1226083

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

14-AMRP-0200

JUN 03 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 600-379, SEGMENT 4 BURN AREA #1 WASTE SITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2013-089 and supporting, "Remaining Waste Site Verification Package for the 600-379, Segment 4 Burn 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, 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-6 **Control No.:** 2013-089

Waste Site Code(s)/Subsite Code(s): 600-379

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 600-379, Segment 4 Burn Area #1 waste site, part of the 100-IU-6 Operable Unit, consisted of a burn area with visible remnants. The 600-379 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 600-379 waste site was subsequently recommended for remove, treat, and dispose (WCH 2013b) without confirmatory sampling due to possible contamination based upon extensive debris and evidence of burning in the area 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 (EPA 2009).

Remediation of the 600-379 waste site was performed from December 18, 2013, through January 8, 2014. No anomalies were encountered during the remediation. The excavation in the remediated area was approximately 70 m^2 (768 ft^2) and 0.6 m (2 ft) below ground surface. A total of approximately 43 bank cubic meters (56 bank cubic yards) of material was removed and direct loaded for disposal at the Environmental Restoration Disposal Facility (ERDF). Cleanup verification sampling was performed on January 8, 2014, to determine if the waste site meets remedial action objectives (RAOs) and remedial action goals (RAGs) established by the Remaining Sites ROD (EPA 1999) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP), DOE/RL-97-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2009b). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at ERDF in the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as 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 600-379 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 600-379, Segment 4 Burn Area #1 Waste Site* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-6 **Control No.:** 2013-089

Waste Site Code(s)/Subsite Code(s): 600-379

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)	J P Neath Signature	5/5/14 Date
NA Ecology Project Manager (printed)	 Signature	 Date
C. Guzzetti EPA Project Manager (printed)	 Signature	5/7/14 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-379, SEGMENT 4 BURN AREA #1 WASTE SITE

Attachment to Waste Site Reclassification Form 2013-089

May 2014

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-379, SEGMENT 4 BURN AREA #1 WASTE SITE

EXECUTIVE SUMMARY

The 600-379, Segment 4 Burn Area #1 waste site, part of the 100-IU-6 Operable Unit, consisted of a burn area with visible remnants. The 600-379 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 600-379 waste site was subsequently recommended for remove, treat, and dispose (WCH 2013b) without confirmatory sampling due to possible contamination based upon extensive debris and evidence of burning in the area 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* (EPA 2009).

Remediation of the 600-379 waste site was performed from December 18, 2013, through January 8, 2014. No anomalies were encountered during the remediation. The remediated area was approximately 70 m^2 (768 ft^2) and 0.6 m (2 ft) below ground surface. A total of approximately 43 bank cubic meters (56 bank cubic yards) of material was removed and direct loaded for disposal at the Environmental Restoration Disposal Facility. Cleanup verification sampling was performed on January 8, 2014. The verification sample results indicated that residual contaminant concentrations met the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 600-379 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 600-379 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 600-379 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 600-379 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 quotient for benzo(ghi)pyrene, the only constituent subject to the hazard quotient calculation, is 1.4×10^{-6}, which is <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The hazard quotient for benzo(ghi)pyrene, the only constituent subject to the hazard quotient calculation, is 1.4×10^{-6}, which is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	All detected COPCs with a carcinogenic RAG attained an excess cancer risk of $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The cumulative excess cancer risk is 1.5×10^{-8}, which is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 600-379 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.	No constituents exceed soil RAGs for groundwater and/or Columbia River protection.	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).

COPC = contaminant of potential concern
DOE = U.S. Department of Energy
MCL = maximum contaminant level
NA = not applicable
RAG = remedial action goal

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 600-379 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. The constituent exceeding the ecological screening level in *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," was vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, cadmium, manganese, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of antimony, cadmium, manganese, vanadium, and zinc 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 this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-379, SEGMENT 4 BURN AREA #1 WASTE SITE

STATEMENT OF PROTECTIVENESS

The 600-379, Segment 4 Burn 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 600-379 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. The constituent exceeding the ecological screening level in *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," was vanadium. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, cadmium, manganese, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of antimony, cadmium, manganese, vanadium, and zinc 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 this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 600-379 waste site, located within the 100-IU-6 Operable Unit, is reported in the *100-F/IU-2/IU-6 Area-Segment 4 Orphan Sites Evaluation Report* (WCH 2011) as a feature consisting of a 4-m (13-ft) burn area with visible remnants. The 600-379 waste site is shown in Figures 1 and 2. There is no process history associated with the 600-379 waste site.

Figure 1. The 600-379 Waste Site Location Map.

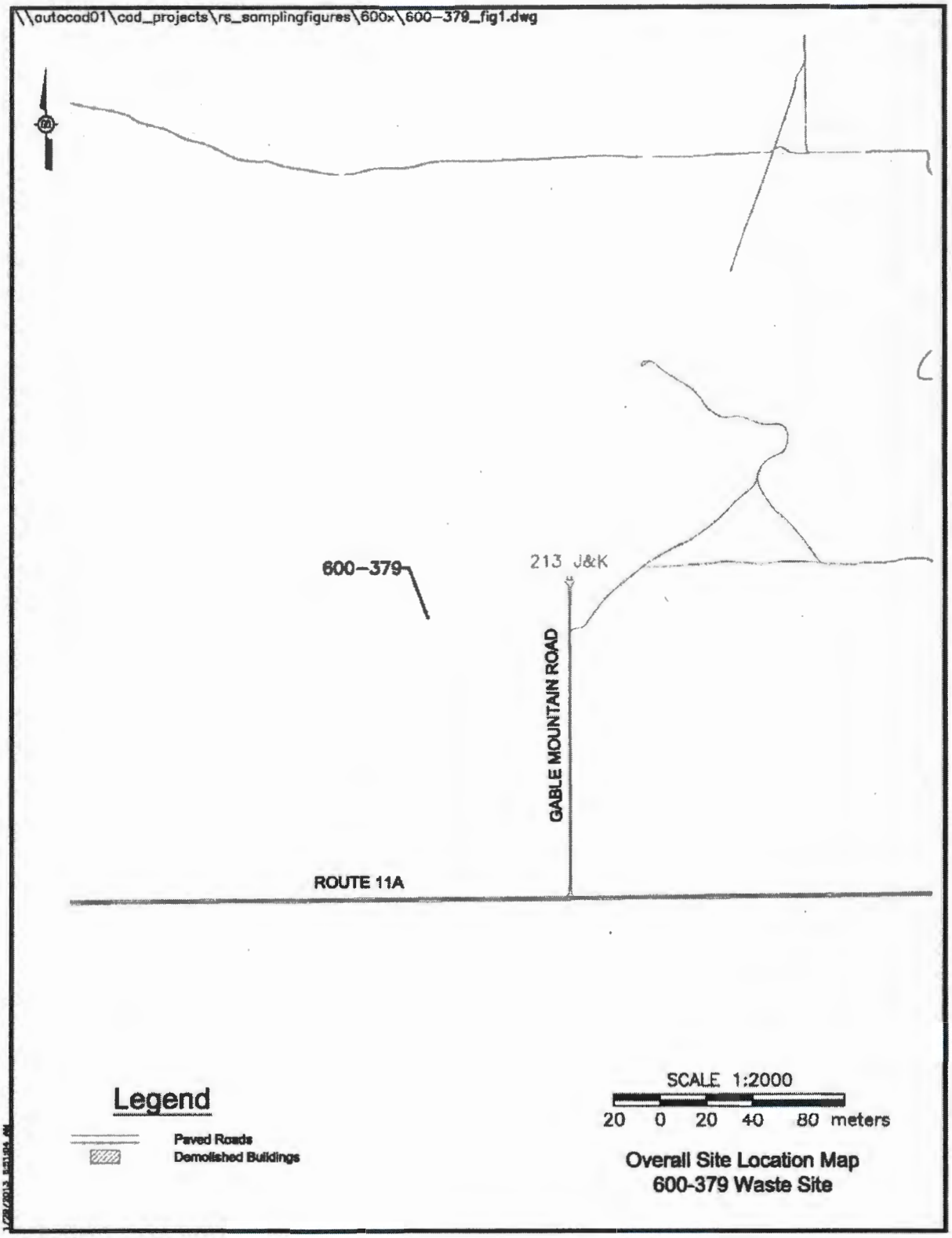
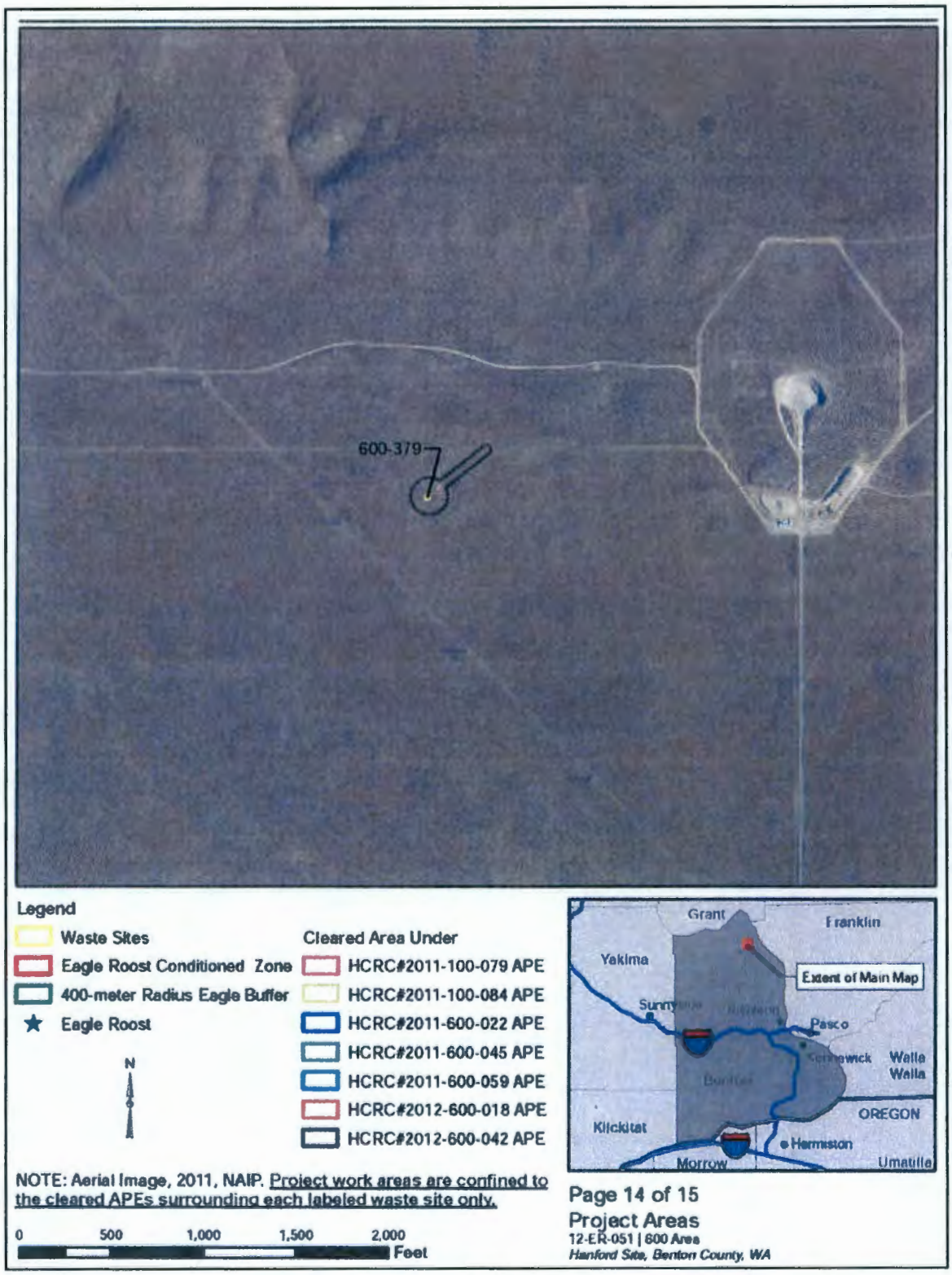


Figure 2. The 600-379 Waste Site Location Map from the Ecological and Cultural Resources Review (WCH 2013c).



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 600-379 waste site was recommended for remediation without confirmatory sampling due to possible contamination based upon extensive debris and evidence of burning (WCH 2013b).

Remediation of the 600-379 waste site was performed from December 18, 2013, through January 8, 2014. No anomalies were encountered during the remediation. The excavation in the remediated area was approximately 70 m^2 (768 ft^2) and 0.6 m (2 ft) below ground surface. A total of approximately 43 bank cubic meters (56 bank cubic yards) of material was removed and direct loaded for disposal at the Environmental Restoration Disposal Facility. Cleanup verification sampling was performed on January 8, 2014. A summary of the remediation of the 600-379 waste site is provided in Table 1. A post-remediation photograph is provided in Figure 3. No waste staging pile area or overburden soil stockpiles are associated with the 600-379 waste site. A walkaround boundary survey was conducted at the 600-379 waste site following site remediation (Figure 4).

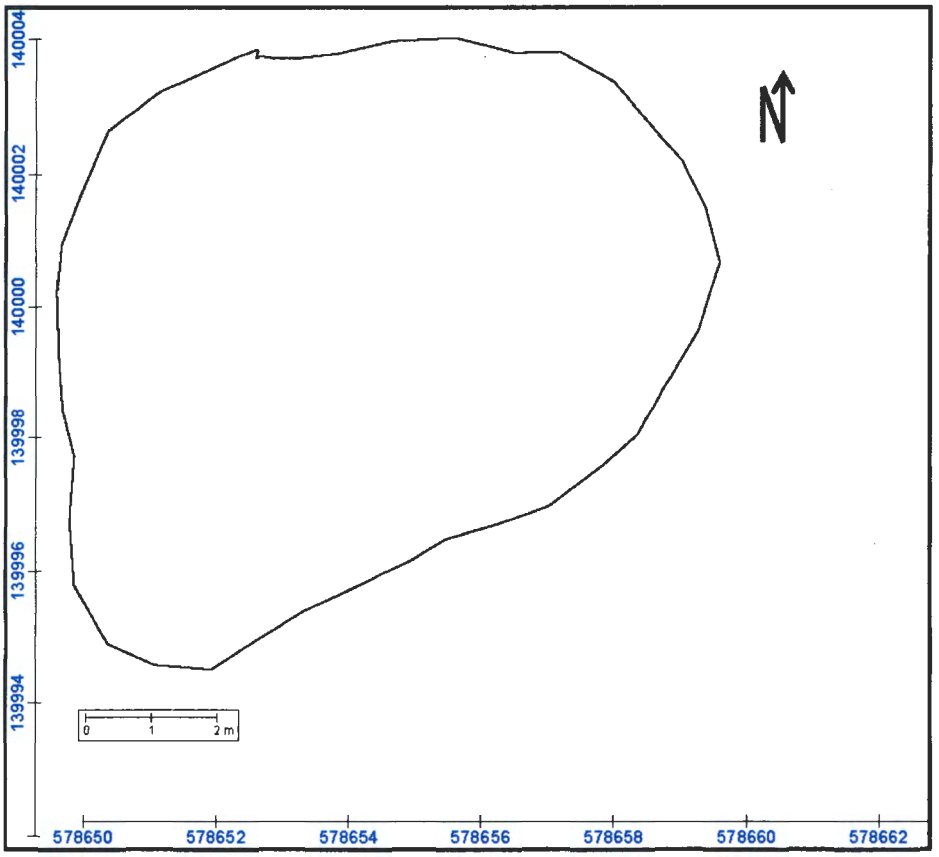
Table 1. 600-379 Waste Site Remediation Summary.

Waste Site	Remediation Date	Remediation		Volume of Material Removed	Anomalies
		Depth (bgs)	Area		
600-379	12/18/13 – 1/8/2014	0.6 m (2 ft)	70 m^2 (768 ft^2)	43 BCM	None

BCM = bank cubic meter
bgs = below ground surface

Figure 3. The 600-379 Waste Site Post-Excavation Photograph (January 8, 2014).

Figure 4. 600-379 Waste Site Post-Remediation Boundary Survey.



VERIFICATION SAMPLING ACTIVITIES

Cleanup verification sampling was performed at the 600-379 waste site on January 8, 2014, 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 2013d). 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 600-379 waste site.

Contaminants of Potential Concern

The COPCs for the 600-379 waste site were inductively coupled plasma (ICP) metals, mercury, total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), and polychlorinated biphenyls (PCBs). The analytical methods that were performed to evaluate the site COPCs are provided in Table 2.

Table 2. 600-379 Waste Site Laboratory Analytical Methods.

Analytical Method	Contaminant of Potential Concern
ICP metals [a] – EPA Method 6010	Metals [a]
Mercury – EPA Method 7471	Mercury
PAH – EPA Method 8310	PAH
PCB – EPA Method 8082	PCBs
TPH – NWTPH-Dx	TPH

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

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

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 2013d), and is outlined in Table 3.

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).

Because the sample area (70 m^2 [768 ft^2]) was less than 100 m^2 (1,076 ft^2), a single composite sample and a duplicate each composed of 25 aliquots of soil was collected from across the surface of the sample location area. The sample and its duplicate were 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* (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 4. 600-379 Waste Site Sample Summary.

Sample Location	HEIS Sample Number	Sample Date	Washington State Plane Coordinates (m)		Sample Analysis
			Northing	Easting	
COMP-1	J1T717	1/8/2014	140000.46	578653.76	ICP metals [a], mercury, TPH, PAH, and PCB
Duplicate of J1T717	J1T718	1/8/2014	140000.46	578653.76	ICP metals [a], mercury, TPH, PAH, and PCB
Equipment blank	J1T719	1/8/2014	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
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

Verification Sample Results

All verification samples were analyzed using EPA-approved analytical methods. Evaluation of the verification data from the 600-379 waste site was performed by direct comparison of the maximum sample results for each COPC against cleanup criteria. The *600-379 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation* is provided in Appendix B.

A comparison of the results for site COPCs with the RAGs for the 600-379 waste site is listed in Table 5. The maximum detected value, as described in the *600-379 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation* (Appendix B), 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 2014) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual*(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).

Table 5. Comparison of Contaminant Concentrations to Action Levels for the 600-379 Waste Site Composite 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		
Antimony	1.84 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	4.52 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	88.2 (<BG)	5,600	200	400	No	--
Beryllium	0.522 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.457 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium	7.43 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.59 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	12.8 (<BG)	2,960	59.2	22.0 [c]	No	--
Lead	6.11 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	343 (<BG)	3,760	512 [c]	512 [c]	No	--
Mercury	0.0358 (<BG)	24	0.33 [c]	0.33 [c]	No	--
Nickel	8.62 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	65.4 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	47.1 (<BG)	24,000	480	67.8 [c]	No	--
TPH – motor oil + diesel range	21.2	200	200	200	No	--
Benzo(a)pyrene	0.00169	0.137	0.015 [g]	0.015 [g]	No	--
Benzo(b)fluoranthene	0.00192	1.37	0.015 [g]	0.015 [g]	No	--
Benzo(ghi)perylene	0.00329	2,400	48	192	No	--
Indeno(1,2,3-cd)pyrene	0.00184	1.37	0.33 [g]	0.33 [g]	No	--

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

[b] Maximum results as described in the *600-379 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] 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).

[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 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).

[g] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid turnaround analyses. Prior notification and concurrence with the laboratory may be necessary to analyze to meet this RDL. Actual detection limits may differ from any RDL.

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

DATA EVALUATION

This section demonstrates that contaminant concentrations at the 600-379 waste site achieves 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 600-379 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, groundwater, and river protection soil RAGs. Residual concentrations of all COPCs are not predicted to migrate through the soil column to groundwater (and thus the Columbia River) within 1,000 years.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 600-379 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 600-379 waste site using the maximum detected values. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. The hazard quotient for benzo(ghi)pyrene, the only constituent subject to the hazard quotient calculation, is 1.4×10^{-6}, which is less than 1.0. The individual excess carcinogenic risk values were all less than 1×10^{-6}. Also, the cumulative excess cancer risk is 1.5×10^{-8}, which is less than 1×10^{-5}. Therefore, the nonradionuclide risk requirements are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach (WCH 2013d), 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 600-379 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 600-379 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 600-379 waste site to Interim Closed Out.

REFERENCES

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.

BHI, 2001, *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* as amended, U. S. Department of Energy, Washington, D.C.

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.

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

DOE-RL, 2011, *Tri-Party Agreement Handbook Management Procedures,* RL-TPA-90-0001, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2012, *100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011*, AR/PIR Accession Number 1202240339, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington.

Ecology, 1996, "Model Toxics Control Act – Cleanup," *Washington Administrative Code* (WAC) 173-340, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2014, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

ENV-1, *Environmental Monitoring & Management*, Washington Closure Hanford, Richland, Washington.

EPA, 1989, *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A), Interim Final*, EPA/540/1-89/002, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1999, *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*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2009, *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.

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

WCH, 2011, *100-F/IU-2/IU-6 Area – Segment 4 Orphan Sites Evaluation Report*, OSR-2011-0001, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014a, *100-K and IU-2/6 Miscellaneous Restoration and Failed Remaining Sites Sampling*, Logbook EL-1666-01, pp. 63-64, Washington Closure Hanford, Richland, Washington.

WCH, 2013b, 600-379, Segment 4 Burn Area #1 for Remedial Action, CCN 169793 to T. M. Blakely from T. Q. Howell, Washington Closure Hanford, Richland, Washington, February 11.

WCH, 2013c, *Ecological and Cultural Resources Review for Hand Sampling at Numerous WIDS Sites in IU2/IU6 and Segment 4 for Waste Characterization Purposes (12-ER-051a and HCRC#2011-600-022, HCRC#2011-600-042, HCRC#2011-600-045, HCRC#2011-600-059, HCRC#2011-600-079 and HCRC#2011-100-084*, CCN 169163 to K. A. Anselm from J. E. Thomson, Washington Closure Hanford, Richland, Washington, January 3.

WCH, 2013d, *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,* 0600X-WI-G0074, Rev. 0, Washington Closure Hanford, Richland, Washington.

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

APPENDIX A

WASTE CHARACTERIZATION SAMPLING RESULTS

Table A-1. 600-379 Waste Site Characterization Data - Metals and TPH.

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-379	J1RD81	1/29/13	13400		16	3.51		1.92	3.77		3.2	487		1.6

Sample Location	HEIS Number	Sample Date	Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-379	J1RD81	1/29/13	0.821		0.64	84.5		6.4	0.387	B	0.64	18500		320

Sample Location	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-379	J1RD81	1/29/13	11.5		0.64	7.32		6.4	174		3.2	21100		64

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-379	J1RD81	1/29/13	62.4		1.6	3120		240	275		16.0	0.0164	B	0.031

Sample Location	HEIS Number	Sample Date	Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-379	J1RD81	1/29/13	0.999	B	6.4	13		12.8	1440		1280	0.96	U	0.96

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-379	J1RD81	1/29/13	282		6.4	0.64	U	0.64	622		160	79.9		8.0

Sample Location	HEIS Number	Sample Date	Zinc			TPH - Diesel			TPH - Motor Oil		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
600-379	J1RD81	1/29/13	125		32.0	1050000		60600	2700000		182000

Table A-2. 600-379 Waste Site Characterization Data – Organics.

CONSTITUENT	CLASS	600-379 J1RD81 1/29/13		
		ug/kg	Q	PQL
Acenaphthene	PAH	3010	U	3010
Acenaphthylene	PAH	1230	JD	3010
Anthracene	PAH	3010	U	3010
Benzo(a)anthracene	PAH	3010	U	3010
Benzo(a)pyrene	PAH	3010	U	3010
Benzo(b)fluoranthene	PAH	3010	U	3010
Benzo(ghi)perylene	PAH	3010	U	3010
Benzo(k)fluoranthene	PAH	3010	U	3010
Chrysene	PAH	3010	U	3010
Dibenz[a,h]anthracene	PAH	3010	U	3010
Fluoranthene	PAH	1560	JD	3010
Fluorene	PAH	3010	U	3010
Indeno(1,2,3-cd)pyrene	PAH	3010	U	3010
Naphthalene	PAH	3010	U	3010
Phenanthrene	PAH	4820	D	3010
Pyrene	PAH	3010	U	3010

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:

600-379 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0600X-CA-V0166, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 600

Discipline: Environmental Calculation No: 0600X-CA-V0166

Subject: 600-379 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2010

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 5 Attachment = 2 Total = 8	J. D. Skoglie	I. B. Berezovskiy	N. K. Schiffern	D. F. Obenauer	2/25/14

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	2/20/2014	Calc. No.:	0600X-CA-V0166	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	2/20/2014
Subject:	600-379 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 5	

PURPOSE:

Using sample data from Attachment 1 provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 600-379 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 600-379 waste site verification 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 600-379; Segment Burn Area #1 Waste Site*, Attachment to Waste Site Reclassification Form 2013-089, 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:	J. D. Skoglie	Date:	2/20/2014	Calc. No.:	0600X-CA-V0166	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	2/20/2014
Subject:	600-379 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 5	

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 600-379 waste site underwent verification sampling that consisted of one composite sample and one duplicate sample. The direct contact hazard quotient and carcinogenic risk calculations for the 600-379 waste site were conservatively calculated using the maximum results from the composite soil sample only from Attachment 1. Of the contaminants of potential concern (COPCs) and other analytes for this site the detected polycyclic aromatic hydrocarbons require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Although total petroleum hydrocarbons (diesel range and motor oil) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for benzo(ghi)perylene is 0.00329 mg/kg, divided by the noncarcinogenic RAG value of 2,400 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 1.4×10^{-6}. 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 for COPCs is 1.4×10^{-6}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for benzo(a)pyrene is 0.00169 mg/kg, divided by 0.137 mg/kg, and multiplied as indicated, is 1.2×10^{-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 for COPCs is 1.5×10^{-8}. 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 evaluation of the attached sample data showed that a given analyte was not detected in the primary

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	2/20/2014	Calc. No.:	0600X-CA-V0166	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	2/20/2014
Subject:	600-379 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 5	

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 2013), 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 600-379 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 600-379 waste site.

Washington Closure Hanford, Inc.		CALCULATION SHEET					
Originator:	J. D. Skoglie	Date:	2/20/2014	Calc. No.:	0600X-CA-V0166	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	2/20/2014
Subject:	600-379 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 5	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 600-379 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
Polycyclic Aromatic Hydrocarbons					
Benzo(a)pyrene	0.00169	--	--	0.137	1.2E-08
Benzo(b)fluoranthene	0.00192	--	--	1.37	1.4E-09
Benzo(ghi)perylene [c]	0.00329	2,400	1.4E-06	--	--
Indeno(1,2,3-cd)pyrene	0.00184	--	--	1.37	1.3E-09
Total Petroleum Hydrocarbons					
TPH - Diesel Range plus motor oil [d]	21.2	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**1.4E-06**		
Cumulative Excess Cancer Risk:					**1.5E-08**

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] = Toxicity data for phananthrene is not available. The cleanup levels are based on use of surrogate chemicals.

benzo(g,h,i)perylene surrogate: pyrene

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

-- = not applicable

RAG = remedial action goal

Table 2. Relative Percent Difference Calculations for the 600-379 Waste Site (2 pages).

600-379 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Aluminum			Barium			Beryllium			Cadmium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J1T717	1/8/14	5790		6.79	88.2		0.0999	0.522		0.0999	0.457	B	0.0999
Duplicate of J1T717	J1T718	1/8/14	5690		6.84	83.0		0.101	0.503		0.101	0.449	B	0.101

Analysis:

TDL		5	2	0.2	0.2
Duplicate Analysis	Both >, PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	1.7%	6.1%		
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable

600-379 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J1T717	1/8/14	3680		7.99	7.41		0.15	8.59	D	0.749	12.8		0.300
Duplicate of J1T717	J1T718	1/8/14	3590		8.04	7.43		0.151	8.39	D	0.754	12.1		0.302

Analysis:

TDL		100	1	2	1
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	2.5%	0.3%		5.6%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable

Washington Closure Hanford, Inc.		CALCULATION SHEET					
Originator:	J. D. Skoglie	Date:	2/20/2014	Calc. No.:	0600X-CA-V0166	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	2/20/2014
Subject:	600-379 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 5 of 5	

Table 2. Relative Percent Difference Calculations for the 600-379 Waste Site (2 pages).

600-379 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Iron mg/kg	Iron Q	Iron PQL	Lead mg/kg	Lead Q	Lead PQL	Magnesium mg/kg	Magnesium Q	Magnesium PQL	Manganese mg/kg	Manganese Q	Manganese PQL
COMP-1	J1T717	1/8/14	22800		7.99	4.58	*BD	1.65	3780		8.49	343		0.200
Duplicate of J1T717	J1T718	1/8/14	23000		8.04	6.11	*D	1.66	3870		8.55	328		0.201

Analysis:

TDL		Iron 5	Lead 5	Magnesium 75	Manganese 5
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	0.9%		2.4%	4.5%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable

600-379 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Nickel mg/kg	Nickel Q	Nickel PQL	Potassium mg/kg	Potassium Q	Potassium PQL	Silicon mg/kg	Silicon Q	Silicon PQL	Sodium mg/kg	Sodium Q	Sodium PQL
COMP-1	J1T717	1/8/14	8.22	M	0.150	1540	N	6.39	544	N	1.50	145		6.99
Duplicate of J1T717	J1T718	1/8/14	8.62	M	0.151	1470	N	6.43	559	N	1.51	125		7.04

Analysis:

TDL		Nickel 4	Potassium 400	Silicon 2	Sodium 50
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD			2.7%	
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	No - acceptable

600-379 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Vanadium mg/kg	Vanadium Q	Vanadium PQL	Zinc mg/kg	Zinc Q	Zinc PQL	TPH - diesel range ug/kg	TPH - diesel range Q	TPH - diesel range PQL	TPH - motor oil (high boiling) ug/kg	TPH - motor oil (high boiling) Q	TPH - motor oil (high boiling) PQL
COMP-1	J1T717	1/8/14	65.4	D	0.499	46.1	D	2.00	3880	J	2350	16900		2350
Duplicate of J1T717	J1T718	1/8/14	64.3	D	0.503	47.1	D	2.01	4340	J	2340	16100		2340

Analysis:

TDL		Vanadium 2.5	Zinc 1	TPH - diesel range 5000	TPH - motor oil (high boiling) 5000
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	1.7%	2.1%		
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable

600-379 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Benzo(ghi)perylene ug/kg	Benzo(ghi)perylene Q	Benzo(ghi)perylene PQL
COMP-1	J1T717	1/8/14	3.29		0.579
Duplicate of J1T717	J1T718	1/8/14	3.28		0.574

Analysis:

TDL		Benzo(ghi)perylene 15
Duplicate Analysis	Both > PQL?	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)
	RPD	
	Difference > 2 TDL?	No - acceptable

CONCLUSION:

The calculations in Tables 1 and 2 demonstrate that the 600-379 waste site meets the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk and RPDs, respectively, as identified in the RDR/RAWP (DOE-RL 2009b) and SAP (DOE-RL 2009a). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

Attachment 1. 600-379 Waste Site Verification Sample Results (Metals and TPH).

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
COMP-1	J1T717	1/8/14	5790		6.79	1.65	DU	1.65	2.84	UJBC	0.499	88.2		0.0999	0.522		0.0999
Duplicate of J1T717	J1T718	1/8/14	5690		6.84	1.84	BD	1.66	4.52		0.503	83.0		0.101	0.503		0.101
Equipment Blank	J1T719	1/8/14	99.3		6.25	0.303	U	0.303	1.28	UJBC	0.460	1.88		0.0919	0.0919	U	0.0919

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J1T717	1/8/14	5.13	UJC	0.999	0.457	B	0.0999	3680		7.99	7.41		0.15	8.59	D	0.749
Duplicate of J1T717	J1T718	1/8/14	3.79	UJBC	1.01	0.449	B	0.101	3590		8.04	7.43		0.151	8.39	D	0.754
Equipment Blank	J1T719	1/8/14	2.08	UJBC	0.919	0.0919	U	0.0919	42.6		7.35	0.138	U	0.138	0.188	B	0.138

Sample Location	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J1T717	1/8/14	12.8		0.300	22800		7.99	4.58	*BD	1.65	3780		8.49	343		0.200
Duplicate of J1T717	J1T718	1/8/14	12.1		0.302	23000		8.04	6.11	*D	1.66	3870		8.55	328		0.201
Equipment Blank	J1T719	1/8/14	0.276	U	0.276	290		7.35	0.38	*B	0.303	22.1	B	7.81	4.16		0.184

Sample Location	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J1T717	1/8/14	0.00424	U	0.00424	0.200	U	0.200	8.22	M	0.150	1540	JN	6.39	0.339	DU	0.339
Duplicate of J1T717	J1T718	1/8/14	0.0358		0.00424	0.201	U	0.201	8.62	M	0.151	1470	JN	6.43	0.318	DU	0.318
Equipment Blank	J1T719	1/8/14	0.00399	U	0.00399	0.184	U	0.184	0.138	MU	0.138	35.4	JN	5.88	0.328	DU	0.328

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J1T717	1/8/14	544	JN	1.50	0.0999	U	0.0999	145		6.99	65.4	D	0.499	46.1	D	2.00
Duplicate of J1T717	J1T718	1/8/14	559	JN	1.51	0.101	U	0.101	125		7.04	64.3	D	0.503	47.1	D	2.01
Equipment Blank	J1T719	1/8/14	99.6	JN	1.38	0.0919	U	0.0919	6.43	U	6.43	0.212	B	0.0919	1.37	UJC	0.368

Sample Location	HEIS Number	Sample Date	TPH - diesel range			TPH - motor oil (high boiling)		
			ug/kg	Q	PQL	ug/kg	Q	PQL
COMP-1	J1T717	1/8/14	3880	J	2350	16900		2350
Duplicate of J1T717	J1T718	1/8/14	4340	J	2340	16100		2340

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

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

* = duplicate analysis not within control limits.
B = blank contamination (inorganic constituents)
C = detected in both sample and associated QC blank, sample concentration </=5X blank concentration.
COMP = Composite
D = reported from a diluted aliquot of a sample.
HEIS = Hanford Environmental Information System
J = estimate
M = sample duplicate precision not met.
N = recovery exceeds upper or lower control limit.
P = >40% difference between the two column analyses.
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
TPH = total petroleum hydrocarbons
U = not detected.

Attachment	1	Sheet No.	1 of 2
Originator	J. D. Skoglie	Date	2/20/2014
Checked	I. B. Berezovskiy	Date	2/20/2014
Calc. No.	0600X-CA-V0166	Rev. No.	0

Attachment 1. 600-379 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	COMP-1 - J1T717			Duplicate of J1T717 - J1T718		
		1/8/14			1/8/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	5.42	U	5.42	5.38	U	5.38
Acenaphthylene	PAH	5.42	U	5.42	5.38	U	5.38
Anthracene	PAH	1.81	U	1.81	1.79	U	1.79
Benzo(a)anthracene	PAH	0.579	U	0.579	0.574	U	0.574
Benzo(a)pyrene	PAH	1.69	J	0.579	0.574	U	0.574
Benzo(b)fluoranthene	PAH	1.92		0.579	0.574	U	0.574
Benzo(ghi)perylene	PAH	3.29		0.579	3.28		0.574
Benzo(k)fluoranthene	PAH	0.289	U	0.289	0.287	U	0.287
Chrysene	PAH	0.579	U	0.579	0.574	U	0.574
Dibenz[a,h]anthracene	PAH	0.579	U	0.579	0.574	U	0.574
Fluoranthene	PAH	0.579	U	0.579	0.574	U	0.574
Fluorene	PAH	5.42	U	5.42	5.38	U	5.38
Indeno(1,2,3-cd)pyrene	PAH	0.579	U	0.579	1.84	P	0.574
Naphthalene	PAH	5.42	U	5.42	5.38	U	5.38
Phenanthrene	PAH	5.42	U	5.42	5.38	U	5.38
Pyrene	PAH	0.579	U	0.579	0.574	U	0.574
Aroclor-1016	PCB	1.20	U	1.20	1.20	U	1.20
Aroclor-1221	PCB	1.20	U	1.20	1.20	U	1.20
Aroclor-1232	PCB	1.20	U	1.20	1.20	U	1.20
Aroclor-1242	PCB	1.20	U	1.20	1.20	U	1.20
Aroclor-1248	PCB	1.20	U	1.20	1.20	U	1.20
Aroclor-1254	PCB	1.20	U	1.20	1.20	U	1.20
Aroclor-1260	PCB	1.20	U	1.20	1.20	U	1.20

Attachment	1	Sheet No.	2 of 2
Originator	J. D. Skoglie	Date	2/20/2014
Checked	I. B. Berezovskiy	Date	2/20/2014
Calc. No.	0600X-CA-V0166	Rev. No.	0

APPENDIX C

DATA QUALITY ASSESSMENT

APPENDIX C

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2013). 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 2013), the field logbook (WCH 2014a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the 100 Area SAP (DOE-RL 2009) data assurance requirements and the data validation procedure for chemical analysis (BHI 2000) is used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 600-379 waste site were provided by the laboratories in sample delivery group (SDG) XP0038. SDG XP0038 was submitted for third-party validation. No major deficiencies were noted for these data sets. Minor deficiencies are discussed for the 600-379 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

MINOR DEFICIENCIES

SDG XP0038

This SDG comprises one composite soil sample (J1T717) collected from the 600-379 waste site excavation. This SDG includes one field duplicate pair (J1T717/J1T718). These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), and polychlorinated biphenyls (PCBs). In addition, one field equipment blank sample (J1T719) was collected and analyzed for ICP metals and mercury. SDG XP0038 was submitted for third-party validation. Minor deficiencies are as follows.

In the ICP metals analysis, arsenic, boron, and zinc were detected in the method blank. Due to method blank contamination, third-party validation qualified all boron results, arsenic results in samples J1T717 and J1T719, and zinc in sample J1T719 as undetected with "UJ" flags. Data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recoveries are out of the project acceptance criteria for potassium (132%) and silicon (27.2%). 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 and potassium did not have a mismatched spike and native concentrations in the MS. Third party validation qualified all silicon and potassium results in SDG XP0038, as estimates with "J" flags. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

Relative percent difference (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 quality assurance/quality control (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 2014) are shown in Table C-1. The main and QA/QC sample results are presented in Appendix B.

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

Sample Area	Main Sample	Duplicate Sample
600-379 waste site excavation	J1T717	J1T718

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. The RPD 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 target detection limit (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. No sample 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 600-379 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 600-379 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes.

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

REFERENCES

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

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

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

WCH, 2013, *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*, 0600X-WI-G0074, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014, 100-K and IU-2/6 Miscellaneous Restoration and Failed Remaining Sites Sampling, Logbook EL 1666-01, pp. 2-8, Washington Closure Hanford, Richland, Washington.