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

11-AMRC-0186

JUL 28 2011

Ms. J. A. Hedges, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Ms. Hedges:

TRANSMITTAL OF APPROVED CLEANUP VERIFICATION PACKAGE FOR THE 118-H-3, CONSTRUCTION BURIAL GROUND, REVISION 0

Attached for your use is the approved, "Cleanup Verification Package for the 118-H-3, Construction Burial Ground," CVP-2010-00006, Rev.0. If you have questions, please contact me or your staff may contact Joanne Chance of my staff, at (509) 376-0811.

Sincerely,

Mark S. French, Federal Project Director
for the River Corridor Closure Project

AMRC:JCC

Attachment

cc w/attach:
N. M. Menard, Ecology
Administrative Record, H6-08

cc w/o attach:
R. D. Cantwell, WCH
S. A. Christman, CHPRC
S. L. Feaster, WCH
T. A. Harris, WCH
M. L. Proctor, WCH

CVP-2010-00006
Rev. 0

Cleanup Verification Package for the 118-H-3, Construction Burial Ground

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

February 2011

EXECUTIVE SUMMARY

This cleanup verification package documents completion of remedial action, sampling activities, and compliance with cleanup criteria for the 118-H-3, Construction Burial Ground waste site on the Hanford Site. The 118-H-3 waste site is located in the 100-HR-2 Operable Unit of the 100-H Area, southeast of the 105-H Reactor Building. The burial ground operated from 1953 to 1957 to receive approximately 3,000 m^3 (3,924 yd^3) of reactor components and hardware, including contaminated 41-cm (16-in.)-diameter pipes that were used as chutes for the removal of reactor vertical safety rod thimbles and other components from reactor modification programs. Originally, two northern trenches were used mostly for the disposal of the chute pipes. A third trench, south of the original two trenches, was developed later as a disposal site for large reactor components and hardware. Remedial action at the 118-H-3 waste site began on March 4, 2009, and was completed on April 22, 2009. Remedial action activities involved removing the buried waste material and the underlying contaminated soil for disposal. All waste materials were disposed at the Environmental Restoration Disposal Facility.

Verification sampling of the 118-H-3 waste site was conducted on December 14 and 15, 2009, and January 5 and April 15, 2010. Results of the verification sampling, laboratory analyses, and data evaluations for the 118-H-3 waste site indicate that all remedial action objectives and goals for direct exposure, protection of groundwater, and protection of the Columbia River have been met (see Table ES-1). The results of the verification sampling are used to make reclassification decisions for the 118-H-3 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2007). In accordance with this evaluation, the verification sampling and/or modeling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009) and the *Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2,*

100-KR-2, Operable Units, Hanford Site, Benton County, Washington (100 Area Burial Grounds ROD) (EPA 2000). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow-zone soil (i.e., surface to 4.6 m [15 ft] deep). The sampling and modeling results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Excavation depths include both shallow-zone and deep-zone components. However, the excavation area is considered as one decision unit and is interim closed out using the more restrictive of the direct exposure and groundwater/river protection criteria; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Table ES-1. Summary of Cleanup Verification Results for the 118-H-3 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years.	All individual radionuclide COC/COPC concentrations are below direct exposure RAGs.	Yes
Direct Exposure – Nonradionuclides	Attain individual COC/COPC RAGs.	All individual COC/COPC concentrations are below direct exposure RAGs.	Yes
Nonradionuclide Risk Requirements	Attain hazard quotient of <1 for noncarcinogens.	All hazard quotients are <1.	Yes
	Attain cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (2.6×10^{-2}) is <1.	
	Attain excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for each nonradionuclide carcinogen detected above background levels is $<1 \times 10^{-6}$.	
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The excess cancer risk is 3.9×10^{-7}, which is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COC/COPC groundwater and river protection RAGs.	None of the radionuclide COC/COPCs are predicted to reach groundwater within 1,000 years.	Yes
	Attain National Primary Drinking Water Standards: 4 mrem/yr (beta/gamma) dose rate to target receptors/organs[a].	None of the radionuclide COC/COPCs are predicted to reach groundwater within 1,000 years.	

Table ES-1. Summary of Cleanup Verification Results for the 118-H-3 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Radionuclides (continued)	Meet drinking water standards for nonuranium alpha emitters: the more stringent of the 15 pCi/L MCL or 1/25th of the derived concentration guide per DOE Order 5400.5 [b].	No nonuranium alpha-emitting radionuclide COCs/COPCs were detected.	Yes
	Meet total uranium standard of 21.2 pCi/L [c].	None of the uranium isotopes are predicted to reach groundwater within 1,000 years.	
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Residual concentrations of cadmium, copper, lead, zinc, and aroclor-1260 in soil fail the WAC 173-340-740 three-part test for river and groundwater protection. However, RESRAD modeling predicts that these constituents will not migrate to groundwater (and thus the Columbia River) at concentrations exceeding groundwater or river criteria within 1,000 years [d]. Therefore, residual concentrations achieve the remedial action objectives for groundwater and river protection.	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and the Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the Hanford Site background, the 30 µg/L uranium MCL (40 *Code of Federal Regulations* 141.66) corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038 (BHI 2001).
[d] Based on RESRAD modeling discussed in Appendix C of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009) the residual concentrations of cadmium, copper, lead, zinc, and aroclor-1260 are not expected to migrate more than 2.8 m (9 ft) vertically in 1,000 years (based on the constituent with the lowest distribution coefficient (K_d), copper with a K_d of 22 mL/g). The distribution coefficients for cadmium, lead, and zinc are 30 mL/g, and the distribution coefficient for aroclor-1260 is 822 mL/g). The vadose zone underlying the soil below the site is approximately 6 m (20 ft) thick. Therefore, residual concentrations of these contaminants 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 (drinking water standard)
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)
WAC = *Washington Administrative Code*

Soil cleanup levels were established in the 100 Area Burial Grounds ROD (EPA 2000) based in part on a limited ecological risk assessment. Although not required by the 100 Area Burial Grounds ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern and other constituents. Those constituents exceeding the ecological screening level in the 2001 *Washington Administrative Code* Chapter 173-340 Table 749-3 were boron, vanadium, and zinc. U.S. Environmental Protection Agency ecological soil screening levels were exceeded

for antimony, cadmium, lead, manganese, vanadium, and zinc. The table showing contaminant concentrations from the 118-H-3 waste site that exceed ecological screening levels is provided in Appendix A. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because the concentrations of antimony, manganese, and vanadium are below Hanford Site background levels it is believed that the presence of these constituents does not pose a risk to environmental 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.

Date Submitted: 01/20/11 Originator: M. L. Proctor Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-HR-2 Waste Site Code: 118-H-3 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2010-044

This form documents agreement among parties listed authorizing classification of the subject unit as Closed Out, Interim Closed Out, No Action, RCRA Postclosure, Rejected, or Consolidated. This form also authorizes backfill of the waste management unit, if appropriate, for Closed Out and Interim Closed Out units. Final removal from the NPL of No Action and Closed Out waste management units will occur at a future date.

Description of current waste site condition:
The 118-H-3, Construction Burial Ground operated from 1953 to 1957 to receive approximately 3,000 m^3 (3,924 yd^3) of reactor components and hardware, including contaminated 41-cm (16-in.)-diameter pipes that were used as chutes for the removal of reactor vertical safety rod thimbles and other components from reactor modification programs. Originally, two northern trenches were used mostly for the disposal of the chute pipes. A third trench, south of the original two trenches, was developed later as a disposal site for large reactor components and hardware. The site has been remediated and will be backfilled with concurrence from the lead regulatory agency. Remediation, verification sampling, and comparison of residual contaminant concentrations against cleanup levels have been performed in accordance with remedial action objectives and goals established by the *Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington* (100 Area Burial Grounds ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2000). 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 Environmental Restoration Disposal Facility at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for reclassification:
In accordance with this evaluation, the verification sampling and/or modeling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the 100 Area Burial Grounds ROD (EPA 2000). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soil (i.e., surface to 4.6 m [15 ft] deep). The sampling and modeling results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Excavation depths include both shallow-zone and deep-zone components. However, the excavation area is considered as one decision unit and is interim closed out using the more restrictive of either the direct exposure or groundwater/river protection criteria; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required. The basis for reclassification is described in detail in the attached *Cleanup Verification Package for the 118-H-3, Construction Burial Ground* (CVP-2010-00006), Washington Closure Hanford, Richland, Washington.

Regulator Comments:
Approval of this WSRF documents regulator agreement that the 118-H-3 waste site qualifies for "Interim Closed Out" under this Interim Action ROD. In addition, Ecology has evaluated the data for this site against WAC 173-340 (2007) clean-up levels for direct contact, groundwater protection, and river protection. This evaluation is documented in the letter transmitting Ecology's approval of the site's interim reclassification to "Interim Closed Out."

Waste Site Controls:
Engineered Controls: Yes ☐ No ☒ Institutional Controls: Yes ☐ No ☒ O&M requirements: Yes ☐ No ☒
If any of the Waste Site Controls are checked Yes specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents.

M. S. French DOE Federal Project Director (printed)	M S French Signature	6/3/11 Date
N. Menard Ecology Project Manager (printed)	Nina M. Menard Signature	6/27/11 Date
NA EPA Project Manager (printed)	Signature	Date

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APPENDICES

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

BCM	bank cubic meters
BCY	bank cubic yards
CFR	*Code of Federal Regulations*
COC	contaminant of concern
COPC	contaminant of potential concern
CVP	cleanup verification package
DOE-RL	U.S. Department of Energy, Richland Operations Office
DQA	data quality assessment
ENRE	Environmental Restoration database
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
GPERS	global positioning environmental radiological surveyor
HEIS	Hanford Environmental Information System
ICP	inductively coupled plasma
MCL	maximum contaminant level
MDA	minimum detectable activity
PCB	polychlorinated biphenyl
RAG	remedial action goal
RAO	remedial action objective
RDL	required detection limit
RDR/RAWP	remedial design report/remedial action work plan
RESRAD	RESidual RADioactivity (dose assessment model)
ROD	record of decision
SAP	sampling and analysis plan
UCL	upper confidence limit
VSP	visual sample plan
WAC	*Washington Administrative Code*

1.0 STATEMENT OF PROTECTIVENESS

This report demonstrates that the 118-H-3 waste site meets the objectives for interim closure as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009) and the *Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington* (100 Area Burial Grounds ROD) (EPA 2000). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soil (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Excavation depths include both shallow-zone and deep-zone components. However, the excavation area is considered as one decision unit and is interim closed out using the more restrictive shallow-zone criteria; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the 100 Area Burial Grounds ROD (EPA 2000) based in part on a limited ecological risk assessment. Although not required by the 100 Area Burial Grounds ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern and other constituents. Those constituents exceeding the ecological screening level in the 2001 *Washington Administrative Code* Chapter 173-340, Table 749-3 were boron, vanadium, and zinc. U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, cadmium, lead, manganese, vanadium, and zinc. The table showing contaminant concentrations from the 118-H-3 waste site that exceed ecological screening levels is provided in Appendix A. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because the concentrations of antimony, manganese, and vanadium are below Hanford Site background levels it is believed that the presence of these constituents does not pose a risk to environmental 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.

2.0 BACKGROUND AND GENERAL SITE INFORMATION

The purpose of this cleanup verification package (CVP) is to document that the 118-H-3, Construction Burial Ground was remediated in accordance with the 100 Area Burial Grounds ROD (EPA 2000). Remedial action objectives (RAOs) and remedial action goals (RAGs) for the 118-H-3 Burial Ground were established by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy, Richland Operations Office (DOE-RL), in concurrence with the Washington State Department of Ecology. These goals and objectives are documented in the 100 Area

Burial Grounds ROD (EPA 2000) and the RDR/RAWP (DOE-RL 2009). The 100 Area Burial Grounds ROD provides DOE-RL the authority, guidance, and objectives to conduct this remedial action.

The preferred remedy specified in the 100 Area Burial Grounds ROD (EPA 2000) and conducted for the 118-H-3 waste site included (1) excavating the site to the extent required to meet specified soil cleanup levels and (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility (ERDF) at the 200 Area of the Hanford Site. Backfilling the site with clean soil to the average adjacent grade elevation will be conducted with concurrence from the lead regulatory agency after waste site reclassification is approved. Excavation was driven by RAOs for direct exposure, protection of groundwater, and protection of the Columbia River.

2.1 GENERAL SITE INFORMATION

The 118-H-3, Construction Burial Ground, part of the 100-HR-2 Operable Unit, operated from 1953 to 1957 to receive approximately 3,000 m^3 (3,924 yd^3) of reactor components and hardware, including contaminated 41-cm (16-in.)-diameter pipes that were used as chutes for the removal of reactor vertical safety rod thimbles and other components from reactor modification programs (Figure 1). Originally, two northern trenches were used mostly for the disposal of the chute pipes. A third trench, south of the original two trenches, was developed later as a disposal site for large reactor components and hardware.

3.0 REMEDIAL ACTION SUMMARY

3.1 EXCAVATION AND DISPOSAL

Remedial action at the 118-H-3, Construction Burial Ground waste site began on March 4, 2009. The excavation of the waste site continued through April 22, 2009, to a depth of approximately 4.6 to 5.5 m (15 to 18 ft), resulting in a total 6,384 bank cubic meters (BCM) (8,350 bank cubic yards [BCY]) of debris and soil removed for disposal at the ERDF. All material removed from within the trenches was taken to sorting cells for surveying and unloading. Large metal and reactor hardware components excavated from trench A were stockpiled in a waste staging area on the east side of the trench (Figure 2). These metal sections were staged for size reduction prior to shipment for disposal. After size reduction was completed on May 18, 2009; the metal debris and an additional 0.3-m (1-ft) layer of underlying soil (approximately 60 BCM [75 BCY]) within the waste staging area footprint was removed.

Figure 1. Overall Site Location Map of the 118-H-3 Burial Ground.

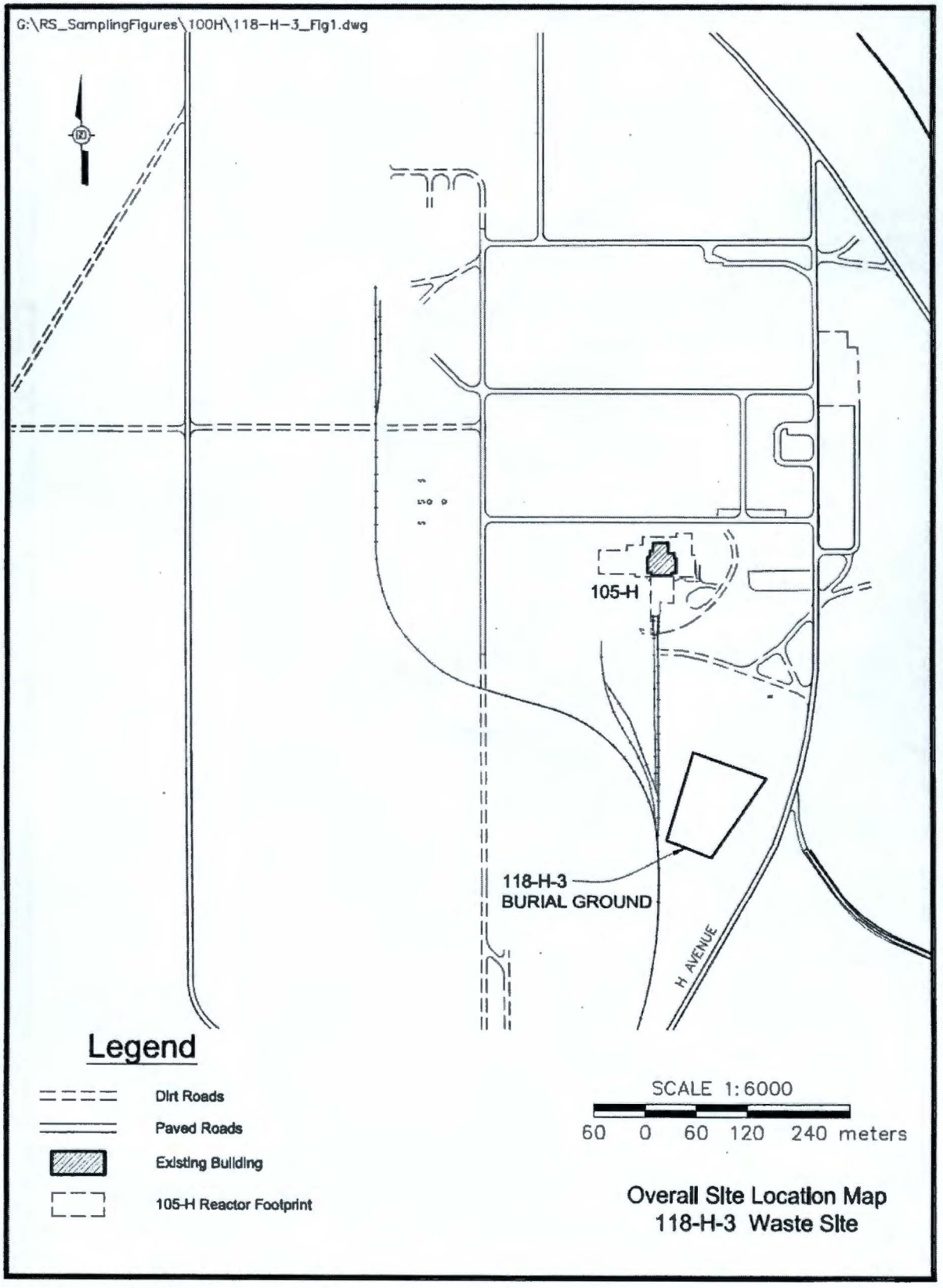
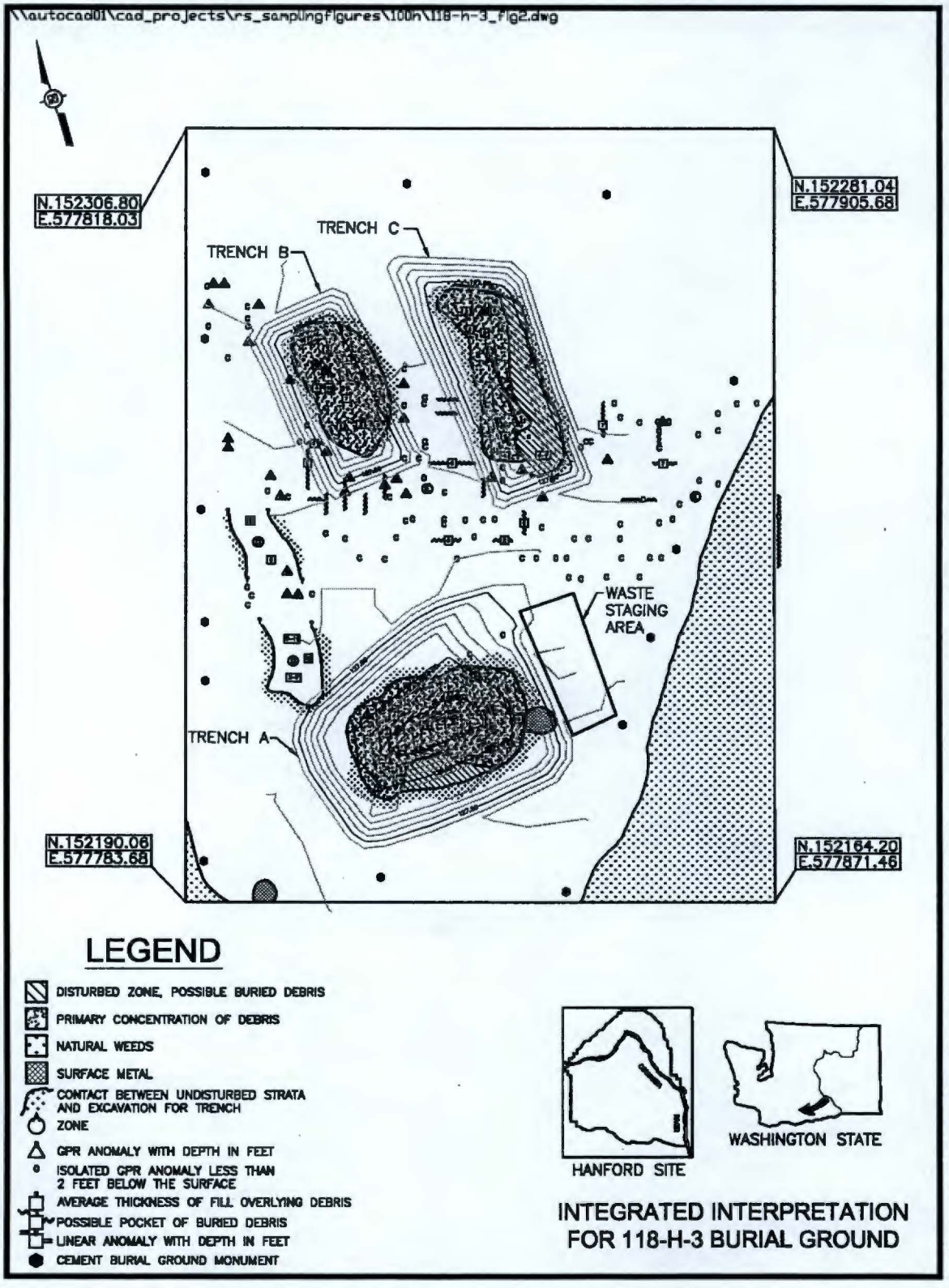


Figure 2. 118-H-3 Post-Remediation Topography Map.



The debris from the 118-H-3, Construction Burial Ground consisted mostly of metal components and very large pieces of reactor hardware (pipes, elbows, etc.). Trench C also contained aluminum tubing. No areas of stained soil or anomalous soil material were identified during the excavation. The waste removed from the trenches was consistent with the types of material expected to be present in this burial ground site.

On March 17, 2009, a suspected flammable gas cylinder, believed to be propane, was discovered. This cylinder, approximately 1.2 m (4 ft) tall and 51 cm (20 in.) in diameter, was located in the southeastern part of trench A (Washington State Plane coordinates N 152204.8, E 577837.2) and had no observable leakage nor was the surrounding soil discolored. This cylinder appeared rusted with blue/gray oxidation on the outlet female valve and the circular valve handle. On May 19, 2009, the cylinder was inspected and found to be empty. Following inspection, the cylinder was reduced in size and shipped to ERDF. No other anomalous material was discovered during the excavation.

4.0 SAMPLING ACTIVITIES

Remedial action goals are the specific numeric goals against which the verification data are evaluated to demonstrate attainment of the RAOs for the site. Verification sampling for the 118-H-3, Construction Burial Ground was performed on December 14 and 21, 2009, and January 5 and April 15, 2010, to collect data to determine if the RAGs had been met. The following subsections provide additional discussion of the information used to determine the contaminants of concern (COCs)/contaminants of potential concern (COPCs) for verification and focused sampling as well as the sampling design selection and basis. The results of the verification sampling are also summarized to support interim closure of the site.

4.1 CONTAMINANTS OF CONCERN/CONTAMINANTS OF POTENTIAL CONCERN

The 118-H-3 waste site contained sections of contaminated 41-cm (16-in.-)-diameter pipe used as chutes for thimble removal from the 105-H Reactor Building. The COPCs identified through process knowledge and listed in the *100 Area Burial Grounds Remedial Action Sampling and Analysis Plan* (100 Area Burial Grounds SAP) (DOE-RL 2001a), are silver-108m, americium-241, carbon-14, cobalt-60, cesium-137, europium-152, europium-154, europium-155, tritium, nickel-63, plutonium-238, plutonium-239/240, strontium-90, uranium-233/234, uranium-238, hexavalent chromium, mercury, lead, cadmium, and polychlorinated biphenyls (PCBs).

Although not considered COPCs, antimony, arsenic, barium, beryllium, boron, chromium (total) cobalt, copper, manganese, magnesium, molybdenum, nickel, selenium, silver, vanadium, and zinc were evaluated by performing analyses for the constituents of the expanded inductively coupled plasma (ICP) metals list.

4.2 FIELD SCREENING

4.2.1 Radiological Surveys

Global positioning environmental radiological surveys (GPERS) were conducted on April 22 and 23, 2009, within each of the 118-H-3 Burial Ground trenches to support the evaluation of completion of remediation activities. The results of these surveys are provided in Appendix B. An additional GPERS survey was completed on June 6, 2009, for the waste staging area after all waste had been removed. The radiological surveys for trench A, trench B, and the waste staging area (H113, H112B, and H155B, respectively) indicated no residual gamma radiological activity exceeding twice the background. The GPERS for trench C (H112A) identified two locations of elevated residual radiological activity, one on the east side wall and one on the west side wall (Appendix B, Figure B-3). The residual radioactivity was localized and no additional excavation was conducted. A focused verification soil sample for radiological and chemical analyses was taken at each of the two locations to verify contamination was not present at levels exceeding remedial action goals.

4.3 VERIFICATION SAMPLING DESIGN

This section describes the design for verification sampling to support interim close out of the 118-H-3 waste site. Verification sampling was performed to support a determination that potential residual contaminant concentrations at this site meet the cleanup criteria specified in the RDR/RAWP (DOE-RL 2009) and the 100 Area Burial Grounds ROD (EPA 2000).

4.3.1 Decision Unit Sampling

Two decision units were identified to support statistical soil sample collection. Decision Unit 1 consisted of trenches B and C that were the original trenches used for disposal of the 41-cm (16-in.)-diameter chute pipes. Decision Unit 2 consisted of trench A, the disposal site for large reactor components and hardware, and the waste staging area adjacent to trench A.

In addition to performing statistical sampling of the burial ground excavation, two focused soil samples were collected. The focused sample locations and sampling requirements are discussed in Section 4.3.3. The focused sample results were compared directly to the cleanup criteria, to verify that residual soil contamination had been adequately removed.

4.3.2 Statistical Sampling Design

The decision rule for demonstrating compliance with the cleanup criteria requires comparison of the true population mean, as estimated by the 95% upper confidence limit (UCL) on the sample mean, with the cleanup level. Therefore, a statistical sampling design was the preferred verification sampling approach for this site because the distribution of potential residual soil contamination over the study area (site) was uncertain. The Washington State Department of Ecology publication *Guidance on*

Sampling and Data Analysis Methods (Ecology 1995) recommends that systematic sampling with sample locations distributed over the entire study area be used.

Visual Sample Plan (VSP) was used as a tool to develop the statistical sampling design for the verification sampling. Additional details concerning the use of VSP to develop the statistical sampling design and derive the number of verification samples to collect are discussed in the *Work Instruction for Verification Sampling of 118-H-3, Construction Burial Ground* (WCH 2009b).

4.3.2.1 Statistical Sampling – Excavation Trenches B and C (Decision Unit 1). Trenches B and C were the original 118-H-3 Burial Ground trenches utilized mostly for the disposal of the 41 cm (16-in.) diameter chute pipes. Twelve statistical verification soil samples were collected from this decision unit.

4.3.2.2 Statistical Sampling – Excavation Trench A and Waste Staging Area Footprint (Decision Unit 2). Trench A was used as a disposal for large reactor components and hardware subsequent to the use of trenches B and C. These large metal components were excavated from trench A and placed on the waste staging area directly east and adjacent to the trench A excavation. Therefore, verification sampling of trench A and the footprint of the waste staging area were performed as a single decision unit. The statistical sampling design for this decision unit was developed as described for the excavation in Section 4.3.2. Twelve statistical verification soil samples were collected from this decision unit.

4.3.3 Focused Sampling Design

Two discrete focused soil samples were collected within the excavation footprint for trench C at the locations identified with elevated radiological activity present. One focused sample was located on the east side wall and one on the west side wall. The sample locations are shown in Figure 3, and coordinates and requested analysis are provided in Table 1.

Figure 3. 118-H-3 Statistical and Focused Verification Soil Sample Locations.

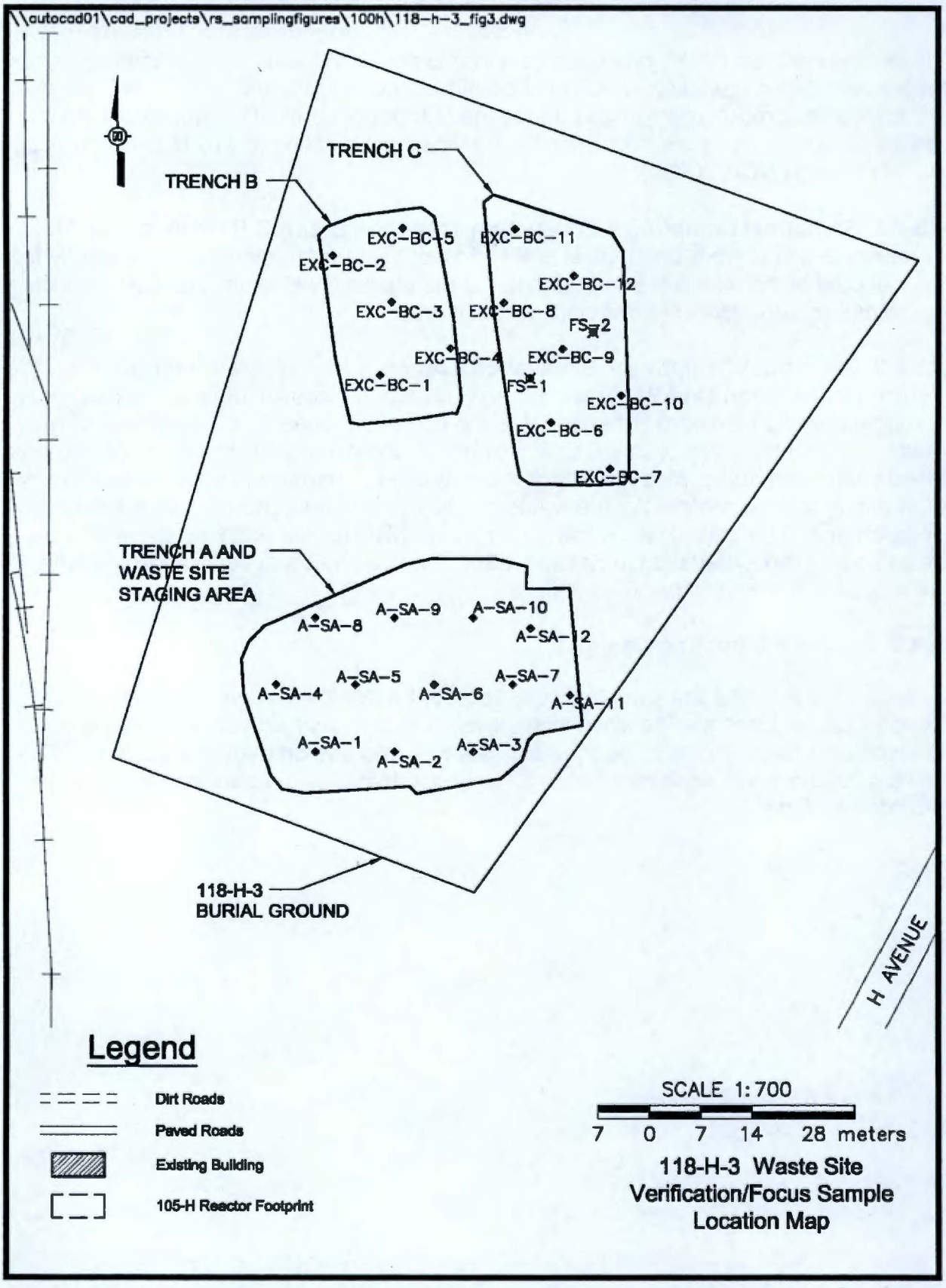


Table 1. 118-H-3 Burial Ground Excavation Verification Sample Summary Table.

Sample Location	Sample Number	WSP Coordinates		Sample Analysis
		Northing (m)	Easting (m)	
EXC-BC-1	J19DC2	152251.9	577826.9	ICP metals [a], mercury, hexavalent chromium, GEA, nickel-63, carbon-14, strontium-90, americium-241, isotopic uranium, isotopic plutonium, tritium [b], PCB
EXC-BC-2	J19DC3	152269.6	577820	
EXC-BC-3	J19DC4	152262.7	577828.5	
EXC-BC-4	J19DC5	152255.8	577837.1	
EXC-BC-5	J19DC6	152273.5	577830.2	
EXC-BC-6	J19DC7	152244.9	577851.8	
EXC-BC-7	J19DC8	152238	577860.4	
EXC-BC-8	J19DC9	152262.6	577844.9	
EXC-BC-9	J18R67	152255.7	577853.4	
EXC-BC-10	J19DD1	152248.9	577862	
EXC-BC-11	J19DD2	152273.4	577846.5	
EXC-BC-12	J19DD3	152266.6	577855.1	
Field duplicate of EXC-BC-12	J19DD4	152266.6	577855.1	
Field split of EXC-BC-12	J19DF9	152266.6	577855.1	
A-SA-1	J19DD5	152196.1	577817.5	
A-SA-2	J19DD6	152196.1	577829	
A-SA-3	J19DD7	152196.1	577840.5	
A-SA-4	J19DD8	152206	577811.8	
A-SA-5	J19DD9	152206	577823.2	
A-SA-6	J18R68	152206	577834.7	
A-SA-7	J19DF1	152206	577846.2	
A-SA-8	J19DF2	152215.9	577817.5	
A-SA-9	J19DF3	152215.9	577829	
A-SA-10	J19DF4	152215.9	577840.5	
A-SA-11	J19DF5	152204.4	577854.5	
A-SA-12	J19DF6	152214.4	577848.8	
Field duplicate of A-SA-3	J19DT1	152196.1	577840.5	
Field split of A-SA-3	J19DH0	152196.1	577840.5	
FS-1	J19DF7	152251.4	577848.7	
FS-2	J19DF8	152258.2	577857.9	
Equipment blank	J19DT2	NA	NA	ICP metals [a], mercury

Source: Field logbook EL-1627-2 (WCH 2009a).

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

[b] The portion of the sample for tritium analysis was collected at a depth of 0.15 m (6 in.) below the excavation surface per Tri-Party Agreement Change Notice TPA-CN-177 (dated August 21, 2007).

GEA = gamma energy analysis
ICP = inductively coupled plasma
NA = not applicable
PCB = polychlorinated biphenyl
WSP = Washington State Plane

5.0 SAMPLING RESULTS

The verification samples were submitted to offsite laboratories for analysis using approved EPA analytical methods, as required per the 100 Area Burial Grounds SAP (DOE-RL 2001a).

5.1 STATISTICAL SAMPLE RESULTS

The laboratory-reported data results from the verification sampling were used in the statistical calculations. The primary statistical calculation to evaluate compliance with cleanup standards is the 95% UCL on the arithmetic mean of the data. The 95% UCL values for each COC/COPC are computed for the two 118-H-3 excavation decision units (Appendix C) as specified by the 100 Area RDR/RAWP (DOE-RL 2009).

Comparisons of the statistical results for site COCs/COPCs with the RAGs for the excavation trenches B and C are listed in Table 2, and the comparisons of the statistical results for site COCs/COPCs with the RAGs for the excavation trench A and waste staging area footprint are listed in Table 3. Data sets with no reported detections were not included in the 95% UCL, therefore are not included in the comparison table. Soils within the top 1 m (3 ft) of previous orchard lands are known to contain residual lead and arsenic as a result of pesticide use on the pre-Manhattan Project orchards. As agreed to by the Tri-Parties, lead and arsenic sample results within the top 1 m (3 ft) of historical orchard sites are not used in the statistical evaluation for the waste site. The remaining lead and arsenic sample results [i.e., results for samples below 1 m (3 ft)] are treated as the statistical data set for purposes of comparison to cleanup levels, using the statistical distribution recommended and results obtained through use of the MTCAStat program. The standard laboratory analysis performed to quantify the concentrations of the COCs/COPCs also detected other analytes. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2009) under *Washington Administrative Code* (WAC) 173-340-740(3) for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium; therefore, these constituents are not considered site COPCs and are also not included in these tables. Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the site, but are not considered in the statistical calculations. These isotopes are naturally occurring, not related to the operational history of the site, and/or were detected below background levels.

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

Table 2. Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-H-3 Excavation Trenches B and C (Decision Unit 1) Verification Sampling.

COC/COPC	Statistical Result [b] (pCi/g)	Site Lookup Values [a] (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Uranium-233/234	0.685 (<BG)	1.1 [c]	1.1 [c]	1.1 [c]	No	--
Uranium-235	0.061	0.61	0.5 [d]	0.5 [d]	No	--
Uranium-238	0.618 (<BG)	1.1 [c]	1.1 [c]	1.1 [c]	No	--
COC/COPC	**Statistical Result [b] (mg/kg)**	**Remedial Action Goals [a] (mg/kg)**			**Does the Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	1.14 (<BG)	32	5 [e]	5 [e]	No	--
Arsenic	4.85 (<BG)	20	20	20	No	--
Barium	89.0 (<BG)	5,600	200	400	No	--
Beryllium	0.327 (<BG)	10.4 [f]	1.51 [e]	1.51 [e]	No	--
Boron [g]	3.08	7,200	320	NA	No	--
Cadmium	0.150 (<BG)	13.9 [f]	0.81 [e]	0.81 [e]	No	--
Chromium	13.6 (<BG)	80,000	18.5 [e]	18.5 [e]	No	--
Cobalt	6.97 (<BG)	24	15.7 [e]	NA	No	--
Copper	22.8	2,960	59.2	22.0 [e]	Yes	Yes [h]
Hexavalent chromium [g]	0.08	2.1 [f]	4.8	2	No	--
Lead	7.75 (<BG)	353	10.2 [e]	10.2 [e]	No	--
Manganese	339 (<BG)	3,760	512 [e]	512 [e]	No	--
Mercury	0.011 (<BG)	24	0.33 [e]	0.33 [e]	No	--
Molybdenum [g]	0.883	400	8	NA	No	--
Nickel	15.4 (<BG)	1,600	19.1 [e]	27.4	No	--
Silver	0.417 (<BG)	400	8	0.73 [g]	No	--
Vanadium	45.6 (<BG)	560	85.1 [e]	NA	No	--
Zinc	86.1	24,000	480	67.8 [e]	Yes	Yes [h]
Aroclor-1260	0.0688	0.5	0.017 [i]	0.017 [i]	Yes	Yes [h]

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009), unless otherwise noted.

[b] *118-H-3 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix C).

[c] The RAG is below the Hanford Site-specific soil background concentration. The value presented is the Hanford Site-specific soil background concentration.

[d] When the RAG is below the minimum detectable activity (MDA) the cleanup level defaults to the MDA.

[e] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996).

[f] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340 750[3]) (Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

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

[h] Based on RESRAD modeling discussed in Appendix C of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009); the residual concentrations of copper, zinc, and aroclor-1260 are not predicted to migrate through the approximately 6-m (20-ft)-thick vadose zone to groundwater in 1,000 years. Based on evaluation of the lowest soil-partitioning distribution coefficient (K_d) value for copper of 22 mL/g, none of these constituents are predicted to migrate more than 2.8 m (9 ft) vertically in 1,000 years. Therefore, residual concentrations of copper and zinc are predicted to be protective of groundwater and the Columbia River.

[i] Where cleanup levels are less than the RDL, the cleanup level defaults to the RDL per WAC 173-340-707(2) (Ecology 1996).

-- = not applicable
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
NA = not available
RAG = remedial action goal
RDL = required detection limit
RESRAD = RESidual RADioactivity (dose assessment model)
WAC = *Washington Administrative Code*

Table 3. Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-H-3 Excavation Trench A and Waste Staging Area Footprint (Decision Unit 2) Verification Sampling.

COC/COPC	Statistical Result [b] (pCi/g)	Site Lookup Values [a] (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Uranium-233/234	0.601 (<BG)	1.1 [c]	1.1 [c]	1.1 [c]	No	--
Uranium-238	0.619 (<BG)	1.1 [c]	1.1 [c]	1.1 [c]	No	--
COC/COPC	**Statistical Result [b] (mg/kg)**	**Remedial Action Goals [a] (mg/kg)**			**Does the Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.12 (<BG)	20	20	20	No	--
Barium	75.3 (<BG)	5,600	200	400	No	--
Beryllium	0.265 (<BG)	10.4 [d]	1.51 [e]	1.51 [e]	No	--
Boron [f]	2.15	7,200	320	NA	No	--
Cadmium	0.0972 (<BG)	13.9 [d]	0.81 [e]	0.81 [e]	No	--
Chromium	11.9 (<BG)	80,000	18.5 [e]	18.5 [e]	No	--
Cobalt	6.17 (<BG)	24	15.7 [e]	NA	No	--
Copper	14.1 (<BG)	2,960	59.2	22.0 [e]	No	--
Hexavalent chromium [f]	0.40	2.1 [d]	4.8	2	No	--
Lead	7.21(<BG)	353	10.2 [e]	10.2 [e]	No	--
Manganese	307 (<BG)	3,760	512 [e]	512 [e]	No	--
Mercury	0.015 (<BG)	24	0.33 [e]	0.33 [e]	No	--
Molybdenum [f]	0.280	400	8	NA	No	--
Nickel	10.9 (<BG)	1,600	19.1 [e]	27.4	No	--
Vanadium	45.5 (<BG)	560	85.1 [e]	NA	No	--
Zinc	39.3 (<BG)	24,000	480	67.8 [e]	No	--
Aroclor-1260	0.00944	0.5	0.017 [g]	0.017 [g]	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009), unless otherwise noted.
[b] *118-H-3 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix C).
[c] The RAG is below the Hanford Site-specific soil background concentration. The value presented is the Hanford Site-specific soil background concentration.
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340 750[3]) (Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996).
[f] No Hanford Site-specific or Washington State background value available.
[g] Where cleanup levels are less than the required detection limit (RDL), the cleanup level defaults to the RDL per WAC 173-340-707(2) (Ecology 1996).

-- = not applicable
BG = background (obtained from *Hanford Site Background: Part 2, Soil Background for Radionuclides* [DOE-RL 1996] and *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes* [DOE-RL 2001b], unless otherwise noted)

COC = contaminant of concern
COPC = contaminant of potential concern
NA = not available
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)

5.2 FOCUSED SAMPLE RESULTS

Two focused samples were collected from the 118-H-3 waste site. Statistical analysis (e.g., calculation of a 95% UCL value) is inappropriate to use for evaluation of focused samples; therefore, the sample results for each focused sample are evaluated using the maximum detected activity for each COC/COPC and comparing the value directly to the cleanup level. Table 4 provides a comparison of the maximum result of the focused samples against the cleanup criteria. Data sets with no reported detections are not included in the comparison table. Individual sample results are provided in Appendix C.

Table 4. Comparison of Maximum Contaminant Concentrations to Action Levels for the 118-H-3 Focused Verification Sampling Verification Sampling. (2 Pages)

COC/COPC	Maximum Result (pCi/g)	Site Lookup Values [a] (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.227 (<BG)	6.2	1,465	2,930	No	--
Cobalt-60	0.525	1.4	13,900	27,800	No	--
Nickel-63	8.76	4,013	83	166	No	--
Uranium-233/234	1.07(<BG)	1.1 [b]	1.1 [b]	1.1 [b]	No	--
Uranium-238	0.947 (<BG)	1.1 [b]	1.1 [b]	1.1 [b]	No	--
COC/COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	4.8 (<BG)	20	20	20	No	--
Barium	56.7 (<BG)	5,600	200	400	No	--
Beryllium	0.211 (<BG)	10.4 [c]	1.51 [d]	1.51 [d]	No	--
Boron [e]	2.63	7,200	320	NA	No	
Cadmium	0.811	13.9 [c]	0.81 [d]	0.81 [d]	Yes	Yes [f]
Chromium	9.11 (<BG)	80,000	18.5 [d]	18.5 [d]	No	--
Cobalt	5.69 (<BG)	24	15.7 [d]	NA	No	--
Copper	15.1 (<BG)	2,960	59.2	22.0 [d]	No	--
Lead	11.6	353	10.2 [d]	10.2 [d]	Yes	Yes [f]
Manganese	255 (<BG)	3,760	512 [d]	512 [d]	No	--
Molybdenum [e]	0.363	400	8	NA	No	--
Nickel	8.55 (<BG)	1,600	19.1 [d]	27.4	No	--
Vanadium	48.3 (<BG)	560	85.1 [d]	NA	No	--

Table 4. Comparison of Maximum Contaminant Concentrations to Action Levels for the 118-H-3 Focused Verification Sampling Verification Sampling. (2 Pages)

COC/COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Zinc	36.9 (<BG)	24,000	480	67.8 [d]	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009), unless otherwise noted.
[b] The remedial action goal is below the Hanford Site-specific soil background concentration. The value presented is the Hanford Site-specific soil background concentration.
[c] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340 750[3]) (Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996).
[e] No Hanford Site-specific or Washington State background value available.
[f] Based on RESRAD modeling discussed in Appendix C of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009); the residual concentrations of cadmium and lead are not expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years (based on the distribution coefficient for cadmium and lead of 30 mL/g). The vadose zone underlying the soil below the site is approximately 6 m (20 ft) thick. Therefore, residual concentrations of cadmium and lead are predicted to be protective of groundwater and the Columbia River.

-- = not applicable
BG = background (obtained from *Hanford Site Background: Part 2, Soil Background for Radionuclides* [DOE-RL 1996] and *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes* [DOE-RL 2001b], unless otherwise noted)
COC = contaminant of concern
COPC = contaminant of potential concern
NA = not available
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)

5.3 DATA QUALITY ASSESSMENT PROCESS

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

The DQA for the 118-H-3 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. All analytical data were found to be acceptable for decision-making purposes. The cleanup verification sample analytical data are stored in the ENRE project-specific database for data evaluation prior to its archival in the HEIS and are summarized in Appendix C. The detailed DQA is presented in Appendix D.

6.0 CLEANUP VERIFICATION DATA EVALUATION

This section demonstrates that remedial action at the 118-H-3 Burial Ground has achieved the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the 100 Area Burial Grounds ROD (EPA 2000) and documented in the RDR/RAWP (DOE-RL 2009).

6.1 RADIONUCLIDES

Evaluation of RAG attainment for radionuclides was performed using the single-radionuclide dose-equivalence lookup values. Because the analytical results were below single radionuclide dose-equivalence lookup values and the sum of fractions is less than one, a site-specific cleanup verification model was not developed. The model used to develop these dose-equivalence lookup values is presented in Appendix B of the RDR/RAWP (DOE-RL 2009).

6.2 NONRADIONUCLIDES

6.2.1 Direct Comparison to RAGs

Evaluation of the results listed in Tables 2, 3, and 4 from the verification sampling at the 118-H-3 Burial Ground indicates that all COCs/COPCs were undetected and/or quantified below RAGs and lookup values, with the exception of copper, zinc, and aroclor-1260 in the excavation trenches B and C decision unit, and cadmium and lead in the focused verification samples. However, RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009) predicts that contaminants with a distribution coefficient (K_d) of 12 mL/g or greater will not migrate more than 6 m (20 ft) through the soil at 118-H-3 to reach groundwater within 1,000 years. The copper K_d of 22 mL/g; the cadmium, lead, and zinc K_d of 30 mL/g; and the aroclor-1260 K_d of 822 mL/g are greater than 12 mL/g; and therefore, the residual concentrations of cadmium, copper, lead, zinc, and aroclor-1260 are predicted not to migrate through the soil column to groundwater (and thus the Columbia River) within 1,000 years.

6.2.2 Direct Contact Noncarcinogenic Hazard Quotient Remedial Action Goal Attained

For nonradionuclide noncarcinogenic COCs/COPCs, WAC 173-340-740(3)(a)(iii)(A) and (B) (Ecology 1996) specifies the evaluation of the hazard quotient, which is given as a daily intake divided by a reference dose. Both individual and cumulative hazard quotient values must be less than 1.0. For the 118-H-3 waste site, all individual hazard quotients are less than 1.0 and the cumulative hazard quotient of 2.6×10^{-2} is less than 1.0 (Appendix C). Therefore, the noncarcinogenic hazard quotient RAG has been attained for the 118-H-3 Burial Ground.

6.2.3 Direct Contact Carcinogenic Risk Remedial Action Goal Attained

For individual nonradionuclide carcinogenic COCs/COPCs, the WAC 173-340 Method B (Ecology 1996) cleanup limits are based on an incremental cancer risk of 1×10^{-6}. For nonradionuclide carcinogenic COCs/COPCs, the total excess cancer risk must be less than 1×10^{-5}. All individual excess carcinogenic risk values are less than 1×10^{-6}. The cumulative excess cancer risk is 3.9×10^{-7} which is less than 1×10^{-5} (Appendix C). Therefore, the carcinogenic risk RAG has been attained for the 118-H-3 Burial Ground.

6.2.4 Hazard Quotient and Carcinogenic Risk Calculation for Groundwater

An additional calculation of the hazard quotient and excess carcinogenic risk values for the potential impact to groundwater was performed for nonradionuclides. This calculation is located in Appendix C. The comparisons for the groundwater pathway 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}. These risk values were conservatively calculated for the entire waste site using the highest applicable values from each of the decision units. Risk values were not calculated for constituents that were not detected, were detected at concentrations below Hanford Site or Washington State background values, or were not predicted to reach groundwater in 1,000 years according to fate and transport modeling. The calculations indicated that all individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the 118-H-3 waste site is 9.3×10^{-2}. No carcinogenic constituents met the criteria for evaluation at the 118-H-3 waste site; therefore, no calculations of excess carcinogenic risk were performed.

6.3 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 118-H-3 Burial Ground is included in the 95% UCL calculation (Appendix C). The results of this evaluation of statistical results indicate that all residual COPC concentrations pass the three-part test in comparison against applicable RAGs, with the exception of the copper, lead, and zinc data set for the excavation trenches B and C decision unit. Copper fails the 95% UCL comparison and the 10% test criteria against soil RAGs for protection of groundwater and/or the Columbia River, lead fails the 10% test criteria of the three-part test in comparison against soil RAGs for protection of groundwater and/or the Columbia River, and zinc fails all three criteria. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009), residual concentrations are not expected to migrate more than 2.8 m (9 ft) vertically within 1,000 years (based on the copper distribution coefficient of 22 mL/g and the lead and zinc distribution coefficient of 30 mL/g). The vadose zone underlying the soil below the site is approximately 6 m (20 ft) thick. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.

An additional application of the three-part test is included for the statistical data sets which default to the maximum because less than half of the data set was detected. The results of this evaluation indicate that all residual COPC concentrations pass the three-part test in comparison against applicable RAGs, except for aroclor-1260 in comparison

against the soil RAGs for groundwater and/or river protection in the excavation trenches B and C decision unit. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009), residual concentrations of aroclor-1260 with a K_d of 822 mL/g are not predicted to migrate to groundwater within 1,000 years, and are therefore protective of groundwater and the Columbia River.

A three-part evaluation was also performed for focused sampling results. Table 4 presents the maximum value associated with each detected constituent. The results of this evaluation indicate that all residual COPC concentrations pass the three-part test in comparison against applicable RAGs, except for cadmium and lead in comparison against the soil RAGs for groundwater and/or river protection. However, residual concentrations of cadmium and lead are not predicted to migrate to groundwater within 1,000 years, and are therefore protective of groundwater and the Columbia River.

7.0 SUMMARY FOR WASTE SITE RECLASSIFICATION

This CVP demonstrates that remedial action at the 118-H-3 waste site has achieved the RAOs and corresponding RAGs established in the 100 Area Burial Grounds ROD (EPA 2000) and RDR/RAWP (DOE-RL 2009). The remaining soils at the 118-H-3 waste site have been sampled, analyzed, and modeled. The results of this effort indicate that the materials from the 118-H-3 waste site containing COCs/COPCs at concentrations exceeding RAGs have been excavated and disposed of at ERDF. These results also indicate that residual concentrations will support future land uses that can be represented (or bounded) by a rural-residential scenario and that residual concentrations throughout the site are predicted to pose no threat to groundwater or the Columbia River. The 118-H-3 waste site is verified to be remediated in accordance with the 100 Area Burial Grounds ROD (EPA 2000).

8.0 REFERENCES

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APPENDIX A

EXCEEDANCES OF ECOLOGICAL SCREENING LEVELS

Maximum or Statistical Contaminant Concentrations that Exceed Ecological Screening Levels for the 118-H-3 Waste Site [a].

Hazardous Substance		2007 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Waste Site Analyses
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
Metals (mg/kg):									
	Background								
Antimony	5	5	NA	NA	NA	78	NA	0.27	1.14 (<BG)
Boron	NA	0.5	NA	NA	NA	NA	NA	NA	3.08
Cadmium	0.81	4	20	14	32	140	0.77	0.36	0.811
Lead	10.2	50	500	118	120	1,700	11	56	11.6
Manganese	512	1,100 [d]	NA	1,500	220	450	4,300	4,000	339 (<BG)
Vanadium	85.1	2	NA	NA	NA	NA	7.8	280	48.3 (<BG)
Zinc	67.8	86 [d]	200	360	160	120	46	79	86.1

Note: Shaded cells are exceeded by the maximum of the focused or statistical result.

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

[b] Available on the internet at (www.epa.gov/ecotox/ecossl).

[c] Wildlife.

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

BG = background
EPA = U.S. Environmental Protection Agency
NA = not available
WAC = *Washington Administrative Code*

APPENDIX B

GLOBAL POSITIONING ENVIRONMENTAL RADIOLOGICAL SURVEYS (GPERS)

Figure B-1. 118-H-3 Burial Ground Gamma Track Map (Trench A).

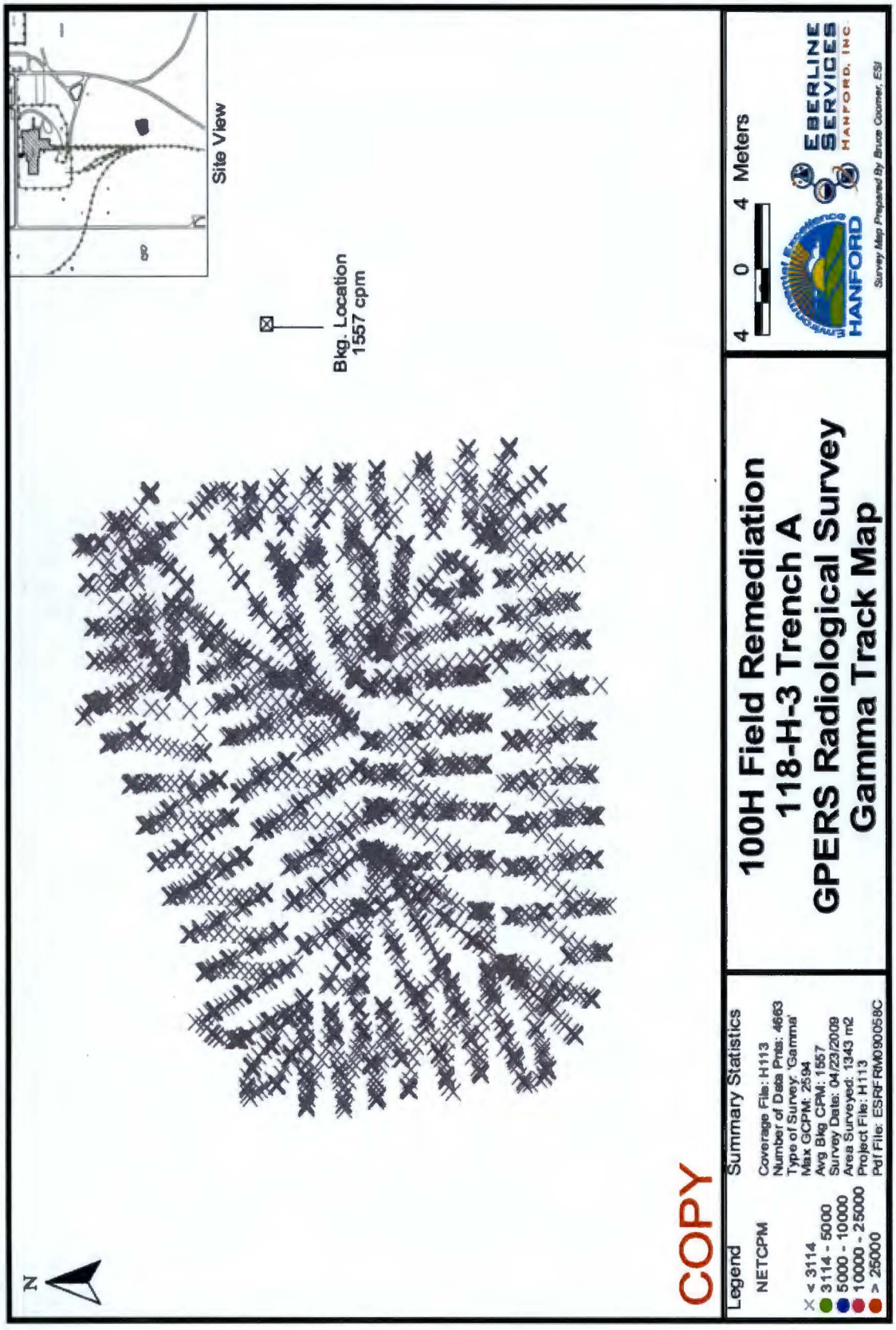


Figure B-2. 118-H-3 Burial Ground Gamma Track Map (Trench B).

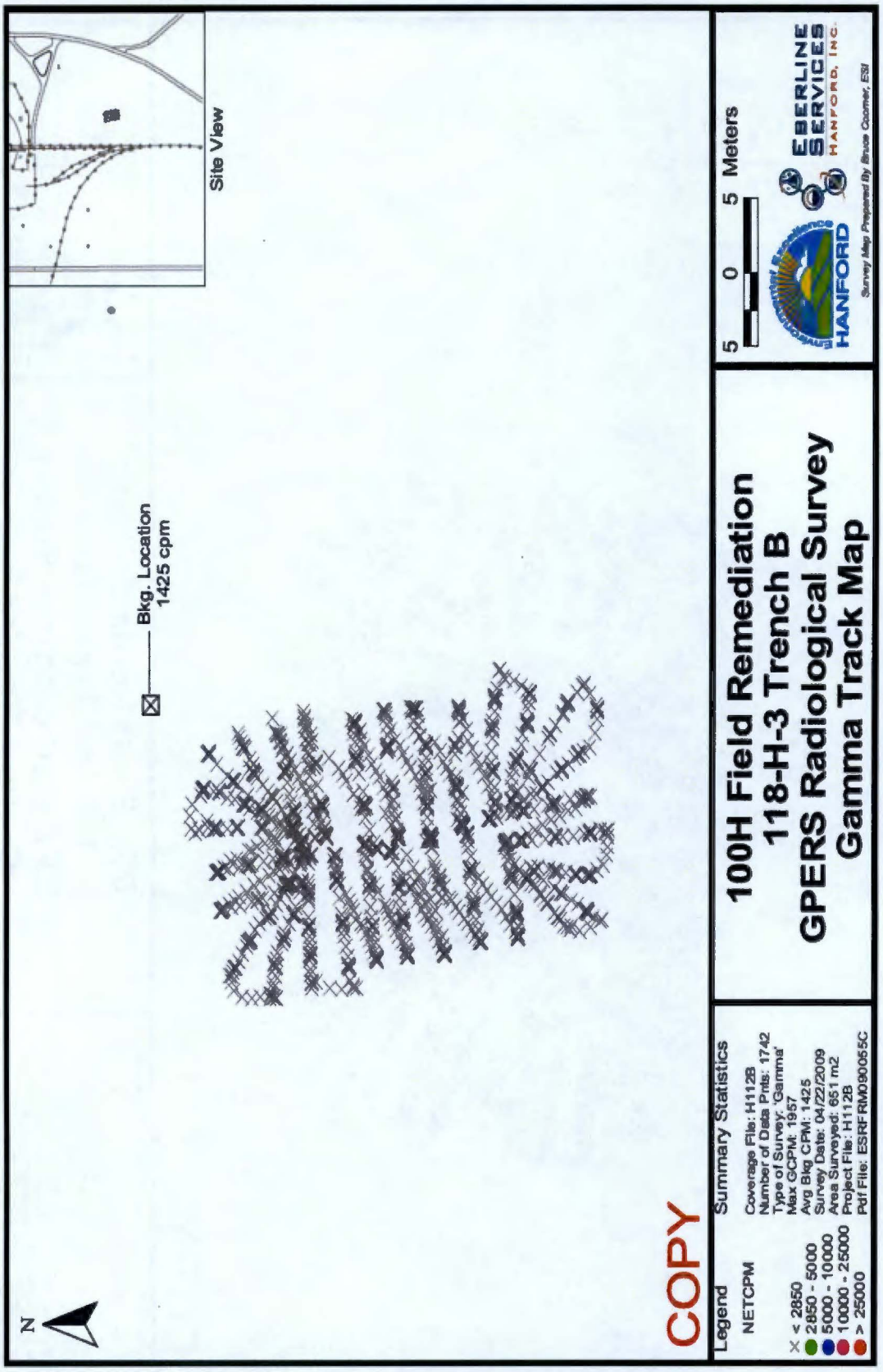


Figure B-3. 118-H-3 Burial Ground Gamma Track Map (Trench C).

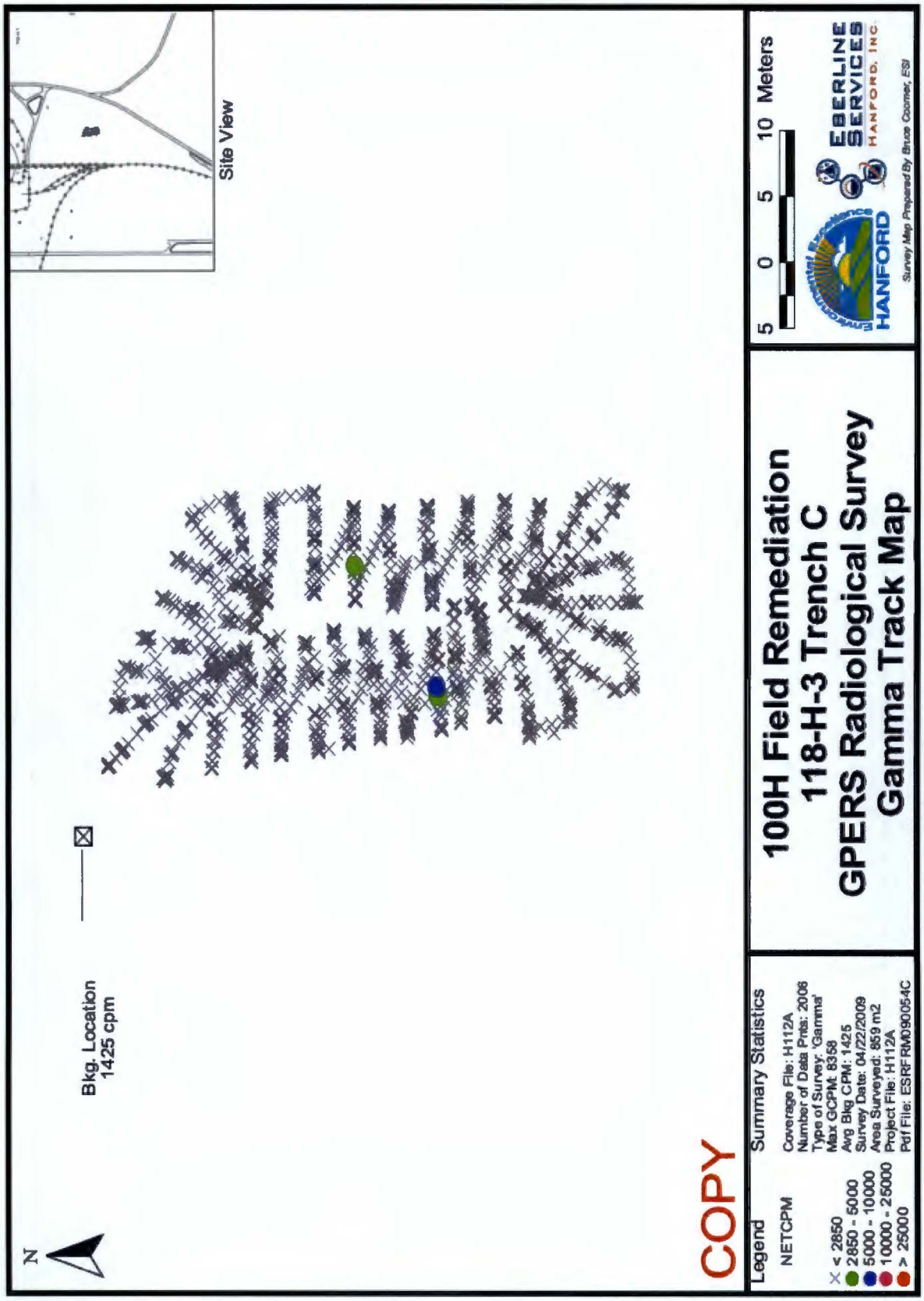
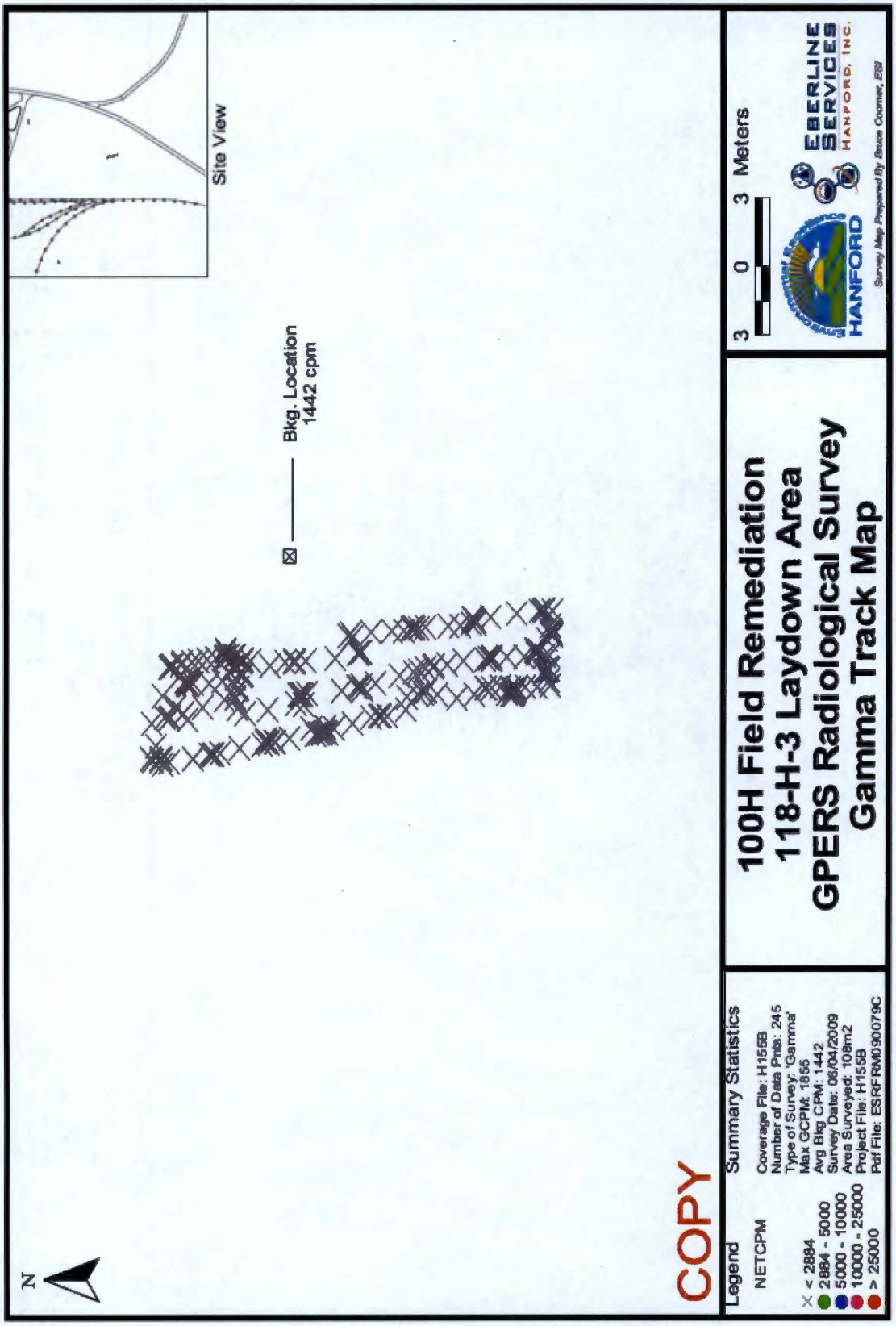


Figure B-4. 118-H-3 Burial Ground Gamma Track Map (Waste Staging Area).



APPENDIX C

CALCULATIONS

APPENDIX C

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 file will be stored in a U.S. Department of Energy, Richland Operations Office, repository. These calculations have been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculation," Washington Closure Hanford, Richland, Washington. The following calculations are provided in this appendix:

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-H Field Remediation **Job No. 14655**

Area: 100-H

Discipline: Environmental *Calculation No: 0100H-CA-V0133

Subject: 118-H-3 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 = 22 Attm. 1 = 13 Total = 36	J. D. Skoglie	T. E. Queen	B. L. Vedder	D. F. Obenauer	Signed on 2/2/11
1	Cover = 1 Sheets = 22 Attm. 1 = 13 Total = 36	J. D. Skoglie	T. E. Queen	NA	D. F. Obenauer	5/5/11

SUMMARY OF REVISION

1	Sheet 3, line 8: uranium-235 and uranium-238 95% UCL Result updated due to formula change for radionuclide calculations on pages 5 and 9. These formulas updated to be consistent with previous calculations.

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** 01/06/11 **Calc. No.** 0100H-CA-V0133 **Rev. No.** 0
Project 100-H Field Remediation **Job No.** 14655 **Checked** T. E. Queen **Date** 01/06/11
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 1 of 22

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:

Given/References:
1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2005b), 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, 2005, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
10) 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 Cleanup Verification Package (CVP).

Calculation Description:
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 118-H-2 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 CVP for this site.

Methodology:
The excavation area of 118-H-3 waste site underwent statistical and focused sampling and is considered two decision units for verification sampling.

Analytical results for all sampling locations are summarized in the tables provided on sheets 3 & 4. Further information of the sample data quality is presented in the data quality assessment section of the associated CVP.

Washington Closure Hanford CALCULATION SHEET

Originator J. D. Skoglie Date 01/06/11 Calc. No. 0100H-CA-V0133 Rev. No. 0
Project 100-H Field Remediation Job No. 14655 Checked T. E. Queen Date 01/06/11
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 2 of 22

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 (2005) under WAC 173-340-740(3) for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium; therefore, these constituents are not considered site COCs/COPCs and are also not included in these calculations. The 95% UCL values were not calculated for potassium-40, radium-226, radium-228, thorium-228, and thorium-232 based on natural occurence at the Hanford Site.

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 CVP.

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie Date 05/04/11 Calc. No. 0100H-CA-V0133 Rev. No. 1
Project 100-H Field Remediation Job No. 14655 Checked T. E. Queen Date 05/04/11
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 3 of 22

Summary (continued)

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

Results Summary - Excavation Trenches B and C [a]

Analyte	95% UCL Result	Maximum Result	Units
Uranium-233/234	0.685	--	pCi/g
Uranium-235	0.061	--	pCi/g
Uranium-238	0.618	--	pCi/g
Arsenic	4.85	--	mg/kg
Barium	89.0	--	mg/kg
Beryllium	0.327	--	mg/kg
Boron	3.08	--	mg/kg
Cadmium	0.150	--	mg/kg
Chromium	13.6	--	mg/kg
Cobalt	6.97	--	mg/kg
Copper	22.8	--	mg/kg
Lead	7.75	--	mg/kg
Manganese	339	--	mg/kg
Molybdenum	0.883	--	mg/kg
Nickel	15.4	--	mg/kg
Vanadium	45.6	--	mg/kg
Zinc	86.1	--	mg/kg
Antimony	--	1.14	mg/kg
Hexavalent chromium	--	0.08	mg/kg
Mercury	--	0.011	mg/kg
Silver	--	0.417	mg/kg
Aroclor-1260	--	0.0688	mg/kg
3 Part Test Evaluation:			
95% UCL or Maximum[a] > Cleanup Limit?	YES	YES	
> 10% above Cleanup Limit?	YES	NO	
Any sample > 2x Cleanup Limit?	YES	YES	

[a]The 95% UCL result or maximum value, depending on data censorship,

-- = not applicable
B = blank contamination (inorganic constituents)
C = Sample was ≤ 5X the blank concentration
CVP = closeout verification package
DE = direct exposure
GW = groundwater
J = estimate
L = dilution indicating physical and chemical interference are present

Results Summary - Excavation Trench A and Waste Staging Area Footprint [a]

Analyte	95% UCL Result	Maximum Result	Units
Uranium-233/234	0.601	--	pCi/g
Uranium-238	0.619	--	pCi/g
Arsenic	3.12	--	mg/kg
Barium	75.3	--	mg/kg
Beryllium	0.265	--	mg/kg
Boron	2.15	--	mg/kg
Cadmium	0.0972	--	mg/kg
Chromium	11.9	--	mg/kg
Cobalt	6.17	--	mg/kg
Copper	14.1	--	mg/kg
Lead	7.21	--	mg/kg
Manganese	307	--	mg/kg
Molybdenum	0.280	--	mg/kg
Nickel	10.9	--	mg/kg
Vanadium	45.5	--	mg/kg
Zinc	39.3	--	mg/kg
Hexavalent chromium	--	0.40	mg/kg
Mercury	--	0.015	mg/kg
Aroclor-1260	--	0.00944	mg/kg
3 Part Test Evaluation:			
95% UCL or Maximum[a] > Cleanup Limit?	NO	NO	
> 10% above Cleanup Limit?	NO	NO	
Any sample > 2x Cleanup Limit?	NO	NO	

[a]The 95% UCL result or maximum value, depending on data censorship,

M = sample duplicate precision not met
MTCA = *Model Toxics Control Act*
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
SAP = sampling and analysis plan
TDL = target detection limit
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie **Date** 01/31/11 **Calc. No.** 0100H-CA-V0133 **Rev. No.** 0
Project 100-H Field Remediation **Job No.** 14655 **Checked** T. E. Queen **Date** 01/31/11
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 4 of 22

Summary (continued)

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

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

Analyte	Excavation Trenches B and C		Excavation Trench A and Waste Staging Area Footprint	
	Duplicate Analysis	Split Analysis	Duplicate Analysis	Split Analysis
Potassium-40	4.7%		3.1%	
Radium-226	0.9%			
Aluminum	10.6%	8.1%	15.2%	26.5%
Barium	14.0%	7.4%	23.2%	27.4%
Calcium	11.5%	13.5%	13.3%	11.4%
Chromium	1.6%	9.3%	5.4%	13.4%
Copper	5.9%	7.9%	20.4%	21.2%
Iron	4.5%	1.0%	10.2%	12.0%
Magnesium	5.9%	7.0%	10.1%	5.2%
Manganese	5.9%	11.4%	8.9%	3.2%
Silicon	26.5%	20.5%	15.8%	38.1%
Sodium			28.9%	
Vanadium	3.1%	6.3%	6.8%	17.0%
Zinc	5.1%	13.4%	9.5%	0.5%

[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 CVP.

Results Summary - Focused Samples

Analyte	Maximum Result	Units
Cesium-137	0.227	pCi/g
Cobalt-60	0.525	pCi/g
Nickel-63	8.76	pCi/g
Uranium-233/234	1.07	pCi/g
Uranium-238	0.947	pCi/g
Arsenic	4.8	mg/kg
Barium	56.7	mg/kg
Beryllium	0.211	mg/kg
Boron	2.63	mg/kg
Cadmium	0.811	mg/kg
Chromium	9.11	mg/kg
Cobalt	5.69	mg/kg
Copper	15.1	mg/kg
Lead	11.6	mg/kg
Manganese	255	mg/kg
Molybdenum	0.363	mg/kg
Nickel	8.55	mg/kg
Vanadium	48.3	mg/kg
Zinc	36.9	mg/kg

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 05/04/11
Job No. 14655

Calc. No. 0100H-CA-V0133
Checked T. E. Queen

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Date 05/04/11
Sheet No. 5 of 22

118-H-3 Statistical Calculations

Verification Data -Excavation Trenches B and C

Sample Area	Sample Number	Sample Date	Uranium-233/234 pCi/g	Q	MDA	Uranium-235 pCi/g	Q	MDA	Uranium-238 pCi/g	Q	MDA
EXC-BC-12	J19DD3	12/21/09	0.482		0.176	0	U	0.212	0.344		0.176
Duplicate of J19DD3	J19DD4	12/21/09	0.497		0.380	0	U	0.461	0.249	U	0.380
EXC-BC-1	J19DC2	12/21/09	0.892		0.227	0.108	U	0.275	0.654		0.227
EXC-BC-2	J19DC3	01/05/10	0.584		0.224	0	U	0.271	0.526		0.224
EXC-BC-3	J19DC4	01/05/10	0.548		0.210	0.033	U	0.254	0.438		0.210
EXC-BC-4	J19DC5	01/05/10	0.662		0.253	0	U	0.307	0.696		0.253
EXC-BC-5	J19DC6	01/05/10	0.783		0.260	0	U	0.315	0.579		0.260
EXC-BC-6	J19DC7	12/21/09	0.467		0.255	0	U	0.309	0.533		0.255
EXC-BC-7	J19DC8	01/05/10	0.646		0.235	0.037	U	0.285	0.800		0.235
EXC-BC-8	J19DC9	01/05/10	0.707		0.258	0.082	U	0.312	0.505		0.258
EXC-BC-9	J18R67	04/15/10	0.416		0.052	0.033		0.031	0.433		0.037
EXC-BC-10	J19DD1	01/05/10	0.714		0.176	0.139	U	0.213	0.737		0.176
EXC-BC-11	J19DD2	12/21/09	0.502		0.226	0.036	U	0.274	0.325		0.226

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Uranium-233/234 pCi/g	Uranium-235 pCi/g	Uranium-238 pCi/g
EXC-BC-12	J19DD3/ J19DD4	12/21/09	0.490	0	0.297
EXC-BC-1	J19DC2	12/21/09	0.892	0.108	0.654
EXC-BC-2	J19DC3	01/05/10	0.584	0	0.526
EXC-BC-3	J19DC4	01/05/10	0.548	0.033	0.438
EXC-BC-4	J19DC5	01/05/10	0.662	0	0.696
EXC-BC-5	J19DC6	01/05/10	0.783	0	0.579
EXC-BC-6	J19DC7	12/21/09	0.467	0	0.533
EXC-BC-7	J19DC8	01/05/10	0.646	0.037	0.800
EXC-BC-8	J19DC9	01/05/10	0.707	0.082	0.505
EXC-BC-9	J18R67	04/15/10	0.416	0.033	0.433
EXC-BC-10	J19DD1	01/05/10	0.714	0.139	0.737
EXC-BC-11	J19DD2	12/21/09-	0.502	0.036	0.325

Statistical Computations

	Uranium-233/234	Uranium-235	Uranium-238
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
N	12	12	12
% < Detection limit	0%	92%	0%
Mean	0.618	0.039	0.544
Standard deviation	0.142	0.047	0.158
Z-statistic	1.64	1.64	1.64
95% UCL on mean	0.685	0.061	0.618
Maximum value	0.892	0.033	0.800

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/12/11
Job No. 14655
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Checked T. E. Queen
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Sheet No. 6 of 22

118-H-3 Statistical Calculations
Verification Data -Excavation Trenches B and C

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL
EXC-BC-12	J19DD3	12/21/09	5.44		1.06	79.8		0.530	0.294		0.212	1.97	B	2.12	0.0843	B	0.265	12.4		1.06	6.52		3.18	13.2		2.12
Duplicate of J19DD3	J19DD4	12/21/09	4.78		0.932	91.8		0.466	0.321		0.186	2.16		1.86	0.0853	B	0.233	12.6		0.932	6.92		2.79	14.0		1.86
EXC-BC-1	J19DC2	12/21/09	2.34		0.722	31.3		0.361	0.145		0.144	0.627	B	1.44	0.0663	B	0.181	9.10		0.722	4.49		2.17	11.1		1.44
EXC-BC-2[a]	J19DC3	01/05/10				65.9		0.434	0.191		0.174	1.10	BJ	1.74	0.0959	B	0.217	10.2		0.868	5.40		2.60	15.0		1.74
EXC-BC-3	J19DC4	01/05/10	2.32		0.911	46.6		0.455	0.156	B	0.182	0.517	BJ	1.82	0.107	B	0.228	8.74		0.911	4.78		2.73	11.6		1.82
EXC-BC-4[a]	J19DC5	01/05/10				54.0		0.562	0.194	B	0.225	1.47	BJ	2.25	0.117	B	0.281	11.1		1.12	5.68		3.37	40.9		2.25
EXC-BC-5	J19DC6	01/05/10	4.15		0.803	89.9		0.402	0.325		0.161	1.33	BJ	1.61	0.0927	B	0.201	12.5		0.803	7.03		2.41	15.0		1.61
EXC-BC-6	J19DC7	12/21/09	3.73		0.872	50.8		0.436	0.197		0.174	1.30	B	1.74	0.0695	B	0.218	12.5		0.872	5.61		2.62	13.3		1.74
EXC-BC-7[a]	J19DC8	01/05/10				141		0.429	0.589		0.172	7.03	J	1.72	0.362		0.214	18.6		0.858	10.2		2.57	38.6		1.72
EXC-BC-8[a]	J19DC9	01/05/10				63.9		0.393	0.218		0.157	1.27	BJ	1.57	0.103	B	0.196	10.6		0.785	5.63		2.36	13.0		1.57
EXC-BC-9	J18R67	04/15/10	1.46		0.689	31.9		0.344	0.115	B	0.138	0.697	B	1.38	0.0398	B	0.172	6.29		0.689	4.20		2.07	9.80		1.38
EXC-BC-10[a]	J19DD1	01/05/10				83.6		0.547	0.315		0.219	3.48	J	2.19	0.121	B	0.273	15.3		1.09	7.24		3.28	17.4		2.19
EXC-BC-11	J19DD2	12/21/09	3.18		0.822	64.9		0.411	0.230		0.164	1.18	B	1.64	0.0708	B	0.205	11.3		0.822	5.94		2.47	14.5		1.64

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg			Barium mg/kg			Beryllium mg/kg			Boron mg/kg			Cadmium mg/kg			Chromium mg/kg			Cobalt mg/kg			Copper mg/kg		
EXC-BC-12	J19DD3/ J19DD4	12/21/09	5.11			85.8			0.308			2.07			0.0848			12.5			6.72			13.6		
EXC-BC-1	J19DC2	12/21/09	2.34			31.3			0.145			0.627			0.0663			9.10			4.49			11.1		
EXC-BC-2	J19DC3	01/05/10				65.9			0.191			1.10			0.0959			10.2			5.40			15.0		
EXC-BC-3	J19DC4	01/05/10	2.32			46.6			0.156			0.517			0.107			8.74			4.78			11.6		
EXC-BC-4	J19DC5	01/05/10				54.0			0.194			1.47			0.117			11.1			5.68			40.9		
EXC-BC-5	J19DC6	01/05/10	4.15			89.9			0.325			1.33			0.0927			12.5			7.03			15.0		
EXC-BC-6	J19DC7	12/21/09	3.73			50.8			0.197			1.30			0.0695			12.5			5.61			13.3		
EXC-BC-7	J19DC8	01/05/10				141			0.589			7.03			0.362			18.6			10.2			38.6		
EXC-BC-8	J19DC9	01/05/10				63.9			0.218			1.27			0.103			10.6			5.63			13.0		
EXC-BC-9	J18R67	04/15/10	1.46			31.9			0.115			0.70			0.0398			6.3			4.20			9.8		
EXC-BC-10	J19DD1	01/05/10				83.6			0.315			3.48			0.121			15.3			7.24			17.4		
EXC-BC-11	J19DD2	12/21/09	3.18			64.9			0.230			1.18			0.0708			11.3			5.94			14.5		

Statistical Computations

	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
95% UCL based on	Small data set (n ≤10), use MTCAStat lognormal distribution.[a]	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
N	7	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%
Mean	3.18	67.5	0.249	1.84	0.111	11.6	6.08	17.8
Standard deviation	1.25	30.1	0.127	1.81	0.083	3.18	1.61	10.5
95% UCL on mean	4.85	89.0	0.327	3.08	0.150	13.6	6.97	22.8
Maximum value	5.44	141	0.589	7.03	0.362	18.6	10.2	40.9
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NO	NA	NO	NA	NO	NA	YES
> 10% above Cleanup Limit?	NA	NO	NA	NO	NA	NO	NA	YES
Any sample > 2X Cleanup Limit?	NA	NO	NA	NO	NA	NO	NA	NO
WAC 173-340 Compliance?	Because all values are below background (6.5 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 (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.81 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 (15.7 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.

[a]Soils within the top 1 meter of previous orchard lands are known to contain residual lead and arsenic as a result of pesticide use on pre-Manhattan Project orchards. As agreed to by the Tri-Parties, lead and arsenic sample results within the top 1 m of historical orchard sites are not used in the statistic evaluation for the waste site. The remaining lead and arsenic sample results (i.e., results for samples below 1 m) are treated as the statistical data set for purposes of comparison to cleanup levels, using the statistical distribution recommended and results obtained through use of the MTCAStat program.

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/12/11
Job No. 14655

Calc. No. 0100H-CA-V0133
Checked T. E. Queen

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Date 01/12/11
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118-H-3 Statistical Calculations

Verification Data -Excavation Trenches B and C

Sample Area	Sample Number	Sample Date	Lead mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
EXC-BC-12	J19DD3	12/21/09	8.19		1.06	315		1.06	0.284	B	1.06	10.3		2.65	44.3		1.06	39.8		3.18
Duplicate of J19DD3	J19DD4	12/21/09	7.54		0.932	334		0.932	0.289	B	0.932	11.5		2.33	45.7		0.932	41.9		2.79
EXC-BC-1	J19DC2	12/21/09	3.67		0.722	216		0.722	0.235	B	0.722	8.36		1.81	37.7		0.722	28.1		2.17
EXC-BC-2[a]	J19DC3	01/05/10				247		0.868	0.360	BJ	0.868	12.1	J	2.17	38.8		0.868	36.7		2.60
EXC-BC-3	J19DC4	01/05/10	4.63		0.911	240		0.911	0.367	BJ	0.911	8.98	J	2.28	38.1		0.911	242		2.73
EXC-BC-4[a]	J19DC5	01/05/10				251		1.12	2.67	J	1.12	17.4	J	2.81	40.6		1.12	40.1		3.37
EXC-BC-5	J19DC6	01/05/10	7.45		0.803	344		0.803	0.438	BJ	0.803	12.1	J	2.01	47.2		0.803	42.7		2.41
EXC-BC-6	J19DC7	12/21/09	10.3		0.872	248		0.872	0.277	B	0.872	19.3		2.18	46.4		0.872	35.0		2.62
EXC-BC-7[a]	J19DC8	01/05/10				560		0.858	0.705	BJ	0.858	18.8	J	2.14	44.5		0.858	80.8		2.57
EXC-BC-8[a]	J19DC9	01/05/10				287		0.785	0.357	BJ	0.785	11.1	J	1.96	45.8		0.785	35.9		2.36
EXC-BC-9	J18R67	04/15/10	1.65		0.689	183		0.689	0.319	B	0.689	6.55		1.72	36.6		0.689	24.9		2.07
EXC-BC-10[a]	J19DD1	01/05/10				342		1.09	0.461	BJ	1.09	14.7	J	2.73	51.3		1.09	47.7		3.28
EXC-BC-11	J19DD2	12/21/09	6.86		0.822	268		0.822	0.273	B	0.822	10.4		2.05	44.5		0.822	38.5		2.47

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Lead mg/kg			Manganese mg/kg			Molybdenum mg/kg			Nickel mg/kg			Vanadium mg/kg			Zinc mg/kg		
EXC-BC-12	J19DD3/ J19DD4	12/21/09	7.87			325			0.287			10.9			45.0			40.9		
EXC-BC-1	J19DC2	12/21/09	3.67			216			0.235			8.36			37.7			28.1		
EXC-BC-2	J19DC3	01/05/10				247			0.360			12.1			38.8			36.7		
EXC-BC-3	J19DC4	01/05/10	4.63			240			0.367			8.98			38.1			242		
EXC-BC-4	J19DC5	01/05/10				251			2.67			17.4			40.6			40.1		
EXC-BC-5	J19DC6	01/05/10	7.45			344			0.438			12.1			47.2			42.7		
EXC-BC-6	J19DC7	12/21/09	10.3			248			0.277			19.3			46.4			35.0		
EXC-BC-7	J19DC8	01/05/10				560			0.705			18.8			44.5			80.8		
EXC-BC-8	J19DC9	01/05/10				287			0.357			11.1			45.8			35.9		
EXC-BC-9	J18R67	04/15/10	1.65			183			0.319			6.55			36.6			24.9		
EXC-BC-10	J19DD1	01/05/10				342			0.461			14.7			51.3			47.7		
EXC-BC-11	J19DD2	12/21/09	6.86			268			0.273			10.4			44.5			38.5		

Statistical Computations

95% UCL based on	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc
	Small data set (n ≤10), use MTCAStat lognormal distribution.[a]	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
N	7	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%
Mean	6.06	293	0.562	12.6	43.0	57.8
Standard deviation	2.92	97.6	0.675	4.14	4.58	59.7
95% UCL on mean	7.75	339	0.883	15.4	45.6	86.1
Maximum value	10.3	560	2.67	19.3	51.3	242
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	10.2 GW & River Protection	512 GW & River Protection	8.0 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	NO	NO	NO	NO	NA	YES
> 10% above Cleanup Limit?	YES	NO	NO	NO	NA	YES
Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NA	YES
WAC 173-340 Compliance?	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (85.1 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.

[a]Soils within the top 1 meter of previous orchard lands are known to contain residual lead and arsenic as a result of pesticide use on pre-Manhattan Project orchards. As agreed to by the Tri-Parties, lead and arsenic sample results within the top 1 m of historical orchard sites are not used in the statistic evaluation for the waste site. The remaining lead and arsenic sample results (i.e., results for samples below 1 m) are treated as the statistical data set for purposes of comparison to cleanup levels, using the statistical distribution recommended and results obtained through use of the MTCAStat program.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/06/11
Job No. 14655

Calc. No. 0100H-CA-V0133
Checked T. E. Queen

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Date 01/06/11
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118-H-3 Maximum Calculations
Verification Data -Excavation Trenches B and C

Sample Area	Sample Number	Sample Date	Antimony			Hexavalent chromium			Mercury			Silver			Aroclor-1260		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL
EXC-BC-12	J19DD3	12/21/09	1.06	U	1.06	0.22	U	0.22	0.0310	U	0.0310	1.06	U	1.06	14.7	U	14.7
Duplicate of J19DD3	J19DD4	12/21/09	0.932	U	0.932	0.23	U	0.23	0.0274	U	0.0274	0.932	U	0.932	15.4	U	15.4
EXC-BC-1	J19DC2	12/21/09	0.722	U	0.722	0.22	U	0.22	0.0314	U	0.0314	0.722	U	0.722	14.4	U	14.4
EXC-BC-2	J19DC3	01/05/10	0.868	UJ	0.868	0.23	U	0.23	0.0267	U	0.0267	0.868	U	0.868	4.89	J	14.4
EXC-BC-3	J19DC4	01/05/10	0.322	BJ	0.911	0.21	U	0.21	0.0302	U	0.0302	0.911	U	0.911	14.3	U	14.3
EXC-BC-4	J19DC5	01/05/10	1.14	J	1.12	0.24	U	0.24	0.0273	U	0.0273	1.12	U	1.12	68.8		68.8
EXC-BC-5	J19DC6	01/05/10	0.803	UJ	0.803	0.25	U	0.25	0.0289	U	0.0289	0.803	U	0.803	16.7	U	16.7
EXC-BC-6	J19DC7	12/21/09	0.872	U	0.872	0.08	B	0.22	0.0270	U	0.0270	0.872	U	0.872	14.4	U	14.4
EXC-BC-7	J19DC8	01/05/10	0.663	BJ	0.858	0.26	U	0.26	0.0113	B	0.0313	0.417	B	0.86	17.1	U	17.1
EXC-BC-8	J19DC9	01/05/10	0.785	UJ	0.785	0.23	U	0.23	0.0328	U	0.0328	0.785	U	0.785	15.0	U	15
EXC-BC-9	J18R67	04/15/10	0.689	U	0.689	0.20	U	0.20	0.0255	U	0.0255	0.689	U	0.689	13.5	U	13.5
EXC-BC-10	J19DD1	01/05/10	0.444	BJ	1.09	0.27	U	0.27	0.0359	U	0.0359	1.09	U	1.09	18.0	U	18
EXC-BC-11	J19DD2	12/21/09	0.822	U	0.822	0.22	U	0.22	0.0258	U	0.0258	0.822	U	0.822	14.9	U	14.9

3-Part Test Evaluations

	Antimony			Hexavalent chromium			Mercury			Silver			Aroclor-1260		
% < Detection limit	67%			92%			92%			92%			83%		
Maximum value	1.14			0.08			0.0113			0.417			68.8		
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise	5	GW & River Protection		2	River Protection		0.33	GW & River Protection		0.73	River Protection		17 ug/kg	GW & River Protection	
3-PART TEST															
Maximum > Cleanup Limit?	NA			NO			NA			NA			YES		
> 10% above Cleanup Limit?	NA			NO			NA			NA			NO		
Any sample > 2X Cleanup Limit?	NA			NO			NA			NA			YES		
3-Part Test Compliance?	Because all values are below background (5 mg/kg) the 3-part test is not required.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			Because all values are below background (0.33 mg/kg) the 3-part test is not required.			Because all values are below background (0.73 mg/kg) the 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.		

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

CALCULATION SHEET

Date 05/04/11
Job No. 14655

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Checked T. E. Queen

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118-H-3 Statistical Calculations

Verification Data -Excavation Trench A and Waste Staging Area Footprint

Sample Area	Sample Number	Sample Date	Uranium-233/234 pCi/g	Q	MDA	Uranium-238 pCi/g	Q	MDA
A-SA-3	J19DD7	12/14/09	0.450		0.287	0.562		0.287
Duplicate of J19DD7	J19DT1	12/14/09	0.415		0.353	0.323	U	0.353
A-SA-1	J19DD5	12/21/09	0.557		0.170	0.579		0.170
A-SA-2	J19DD6	12/21/09	0.460		0.160	0.356		0.160
A-SA-4	J19DD8	12/21/09	0.418		0.168	0.461		0.168
A-SA-5	J19DD9	12/21/09	0.544		0.189	0.644		0.189
A-SA-6	J18R68	04/15/10	0.528		0.449	0.470		0.449
A-SA-7	J19DF1	12/21/09	0.498		0.254	0.332		0.254
A-SA-8	J19DF2	12/21/09	0.812		0.230	0.541		0.230
A-SA-9	J19DF3	12/14/09	0.683		0.275	1.15		0.275
A-SA-10	J19DF4	12/14/09	0.486		0.266	0.348		0.266
A-SA-11	J19DF5	12/21/09	0.650		0.237	0.495		0.237
A-SA-12	J19DF6	12/21/09	0.489		0.234	0.336		0.234

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Uranium-233/234 pCi/g			Uranium-238 pCi/g		
A-SA-3	J19DD7/ J19DT1	12/14/09	0.433			0.443		
A-SA-1	J19DD5	12/21/09	0.557			0.579		
A-SA-2	J19DD6	12/21/09	0.460			0.356		
A-SA-4	J19DD8	12/21/09	0.418			0.461		
A-SA-5	J19DD9	12/21/09	0.544			0.644		
A-SA-6	J18R68	04/15/10	0.528			0.470		
A-SA-7	J19DF1	12/21/09	0.498			0.332		
A-SA-8	J19DF2	12/21/09	0.812			0.541		
A-SA-9	J19DF3	12/14/09	0.683			1.150		
A-SA-10	J19DF4	12/14/09	0.486			0.348		
A-SA-11	J19DF5	12/21/09	0.650			0.495		
A-SA-12	J19DF6	12/21/09	0.489			0.336		

Statistical Computations

	Uranium-233/234			Uranium-238		
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.		
N	12			12		
% < Detection limit	0%			0%		
Mean	0.546			0.513		
Standard deviation	0.115			0.224		
Z-statistic	1.64			1.64		
95% UCL on mean	0.601			0.619		
Maximum value	0.812			1.15		

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

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118-H-3 Statistical Calculations
Verification Data -Excavation Trench A and Waste Staging Area Footprint

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL
A-SA-3	J19DD7	12/14/09	1.99		0.813	69.8		0.407	0.220		0.163	1.16	B	1.63	0.0988	B	0.203	9.95		0.813	6.12		2.44	15.1		1.63
Duplicate of J19DD7	J19DT1	12/14/09	1.87		0.750	55.3		0.370	0.195		0.150	0.814	B	1.49	0.0957	B	0.186	10.5		0.746	5.31		2.24	12.3		1.49
A-SA-1	J19DD5	12/21/09	3.97		0.828	76.0		0.414	0.243		0.166	2.27		1.66	0.0878	B	0.207	11.3		0.828	5.65		2.48	12.2		1.66
A-SA-2	J19DD6	12/21/09	1.95		0.756	51.2		0.378	0.155		0.151	0.546	B	1.51	0.0621	B	0.189	10.3		0.756	4.60		2.27	13.2		1.51
A-SA-4	J19DD8	12/21/09	2.58		0.799	60.2		0.399	0.221		0.160	1.41	B	1.60	0.0764	B	0.200	10.8		0.799	5.43		2.40	13.0		1.60
A-SA-5	J19DD9	12/21/09	2.02		0.801	37.9		0.401	0.110	B	0.160	1.60	U	1.60	0.0642	B	0.200	8.95		0.801	4.33		2.40	9.79		1.60
A-SA-6	J18R68	04/15/10	1.49		0.739	34.7		0.369	0.133	B	0.148	0.634	B	1.48	0.185	U	0.185	7.29		0.739	3.84		2.22	10.1		1.48
A-SA-7	J19DF1	12/21/09	1.60		0.885	44.2		0.442	0.135	B	0.177	0.472	B	1.77	0.0713	B	0.221	6.41		0.885	5.23		2.65	11.5		1.77
A-SA-8	J19DF2	12/21/09	1.66		0.750	41.4		0.375	0.143	B	0.150	0.629	B	1.50	0.0732	B	0.187	8.07		0.750	4.61		2.25	11.7		1.50
A-SA-9	J19DF3	12/14/09	2.57		0.760	39.5		0.380	0.159		0.150	0.587	B	1.51	0.0766	B	0.189	14.4		0.755	5.69		2.26	13.6		1.51
A-SA-10	J19DF4	12/14/09	2.26		0.790	62.9		0.400	0.203		0.160	1.19	B	1.59	0.100	B	0.198	9.03		0.793	5.84		2.38	13.6		1.59
A-SA-11	J19DF5	12/21/09	4.38		0.929	108		0.465	0.415		0.186	2.95		1.86	0.0985	B	0.232	14.0		0.929	7.81		2.79	18.0		1.86
A-SA-12	J19DF6	12/21/09	3.65		1.05	100		0.523	0.354		0.209	3.28		2.09	0.132	B	0.262	12.7		1.05	7.30		3.14	14.1		2.09

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg
A-SA-3	J19DD7/ J19DT1	12/14/09	1.93	62.6	0.208	0.987	0.0973	10.2	5.72	13.7
A-SA-1	J19DD5	12/21/09	3.97	76.0	0.243	2.27	0.0878	11.3	5.65	12.2
A-SA-2	J19DD6	12/21/09	1.95	51.2	0.155	0.546	0.0621	10.3	4.60	13.2
A-SA-4	J19DD8	12/21/09	2.58	60.2	0.221	1.41	0.0764	10.8	5.43	13.0
A-SA-5	J19DD9	12/21/09	2.02	37.9	0.110	0.800	0.0642	8.95	4.33	9.79
A-SA-6	J18R68	04/15/10	1.49	34.7	0.133	0.634	0.0925	7.29	3.84	10.1
A-SA-7	J19DF1	12/21/09	1.60	44.2	0.135	0.472	0.0713	6.41	5.23	11.5
A-SA-8	J19DF2	12/21/09	1.66	41.4	0.143	0.629	0.0732	8.07	4.61	11.7
A-SA-9	J19DF3	12/14/09	2.57	39.5	0.159	0.587	0.0766	14.4	5.69	13.6
A-SA-10	J19DF4	12/14/09	2.26	62.9	0.203	1.19	0.100	9.03	5.84	13.6
A-SA-11	J19DF5	12/21/09	4.38	108	0.415	2.95	0.0985	14.0	7.81	18.0
A-SA-12	J19DF6	12/21/09	3.65	100	0.354	3.28	0.132	12.7	7.30	14.1

Statistical Computations

	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
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.
N	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	8%	8%	0%	0%	0%
Mean	2.51	59.9	0.207	1.31	0.0860	10.3	5.50	12.9
Standard deviation	0.976	24.1	0.0932	0.982	0.0196	2.52	1.15	2.14
95% UCL on mean	3.12	75.3	0.265	2.15	0.0972	11.9	6.17	14.1
Maximum value	4.38	108	0.415	3.28	0.132	14.4	7.81	18.0
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
WAC 173-340 Compliance?	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (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.

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

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118-H-3 Statistical Calculations

Verification Data -Excavation Trench A and Waste Staging Area Footprint

Sample Area	Sample Number	Sample Date	Lead mg/kg	Lead Q	Lead PQL	Manganese mg/kg	Manganese Q	Manganese PQL	Molybdenum mg/kg	Molybdenum Q	Molybdenum PQL	Nickel mg/kg	Nickel Q	Nickel PQL	Vanadium mg/kg	Vanadium Q	Vanadium PQL	Zinc mg/kg	Zinc Q	Zinc PQL
A-SA-3	J19DD7	12/14/09	3.56		0.810	282		0.810	0.288	B	0.81	10.9		2.03	50.5		0.810	38.7		2.44
Duplicate of J19DD7	J19DT1	12/14/09	3.05		0.750	258		0.750	0.230	B	0.750	11.5		1.86	47.2		0.750	35.2		2.24
A-SA-1	J19DD5	12/21/09	14.7		0.828	277		0.828	0.317	B	0.828	10.4		2.07	40.9		0.828	37.5		2.48
A-SA-2	J19DD6	12/21/09	2.23		0.756	233		0.756	0.195	B	0.756	9.18		1.89	34.4		0.756	30.0		2.27
A-SA-4	J19DD8	12/21/09	3.49		0.799	324		0.799	0.257	B	0.799	9.74		2.00	40.7		0.799	34.2		2.40
A-SA-5	J19DD9	12/21/09	1.74		0.801	169		0.801	0.200	B	0.801	9.32		2.00	34.2		0.801	24.2		2.40
A-SA-6	J18R68	04/15/10	1.87		0.739	181		0.739	0.250	B	0.739	7.73		1.85	33.9		0.739	23.7		2.22
A-SA-7	J19DF1	12/21/09	2.18		0.885	215		0.885	0.238	B	0.885	7.72		2.21	45.9		0.885	33.6		2.65
A-SA-8	J19DF2	12/21/09	2.45		0.750	213		0.750	0.206	B	0.750	7.15		1.87	38.7		0.750	29.5		2.25
A-SA-9	J19DF3	12/14/09	3.03		0.760	272		0.760	0.276	B	0.760	11.7		1.89	46.9		0.760	33.9		2.26
A-SA-10	J19DF4	12/14/09	4.57		0.790	279		0.790	0.244	B	0.790	9.11		1.98	51.1		0.790	38.5		2.38
A-SA-11	J19DF5	12/21/09	8.18		0.929	372		0.929	0.306	B	0.929	13.2		2.32	42.3		0.929	48.1		2.79
A-SA-12	J19DF6	12/21/09	7.05		1.05	371		1.05	0.314	B	1.05	11.1		2.62	46.4		1.05	46.1		3.14

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Lead mg/kg	Manganese mg/kg	Molybdenum mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg
A-SA-3	J19DD7/ J19DT1	12/14/09	3.31	270	0.259	11.2	48.9	37.0
A-SA-1	J19DD5	12/21/09	14.7	277	0.317	10.4	40.9	37.5
A-SA-2	J19DD6	12/21/09	2.23	233	0.195	9.18	34.4	30.0
A-SA-4	J19DD8	12/21/09	3.49	324	0.257	9.74	40.7	34.2
A-SA-5	J19DD9	12/21/09	1.74	169	0.200	9.32	34.2	24.2
A-SA-6	J18R68	04/15/10	1.87	181	0.250	7.73	33.9	23.7
A-SA-7	J19DF1	12/21/09	2.18	215	0.238	7.72	45.9	33.6
A-SA-8	J19DF2	12/21/09	2.45	213	0.206	7.15	38.7	29.5
A-SA-9	J19DF3	12/14/09	3.03	272	0.276	11.7	46.9	33.9
A-SA-10	J19DF4	12/14/09	4.57	279	0.244	9.11	51.1	38.5
A-SA-11	J19DF5	12/21/09	8.18	372	0.306	13.2	42.3	48.1
A-SA-12	J19DF6	12/21/09	7.05	371	0.314	11.1	46.4	46.1

Statistical Computations

	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc
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), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%
Mean	4.57	265	0.255	9.80	42.0	34.7
Standard deviation	3.79	66.8	0.0425	1.81	5.93	7.50
95% UCL on mean	7.21	307	0.280	10.9	45.5	39.3
Maximum value	14.7	372	0.317	13.2	51.1	48.1
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	10.2 GW & River Protection	512 GW & River Protection	8.0 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	NO	NA	NO	NA	NA	NA
> 10% above Cleanup Limit?	NO	NA	NO	NA	NA	NA
Any sample > 2X Cleanup Limit?	NO	NA	NO	NA	NA	NA
WAC 173-340 Compliance?	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.	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.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/06/11
Job No. 14655
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1 118-H-3 Maximum Calculations
2 Verification Data -Excavation Trench A and Waste Staging Area Footprint

3	Sample	Sample	Sample	Hexavalent chromium			Mercury			Aroclor-1260		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL
5	A-SA-3	J19DD7	12/14/09	0.16	B	0.21	0.012	B	0.03	14.1	U	14.1
6	Duplicate of J19DD7	J19DT1	12/14/09	0.07	B	0.21	0.015	B	0.03	13.9	U	13.9
7	A-SA-1	J19DD5	12/21/09	0.23	U	0.23	0.0275	U	0.0275	15.4	U	15.4
8	A-SA-2	J19DD6	12/21/09	0.21	U	0.21	0.0302	U	0.0302	14.3	U	14.3
9	A-SA-4	J19DD8	12/21/09	0.40		0.22	0.0272	U	0.0272	14.9	U	14.9
10	A-SA-5	J19DD9	12/21/09	0.21	U	0.21	0.0307	U	0.0307	14.1	U	14.1
11	A-SA-6	J18R68	04/15/10	0.20	U	0.20	0.0241	U	0.0241	13.5	U	13.5
12	A-SA-7	J19DF1	12/21/09	0.21	U	0.21	0.0299	U	0.0299	14.1	U	14.1
13	A-SA-8	J19DF2	12/21/09	0.22	U	0.22	0.0249	U	0.0249	14.4	U	14.4
14	A-SA-9	J19DF3	12/14/09	0.21	U	0.21	0.012	B	0.03	13.7	U	13.7
15	A-SA-10	J19DF4	12/14/09	0.15	B	0.21	0.013	B	0.02	13.9	U	13.9
16	A-SA-11	J19DF5	12/21/09	0.25	U	0.25	0.0141	B	0.0299	9.44	J	9.44
17	A-SA-12	J19DF6	12/21/09	0.23	U	0.23	0.0330	U	0.0330	15.6	U	15.6

18 3-Part Test Evaluations

19		Hexavalent chromium	Mercury	Aroclor-1260
20	% < Detection limit	75%	67%	92%
21	Maximum value	0.40	0.0150	9.44
22	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	2 River Protection	0.33 GW & River Protection	17 ug/kg GW & River Protection
23	**3-PART TEST**			
24	Maximum > Cleanup Limit?	NO	NA	NO
25	> 10% above Cleanup Limit?	NO	NA	NO
26	Any sample > 2X Cleanup Limit?	NO	NA	NO
27	**3-Part Test Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.33 mg/kg) the 3-part test is not required.	The data set meets the 3-part test criteria when compared to the direct exposure RAG.

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/12/11
Job No. 14655

Calc. No. 0100H-CA-V0133
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Ecology Software (MTCAStat) Results, 118-H-3 Excavation Trenches B and C

Arsenic 95% UCL Calculation

DATA	ID
5.11	J19DD3/ J19DD4
2.34	J19DC2
	J19DC3
2.32	J19DC4
	J19DC5
4.15	J19DC6
3.73	J19DC7
	J19DC8
	J19DC9
1.46	J18R67
	J19DD1
3.18	J19DD2

Number of samples		Uncensored values	
Uncensored	7	Mean	3.18
Censored		Lognormal mean	3.24
Detection limit or PQL		Std. devn.	1.25
Method detection limit		Median	3.18
TOTAL	7	Min.	1.46
		Max.	5.11

Lognormal distribution? Normal distribution?
r-squared is: 0.964 r-squared is: 0.980
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 4.85

Barium 95% UCL Calculation

DATA	ID
85.8	J19DD3/ J19DD4
31.3	J19DC2
65.9	J19DC3
46.6	J19DC4
54.0	J19DC5
89.9	J19DC6
50.8	J19DC7
141	J19DC8
63.9	J19DC9
31.9	J18R67
83.6	J19DD1
64.9	J19DD2

Number of samples		Uncensored values	
Uncensored	12	Mean	67.5
Censored		Lognormal mean	68.0
Detection limit or PQL		Std. devn.	30.1
Method detection limit		Median	64.4
TOTAL	12	Min.	31.3
		Max.	141

Lognormal distribution? Normal distribution?
r-squared is: 0.963 r-squared is: 0.890
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 89.0

Beryllium 95% UCL Calculation

DATA	ID
0.308	J19DD3/ J19DD4
0.145	J19DC2
0.191	J19DC3
0.156	J19DC4
0.194	J19DC5
0.325	J19DC6
0.197	J19DC7
0.589	J19DC8
0.218	J19DC9
0.115	J18R67
0.315	J19DD1
0.230	J19DD2

Number of samples		Uncensored values	
Uncensored	12	Mean	0.249
Censored		Lognormal mean	0.249
Detection limit or PQL		Std. devn.	0.127
Method detection limit		Median	0.208
TOTAL	12	Min.	0.115
		Max.	0.589

Lognormal distribution? Normal distribution?
r-squared is: 0.945 r-squared is: 0.793
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.327

Boron 95% UCL Calculation

DATA	ID
2.07	J19DD3/ J19DD4
0.627	J19DC2
1.10	J19DC3
0.517	J19DC4
1.47	J19DC5
1.33	J19DC6
1.30	J19DC7
7.03	J19DC8
1.27	J19DC9
0.70	J18R67
3.48	J19DD1
1.18	J19DD2

Number of samples		Uncensored values	
Uncensored	12	Mean	1.84
Censored		Lognormal mean	1.80
Detection limit or PQL		Std. devn.	1.81
Method detection limit		Median	1.29
TOTAL	12	Min.	0.517
		Max.	7.03

Lognormal distribution? Normal distribution?
r-squared is: 0.911 r-squared is: 0.643
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3.08

Cadmium 95% UCL Calculation

DATA	ID
0.0848	J19DD3/ J19DD4
0.0663	J19DC2
0.0959	J19DC3
0.107	J19DC4
0.117	J19DC5
0.0927	J19DC6
0.0695	J19DC7
0.362	J19DC8
0.103	J19DC9
0.0398	J18R67
0.121	J19DD1
0.0708	J19DD2

Number of samples		Uncensored values	
Uncensored	12	Mean	0.111
Censored		Lognormal mean	0.109
Detection limit or PQL		Std. devn.	0.0825
Method detection limit		Median	0.0943
TOTAL	12	Min.	0.0398
		Max.	0.362

Lognormal distribution? Normal distribution?
r-squared is: 0.838 r-squared is: 0.573
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 0.150

Chromium 95% UCL Calculation

DATA	ID
12.5	J19DD3/ J19DD4
9.10	J19DC2
10.2	J19DC3
8.74	J19DC4
11.1	J19DC5
12.5	J19DC6
12.5	J19DC7
18.6	J19DC8
10.6	J19DC9
6.29	J18R67
15.3	J19DD1
11.3	J19DD2

Number of samples		Uncensored values	
Uncensored	12	Mean	11.6
Censored		Lognormal mean	11.6
Detection limit or PQL		Std. devn.	3.18
Method detection limit		Median	11.2
TOTAL	12	Min.	6.29
		Max.	18.6

Lognormal distribution? Normal distribution?
r-squared is: 0.952 r-squared is: 0.933
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 13.6

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
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Ecology Software (MTCAStat) Results, 118-H-3 Excavation Trenches B and C

DATA	ID
6.72	J19DD3/ J19DD4
4.49	J19DC2
5.40	J19DC3
4.78	J19DC4
5.68	J19DC5
7.03	J19DC6
5.61	J19DC7
10.2	J19DC8
5.63	J19DC9
4.20	J18R67
7.24	J19DD1
5.94	J19DD2

Cobalt 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	6.08
Censored		Lognormal mean	6.08
Detection limit or PQL		Std. devn.	1.61
Method detection limit		Median	5.66
TOTAL	12	Min.	4.20
		Max.	10.2

Lognormal distribution? Normal distribution?
r-squared is: 0.934 r-squared is: 0.852
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.97

DATA	ID
13.6	J19DD3/ J19DD4
11.1	J19DC2
15.0	J19DC3
11.6	J19DC4
40.9	J19DC5
15.0	J19DC6
13.3	J19DC7
38.6	J19DC8
13.0	J19DC9
9.80	J18R67
17.4	J19DD1
14.5	J19DD2

Copper 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	17.8
Censored		Lognormal mean	17.6
Detection limit or PQL		Std. devn.	10.5
Method detection limit		Median	14.1
TOTAL	12	Min.	9.80
		Max.	40.9

Lognormal distribution? Normal distribution?
r-squared is: 0.777 r-squared is: 0.650
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 22.8

DATA	ID
7.87	J19DD3/ J19DD4
3.67	J19DC2
	J19DC3
4.63	J19DC4
	J19DC5
7.45	J19DC6
10.3	J19DC7
	J19DC8
	J19DC9
1.65	J18R67
	J19DD1
6.86	J19DD2

Lead 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	7	Mean	6.06
Censored		Lognormal mean	6.93
Detection limit or PQL		Std. devn.	2.92
Method detection limit		Median	6.86
TOTAL	7	Min.	1.65
		Max.	10.3

Lognormal distribution? Normal distribution?
r-squared is: NA r-squared is: 0.946
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 7.75

DATA	ID
325	J19DD3/ J19DD4
216	J19DC2
247	J19DC3
240	J19DC4
251	J19DC5
344	J19DC6
248	J19DC7
560	J19DC8
287	J19DC9
183	J18R67
342	J19DD1
268	J19DD2

Manganese 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	293
Censored		Lognormal mean	292
Detection limit or PQL		Std. devn.	97.6
Method detection limit		Median	260
TOTAL	12	Min.	183
		Max.	560

Lognormal distribution? Normal distribution?
r-squared is: 0.897 r-squared is: 0.775
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 339

DATA	ID
0.287	J19DD3/ J19DD4
0.235	J19DC2
0.360	J19DC3
0.367	J19DC4
2.67	J19DC5
0.438	J19DC6
0.277	J19DC7
0.705	J19DC8
0.357	J19DC9
0.319	J18R67
0.461	J19DD1
0.273	J19DD2

Molybdenum 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	0.562
Censored		Lognormal mean	0.518
Detection limit or PQL		Std. devn.	0.675
Method detection limit		Median	0.359
TOTAL	12	Min.	0.235
		Max.	2.67

Lognormal distribution? Normal distribution?
r-squared is: 0.704 r-squared is: 0.447
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 0.883

DATA	ID
10.9	J19DD3/ J19DD4
8.36	J19DC2
12.1	J19DC3
8.98	J19DC4
17.4	J19DC5
12.1	J19DC6
19.3	J19DC7
18.8	J19DC8
11.1	J19DC9
6.55	J18R67
14.7	J19DD1
10.4	J19DD2

Nickel 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	12.6
Censored		Lognormal mean	12.6
Detection limit or PQL		Std. devn.	4.14
Method detection limit		Median	11.6
TOTAL	12	Min.	6.55
		Max.	19.3

Lognormal distribution? Normal distribution?
r-squared is: 0.968 r-squared is: 0.942
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 15.4

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Ecology Software (MTCAStat) Results, 118-H-3 Excavation Trenches B and C

Vanadium 95% UCL Calculation

DATA	ID
45.0	J19DD3/ J19DD4
37.7	J19DC2
38.8	J19DC3
38.1	J19DC4
40.6	J19DC5
47.2	J19DC6
46.4	J19DC7
44.5	J19DC8
45.8	J19DC9
36.6	J18R67
51.3	J19DD1
44.5	J19DD2

Number of samples		Uncensored values	
Uncensored	12	Mean	43.0
Censored		Lognormal mean	43.1
Detection limit or PQL		Std. devn.	4.58
Method detection limit			44.5
TOTAL	12	Min.	36.6
		Max.	51.3

Lognormal distribution? Normal distribution?
r-squared is: 0.940 r-squared is: 0.941
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 45.6

Zinc 95% UCL Calculation

DATA	ID
40.9	J19DD3/ J19DD4
28.1	J19DC2
36.7	J19DC3
242	J19DC4
40.1	J19DC5
42.7	J19DC6
35.0	J19DC7
80.8	J19DC8
35.9	J19DC9
24.9	J18R67
47.7	J19DD1
38.5	J19DD2

Number of samples		Uncensored values	
Uncensored	12	Mean	57.8
Censored		Lognormal mean	54.6
Detection limit or PQL		Std. devn.	59.7
Method detection limit		Median	39.3
TOTAL	12	Min.	24.9
		Max.	242

Lognormal distribution? Normal distribution?
r-squared is: 0.712 r-squared is: 0.476
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 86.1

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DATA	ID	Arsenic 95% UCL Calculation			
1.93	J19DD7/ J19DT1				
3.97	J19DD5				
1.95	J19DD6	Number of samples		Uncensored values	
2.58	J19DD8	Uncensored	12	Mean	2.51
2.02	J19DD9	Censored		Lognormal mean	2.51
1.49	J18R68	Detection limit or PQL		Std. devn.	0.976
1.60	J19DF1	Method detection limit			2.14
1.66	J19DF2	TOTAL	12	Min.	1.49
2.57	J19DF3			Max.	4.38
2.26	J19DF4				
4.38	J19DF5				
3.65	J19DF6				

Lognormal distribution? Normal distribution?
r-squared is: 0.934 r-squared is: 0.874
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3.12

DATA	ID	Barium 95% UCL Calculation			
62.6	J19DD7/ J19DT1				
76.0	J19DD5				
51.2	J19DD6	Number of samples		Uncensored values	
60.2	J19DD8	Uncensored	12	Mean	59.9
37.9	J19DD9	Censored		Lognormal mean	60.1
34.7	J18R68	Detection limit or PQL		Std. devn.	24.1
44.2	J19DF1	Method detection limit		Median	55.7
41.4	J19DF2	TOTAL	12	Min.	34.7
39.5	J19DF3			Max.	108
62.9	J19DF4				
108	J19DF5				
100	J19DF6				

Lognormal distribution? Normal distribution?
r-squared is: 0.946 r-squared is: 0.883
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 75.3

DATA	ID	Beryllium 95% UCL Calculation			
0.208	J19DD7/ J19DT1				
0.243	J19DD5				
0.155	J19DD6	Number of samples		Uncensored values	
0.221	J19DD8	Uncensored	12	Mean	0.207
0.110	J19DD9	Censored		Lognormal mean	0.207
0.133	J18R68	Detection limit or PQL		Std. devn.	0.0932
0.135	J19DF1	Method detection limit		Median	0.181
0.143	J19DF2	TOTAL	12	Min.	0.110
0.159	J19DF3			Max.	0.415
0.203	J19DF4				
0.415	J19DF5				
0.354	J19DF6				

Lognormal distribution? Normal distribution?
r-squared is: 0.940 r-squared is: 0.845
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.265

DATA	ID	Boron 95% UCL Calculation			
0.987	J19DD7/ J19DT1				
2.27	J19DD5				
0.546	J19DD6	Number of samples		Uncensored values	
1.41	J19DD8	Uncensored	12	Mean	1.31
0.800	J19DD9	Censored		Lognormal mean	1.32
0.634	J18R68	Detection limit or PQL		Std. devn.	0.982
0.472	J19DF1	Method detection limit		Median	0.894
0.629	J19DF2	TOTAL	12	Min.	0.472
0.587	J19DF3			Max.	3.28
1.19	J19DF4				
2.95	J19DF5				
3.28	J19DF6				

Lognormal distribution? Normal distribution?
r-squared is: 0.917 r-squared is: 0.810
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.15

DATA	ID	Cadmium 95% UCL Calculation			
0.0973	J19DD7/ J19DT1				
0.0878	J19DD5				
0.0621	J19DD6	Number of samples		Uncensored values	
0.0764	J19DD8	Uncensored	12	Mean	0.0860
0.0642	J19DD9	Censored		Lognormal mean	0.0861
0.0925	J18R68	Detection limit or PQL		Std. devn.	0.0196
0.0713	J19DF1	Method detection limit		Median	0.0822
0.0732	J19DF2	TOTAL	12	Min.	0.0621
0.0766	J19DF3			Max.	0.132
0.100	J19DF4				
0.0985	J19DF5				
0.132	J19DF6				

Lognormal distribution? Normal distribution?
r-squared is: 0.951 r-squared is: 0.905
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.0972

DATA	ID	Chromium 95% UCL Calculation			
10.2	J19DD7/ J19DT1				
11.3	J19DD5				
10.3	J19DD6	Number of samples		Uncensored values	
10.8	J19DD8	Uncensored	12	Mean	10.3
8.95	J19DD9	Censored		Lognormal mean	10.3
7.29	J18R68	Detection limit or PQL		Std. devn.	2.52
6.41	J19DF1	Method detection limit		Median	10.3
8.07	J19DF2	TOTAL	12	Min.	6.41
14.4	J19DF3			Max.	14.4
9.03	J19DF4				
14.0	J19DF5				
12.7	J19DF6				

Lognormal distribution? Normal distribution?
r-squared is: 0.983 r-squared is: 0.978
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.9

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DATA	ID
5.72	J19DD7/ J19DT1
5.65	J19DD5
4.60	J19DD6
5.43	J19DD8
4.33	J19DD9
3.84	J18R68
5.23	J19DF1
4.61	J19DF2
5.69	J19DF3
5.84	J19DF4
7.81	J19DF5
7.30	J19DF6

Cobalt 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	5.50
Censored		Lognormal mean	5.51
Detection limit or PQL		Std. devn.	1.15
Method detection limit		Median	5.54
TOTAL	12	Min.	3.84
		Max.	7.81

Lognormal distribution? Normal distribution?
r-squared is: 0.954 r-squared is: 0.924
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.17

DATA	ID
13.7	J19DD7/ J19DT1
12.2	J19DD5
13.2	J19DD6
13.0	J19DD8
9.79	J19DD9
10.1	J18R68
11.5	J19DF1
11.7	J19DF2
13.6	J19DF3
13.6	J19DF4
18.0	J19DF5
14.1	J19DF6

Copper 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	12.9
Censored		Lognormal mean	12.9
Detection limit or PQL		Std. devn.	2.14
Method detection limit		Median	13.1
TOTAL	12	Min.	9.79
		Max.	18.0

Lognormal distribution? Normal distribution?
r-squared is: 0.925 r-squared is: 0.892
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 14.1

DATA	ID
3.31	J19DD7/ J19DT1
14.7	J19DD5
2.23	J19DD6
3.49	J19DD8
1.74	J19DD9
1.87	J18R68
2.18	J19DF1
2.45	J19DF2
3.03	J19DF3
4.57	J19DF4
8.18	J19DF5
7.05	J19DF6

Lead 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	4.57
Censored		Lognormal mean	4.51
Detection limit or PQL		Std. devn.	3.79
Method detection limit		Median	3.17
TOTAL	12	Min.	1.74
		Max.	14.7

Lognormal distribution? Normal distribution?
r-squared is: 0.913 r-squared is: 0.728
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 7.21

DATA	ID
270	J19DD7/ J19DT1
277	J19DD5
233	J19DD6
324	J19DD8
169	J19DD9
181	J18R68
215	J19DF1
213	J19DF2
272	J19DF3
279	J19DF4
372	J19DF5
371	J19DF6

Manganese 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	265
Censored		Lognormal mean	265
Detection limit or PQL		Std. devn.	66.8
Method detection limit		Median	271
TOTAL	12	Min.	169
		Max.	372

Lognormal distribution? Normal distribution?
r-squared is: 0.965 r-squared is: 0.953
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 307

DATA	ID
0.259	J19DD7/ J19DT1
0.317	J19DD5
0.195	J19DD6
0.257	J19DD8
0.200	J19DD9
0.250	J18R68
0.238	J19DF1
0.206	J19DF2
0.276	J19DF3
0.244	J19DF4
0.306	J19DF5
0.314	J19DF6

Molybdenum 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	0.255
Censored		Lognormal mean	0.255
Detection limit or PQL		Std. devn.	0.0425
Method detection limit		Median	0.254
TOTAL	12	Min.	0.195
		Max.	0.317

Lognormal distribution? Normal distribution?
r-squared is: 0.950 r-squared is: 0.950
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.280

DATA	ID
11.2	J19DD7/ J19DT1
10.4	J19DD5
9.18	J19DD6
9.74	J19DD8
9.32	J19DD9
7.73	J18R68
7.72	J19DF1
7.15	J19DF2
11.7	J19DF3
9.11	J19DF4
13.2	J19DF5
11.1	J19DF6

Nickel 95% UCL Calculation

Number of samples		Uncensored values	
Uncensored	12	Mean	9.80
Censored		Lognormal mean	9.81
Detection limit or PQL		Std. devn.	1.81
Method detection limit		Median	9.53
TOTAL	12	Min.	7.15
		Max.	13.2

Lognormal distribution? Normal distribution?
r-squared is: 0.974 r-squared is: 0.972
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.9

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Ecology Software (MTCAStat) Results, 118-H-3 Excavation Trench A and Waste Staging Area Footprint

	DATA	ID	Vanadium 95% UCL Calculation				DATA	ID	Zinc 95% UCL Calculation			
1												
2	48.9	J19DD7/ J19DT1					37.0	J19DD7/ J19DT1				
3	40.9	J19DD5					37.5	J19DD5				
4	34.4	J19DD6	Number of samples		Uncensored values		30.0	J19DD6	Number of samples		Uncensored values	
5	40.7	J19DD8	Uncensored	12	Mean	42.0	34.2	J19DD8	Uncensored	12	Mean	34.7
6	34.2	J19DD9	Censored		Lognormal mean	42.1	24.2	J19DD9	Censored		Lognormal mean	34.8
7	33.9	J18R68	Detection limit or PQL		Std. devn.	5.93	23.7	J18R68	Detection limit or PQL		Std. devn.	7.50
8	45.9	J19DF1	Method detection limit			41.6	33.6	J19DF1	Method detection limit		Median	34.1
9	38.7	J19DF2	TOTAL	12	Min.	33.9	29.5	J19DF2	TOTAL	12	Min.	23.7
10	46.9	J19DF3			Max.	51.1	33.9	J19DF3			Max.	48.1
11	51.1	J19DF4					38.5	J19DF4				
12	42.3	J19DF5					48.1	J19DF5				
13	46.4	J19DF6					46.1	J19DF6				
14												
15												
16												
17			Lognormal distribution?		Normal distribution?				Lognormal distribution?		Normal distribution?	
18			r-squared is: 0.942		r-squared is: 0.951				r-squared is: 0.961		r-squared is: 0.957	
19			Recommendations:						Recommendations:			
20			Use lognormal distribution.						Use lognormal distribution.			
21												
22			UCL (Land's method) is		45.5				UCL (Land's method) is		39.3	
23												
24												

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Duplicate/Split Analysis - 118-H-3 Waste Site Excavation Trenches B and C

Sampling Area	Sample Number	Sample Date	Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranium-238			Aluminum		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
EXC-BC-12	J19DD3	12/21/09	15.4		0.177	0.658		0.034	0.894		0.088	0.941		0.032	0.894		0.088	0.482		0.176	0.344		0.176	9080		21.2
Duplicate of J19DD3	J19DD4	12/21/09	14.7		0.254	0.652		0.053	1.03		0.121	1.18		0.052	1.03		0.121	0.497		0.380	0.249	U	0.380	10100		18.6
Split of J19DD3	J19DF9	12/21/09																0.834		0.0301	0.765		0.0301	8370		16.1

Analysis:

	TDL	0.5	0.1	0.2	1	1	1	1	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)		Yes (calc RPD)
	RPD	4.7%	0.9%						10.6%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable
Split Analysis	Both > PQL?						Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?						No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD								8.1%
	Difference > 2 TDL?						No - acceptable	No - acceptable	Not applicable

Duplicate/Split Analysis - 118-H-3 Waste Site Excavation Trenches B and C

Sampling Area	HEIS Number	Sample Date	Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-BC-12	J19DD3	12/21/09	5.44		1.06	79.8		0.530	0.294		0.212	1.97	B	2.12	0.0843	B	0.265	4510		21.2	12.4		1.06	6.52		3.18
Duplicate of J19DD3	J19DD4	12/21/09	4.78		0.932	91.8		0.466	0.321		0.186	2.16		1.86	0.0853	B	0.233	4020		18.6	12.6		0.932	6.92		2.79
Split of J19DD3	J19DF9	12/21/09	5.20	B	1.80	85.9		0.290	0.39	B	0.19	45.2	BC	8.60	0.54	B	0.057	3940		15.3	11.3		0.35	9.2		1.1

Analysis:

	TDL	10	2	0.2	2	0.2	100	0.2	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)			Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		14.0%				11.5%	1.6%	
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable
Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)			Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		7.4%				13.5%	9.3%	
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Yes - assess further	Yes - assess further	Not applicable	Not applicable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/06/11
Job No. 14655

Calc. No. 0100H-CA-V0133
Checked T. E. Queen

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Duplicate/Split Analysis - 118-H-3 Waste Site Excavation Trenches B and C

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-BC-12	J19DD3	12/21/09	13.2		2.12	19400		21.2	8.19		1.06	4300		5.30	315		1.06	0.284	B	1.06	10.3		2.65	1730		106
Duplicate of J19DD3	J19DD4	12/21/09	14.0		1.86	20300		18.6	7.54		0.932	4560		4.66	334		0.932	0.289	B	0.932	11.5		2.33	1980		93.2
Split of J19DD3	J19DF9	12/21/09	12.2		0.83	19600		17.0	9.6		0.99	4610		9.5	353		0.18	0.36	U	0.36	12.0		0.26	2210		387

Analysis:

	TDL	1	5	5	75	5	2	4	400
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)	No-Stop (acceptable)
	RPD	5.9%	4.5%		5.9%	5.9%			
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable
Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)	No-Stop (acceptable)
	RPD	7.9%	1.0%		7.0%	11.4%			
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Duplicate/Split Analysis - 118-H-3 Waste Site Excavation Trenches B and C

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-BC-12	J19DD3	12/21/09	838		6.36	194		53	44.3		1.06	39.8		3.18
Duplicate of J19DD3	J19DD4	12/21/09	642		5.59	201		46.6	45.7		0.932	41.9		2.79
Split of J19DD3	J19DF9	12/21/09	682	C	8.90	116		54.1	41.6		1.4	45.5		2.30

Analysis:

	TDL	2	50	2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD	26.5%		3.1%	5.1%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable
Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD	20.5%		6.3%	13.4%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
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Job No. 14655

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Duplicate/Split Analysis - 118-H-3 Waste Site Excavation Trench A and Waste Staging Area Footprint

Sampling Area	Sample Number	Sample Date	Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranium-238			Aluminum		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
A-SA-3	J19DD7	12/14/09	13.3		0.341	0.504		0.061	0.581		0.159	0.794		0.057	0.581		0.159	0.450		0.287	0.562		0.287	7860		16.3
Duplicate of J19DD7	J19DT1	12/14/09	12.9		0.268	0.454		0.056	0.606		0.138	0.797		0.053	0.606		0.138	0.415		0.353	0.323	U	0.353	6750		14.9
Split of J19DD7	J19DH0	12/14/09																0.827		0.0407	0.912		0.0314	6020		14.7

Analysis:

	TDL	0.5	0.1	0.2	1	1	1	1	5
Duplicate Analysis	Both > PQL?	Yes (continue)		Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)		Yes (calc RPD)
	RPD	3.1%							15.2%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable
Split Analysis	Both > PQL?						Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?						No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD								26.5%
	Difference > 2 TDL?						No - acceptable	No - acceptable	Not applicable

Duplicate/Split Analysis - 118-H-3 Waste Site Excavation Trench A and Waste Staging Area Footprint

Sampling Area	HEIS Number	Sample Date	Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A-SA-3	J19DD7	12/14/09	1.99		0.813	69.8		0.407	0.22		0.163	1.16	B	1.63	0.0988	B	0.203	6400		16.3	9.95		0.813	6.12		2.44
Duplicate of J19DD7	J19DT1	12/14/09	1.87		0.75	55.3		0.37	0.195		0.15	0.814	B	1.49	0.0957	B	0.186	5600		14.9	10.5		0.746	5.31		2.24
Split of J19DD7	J19DH0	12/14/09	2.9	B	1.7	53		0.26	0.26	B	0.18	42.2	B	7.90	0.4	B	0.053	5710		70	8.7		0.32	8		0.99

Analysis:

	TDL	10	2	0.2	2	0.2	100	0.2	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)			Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		23.2%				13.3%	5.4%	
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable
Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)			Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		27.4%				11.4%	13.4%	
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Yes - assess further	No - acceptable	Not applicable	Not applicable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 118-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/06/11
Job No. 14655

Calc. No. 0100H-CA-V0133
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Date 01/06/11
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Duplicate/Split Analysis - 118-H-3 Waste Site Excavation Trench A and Waste Staging Area Footprint

Sampling Area	HEIS Number	Sample Date	Copper			Hexavalent chromium			Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			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
A-SA-3	J19DD7	12/14/09	15.1		1.63	0.16	B	0.21	18500		16.3	3.56		0.81	4570		4.07	282		0.81	0.012	B	0.03	0.288	B	0.81
Duplicate of J19DD7	J19DT1	12/14/09	12.3		1.49	0.07	B	0.21	16700		14.9	3.05		0.75	4130		3.73	258		0.75	0.015	B	0.03	0.23	B	0.75
Split of J19DD7	J19DH0	12/14/09	12.2		0.76	0.155	U	0.155	16400		15.6	2.9	B	0.9	4340		8.7	273		0.16	0.0053	U	0.0053	0.33	U	0.33

Analysis:

		TDL	1	0.5	5	5	75	5	0.2	2
Duplicate Analysis		Both > PQL?	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)
		Both >5xTDL?	Yes (calc RPD)		Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)		
		RPD	20.4%		10.2%		10.1%	8.9%		
		Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable
Split Analysis		Both > PQL?	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)
		Both >5xTDL?	Yes (calc RPD)		Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)		
		RPD	21.2%		12.0%		5.2%	3.2%		
		Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

Duplicate/Split Analysis - 118-H-3 Waste Site Excavation Trench A and Waste Staging Area Footprint

Sampling Area	HEIS Number	Sample Date	Nickel			Potassium			Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A-SA-3	J19DD7	12/14/09	10.9		2.03	1220		81.3	1500		4.88	471		40.7	50.5		0.81	38.7		2.44
Duplicate of J19DD7	J19DT1	12/14/09	11.5		1.86	909		74.6	1280		4.48	352		37.3	47.2		0.75	35.2		2.24
Split of J19DD7	J19DH0	12/14/09	9.50		0.24	1190		355	1020		1.60	178		49.5	42.6		1.3	38.9		2.1

Analysis:

		TDL	4	400	2	50	2.5	1
Duplicate Analysis		Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
		Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
		RPD			15.8%	28.9%	6.8%	9.5%
		Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable
Split Analysis		Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
		Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
		RPD			38.1%		17.0%	0.5%
		Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	Yes - assess further	Not applicable	Not applicable

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Radionuclides)

Sample Location	HEIS Number	Sample Date	Americium-241			Americium-241 GEA			Barium-133			Carbon-14			Cesium-137		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-BC-12	J19DD3	12/21/09				0.099	U	0.099	0.031	U	0.031	-0.807	U	5.77	0.055	U	0.055
Duplicate of J19DD3	J19DD4	12/21/09				0.046	U	0.046	0.028	U	0.028	0.829	U	5.93	0.090	U	0.090
EXC-BC-1	J19DC2	12/21/09				0.176	U	0.176	0.093	U	0.093	2.74	U	6.22	0.067	U	0.067
EXC-BC-2	J19DC3	01/05/10				0.421	U	0.421	0.051	U	0.051	-3.17	UJ	5.83	0.052	U	0.052
EXC-BC-3	J19DC4	01/05/10				0.046	U	0.046	0.026	U	0.026	-0.678	UJ	6.34	0.031	U	0.031
EXC-BC-4	J19DC5	01/05/10				0.044	U	0.044	0.022	U	0.022	-2.24	UJ	5.48	0.052	U	0.052
EXC-BC-5	J19DC6	01/05/10				0.130	U	0.130	0.036	U	0.036	-2.66	UJ	6.69	0.026	U	0.026
EXC-BC-6	J19DC7	12/21/09				0.052	U	0.052	0.031	U	0.031	0.135	U	6.76	0.032	U	0.032
EXC-BC-7	J19DC8	01/05/10				0.150	U	0.150	0.054	U	0.054	-0.431	UJ	6.34	0.042	U	0.042
EXC-BC-8	J19DC9	01/05/10				0.291	U	0.291	0.045	U	0.045	-1.59	UJ	5.64	0.044	U	0.044
EXC-BC-9	J19DD0	12/21/09				0.645		0.062	0.059	U	0.059	2.17	U	6.22	3.82		0.078
EXC-BC-9	J18R67	04/15/10				0.039	U	0.039	0.025	U	0.025	1.02	U	1.77	0.021	U	0.021
EXC-BC-10	J19DD1	01/05/10				0.046	U	0.046	0.045	U	0.045	-2.35	UJ	6.71	0.031	U	0.031
EXC-BC-11	J19DD2	12/21/09				0.234	U	0.234	0.028	U	0.028	0.701	U	5.85	0.029	U	0.029
Split of J19DD3	J19DF9	12/21/09	0.0174	U	0.0464	0.0269	U	0.0396	-0.0106	U	0.0245	0.107	U	0.851	0.0452		0.0247
A-SA-3	J19DD7	12/14/09				0.119	U	0.119	0.044	U	0.044	-1.12	U	3.97	0.035	U	0.035
Duplicate of J19DD7	J19DT1	12/14/09				0.112	U	0.112	0.042	U	0.042	-0.827	U	3.71	0.033	U	0.033
A-SA-1	J19DD5	12/21/09				0.039	U	0.039	0.020	U	0.020	0.946	U	5.57	0.019	U	0.019
A-SA-2	J19DD6	12/21/09				0.305	U	0.305	0.037	U	0.037	1.16	U	5.52	0.036	U	0.036
A-SA-4	J19DD8	12/21/09				0.056	U	0.056	0.055	U	0.055	0.832	U	5.55	0.041	U	0.041
A-SA-5	J19DD9	12/21/09				0.316	U	0.316	0.041	U	0.041	-0.112	U	5.63	0.041	U	0.041
A-SA-6	J19DF0	12/21/09				0.043	U	0.043	0.044	U	0.044	0.695	U	5.8	0.033	U	0.033
A-SA-6	J18R68	04/15/10				0.091	U	0.091	0.025	U	0.025	1.08	U	1.66	0.020	U	0.020
A-SA-7	J19DF1	12/21/09				0.292	U	0.292	0.033	U	0.033	0.555	U	6.17	0.038	U	0.038
A-SA-8	J19DF2	12/21/09				0.022	U	0.022	0.021	U	0.021	0.523	U	5.82	0.016	U	0.016
A-SA-9	J19DF3	12/14/09				0.048	U	0.048	0.041	U	0.041	0.282	U	3.64	0.036	U	0.036
A-SA-10	J19DF4	12/14/09				0.328	U	0.328	0.033	U	0.033	-0.856	U	3.54	0.040	U	0.040
A-SA-11	J19DF5	12/21/09				0.036	U	0.036	0.036	U	0.036	-1.48	U	5.49	0.066	U	0.066
A-SA-12	J19DF6	12/21/09				0.048	U	0.048	0.050	U	0.050	1.98	U	5.35	0.038	U	0.038
Split of J19DD7	J19DH0	12/14/09				-0.0419	U	0.0892	0.0000482	U	0.0139	0.426	U	0.806	0.00813	U	0.0145
FS-1	J19DF7	01/05/10				0.045	U	0.045	0.025	U	0.025	-1.81	UJ	6.00	0.023	U	0.023
FS-2	J19DF8	12/21/09				0.340	U	0.340	0.044	U	0.044	2.09	U	5.22	0.227		0.052

Acronyms and notes apply to all of the tables in this attachment.
Note: Data qualified with B, C, and/or J are considered acceptable values.
B = blank contamination (inorganic constituents)
C = </= 5x the blank concentration
HEIS = Hanford Environmental Information System
J = estimate
M = Sample
PQL = practical quantitation limit
Q = qualifier
U = undetected

Attachment	1	Sheet No.	1 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Radionuclides)

Sample Location	HEIS Number	Sample Date	Cobalt-60			Europium-152			Europium-154			Europium-155			Nickel-63		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EX-BC-12	J19DD3	12/21/09	0.048	U	0.048	0.056	U	0.056	0.056	U	0.056	0.070	U	0.070	-0.704	U	2.54
Duplicate of J19DD3	J19DD4	12/21/09	0.041	U	0.041	0.067	U	0.067	0.094	U	0.094	0.068	U	0.068	1.36	U	2.75
EX-BC-1	J19DC2	12/21/09	0.068	U	0.068	0.202	U	0.202	0.205	U	0.205	0.195	U	0.195	0.447	U	3.07
EXC-BC-2	J19DC3	01/05/10	0.051	U	0.051	0.142	U	0.142	0.152	U	0.152	0.196	U	0.196	-1.50	U	3.34
EXC-BC-3	J19DC4	01/05/10	0.031	U	0.031	0.069	U	0.069	0.089	U	0.089	0.075	U	0.075	-0.039	U	3.06
EXC-BC-4	J19DC5	01/05/10	0.025	U	0.025	0.060	U	0.060	0.085	U	0.085	0.070	U	0.070	-0.604	U	3.14
EXC-BC-5	J19DC6	01/05/10	0.021	U	0.021	0.075	U	0.075	0.082	U	0.082	0.107	U	0.107	0.345	U	3.00
EXC-BC-6	J19DC7	12/21/09	0.036	U	0.036	0.084	U	0.084	0.120	U	0.120	0.076	U	0.076	-0.320	U	2.74
EXC-BC-7	J19DC8	01/05/10	0.047	U	0.047	0.116	U	0.116	0.142	U	0.142	0.112	U	0.112	-1.10	U	3.31
EXC-BC-8	J19DC9	01/05/10	0.042	U	0.042	0.110	U	0.110	0.151	U	0.151	0.128	U	0.128	-0.695	U	3.19
EXC-BC-9	J19DD0	12/21/09	8.56		0.063	0.233	U	0.233	1.43	U	1.43	0.136	U	0.136	47.9		2.79
EXC-BC-9	J18R67	04/15/10	0.034	U	0.034	0.053	U	0.053	0.085	U	0.085	0.067	U	0.067	0.515	U	2.94
EXC-BC-10	J19DD1	01/05/10	0.035	U	0.035	0.084	U	0.084	0.111	U	0.111	0.075	U	0.075	-0.944	U	3.21
EXC-BC-11	J19DD2	12/21/09	0.032	U	0.032	0.079	U	0.079	0.117	U	0.117	0.090	U	0.090	0.539	U	2.64
Split of J19DD3	J19DF9	12/21/09	0.036	U	0.0288	-0.00563	U	0.0592	-0.0122	U	0.0697	0.0175	U	0.0557	4.09	U	6.11
A-SA-3	J19DD7	12/14/09	0.040	U	0.040	0.085	U	0.085	0.129	U	0.129	0.095	U	0.095	0.591	U	3.42
Duplicate of J19DD7	J19DT1	12/14/09	0.037	U	0.037	0.077	U	0.077	0.120	U	0.120	0.088	U	0.088	-0.126	U	3.39
A-SA-1	J19DD5	12/21/09	0.021	U	0.021	0.049	U	0.049	0.068	U	0.068	0.061	U	0.061	-0.630	U	2.54
A-SA-2	J19DD6	12/21/09	0.048	U	0.048	0.105	U	0.105	0.154	U	0.154	0.114	U	0.114	-0.238	U	2.72
A-SA-4	J19DD8	12/21/09	0.044	U	0.044	0.116	U	0.116	0.162	U	0.162	0.093	U	0.093	-0.467	U	2.67
A-SA-5	J19DD9	12/21/09	0.046	U	0.046	0.112	U	0.112	0.162	U	0.162	0.118	U	0.118	-1.76	U	2.81
A-SA-6	J19DF0	12/21/09	0.037	U	0.037	0.092	U	0.092	0.124	U	0.124	0.073	U	0.073	-1.33	U	3.15
A-SA-6	J18R68	04/15/10	0.021	U	0.021	0.053	U	0.053	0.063	U	0.063	0.072	U	0.072	0.814	U	3.02
A-SA-7	J19DF1	12/21/09	0.037	U	0.037	0.095	U	0.095	0.142	U	0.142	0.108	U	0.108	-0.476	U	2.72
A-SA-8	J19DF2	12/21/09	0.017	U	0.017	0.045	U	0.045	0.060	U	0.060	0.064	U	0.064	-0.814	U	2.54
A-SA-9	J19DF3	12/14/09	0.039	U	0.039	0.094	U	0.094	0.131	U	0.131	0.086	U	0.086	0	U	3.35
A-SA-10	J19DF4	12/14/09	0.038	U	0.038	0.096	U	0.096	0.121	U	0.121	0.109	U	0.109	0.861	U	3.32
A-SA-11	J19DF5	12/21/09	0.027	U	0.027	0.072	U	0.072	0.092	U	0.092	0.057	U	0.057	-0.217	U	2.48
A-SA-12	J19DF6	12/21/09	0.038	U	0.038	0.091	U	0.091	0.130	U	0.130	0.087	U	0.087	-0.269	U	2.64
Split of J19DD7	J19DH0	12/14/09	-0.000672	U	0.0146	0.012	U	0.0344	-0.0139	U	0.0455	0.0171	U	0.0392	4.00	U	13.2
FS-1	J19DF7	01/05/10	0.027	U	0.027	0.058	U	0.058	0.086	U	0.086	0.092	U	0.092	0.042	U	3.28
FS-2	J19DF8	12/21/09	0.525		0.058	0.128	U	0.128	0.166	U	0.166	0.131	U	0.131	8.76		2.57

Attachment	1	Sheet No.	2 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Radionuclides)

Sample Location	HEIS Number	Sample Date	Plutonium-238			Plutonium-239/240			Potassium-40			Radium-226			Radium-228		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EX-BC-12	J19DD3	12/21/09	0.025	U	0.24	0.025	U	0.192	15.4		0.177	0.658		0.034	0.894		0.088
Duplicate of J19DD3	J19DD4	12/21/09	0	U	0.355	-0.029	U	0.220	14.7		0.254	0.652		0.053	1.03		0.121
EX-BC-1	J19DC2	12/21/09	0.036	U	0.443	-0.036	U	0.276	14.5		0.479	0.379		0.143	0.584		0.26
EXC-BC-2	J19DC3	01/05/10	0	U	0.334	0	U	0.231	15.2		0.467	0.817		0.091	0.833		0.23
EXC-BC-3	J19DC4	01/05/10	0.026	U	0.201	0.026	U	0.201	17.3		0.299	0.435		0.049	0.702		0.118
EXC-BC-4	J19DC5	01/05/10	0.027	U	0.298	0	U	0.206	14.3		0.229	0.510		0.049	0.702		0.104
EXC-BC-5	J19DC6	01/05/10	0	U	0.262	0	U	0.209	16.1		0.226	0.586		0.058	1.00		0.110
EXC-BC-6	J19DC7	12/21/09	0.071	U	0.339	0	U	0.338	14.4		0.256	0.551		0.056	0.757		0.129
EXC-BC-7	J19DC8	01/05/10	0.033	U	0.312	0.065	U	0.250	9.36		0.311	0.466		0.084	0.631		0.171
EXC-BC-8	J19DC9	01/05/10	0	U	0.400	0.036	U	0.277	14.4		0.38	0.463		0.08	0.797		0.203
EXC-BC-9	J19DD0	12/21/09	0.104	U	0.331	0.173	U	0.264	16.7		0.446	0.500		0.099	0.726		0.371
EXC-BC-9	J18R67	04/15/10	0	U	0.418	-0.044	U	0.334	13.2		0.29	0.716		0.038	0.641		0.100
EXC-BC-10	J19DD1	01/05/10	-0.022	U	0.172	0	U	0.172	12.0		0.362	0.488		0.057	0.661		0.147
EXC-BC-11	J19DD2	12/21/09	-0.033	U	0.370	0	U	0.256	13.6		0.282	0.603		0.055	0.866		0.127
Split of J19DD3	J19DF9	12/21/09	0	U	0.0649	-0.00813	U	0.0854									
A-SA-3	J19DD7	12/14/09	-0.027	U	0.259	0	U	0.207	13.3		0.341	0.504		0.061	0.581		0.159
Duplicate of J19DD7	J19DT1	12/14/09	-0.091	U	0.306	0	U	0.175	12.9		0.268	0.454		0.056	0.606		0.138
A-SA-1	J19DD5	12/21/09	-0.106	U	0.389	0	U	0.269	15.4		0.233	0.589		0.040	0.912		0.092
A-SA-2	J19DD6	12/21/09	-0.025	U	0.275	0.025	U	0.190	16.5		0.382	0.518		0.079	0.785		0.154
A-SA-4	J19DD8	12/21/09	0.028	U	0.214	0	U	0.214	14.3		0.485	0.582		0.064	0.834		0.197
A-SA-5	J19DD9	12/21/09	-0.030	U	0.227	-0.030	U	0.227	14.8		0.39	0.524		0.076	0.816		0.173
A-SA-6	J19DF0	12/21/09	0	U	0.225	0	U	0.225	13.5		0.375	0.407		0.061	0.548		0.141
A-SA-6	J18R68	04/15/10	0	U	0.280	0.058	U	0.223	13.8		0.187	0.427		0.036	0.604		0.097
A-SA-7	J19DF1	12/21/09	-0.028	U	0.211	0	U	0.211	13.2		0.347	0.401		0.069	0.638		0.164
A-SA-8	J19DF2	12/21/09	0.054	U	0.413	0.054	U	0.413	13.8		0.173	0.503		0.03	0.712		0.069
A-SA-9	J19DF3	12/14/09	-0.021	U	0.254	0	U	0.158	15.9		0.449	0.634		0.056	0.997		0.146
A-SA-10	J19DF4	12/14/09	0.020	U	0.243	0.020	U	0.151	12.4		0.331	0.555		0.071	0.735		0.188
A-SA-11	J19DF5	12/21/09	0	U	0.196	0	U	0.196	12.1		0.286	0.629		0.043	0.748		0.117
A-SA-12	J19DF6	12/21/09	-0.077	U	0.427	-0.039	U	0.295	13.4		0.4	0.631		0.067	0.954		0.154
Split of J19DD7	J19DH0	12/14/09	-0.00418	U	0.0599	-0.00837	U	0.0544									
FS-1	J19DF7	01/05/10	0	U	0.320	-0.042	U	0.320	13.6		0.267	0.491		0.054	0.668		0.113
FS-2	J19DF8	12/21/09	0.069	U	0.265	0.104	U	0.332	13.9		0.376	0.592		0.086	0.940		0.203

Attachment	1	Sheet No.	3 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Radionuclides)

Sample Location	HEIS Number	Sample Date	Silver-108 metastable			Thorium-228 GEA			Thorium-232 GEA			Total beta radiostrontium			Tritium		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EX-BC-12	J19DD3	12/21/09	0.014	U	0.014	0.941		0.032	0.894		0.088	0.027	U	0.296	1.80	U	7.09
Duplicate of J19DD3	J19DD4	12/21/09	0.020	U	0.020	1.18		0.052	1.03		0.121	0.042	U	0.304	-1.69	U	7.14
EX-BC-1	J19DC2	12/21/09	0.050	U	0.050	0.580		0.091	0.584		0.260	-0.095	U	0.312	-0.78	U	7.15
EXC-BC-2	J19DC3	01/05/10	0.036	U	0.036	0.905		0.074	0.833		0.230	-0.030	U	0.214	1.60	UJ	7.55
EXC-BC-3	J19DC4	01/05/10	0.018	U	0.018	0.582		0.030	0.702		0.118	-0.002	U	0.200	0	UJ	6.82
EXC-BC-4	J19DC5	01/05/10	0.015	U	0.015	0.674		0.029	0.702		0.104	-0.033	U	0.331	-2.95	UJ	6.70
EXC-BC-5	J19DC6	01/05/10	0.021	U	0.021	0.945		0.043	1.00		0.110	0.045	U	0.305	-1.18	UJ	7.26
EXC-BC-6	J19DC7	12/21/09	0.024	U	0.024	0.786		0.037	0.757		0.129	-0.107	U	0.330	-1.45	U	7.95
EXC-BC-7	J19DC8	01/05/10	0.030	U	0.030	0.916		0.067	0.631		0.171	0.092	U	0.316	-0.339	UJ	6.93
EXC-BC-8	J19DC9	01/05/10	0.029	U	0.029	0.695		0.058	0.797		0.203	-0.039	U	0.305	-1.59	UJ	6.09
EXC-BC-9	J19DD0	12/21/09	0.122	U	0.122	0.676		0.070	0.726		0.371	0.700		0.272	3.58	U	7.29
EXC-BC-9	J18R67	04/15/10	0.014	U	0.014	0.528		0.029	0.641		0.100	0.088	U	0.267	1.46	U	2.96
EXC-BC-10	J19DD1	01/05/10	0.023	U	0.023	0.961		0.057	0.661		0.147	-0.046	U	0.317	-1.08	UJ	8.29
EXC-BC-11	J19DD2	12/21/09	0.022	U	0.022	0.727		0.039	0.866		0.127	0.003	U	0.311	1.70	U	6.70
Split of J19DD3	J19DF9	12/21/09	-0.00363	U	0.0178							0.0691	U	0.096	0.0164	U	0.033
A-SA-3	J19DD7	12/14/09	0.025	U	0.025	0.794		0.057	0.581		0.159	0.135	U	0.365	1.04	U	4.37
Duplicate of J19DD7	J19DT1	12/14/09	0.024	U	0.024	0.797		0.053	0.606		0.138	-0.003	U	0.341	0.127	U	3.99
A-SA-1	J19DD5	12/21/09	0.014	U	0.014	0.774		0.025	0.912		0.092	0.031	U	0.294	-0.114	U	6.30
A-SA-2	J19DD6	12/21/09	0.026	U	0.026	0.636		0.051	0.785		0.154	-0.007	U	0.303	4.32	U	6.42
A-SA-4	J19DD8	12/21/09	0.031	U	0.031	1.05		0.076	0.834		0.197	-0.031	U	0.291	1.14	U	6.26
A-SA-5	J19DD9	12/21/09	0.028	U	0.028	0.568		0.056	0.816		0.173	0.067	U	0.297	1.16	U	6.39
A-SA-6	J19DF0	12/21/09	0.025	U	0.025	0.834		0.062	0.548		0.141	0.037	U	0.298	4.03	U	6.51
A-SA-6	J18R68	04/15/10	0.016	U	0.016	0.553		0.027	0.604		0.097	0.018	U	0.380	0.175	U	2.94
A-SA-7	J19DF1	12/21/09	0.026	U	0.026	0.573		0.049	0.638		0.164	-0.033	U	0.314	-0.522	U	7.17
A-SA-8	J19DF2	12/21/09	0.012	U	0.012	0.915		0.030	0.712		0.069	-0.031	U	0.289	-0.242	U	6.67
A-SA-9	J19DF3	12/14/09	0.028	U	0.028	0.975		0.049	0.997		0.146	0.035	U	0.339	-0.062	U	3.93
A-SA-10	J19DF4	12/14/09	0.024	U	0.024	0.634		0.047	0.735		0.188	0.070	U	0.353	0.497	U	3.92
A-SA-11	J19DF5	12/21/09	0.019	U	0.019	1.19		0.048	0.748		0.117	-0.056	U	0.291	0.825	U	6.48
A-SA-12	J19DF6	12/21/09	0.026	U	0.026	1.25		0.072	0.954		0.154	0.070	U	0.307	3.82	U	6.17
Split of J19DD7	J19DH0	12/14/09	0.00219	U	0.0104							0.109		0.0776	0.128	U	0.645
FS-1	J19DF7	01/05/10	0.017	U	0.017	0.626		0.028	0.668		0.113	-0.117	U	0.261	-2.00	UJ	6.45
FS-2	J19DF8	12/21/09	0.033	U	0.033	0.782		0.060	0.940		0.203	0.130	U	0.364	1.46	U	6.19

Attachment	1	Sheet No.	4 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Radionuclides)

Sample Location	HEIS Number	Sample Date	Uranium-233/234			Uranium-235			Uranium-235 GEA			Uranium-238			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EX-BC-12	J19DD3	12/21/09	0.482		0.176	0	U	0.212	0.139	U	0.139	0.344		0.176	3.24	U	3.24
Duplicate of J19DD3	J19DD4	12/21/09	0.497		0.380	0	U	0.461	0.163	U	0.163	0.249	U	0.380	3.28	U	3.28
EX-BC-1	J19DC2	12/21/09	0.892		0.227	0.108	U	0.275	0.464	U	0.464	0.654		0.227	6.75	U	6.75
EXC-BC-2	J19DC3	01/05/10	0.584		0.224	0	U	0.271	0.370	U	0.370	0.526		0.224	6.50	U	6.50
EXC-BC-3	J19DC4	01/05/10	0.548		0.210	0.033	U	0.254	0.146	U	0.146	0.438		0.210	3.64	U	3.64
EXC-BC-4	J19DC5	01/05/10	0.662		0.253	0	U	0.307	0.160	U	0.160	0.696		0.253	3.15	U	3.15
EXC-BC-5	J19DC6	01/05/10	0.783		0.260	0	U	0.315	0.216	U	0.216	0.579		0.260	3.16	U	3.16
EXC-BC-6	J19DC7	12/21/09	0.467		0.255	0	U	0.309	0.192	U	0.192	0.533		0.255	3.72	U	3.72
EXC-BC-7	J19DC8	01/05/10	0.646		0.235	0.037	U	0.285	0.222	U	0.222	0.800		0.235	5.21	U	5.21
EXC-BC-8	J19DC9	01/05/10	0.707		0.258	0.082	U	0.312	0.269	U	0.269	0.505		0.258	5.46	U	5.46
EXC-BC-9	J19DD0	12/21/09	0.408		0.223	0.035	U	0.270	0.260	U	0.260	0.467		0.223	10.6	U	10.6
EXC-BC-9	J18R67	04/15/10	0.416		0.052	0.033		0.031	0.197	U	0.197	0.433		0.037	2.97	U	2.97
EXC-BC-10	J19DD1	01/05/10	0.714		0.176	0.139	U	0.213	0.180	U	0.180	0.737		0.176	4.12	U	4.12
EXC-BC-11	J19DD2	12/21/09	0.502		0.226	0.036	U	0.274	0.182	U	0.182	0.325		0.226	3.38	U	3.38
Split of J19DD3	J19DF9	12/21/09	0.834		0.0301	0.0439		0.0301				0.765		0.0301			
A-SA-3	J19DD7	12/14/09	0.450		0.287	0	U	0.347	0.186	U	0.186	0.562		0.287	4.32	U	4.32
Duplicate of J19DD7	J19DT1	12/14/09	0.415		0.353	0	U	0.427	0.172	U	0.172	0.323	U	0.353	4.28	U	4.28
A-SA-1	J19DD5	12/21/09	0.557		0.170	0.054	U	0.206	0.120	U	0.120	0.579		0.170	3.27	U	3.27
A-SA-2	J19DD6	12/21/09	0.460		0.160	0	U	0.194	0.242	U	0.242	0.356		0.160	4.52	U	4.52
A-SA-4	J19DD8	12/21/09	0.418		0.168	0.053	U	0.204	0.227	U	0.227	0.461		0.168	5.64	U	5.64
A-SA-5	J19DD9	12/21/09	0.544		0.189	0.060	U	0.229	0.248	U	0.248	0.644		0.189	4.78	U	4.78
A-SA-6	J19DF0	12/21/09	0.392		0.158	0.025	U	0.191	0.179	U	0.179	0.372		0.158	4.34	U	4.34
A-SA-6	J18R68	04/15/10	0.528		0.449	0	U	0.544	0.146	U	0.146	0.470		0.449	2.35	U	2.35
A-SA-7	J19DF1	12/21/09	0.498		0.254	0	U	0.307	0.215	U	0.215	0.332		0.254	4.03	U	4.03
A-SA-8	J19DF2	12/21/09	0.812		0.230	0.146	U	0.278	0.089	U	0.089	0.541		0.230	2.05	U	2.05
A-SA-9	J19DF3	12/14/09	0.683		0.275	0.044	U	0.333	0.196	U	0.196	1.15		0.275	4.29	U	4.29
A-SA-10	J19DF4	12/14/09	0.486		0.266	0.084	U	0.322	0.226	U	0.226	0.348		0.266	4.40	U	4.40
A-SA-11	J19DF5	12/21/09	0.650		0.237	0.075	U	0.287	0.140	U	0.140	0.495		0.237	3.13	U	3.13
A-SA-12	J19DF6	12/21/09	0.489		0.234	0	U	0.283	0.207	U	0.207	0.336		0.234	4.73	U	4.73
Split of J19DD7	J19DH0	12/14/09	0.827		0.0407	0.0247	U	0.0388				0.912		0.0314			
FS-1	J19DF7	01/05/10	1.07		0.242	0.038	U	0.292	0.139	U	0.139	0.947		0.242	3.24	U	3.24
FS-2	J19DF8	12/21/09	0.344		0.219	0	U	0.265	0.262	U	0.262	0.372		0.219	6.05	U	6.05

Attachment	1	Sheet No.	5 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EX-BC-12	J19DD3	12/21/09	9080		21.2	1.06	U	1.06	5.44		1.06	79.8		0.530	0.294		0.212	1.97	B	2.12
Duplicate of J19DD3	J19DD4	12/21/09	10100		18.6	0.932	U	0.932	4.78		0.932	91.8		0.466	0.321		0.186	2.16		1.86
EX-BC-1	J19DC2	12/21/09	4980		14.4	0.722	U	0.722	2.34		0.722	31.3		0.361	0.145		0.144	0.627	B	1.44
EXC-BC-2	J19DC3	1/5/10	6120		17.4	0.868	UJ	0.868	10.1		0.868	65.9		0.434	0.191		0.174	1.10	BJ	1.74
EXC-BC-3	J19DC4	1/5/10	4900		18.2	0.322	BJ	0.911	2.32		0.911	46.6		0.455	0.156	B	0.182	0.517	BJ	1.82
EXC-BC-4	J19DC5	1/5/10	5720		22.5	1.14	J	1.12	17.9		1.12	54.0		0.562	0.194	B	0.225	1.47	BJ	2.25
EXC-BC-5	J19DC6	1/5/10	9630		16.1	0.803	UJ	0.803	4.15		0.80	89.9		0.402	0.325		0.161	1.33	BJ	1.61
EXC-BC-6	J19DC7	12/21/09	6370		17.4	0.872	U	0.872	3.73		0.872	50.8		0.436	0.197		0.174	1.30	B	1.74
EXC-BC-7	J19DC8	1/5/10	15800		17.2	0.663	BJ	0.858	37.0		0.858	141		0.429	0.589		0.172	7.03	J	1.72
EXC-BC-8	J19DC9	1/5/10	6870		15.7	0.785	UJ	0.785	13.5		0.785	63.9		0.393	0.218		0.157	1.27	BJ	1.57
EXC-BC-9	J19DD0	12/21/09	6660		15.4	0.772	U	0.772	4.60		0.772	52.9		0.386	0.187		0.154	9.85		1.54
EXC-BC-9	J18R67	4/15/10	4550		13.8	0.689	U	0.689	1.46		0.689	31.9		0.344	0.115	B	0.138	0.697	B	1.38
EXC-BC-10	J19DD1	1/5/10	9300		21.9	0.444	BJ	1.09	8.82		1.09	83.6		0.547	0.315		0.219	3.48	J	2.19
EXC-BC-11	J19DD2	12/21/09	7290		16.4	0.822	U	0.822	3.18		0.822	64.9		0.411	0.230		0.164	1.18	B	1.64
Split of J19DD3	J19DF9	12/21/09	8370		16.1	2.00	C	0.23	5.20	B	1.80	85.9		0.290	0.39	B	0.19	45.2	BC	8.60
A-SA-3	J19DD7	12/14/09	7860		16.3	0.813	U	0.813	1.99		0.813	69.8		0.407	0.22		0.163	1.16	B	1.63
Duplicate of J19DD7	J19DT1	12/14/09	6750		14.9	0.746	U	0.746	1.87		0.75	55.3		0.37	0.195		0.15	0.814	B	1.49
A-SA-1	J19DD5	12/21/09	7640		16.6	0.828	U	0.828	3.97		0.828	76.0		0.414	0.243		0.166	2.27		1.66
A-SA-2	J19DD6	12/21/09	5640		15.1	0.756	U	0.756	1.95		0.756	51.2		0.378	0.155		0.151	0.546	B	1.51
A-SA-4	J19DD8	12/21/09	7370		16.0	0.799	U	0.799	2.58		0.799	60.2		0.399	0.221		0.160	1.41	B	1.60
A-SA-5	J19DD9	12/21/09	5140		16.0	0.801	U	0.801	2.02		0.801	37.9		0.401	0.110	B	0.160	1.60	U	1.60
A-SA-6	J19DF0	12/21/09	4310		15.7	0.787	U	0.787	1.54		0.787	45.0		0.393	0.127	B	0.157	0.703	B	1.57
A-SA-6	J18R68	4/15/10	4800		14.8	0.739	U	0.739	1.49		0.739	34.7		0.369	0.133	B	0.148	0.634	B	1.48
A-SA-7	J19DF1	12/21/09	4830		17.7	0.885	U	0.885	1.60		0.885	44.2		0.442	0.135	B	0.177	0.472	B	1.77
A-SA-8	J19DF2	12/21/09	5010		15.0	0.750	U	0.75	1.66		0.750	41.4		0.375	0.143	B	0.150	0.629	B	1.50
A-SA-9	J19DF3	12/14/09	6330		15.1	0.755	U	0.755	2.57		0.76	39.5		0.38	0.159		0.15	0.587	B	1.51
A-SA-10	J19DF4	12/14/09	7180		15.9	0.793	U	0.793	2.26		0.79	62.9		0.4	0.203		0.16	1.19	B	1.59
A-SA-11	J19DF5	12/21/09	12700		18.6	0.929	U	0.929	4.38		0.929	108		0.465	0.415		0.186	2.95		1.86
A-SA-12	J19DF6	12/21/09	10800		20.9	1.05	U	1.05	3.65		1.05	100		0.523	0.354		0.209	3.28		2.09
FS-1	J19DF7	1/5/10	4340		13.2	0.661	UJ	0.661	1.61		0.661	33.7		0.331	0.137		0.132	0.411	BJ	1.32
FS-2	J19DF8	12/21/09	7100		16.5	0.823	U	0.823	4.80		0.823	56.7		0.411	0.211		0.165	2.63		1.65
Split of J19DD7	J19DH0	12/14/09	6020		14.7	1.30		0.210	2.9	B	1.7	53		0.26	0.26	B	0.18	42.2	B	7.90
Equipment Blank	J19DT2	12/14/09	191		14.1	0.705	U	0.705	0.705	U	0.71	2.27		0.35	0.141	U	0.14	1.41	U	1.41

Attachment	1	Sheet No.	6 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EX-BC-12	J19DD3	12/21/09	0.0843	B	0.265	4510		21.2	12.4		1.06	6.52		3.18	13.2		2.12	0.22	U	0.22
Duplicate of J19DD3	J19DD4	12/21/09	0.0853	B	0.233	4020		18.6	12.6		0.932	6.92		2.79	14.0		1.86	0.23	U	0.23
EX-BC-1	J19DC2	12/21/09	0.0663	B	0.181	6180		14.4	9.10		0.722	4.49		2.17	11.1		1.44	0.22	U	0.22
EXC-BC-2	J19DC3	1/5/10	0.0959	B	0.217	7090	J	17.4	10.2		0.868	5.40		2.60	15.0		1.74	0.23	U	0.23
EXC-BC-3	J19DC4	1/5/10	0.107	B	0.228	4960	J	18.2	8.74		0.911	4.78		2.73	11.6		1.82	0.21	U	0.21
EXC-BC-4	J19DC5	1/5/10	0.117	B	0.281	8380	J	22.5	11.1		1.12	5.68		3.37	40.9		2.25	0.24	U	0.24
EXC-BC-5	J19DC6	1/5/10	0.0927	B	0.201	4340	J	16.1	12.5		0.803	7.03		2.41	15.0		1.61	0.25	U	0.25
EXC-BC-6	J19DC7	12/21/09	0.0695	B	0.218	4850		17.4	12.5		0.872	5.61		2.62	13.3		1.74	0.08	B	0.22
EXC-BC-7	J19DC8	1/5/10	0.362		0.214	12000	J	17.2	18.6		0.858	10.2		2.57	38.6		1.72	0.26	U	0.26
EXC-BC-8	J19DC9	1/5/10	0.103	B	0.196	4510	J	15.7	10.6		0.785	5.63		2.36	13.0		1.57	0.23	U	0.23
EXC-BC-9	J19DD0	12/21/09	0.0737	B	0.193	6610		15.4	17.2		0.772	5.30		2.32	18.8		1.54	0.22	U	0.22
EXC-BC-9	J18R67	4/15/10	0.0398	B	0.172	4120		13.8	6.29		0.689	4.20		2.07	9.80		1.38	0.20	U	0.20
EXC-BC-10	J19DD1	1/5/10	0.121	B	0.273	6950	J	21.9	15.3		1.09	7.24		3.28	17.4		2.19	0.27	U	0.27
EXC-BC-11	J19DD2	12/21/09	0.0708	B	0.205	4060		16.4	11.3		0.822	5.94		2.47	14.5		1.64	0.22	U	0.22
Split of J19DD3	J19DF9	12/21/09	0.54	B	0.057	3940		15.3	11.3		0.35	9.2		1.1	12.2		0.83	0.155	U	0.155
A-SA-3	J19DD7	12/14/09	0.0988	B	0.203	6400		16.3	9.95		0.813	6.12		2.44	15.1		1.63	0.16	B	0.21
Duplicate of J19DD7	J19DT1	12/14/09	0.0957	B	0.186	5600		14.9	10.5		0.746	5.31		2.24	12.3		1.49	0.07	B	0.21
A-SA-1	J19DD5	12/21/09	0.0878	B	0.207	4790		16.6	11.3		0.828	5.65		2.48	12.2		1.66	0.23	U	0.23
A-SA-2	J19DD6	12/21/09	0.0621	B	0.189	6600		15.1	10.3		0.756	4.60		2.27	13.2		1.51	0.21	U	0.21
A-SA-4	J19DD8	12/21/09	0.0764	B	0.200	5550		16.0	10.8		0.799	5.43		2.40	13.0		1.60	0.40		0.22
A-SA-5	J19DD9	12/21/09	0.0642	B	0.200	4850		16.0	8.95		0.801	4.33		2.4	9.79		1.60	0.21	U	0.21
A-SA-6	J19DF0	12/21/09	0.0559	B	0.197	4720		15.7	7.11		0.787	4.27		2.36	9.75		1.57	4.4[1]		0.22
A-SA-6	J18R68	4/15/10	0.185	U	0.185	4290		14.8	7.29		0.739	3.84		2.22	10.1		1.48	0.20	U	0.20
A-SA-7	J19DF1	12/21/09	0.0713	B	0.221	4460		17.7	6.41		0.885	5.23		2.65	11.5		1.77	0.21	U	0.21
A-SA-8	J19DF2	12/21/09	0.0732	B	0.187	5520		15	8.07		0.750	4.61		2.25	11.7		1.50	0.22	U	0.22
A-SA-9	J19DF3	12/14/09	0.0766	B	0.189	8570		15.1	14.4		0.755	5.69		2.26	13.6		1.51	0.21	U	0.21
A-SA-10	J19DF4	12/14/09	0.100	B	0.198	6870		15.9	9.03		0.793	5.84		2.38	13.6		1.59	0.15	B	0.21
A-SA-11	J19DF5	12/21/09	0.0985	B	0.232	4950		18.6	14.0		0.929	7.81		2.79	18.0		1.86	0.25	U	0.25
A-SA-12	J19DF6	12/21/09	0.132	B	0.262	4080		20.9	12.7		1.05	7.30		3.14	14.1		2.09	0.23	U	0.23
FS-1	J19DF7	1/5/10	0.0667	B	0.165	5970	J	13.2	6.90		0.661	5.02		1.98	11.9		1.32	0.21	U	0.21
FS-2	J19DF8	12/21/09	0.0811	B	0.206	5360		16.5	9.11		0.823	5.69		2.47	15.1		1.65	0.22	U	0.22
Split of J19DD7	J19DH0	12/14/09	0.4	B	0.053	5710		70	8.7		0.32	8		0.99	12.2		0.76	0.155	U	0.155
Equipment Blank	J19DT2	12/14/09	0.176	U	0.176	41.4		14.1	0.162	B	0.705	2.11	U	2.11	1.41	U	1.41			

Attachment	1	Sheet No.	7 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EX-BC-12	J19DD3	12/21/09	19400		21.2	8.19		1.06	4300		5.30	315		1.06	0.0310	U	0.0310	0.284	B	1.06
Duplicate of J19DD3	J19DD4	12/21/09	20300		18.6	7.54		0.932	4560		4.66	334		0.932	0.0274	U	0.0274	0.289	B	0.932
EX-BC-1	J19DC2	12/21/09	13500		14.4	3.67		0.722	3490		3.61	216		0.722	0.0314	U	0.0314	0.235	B	0.722
EXC-BC-2	J19DC3	1/5/10	15700		17.4	21.9		0.868	3660		4.34	247		0.868	0.0267	U	0.0267	0.360	BJ	0.868
EXC-BC-3	J19DC4	1/5/10	14400		18.2	4.63		0.911	3720		4.55	240		0.911	0.0302	U	0.0302	0.367	BJ	0.911
EXC-BC-4	J19DC5	1/5/10	21600		22.5	48.1		1.12	3320		5.62	251		1.12	0.0273	U	0.0273	2.67	J	1.12
EXC-BC-5	J19DC6	1/5/10	21300		16.1	7.45		0.803	4830		4.02	344		0.803	0.0289	U	0.0289	0.438	BJ	0.803
EXC-BC-6	J19DC7	12/21/09	16900		17.4	10.3		0.872	4170		4.36	248		0.872	0.0270	U	0.0270	0.277	B	0.872
EXC-BC-7	J19DC8	1/5/10	25800		17.2	147		0.858	7120		4.29	560		0.858	0.0113	B	0.0313	0.705	BJ	0.858
EXC-BC-8	J19DC9	1/5/10	17600		15.7	52.7		0.785	4220		3.93	287		0.785	0.0328	U	0.0328	0.357	BJ	0.785
EXC-BC-9	J19DD0	12/21/09	15800		15.4	7.64		0.772	4150		3.86	247		0.772	0.0299	U	0.0299	0.377	B	0.772
EXC-BC-9	J18R67	4/15/10	13100		13.8	1.65		0.689	2850		3.44	183		0.689	0.0255	U	0.0255	0.319	B	0.689
EXC-BC-10	J19DD1	1/5/10	21600		21.9	25.5		1.09	5110		5.47	342		1.09	0.0359	U	0.0359	0.461	BJ	1.09
EXC-BC-11	J19DD2	12/21/09	17600		16.4	6.86		0.822	4170		4.11	268		0.822	0.0258	U	0.0258	0.273	B	0.822
Split of J19DD3	J19DF9	12/21/09	19600		17.0	9.6		0.99	4610		9.5	353		0.18	0.0057	U	0.0057	0.36	U	0.36
A-SA-3	J19DD7	12/14/09	18500		16.3	3.56		0.81	4570		4.07	282		0.81	0.012	B	0.03	0.288	B	0.81
Duplicate of J19DD7	J19DT1	12/14/09	16700		14.9	3.05		0.75	4130		3.73	258		0.75	0.015	B	0.03	0.23	B	0.75
A-SA-1	J19DD5	12/21/09	16800		16.6	14.7		0.828	3920		4.14	277		0.828	0.0275	U	0.0275	0.317	B	0.828
A-SA-2	J19DD6	12/21/09	13000		15.1	2.23		0.756	3850		3.78	233		0.756	0.0302	U	0.0302	0.195	B	0.756
A-SA-4	J19DD8	12/21/09	16200		16.0	3.49		0.799	4150		3.99	324		0.799	0.0272	U	0.0272	0.257	B	0.799
A-SA-5	J19DD9	12/21/09	12100		16.0	1.74		0.801	3350		4.01	169		0.801	0.0307	U	0.0307	0.200	B	0.801
A-SA-6	J19DF0	12/21/09	13400		15.7	1.98		0.787	3200		3.93	191		0.787	0.0305	U	0.0305	0.209	B	0.787
A-SA-6	J18R68	4/15/10	11700		14.8	1.87		0.739	3020		3.69	181		0.739	0.0241	U	0.0241	0.250	B	0.739
A-SA-7	J19DF1	12/21/09	15900		17.7	2.18		0.885	3460		4.42	215		0.885	0.0299	U	0.0299	0.238	B	0.885
A-SA-8	J19DF2	12/21/09	13800		15.0	2.45		0.750	3320		3.75	213		0.750	0.0249	U	0.0249	0.206	B	0.750
A-SA-9	J19DF3	12/14/09	18000		15.1	3.03		0.76	4770		3.77	272		0.76	0.012	B	0.03	0.276	B	0.76
A-SA-10	J19DF4	12/14/09	18600		15.9	4.57		0.79	4560		3.97	279		0.79	0.013	B	0.02	0.244	B	0.79
A-SA-11	J19DF5	12/21/09	21200		18.6	8.18		0.929	5150		4.65	372		0.929	0.0141	B	0.0299	0.306	B	0.929
A-SA-12	J19DF6	12/21/09	21400		20.9	7.05		1.05	4600		5.23	371		1.05	0.0330	U	0.0330	0.314	B	1.05
FS-1	J19DF7	1/5/10	16500		13.2	3.07		0.661	3230		3.31	213		0.661	0.0269	U	0.0269	0.363	BJ	0.661
FS-2	J19DF8	12/21/09	16600		16.5	11.6		0.823	3690		4.11	255		0.823	0.0254	U	0.0254	0.252	B	0.823
Split of J19DD7	J19DH0	12/14/09	16400		15.6	2.9	B	0.9	4340		8.7	273		0.16	0.0053	U	0.0053	0.33	U	0.33
Equipment Blank	J19DT2	12/14/09	239		14.1	0.417	B	0.71	31.2		3.52	3.63		0.71	0.028	U	0.03	0.705	U	0.71

Attachment	1	Sheet No.	8 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EX-BC-12	J19DD3	12/21/09	10.3		2.65	1730		106	0.318	U	0.318	838		6.36	1.06	U	1.06	194		53
Duplicate of J19DD3	J19DD4	12/21/09	11.5		2.33	1980		93.2	0.279	U	0.279	642		5.59	0.932	U	0.932	201		46.6
EX-BC-1	J19DC2	12/21/09	8.36		1.81	602		72.2	0.217	U	0.217	242		4.33	0.722	U	0.722	154		36.1
EXC-BC-2	J19DC3	1/5/10	12.1	J	2.17	952		86.8	0.260	U	0.260	648	J	5.21	0.868	U	0.868	164		43.4
EXC-BC-3	J19DC4	1/5/10	8.98	J	2.28	672		91.1	0.273	U	0.273	434	J	5.46	0.911	U	0.911	142		45.5
EXC-BC-4	J19DC5	1/5/10	17.4	J	2.81	921		112	0.337	U	0.337	865	J	6.74	1.12	U	1.12	157		56.2
EXC-BC-5	J19DC6	1/5/10	12.1	J	2.01	1960		80.3	0.241	U	0.241	837	J	4.82	0.803	U	0.803	210		40.2
EXC-BC-6	J19DC7	12/21/09	19.3		2.18	869		87.2	0.262	U	0.262	441		5.23	0.872	U	0.872	184		43.6
EXC-BC-7	J19DC8	1/5/10	18.8	J	2.14	3330		85.8	0.257	U	0.257	736	J	5.15	0.417	B	0.86	236		42.9
EXC-BC-8	J19DC9	1/5/10	11.1	J	1.96	1130		78.5	0.236	U	0.236	690	J	4.71	0.785	U	0.785	182		39.3
EXC-BC-9	J19DD0	12/21/09	10.1		1.93	924		77.2	0.232	U	0.232	447		4.63	0.772	U	0.772	188		38.6
EXC-BC-9	J18R67	4/15/10	6.55		1.72	542		68.9	0.207	U	0.207	165		4.13	0.689	U	0.689	179		34.4
EXC-BC-10	J19DD1	1/5/10	14.7	J	2.73	1810		109	0.328	U	0.328	1180	J	6.56	1.09	U	1.09	205		54.7
EXC-BC-11	J19DD2	12/21/09	10.4		2.05	1170		82.2	0.247	U	0.247	483		4.93	0.822	U	0.822	205		41.1
Split of J19DD3	J19DF9	12/21/09	12.0		0.26	2210		387	1.70	U	1.70	682	C	8.90	0.270	U	0.270	116		54.1
A-SA-3	J19DD7	12/14/09	10.9		2.03	1220		81.3	0.244	U	0.24	1500		4.88	0.813	U	0.813	471		40.7
Duplicate of J19DD7	J19DT1	12/14/09	11.5		1.86	909		74.6	0.224	U	0.224	1280		4.48	0.746	U	0.746	352		37.3
A-SA-1	J19DD5	12/21/09	10.4		2.07	1350		82.8	0.248	U	0.248	466		4.97	0.828	U	0.828	220		41.4
A-SA-2	J19DD6	12/21/09	9.18		1.89	757		75.6	0.227	U	0.227	304		4.54	0.756	U	0.756	166		37.8
A-SA-4	J19DD8	12/21/09	9.74		2.00	1240		79.9	0.240	U	0.240	490		4.79	0.799	U	0.799	242		39.9
A-SA-5	J19DD9	12/21/09	9.32		2.00	578		80.1	0.240	U	0.240	194		4.81	0.801	U	0.801	282		40.1
A-SA-6	J19DF0	12/21/09	7.3		1.97	571		78.7	0.236	U	0.236	211		4.72	0.787	U	0.787	154		39.3
A-SA-6	J18R68	4/15/10	7.73		1.85	561		73.9	0.222	U	0.222	227		4.43	0.739	U	0.739	157		36.9
A-SA-7	J19DF1	12/21/09	7.72		2.21	694		88.5	0.265	U	0.265	240		5.31	0.885	U	0.885	247		44.2
A-SA-8	J19DF2	12/21/09	7.15		1.87	721		75.0	0.225	U	0.225	274		4.50	0.750	U	0.750	205		37.5
A-SA-9	J19DF3	12/14/09	11.7		1.89	787		75.5	0.226	U	0.226	1310		4.53	0.755	U	0.755	342		37.7
A-SA-10	J19DF4	12/14/09	9.11		1.98	1070		79.3	0.238	U	0.238	1440		4.76	0.793	U	0.793	455		39.7
A-SA-11	J19DF5	12/21/09	13.2		2.32	2680		92.9	0.279	U	0.279	616		5.58	0.929	U	0.929	308		46.5
A-SA-12	J19DF6	12/21/09	11.1		2.62	2460		105	0.314	U	0.314	684		6.28	1.05	U	1.05	373		52.3
FS-1	J19DF7	1/5/10	7.50	J	1.65	503		66.1	0.198	U	0.198	284	J	3.97	0.661	U	0.661	199		33.1
FS-2	J19DF8	12/21/09	8.55		2.06	1170		82.3	0.247	U	0.247	467		4.94	0.823	U	0.823	224		41.1
Split of J19DD7	J19DH0	12/14/09	9.50		0.24	1190		355	1.50	U	1.50	1020		1.60	0.250	U	0.250	178		49.5
Equipment Blank	J19DT2	12/14/09	1.76	U	1.76	46	B	70.5	0.211	U	0.211	321		4.23	0.705	U	0.705	35.2	U	35.2

Attachment	1	Sheet No.	9 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
EX-BC-12	J19DD3	12/21/09	44.3		1.06	39.8		3.18
Duplicate of J19DD3	J19DD4	12/21/09	45.7		0.932	41.9		2.79
EX-BC-1	J19DC2	12/21/09	37.7		0.722	28.1		2.17
EXC-BC-2	J19DC3	1/5/10	38.8		0.868	36.7		2.60
EXC-BC-3	J19DC4	1/5/10	38.1		0.911	242		2.73
EXC-BC-4	J19DC5	1/5/10	40.6		1.12	40.1		3.37
EXC-BC-5	J19DC6	1/5/10	47.2		0.803	42.7		2.41
EXC-BC-6	J19DC7	12/21/09	46.4		0.872	35.0		2.62
EXC-BC-7	J19DC8	1/5/10	44.5		0.858	80.8		2.57
EXC-BC-8	J19DC9	1/5/10	45.8		0.785	35.9		2.36
EXC-BC-9	J19DD0	12/21/09	39.2		0.772	33.4		2.32
EXC-BC-9	J18R67	4/15/10	36.6		0.689	24.9		2.07
EXC-BC-10	J19DD1	1/5/10	51.3		1.09	47.7		3.28
EXC-BC-11	J19DD2	12/21/09	44.5		0.822	38.5		2.47
Split of J19DD3	J19DF9	12/21/09	41.6		1.4	45.5		2.30
A-SA-3	J19DD7	12/14/09	50.5		0.81	38.7		2.44
Duplicate of J19DD7	J19DT1	12/14/09	47.2		0.75	35.2		2.24
A-SA-1	J19DD5	12/21/09	40.9		0.828	37.5		2.48
A-SA-2	J19DD6	12/21/09	34.4		0.756	30.0		2.27
A-SA-4	J19DD8	12/21/09	40.7		0.799	34.2		2.40
A-SA-5	J19DD9	12/21/09	34.2		0.801	24.2		2.40
A-SA-6	J19DF0	12/21/09	35.9		0.787	27.2		2.36
A-SA-6	J18R68	4/15/10	33.9		0.739	23.7		2.22
A-SA-7	J19DF1	12/21/09	45.9		0.885	33.6		2.65
A-SA-8	J19DF2	12/21/09	38.7		0.750	29.5		2.25
A-SA-9	J19DF3	12/14/09	46.9		0.76	33.9		2.26
A-SA-10	J19DF4	12/14/09	51.1		0.79	38.5		2.38
A-SA-11	J19DF5	12/21/09	42.3		0.929	48.1		2.79
A-SA-12	J19DF6	12/21/09	46.4		1.05	46.1		3.14
FS-1	J19DF7	1/5/10	48.3		0.661	32.6		1.98
FS-2	J19DF8	12/21/09	44.7		0.823	36.9		2.47
Split of J19DD7	J19DH0	12/14/09	42.6		1.3	38.9		2.1
Equipment Blank	J19DT2	12/14/09	0.282	B	0.71	0.815	B	2.11

Attachment	1	Sheet No.	10 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Organics)

Constituent	EXC-BC-12, J19DD3 - Sampled on 12/21/09			Duplicate of J19DD3, J19DD4 - Sampled on 12/21/09			EX-BC-1, J19DC2 - Sampled on 12/21/09			EXC-BC-2, J19DC3 - Sampled on 1/5/10			EXC-BC-3, J19DC4 - Sampled on 1/5/10			EXC-BC-4, J19DC5 - Sampled on 1/5/10		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	14.7	U	14.7	15.4	U	15.4	14.4	U	14.4	15	U	15	14.3	U	14.3	16.1	U	16.1
Aroclor-1221	14.7	U	14.7	15.4	U	15.4	14.4	U	14.4	15	U	15	14.3	U	14.3	16.1	U	16.1
Aroclor-1232	14.7	U	14.7	15.4	U	15.4	14.4	U	14.4	15	U	15	14.3	U	14.3	16.1	U	16.1
Aroclor-1242	14.7	U	14.7	15.4	U	15.4	14.4	U	14.4	15	U	15	14.3	U	14.3	16.1	U	16.1
Aroclor-1248	14.7	U	14.7	15.4	U	15.4	14.4	U	14.4	15	U	15	14.3	U	14.3	16.1	U	16.1
Aroclor-1254	14.7	U	14.7	15.4	U	15.4	14.4	U	14.4	15	U	15	14.3	U	14.3	16.1	U	16.1
Aroclor-1260	14.7	U	14.7	15.4	U	15.4	14.4	U	14.4	4.89	J	15	14.3	U	14.3	68.8		68.8

Constituent	EXC-BC-5, J19DC6 - Sampled on 1/5/10			EXC-BC-6, J19DC7 - Sampled on 12/21/09			EXC-BC-7, J19DC8 - Sampled on 1/5/10			EXC-BC-8, J19DC9 - Sampled on 1/5/10			EXC-BC-9, J19DD0 - Sampled on 12/21/09			EXC-BC-9, J18R67 - Sampled on 4/15/10		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	16.7	U	16.7	14.4	U	14.4	17.1	U	17.1	15	U	15	14.6	U	14.6	13.5	U	13.5
Aroclor-1221	16.7	U	16.7	14.4	U	14.4	17.1	U	17.1	15	U	15	14.6	U	14.6	13.5	U	13.5
Aroclor-1232	16.7	U	16.7	14.4	U	14.4	17.1	U	17.1	15	U	15	14.6	U	14.6	13.5	U	13.5
Aroclor-1242	16.7	U	16.7	14.4	U	14.4	17.1	U	17.1	15	U	15	14.6	U	14.6	13.5	U	13.5
Aroclor-1248	16.7	U	16.7	14.4	U	14.4	17.1	U	17.1	15	U	15	14.6	U	14.6	13.5	U	13.5
Aroclor-1254	16.7	U	16.7	14.4	U	14.4	17.1	U	17.1	15	U	15	14.6	U	14.6	13.5	U	13.5
Aroclor-1260	16.7	U	16.7	14.4	U	14.4	17.1	U	17.1	15	U	15	14.6	U	14.6	13.5	U	13.5

Constituent	EXC-BC-10, J19DD1 - Sampled on 1/5/10			EXC-BC-11 - J19DD2, Sampled on 12/21/09			Split of J19DD3, J19DF9 - Sampled on 12/21/09			A-SA-3, J19DD7 - Sampled on 12/14/09			Duplicate of J19DD7, J19DT1 - Sampled on 12/14/09			A-SA-1, J19DD5 - Sampled on 12/21/09		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	18	U	18	14.9	U	14.9	3.7	U	3.7	14.1	U	14.1	13.9	U	13.9	15.4	U	15.4
Aroclor-1221	18	U	18	14.9	U	14.9	3.7	U	3.7	14.1	U	14.1	13.9	U	13.9	15.4	U	15.4
Aroclor-1232	18	U	18	14.9	U	14.9	3.7	U	3.7	14.1	U	14.1	13.9	U	13.9	15.4	U	15.4
Aroclor-1242	18	U	18	14.9	U	14.9	3.7	U	3.7	14.1	U	14.1	13.9	U	13.9	15.4	U	15.4
Aroclor-1248	18	U	18	14.9	U	14.9	3.7	U	3.7	14.1	U	14.1	13.9	U	13.9	15.4	U	15.4
Aroclor-1254	18	U	18	14.9	U	14.9	2.9	U	2.9	14.1	U	14.1	13.9	U	13.9	15.4	U	15.4
Aroclor-1260	18	U	18	14.9	U	14.9	2.9	U	2.9	14.1	U	14.1	13.9	U	13.9	15.4	U	15.4

Constituent	A-SA-2, J19DD6 - Sampled on 12/21/09			A-SA-4, J19DD8 - Sampled on 12/21/09			A-SA-5, J19DD9 - Sampled on 12/21/09			A-SA-6, J19DF0 - Sampled on 12/21/09			A-SA-6, J18R68 - Sampled on 4/15/10			A-SA-7, J19DF1 - Sampled on 12/21/09		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	14.3	U	14.3	14.9	U	14.9	14.1	U	14.1	14.4	U	14.4	13.5	U	13.5	14.1	U	14.1
Aroclor-1221	14.3	U	14.3	14.9	U	14.9	14.1	U	14.1	14.4	U	14.4	13.5	U	13.5	14.1	U	14.1
Aroclor-1232	14.3	U	14.3	14.9	U	14.9	14.1	U	14.1	14.4	U	14.4	13.5	U	13.5	14.1	U	14.1
Aroclor-1242	14.3	U	14.3	14.9	U	14.9	14.1	U	14.1	14.4	U	14.4	13.5	U	13.5	14.1	U	14.1
Aroclor-1248	14.3	U	14.3	14.9	U	14.9	14.1	U	14.1	14.4	U	14.4	13.5	U	13.5	14.1	U	14.1
Aroclor-1254	14.3	U	14.3	14.9	U	14.9	14.1	U	14.1	14.4	U	14.4	13.5	U	13.5	14.1	U	14.1
Aroclor-1260	14.3	U	14.3	14.9	U	14.9	14.1	U	14.1	14.4	U	14.4	13.5	U	13.5	14.1	U	14.1

Attachment	1	Sheet No.	11 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (Organics)

Constituent	A-SA-8, J19DF2 - Sampled on 12/21/09			A-SA-9, J19DF3 - Sampled on 12/14/09			A-SA-10, J19DF4 - Sampled on 12/14/09			A-SA-11, J19DF5 - Sampled on 12/21/09			A-SA-12, J19DF6 - Sampled on 12/21/09			Split of J19DD7, J19DH0 - Sampled on 12/14/09		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	14.4	U	14.4	13.7	U	13.7	13.9	U	13.9	16.8	U	16.8	15.6	U	15.6	3.4	U	3.4
Aroclor-1221	14.4	U	14.4	13.7	U	13.7	13.9	U	13.9	16.8	U	16.8	15.6	U	15.6	3.4	U	3.4
Aroclor-1232	14.4	U	14.4	13.7	U	13.7	13.9	U	13.9	16.8	U	16.8	15.6	U	15.6	3.4	U	3.4
Aroclor-1242	14.4	U	14.4	13.7	U	13.7	13.9	U	13.9	16.8	U	16.8	15.6	U	15.6	3.4	U	3.4
Aroclor-1248	14.4	U	14.4	13.7	U	13.7	13.9	U	13.9	16.8	U	16.8	15.6	U	15.6	3.4	U	3.4
Aroclor-1254	14.4	U	14.4	13.7	U	13.7	13.9	U	13.9	16.8	U	16.8	15.6	U	15.6	2.7	U	2.7
Aroclor-1260	14.4	U	14.4	13.7	U	13.7	13.9	U	13.9	9.44	J	9.44	15.6	U	15.6	2.7	U	2.7

Constituent	FS-1, J19DF7 - Sampled on 1/5/10			FS-2, J19DF8 - Sampled on 12/21/09		
	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	13.9	U	13.9	14.7	U	14.7
Aroclor-1221	13.9	U	13.9	14.7	U	14.7
Aroclor-1232	13.9	U	13.9	14.7	U	14.7
Aroclor-1242	13.9	U	13.9	14.7	U	14.7
Aroclor-1248	13.9	U	13.9	14.7	U	14.7
Aroclor-1254	13.9	U	13.9	14.7	U	14.7
Aroclor-1260	13.9	U	13.9	14.7	U	14.7

Attachment 1. 118-H-3 Waste Site Verification Sampling Results (TCLP).

Sample Location	HEIS Number	Sample Date	TCLP-Arsenic			TCLP-Barium			TCLP-Cadmium			TCLP-Chromium		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
EXC-BC-7	J19DC8	1/5/10 13:50	0.18		0.09	0.437		0.01	0.018	U	0.02	0.03	U	0.03

Sample Location	HEIS Number	Sample Date	TCLP-Lead			TCLP-Selenium			TCLP-Silver		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
EXC-BC-7	J19DC8	1/5/10 13:50	0.027		0.06	0.12	U	0.12	0.036	U	0.04

Attachment	1	Sheet No.	13 of 13
Originator	J. D. Skoglie	Date	12/14/10
Checked	T. E. Queen	Date	12/14/10
Calc. No.	0100H-CA-V0133	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-H Field Remediation **Job No. 14655**

Area: 100-H

Discipline: Environmental *Calculation No: 0100H-CA-V0154

Subject: 118-H-3 Protection of Groundwater Hazard Quotient and Carcinogenic Risk 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 = 3 Total = 4	E. J. Farris	B. L. Vedder	T. E. Queen	D. F. Obenauer	2/2/6

SUMMARY OF REVISION

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	E. J. Farris	Date:	2/1/2011	Calc. No.:	0100H-CA-V0154	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	B. L. Vedder	Date:	2/1/2011
Subject:	118-H-3 Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for the 118-H-3 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009), the following criteria must be met:

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

GIVEN/REFERENCES:

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

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

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

4) WCH, 2011, *118-H-3 Waste Site Cleanup Verification 95% UCL Calculation*, 0100H-CA-V0133, Rev. 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

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

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

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	E. J. Farris	Date:	2/1/2011	Calc. No.:	0100H-CA-V0154	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	B. L. Vedder	Date:	2/1/2011
Subject:	118-H-3 Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	2 of 3

METHODOLOGY:

The 118-H-3 is comprised of two decision units for verification sampling consisting of the excavation trenches B and C, and excavation trench A and waste staging area. Two focused samples were also collected at this waste site. The protection of groundwater hazard quotient and carcinogenic risk calculations for the 118-H-3 waste site were conservatively calculated for the entire waste site using the greater of the statistical or maximum value for each analyte in all decision units from WCH (2011). Of the contaminants of potential concern (COPCs) for this site, boron and hexavalent chromium are included because no Hanford background value has been established and the distribution coefficients are less than that necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (BHI 2005). Based on this model and a vadose zone of approximately 6 m (20 ft) thickness, a K_d of 12 or greater is required to show no predicted migration to groundwater in 1,000 years. All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than or equal to 12. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (mg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720(3)(a)(ii)(A), 1996) x 100 x 1 mg/1000 mg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii)(A) (1996). For example, the maximum value for boron of 3.08 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg is 9.6×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The cumulative HQ for the 118-H-3 waste site is 9.3×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) No carcinogenic constituents met the criteria for evaluation in groundwater at the 118-H-3 waste site; therefore, no calculations of excess carcinogenic risk were performed.

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	E. J. Farris		Date:	2/1/2011	Calc. No.:	0100H-CA-V0154	Rev.: 0
Project:	100-H Area Field Remediation		Job No:	14655	Checked:	B. L. Vedder	Date: 2/1/2011
Subject:	118-H-3 Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation						Sheet No. 3 of 3

Table 1 shows the results of the calculations.

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 118-H-3 Waste Site.

Contaminants of Potential Concern	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	3.08	320	9.6E-03	--	--
Chromium, hexavalent	0.40	4.8	8.3E-02	--	--
Totals					
Cumulative Hazard Quotient:			**9.3E-02**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:
[a] = From WCH (2011).
[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 118-H-3 site meets the requirements for the hazard quotients and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2009).

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CALCULATION COVER SHEET

Project Title: 100-H Field Remediation **Job No. 14655**

Area: 100-H

Discipline: Environmental *Calculation No: 0100H-CA-V0134

Subject: 118-H-3 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk 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 = 3 Total = 4	J. D. Skoglie	T. E. Queen	B. L. Vedder	D. F. Obenauer	2/2/11

SUMMARY OF REVISION

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	01/12/11	Calc. No.:	0100H-CA-V0134	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	01/12/11
Subject:	118-H-3 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 118-H-3 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009), the following criteria must be met:

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

GIVEN/REFERENCES:

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

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

3) WCH, 2011, 118-H-3 *Waste Site Cleanup Verification 95% UCL Calculation*, 0100H-CA-V0133, Rev 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

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

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

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

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

Washington Closure Hanford Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	01/12/11	Calc. No.:	0100H-CA-V0134	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	01/12/11
Subject:	118-H-3 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	2 of 3

METHODOLOGY:

The 118-H-3 waste site is comprised of two decision units for verification sampling consisting of the excavation trenches B and C and excavation trench A and waste staging area. Two focused samples were also collected at this waste site. The direct contact hazard quotient and carcinogenic risk calculations for the 118-H-3 waste site were conservatively calculated for the entire waste site using the greater of the statistical or maximum value for each analyte in all decision units from WCH (2011). Of the contaminants of potential concern (COPCs) for this site, boron, hexavalent chromium, molybdenum, and aroclor-1260 require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Cadmium, copper, and zinc require HQ and risk calculations because these analytes were detected above background values. Lead is not included in the calculation because its reference dose is based on modeling of child blood levels, which is fundamentally different from the oral reference dose and cancer slope factors used to calculate typical cleanup levels and associated HQs and cancer risks. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the statistical value for boron is 3.08 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 4.3×10^{-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^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, and then multiplied by 1.0×10^{-6}. For example, the maximum value for cadmium is 0.811 mg/kg, divided by 13.9 mg/kg, and multiplied as indicated, is 5.8×10^{-8}. 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 3.9×10^{-7}. Comparing these values to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

Table 1 shows the results of the calculations.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	01/31/11	Calc. No.:	0100H-CA-V0134	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	01/31/11
Subject:	118-H-3 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	3 of 3

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 118-H-3 Waste Site.

Contaminants of Potential Concern	Maximum or statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	3.08	7200	4.3E-04	--	--
Cadmium[c]	0.811	80	1.0E-02	13.9	5.8E-08
Chromium, hexavalent[c]	0.40	240	1.7E-03	2.1	1.9E-07
Copper	22.8	2960	7.7E-03	--	--
Lead[d]	11.6	353	--	--	--
Molybdenum	0.883	400	2.2E-03	--	--
Zinc	86.1	24,000	3.6E-03	--	--
Polychlorinated Biphenyls					
Aroclor-1260	0.0688	--	--	0.5	1.4E-07
Totals					
Cumulative Hazard Quotient:			**2.6E-02**		
Cumulative Excess Cancer Risk:					**3.9E-07**

Notes:

[a] = From WCH (2011).

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

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

[d] = 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:

This calculation demonstrates that the 118-H-3 waste site meets the requirements for the direct contact hazard quotients and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2009).

APPENDIX D

DATA QUALITY ASSESSMENT

APPENDIX D

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 2010c). This DQA was performed in accordance with site specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009).

A review of the sample design (WCH 2010c), the field logbooks (WCH 2010a, 2010b), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical analysis and radiochemical analysis (BHI 2000a, 2000b) 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 118-H-3 waste sites were provided by the laboratories in six sample delivery groups (SDGs): SDG K1858, J00647, K1875, J00652, K1880, and K2021. SDG K1880 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 118-H-3 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.

SDG K1858

This SDG comprises four statistical soil samples (J19DC2, J19DF3-J19DF4, and J19DT1) from the excavation trench A and waste staging area footprint. A field duplicate pair (J19DD7/J19DT1) is included in this SDG. These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, polychlorinated biphenyls (PCBs), strontium-90, isotopic plutonium, isotopic uranium, by gamma energy analysis (GEA), and carbon-14, tritium, and nickel-63 by liquid scintillation. In addition, one equipment blank (J19DT2) was collected and analyzed for ICP metals and mercury. Minor deficiencies are as follows:

In the ICP metals analysis, the matrix spike (MS) recoveries were out of project acceptance criteria for eight analytes (aluminum, calcium, chromium, iron, magnesium, manganese, antimony, and silicon). For aluminum, iron, manganese, and silicon the spiking concentration was insignificant compared to the native concentration in the

sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony, calcium, chromium, and magnesium did not have mismatched spike and native concentrations in the original MS. The original MS recoveries for antimony, calcium, chromium, and magnesium were 54%, 28%, 73% and 58%, respectively. All antimony, calcium, chromium, and magnesium data may be considered estimated. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the silicon results may be considered estimated due to a laboratory duplicate relative percent difference (RPD) above the quality control (QC) limit of 30% at 48%. Estimated data are useable for decision-making purposes.

SDG J00647

This SDG comprises a split soil sample (J19DH0) of sample J19DD7 from the excavation trench A and waste staging area footprint. This sample was analyzed for ICP metals, mercury, hexavalent chromium, PCBs, strontium-90, isotopic plutonium, isotopic uranium, by GEA, and carbon-14, tritium, and nickel-63 by liquid scintillation. Minor deficiencies are as follows:

In the radionuclide analysis, all plutonium-238 and uranium-235 results may be considered estimated due to the lack of a laboratory control sample (LCS) analysis. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the MS and/or matrix spike duplicate (MSD) recoveries were out of project acceptance criteria for seven analytes (aluminum, calcium, iron, magnesium, manganese, silicon, and sodium). For aluminum, calcium, iron, and silicon, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Magnesium, manganese, and sodium did not have mismatched spike and native concentrations in the original MS and/or MSD. The original MS and MSD recoveries for magnesium were 186% and 188%, the original MS and MSD for manganese were 192% and 153%, and the original MS for sodium was 131%. All magnesium, manganese, and sodium data may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K1875

This SDG comprises nine statistical soil samples (J19DD5-J19DD6, J19DD8-J19DD9, J19DF0-J19DF2, J19DF5-J19DF6) from the excavation trench A and waste staging area footprint, six statistical soil samples (J19DC2, J19DC7, J19DD0, J19DD2-J19DD4) from the excavation trenches B and C, and one focused soil sample (J19DF8). These samples were analyzed for ICP metals, mercury, hexavalent chromium, PCBs, strontium-90, isotopic plutonium, isotopic uranium, by GEA, and carbon-14, tritium, and nickel-63 by liquid scintillation. Minor deficiencies are as follows:

In the radionuclide analysis, all carbon-14 and tritium results may be considered estimated due to the lack of a MS analysis. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for four analytes (aluminum, iron, antimony, and silicon). For aluminum and iron, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the original MS. The original MS recoveries for antimony and silicon were 59% and 405%, respectively. All antimony and silicon data may be considered estimated. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the arsenic and silicon results may be considered estimated due to a laboratory duplicate RPD above the QC limit of 30% at 32% and 36%, respectively. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, all silicon results may be considered estimated due to an LCS below QC limits at 60%. Estimated data are useable for decision-making purposes.

SDG J00652

This SDG comprises a split soil sample (J19DF9) of sample J19DD4 from the excavation trenches B and C. This sample was analyzed for ICP metals, mercury, hexavalent chromium, PCBs, strontium-90, isotopic plutonium, isotopic uranium, by GEA, and carbon-14, tritium, and nickel-63 by liquid scintillation. Minor deficiencies are as follows:

In the radionuclide analysis, all plutonium-238 and uranium-235 results may be considered estimated due to the lack of a LCS analysis. Estimated data are useable for decision-making purposes.

In the radionuclide analysis, all carbon-14 and tritium results may be considered estimated due to the lack of an MS analysis. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the MS and/or MSD recoveries were out of project acceptance criteria for five analytes (aluminum, calcium, iron, magnesium, and silicon). For aluminum, iron, and silicon, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Calcium and magnesium did not have mismatched spike and native concentrations in the original MS and MSD. The

original MS and MSD recoveries for calcium were 331% and 218%, and for magnesium were 248% and 152%. All calcium and magnesium data may be considered estimated. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, all aluminum results may be considered estimated due to an LCS below QC limits at 68%. Estimated data are useable for decision-making purposes.

SDG K1880

This SDG comprises seven statistical soil samples (J19DC3-J19DC6, J19DC8-J19DC9, J19DD1) from the excavation trenches B and C, and one focused soil sample (J19DF7). A field duplicate pair (J19DD3/J19DD4) is included in this SDG. These samples were analyzed for ICP metals, mercury, hexavalent chromium, PCBs, strontium-90, isotopic plutonium, isotopic uranium, by GEA, and carbon-14, tritium, and nickel-63 by liquid scintillation. SDG K1880 was submitted for third-party validation. Minor deficiencies are as follows:

In the radionuclide analysis, all carbon-14 and tritium results were qualified as estimates and flagged "J" by third-party validation, due to the lack of a MS analysis. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for seven analytes (aluminum, calcium, iron, manganese, nickel, antimony, and silicon). For aluminum, iron, manganese, and silicon, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony, calcium, and nickel did not have mismatched spike and native concentrations in the original MS. The original MS recoveries for antimony, calcium, and nickel were 45%, 155%, and 73%, respectively. All antimony, calcium, and nickel data were qualified as estimates and flagged "J" by third-party validation. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, all silicon, boron, and molybdenum results were qualified as estimates and flagged "J" by third-party validation, due to the lack of an LCS analysis. Estimated data are useable for decision-making purposes.

SDG K2021

This SDG comprises one statistical soil sample (J18R68) from the excavation trench A and waste staging area, and one statistical soil sample (J18R67) from the excavation trenches B and C. These samples were analyzed for ICP metals, mercury, hexavalent chromium, PCBs, strontium-90, isotopic plutonium, isotopic uranium, by GEA, and carbon-14, tritium, and nickel-63 by liquid scintillation. The samples were taken to replace excavation results from the December 21, 2009 sampling event (reported in

SDG K1875) in comparison to cleanup values for verification sampling of the 118-H-3 waste site. The replacement is needed because a portion of the analytical results from the December 21, 2009 sampling event exceeded cleanup levels, and further excavation at the locations was performed following the initial sample event. Minor deficiencies are as follows:

In the radionuclide analysis, all carbon-14 and tritium results may be considered estimated due to the lack of a MS analysis. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for five analytes (aluminum, iron, manganese, antimony, and silicon). For aluminum and iron, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Manganese, antimony, and silicon did not have mismatched spike and native concentrations in the original MS. The original MS recoveries for manganese, antimony, and silicon were 135%, 64%, and 276%, respectively. The sample results for manganese, antimony, and silicon may be considered estimated. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the lead results may be considered estimated due to a laboratory duplicate RPD above the QC limit of 30% at 37%. Estimated data are useable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

RPD 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 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 logbooks (WCH 2010a, 2010b), are shown in Table D-1. The main and QA/QC sample results are presented in Appendix C.

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

Sample Area	Main Sample	Duplicate Sample	Split Sample
Excavation trench A and waste staging area	J19DD7	J19DT1	J19DH0
Excavation trenches B and C	J19DD3	J19DD4	J19DF9

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern (COPC). RPDs are not calculated for analytes that are not detected in both the main and duplicate sample at more than 5 times the target detection limit (TDL). RPDs of analytes detected at low concentrations (less than 5 times the detection limit) are not considered to be indicative of the analytical system performance. The 95% upper confidence limit (UCL) calculation brief in Appendix C provides details on duplicate pair evaluation and RPD calculation.

The RPD calculated for silicon in the excavation trench A and waste staging area footprint split sample (J19DH0) is above the acceptance criteria of 30% at 38.1%. A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than 5 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. Boron and sodium in the excavation trench A and waste staging area footprint, and cadmium and boron in the excavation trenches B and C split results required this check. These results are attributed to heterogeneities in the sample matrix from which the samples were collected. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are useable 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 118-H-3 waste sites 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 118-H-3 waste sites concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in the Environmental Restoration (ENRE) project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System (HEIS) database. The verification sample analytical data are also summarized in Appendix C.

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