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

14-AMRP-0174

MAY 01 2014

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

Dear Mr. Faulk:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 600-375, SEGMENT 4 DRY CELL BATTERY DEBRIS AREA #1 WASTE SITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2013-092 and supporting, "Remaining Waste Site Verification Package for the 600-375, Segment 4 Dry Cell Battery Debris Area #1 Waste Site," Rev. 0. If you have questions, please contact me or your staff may contact Ellwood Glossbrenner, of my staff, at (509) 376-5828.

Sincerely,

Mark S. French

Mark S. French, Director
River Corridor Division

AMRP:ETG

Attachment

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

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

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-2 **Control No.:** 2013-092

Waste Site Code(s)/Subsite Code(s): 600-375

Reclassification Category: Interim ☒ Final ☐

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

Approvals Needed: DOE ☒ Ecology ☐ EPA ☒

Description of current waste site condition:

The 600-375, Segment 4 Dry Cell Battery Debris Area #1 waste site, part of the 100-IU-2 Operable Unit, consisted of five locations with stained soil and dry cell battery debris. The five locations have been divided into subsites 600-375:1, 600-375:2, 600-375:3, 600-375:4, and 600-375:5. All of the subsites are addressed in this Waste Site Reclassification Form and are discussed further as the 600-375 waste site. The 600-375 waste site was added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999), as a candidate site for confirmatory sampling in the Fact Sheet *100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011,* U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2012). The 600-375 waste site was subsequently recommended for remove, treat, and dispose without confirmatory sampling based on the observed presence of dry cell battery debris and stained soil, and was dispositioned as a "plug-in" site in accordance with the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (100 Area ESD) (EPA 2009).

Remediation of the 600-375 waste site was performed from August 8 through October 29, 2013. No anomalies were encountered during the remediation. A total of approximately 125 bank cubic meters (164 bank cubic yards) of material was removed and direct loaded for disposal at the Environmental Restoration Disposal Facility (ERDF). Cleanup verification sampling was performed between August 12 and October 29, 2013, to determine if the waste site meets remedial action objectives (RAOs) and remedial action goals (RAGs) established by the Remaining Sites ROD (EPA 1999) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Areas* (100 Area RDR/RAWP), DOE/RL-97-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2009b). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at ERDF at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-375 waste site to Interim Closed Out. The current site conditions achieve the RAOs and RAGs established by the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). The results of verification sampling do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The analytical results and rationale presented in the attached remaining sites verification package also demonstrate that residual contaminant concentrations meet direct exposure cleanup criteria and are protective of groundwater and the Columbia River. The waste site contamination does not extend into the deep zone soils. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 600-375, Segment 4 Dry Cell Battery Debris Area #1 Waste Site* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-2 **Control No.:** 2013-092

Waste Site Code(s)/Subsite Code(s): 600-375

Regulator comments:

Waste Site Controls:

Engineered Controls:	☐ Yes	☒ No	Institutional Controls:	☐ Yes	☒ No	O&M Requirements:	☐ Yes	☒ No

If any of the Waste Site Controls are checked Yes, specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents:

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

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-375, SEGMENT 4 DRY CELL BATTERY DEBRIS AREA #1 WASTE SITE

Attachment to Waste Site Reclassification Form 2013-092

April 2014

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-375, SEGMENT 4 DRY CELL BATTERY DEBRIS AREA #1 WASTE SITE

EXECUTIVE SUMMARY

The 600-375, Segment 4 Dry Cell Battery Debris Area #1 waste site, part of the 100-IU-2 Operable Unit, consisted of five locations with stained soil and dry cell battery debris. The 600-375 waste site was added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999) as a candidate site for confirmatory sampling in the Fact Sheet *100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011* (DOE-RL 2012). The 600-375 waste site was subsequently recommended for remove, treat, and dispose without confirmatory sampling based on the observed presence of stained soil and dry cell battery debris, stressed vegetation, and barren ground (WCH 2013b) and was dispositioned as a "plug-in" site in accordance with the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington* (100 Area ESD) (EPA 2009).

Remediation of the 600-375 waste site was performed from August 8 through October 29, 2013. No anomalies were encountered during the remediation. Approximately 125 bank cubic meters (164 bank cubic yards) of contaminated soil and debris was removed and direct loaded for disposal at the Environmental Restoration Disposal Facility. No overburden soil was stockpiled to be used as backfill.

Following remediation, verification sampling was conducted between August 12 and October 29, 2013. The verification sample results indicated that residual contaminant concentrations met the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 600-375 waste site. Verification sampling results support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The results indicated that the waste removal action achieved compliance with the RAOs and RAGs for the 600-375 waste site.

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

Table ES-1. Summary of Remedial Action Goals for the 600-375 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15 mrem/yr above background over 1,000 years.	Radionuclides were not COPCs for the 600-375 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for all sampling areas (5.2×10^{-1}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for cadmium, the only constituent subject to the excess cancer risk calculation is 3.7×10^{-7}, which is $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The excess cancer risk for cadmium, the only constituent subject to the excess cancer risk calculation is 3.7×10^{-7}, which is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 600-375 waste site.	NA
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [a].		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 21.2 pCi/L [c].		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Cadmium, lead, manganese, and zinc, are present at concentrations exceeding soil RAGs for groundwater and/or Columbia River protection. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), it is predicted that these constituents will not reach groundwater (and thus the Columbia River) within 1,000 years [d].	Yes

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

[b] *Radiation Protection of the Public and Environment* (DOE Order 5400.5).

[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).

[d] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentrations of cadmium, lead, manganese, and zinc are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years (based on the contaminants with the lowest distribution coefficients [30 mL/g for cadmium, lead, and zinc]). The vadose zone underlying the soil below all of the subsites is a minimum of approximately 6.7 m (22 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

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

In accordance with this evaluation, the verification sampling results support a reclassification of this site to interim closed out. The current site conditions achieve the RAOs and the corresponding RAGs established in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River. The 600-375 waste site contamination does not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern, contaminants of potential concern, and other constituents. Those constituents exceeding the ecological screening level in *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were boron, cadmium, manganese, mercury, selenium, vanadium, and zinc. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for cadmium, lead, manganese, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of mercury, selenium, and vanadium are below Hanford Site or Washington State background levels, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-375, SEGMENT 4 DRY CELL BATTERY DEBRIS AREA #1 WASTE SITE

STATEMENT OF PROTECTIVENESS

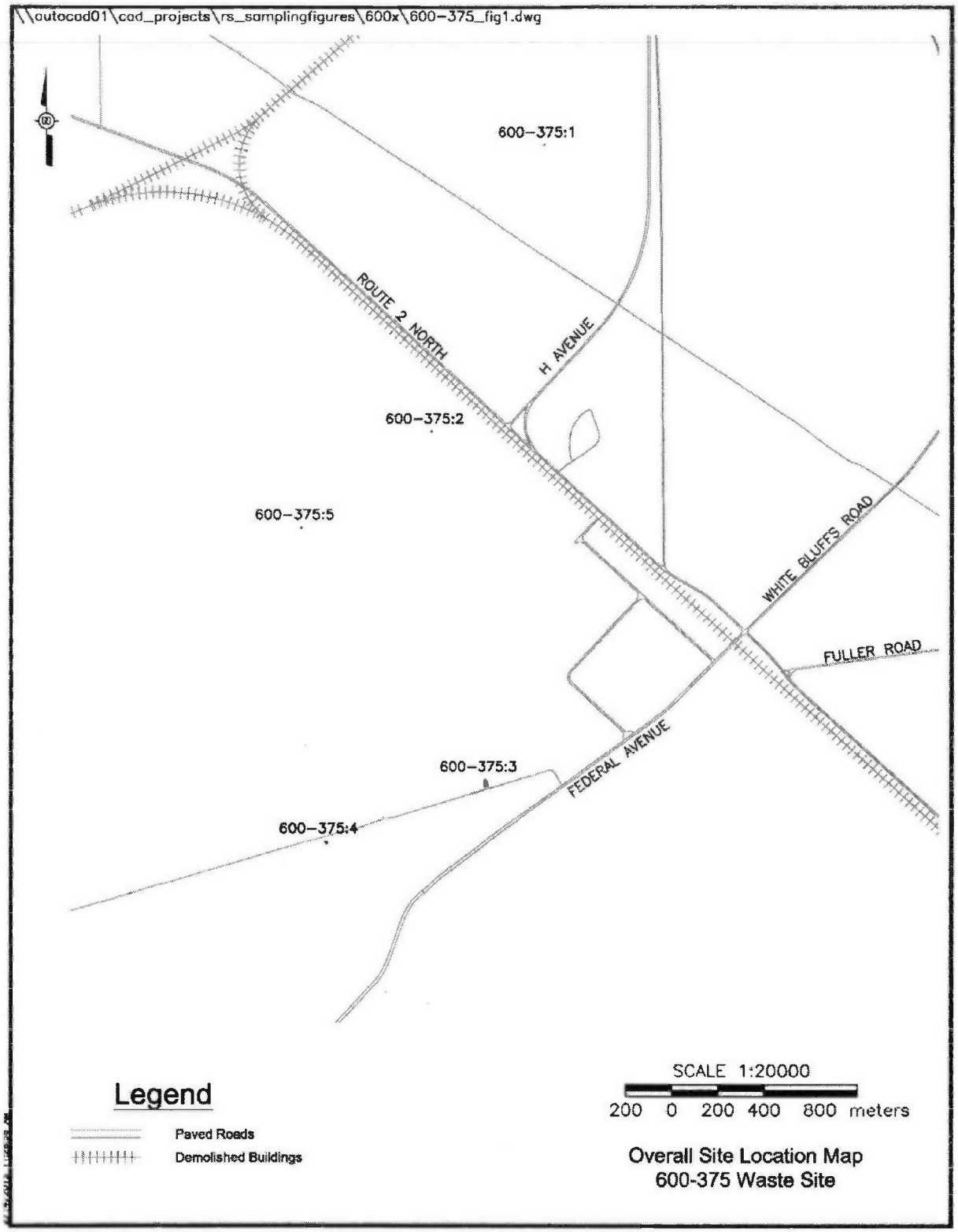
The 600-375, Segment 4 Dry Cell Battery Debris Area #1 waste site verification sampling data, site evaluations, and supporting documentation demonstrate that this waste site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]) and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Contamination from the 600-375 waste site does not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern, contaminants of potential concern (COPCs), and other constituents. Those constituents exceeding the ecological screening level in *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were boron, cadmium, manganese, mercury, selenium, vanadium, and zinc. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for cadmium, lead, manganese, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of mercury, selenium, and vanadium are below Hanford Site or Washington State background levels, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site.

GENERAL SITE INFORMATION AND BACKGROUND

The 600-375 waste site, located within the 100-IU-2 Operable Unit, is reported in the *100-F/IU-2/IU-6 Area-Segment 4 Orphan Sites Evaluation Report* (WCH 2011) as five locations that have dry cell battery debris and stained soil. The 600-375 waste site has been divided into five subsites, and their locations are shown in Figure 1. The descriptions of each subsite are listed below. There is no process history associated with the 600-375 waste site.

Figure 1. The 600-375 Waste Site Location Map.



600-375:1, Segment 4 Dry Cell Battery Debris Area #1a – Consisted of four dry cell batteries within a known farmstead debris site. No visible stains were noted. The location is centered at Washington State Plane (WSP) coordinates N 150162.85, E 577208.71

600-375:2, Segment 4 Dry Cell Battery Debris Area #1b – Consisted of a 1-m (3-ft)-diameter debris stain from dry cell batteries. The location is centered at WSP coordinates N 148913.05, E 576718.36.

600-375:3, Segment 4 Dry Cell Battery Debris Area #1c – Consisted of a 30-m (98-ft)-diameter area of multiple battery debris sites and stained soil within a larger farmstead debris area. The location is centered at WSP coordinates N 147365.45, E576955.64.

600-375:4, Segment 4 Dry Cell Battery Debris Area #1d – Consisted of a 10-m (33-ft)-diameter area with two locations where multiple decayed dry cell batteries have stained the ground. The location is centered at WSP coordinates N 147106.86, E 576263.76.

600-375:5, Segment 4 Dry Cell Battery Debris Area #1e – Consisted of a 1-m (3-ft)-diameter area of dry cell battery debris and stained soil. The location is centered at WSP coordinates N 148489.60, E 576156.50.

Waste Characterization Sampling

Waste characterization sampling was performed for waste disposal purposes. The waste characterization sampling data are included in Appendix A.

REMEDIAL ACTION SUMMARY

The 600-375 waste site was recommended for remediation without confirmatory sampling based on the observed presence of stained soil and battery debris (WCH 2013b).

Remediation of the 600-375 waste site was performed from August 8 through October 29, 2013. Approximately 125 bank cubic meters (163 bank cubic yards) of excavated materials from the 600-375 waste site were removed and direct loaded for disposal at the Environmental Restoration Disposal Facility. The approximate depths of the excavations range from 0.3 m (1.0 ft) to 0.7 m (2.3 ft) below ground surface. A summary of the remediated subsites is provided in Table 1. Post-remediation photographs are provided in Figures 2 through 6. No waste staging pile area or overburden soil stockpiles are associated with the 600-375 waste site. With the exception of the 600-375:1 subsite, a walkaround boundary survey was conducted at the 600-375 subsites following the site remediations. Because the size of the 600-375:1 site after remediation was small, no boundary survey was conducted. A post-remediation photograph of the 600-375:1 is provided in Figure 2. The boundary surveys (shape files) are provided in Figures 7 through 10.

Table 1. 600-375 Waste Site Remediation Summary.

Subsite	Remediation Date	Remediation Depth (bgs)	Volume of Material Removed	Anomalies
600-375:1	August 8, 2013	0.6 m (2 ft)	1 BCM	None
600-375:2	September 23, 2013	0.3 m (1 ft)	2 BCM	None
600-375:3	October 29, 2013	0.6 m (2 ft)	41 BCM	None
600-375:4	September 25, 2013	0.7 m (2.3 ft)	78 BCM	None
600-475:5	September 23, 2013	0.3 m (1 ft)	3 BCM	None

BCM = bank cubic meter
bgs = below ground surface

Figure 2. The 600-375:1 Waste Site Post-Excavation Photograph (August 12, 2013).

Figure 3. The 600-375:2 Waste Site Post-Excavation Photograph (September 23, 2013).

Figure 4. The 600-375:3 Waste Site Post-Excavation Photograph (October 29, 2013).

Figure 5. The 600-375:4 Waste Site Post-Excavation Photograph (September 25, 2013).

Figure 6. The 600-375:5 Waste Site Post-Excavation Photograph (September 23, 2013).

Figure 7. 600-375:2 Subsite Post-Remediation Boundary Survey.

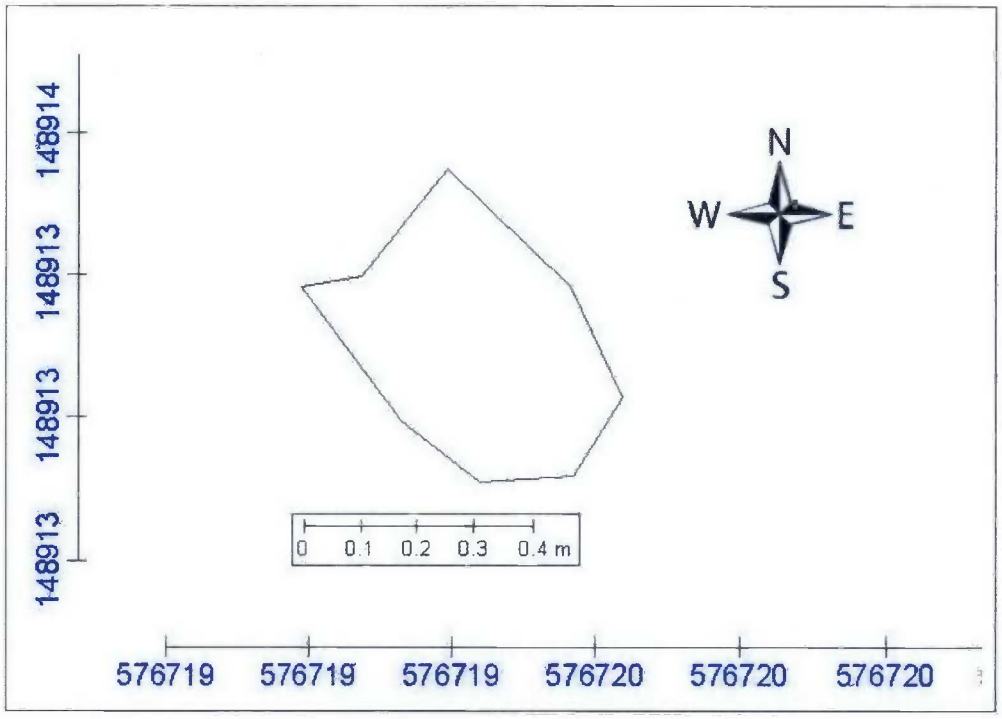


Figure 8. 600-375:3 Subsite Post-Remediation Boundary Survey.

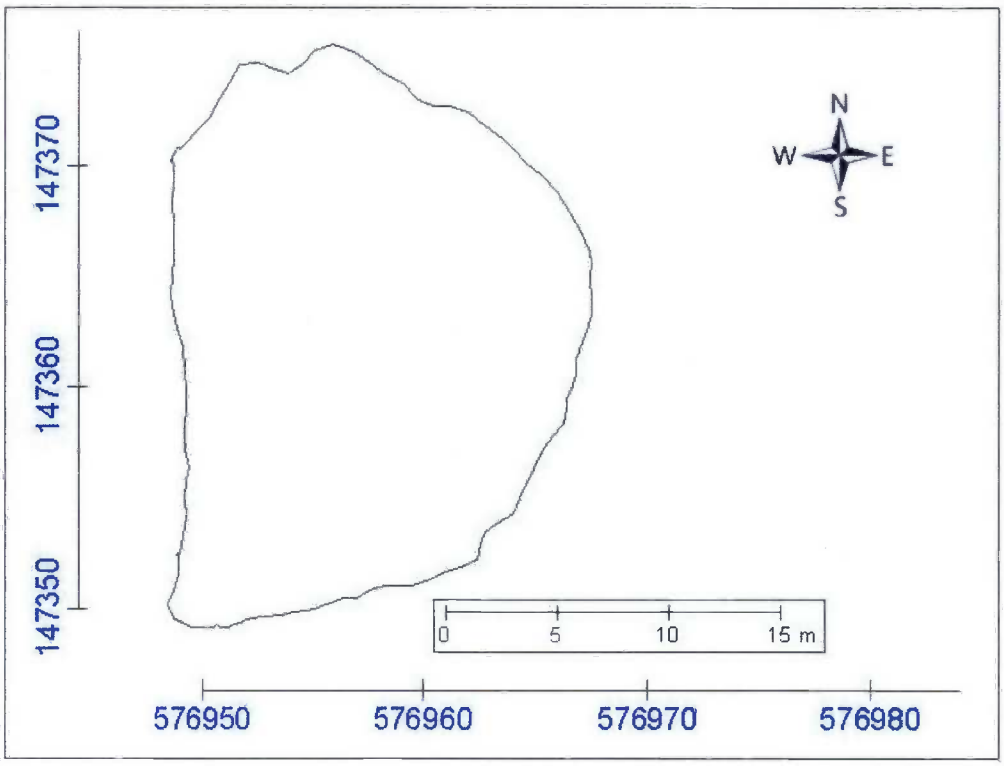


Figure 9. 600-375:4 Subsite Post-Remediation Boundary Survey.

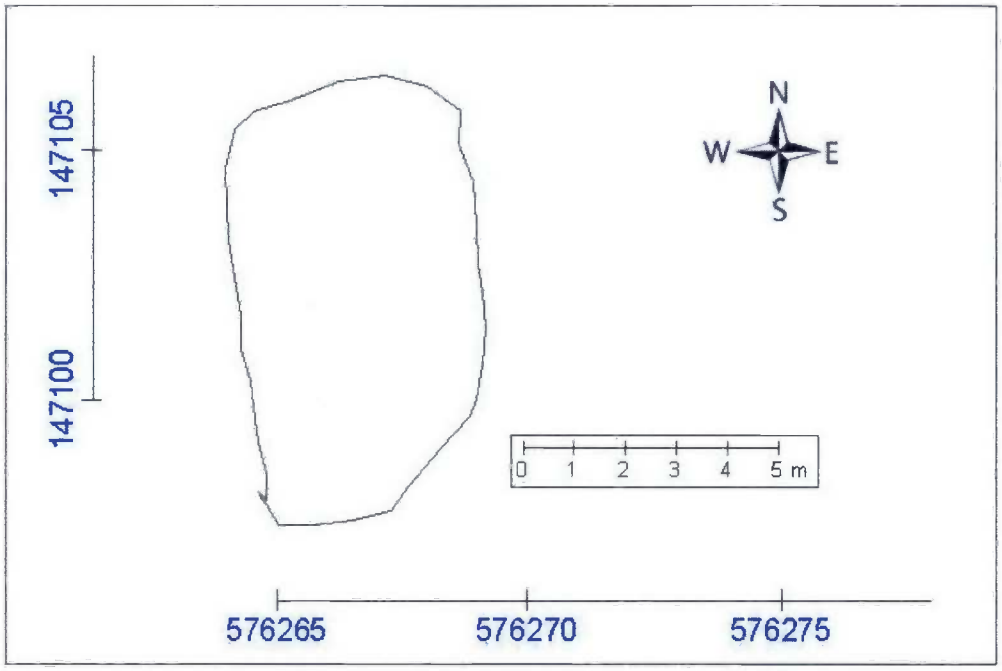
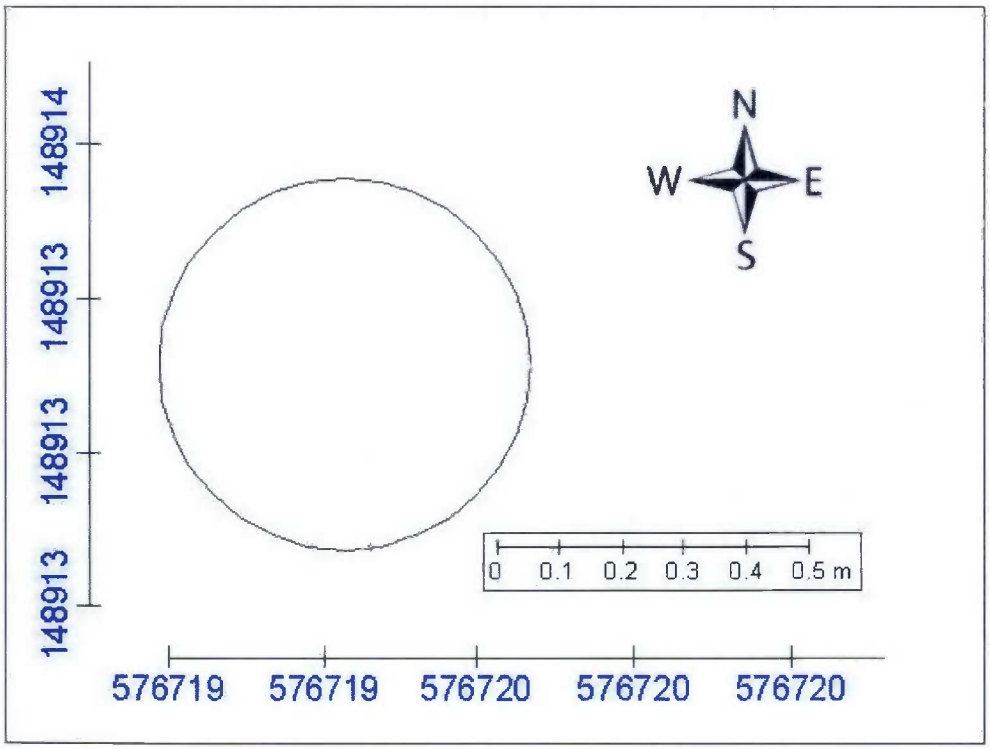


Figure 10. 600-375:5 Subsite Post-Remediation Boundary Survey.



VERIFICATION SAMPLING ACTIVITIES

Cleanup verification sampling was performed at the 600-375 waste site between August 12 and October 29, 2013, per the *Work Instruction for Verification Sampling of the Combined 600 Area Waste Sites, 600-368, 600-369, 600-370, 600-371, 600-372, 600-373, 600-374, 600-375, 600-376, 600-377, 600-379* (WCH 2013c). Sampling was conducted to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999).

The verification sample results are provided in Appendix B and indicate that the waste removal action achieved compliance with the remedial action objectives and remedial action goals (RAGs) for the 600-375 waste site.

Contaminants of Potential Concern

The COPCs for the 600-375 waste site were originally determined based on potential constituents released from the batteries and included inductively coupled plasma (ICP) metals. Waste characterization sample data obtained from the 600-375 waste site were used to better define the site COPCs. Because barium, cadmium, copper, lead, manganese, mercury, nickel, silver, and zinc were detected above a RAG in the waste characterization samples, they were retained as site COPCs. Although not considered site COPCs, antimony, arsenic, beryllium, boron, chromium (total), cobalt, molybdenum, selenium, and vanadium were included in the expanded list of ICP metals. The analytical methods that were performed to evaluate the site COPCs are provided in Table 2.

Verification Sample Design

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples that were collected. The number of composite samples was determined based on the size of the remediated area of the waste site as described in the *Work Instruction for Verification Sampling of the Combined 600 Area Waste Sites, 600-368, 600-369, 600-370, 600-371, 600-372, 600-373, 600-374, 600-375, 600-376, 600-377, 600-379* (WCH 2013c) and is outlined in Table 3.

A composite sample composed of 25 aliquots of soil was collected from across the surface of each of the sample location areas and analyzed using the methods identified in Table 2. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009a). Additional information related to verification sampling can be found in the field sampling logbook (WCH 2013a). A summary of all samples collected is presented in Table 4.

Table 2. Laboratory Analytical Methods for the 600-375 Waste Site.

Analytical Method	Contaminants of Potential Concern
ICP metals [a] – EPA Method 6010	Barium, cadmium, copper, lead, manganese, mercury, nickel, silver, zinc

[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.

EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma

Table 3. Verification Sampling Design Based on Waste Site Surface Area.

Surface Area	Sample Design
<100 m^2	One composite sample
100 – 500 m^2	Two composite samples (halves)
500 – 1,000 m^2	Four composite samples (quadrants)
>1,000 m^2	Statistical design using Visual Sample Plan

Source: WCH (2013c).

Table 4. 600-375 Verification Sample Summary.

Sample Location	HEIS Sample Number	Sample Date	Washington State Plane Coordinates (m)		Sample Analysis
			Northing	Easting	
600-375:1	J1RW10	8/12/2013	150161	577207	ICP metals [a], mercury
Duplicate of 600-375:1	J1RW11	8/12/2013	150161	577207	ICP metals [a], mercury
600-375:2	J1T1V7	9/24/2013	148913	576719	ICP metals [a], mercury
600-375:3a	J1T483	10/29/2013	147357	576956	ICP metals [a], mercury
600-375:3b	J1T484	10/29/2013	147367	576951	ICP metals [a], mercury
600-375:4	J1T293	9/30/2013	147102	576266	ICP metals [a], mercury
600-375:5	J1T1V8	9/24/2013	148492	576155	ICP metals [a], mercury
Equipment blank	J1RW12	8/12/2013	NA	NA	ICP metals [a], mercury

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

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Verification Sample Results

All verification samples were analyzed using EPA-approved analytical methods. Evaluation of the verification data from the 600-375 waste site was performed by direct comparison of the maximum sample results for each COPC against cleanup criteria. The *600-375 Waste Site*

Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation is provided in Appendix B.

Comparisons of the results for site COPCs with the RAGs for the 600-375 subsites are listed in Table 5. The maximum detected value for all of the subsites was used for comparison to the RAGs. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2012) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. The laboratory-reported data results for all constituents are stored in the Washington Closure Hanford (WCH) project-specific database prior to archival in the Hanford Environmental Information System, and are presented in the calculations (Appendix B).

DATA EVALUATION

This section demonstrates that contaminant concentrations at the 600-375 waste site achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the Remaining Sites ROD (EPA 1999) and documented in the 100 Area RDR/RAWP (DOE-RL 2009b).

Attainment of Nonradionuclide RAGs

Table 5 compares the cleanup verification sample values for the 600-375 waste site excavation to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. All COPCs were quantified below direct exposure RAGs. All COPCs were quantified below groundwater and/or river protection soil RAGs with the exception of cadmium, lead, manganese, and zinc. However, based on the contaminants with the lowest distribution coefficients (30 mL/g for cadmium, lead, and zinc), they would be not be expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years based on RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b). The vadose zone underlying the excavation is approximately 6.7 m (22 ft) thick. Therefore, residual concentrations of cadmium, lead, manganese, and zinc are not predicted to migrate through the soil column to groundwater (and thus the Columbia River) within 1,000 years.

Table 5. Comparison of Contaminant Concentrations to Action Levels for the 600-375 Waste Site Focused Verification Soil Samples.

COPC	Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	4.50 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	81.1 (<BG)	5,600	200	400	No	--
Beryllium	0.761 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.29	7,200	320	-- [f]	No	--
Cadmium [g]	5.09	13.9 [d]	0.81 [c]	0.81 [c]	Yes	Yes [h]
Chromium	12.2 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.59 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	14.2 (<BG)	2,960	59.2	22.0 [c]	No	--
Lead	13.0	353	10.2 [c]	10.2 [c]	Yes	Yes [h]
Manganese	1,540	3,760	512 [c]	512 [c]	Yes	Yes [h]
Mercury	0.203 (<BG)	24	0.33 [c]	0.33 [c]	No	--
Molybdenum [e]	1.07	400	8	-- [f]	No	--
Nickel	12.3 (<BG)	1,600	19.1 [c]	27.4	No	--
Selenium [g]	0.333 (<BG)	400	5	1	No	--
Silver	0.465 (<BG)	400	8	0.73 [c]	No	--
Vanadium	68.5 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	937	24,000	480	67.8 [c]	Yes	Yes [h]

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

[b] Maximum result of all subsites as described in the *600-375 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation* (Appendix B).

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

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

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

[f] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).

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

[h] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentrations of cadmium, lead, manganese, and zinc are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years (based on the contaminants with the lowest distribution coefficients [30 mL/g for cadmium, lead, and zinc]. The vadose zone below all of the subsites is a minimum of approximately 6.7 m (22 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

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

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 600-375 waste site was determined by calculation of the hazard quotient and excess carcinogenic risk. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. The hazard quotient and excess carcinogenic risk calculations (Appendix B) for direct contact were conservatively performed for the 600-375 waste site using the highest of the focused values from all decision units. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients are less than 1.0. The cumulative hazard quotient is 5.2×10^{-1}, which is less than 1.0. The individual excess carcinogenic risk value for cadmium, the only constituent subject to the excess cancer calculation, is 3.7×10^{-7}, and hence is less than 1×10^{-6}. Therefore, the nonradionuclide risk requirements are met.

DATA QUALITY ASSESSMENT

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

The DQA for the 600-375 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in the WCH project-specific database for data evaluation prior to archival in the Hanford Environmental Information System and are summarized in Appendix B. The detailed DQA is presented in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 600-375 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). Verification sampling was performed and the analytical results indicate that the residual concentrations of COPCs met the RAGs and associated remedial action objectives for direct exposure, groundwater protection, and river protection. Site contamination did not extend into the deep zone (below 4.6 m [15 ft]) soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-375 waste site to Interim Closed Out.

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APPENDIX A

WASTE CHARACTERIZATION SAMPLING RESULTS

600-375 Waste Characterization Data

Sample Location	HEIS Number	Sample Date	Northing	Easting	Aluminum			Antimony			Arsenic			Barium		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:4	J1RH06	2/26/2013	147106	576263	7950		1.5	0.8		0.37	9		0.64	167		0.074
600-375:5	J1RH07	2/26/2013	148489	576176	7180		1.5	0.36	U	0.36	3.8		0.63	74.5		0.072
600-375:3	J1RH08	2/26/2013	147364	576956	6120		1.3	0.91		0.33	7		0.57	296		0.065
600-375:2	J1RH09	2/26/2013	148913	576718	7090		1.5	0.83		0.37	10.8		0.64	98.5		0.074
600-375:1	J1RH10	2/26/2013	150162	577208	9040		1.6	0.39	U	0.39	4.7		0.68	106		0.079

Sample Location	HEIS Number	Sample Date	Northing	Easting	Beryllium			Boron			Cadmium			Calcium		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:4	J1RH06	2/26/2013	147106	576263	0.032	U	0.032	1.5	B	0.95	8.2		0.04	3770		13.7
600-375:5	J1RH07	2/26/2013	148489	576176	0.39		0.031	1.6	B	0.93	1.7		0.039	3380		13.4
600-375:3	J1RH08	2/26/2013	147364	576956	0.028	U	0.028	1.9		0.84	12.3		0.035	3100		12.1
600-375:2	J1RH09	2/26/2013	148913	576718	0.032	U	0.032	1.4	B	0.95	6.3		0.04	2960		13.7
600-375:1	J1RH10	2/26/2013	150162	577208	0.49		0.034	1.7	B	1	2.1		0.043	3310		14.6

Sample Location	HEIS Number	Sample Date	Northing	Easting	Chromium			Cobalt			Copper			Iron		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:4	J1RH06	2/26/2013	147106	576263	11.4		0.056	9.7		0.97	23.9		0.21	20800		3.7
600-375:5	J1RH07	2/26/2013	148489	576176	9.7		0.055	5.6		0.47	13.3		0.21	15100		3.6
600-375:3	J1RH08	2/26/2013	147364	576956	7.2		0.05	9.2		0.86	33.2		0.19	18500		3.3
600-375:2	J1RH09	2/26/2013	148913	576718	9.5		0.056	9.4		0.48	17.9		0.21	22100		3.7
600-375:1	J1RH10	2/26/2013	150162	577208	10.3		0.06	6.6		0.1	12.7		0.23	18200		3.9

Sample Location	HEIS Number	Sample Date	Northing	Easting	Lead			Magnesium			Manganese			Mercury		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:4	J1RH06	2/26/2013	147106	576263	69.6		0.26	4120		36	13200		0.97	0.41		0.0056
600-375:5	J1RH07	2/26/2013	148489	576176	12.6		0.26	3840		17.6	1080	M	0.47	0.13		0.0052
600-375:3	J1RH08	2/26/2013	147364	576956	125		0.23	3320		31.8	14800		0.86	1		0.048
600-375:2	J1RH09	2/26/2013	148913	576718	110		0.26	3960		17.9	9340		0.48	0.92		0.059
600-375:1	J1RH10	2/26/2013	150162	577208	23.5		0.28	3870		3.8	1900		0.1	0.62		0.0062

Sample Location	HEIS Number	Sample Date	Northing	Easting	Molybdenum			Nickel			Potassium			Selenium		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:4	J1RH06	2/26/2013	147106	576263	0.25	U	0.25	14		0.12	1800		39.9	8.4	U	8.4
600-375:5	J1RH07	2/26/2013	148489	576176	0.25	U	0.25	9.3		0.12	1900		38.9	4.1	U	4.1
600-375:3	J1RH08	2/26/2013	147364	576956	0.22	U	0.22	20.2		0.11	1340		35.2	7.4	U	7.4
600-375:2	J1RH09	2/26/2013	148913	576718	2.8		0.25	16.5		0.12	1760		39.7	4.2	U	4.2
600-375:1	J1RH10	2/26/2013	150162	577208	0.5	B	0.27	11.7		0.13	2130		42.6	0.89	U	0.89

Sample Location	HEIS Number	Sample Date	Northing	Easting	Silicon			Silver			Sodium			Vanadium		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:4	J1RH06	2/26/2013	147106	576263	493	N	5.5	1.6	U	1.6	233		57.5	48.3		0.92
600-375:5	J1RH07	2/26/2013	148489	576176	417	N	5.4	0.76	U	0.76	193		56	34.5		0.45
600-375:3	J1RH08	2/26/2013	147364	576956	280	N	4.9	1.4	U	1.4	188		50.7	45		0.81
600-375:2	J1RH09	2/26/2013	148913	576718	344	N	5.5	0.77	U	0.77	176		57.1	48.8		0.46
600-375:1	J1RH10	2/26/2013	150162	577208	496	N	5.9	0.17	U	0.17	199		61.2	36.8		0.098

Sample Location	HEIS Number	Sample Date	Northing	Easting	Zinc			Percent Moisture		
					mg/kg	Q	PQL	%	Q	PQL
600-375:4	J1RH06	2/26/2013	147106	576263	3370		0.39	4.1		0
600-375:5	J1RH07	2/26/2013	148489	576176	590		0.38	2.4		0
600-375:3	J1RH08	2/26/2013	147364	576956	3660		0.34	3		0
600-375:2	J1RH09	2/26/2013	148913	576718	2170		0.39	11.7		0
600-375:1	J1RH10	2/26/2013	150162	577208	784		0.41	7.4		0

APPENDIX B

CALCULATIONS

APPENDIX B

CALCULATIONS

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

600-375 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0600X-CA-V0159, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 600 Area Field Remediation **Job No. 14655**

Area: 600 Area

Discipline: Environmental Calculation No: 0600X-CA-V0159

Subject: 600-375 Waste Site Relative Percent Difference and 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 Summary = 6 Attachment = 2 Total = 9	H. M. Sulloway HMSulloway	C. H. Dobie CH Dobie	I. B. Berezovskiy IB Berezovskiy	D. F. Obenauer D.F. Obenauer	12/17/13

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	H. M. Sulloway HMS	Date:	11/26/2013	Calc. No.:	0600X-CA-V0159	Rev.:	0
Project:	600 Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie CHD	Date:	11/26/2013
Subject:	600-375 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 6	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 600-375 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009b), the following criteria must be met:

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

Also, calculate the relative percent difference (RPD) for primary-duplicate sample pairs from 600-375 waste site confirmatory sampling, as necessary.

GIVEN/REFERENCES:

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

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

3) EPA, 1994, USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013, U.S. Environmental Protection Agency, Washington, D.C.

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

5) WCH, 2014, *Remaining Sites Verification Package for the 600-375, Segment 4 Dry Cell Battery Debris Area #1 Waste Site*, Attachment to Waste Site Reclassification Form 2013-092, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

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

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	H. M. Sulloway	Date:	11/26/2013	Calc. No.:	0600X-CA-V0159	Rev.:	0
Project:	600 Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie CD	Date:	11/26/2013
Subject:	600-375 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 6	

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

5) Use data from Attachment 1 to perform the RPD calculations for primary-duplicate sample pairs, as required.

METHODOLOGY:

The 600-375 waste site underwent verification focused sampling at each of the five subsites. Direct contact hazard quotient and carcinogenic risk calculations for the 600-375 waste site were conservatively calculated using the maximum results from the underlying soil samples only from Attachment 1. Of the contaminants of potential concern (COPCs) for this site, cadmium, manganese, and zinc are included because they are quantitated at a concentration above Hanford Site background. Boron and molybdenum require HQ and/or risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead was detected above background; however, lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron is 1.29 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 1.8×10^{-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 5.2×10^{-1}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for cadmium is 5.09 mg/kg, divided by 13.9 mg/kg, and multiplied as indicated, produces an HQ value of 3.7×10^{-7}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 3.7×10^{-7}. Comparing these values to the requirement of $<1 \times 10^{-5}$, this criterion is met.

5) The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed for certain analytes in Table II-1 of the SAP (DOE-RL 2009a). Other analytes will have their own pre-determined constituents and will have their own TDLs based on the laboratory and method used. Where direct

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	H. M. Sulloway HMS	Date:	12/17/2013	Calc. No.:	0600X-CA-V0159	Rev.:	0
Project:	600 Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	12/17/2013
Subject:	600-375 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 6	

constituents and will have their own TDLs 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:

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

where, M = main sample value D = duplicate sample value

When an analyte is detected in the primary or duplicate sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate results exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. This assessment is provided in the data quality assessment section of the RSVP.

For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. No split samples were collected for the verification sampling at the subject site. Additional discussion is provided in the data quality assessment section of the applicable RSVP (WCH 2014), as necessary.

RESULTS:

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

Table 1 shows the results of the hazard quotient and excess cancer risk calculations for the 600-375 waste site.

5) The evaluation of the QA/QC duplicate RPD calculations are performed within the data quality assessment section of the RSVP.

Table 2 shows the results of the RPD calculations for the 600-375 waste site.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	H. M. Sulloway	Date:	11/26/2013	Calc. No.:	0600X-CA-V0159	Rev.:	0
Project:	600 Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	11/26/2013
Subject:	600-375 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 6	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 600-375 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	1.29	7,200	1.8E-04	--	--
Cadmium	5.09	80	6.4E-02	13.9	3.7E-07
Lead [c]	13.0	353	--	--	--
Manganese	1540	3,760	4.1E-01	--	--
Molybdenum	1.07	400	2.7E-03	--	--
Zinc	937	24,000	3.9E-02	--	--
Totals					
Cumulative Hazard Quotient:			**5.2E-01**		
Cumulative Excess Cancer Risk:					**3.7E-07**

Notes:

[a] = From Attachment 1.

[b] = Value obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) or *Washington Administrative Code (WAC) 173-340-740(3)*, Method B, 1996, unless otherwise noted.

[c] = Value for the noncarcinogenic RAG calculated using Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for 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

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Table 2. Relative Percent Difference Calculations for the 600-375 Waste Site.

600-375 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	6650		6.60	1.50	B	0.485	80.7		0.0970	0.619		0.0970
Duplicate of J1RW10	J1RW11	8/12/2013	6590		6.35	2.19	B	0.467	81.1		0.0933	0.615		0.0933

Analysis:

TDL		5	10	2	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	0.9%		0.5%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable

600-375 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Boron			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	1.19	B	0.970	3270		7.76	12.1		0.146	7.23	D	0.728
Duplicate of J1RW10	J1RW11	8/12/2013	1.10	B	0.933	3330		7.47	12.2		0.140	7.30	D	0.700

Analysis:

TDL		2	100	1	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		1.8%	0.8%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable

600-375 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	13.6		0.291	20000		7.76	6.17	D	1.60	4530		8.25
Duplicate of J1RW10	J1RW11	8/12/2013	14.2		0.280	20100		7.47	5.02	D	1.54	4440		7.93

Analysis:

TDL		1	5	5	75
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	4.3%	0.5%		2.0%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable

600-375 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Manganese			Nickel			Potassium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	306		0.194	11.3		0.146	1420		6.21	478	*NJ	1.46
Duplicate of J1RW10	J1RW11	8/12/2013	306		0.187	10.8		0.140	1430		5.97	615	*NJ	1.40

Analysis:

TDL		5	4	400	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	0%			25.1%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable

600-375 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	0.0982	B	0.0970	109		6.79	47.2	D	0.485	41.0	D	1.94
Duplicate of J1RW10	J1RW11	8/12/2013	0.165	B	0.0933	104		6.53	48.9	D	0.467	40.2	D	1.87

Analysis:

TDL		0.2	50	2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD			3.5%	2.0%
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	Not applicable

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Project:	600 Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	11/26/2013
Subject:	600-375 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 6 of 6	

CONCLUSION:

The calculations in Tables 1 and 2 demonstrate that the 600-375 waste site meets the requirements for the direct contact hazard quotients and excess carcinogenic risk and RPDs as identified in the RDR/RAWP (DOE-RL 2009b) and SAP (DOE-RL 2009a). The direct contact hazard quotient and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

Attachment 1. 600-375 Waste Site Verification Sample Data - Metals. (2 pages)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	6650		6.60	1.60	DU	1.60	1.50	B	0.485	80.7		0.097	0.619		0.097
Duplicate of J1RW10	J1RW11	8/12/2013	6590		6.35	1.54	DU	1.54	2.19	B	0.467	81.1		0.0933	0.615		0.0933
600-375:2	J1T1V7	9/24/2013	5800		6.77	1.64	DU	1.64	4.25		0.498	63.0		0.0995	0.727		0.0995
600-375:3	J1T483	10/29/2013	5150		6.79	1.65	DU	1.65	2.06	BC	0.499	66.8		0.0998	0.761		0.0998
600-375:3	J1T484	10/29/2013	5320		6.99	1.70	DU	1.70	2.63	B	0.514	61.2		0.103	0.632		0.103
600-375:4	J1T293	9/30/2013	5400		7.04	1.71	DU	1.71	4.50		0.518	76.9		0.104	0.759		0.104
600-375:5	J1T1V8	9/24/2013	5510		6.89	0.334	U	0.334	3.92		0.507	62.7		0.101	0.459	B	0.101
Equipment blank	J1RW12	8/12/2013	127		6.69	0.325	U	0.325	0.650	B	0.492	3.00		0.0984	0.0984	U	0.0984

Site Code	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	1.19	B	0.970	0.097	U	0.097	3270		7.76	12.1		0.146	7.23	D	0.728
Duplicate of J1RW10	J1RW11	8/12/2013	1.10	B	0.933	0.0933	U	0.0933	3330		7.47	12.2		0.140	7.30	D	0.700
600-375:2	J1T1V7	9/24/2013	1.28	B	0.995	5.09	*	0.0995	2680		7.96	10.1		0.149	8.03	D	0.746
600-375:3	J1T483	10/29/2013	0.998	U	0.998	0.489	B	0.0998	2860		7.99	10.5		0.150	7.69	D	0.749
600-375:3	J1T484	10/29/2013	1.03	U	1.03	0.393	B	0.103	2780		8.23	8.60		0.154	6.32	D	0.771
600-375:4	J1T293	9/30/2013	1.29	B	1.04	0.592		0.104	3500		8.28	9.29	D	0.776	8.59	D	0.776
600-375:5	J1T1V8	9/24/2013	1.19	B	1.01	1.46		0.101	2580		8.10	11.0		0.152	5.57		0.152
Equipment blank	J1RW12	8/12/2013	0.984	U	0.984	0.0984	U	0.0984	41.6		7.87	0.148	U	0.148	0.218	B	0.148

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

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

* = Duplicate analysis not within control limits

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

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

D = obtained from dilution

HEIS = Hanford Environmental Information System

MDL = method detection limit

M = sample duplicate precision not met

N= recovery exceeds upper or lower control limits

PQL = practical quantitation limit

Q = qualifier

RDL = required detection limit

U = undetected

Attachment	1	Sheet No.	1 of 2
Originator	H. M. Sulloway	Date	11/26/13
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Attachment 1. 600-375 Waste Site Verification Sample Data - Metals. (2 pages)

Site Code	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	13.6		0.291	20000		7.76	6.17	D	1.60	4530		8.25	306		0.194
Duplicate of J1RW10	J1RW11	8/12/2013	14.2		0.280	20100		7.47	5.02	D	1.54	4440		7.93	306		0.187
600-375:2	J1T1V7	9/24/2013	13.9		0.299	24500		7.96	13.0		0.328	3930		8.46	1330		0.199
600-375:3	J1T483	10/29/2013	11.5		0.300	21200		7.99	6.05	D	1.65	3520		8.49	322		0.200
600-375:3	J1T484	10/29/2013	10.6		0.309	18300		8.23	5.25	D	1.70	3430		8.74	270		0.206
600-375:4	J1T293	9/30/2013	14.1		0.311	20900		8.28	10.3	D	1.71	3870		8.80	1540	*D	1.04
600-375:5	J1T1V8	9/24/2013	13.4	N	0.304	16600		8.10	9.38		0.334	3590		8.61	573	*	0.203
Equipment blank	J1RW12	8/12/2013	0.295	U	0.295	1120		7.87	1.01		0.325	19.2	B	8.37	26.9		0.197

Site Code	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	0.00391	U	0.00391	0.194	U	0.194	11.3		0.146	1420		6.21	0.320	DU	0.320
Duplicate of J1RW10	J1RW11	8/12/2013	0.00381	U	0.00381	0.187	U	0.187	10.8		0.140	1430		5.97	0.333	D	0.333
600-375:2	J1T1V7	9/24/2013	0.147	*MN	0.00395	1.07		0.199	10.6		0.149	1360		6.37	0.323	DU	0.323
600-375:3	J1T483	10/29/2013	0.00641	B	0.00413	0.333	B	0.200	8.66		0.150	1490		6.39	0.344	DU	0.344
600-375:3	J1T484	10/29/2013	0.00803	B	0.00434	0.311	B	0.206	8.48		0.154	1400		6.58	0.303	DU	0.303
600-375:4	J1T293	9/30/2013	0.00419	U	0.00419	0.629	B	0.207	12.3	*	0.155	1400		6.62	0.343	DU	0.343
600-375:5	J1T1V8	9/24/2013	0.203	MN	0.0041	0.478	B	0.203	9.24		0.152	1380		6.48	0.338	DU	0.338
Equipment blank	J1RW12	8/12/2013	0.0036	U	0.0036	0.197	U	0.197	0.148	U	0.148	49.9		6.30	0.316	D	0.316

Site Code	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-375:1	J1RW10	8/12/2013	478	*NJ	1.46	0.0982	B	0.097	109		6.79	47.2	D	0.485	41.0	D	1.94
Duplicate of J1RW10	J1RW11	8/12/2013	615	*NJ	1.40	0.165	B	0.0933	104		6.53	48.9	D	0.467	40.2	D	1.87
600-375:2	J1T1V7	9/24/2013	366	N	1.49	0.279	B	0.0995	85.4		6.97	68.5	D	0.498	937	*D	1.99
600-375:3	J1T483	10/29/2013	999	N	1.50	0.465	B	0.0998	140	N	6.99	66.1	D	0.499	63.4	D	2.00
600-375:3	J1T484	10/29/2013	1150	N	1.54	0.433	B	0.103	144	N	7.20	53.7	D	0.514	48.9	D	2.06
600-375:4	J1T293	9/30/2013	299	N	1.55	0.156	B	0.104	111		7.25	57.8	D	0.518	126	*DN	2.07
600-375:5	J1T1V8	9/24/2013	450	N	1.52	0.315	B	0.101	70.7		7.09	41.8		0.101	383	*	0.405
Equipment blank	J1RW12	8/12/2013	146	*NJ	1.48	0.0984	U	0.0984	6.89	U	6.89	0.405	B	0.0984	2.29		0.394

Attachment	1	Sheet No.	2 of 2
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Calc. No.	0600X-CA-V0159	Rev. No.	0

APPENDIX C

DATA QUALITY ASSESSMENT

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DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2013b). This DQA was performed in accordance with site-specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009).

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

The 600-375 waste site is comprised of five subsites: 600-375:1, 600-375:2, 600-375:3, 600-375:4, and 600-375:5. Verification sample data collected at the 600-375 waste site were provided by the laboratories in five sample delivery groups (SDGs): SDG XP0006, SDG XP0017, SDG XP0018, SDG XP0020, and SDG XP0025. SDG XP0006 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 600-375 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 XP0006

This SDG comprises one focused composite soil sample (J1RW10) from the 600-375:1 subsite excavation. This SDG includes a field duplicate pair (J1RW10/J1RW11) and one equipment blank (J1RW12). These samples were analyzed for inductively coupled plasma (ICP) metals and mercury. SDG XP0006 was submitted for third-party validation. Minor deficiencies are as follows.

In the ICP metals analysis, the matrix spike (MS) recovery is below the project acceptance criteria for silicon. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Silicon did not have mismatched spike and native concentrations in the MS. The MS recovery for silicon was 23.4%. All silicon results in SDG XP0006 are qualified as estimates by third-party validation with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory duplicate relative percent difference (RPD) calculation for silicon is above the acceptance criteria of 30%, at 30.1%. Elevated RPDs in environmental soil samples are generally attributed to natural heterogeneities in the sample matrix. All silicon results for SDG XP0006 were qualified as estimates by third-party validation with "J" flags. Estimated data are usable for decision-making purposes.

SDG XP0018

This SDG comprises one focused composite soil sample (J1T1V7) from the 600-375:2 subsite excavation. This sample was analyzed for ICP metals and mercury. Minor deficiencies are as follows.

In the ICP metals analysis, the laboratory duplicate RPD calculation for antimony, cadmium, and zinc is above the acceptance criteria of 30%, at 47.5%, 44.4%, and 47.7%, respectively. Elevated RPDs in environmental soil samples are generally attributed to natural heterogeneities in the sample matrix. Although not qualified for RPDs above quality control (QC) limits, antimony, cadmium, and zinc results for SDG XP0018 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, antimony, nickel, and potassium were detected in the method blank (MB), at very low levels, less than 1/25th of the detected field sample result. Although not qualified for method blank contamination, antimony, nickel, and potassium results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery is below the project acceptance criteria for silicon. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Silicon did not have mismatched spike and native concentrations in the MS. The MS recovery for silicon was 32.6%. Although not qualified for MS recovery outside of QC limits, all silicon results in SDG XP0018 may be considered estimated. Estimated data are usable for decision-making purposes.

In the mercury analysis, the laboratory duplicate RPD calculation for mercury is above the acceptance criteria of 30%, at 61.5%. Elevated RPDs in environmental soil samples are generally attributed to natural heterogeneities in the sample matrix. Although not qualified for RPD above QC limits, mercury results in SDG XP0018 may be considered estimated. Estimated data are usable for decision-making purposes.

In the mercury analysis, the MS recovery was below the QC limits at 37.1%. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Mercury did not have mismatched spike and native concentrations in the MS. Although not qualified for MS recovery below the QC limits, all mercury results in SDG XP0018 may be considered estimated. Estimated data are usable for decision-making purposes.

SDG XP0025

This SDG comprises two focused composite soil samples (J1T483 and J1T484) from the 600-375:3 subsite excavation. These samples were analyzed for ICP metals and mercury. Minor deficiencies are as follows.

In the ICP metals analysis, arsenic, chromium, and zinc were detected in the MB at very low levels, less than 1/25th of the applicable, most stringent cleanup remedial action goal. Although not qualified for MB contamination, all arsenic, chromium, and zinc results may be considered estimated. Estimated data are usable for decision-making purposes.

In the mercury analysis, the laboratory duplicate RPD calculation for mercury is above the acceptance criteria of 30%, at 36.9%. Elevated RPDs in environmental soil samples are generally attributed to natural heterogeneities in the sample matrix. Although not qualified for RPD above QC limit, mercury results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery is below the project acceptance criteria for silicon. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Silicon did not have mismatched spike and native concentrations in the MS. The MS recovery for silicon was 40.5%. Although not qualified for MS recovery outside of QC limits, all silicon results in SDG XP0025 may be considered estimated. Estimated data are usable for decision-making purposes.

SDG XP0020

This SDG comprises one focused composite soil sample (J1T293) from the 600-375:4 subsite excavation. This sample was analyzed for ICP metals and mercury. Minor deficiencies are as follows.

In the ICP metals analysis, the laboratory duplicate RPD calculation for arsenic (51.8%), cadmium (44.5%), manganese (116%), silver (116%), and zinc (34.4%) are above the acceptance criteria of 30%. Elevated RPDs in environmental soil samples are generally attributed to natural heterogeneities in the sample matrix. Although not qualified for RPDs above QC limits, arsenic, cadmium, manganese, silver, and zinc results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, antimony, nickel, and potassium were detected in the MB at very low levels, less than 1/25th of the detected field result. Although not qualified for MB contamination, all antimony, nickel, and potassium results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery is below the project acceptance criteria for silicon. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Silicon did not have mismatched spike and native concentrations in the MS. The MS recovery for silicon was 0%. Although not qualified for MS

recovery outside of QC limits, all silicon results in SDG XP0020 may be considered estimated. Estimated data are usable for decision-making purposes.

SDG XP0017

This SDG comprises one focused composite soil sample (J1T1V8) from the 600-375:5 subsite excavation. This sample was analyzed for ICP metals and mercury. Minor deficiencies are as follows.

In the ICP metals analysis, the laboratory duplicate RPD calculation for manganese (118%) and molybdenum (43.1%) are above the acceptance criteria of 30%. Elevated RPDs in environmental soil samples are generally attributed to natural heterogeneities in the sample matrix. Although not qualified for RPDs above QC limits, manganese and molybdenum results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, antimony, nickel, and potassium were detected in the MB at very low levels, less than 1/25th of the detected field result. Although not qualified for MB contamination, all antimony, nickel, and potassium results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries are outside the QC limits for copper and silicon. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Copper and silicon did not have mismatched spike and native concentrations in the MS. The MS recoveries for copper and silicon were 135% and 18.9%, respectively. Although not qualified for MS recovery outside of QC limits, all copper and silicon results in SDG XP0017 may be considered estimated. Estimated data are usable for decision-making purposes.

In the mercury analysis, the MS recovery is above the project QC limits for mercury (1,470%). The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Mercury did not have mismatched spike and native concentrations in the MS. Although not qualified for MS recovery outside of QC limits, all mercury results in SDG XP0017 may be considered estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples listed in the field logbook (WCH 2013a) are the 600-375:1 primary and duplicate samples J1RW10/J1RW11. The sample results are presented in Appendix B.

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

None of the RPDs calculated for the field duplicate sample are above the acceptance criteria (30%). A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. None of the data required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

SUMMARY

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 600-375 waste site verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 600-375 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in a Washington Closure Hanford project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix B.

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