	5926	--	25,000	-- [f]	No	--
Benzo(a)anthracene	0.0336	1.37	0.015 [i]	0.015 [i]	Yes	Yes [h]
Benzo(a)pyrene	0.0396	0.137	0.015 [i]	0.015 [i]	Yes	Yes [h]
Benzo(b)fluoranthene	0.0406	1.37	0.015 [i]	0.015 [i]	Yes	Yes [h]
Benzo(k)fluoranthene	0.0155	1.37	0.015 [i]	0.015 [i]	Yes	Yes [h]
Chrysene	0.0346	13.7	0.12	0.1 [i]	No	--
Fluoranthene	0.0438	3,200	64	18.0	No	--
Pyrene	0.0445	2,400	48	192	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).

[b] Maximum or 95% UCL, depending on data censorship, as described in the *600-279 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix B).

[c] 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).

[d] 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]).

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

[f] 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 2013) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).

[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[h] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years (based on the contaminant with the lowest distribution coefficient, lead, with a value of 30 mL/g). The vadose zone underlying the soil below the site is approximately 6.2 m (20.3 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

[i] 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
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 5. Comparison of Contaminant Concentrations to Action Levels for the 600-279 Excavation Focused Verification Samples.

COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.96 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	42.3 (<BG)	5,600	200	400	No	--
Beryllium	0.445 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Boron [d]	1.05	7,200	320	-- [e]	No	--
Cadmium [f]	0.125 (<BG)	13.9 [c]	0.81 [b]	0.81 [b]	No	--
Chromium	11.9 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	4.16 (<BG)	24	15.7 [b]	-- [e]	No	--
Copper	14.4 (<BG)	2,960	59.2	22.0 [b]	No	--
Lead	4.04 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	172 (<BG)	3,760	512 [b]	512 [b]	No	--
Mercury	0.00573 (<BG)	24	0.33 [b]	0.33 [b]	No	--
Molybdenum [d]	0.353	400	8	-- [e]	No	--
Nickel	6.64 (<BG)	1,600	19.1 [b]	27.4	No	--
Vanadium	45.2 (<BG)	560	85.1 [b]	-- [e]	No	--
Zinc	32.5 (<BG)	24,000	480	67.8 [c]	No	--
Chloride	2.23 (<BG)	--	25,000	-- [e]	No	--
Fluoride	6.95	4,800	96	400	No	--
Nitrogen in nitrate	0.536 (<BG)	128,000	1,000	2,000	No	--
Sulfate	6,080	--	25,000	-- [e]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).

[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 2013) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).

[f] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

-- = not applicable
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

VERIFICATION SAMPLE DATA EVALUATION

This section demonstrates that contaminant concentrations at the 600-279 waste site achieve 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).

Direct Comparison to RAGs

Evaluation of the verification sampling results in Tables 4 and 5 shows that all direct exposure RAGs are met for the 600-279 waste site. Groundwater protection and/or Columbia River protection cleanup levels were exceeded for lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene.

Based on the RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), residual concentrations of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not predicted to migrate more than 1.8 m (5.9 ft) vertically within 1,000 years (based on the lowest distribution coefficient of the contaminants exceeding the RAGs, lead with a distribution coefficient value of 30 mL/g). The vadose zone underlying the excavation is approximately 6.2 m (20.3 ft) thick. Therefore, residual concentrations of these constituents are not predicted to migrate through the soil column to groundwater (and thus the Columbia River) within 1,000 years.

Three-Part Test for Nonradionuclides

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. The WAC 173-340 three-part test consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection can 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 600-279 excavation is included in the statistical calculations (Appendix B). The results of this evaluation indicate that the residual COPC concentrations pass the three-part test in comparison against applicable RAGs with the exception of lead, which fails all parts of the three-part test to be protective of groundwater and the Columbia River. However, based on the RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), residual concentrations of lead are not predicted to migrate more than 1.8 m (5.9 ft) vertically within 1,000 years (based on the lead distribution coefficient value of 30 mL/g). Therefore, the residual concentrations of lead are predicted to be protective of groundwater and the Columbia River.

The 600-279 waste site is associated with the use of pesticides previous to the Manhattan Project; however, the verification results demonstrate that the residual concentration of lead and arsenic are protective of groundwater and the Columbia River.

Direct Contact Noncarcinogenic Hazard Quotient Remedial Action Goal

Assessment of the risk requirements for the 600-279 waste site was determined by calculation of the hazard quotient and excess carcinogenic risk. The 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 excess carcinogenic risk of less than 1×10^{-5}. Hazard quotient and excess carcinogenic risk calculations for direct contact were conservatively performed for the 600-279 waste site in Appendix B using the highest of the focused and statistical values from the entire excavation decision unit. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients are below 1.0, and all individual excess carcinogenic risk values are below 1×10^{-6}. The direct contact cumulative hazard quotient for the 600-279 waste site is 2.6×10^{-3}, and the cumulative excess carcinogenic risk value is 3.6×10^{-7}, satisfying the criteria to be less than 1.0 and less than 1×10^{-5}, respectively. Therefore, the nonradionuclide risk requirements are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach (WCH 2013b), the field logbooks (WCH 2013a), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 600-279 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 WCH 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 600-279 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 met the RAGs and associated RAOs for direct exposure, groundwater protection, and river protection. Residual contamination above direct exposure levels was not observed in shallow or deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-279 waste site to Interim Closed Out.

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APPENDIX A

IN-PROCESS SAMPLING RESULTS

600-279 Waste Site In-process Sampling_Metals

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	7740		5.93	1.44	DU	1.44	20.7		0.436	73.5		0.0872
Composite 2	J1T3J3	10/8/2013	5670		6.43	0.312	U	0.312	3.26		0.473	33.2		0.0946

Sample Location	HEIS Number	Sample Date	Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	0.704		0.0872	3.12	B	0.872	0.392	B	0.0872	11600		6.97
Composite 2	J1T3J3	10/8/2013	0.332	B	0.0946	3.82	B	0.946	0.0946	U	0.0946	17300		7.56

Sample Location	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	11.3		0.131	4.94	D	0.654	11.3		0.261	17300		6.97
Composite 2	J1T3J3	10/8/2013	8.57		0.142	6.57		0.142	15.5		0.281	17600		7.56

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	59.5	D	1.44	2630		7.41	196		0.174	0.0042	B	0.004
Composite 2	J1T3J3	10/8/2013	3.72		0.312	3230		8.04	175	N	0.189	0.0091	B	0.0042

Sample Location	HEIS Number	Sample Date	Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	0.174	U	0.174	7.12		0.131	2110		5.58	0.329	DU	0.329
Composite 2	J1T3J3	10/8/2013	0.903	B	0.189	7.47		0.142	993		6.62	0.335	DU	0.335

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	388	N	1.31	0.0872	U	0.0872	476		6.10	47.2	D	0.436
Composite 2	J1T3J3	10/8/2013	346	N*	1.42	0.473	DU	0.473	438		6.62	41.5		0.0946

Sample Location	HEIS Number	Sample Date	Zinc		
			mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	65.9	D	1.74
Composite 2	J1T3J3	10/8/2013	31.3	*	0.378

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

Gray cells indicate not applicable.

Yellow highlighted value indicates RAG exceedance.

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

* = Duplicate analysis not within control limits.

B = estimated result; result is less than the RL but greater than the MDL.

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reported from a

Environmental

HERB = herbicides

J = estimated

precision not met.

the control limits.

PEST = pesticides

PQL = practical quantitation limit

Q = qualifier

SVOA = semivolatile organic analysis

TCLP = toxicity characteristic leaching procedure

U = undetected

VOA = volatile organic analysis

X = missed holding time.

Sample Location	HEIS Number	Sample Date	Bromide			Chloride			Cyanide		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	0.691	U	0.691	1.23	B	0.691	0.106	B	0.0813

Sample Location	HEIS Number	Sample Date	Fluoride			Nitrogen in Nitrate			Nitrogen in Nitrite		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	1.99		0.341	2.73		0.341	2.09		0.172

Sample Location	HEIS Number	Sample Date	Nitrogen in Nitrite			Phosphorous in Phosphate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Composite 1	J1RWK4	8/19/2013	0.341	U	0.341	0.82	B	0.691	18200	D	274

Sample Location	HEIS Number	Sample Date	Sulfide			pH Measurement		
			mg/kg	Q	PQL	pH	Q	PQL
Composite 1	J1RWK4	8/19/2013	8.61	U	8.61	2.88	X	0.0100
Composite 2	J1T3J3	10/8/2013				3.99	X	0.0100

600-279 Waste Site In-process Sampling_TCLP

Sample Location	HEIS Number	Sample Date	2,4-Dichlorophenoxyacetic acid			2-(2,4,5-Trichlorophenoxy)propionic acid		
			mg/L	Q	PQL	mg/L	Q	PQL
600-279	J1RWK4	8/19/2013	0.0166	U	0.0166	0.0166	U	0.0166

Sample Location	HEIS Number	Sample Date	Chlordane			Endrin		
			mg/L	Q	PQL	mg/L	Q	PQL
600-279	J1RWK4	8/19/2013	0.000765	U	0.000765	0.00010	U	0.00010

Sample Location	HEIS Number	Sample Date	Gamma-BHC (Lindane)			Heptachlor epoxide		
			mg/L	Q	PQL	mg/L	Q	PQL
600-279	J1RWK4	8/19/2013	0.000067	U	0.000067	0.000067	U	0.000067

Sample Location	HEIS Number	Sample Date	Heptachlor			Methoxychlor		
			mg/L	Q	PQL	mg/L	Q	PQL
600-279	J1RWK4	8/19/2013	0.000067	U	0.000067	0.00050	U	0.00050

Sample Location	HEIS Number	Sample Date	Toxaphene		
			mg/L	Q	PQL
600-279	J1RWK4	8/19/2013	0.0015	U	0.0015

Sample Location	HEIS Number	Sample Date	Arsenic			Barium		
			mg/L	Q	PQL	mg/L	Q	PQL
600-279	J1RWK4	8/19/2013	0.0605	B	0.050	0.0563	CN	0.010

Sample Location	HEIS Number	Sample Date	Cadmium			Chromium		
			mg/L	Q	PQL	mg/L	Q	PQL
600-279	J1RWK4	8/19/2013	0.010	U	0.010	0.0312	B	0.010

Sample Location	HEIS Number	Sample Date	Lead			Mercury		
			mg/L	Q	PQL	mg/L	Q	PQL
600-279	J1RWK4	8/19/2013	0.033	NU	0.033	0.00067	U	0.00067

Sample Location	HEIS Number	Sample Date	Selenium			Silver		
			mg/L	Q	PQL	mg/L	Q	PQL
600-279	J1RWK4	8/19/2013	0.060	U	0.060	0.010	U	0.010

600-279 Waste Site In-process Sampling_Organics

CONSTITUENT	CLASS	J1RWK4 Composite 1			J1T3J3 Composite 2		
		8/19/2013			10/8/2013		
		ug/kg	Q	PQL	ug/kg	Q	PQL
2-(2,4,5-Trichlorophenoxy)propionic acid	HERB	171	DU	171	17.9	DU	17.9
2,4,5-Trichlorophenoxyacetic acid	HERB	171	DU	171	17.9	DU	17.9
2,4-Dichlorophenoxyacetic acid	HERB	171	DU	171	17.9	DTU	17.9
2-secButyl-4,6-dinitrophenol(DNBP)	HERB	171	DU	171	17.9	DTU	17.9
4-(2,4-Dichlorophenoxy)butanoic acid	HERB	171	DU	171	17.9	DTU	17.9
Dalapon	HERB	3610	DU	3610	378	DTU	378
Dicamba	HERB	206	DU	206	21.6	DU	21.6
Dichloroprop	HERB	233	DU	233	24.4	DTU	24.4
MCPA	HERB				2490	DTU	2490
MCPP	HERB				2160	DTU	2160
Aldrin	PEST	1.71	DU	1.71			
Alpha-BHC	PEST	1.71	DU	1.71			
alpha-Chlordane	PEST	1.71	DU	1.71			
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	1.71	DU	1.71			
Delta-BHC	PEST	1.71	DU	1.71			
Dichlorodiphenyldichloroethane	PEST	3.43	DU	3.43			
Dichlorodiphenyldichloroethylene	PEST	3.43	DU	3.43			
Dichlorodiphenyltrichloroethane	PEST	3.43	DU	3.43			
Dieldrin	PEST	3.43	DU	3.43			
Endosulfan I	PEST	1.71	DU	1.71			
Endosulfan II	PEST	3.43	DU	3.43			
Endosulfan sulfate	PEST	3.43	DU	3.43			
Endrin	PEST	3.43	DU	3.43			
Endrin aldehyde	PEST	3.43	DU	3.43			
Endrin ketone	PEST	3.43	DU	3.43			
Gamma-BHC (Lindane)	PEST	1.71	DU	1.71			
gamma-Chlordane	PEST	1.71	DU	1.71			
Heptachlor	PEST	1.71	DU	1.71			
Heptachlor epoxide	PEST	1.71	DU	1.71			
Methoxychlor	PEST	17.1	DU	17.1			
Toxaphene	PEST	57.1	DU	57.1			
1,2,4-Trichlorobenzene	SVOA	103	U	103			
1,2-Dichlorobenzene	SVOA	103	U	103			
1,3-Dichlorobenzene	SVOA	103	U	103			
1,4-Dichlorobenzene	SVOA	103	U	103			
2,4,5-Trichlorophenol	SVOA	103	U	103			
2,4,6-Trichlorophenol	SVOA	103	U	103			
2,4-Dichlorophenol	SVOA	103	U	103			
2,4-Dimethylphenol	SVOA	103	U	103			
2,4-Dinitrophenol	SVOA	103	U	103			
2,4-Dinitrotoluene	SVOA	103	U	103			
2,6-Dinitrotoluene	SVOA	103	U	103			
2-Chloronaphthalene	SVOA	10.3	U	10.3			
2-Chlorophenol	SVOA	103	U	103			
2-Methylnaphthalene	SVOA	10.3	U	10.3			
2-Methylphenol (cresol, o-)	SVOA	103	U	103			
2-Nitroaniline	SVOA	114	U	114			
2-Nitrophenol	SVOA	103	U	103			
3,3'-Dichlorobenzidine	SVOA	103	U	103			
3+4 Methylphenol (cresol, m+p)	SVOA	103	U	103			

600-279 Waste Site In-process Sampling_Organics

CONSTITUENT	CLASS	J1RWK4 Composite 1 8/19/2013		
		ug/kg	Q	PQL
3-Nitroaniline	SVOA	103	U	103
4,6-Dinitro-2-methylphenol	SVOA	103	U	103
4-Bromophenylphenyl ether	SVOA	103	U	103
4-Chloro-3-methylphenol	SVOA	138	U	138
4-Chloroaniline	SVOA	103	U	103
4-Chlorophenylphenyl ether	SVOA	103	U	103
4-Nitroaniline	SVOA	103	U	103
4-Nitrophenol	SVOA	103	U	103
Acenaphthene	SVOA	10.3	U	10.3
Acenaphthylene	SVOA	10.3	U	10.3
Anthracene	SVOA	10.3	U	10.3
Benzo(a)anthracene	SVOA	76.4		10.3
Benzo(a)pyrene	SVOA	104		10.3
Benzo(b)fluoranthene	SVOA	125		10.3
Benzo(ghi)perylene	SVOA	68.1		10.3
Benzo(k)fluoranthene	SVOA	55.7		10.3
Bis(2-Chloroethoxy)methane	SVOA	103	U	103
Bis(2-chloroethyl) ether	SVOA	103	U	103
Bis(2-chloroisopropyl) ether	SVOA	103	U	103
Bis(2-ethylhexyl) phthalate	SVOA	103	U	103
Butylbenzylphthalate	SVOA	103	U	103
Carbazole	SVOA	10.3	U	10.3
Chrysene	SVOA	99.7		10.3
Dibenz[a,h]anthracene	SVOA	15.8	J	10.3
Dibenzofuran	SVOA	103	U	103
Diethylphthalate	SVOA	103	U	103
Dimethyl phthalate	SVOA	103	U	103
Di-n-butylphthalate	SVOA	103	U	103
Di-n-octylphthalate	SVOA	103	U	103
Diphenylamine	SVOA	103	U	103
Fluoranthene	SVOA	152		10.3
Fluorene	SVOA	10.3	U	10.3
Hexachlorobenzene	SVOA	103	U	103
Hexachlorobutadiene	SVOA	103	U	103
Hexachlorocyclopentadiene	SVOA	103	U	103
Hexachloroethane	SVOA	103	U	103
Indeno(1,2,3-cd)pyrene	SVOA	61.2		10.3
Isophorone	SVOA	103	U	103
Naphthalene	SVOA	10.3	U	10.3
Nitrobenzene	SVOA	103	U	103
N-Nitroso-di-n-dipropylamine	SVOA	103	U	103
Pentachlorophenol	SVOA	103	U	103
Phenanthrene	SVOA	74.6		10.3
Phenol	SVOA	103	U	103
Pyrene	SVOA	211		10.3
1,1,1-Trichloroethane	VOA	0.387	U	0.387
1,1,2,2-Tetrachloroethane	VOA	0.387	U	0.387
1,1,2-Trichloroethane	VOA	0.387	U	0.387
1,1-Dichloroethane	VOA	0.387	U	0.387
1,1-Dichloroethene	VOA	0.387	U	0.387

600-279 Waste Site In-process Sampling_Organics

CONSTITUENT	CLASS	J1RWK4 Composite 1 8/19/2013		
		ug/kg	Q	PQL
1,2-Dichloroethane	VOA	0.387	U	0.387
1,2-Dichloroethene(Total)	VOA	0.387	U	0.387
1,2-Dichloropropane	VOA	0.387	U	0.387
2-Butanone	VOA	1.93	U	1.93
2-Hexanone	VOA	1.93	U	1.93
4-Methyl-2-Pentanone	VOA	1.93	U	1.93
Acetone	VOA	2.44	J	1.93
Benzene	VOA	0.387	U	0.387
Bromodichloromethane	VOA	0.387	U	0.387
Bromoform	VOA	0.387	U	0.387
Bromomethane	VOA	0.387	U	0.387
Carbon disulfide	VOA	1.93	U	1.93
Carbon tetrachloride	VOA	0.387	U	0.387
Chlorobenzene	VOA	0.387	U	0.387
Chloroethane	VOA	0.387	U	0.387
Chloroform	VOA	0.387	U	0.387
Chloromethane	VOA	0.387	U	0.387
cis-1,2-Dichloroethylene	VOA	0.387	U	0.387
cis-1,3-Dichloropropene	VOA	0.387	U	0.387
Dibromochloromethane	VOA	0.387	U	0.387
Ethylbenzene	VOA	0.387	U	0.387
Methylenechloride	VOA	2.58	U	2.58
Styrene	VOA	0.387	U	0.387
Tetrachloroethene	VOA	0.387	U	0.387
Toluene	VOA	0.387	U	0.387
trans-1,2-Dichloroethylene	VOA	0.387	U	0.387
trans-1,3-Dichloropropene	VOA	0.387	U	0.387
Trichloroethene	VOA	0.387	U	0.387
Vinyl chloride	VOA	0.387	U	0.387
Xylenes (total)	VOA	0.387	U	0.387

APPENDIX B

CALCULATIONS

APPENDIX B

CALCULATIONS

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

600-279 Waste Site Cleanup Verification 95% UCL Calculation, 0600X-CA-V0164, Rev. 0, Washington Closure Hanford, Richland, Washington.

600-279 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0600X-CA-V0165, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-IU-2/6 Field Remediation **Job No. 14655**

Area: 600 Area

Discipline: Environmental *Calculation No: 0600X-CA-V0164

Subject: 600-279 Waste Site Cleanup Verification 95% UCL Calculation

Computer Program: Excel Program No: Excel 2003

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 = 8 Attm. 1 = 10 Total = 19	J. D. Skoglie	N. K. Schiffern	I. B. Berezovskiy	D. F. Obenauer	1/6/14

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	12/24/13	Calc. No. 0600X-CA-V0164	Rev. No. 0
Project	100-IU-2/6 Remediation	Job No.	14655	Checked N. K. Schiffern	Date 12/24/13
Subject	600-279 Waste Site Cleanup Verification 95% UCL Calculation				Sheet No. 1 of 8

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 3 - Calculation Sheet Summary
Sheets 4 to 5 - Calculation Sheet Verification Data - 600-279 Excavation
Sheets 6 to 7 - Ecology Software (MTCAStat) Results
Sheet 8 - Calculation Sheet Duplicate Analysis
Attachment 1 - 600-279, Waste Site Verification Sampling Results (10 sheets)

Given/References:
1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2009b), DOE-RL (2001), and Ecology (1996).
3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 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.
5) 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.
6) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
7) 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.
8) Ecology, 1996, *Model Toxic Control Act Cleanup Levels and Risk Calculations (CLARC II)*, Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
9) Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
10) 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.
11) EPA, 2013, "EPA Concurrence for 600-294 Additional Sampling," CCN 173590 to H. M. Carman from C. J. Guzzetti, Washington Closure Hanford, Richland, Washington, October 30.
12) 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 and focused data from verification samples (Attachment 1) from the 600-279 waste site. The data were entered into an EXCEL 2003 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 600-279 waste site underwent statistical verification sampling at one decision unit (excavation) and one focused sample. A duplicate sample was also taken within the excavation. Analytical results for all sampling locations are summarized in the tables provided on sheet 3. Further information of the sample data quality is presented in the data quality assessment section of the associated RSVP.

Washington Closure Hanford

CALCULATION SHEET

Originator	J. D. Skoglie	Date 12/24/13	Calc. No. 0600X-CA-V0164	Rev. No.	0
Project	100-IU-2/6 Remediation	Job No. 14655	Checked N. K. Schiffern	Date	12/24/13
Subject	600-279 Waste Site Cleanup Verification 95% UCL Calculation			Sheet No.	2 of 8

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 (which includes primary and duplicate samples) 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 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 either the duplicate or split value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed in Table 2-1 of the SAP (DOE-RL 2009a) for certain constituents. All other constituents will have their own pre-determined TDL's based on the laboratory and method used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

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

For quality assurance/quality control (QA/QC) 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/split sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate/split result 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 12/31/13 Calc. No. 0600X-CA-V0164 Rev. No. 0
Project 100-IU-2/6 Remediation Job No. 14655 Checked N. K. Schiffern Date 12/31/13
Subject 600-279 Waste Site Cleanup Verification 95% UCL Calculation Sheet No. 3 of 8

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL and/or maximum calculations for the 600-279 excavation, focused sample, 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.

600-279 Statistical and Focused Sampling Results Summary [a]

Analyte	600-279 Excavation		FS-1	Units
	95% UCL	Maximum	Maximum	
Arsenic	13.9	--	3.96	mg/kg
Barium	73.4	--	42.3	mg/kg
Beryllium	0.605	--	0.445	mg/kg
Boron	--	1.42	1.05	mg/kg
Cadmium	0.280	--	0.125	mg/kg
Chromium	12.3	--	11.9	mg/kg
Cobalt	6.96	--	4.16	mg/kg
Copper	14.7	--	14.4	mg/kg
Lead	28.3	--	4.04	mg/kg
Manganese	301	--	172	mg/kg
Mercury	--	0.00451	0.00573	mg/kg
Molybdenum	0.332	--	0.353	mg/kg
Nickel	10.5	--	6.64	mg/kg
Vanadium	48.0	--	45.2	mg/kg
Zinc	39.8	--	32.5	mg/kg
Chloride	2.38	--	2.23	mg/kg
Fluoride	1.63	--	6.95	mg/kg
Nitrogen in nitrate	2.36	--	0.536	mg/kg
Nitrogen in nitrate and nitrite	6.00	--	--	mg/kg
Sulfate	5926	--	6080	mg/kg
Benzo(a)anthracene	--	0.0336	--	mg/kg
Benzo(a)pyrene	--	0.0396	--	mg/kg
Benzo(b)fluoranthene	--	0.0406	--	mg/kg
Benzo(k)fluoranthene	--	0.0155	--	mg/kg
Chrysene	--	0.0346	--	mg/kg
Fluoranthene	--	0.0438	--	mg/kg
Pyrene	--	0.0445	--	mg/kg

3-Part Test Evaluation:	**600-279**
95% UCL or maximum [a] > Cleanup Limit?	YES
> 10% above Cleanup Limit?	YES
Any sample > 2x Cleanup Limit?	YES

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

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

Analyte	600-279 Duplicate Analysis
	EXC
Aluminum	5.7%
Barium	2.2%
Calcium	7.4%
Chromium	1.9%
Copper	2.3%
Iron	0.6%
Magnesium	5.0%
Manganese	4.1%
Silicon	***82.4%***
Vanadium	3.8%
Zinc	11.4%
Sulfate	29.6%

[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.

-- = not applicable
* = duplicate analysis not within control limits
B = the analyte was detected in both the associated QC blank and in the sample.
D = dilution
DE = direct exposure
EXC = excavation
FS = focused sample
GW = groundwater
J = estimate
M = duplicate precision not met
MTCA = *Model Toxics Control Act*
N = spike sample recovery outside control limits
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
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-279 Waste Site Cleanup Verification 95% UCL Calculation

Date 12/24/13
Job No. 14655

Calc. No. 0600X-CA-V0164
Checked N. K. Schiffern

Rev. No. 0
Date 12/24/13
Sheet No. 4 of 8

1 600-279 Statistical Calculations

2 Verification Data - 600-279 Waste Site Excavation

3	Sample	Sample	Sample	Arsenic			Barium			Beryllium			Cadmium			Chromium			Cobalt			Copper			Lead			Manganese			Molybdenum		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	EXC-1	J1T469	11/13/13	3.33		0.448	54.0	JN	0.0896	0.549		0.0896	0.308	B	0.0896	10.4		0.134	7.12	D	0.672	17.0		0.269	4.70	D	1.48	288		0.179	0.278	B	0.179
6	Duplicate of J1T469	J1T481	11/13/13	2.78		0.459	52.8	JN	0.0918	0.541		0.0918	0.264	B	0.0918	10.2		0.138	7.84	D	0.688	17.4		0.275	4.00	BD	1.51	300		0.184	0.261	B	0.184
7	EXC-2	J1T470	11/13/13	3.67		0.468	64.6	JN	0.0932	0.612		0.0932	0.299	B	0.0932	11.1		0.140	6.96	D	0.699	12.2		0.280	6.66	D	1.54	299		0.186	0.322	B	0.186
8	EXC-3	J1T471	11/13/13	25.1		0.501	89.5	JN	0.100	0.699		0.100	0.280	B	0.100	11.9		0.150	8.10	D	0.752	14.1		0.301	24.0	D	1.85	341		0.200	0.330	B	0.200
9	EXC-4	J1T472	11/13/13	4.13		0.466	51.2	JN	0.0933	0.540		0.0933	0.235	B	0.0933	13.1		0.140	6.95	D	0.700	14.4		0.280	11.1	D	1.54	283		0.187	0.327	B	0.187
10	EXC-5	J1T473	11/13/13	4.01		0.454	58.5	JN	0.0908	0.466		0.0908	0.252	B	0.0908	9.68		0.136	5.59	D	0.681	12.3		0.272	5.56	D	1.50	228		0.182	0.240	B	0.182
11	EXC-6	J1T474	11/13/13	5.51		0.453	46.9	JN	0.0906	0.492		0.0906	0.245	B	0.0906	8.18		0.136	5.20	D	0.680	13.0		0.272	10.9	D	1.50	223		0.181	0.322	B	0.181
12	EXC-7	J1T475	11/13/13	10.3		0.518	76.1	JN	0.104	0.657		0.104	0.306	B	0.104	10.3		0.155	6.60	D	0.777	13.7		0.311	8.59	D	1.71	334		0.207	0.267	B	0.207
13	EXC-8	J1T476	11/13/13	4.81		0.502	64.7	JN	0.100	0.488	B	0.100	0.259	B	0.100	14.1		0.151	5.80	D	0.754	16.5		0.301	3.17	BD	1.66	248		0.201	0.318	B	0.201
14	EXC-9	J1T477	11/13/13	7.37		0.503	67.5	JN	0.101	0.551		0.101	0.244	B	0.101	10.1		0.151	6.11	D	0.754	11.0		0.302	21.6	D	1.66	279		0.201	0.386	B	0.201
15	EXC-10	J1T478	11/13/13	17.7		0.510	85.9	JN	0.102	0.613		0.102	0.284	B	0.102	14.0		0.153	6.09	D	0.764	13.5		0.306	37.7	D	1.68	308		0.204	0.288	B	0.204
16	EXC-11	J1T479	11/13/13	8.50		0.471	50.5	JN	0.0942	0.534		0.0942	0.258	B	0.0942	9.36		0.141	6.10	D	0.707	12.9		0.283	20.0	D	1.55	252		0.188	0.261	B	0.188
17	EXC-12	J1T480	11/13/13	10.7		0.441	72.7	JN	0.0882	0.589		0.0882	0.259	B	0.0882	12.1		0.132	6.96	D	0.661	14.0		0.264	24.2	D	1.45	265		0.176	0.356	B	0.176

18

19 Statistical Computation Input Data

20	Sample	Sample	Sample	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Molybdenum
21	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
22	EXC-1	J1T469/ J1T481	11/13/13	3.06	53.4	0.545	0.286	10.3	7.48	17.2	4.35	294	0.270
23	EXC-2	J1T470	11/13/13	3.67	64.6	0.612	0.299	11.1	6.96	12.2	6.66	299	0.322
24	EXC-3	J1T471	11/13/13	25.1	89.5	0.699	0.280	11.9	8.10	14.1	24.0	341	0.330
25	EXC-4	J1T472	11/13/13	4.13	51.2	0.540	0.235	13.1	6.95	14.4	11.1	283	0.327
26	EXC-5	J1T473	11/13/13	4.01	58.5	0.466	0.252	9.68	5.59	12.3	5.56	228	0.240
27	EXC-6	J1T474	11/13/13	5.51	46.9	0.492	0.245	8.18	5.20	13.0	10.9	223	0.322
28	EXC-7	J1T475	11/13/13	10.3	76.1	0.657	0.306	10.3	6.60	13.7	8.59	334	0.267
29	EXC-8	J1T476	11/13/13	4.81	64.7	0.488	0.259	14.1	5.80	16.5	3.17	248	0.318
30	EXC-9	J1T477	11/13/13	7.37	67.5	0.551	0.244	10.1	6.11	11.0	21.6	279	0.386
31	EXC-10	J1T478	11/13/13	17.7	85.9	0.613	0.284	14.0	6.09	13.5	37.7	308	0.288
32	EXC-11	J1T479	11/13/13	8.50	50.5	0.534	0.258	9.36	6.10	12.9	20.0	252	0.261
33	EXC-12	J1T480	11/13/13	10.7	72.7	0.589	0.259	12.1	6.96	14.0	24.2	265	0.356

34 Statistical Computations

35		Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Molybdenum
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), 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), 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), use MTCAStat lognormal distribution.
37	N	12	12	12	12	12	12	12	12	12	12
38	% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
39	Mean	8.74	65.1	0.566	0.267	11.2	6.50	13.7	14.8	280	0.307
40	Standard deviation	6.63	13.9	0.0705	0.0230	1.88	0.834	1.74	10.6	38.1	0.0428
41	95% UCL on mean	13.9	73.4	0.605	0.280	12.3	6.96	14.7	28.3	301	0.332
42	Maximum value	25.1	89.5	0.699	0.308	14.1	8.10	17.4	37.7	341	0.386
43	Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW, & River Protection	200 GW Protection	1.51 GW & River Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection	10.2 GW & River Protection	512 GW & River Protection	8 GW Protection
44	WAC 173-340 3-PART TEST										
45	95% UCL > Cleanup Limit?	NO	NA	NA	NA	NA	NA	NA	YES	NA	NO
46	> 10% above Cleanup Limit?	NO	NA	NA	NA	NA	NA	NA	YES	NA	NO
47	Any sample > 2X Cleanup Limit?	NO	NA	NA	NA	NA	NA	NA	YES	NA	NO
48	WAC 173-340 Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	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.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 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.

49

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-279 Waste Site Cleanup Verification 95% UCL Calculation

Date 12/31/13
Job No. 14655

Calc. No. 0600X-CA-V0164
Checked N. K. Schiffern

Rev. No. 0
Date 12/31/13
Sheet No. 5 of 8

1 600-279 Statistical Calculations
2 Verification Data - 600-279 Waste Site Excavation

3	Sample	Sample	Sample	Nickel			Vanadium			Zinc			Chloride			Fluoride			Nitrogen in Nitrate			Nitrogen in Nitrite and Nitrate			Sulfate		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	EXC-1	J1T469	11/13/13	10.2		0.134	51.3	JDN	0.448	37.9	JDN	1.79	1.37	B	0.687	2.93		0.338	0.555	JB	0.338	0.219	B	0.173	1670	D	27.3
6	Duplicate of J1T469	J1T481	11/13/13	11.2		0.138	49.4	JDN	0.459	33.8	JDN	1.84	1.31	B	0.685	2.80		0.338	0.559	JB	0.338	0.177	U	0.177	1240	D	13.6
7	EXC-2	J1T470	11/13/13	9.50		0.140	50.6	JDN	0.466	37.5	JDN	1.86	1.05	B	0.695	0.799	B	0.342	0.603	JB	0.342	0.340	B	0.171	410	D	6.90
8	EXC-3	J1T471	11/13/13	10.6		0.150	51.2	JDN	0.501	45.5	JDN	2.00	0.847	B	0.701	0.626	B	0.345	0.780	JB	0.345	0.841		0.179	44.2		1.39
9	EXC-4	J1T472	11/13/13	11.3		0.140	48.1	JDN	0.466	35.1	JDN	1.87	1.39	B	0.687	2.47		0.338	2.01	J	0.338	2.10		0.172	1780	D	27.3
10	EXC-5	J1T473	11/13/13	9.51		0.136	40.9	JDN	0.454	32.4	JDN	1.82	0.854	B	0.700	0.621	B	0.345	0.417	JB	0.345	0.173	U	0.173	408	D	6.95
11	EXC-6	J1T474	11/13/13	9.93		0.136	37.3	JDN	0.453	29.7	JDN	1.81	4.32		0.694	0.86	B	0.342	0.644	JB	0.342	0.173	U	0.173	55.3		1.38
12	EXC-7	J1T475	11/13/13	9.75		0.155	42.2	JDN	0.518	35.1	JDN	2.07	4.03		0.714	1.07		0.351	1.72	J	0.351	1.69		0.181	286	D	2.83
13	EXC-8	J1T476	11/13/13	8.37		0.151	39.7	JDN	0.502	38.6	JDN	2.01	0.947	B	0.704	1.25		0.347	2.29	J	0.347	1.88		0.175	2450	D	27.9
14	EXC-9	J1T477	11/13/13	9.88		0.151	44.4	JDN	0.503	36.5	JDN	2.01	2.70		0.693	0.674	B	0.341	1.38	J	0.341	1.15		0.180	758	D	13.8
15	EXC-10	J1T478	11/13/13	11.5		0.153	44.1	JDN	0.510	37.1	JDN	2.04	1.46	B	0.698	0.478	B	0.344	4.27	J	0.344	4.56		0.180	1590	D	27.7
16	EXC-11	J1T479	11/13/13	9.64		0.141	43.5	JDN	0.471	33.9	JDN	1.88	1.56	B	0.696	1.14		0.343	1.30	J	0.343	1.04		0.179	822	D	13.8
17	EXC-12	J1T480	11/13/13	9.16		0.132	50.6	JDN	0.441	47.5	JDN	1.76	1.20	B	0.689	0.532	B	0.339	1.08	J	0.339	0.645		0.173	63.1		1.37

18
19 Statistical Computation Input Data

20	Sample	Sample	Sample	Nickel	Vanadium	Zinc	Chloride	Fluoride	Nitrogen in Nitrate	Nitrogen in Nitrite and Nitrate	Sulfate
21	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
22	EXC-1	J1T469/ J1T481	11/13/13	10.7	50.4	35.9	1.34	2.87	0.557	0.154	1455
23	EXC-2	J1T470	11/13/13	9.50	50.6	37.5	1.05	0.799	0.603	0.340	410
24	EXC-3	J1T471	11/13/13	10.6	51.2	45.5	0.847	0.626	0.780	0.841	44.2
25	EXC-4	J1T472	11/13/13	11.3	48.1	35.1	1.39	2.47	2.01	2.10	1780
26	EXC-5	J1T473	11/13/13	9.51	40.9	32.4	0.854	0.621	0.417	0.0865	408
27	EXC-6	J1T474	11/13/13	9.93	37.3	29.7	4.32	0.860	0.644	0.0865	55.3
28	EXC-7	J1T475	11/13/13	9.75	42.2	35.1	4.03	1.07	1.72	1.69	286
29	EXC-8	J1T476	11/13/13	8.37	39.7	38.6	0.947	1.25	2.29	1.88	2450
30	EXC-9	J1T477	11/13/13	9.88	44.4	36.5	2.70	0.674	1.38	1.15	758
31	EXC-10	J1T478	11/13/13	11.5	44.1	37.1	1.46	0.478	4.27	4.56	1590
32	EXC-11	J1T479	11/13/13	9.64	43.5	33.9	1.56	1.14	1.30	1.04	822
33	EXC-12	J1T480	11/13/13	9.16	50.6	47.5	1.20	0.532	1.08	0.645	63.1

34 Statistical Computations

35		Nickel	Vanadium	Zinc	Chloride	Fluoride	Nitrogen in Nitrate	Nitrogen in Nitrite and Nitrate	Sulfate
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), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
37	N	12	12	12	12	12	12	12	12
38	% < Detection limit	0%	0%	0%	0%	0%	0%	17%	0%
39	Mean	9.99	45.2	37.1	1.81	1.12	1.42	1.21	843
40	Standard deviation	0.897	4.81	5.03	1.21	0.769	1.08	1.26	795
41	95% UCL on mean	10.5	48.0	39.8	2.38	1.63	2.36	6.00	5926
42	Maximum value	11.5	51.3	47.5	4.32	2.93	4.27	4.56	2450
43	Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	25000 GW Protection	96 GW Protection	1000 GW Protection	1000 GW Protection	25000 GW Protection
44	WAC 173-340 3-PART TEST								
45	95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NO
46	> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NO
47	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NO
48	WAC 173-340 Compliance?	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.	Because all values are below background (100 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 (11.8 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (11.8 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.

49

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-279 Waste Site Cleanup Verification 95% UCL Calculation

Date 12/31/13
Job No. 14655

Calc. No. 0600X-CA-V0164
Checked N. K. Schiffern

Rev. No. 0
Date 12/31/13
Sheet No. 6 of 8

Ecology Software (MTCAStat) Results, 600-279 Waste Site

Arsenic 95% UCL Calculation

DATA	ID
	J1T469/
3.06	J1T481
3.67	J1T470
25.1	J1T471
4.13	J1T472
4.01	J1T473
5.51	J1T474
10.3	J1T475
4.81	J1T476
7.37	J1T477
17.7	J1T478
8.50	J1T479
10.7	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	8.74
Censored		Lognormal mean	8.75
Detection limit or PQL		Std. devn.	6.63
Method detection limit		Median	6.44
TOTAL	12	Min.	3.06
		Max.	25.1

Lognormal distribution? r-squared is: 0.949
Normal distribution? r-squared is: 0.795
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 13.9

Barium 95% UCL Calculation

DATA	ID
	J1T469/
53.4	J1T481
64.6	J1T470
89.5	J1T471
51.2	J1T472
58.5	J1T473
46.9	J1T474
76.1	J1T475
64.7	J1T476
67.5	J1T477
85.9	J1T478
50.5	J1T479
72.7	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	65.1
Censored		Lognormal mean	65.2
Detection limit or PQL		Std. devn.	13.9
Method detection limit		Median	64.7
TOTAL	12	Min.	46.9
		Max.	89.5

Lognormal distribution? r-squared is: 0.972
Normal distribution? r-squared is: 0.958
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 73.4

Beryllium 95% UCL Calculation

DATA	ID
	J1T469/
0.545	J1T481
0.612	J1T470
0.699	J1T471
0.540	J1T472
0.466	J1T473
0.492	J1T474
0.657	J1T475
0.488	J1T476
0.551	J1T477
0.613	J1T478
0.534	J1T479
0.589	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	0.566
Censored		Lognormal mean	0.566
Detection limit or PQL		Std. devn.	0.0705
Method detection limit		Median	0.548
TOTAL	12	Min.	0.466
		Max.	0.699

Lognormal distribution? r-squared is: 0.976
Normal distribution? r-squared is: 0.966
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.605

Cadmium 95% UCL Calculation

DATA	ID
	J1T469/
0.286	J1T481
0.299	J1T470
0.280	J1T471
0.235	J1T472
0.252	J1T473
0.245	J1T474
0.306	J1T475
0.259	J1T476
0.244	J1T477
0.284	J1T478
0.258	J1T479
0.259	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	0.267
Censored		Lognormal mean	0.267
Detection limit or PQL		Std. devn.	0.0230
Method detection limit		Median	0.259
TOTAL	12	Min.	0.235
		Max.	0.306

Lognormal distribution? r-squared is: 0.955
Normal distribution? r-squared is: 0.949
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.280

Chromium 95% UCL Calculation

DATA	ID
	J1T469/
10.3	J1T481
11.1	J1T470
11.9	J1T471
13.1	J1T472
9.68	J1T473
8.18	J1T474
10.3	J1T475
14.1	J1T476
10.1	J1T477
14.0	J1T478
9.36	J1T479
12.1	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	11.2
Censored		Lognormal mean	11.2
Detection limit or PQL		Std. devn.	1.88
Method detection limit		Median	10.7
TOTAL	12	Min.	8.18
		Max.	14.1

Lognormal distribution? r-squared is: 0.971
Normal distribution? r-squared is: 0.963
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 12.3

Cobalt 95% UCL Calculation

DATA	ID
	J1T469/
7.48	J1T481
6.96	J1T470
8.10	J1T471
6.95	J1T472
5.59	J1T473
5.20	J1T474
6.60	J1T475
5.80	J1T476
6.11	J1T477
6.09	J1T478
6.10	J1T479
6.96	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	6.50
Censored		Lognormal mean	6.50
Detection limit or PQL		Std. devn.	0.834
Method detection limit		Median	6.36
TOTAL	12	Min.	5.20
		Max.	8.10

Lognormal distribution? r-squared is: 0.976
Normal distribution? r-squared is: 0.968
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.96

Copper 95% UCL Calculation

DATA	ID
	J1T469/
17.2	J1T481
12.2	J1T470
14.1	J1T471
14.4	J1T472
12.3	J1T473
13.0	J1T474
13.7	J1T475
16.5	J1T476
11.0	J1T477
13.5	J1T478
12.9	J1T479
14.0	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	13.7
Censored		Lognormal mean	13.7
Detection limit or PQL		Std. devn.	1.74
Method detection limit		Median	13.6
TOTAL	12	Min.	11.0
		Max.	17.2

Lognormal distribution? r-squared is: 0.954
Normal distribution? r-squared is: 0.933
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 14.7

Lead 95% UCL Calculation

DATA	ID
	J1T469/
4.35	J1T481
6.66	J1T470
24.0	J1T471
11.1	J1T472
5.56	J1T473
10.9	J1T474
8.59	J1T475
3.17	J1T476
21.6	J1T477
37.7	J1T478
20.0	J1T479
24.2	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	14.8
Censored		Lognormal mean	15.5
Detection limit or PQL		Std. devn.	10.6
Method detection limit		Median	11.0
TOTAL	12	Min.	3.17
		Max.	37.7

Lognormal distribution? r-squared is: 0.967
Normal distribution? r-squared is: 0.901
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 28.3

Manganese 95% UCL Calculation

DATA	ID
	J1T469/
294	J1T481
299	J1T470
341	J1T471
283	J1T472
228	J1T473
223	J1T474
334	J1T475
248	J1T476
279	J1T477
308	J1T478
252	J1T479
265	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	280
Censored		Lognormal mean	280
Detection limit or PQL		Std. devn.	38.1
Method detection limit		Median	281
TOTAL	12	Min.	223
		Max.	341

Lognormal distribution? r-squared is: 0.980
Normal distribution? r-squared is: 0.980
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 301

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-279 Waste Site Cleanup Verification 95% UCL Calculation

Date 12/31/13
Job No. 14655

Calc. No. 0600X-CA-V0164
Checked N. K. Schiffern

Rev. No. 0
Date 12/31/13
Sheet No. 7 of 8

Ecology Software (MTCAStat) Results, 600-279 Waste Site

Molybdenum 95% UCL Calculation

DATA	ID
	J1T469/
0.270	J1T481
0.322	J1T470
0.330	J1T471
0.327	J1T472
0.240	J1T473
0.322	J1T474
0.267	J1T475
0.318	J1T476
0.386	J1T477
0.288	J1T478
0.261	J1T479
0.356	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	0.307
Censored		Lognormal mean	0.307
Detection limit or PQL		Std. devn.	0.0428
Method detection limit		Median	0.320
TOTAL	12	Min.	0.240
		Max.	0.386

Lognormal distribution? r-squared is: 0.959
Normal distribution? r-squared is: 0.958
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.332

Nickel 95% UCL Calculation

DATA	ID
	J1T469/
10.7	J1T481
9.50	J1T470
10.6	J1T471
11.3	J1T472
9.51	J1T473
9.93	J1T474
9.75	J1T475
8.37	J1T476
9.88	J1T477
11.5	J1T478
9.64	J1T479
9.16	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	9.99
Censored		Lognormal mean	9.99
Detection limit or PQL		Std. devn.	0.897
Method detection limit		Median	9.82
TOTAL	12	Min.	8.37
		Max.	11.5

Lognormal distribution? r-squared is: 0.957
Normal distribution? r-squared is: 0.956
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.5

Vanadium 95% UCL Calculation

DATA	ID
	J1T469/
50.4	J1T481
50.6	J1T470
51.2	J1T471
48.1	J1T472
40.9	J1T473
37.3	J1T474
42.2	J1T475
39.7	J1T476
44.4	J1T477
44.1	J1T478
43.5	J1T479
50.6	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	45.2
Censored		Lognormal mean	45.3
Detection limit or PQL		Std. devn.	4.81
Method detection limit		Median	44.3
TOTAL	12	Min.	37.3
		Max.	51.2

Lognormal distribution? r-squared is: 0.935
Normal distribution? r-squared is: 0.933
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 48.0

Zinc 95% UCL Calculation

DATA	ID
	J1T469/
35.9	J1T481
37.5	J1T470
45.5	J1T471
35.1	J1T472
32.4	J1T473
29.7	J1T474
35.1	J1T475
38.6	J1T476
36.5	J1T477
37.1	J1T478
33.9	J1T479
47.5	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	37.1
Censored		Lognormal mean	37.1
Detection limit or PQL		Std. devn.	5.03
Method detection limit		Median	36.2
TOTAL	12	Min.	29.7
		Max.	47.5

Lognormal distribution? r-squared is: 0.920
Normal distribution? r-squared is: 0.889
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 39.8

Chloride 95% UCL Calculation

DATA	ID
	J1T469/
1.34	J1T481
1.05	J1T470
0.847	J1T471
1.39	J1T472
0.854	J1T473
4.32	J1T474
4.03	J1T475
0.947	J1T476
2.70	J1T477
1.46	J1T478
1.56	J1T479
1.20	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	1.81
Censored		Lognormal mean	1.80
Detection limit or PQL		Std. devn.	1.21
Method detection limit		Median	1.37
TOTAL	12	Min.	0.847
		Max.	4.32

Lognormal distribution? r-squared is: 0.878
Normal distribution? r-squared is: 0.754
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2.38

Fluoride 95% UCL Calculation

DATA	ID
	J1T469/
2.87	J1T481
0.799	J1T470
0.626	J1T471
2.47	J1T472
0.621	J1T473
0.860	J1T474
1.07	J1T475
1.25	J1T476
0.674	J1T477
0.478	J1T478
1.14	J1T479
0.532	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	1.12
Censored		Lognormal mean	1.11
Detection limit or PQL		Std. devn.	0.769
Method detection limit		Median	0.830
TOTAL	12	Min.	0.478
		Max.	2.87

Lognormal distribution? r-squared is: 0.910
Normal distribution? r-squared is: 0.755
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1.63

Nitrogen in nitrate 95% UCL Calculation

DATA	ID
	J1T469/
0.557	J1T481
0.603	J1T470
0.780	J1T471
2.01	J1T472
0.417	J1T473
0.644	J1T474
1.72	J1T475
2.29	J1T476
1.38	J1T477
4.27	J1T478
1.30	J1T479
1.08	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	1.42
Censored		Lognormal mean	1.44
Detection limit or PQL		Std. devn.	1.08
Method detection limit		Median	1.19
TOTAL	12	Min.	0.417
		Max.	4.27

Lognormal distribution? r-squared is: 0.974
Normal distribution? r-squared is: 0.807
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.36

Nitrogen in nitrate and nitrite 95% UCL Calculation

DATA	ID
	J1T469/
0.154	J1T481
0.340	J1T470
0.841	J1T471
2.10	J1T472
0.0865	J1T473
0.0865	J1T474
1.69	J1T475
1.88	J1T476
1.15	J1T477
4.56	J1T478
1.04	J1T479
0.645	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	1.21
Censored		Lognormal mean	1.54
Detection limit or PQL		Std. devn.	1.26
Method detection limit		Median	0.941
TOTAL	12	Min.	0.0865
		Max.	4.56

Lognormal distribution? r-squared is: 0.939
Normal distribution? r-squared is: 0.806
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.00

Sulfate 95% UCL Calculation

DATA	ID
	J1T469/
1455	J1T481
410	J1T470
44.2	J1T471
1780	J1T472
408	J1T473
55.3	J1T474
286	J1T475
2450	J1T476
758	J1T477
1590	J1T478
822	J1T479
63.1	J1T480

Number of samples		Uncensored values	
Uncensored	12	Mean	843
Censored		Lognormal mean	1195
Detection limit or PQL		Std. devn.	795
Method detection limit		Median	584
TOTAL	12	Min.	44.2
		Max.	2450

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

UCL (Land's method) is 5925

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie

Project 100-IU-2/6 Remediation

Subject 600-279 Waste Site Cleanup Verification 95% UCL Calculation

Date 12/24/13

Job No. 14655

Calc. No. 0600X-CA-V0164

Checked N. K. Schiffern

Rev. No. 0

Date 12/24/13

Sheet No. 8 of 8

Duplicate Analysis - 600-279

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium			Cobalt			Copper		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1T469	11/13/13	5480	M	6.10	3.33		0.448	54.0	JN	0.0896	0.549		0.0896	0.308	B	0.0896	3910		7.17	10.4		0.134	7.12	D	0.672	17.0		0.269
Duplicate of J1T469	J1T481	11/13/13	5800	M	6.24	2.78		0.459	52.8	JN	0.0918	0.541		0.0918	0.264	B	0.0918	4210		7.34	10.2		0.138	7.84	D	0.688	17.4		0.275

Analysis:

TDL		5	10	2	0.2	0.2	100	1	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	5.7%		2.2%			7.4%	1.9%		2.3%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - 600-279

Sampling Area	Sample Number	Sample Date	Iron			Lead			Magnesium			Manganese			Molybdenum			Nickel			Potassium			Silicon			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1T469	11/13/13	18100		7.17	4.70	D	1.48	4090		7.62	288		0.179	0.278	B	0.179	10.2		0.134	717	JN	5.74	972	*JN	1.34	204		6.27
Duplicate of J1T469	J1T481	11/13/13	18000		7.34	4.00	BD	1.51	4300		7.80	300		0.184	0.261	B	0.184	11.2		0.138	772	JN	5.87	405	*JN	1.38	107		6.42

Analysis:

TDL		5	5	75	5	2	4	400	2	50
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	0.6%		5.0%	4.1%				82.4%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	No - acceptable

Duplicate Analysis - 600-279

Sampling Area	Sample Number	Sample Date	Vanadium			Zinc			Chloride			Fluoride			Nitrogen in Nitrate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1T469	11/13/13	51.3	JDN	0.448	37.9	JDN	1.79	1.37	B	0.687	2.93		0.338	0.555	JB	0.338	1670	D	27.3
Duplicate of J1T469	J1T481	11/13/13	49.4	JDN	0.459	33.8	JDN	1.84	1.31	B	0.685	2.80		0.338	0.559	JB	0.338	1240	D	13.6

Analysis:

TDL		2.5	1	2	5	0.75	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	3.8%	11.4%				29.6%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable

Attachment 1. 600-279 Waste Site Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1T469	11/13/13	5480	M	6.10	1.48	UD	1.48	3.33		0.448	54.0	JN	0.0896	0.549		0.0896
Duplicate of J1T469	J1T481	11/13/13	5800	M	6.24	1.51	UD	1.51	2.78		0.459	52.8	JN	0.0918	0.541		0.0918
EXC-2	J1T470	11/13/13	6010	M	6.34	1.54	UD	1.54	3.67		0.466	64.6	JN	0.0932	0.612		0.0932
EXC-3	J1T471	11/13/13	7440	M	6.81	1.65	UD	1.65	25.1		0.501	89.5	JN	0.100	0.699		0.100
EXC-4	J1T472	11/13/13	5560	M	6.34	1.54	UD	1.54	4.13		0.466	51.2	JN	0.0933	0.540		0.0933
EXC-5	J1T473	11/13/13	5240	M	6.17	1.50	UD	1.50	4.01		0.454	58.5	JN	0.0908	0.466		0.0908
EXC-6	J1T474	11/13/13	4860	M	6.16	1.50	UD	1.50	5.51		0.453	46.9	JN	0.0906	0.492		0.0906
EXC-7	J1T475	11/13/13	6870	M	7.05	1.71	UD	1.71	10.3		0.518	76.1	JN	0.104	0.657		0.104
EXC-8	J1T476	11/13/13	6060	M	6.83	1.66	UD	1.66	4.81		0.502	64.7	JN	0.100	0.488	B	0.100
EXC-9	J1T477	11/13/13	5530	M	6.84	1.66	UD	1.66	7.37		0.503	67.5	JN	0.101	0.551		0.101
EXC-10	J1T478	11/13/13	6490	M	6.93	1.68	UD	1.68	17.7		0.510	85.9	JN	0.102	0.613		0.102
EXC-11	J1T479	11/13/13	5440	M	6.41	1.55	UD	1.55	8.50		0.471	50.5	JN	0.0942	0.534		0.0942
EXC-12	J1T480	11/13/13	7060	M	5.99	1.45	UD	1.45	10.7		0.441	72.7	JN	0.0882	0.589		0.0882
FS-1	J1T461	10/23/13	5640		7.01	0.340	U	0.340	3.96		0.515	42.3	J	0.103	0.445	B	0.103
Equipment Blank	J1T482	11/13/13	96.1	M	6.36	0.308	U	0.308	0.467	U	0.467	1.55	JN	0.0935	0.0935	U	0.0935

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1T469	11/13/13	0.896	U	0.896	0.308	B	0.0896	3910		7.17	10.4		0.134	7.12	D	0.672
Duplicate of J1T469	J1T481	11/13/13	0.918	U	0.918	0.264	B	0.0918	4210		7.34	10.2		0.138	7.84	D	0.688
EXC-2	J1T470	11/13/13	0.932	U	0.932	0.299	B	0.0932	2800		7.46	11.1		0.140	6.96	D	0.699
EXC-3	J1T471	11/13/13	1.42	B	1.00	0.280	B	0.100	3510		8.02	11.9		0.150	8.10	D	0.752
EXC-4	J1T472	11/13/13	0.933	U	0.933	0.235	B	0.0933	4200		7.46	13.1		0.140	6.95	D	0.700
EXC-5	J1T473	11/13/13	0.908	U	0.908	0.252	B	0.0908	2790		7.26	9.68		0.136	5.59	D	0.681
EXC-6	J1T474	11/13/13	0.906	U	0.906	0.245	B	0.0906	4180		7.25	8.18		0.136	5.20	D	0.680
EXC-7	J1T475	11/13/13	1.04	U	1.04	0.306	B	0.104	3410		8.29	10.3		0.155	6.60	D	0.777
EXC-8	J1T476	11/13/13	1.00	U	1.00	0.259	B	0.100	3170		8.04	14.1		0.151	5.80	D	0.754
EXC-9	J1T477	11/13/13	1.01	U	1.01	0.244	B	0.101	2560		8.04	10.1		0.151	6.11	D	0.754
EXC-10	J1T478	11/13/13	1.02	B	1.02	0.284	B	0.102	3670		8.15	14.0		0.153	6.09	D	0.764
EXC-11	J1T479	11/13/13	0.942	U	0.942	0.258	B	0.0942	3510		7.54	9.36		0.141	6.10	D	0.707
EXC-12	J1T480	11/13/13	0.882	U	0.882	0.259	B	0.0882	2280		7.05	12.1		0.132	6.96	D	0.661
FS-1	J1T461	10/23/13	1.05	B	1.03	0.125	B	0.103	12000		8.25	11.9		0.155	4.16		0.155
Equipment Blank	J1T482	11/13/13	0.935	U	0.935	0.0935	U	0.0935	33.6		7.48	0.140	U	0.140	0.140	U	0.140

Note: Gray cells indicate not applicable.

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

* = duplicate analysis not within control limits

B = estimated result; result is less than the RL but greater than the MDL.

C = target analyte was detected in the sample and the associated blank, and the sample concentration was ≤ 5 times the blank concentration.

D = reported from a dilution

EXC = excavation

FS = focused sample

HEIS = Hanford Environmental Information System

HERB = herbicide

J = estimate

M = duplicate precision not met

N = recovery is outside control limits.

PQL = practical quantitation limit

PEST = pesticide

Q = qualifier

R = rejected

SVOA = semivolatile organic analysis

T = spike and/or spike duplicate sample recovery is outside control limits

U = undetected

X = serial dilution in the analytical batch indicates that physical and chemical interferences are present.

Attachment	1	Sheet No.	1 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Attachment 1. 600-279 Waste Site Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1T469	11/13/13	17.0		0.269	18100		7.17	4.70	D	1.48	4090		7.62	288		0.179
Duplicate of J1T469	J1T481	11/13/13	17.4		0.275	18000		7.34	4.00	BD	1.51	4300		7.80	300		0.184
EXC-2	J1T470	11/13/13	12.2		0.280	19100		7.46	6.66	D	1.54	3710		7.92	299		0.186
EXC-3	J1T471	11/13/13	14.1		0.301	20900		8.02	24.0	D	1.65	4320		8.52	341		0.200
EXC-4	J1T472	11/13/13	14.4		0.280	17500		7.46	11.1	D	1.54	4380		7.93	283		0.187
EXC-5	J1T473	11/13/13	12.3		0.272	15500		7.26	5.56	D	1.50	3700		7.71	228		0.182
EXC-6	J1T474	11/13/13	13.0		0.272	14700		7.25	10.9	D	1.50	3750		7.70	223		0.181
EXC-7	J1T475	11/13/13	13.7		0.311	19500		8.29	8.59	D	1.71	4100		8.81	334		0.207
EXC-8	J1T476	11/13/13	16.5		0.301	19800		8.04	3.17	BD	1.66	3580		8.54	248		0.201
EXC-9	J1T477	11/13/13	11.0		0.302	17500		8.04	21.6	D	1.66	3520		8.54	279		0.201
EXC-10	J1T478	11/13/13	13.5		0.306	20200		8.15	37.7	D	1.68	4100		8.66	308		0.204
EXC-11	J1T479	11/13/13	12.9		0.283	16700		7.54	20.0	D	1.55	3660		8.01	252		0.188
EXC-12	J1T480	11/13/13	14.0		0.264	19900		7.05	24.2	D	1.45	3530		7.49	265		0.176
FS-1	J1T461	10/23/13	14.4		0.309	18000		8.25	4.04		0.340	3770		8.76	172	M	0.206
Equipment Blank	J1T482	11/13/13	0.280	U	0.280	206		7.48	0.308	U	0.308	13.8	B	7.94	4.73		0.187

Sample Location	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1T469	11/13/13	0.00396	U	0.00396	0.278	B	0.179	10.2		0.134	717	JN	5.74	0.306	UD	0.306
Duplicate of J1T469	J1T481	11/13/13	0.00378	U	0.00378	0.261	B	0.184	11.2		0.138	772	JN	5.87	0.339	UD	0.339
EXC-2	J1T470	11/13/13	0.00392	U	0.00392	0.322	B	0.186	9.50		0.140	1470	JN	5.97	0.326	UD	0.326
EXC-3	J1T471	11/13/13	0.00405	U	0.00405	0.330	B	0.200	10.6		0.150	1550	JN	6.41	0.315	UD	0.315
EXC-4	J1T472	11/13/13	0.00413	U	0.00413	0.327	B	0.187	11.3		0.140	827	JN	5.97	0.318	UD	0.318
EXC-5	J1T473	11/13/13	0.00415	U	0.00415	0.240	B	0.182	9.51		0.136	1080	JN	5.81	0.300	UD	0.300
EXC-6	J1T474	11/13/13	0.00403	U	0.00403	0.322	B	0.181	9.93		0.136	726	JN	5.80	0.315	UD	0.315
EXC-7	J1T475	11/13/13	0.00420	U	0.00420	0.267	B	0.207	9.75		0.155	1600	JN	6.63	0.336	UD	0.336
EXC-8	J1T476	11/13/13	0.00422	U	0.00422	0.318	B	0.201	8.37		0.151	1090	JN	6.43	0.328	UD	0.328
EXC-9	J1T477	11/13/13	0.00375	U	0.00375	0.386	B	0.201	9.88		0.151	1450	JN	6.43	0.330	UD	0.330
EXC-10	J1T478	11/13/13	0.00451	B	0.00378	0.288	B	0.204	11.5		0.153	1610	JN	6.52	0.327	UD	0.327
EXC-11	J1T479	11/13/13	0.00364	U	0.00364	0.261	B	0.188	9.64		0.141	954	JN	6.03	0.341	UD	0.341
EXC-12	J1T480	11/13/13	0.00387	U	0.00387	0.356	B	0.176	9.16		0.132	1540	JN	5.64	0.298	UD	0.298
FS-1	J1T461	10/23/13	0.00573	B	0.00409	0.353	B	0.206	6.64		0.155	923	J	6.60	0.340	UD	0.340
Equipment Blank	J1T482	11/13/13	0.00372	U	0.00372	0.187	U	0.187	0.147	UJBC	0.147	35.3	JN	5.98	0.291	UD	0.291

Attachment	1	Sheet No.	2 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Attachment 1. 600-279 Waste Site Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1T469	11/13/13	972	*JN	1.34	0.0896	U	0.0896	204		6.27	51.3	DJN	0.448	37.9	JDN	1.79
Duplicate of J1T469	J1T481	11/13/13	405	*JN	1.38	0.0918	U	0.0918	107		6.42	49.4	DJN	0.459	33.8	JDN	1.84
EXC-2	J1T470	11/13/13	565	*JN	1.40	0.0932	U	0.0932	138		6.53	50.6	DJN	0.466	37.5	JDN	1.86
EXC-3	J1T471	11/13/13	985	*JN	1.50	0.100	U	0.100	167		7.02	51.2	DJN	0.501	45.5	JDN	2.00
EXC-4	J1T472	11/13/13	684	*JN	1.40	0.0933	U	0.0933	181		6.53	48.1	DJN	0.466	35.1	JDN	1.87
EXC-5	J1T473	11/13/13	807	*JN	1.36	0.0908	U	0.0908	92.0		6.35	40.9	DJN	0.454	32.4	JDN	1.82
EXC-6	J1T474	11/13/13	780	*JN	1.36	0.0906	U	0.0906	151		6.34	37.3	DJN	0.453	29.7	JDN	1.81
EXC-7	J1T475	11/13/13	542	*JN	1.55	0.104	U	0.104	139		7.26	42.2	DJN	0.518	35.1	JDN	2.07
EXC-8	J1T476	11/13/13	698	*JN	1.51	0.100	U	0.100	189		7.03	39.7	DJN	0.502	38.6	JDN	2.01
EXC-9	J1T477	11/13/13	943	*JN	1.51	0.101	U	0.101	95.9		7.04	44.4	DJN	0.503	36.5	JDN	2.01
EXC-10	J1T478	11/13/13	635	*JN	1.53	0.102	U	0.102	191		7.14	44.1	DJN	0.510	37.1	JDN	2.04
EXC-11	J1T479	11/13/13	570	*JN	1.41	0.0942	U	0.0942	118		6.59	43.5	DJN	0.471	33.9	JDN	1.88
EXC-12	J1T480	11/13/13	489	*JN	1.32	0.0882	U	0.0882	93.2		6.17	50.6	DJN	0.441	47.5	JDN	1.76
FS-1	J1T461	10/23/13	775	JN	1.55	0.103	U	0.103	261		7.22	45.2	J	0.103	32.5	J	0.412
Equipment Blank	J1T482	11/13/13	96.8	*JN	1.40	0.0935	U	0.0935	6.54	U	6.54	0.270	UJBCN	0.0935	1.23	UJCN	0.374

Attachment	1	Sheet No.	3 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Attachment 1. 600-279 Waste Site Verification Sample Results (Anions and pH).

Sample Location	HEIS Number	Sample Date	Bromide			Chloride			Cyanide			Fluoride			Nitrogen in Nitrate			Nitrogen in Nitrite and Nitrate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1T469	11/13/13	0.687	U	0.687	1.37	B	0.687				2.93		0.338	0.555	JB	0.338	0.219	B	0.173
Duplicate of J1T469	J1T481	11/13/13	0.685	U	0.685	1.31	B	0.685				2.80		0.338	0.559	JB	0.338	0.177	U	0.177
EXC-2	J1T470	11/13/13	0.695	U	0.695	1.05	B	0.695				0.799	B	0.342	0.603	JB	0.342	0.340	B	0.171
EXC-3	J1T471	11/13/13	0.701	U	0.701	0.847	B	0.701				0.626	B	0.345	0.780	JB	0.345	0.841		0.179
EXC-4	J1T472	11/13/13	0.687	U	0.687	1.39	B	0.687				2.47		0.338	2.01	J	0.338	2.10		0.172
EXC-5	J1T473	11/13/13	0.700	U	0.700	0.854	B	0.700				0.621	B	0.345	0.417	JB	0.345	0.173	U	0.173
EXC-6	J1T474	11/13/13	0.694	U	0.694	4.32		0.694				0.860	B	0.342	0.644	JB	0.342	0.173	U	0.173
EXC-7	J1T475	11/13/13	0.714	U	0.714	4.03		0.714				1.07		0.351	1.72	J	0.351	1.69		0.181
EXC-8	J1T476	11/13/13	0.704	U	0.704	0.947	B	0.704				1.25		0.347	2.29	J	0.347	1.88		0.175
EXC-9	J1T477	11/13/13	0.693	U	0.693	2.70		0.693				0.674	B	0.341	1.38	J	0.341	1.15		0.180
EXC-10	J1T478	11/13/13	0.698	U	0.698	1.46	B	0.698				0.478	B	0.344	4.27	J	0.344	4.56		0.180
EXC-11	J1T479	11/13/13	0.696	U	0.696	1.56	B	0.696				1.14		0.343	1.30	J	0.343	1.04		0.179
EXC-12	J1T480	11/13/13	0.689	U	0.689	1.20	B	0.689				0.532	B	0.339	1.08	J	0.339	0.645		0.173
FS-1	J1T461	10/23/13	0.691	U	0.691	2.23		0.691	0.0812	U	0.0812	6.95		0.340	0.536	B	0.340	0.175	U	0.175

Sample Location	HEIS Number	Sample Date	Nitrogen in Nitrite			Phosphorous in phosphate			Sulfate			Sulfide			pH Measurement		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	pH	Q	PQL
EXC-1	J1T469	11/13/13	0.338	UR	0.338	0.687	UR	0.687	1670	D	27.3	8.60	U	8.60	7.53	JX	0.010
Duplicate of J1T469	J1T481	11/13/13	0.338	UR	0.338	0.685	UR	0.685	1240	D	13.6	8.62	UJ	8.62	7.51	JX	0.010
EXC-2	J1T470	11/13/13	0.342	UR	0.342	0.695	UR	0.695	410	D	6.9	8.70	U	8.70	5.91	JX	0.010
EXC-3	J1T471	11/13/13	0.345	UR	0.345	0.701	UR	0.701	44.2		1.39	8.80	U	8.80	7.81	JX	0.010
EXC-4	J1T472	11/13/13	0.338	UR	0.338	0.687	UR	0.687	1780	D	27.3	8.75	U	8.75	7.44	JX	0.010
EXC-5	J1T473	11/13/13	0.345	UR	0.345	0.700	UR	0.700	408	D	6.95	8.72	U	8.72	7.27	JX	0.010
EXC-6	J1T474	11/13/13	0.342	UR	0.342	0.694	UR	0.694	55.3		1.38	8.64	U	8.64	8.29	JX	0.010
EXC-7	J1T475	11/13/13	0.351	UR	0.351	0.714	UR	0.714	286	D	2.83	8.91	U	8.91	7.76	JX	0.010
EXC-8	J1T476	11/13/13	0.347	UR	0.347	0.704	UR	0.704	2450	D	27.9	8.85	U	8.85	3.91	JX	0.010
EXC-9	J1T477	11/13/13	0.341	UR	0.341	0.693	UR	0.693	758	D	13.8	8.79	U	8.79	4.90	JX	0.010
EXC-10	J1T478	11/13/13	0.344	UR	0.344	0.698	UR	0.698	1590	D	27.7	17.6	UJ	17.6	5.41	JX	0.010
EXC-11	J1T479	11/13/13	0.343	UR	0.343	0.696	UR	0.696	822	D	13.8	8.83	UJ	8.83	7.33	JX	0.010
EXC-12	J1T480	11/13/13	0.339	UR	0.339	0.689	UR	0.689	63.1		1.37	8.75	UJ	8.75	4.97	JX	0.010
FS-1	J1T461	10/23/13	0.340	U	0.340	0.691	U	0.691	6080	D	68.6	17.2	U	17.2	3.92	X	0.010

Attachment	1	Sheet No.	4 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Attachment 1. 600-279 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-1 - J1T469			Duplicate of J1T469 - J1T481			EXC-2 - J1T470			EXC-3 - J1T471			EXC-4 - J1T472		
		11/13/13			11/13/13			11/13/13			11/13/13			11/13/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
2-(2,4,5-Trichlorophenoxy)propionic acid	HERB	1.71	U	1.71	1.71	U	1.71	1.73	U	1.73	1.75	U	1.75	1.74	U	1.74
2-(2-methyl-4-chlorophenoxy) propionic acid	HERB	206	UT	206	206	UT	206	208	UT	208	211	UT	211	210	UT	210
2,4,5-Trichlorophenoxyacetic acid	HERB	1.71	U	1.71	1.71	U	1.71	1.73	U	1.73	1.75	U	1.75	1.74	U	1.74
2,4-Dichlorophenoxyacetic acid	HERB	1.71	UJT	1.71	1.71	UJT	1.71	1.73	UJT	1.73	1.75	UJT	1.75	1.74	UJT	1.74
2-Methyl-4 chlorophenoxyacetic acid	HERB	237	UT	237	237	UT	237	239	UT	239	242	UT	242	241	UT	241
2-secButyl-4,6-dinitrophenol(DNBP)	HERB	1.71	U	1.71	1.71	U	1.71	1.73	U	1.73	1.75	U	1.75	1.74	U	1.74
4-(2,4-Dichlorophenoxy)butanoic acid	HERB	1.71	UJT	1.71	1.71	UJT	1.71	1.73	UJT	1.73	1.75	UJT	1.75	1.74	UJT	1.74
Dalapon	HERB	36.1	U	36.1	36.1	U	36.1	36.4	U	36.4	36.9	U	36.9	36.7	U	36.7
Dicamba	HERB	2.06	U	2.06	2.06	U	2.06	2.08	U	2.08	2.11	U	2.11	2.10	U	2.10
Dichloroprop	HERB	2.33	UJT	2.33	2.33	UJT	2.33	2.35	UJT	2.35	2.38	UJT	2.38	2.37	UJT	2.37
Aldrin	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
Alpha-BHC	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
alpha-Chlordane	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
beta-BHC	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
Delta-BHC	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
4-4'-DDD	PEST	0.343	U	0.343	0.343	U	0.343	0.347	U	0.347	0.350	U	0.350	0.348	U	0.348
4-4'-DDE	PEST	0.343	U	0.343	0.343	U	0.343	0.347	U	0.347	0.350	U	0.350	0.348	U	0.348
4-4'-DDT	PEST	0.343	UJ	0.343	0.343	UJ	0.343	0.347	UJ	0.347	0.350	UJ	0.350	0.348	UJ	0.348
Dieldrin	PEST	0.343	U	0.343	0.343	U	0.343	0.347	U	0.347	0.350	U	0.350	0.348	U	0.348
Endosulfan I	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
Endosulfan II	PEST	0.343	U	0.343	0.343	U	0.343	0.347	U	0.347	0.350	U	0.350	0.348	U	0.348
Endosulfan sulfate	PEST	0.343	U	0.343	0.343	U	0.343	0.347	U	0.347	0.350	U	0.350	0.348	U	0.348
Endrin	PEST	0.343	U	0.343	0.343	U	0.343	0.347	U	0.347	0.350	U	0.350	0.348	U	0.348
Endrin aldehyde	PEST	0.343	U	0.343	0.343	U	0.343	0.347	U	0.347	0.350	U	0.350	0.348	U	0.348
Endrin ketone	PEST	0.343	U	0.343	0.343	U	0.343	0.347	U	0.347	0.350	U	0.350	0.348	U	0.348
Gamma-BHC (Lindane)	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
gamma-Chlordane	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
Heptachlor	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
Heptachlor epoxide	PEST	0.172	U	0.172	0.171	U	0.171	0.174	U	0.174	0.175	U	0.175	0.174	U	0.174
Methoxychlor	PEST	1.72	U	1.72	1.71	U	1.71	1.74	U	1.74	1.75	U	1.75	1.74	U	1.74
Toxaphene	PEST	5.71	UJ	5.71	5.71	UJ	5.71	5.78	UJ	5.78	5.83	UJ	5.83	5.80	UJ	5.80

Attachment	1	Sheet No.	5 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Attachment 1. 600-279 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-5 - J1T473			EXC-6 - J1T474			EXC-7 - J1T475			EXC-8 - J1T476			EXC-9 - J1T477		
		11/13/13			11/13/13			11/13/13			11/13/13			11/13/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
2-(2,4,5-Trichlorophenoxy)propionic acid	HERB	1.73	U	1.73	1.72	U	1.72	1.77	U	1.77	1.76	U	1.76	1.75	U	1.75
2-(2-methyl-4-chlorophenoxy) propionic acid	HERB	209	UT	209	207	UT	207	213	UT	213	212	UT	212	211	UT	211
2,4,5-Trichlorophenoxyacetic acid	HERB	1.73	U	1.73	1.72	U	1.72	1.77	U	1.77	1.76	U	1.76	1.75	U	1.75
2,4-Dichlorophenoxyacetic acid	HERB	1.73	UJT	1.73	1.72	UJT	1.72	1.77	UJT	1.77	1.76	UJT	1.76	1.75	UJT	1.75
2-Methyl-4 chlorophenoxyacetic acid	HERB	240	UT	240	238	UT	238	245	UT	245	244	UT	244	242	UT	242
2-secButyl-4,6-dinitrophenol(DNBP)	HERB	1.73	U	1.73	1.72	U	1.72	1.77	U	1.77	1.76	U	1.76	1.75	U	1.75
4-(2,4-Dichlorophenoxy)butanoic acid	HERB	1.73	UJT	1.73	1.72	UJT	1.72	1.77	UJT	1.77	1.76	UJT	1.76	1.75	UJT	1.75
Dalapon	HERB	36.6	U	36.6	36.2	U	36.2	37.3	U	37.3	37.1	U	37.1	36.9	U	36.9
Dicamba	HERB	2.09	U	2.09	2.07	U	2.07	2.13	U	2.13	2.12	U	2.12	2.11	U	2.11
Dichloroprop	HERB	2.36	UJT	2.36	2.34	UJT	2.34	2.41	UJT	2.41	2.40	UJT	2.40	2.38	UJT	2.38
Aldrin	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
Alpha-BHC	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
alpha-Chlordane	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
beta-BHC	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
Delta-BHC	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
4-4'-DDD	PEST	0.348	U	0.348	0.344	U	0.344	0.355	U	0.355	0.353	U	0.353	0.350	U	0.350
4-4'-DDE	PEST	0.348	U	0.348	0.344	U	0.344	0.355	U	0.355	0.353	U	0.353	0.350	U	0.350
4-4'-DDT	PEST	0.348	UJ	0.348	0.344	UJ	0.344	0.355	UJ	0.355	0.353	UJ	0.353	0.350	UJ	0.350
Dieldrin	PEST	0.348	U	0.348	0.344	U	0.344	0.355	U	0.355	0.353	U	0.353	0.350	U	0.350
Endosulfan I	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
Endosulfan II	PEST	0.348	U	0.348	0.344	U	0.344	0.355	U	0.355	0.353	U	0.353	0.350	U	0.350
Endosulfan sulfate	PEST	0.348	U	0.348	0.344	U	0.344	0.355	U	0.355	0.353	U	0.353	0.350	U	0.350
Endrin	PEST	0.348	U	0.348	0.344	U	0.344	0.355	U	0.355	0.353	U	0.353	0.350	U	0.350
Endrin aldehyde	PEST	0.348	U	0.348	0.344	U	0.344	0.355	U	0.355	0.353	U	0.353	0.350	U	0.350
Endrin ketone	PEST	0.348	U	0.348	0.344	U	0.344	0.355	U	0.355	0.353	U	0.353	0.350	U	0.350
Gamma-BHC (Lindane)	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
gamma-Chlordane	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
Heptachlor	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
Heptachlor epoxide	PEST	0.174	U	0.174	0.172	U	0.172	0.177	U	0.177	0.176	U	0.176	0.175	U	0.175
Methoxychlor	PEST	1.74	U	1.74	1.72	U	1.72	1.77	U	1.77	1.76	U	1.76	1.75	U	1.75
Toxaphene	PEST	5.79	UJ	5.79	5.73	UJ	5.73	5.90	UJ	5.90	5.87	UJ	5.87	5.83	UJ	5.83

Attachment	1	Sheet No.	6 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Attachment 1. 600-279 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-10 - J1T478			EXC-11 - J1T479			EXC-12 - J1T480			FS-1 - J1T461		
		11/13/13			11/13/13			11/13/13			10/23/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
2-(2,4,5-Trichlorophenoxy)propionic acid	HERB	1.76	U	1.76	1.75	U	1.75	1.74	U	1.74	1.70	U	1.70
2-(2-methyl-4-chlorophenoxy) propionic acid	HERB	212	UT	212	211	UT	211	210	UT	210	205	U	205
2,4,5-Trichlorophenoxyacetic acid	HERB	1.76	U	1.76	1.75	U	1.75	1.74	U	1.74	1.70	U	1.70
2,4-Dichlorophenoxyacetic acid	HERB	1.76	UJT	1.76	1.75	UJT	1.75	1.74	UJT	1.74	1.70	U	1.70
2-Methyl-4 chlorophenoxyacetic acid	HERB	244	UT	244	243	UT	243	241	UT	241	236	U	236
2-secButyl-4,6-dinitrophenol(DNBP)	HERB	1.76	U	1.76	1.75	U	1.75	1.74	U	1.74	1.70	U	1.70
4-(2,4-Dichlorophenoxy)butanoic acid	HERB	1.76	UJT	1.76	1.75	UJT	1.75	1.74	UJT	1.74	1.70	U	1.70
Dalapon	HERB	37.2	U	37.2	37.0	U	37.0	36.7	U	36.7	35.9	U	35.9
Dicamba	HERB	2.12	U	2.12	2.11	U	2.11	2.10	U	2.10	2.05	U	2.05
Dichloroprop	HERB	2.40	UJT	2.40	2.39	UJT	2.39	2.37	UJT	2.37	2.32	U	2.32
Aldrin	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
Alpha-BHC	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
alpha-Chlordane	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
beta-BHC	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
Delta-BHC	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
4-4'-DDD	PEST	0.352	U	0.352	0.352	U	0.352	0.348	U	0.348	0.343	U	0.343
4-4'-DDE	PEST	0.352	U	0.352	0.352	U	0.352	0.348	U	0.348	0.343	U	0.343
4-4'-DDT	PEST	0.352	UJ	0.352	0.352	UJ	0.352	0.348	UJ	0.348	0.343	U	0.343
Dieldrin	PEST	0.352	U	0.352	0.352	U	0.352	0.348	U	0.348	0.343	U	0.343
Endosulfan I	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
Endosulfan II	PEST	0.352	U	0.352	0.352	U	0.352	0.348	U	0.348	0.343	U	0.343
Endosulfan sulfate	PEST	0.352	U	0.352	0.352	U	0.352	0.348	U	0.348	0.343	U	0.343
Endrin	PEST	0.352	U	0.352	0.352	U	0.352	0.348	U	0.348	0.343	U	0.343
Endrin aldehyde	PEST	0.352	U	0.352	0.352	U	0.352	0.348	U	0.348	0.343	U	0.343
Endrin ketone	PEST	0.352	U	0.352	0.352	U	0.352	0.348	U	0.348	0.343	U	0.343
Gamma-BHC (Lindane)	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
gamma-Chlordane	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
Heptachlor	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
Heptachlor epoxide	PEST	0.176	U	0.176	0.176	U	0.176	0.174	U	0.174	0.172	U	0.172
Methoxychlor	PEST	1.76	U	1.76	1.76	U	1.76	1.74	U	1.74	1.72	U	1.72
Toxaphene	PEST	5.87	UJ	5.87	5.86	UJ	5.86	5.79	UJ	5.79	5.71	U	5.71

Attachment	1	Sheet No.	7 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Attachment 1. 600-279 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-1 - J1T469			Duplicate of J1T469 - J1T481			EXC-2 - J1T470			EXC-3 - J1T471			EXC-4 - J1T472		
		11/13/13			11/13/13			11/13/13			11/13/13			11/13/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
1,2-Dichlorobenzene	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
1,3-Dichlorobenzene	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
1,4-Dichlorobenzene	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
2,4,5-Trichlorophenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
2,4,6-Trichlorophenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
2,4-Dichlorophenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
2,4-Dimethylphenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
2,4-Dinitrophenol	SVOA	103	UJ	103	103	UJ	103	104	UJ	104	105	UJ	105	105	UJ	105
2,4-Dinitrotoluene	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
2,6-Dinitrotoluene	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
2-Chloronaphthalene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
2-Chlorophenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
2-Methylnaphthalene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
2-Methylphenol (cresol, o-)	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
2-Nitroaniline	SVOA	113	U	113	113	U	113	115	U	115	116	U	116	115	U	115
2-Nitrophenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
3,3'-Dichlorobenzidine	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
3+4 Methylphenol (cresol, m+p)	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
3-Nitroaniline	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
4,6-Dinitro-2-methylphenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
4-Bromophenylphenyl ether	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
4-Chloro-3-methylphenol	SVOA	137	U	137	137	U	137	139	U	139	140	U	140	140	U	140
4-Chloroaniline	SVOA	103	UJ	103	103	UJ	103	104	UJ	104	105	UJ	105	105	UJ	105
4-Chlorophenylphenyl ether	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
4-Nitroaniline	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
4-Nitrophenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Acenaphthene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Acenaphthylene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Anthracene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Benzo(a)anthracene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	11.2	J	10.5	10.5	U	10.5
Benzo(a)pyrene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Benzo(b)fluoranthene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Benzo(ghi)perylene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Benzo(k)fluoranthene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Bis(2-chloro-1-methylethyl)ether	SVOA	103	UJ	103	103	UJ	103	104	UJ	104	105	UJ	105	105	UJ	105
Bis(2-Chloroethoxy)methane	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Bis(2-chloroethyl) ether	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Bis(2-ethylhexyl) phthalate	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Butylbenzylphthalate	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Carbazole	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Chrysene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Dibenz[a,h]anthracene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Dibenzofuran	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Diethylphthalate	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Dimethyl phthalate	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Di-n-butylphthalate	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Di-n-octylphthalate	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Diphenylamine	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Fluoranthene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	15.4	J	10.5	10.5	U	10.5
Fluorene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Hexachlorobenzene	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Hexachlorobutadiene	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Hexachlorocyclopentadiene	SVOA	103	UJ	103	103	UJ	103	104	UJ	104	105	UJ	105	105	UJ	105
Hexachloroethane	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Indeno(1,2,3-cd)pyrene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Isophorone	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Naphthalene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Nitrobenzene	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
N-Nitroso-di-n-dipropylamine	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Pentachlorophenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Phenanthrene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	10.5	U	10.5	10.5	U	10.5
Phenol	SVOA	103	U	103	103	U	103	104	U	104	105	U	105	105	U	105
Pyrene	SVOA	10.3	U	10.3	10.3	U	10.3	10.4	U	10.4	24.6	J	10.5	10.5	U	10.5

Attachment	1	Sheet No.	8 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Attachment 1. 600-279 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-5 - J1T473			EXC-6 - J1T474			EXC-7 - J1T475			EXC-8 - J1T476			EXC-9 - J1T477		
		11/13/13			11/13/13			11/13/13			11/13/13			11/13/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
1,2-Dichlorobenzene	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
1,3-Dichlorobenzene	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
1,4-Dichlorobenzene	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
2,4,5-Trichlorophenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
2,4,6-Trichlorophenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
2,4-Dichlorophenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
2,4-Dimethylphenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
2,4-Dinitrophenol	SVOA	104	UJ	104	103	UJ	103	107	UJ	107	106	UJ	106	106	UJ	106
2,4-Dinitrotoluene	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
2,6-Dinitrotoluene	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
2-Chloronaphthalene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
2-Chlorophenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
2-Methylnaphthalene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
2-Methylphenol (cresol, o-)	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
2-Nitroaniline	SVOA	115	U	115	114	U	114	117	U	117	116	U	116	116	U	116
2-Nitrophenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
3,3'-Dichlorobenzidine	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
3+4 Methylphenol (cresol, m+p)	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
3-Nitroaniline	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
4,6-Dinitro-2-methylphenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
4-Bromophenylphenyl ether	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
4-Chloro-3-methylphenol	SVOA	139	U	139	138	U	138	142	U	142	141	U	141	141	U	141
4-Chloroaniline	SVOA	104	UJ	104	103	UJ	103	107	UJ	107	106	UJ	106	106	UJ	106
4-Chlorophenylphenyl ether	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
4-Nitroaniline	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
4-Nitrophenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Acenaphthene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Acenaphthylene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Anthracene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Benzo(a)anthracene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	25.7	J	10.6
Benzo(a)pyrene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	28.5	J	10.6
Benzo(b)fluoranthene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	33.4	J	10.6
Benzo(ghi)perylene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Benzo(k)fluoranthene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	15.5	J	10.6
Bis(2-chloro-1-methylethyl)ether	SVOA	104	UJ	104	103	UJ	103	107	UJ	107	106	UJ	106	106	UJ	106
Bis(2-Chloroethoxy)methane	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Bis(2-chloroethyl) ether	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Bis(2-ethylhexyl) phthalate	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Butylbenzylphthalate	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Carbazole	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Chrysene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	27.8	J	10.6
Dibenz[a,h]anthracene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Dibenzofuran	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Diethylphthalate	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Dimethyl phthalate	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Di-n-butylphthalate	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Di-n-octylphthalate	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Diphenylamine	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Fluoranthene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	35.9		10.6
Fluorene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Hexachlorobenzene	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Hexachlorobutadiene	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Hexachlorocyclopentadiene	SVOA	104	UJ	104	103	UJ	103	107	UJ	107	106	UJ	106	106	UJ	106
Hexachloroethane	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Indeno(1,2,3-cd)pyrene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Isophorone	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Naphthalene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Nitrobenzene	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
N-Nitroso-di-n-dipropylamine	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Pentachlorophenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Phenanthrene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	10.6	U	10.6
Phenol	SVOA	104	U	104	103	U	103	107	U	107	106	U	106	106	U	106
Pyrene	SVOA	10.4	U	10.4	10.3	U	10.3	10.7	U	10.7	10.6	U	10.6	33.1	J	10.6

Attachment	1	Sheet No.	9 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Attachment 1. 600-279 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-10 - J1T478			EXC-11 - J1T479			EXC-12 - J1T480			FS-1 - J1T461		
		11/13/13			11/13/13			11/13/13			10/23/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
1,2-Dichlorobenzene	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
1,3-Dichlorobenzene	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
1,4-Dichlorobenzene	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
2,4,5-Trichlorophenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
2,4,6-Trichlorophenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
2,4-Dichlorophenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
2,4-Dimethylphenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
2,4-Dinitrophenol	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	103	U	103
2,4-Dinitrotoluene	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
2,6-Dinitrotoluene	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
2-Chloronaphthalene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
2-Chlorophenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
2-Methylnaphthalene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
2-Methylphenol (cresol, o-)	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
2-Nitroaniline	SVOA	117	U	117	116	U	116	115	U	115	113	U	113
2-Nitrophenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
3,3'-Dichlorobenzidine	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
3+4 Methylphenol (cresol, m+p)	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
3-Nitroaniline	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
4,6-Dinitro-2-methylphenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
4-Bromophenylphenyl ether	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
4-Chloro-3-methylphenol	SVOA	141	U	141	141	U	141	140	U	140	137	U	137
4-Chloroaniline	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	103	U	103
4-Chlorophenylphenyl ether	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
4-Nitroaniline	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
4-Nitrophenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Acenaphthene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Acenaphthylene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Anthracene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Benzo(a)anthracene	SVOA	33.6	J	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Benzo(a)pyrene	SVOA	39.6		10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Benzo(b)fluoranthene	SVOA	40.6		10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Benzo(ghi)perylene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Benzo(k)fluoranthene	SVOA	13.8	J	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Bis(2-chloro-1-methylethyl)ether	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	103	U	103
Bis(2-Chloroethoxy)methane	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Bis(2-chloroethyl) ether	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Bis(2-ethylhexyl) phthalate	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Butylbenzylphthalate	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Carbazole	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Chrysene	SVOA	34.6	J	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Dibenz[a,h]anthracene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Dibenzofuran	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Diethylphthalate	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Dimethyl phthalate	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Di-n-butylphthalate	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Di-n-octylphthalate	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Diphenylamine	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Fluoranthene	SVOA	43.8		10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Fluorene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Hexachlorobenzene	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Hexachlorobutadiene	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Hexachlorocyclopentadiene	SVOA	106	UJ	106	106	UJ	106	105	UJ	105	103	U	103
Hexachloroethane	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Indeno(1,2,3-cd)pyrene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Isophorone	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Naphthalene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Nitrobenzene	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
N-Nitroso-di-n-dipropylamine	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Pentachlorophenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Phenanthrene	SVOA	10.6	U	10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3
Phenol	SVOA	106	U	106	106	U	106	105	U	105	103	U	103
Pyrene	SVOA	44.5		10.6	10.6	U	10.6	10.5	U	10.5	10.3	U	10.3

Attachment	1	Sheet No.	10 of 10
Originator	J. D. Skoglie	Date	12/31/13
Checked	N. K. Schiffern	Date	12/31/13
Calc. No.	0600X-CA-V0164	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-IU-2/6 Field Remediation **Job No. 14655**

Area: 600 Area

Discipline: Environmental Calculation No: 0600X-CA-V0165

Subject: 600-279 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 3 Total = 4	J. D. Skoglie	N. K. Schiffern	I. B. Berezovskiy	D. F. Obenauer	1/6/14

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007)

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	12/31/2013	Calc. No.:	0600X-CA-V0165	Rev.:	0
Project:	100-IU-2 Field Remediation	Job No:	14655	Checked:	N. K. Schiffern	Date:	12/31/2013
Subject:	600-279 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					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 600-279 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009b), 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, *100 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, 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, *Remaining Sites Verification Package for the 600-279, Vegetation Free Area Between White Bluffs and 100F*, Attachment to Waste Site Reclassification Form 2013-134, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

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

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 2009b).

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	12/31/2013	Calc. No.:	0600X-CA-V0165	Rev.:	0
Project:	100-IU-2 Field Remediation	Job No:	14655	Checked:	N. K. Schiffern	Date:	12/31/2013
Subject:	600-279 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 3	

METHODOLOGY:

The 600-279 waste site underwent statistical verification sampling at one decision unit (excavation) and one focused sample. A duplicate sample was also taken. The direct contact hazard quotient and carcinogenic risk calculations for the 600-279 waste site were conservatively calculated for the entire waste site using the greater of the statistical and focused verification soil sample results (WCH 2014). Of the contaminants of potential concern (COPCs) for this site, boron, molybdenum, and the detected semivolatile organic compounds (SVOCs) require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Fluoride is included because it was detected above a Washington State or Hanford Site background value. Additionally, arsenic was detected above background; however, the arsenic standard is not toxicity based. Lead was detected above background; however, lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake. 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 maximum value for boron is 1.42 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 2.0×10^{-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 2.6×10^{-3}. 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 maximum value for benzo(a)pyrene is 0.0396 mg/kg, divided by 0.137 mg/kg, and multiplied as indicated, is 2.9×10^{-7}. 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 sum of the excess cancer risk values is 3.6×10^{-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 hazard quotient and excess cancer risk calculations.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	12/31/2013	Calc. No.:	0600X-CA-V0165	Rev.:	0
Project:	100-IU-2 Field Remediation	Job No:	14655	Checked:	N. K. Schiffern	Date:	12/31/2013
Subject:	600-279 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 3	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 600-279 Waste Site.

Contaminants of Potential Concern	Statistical or Maximum Value [a] (mg/kg)	Noncarcinogen RAG [b] (mg/kg)	Hazard Quotient	Carcinogen RAG [b] (mg/kg)	Carcinogen Risk
Metals					
Arsenic [c]	13.9	20	--	0.667	--
Boron	1.42	7,200	2.0E-04	--	--
Lead [d]	28.3	353	--	--	--
Molybdenum	0.353	400	8.8E-04	--	--
Semivolatiles					
Benzo(a)anthracene	0.0336	--	--	1.37	2.5E-08
Benzo(a)pyrene	0.0396	--	--	0.137	2.9E-07
Benzo(b)fluoranthene	0.0406	--	--	1.37	3.0E-08
Benzo(k)fluoranthene	0.0155	--	--	1.37	1.1E-08
Chrysene	0.0346	--	--	13.7	2.5E-09
Fluoranthene	0.0438	3,200	1.4E-05	--	--
Pyrene	0.0445	2,400	1.9E-05	--	--
Anions					
Fluoride	6.95	4,800	1.4E-03	--	--
Totals					
Cumulative Hazard Quotient:			**2.6E-03**		
Cumulative Excess Cancer Risk:					**3.6E-07**

[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] = The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b). The arsenic standard is not toxicity based, therefore, the hazard quotient will not be calculated.

[d] = Value for the noncarcinogenic RAG calculated using Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, EPA/540/R 93/081, Publication No. 9285.7, U.S. Environmental Protection Agency, Washington, D.C.

-- = not applicable

RAG = remedial action goal

CONCLUSION:

The calculations in Table 1 demonstrate that the 600-279 waste site meets the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk, respectively, as identified in the RDR/RAWP (DOE-RL 2009b) and SAP (DOE-RL 2009a). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

APPENDIX C

DATA QUALITY ASSESSMENT

APPENDIX C

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2013b). 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 2013b), the field logbook (WCH 2013a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the 100 Area SAP (DOE-RL 2009) data assurance requirements and the data validation procedures for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 600-279 waste site were provided by the laboratories in two sample delivery groups (SDGs): SDG XP0023 and XP0027. SDG XP0027 was submitted for third-party validation. Major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 600-279 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.

MAJOR DEFICIENCIES

In the ion chromatograph anions analysis, the holding times for nitrate, nitrite, and orthophosphate in method 300.0 were exceeded by more than twice the limit. All undetected nitrate, nitrite, and orthophosphate results in these SDG XP0027 were qualified as rejected with "R" flags by third-party validation. Similarly, the project has rejected all undetected nitrate, nitrite, and orthophosphate results in SDG XP0023. These results were anticipated by the project. To obtain usable nitrate and nitrite, data method 353.2 was also run, which has longer allowable holding times. The method 353.2 data effectively replace the rejected method 300.0 nitrate and nitrite data. Orthophosphate is not a regulated compound. Therefore, the resulting data set is sufficient for decision-making purposes.

MINOR DEFICIENCIES

SDG XP0023

This SDG comprises one focused soil grab samples (J1T461) collected from the 600-279 excavation on October 23, 2013. This sample was analyzed for inductively coupled plasma (ICP) metals, mercury, anions, semivolatile organic compounds (SVOCs), herbicides, pesticides, and pH. No major deficiencies were noted. Minor deficiencies are as follows.

In the SVOC analysis, matrix spike (MS) recoveries for 2-methyl-4,6-dinitrophenol (117%) and 2,4-dinitrophenol (115%) are above the laboratory acceptance criteria, but are within the projects acceptance criteria. The matrix spike duplicate (MSD) for 2-methyl-4,6-dinitrophenol (111%) was similarly elevated. The laboratory control samples (LCS) results were not affected. The laboratory concluded these results may be due to matrix interference. Results for 2-methyl-4,6-dinitrophenol and 2,4-dinitrophenol may be considered estimated. Estimated data are usable for decision-making purposes.

In the herbicide analysis, the continuing calibration verification standard for methylchlorophenoxypropionic acid (MCPP) returned a high bias on the confirmatory column. Similarly, the MS/MSD (163%, 172%) and LCS result for MCPP (130%) are above the laboratory acceptance criteria. However, the field sample result for sample J1T461 was nondetect for MCPP. Therefore, the possible high bias has no impact on the field sample data. The data are usable for decision-making purposes.

In the herbicide analysis, the MS/MSD recoveries for 2,4-D (568%, 865%), and dichloroprop (251%, 381%) are all above the quality control (QC) range. Additionally, the MSD result for 2,4-DB (166%) is also above the QC range. The relative percent difference for dichloroprop (41.3%) is also elevated. Because these results are all similar, the laboratory concluded they are due to matrix interference. The field sample results for sample J1T461 is nondetect for all of these analytes. Therefore, the possible high bias implied by these results has no impact on the field sample data. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery for silicon (67.6%) is below the acceptance criteria. The laboratory has qualified the associated silicon data with "N" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, serial dilutions identified matrix interference for the analyte manganese. The laboratory has qualified the associated manganese data with "M" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the pH analysis, the sample was analyzed past the specified holding time because the holding time specified is "immediate." Analysis of pH at a fixed laboratory is more reliable and standardized than is usually possible in the field. Also, pH is not a regulated quantity and is collected for informational purposes. The data are usable for decision-making purposes.

SDG XP0027

This SDG comprises 13 statistical (J1T469, J1T470 through J1T479, J1T480, J1T481) and an equipment blank (J1T482). The statistical samples were collected from the 600-279 excavation on November 13, 2013, and the equipment blank was prepared on that same day. The equipment blank was analyzed for ICP metals and the statistical samples were analyzed for ICP metals, mercury, anions, SVOCs, sulfides, herbicides, pesticides, and pH. A field duplicate pair (J1T469/J1T481) is included in this data set. SDG XP0027 was submitted for third-party validation. No major deficiencies were noted. Minor deficiencies are as follows.

In the pesticide analysis, toxaphene was not included in the spiking solution for the MS, MSD, or LCS. Toxaphene is a mixture of compounds that would interfere with the other analytes being evaluated and is not generally included in the spiking mixtures. Third-party validation has qualified all toxaphene results in SDG XP0027 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the pesticide analysis, the relative percent difference (RPD) calculated for 4,4-DDT (36.2%) is outside QC limits. Third-party validation has qualified all results for 4,4-DDT in SDG XP0027 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the herbicide analysis, RPDs calculated for 2,4-D (77.8%), 2,4-DB (51.7%), and dichloroprop (61.5%) are outside QC limits. Third-party validation has qualified all results for these analytes in SDG XP0027 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the anions analysis, the holding times for nitrate, nitrite, orthophosphate, and pH were exceeded by more than twice the listed hold time. The undetected results for nitrate, nitrite, and orthophosphate are discussed above in the Major Deficiencies section. The detected results for nitrate, nitrite, orthophosphate, and pH were qualified by third-party validation as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the anions analysis, the MS recovery for orthophosphate (65.8%) is outside the QC limit. Third-party validation indicated that this would have resulted in qualifying the data as estimated and the application of "J" flags. However, all of the orthophosphate data has been rejected and no additional "J" flags have been applied. Orthophosphate is not a regulated compound. The resulting data set is usable for decision-making purposes.

In the sulfides analysis, the MS recovery for sulfide (68.1%) is outside the QC limits. Third-party validation qualified the associated sulfide data in samples J1T478, J1T479, J1T480, and J1T481 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, low levels of nickel, vanadium, and zinc were detected in the method blank. Similar concentrations were detected in the field blank (J1T482). Third-party validation qualified results for nickel, vanadium, and zinc in sample J1T482 as nondetected and estimated with "UJ" flags. Nondetected and estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for barium (52.8%), potassium (40.9%), silicon (0%), vanadium (66.3%), and zinc (63.2%) are outside the QC limits. Third-party validation qualified all results for these analytes as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the LCS recoveries for 2,4-dintitrophenol (38.8%), hexachlorocyclopentadiene (40.1%), and bis(2-chloroisopropyl)ether (49.7%) are outside the QC limits. Third-party validation qualified all results for these analytes as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the MS recoveries for 2,4-dinitrophenol (38.5%), 4-chloroanaline (48.6%), hexachlorocyclopentadiene (24.8%), and bis(2-chloroisopropyl)ether (48.2%) are outside the QC limits. Similarly the MSD recovery for hexachlorocyclopentadiene (24.9%) was also outside the QC limits. Third-party validation qualified all results for these analytes as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the RPD calculated for 2,4-dinitrophenol (39%) is above the QC range. Third-party validation qualified all results for 2,4-dinitrophenol as estimated with "J" flags. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance (QA)/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 2013a) for the 600-279 waste site include one set of duplicate samples (J1T469/J1T481). The QA/QC sample results are presented in Appendix B.

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 (TDL). 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.

The RPD calculated for silicon in the field duplicate pair (J1T469/J1T481) is above the acceptance criteria (30%) at 82.4%. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix and do not necessarily indicate a problem with the sample handling or analysis. Additionally, silicon, known to be a poor

performing analyte in the ICP metals analysis, is not a regulated compound. The data set is usable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. None of the 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 600-279 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 600-279 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 Environmental Restoration 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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