

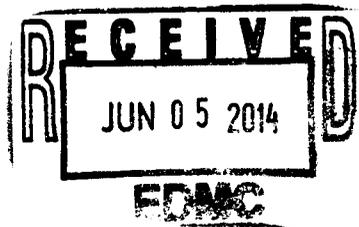


Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

14-AMRP-0201

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 600-377, SEGMENT 4 OIL STAIN AND
FILTER AREA #2 WASTE SITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2013-088
and supporting, "Remaining Waste Site Verification Package for the 600-377, Segment 4 Oil
Stain and Filter Area #2 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,

A handwritten signature in cursive script that reads "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.: 2013-088

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

600-377, Segment 4 Oil Stain and Filter Area #2

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 600-377, Segment 4 Oil Stain and Filter Area #2, located in the 100-IU-6 Operable Unit of the Hanford Site, consisted of a 3 m² (32 ft²) area devoid of vegetation and containing multiple oil filters. The 600-377 waste site was located approximately 3 km (1.9 mi) south of Route 1 and 97 m (318 ft) east of Route 4 North. The area is between Route 4 North and the west end of Gable Mountain. The 600-377 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). This waste site was subsequently recommended for remove, treat, and dispose (RTD) without confirmatory sampling 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 600-377 waste site was performed on December 16, 2013. No anomalies were discovered during excavation of the area. A total of approximately 2.64 bank cubic meters (3.45 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 6, 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 the ERDF at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-377 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 2009). 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 600-377, Segment 4 Oil Stain and Filter Area #2 Waste Site* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-2

Control No.: 2013-088

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

600-377, Segment 4 Oil Stain and Filter Area #2

Regulator comments:

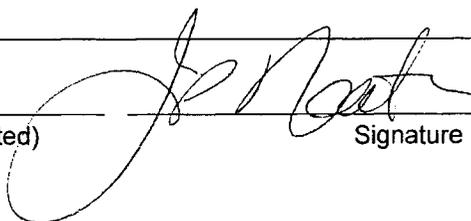
Waste Site Controls:

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

5/5/14

Date

NA

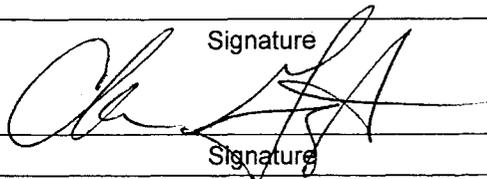
Ecology Project Manager (printed)

Signature

Date

C. Guzzetti

EPA Project Manager (printed)



Signature

5/13/14

Date

**REMAINING SITES VERIFICATION PACKAGE FOR THE
600-377, SEGMENT 4 OIL STAIN AND FILTER AREA #2
WASTE SITE**

Attachment to Waste Site Reclassification Form 2013-088

May 2014

**REMAINING SITES VERIFICATION PACKAGE FOR THE
600-377, SEGMENT 4 OIL STAIN AND FILTER AREA #2
WASTE SITE**

EXECUTIVE SUMMARY

The 600-377, Segment 4 Oil Stain and Filter Area #2 waste site, located in the 100-IU-6 Operable Unit, consisted of a 3 m² (32 ft²) area devoid of vegetation and containing multiple oil filters. The 600-377 waste site was located approximately 3 km (1.9 mi) south of Route 1 and 97 m (318 ft) east of Route 4 North. The area is between Route 4 North and the west end of Gable Mountain. This waste site was added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999) as a candidate site for confirmatory sampling in the Fact Sheet *100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011* (DOE-RL 2012). This waste site was subsequently recommended for remove, treat, and dispose (RTD) without confirmatory sampling based on the observed presence of stained soils, stressed vegetation, and barren ground (WCH 2013) and is being 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 600-377 waste site was performed on December 16, 2014. No anomalies were discovered during excavation. A total of approximately 2.64 bank cubic meters (3.45 bank cubic yards) of material 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 for the 600-377 waste site on January 6, 2014. These results indicated that residual contaminant concentrations met the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 600-377 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 600-377 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 600-377 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 600-377 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC direct exposure RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for all sampling areas (1.3×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk values for individual nonradionuclide COPCs are all $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The cumulative excess cancer risk (7.7×10^{-8}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COC groundwater and river RAGs.	Radionuclides were not COPCs for the 600-377 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 1/25 th 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.	Aroclor-1260 is present at a concentration exceeding soil RAGs for groundwater and Columbia River protection. However, an evaluation based upon RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b) shows that the residual concentration of aroclor-1260 is predicted to be protective of groundwater and the river.	Yes ^d

^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 concentration of aroclor-1260 is not expected to migrate vertically in 1,000 years (based on the distribution coefficient of aroclor-1260 of 822 mL/g). The vadose zone underlying the site is approximately 21.5 m (70.5 ft). Therefore, residual concentrations of aroclor-1260 are predicted to be protective of groundwater and the Columbia River.

COC = contaminant of concern
COPC = contaminant of potential concern
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 600-377 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* 173-340 were boron and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for manganese, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of manganese, vanadium, and zinc are below Hanford Site 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
600-377, SEGMENT 4 OIL STAIN AND FILTER AREA #2
WASTE SITE**

STATEMENT OF PROTECTIVENESS

The 600-377, Segment 4 Oil Stain and Filter Area #2 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 600-377 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 were boron and vanadium. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for manganese, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of manganese, vanadium, and zinc are below Hanford Site 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 600-377 waste site is located within the 100-IU-6 Operable Unit. The 600-377 waste site is reported in the *100-F/IU-2/IU-6 Area-Segment 4 Orphan Sites Evaluation Report* (WCH 2011) as SG4-549, consisting of a 3 m² (32 ft²) area of surface staining devoid of vegetation and containing multiple oil filters. The 600-377 waste site was located approximately 3 km (1.9 mi) south of Route 1 and 97 m (318 ft) east of Route 4 North. The area is between Route 4 North and the west end of Gable Mountain and located at Washington State Plane (WSP) coordinates N 142187.40, E 572340.93 (Figure 1). There is no process history associated with the 600-377 waste site. A photograph of the waste site is provided in Figure 2.

Figure 1. The 600-377 Waste Site Location Map.

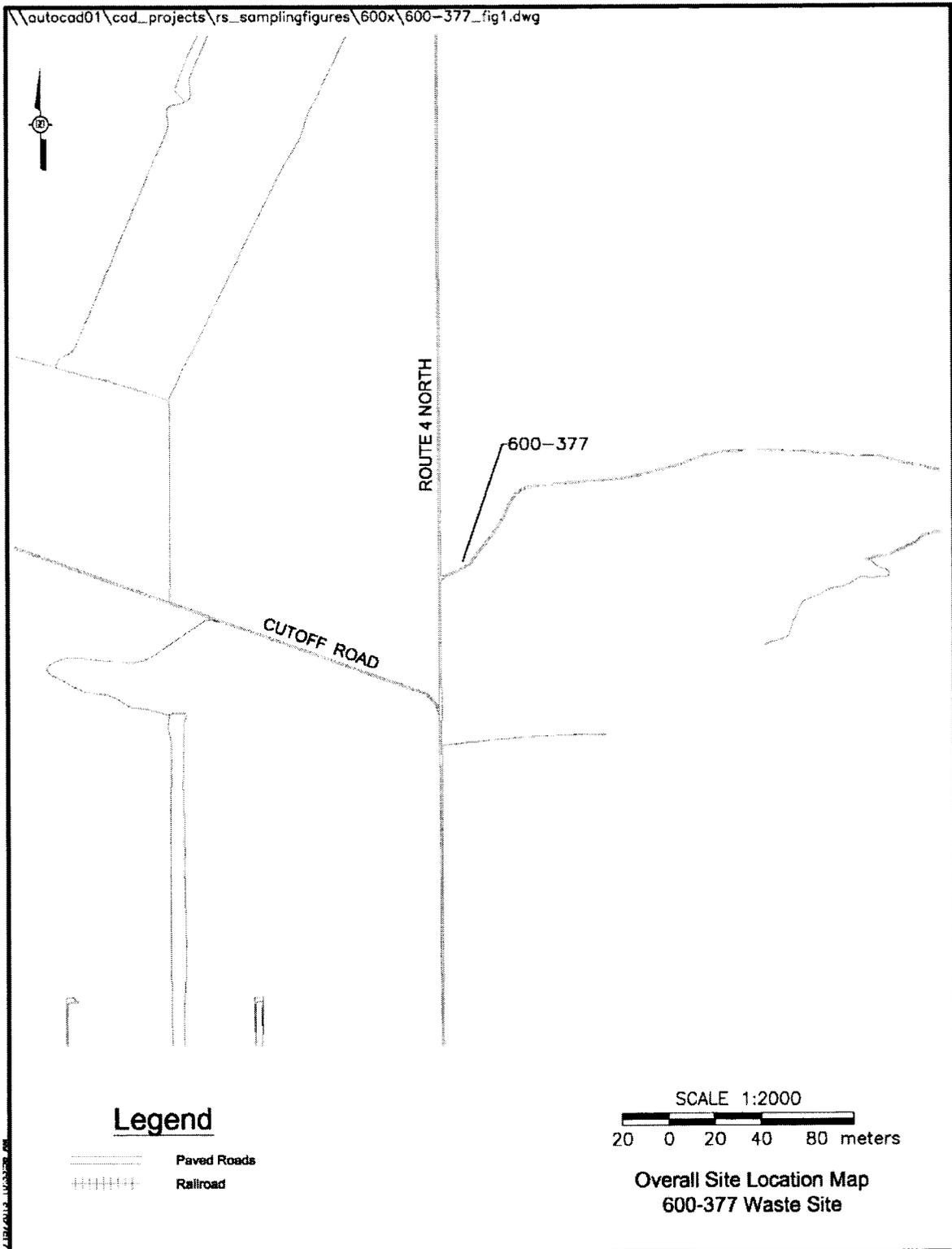


Figure 2. The 600-377 Waste Site (December 16, 2010).**REMEDIAL ACTION SUMMARY**

The 600-377 waste site was recommended for remediation without confirmatory sampling based on the observed presence of burned debris, stained soils, stressed vegetation, and barren ground at this site (WCH 2013).

Remedial Action

Remediation of the 600-377 waste site was performed on December 16, 2013. No anomalies were discovered during excavation. A total of approximately 2.64 bank cubic meters (3.45 bank cubic yards) of material was removed and direct loaded for disposal at the Environmental Restoration Disposal Facility. No overburden soil was stockpiled to be used as backfill. The 600-377 waste site excavation area is approximately 8 m² (86 ft²), with the approximate depth of 0.30 m (1 ft) below ground surface. A post-excavation photograph of the waste site excavation is provided in Figure 3. All excavated materials were direct loaded, and no soil staging pile area or overburden areas were utilized.

**Figure 3. The 600-377 Waste Site Post-Excavation Photograph
(December 18, 2013).**



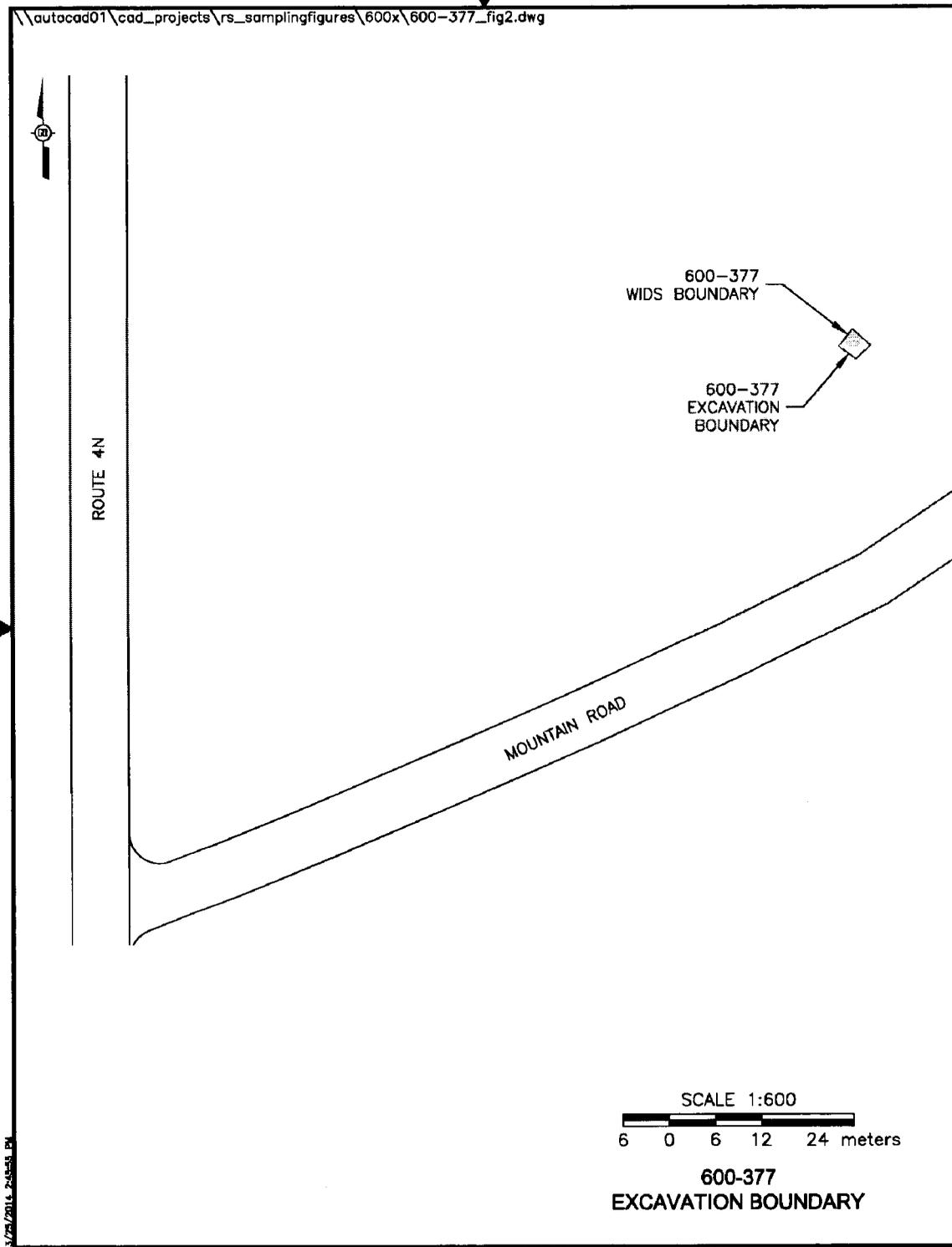
Figure 4 shows the walkaround boundary of the excavation, performed following remediation of the 600-377 waste site.

VERIFICATION SAMPLING ACTIVITIES

Cleanup verification sampling was performed at the 600-377 waste site on January 6, 2014. 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).



Figure 4. 600-377 Waste Site Excavation Walkaround Boundary.



The verification sample results are provided in Appendix A and indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 600-377 waste site. The following subsections provide additional discussion of the information used to develop the verification sampling design. A more detailed discussion of the verification sampling can be found 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 2013).

Contaminants of Potential Concern

The COPCs for the 600-377 waste site were based on site descriptions and professional judgment. The 600-377 COPCs include inductively coupled plasma (ICP) metals, mercury, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAH), and total petroleum hydrocarbons (TPH). The COPCs for verification sampling and the laboratory analytical methods are identified in Table 1.

Table 1. 600-377 Laboratory Analytical Methods and Contaminants of Potential Concern.

Analysis	Analytical Method	Contaminant of Potential Concern
ICP metals ^a	EPA Method 6010	Metals
Mercury	EPA Method 7471	Mercury
PCBs	EPA Method 8082	Polychlorinated biphenyls
PAH	EPA Method 8310	Polycyclic aromatic hydrocarbons
TPH	NWTPH-Dx	Total petroleum hydrocarbons

^a Analysis performed for 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.

EPA = U.S. Environmental Protection Agency

ICP = inductively coupled plasma

NWTPH-Dx = Northwest total petroleum hydrocarbons–diesel range organics

PCB = polychlorinated biphenyls

PAH = polycyclic aromatic hydrocarbons

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. All sampling was performed in accordance with the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009a). Verification sampling occurred based on the size of the 600-377 waste site excavation area in accordance with Table 2.

Table 2. 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 (2013).

Table 2 was originally presented in the verification sampling instruction (WCH 2013). The final area of the 600-377 waste site excavation is approximately 8 m² (86 ft²), which per Table 2 indicates one composite sample for the 600-377 waste site.

A composite soil sample and a duplicate (Table 3) were collected from the bottom of the excavated waste site and analyzed using the methods identified in Table 1.

Table 3. 600-377 Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Northing	Easting	
COMP-1	J1T714	142187	572340	ICP metals ^a , mercury, PAH, PCBs, TPH
Duplicate of J1T714	J1T715			
Equipment blank	J1T716	NA	NA	ICP metals ^a

^a The expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium(total), cobalt, copper, lead, manganese, magnesium, molybdenum, nickel, silver, selenium, 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

All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the 100 Area SAP (DOE-RL 2009a). Additional information related to verification sampling can be found in the field sampling logbook (WCH 2014).

Verification Sample Results

All verification samples were analyzed using analytical methods approved by EPA (DOE-RL 2009b). Evaluation of the verification data from the 600-377 waste site was performed by direct comparison of the maximum sample results for each COPC against cleanup criteria. If no detections for a given COPC were reported in the data set, then no evaluation or calculations were performed for that COPC.

Comparisons of the results for site COPCs with the RAGs for the 600-377 waste site are listed in Table 4. Contaminants that were not detected by laboratory analysis are excluded from this table. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2014) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. The laboratory-reported data results for all constituents are stored in the Washington Closure Hanford (WCH) project-specific database prior to archival in the Hanford Environmental Information System and are presented in Attachment 1 of the relative percent difference and direct contact hazard quotient and carcinogenic calculations (Appendix A).

VERIFICATION SAMPLE DATA EVALUATION

This section demonstrates that contaminant concentrations at the 600-377 waste site achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the Remaining Sites ROD (EPA 1999) and documented in the 100 Area RDR/RAWP (DOE-RL 2009b).

Direct Comparison to RAGs

Evaluation of the verification sampling results in Table 4 shows that all direct exposure RAGs are met for the 600-377 waste site. Groundwater protection and/or Columbia River protection cleanup levels were exceeded for aroclor-1260.

Based on the RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), residual concentrations of aroclor-1260 are not predicted to migrate vertically within 1,000 years (based on the distribution coefficient of 822 mL/g for aroclor-1260). The vadose zone underlying the excavation is approximately 21.5 m (70.5 ft) thick. Therefore, the residual concentration of aroclor-1260 is not predicted to migrate through the soil column to groundwater (and thus the Columbia River) within 1,000 years.

Three-Part Test for Nonradionuclides

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. Statistical samples were not collected for the 600-377 waste site, therefore the three-part test is not applied.

Table 4. Comparison of Contaminant Concentrations to Action Levels for the 600-377 Excavation Verification Samples.

COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg) ^a			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.87 (<BG)	20 ^b	20 ^b	20 ^b	No	--
Barium	84.2 (<BG)	5,600 ^c	200	400	No	--
Beryllium	0.876 (<BG)	10.4 ^d	1.51 ^b	1.51 ^b	No	--
Boron ^e	1.21	7,200 ^c	320	-- ^f	No	--
Cadmium ^g	0.111 (<BG)	13.9 ^d	0.81 ^b	0.81 ^b	No	--
Chromium	14.1 (<BG)	80,000 ^c	18.5 ^b	18.5 ^b	No	--
Cobalt	9.93 (<BG)	24 ^c	15.7 ^b	-- ^f	No	--
Copper	19.7 (<BG)	2,960 ^c	59.2	22.0 ^b	No	--
Lead	10.0 (<BG)	353	10.2 ^b	10.2 ^b	No	--
Manganese	405 (<BG)	3,760 ^c	512 ^b	-- ^f	No	--
Molybdenum ^e	0.465	400 ^d	8	-- ^f	No	--
Nickel	12.6 (<BG)	1,600 ^c	19.1 ^b	27.4	No	--
Vanadium	56.3 (<BG)	560 ^c	85.1 ^b	-- ^f	No	--
Zinc	50.0	24,000 ^c	480	67.8 ^b	No	--
TPH-motor oil	22.8	200	200	200	No	--
Aroclor-1260	0.0386	0.5	0.017	0.017	Yes	Yes ^h

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

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

^c Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B (Ecology 1996).

^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/m³ (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 2014) 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 concentration of aroclor-1260 is not expected to migrate vertically in 1,000 years (based on the distribution coefficient 822 mL/g for aroclor-1260). The vadose zone underlying the soil below the site is approximately 21.5 m (70.5 ft).

Therefore, residual concentrations of aroclor-1260 are predicted to be protective of groundwater and the Columbia River.

-- = not applicable

BG = background

COPC = contaminant of potential concern

EPA = U.S. Environmental Protection Agency

RAG = remedial action goal

RDR/RAWP = Remedial Design Report/Remedial Action Work Plan

RESRAD = RESidual RADioactivity (dose model)

TPH = total petroleum hydrocarbons

WAC = Washington Administrative Code

Direct Contact Noncarcinogenic Hazard Quotient Remedial Action Goal

Assessment of the risk requirements for the 600-377 waste site was determined by calculation of the hazard quotient and excess carcinogenic risk. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6} , and a cumulative excess carcinogenic risk of less than 1×10^{-5} . Hazard quotient and excess carcinogenic risk calculations for direct contact were conservatively performed for the 600-377 waste site in Appendix A using the highest of the composite and duplicate sample 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. All individual hazard quotients are below 1.0, and all individual excess carcinogenic risk values are below 1×10^{-6} . The direct contact cumulative hazard quotient for the 600-377 waste site is 1.3×10^{-3} , and the cumulative excess carcinogenic risk value is 7.7×10^{-8} , satisfying the criteria to be less than 1.0 and less than 1×10^{-5} , respectively. Therefore, the nonradionuclide risk requirements are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach (WCH 2013), the field logbook (WCH 2014), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 600-377 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 A. The detailed DQA is presented in Appendix B.

SUMMARY FOR INTERIM CLOSURE

The 600-377 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). Verification sampling was performed and the analytical results indicate that the residual concentrations of COPCs met the RAGs and associated RAOs for direct exposure, groundwater protection, and river protection. 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 600-377 waste site to Interim Closed Out.

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APPENDIX A
CALCULATIONS

APPENDIX A
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:

600-377 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0600X-CA-V0169, 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.

CALCULATION COVER SHEETProject Title: 600 Field Remediation Job No. 14655Area: 600 AreaDiscipline: Environmental Calculation No: 0600X-CA-V0169Subject: 600-377 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk CalculationsComputer 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	N. K. Schiffern <i>N.K. Schiffern</i>	I. B. Berezovskiy <i>I.B. Berezovskiy</i>	J. D. Skoglie <i>J.D. Skoglie</i>	D. F. Obenauer <i>D.F. Obenauer</i>	4/21/14

SUMMARY OF REVISION

--	--

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

DE01-437.03

Washington Closure Hanford, Inc.

CALCULATION SHEET

Originator:	N. K. Schiffern <input checked="" type="checkbox"/>	Date:	3/6/2014	Calc. No.:	0600X-CA-V0169	Rev.:	0	
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy <input checked="" type="checkbox"/>	Date:	3/6/2014	
Subject:	600-377 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations						Sheet No. 1 of 5	

1 **PURPOSE:**

2
3 Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess
4 carcinogenic risk for the 600-377 waste site. In accordance with the remedial action goals (RAGs) in
5 the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009b), the following
6 criteria must be met:

- 7
8 1) An HQ of <1.0 for all individual noncarcinogens
9 2) A cumulative HQ of <1.0 for noncarcinogens
10 3) An excess cancer risk of <1 x 10⁻⁶ for individual carcinogens
11 4) A cumulative excess cancer risk of <1 x 10⁻⁵ for carcinogens.

12
13 Also, calculate the relative percent difference (RPD) for primary-duplicate sample pairs from the
14 600-377 waste site verification sampling, as necessary.

15
16
17 **GIVEN/REFERENCES:**

- 18
19 1) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 5,
20 U.S. Department of Energy, Richland Operations Office, Richland, Washington.
21
22 2) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*,
23 DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office,
24 Richland, Washington.
25
26 3) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines*
27 *for Inorganic Data Review*, EPA 540/R-94/013, U.S. Environmental Protection Agency, Washington,
28 D.C.
29
30 4) WAC 173-340, "Model Toxics Control Act – Cleanup," Washington Administrative Code, 1996.
31
32 5) WCH, 2014, *Remaining Sites Verification Package for the 600-377, Segment 4 Oil Stain and Filter*
33 *Area #2*, Attachment to Waste Site Reclassification Form 2013-088, Washington Closure Hanford,
34 Inc., Richland, Washington.
35

36
37 **SOLUTION:**

- 38
39 1) Generate an HQ for each noncarcinogenic constituent detected above background or required
40 detection limit/practical quantitation limit and compare it to the individual HQ of <1.0
41 (DOE-RL 2009b).
42
43 2) Sum the HQs and compare this value to the cumulative HQ of <1.0.
44
45 3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or
46 required detection limit/practical quantitation limit and compare it to the excess cancer risk of
47 <1 x 10⁻⁶ (DOE-RL 2009b).

Washington Closure Hanford, Inc.		CALCULATION SHEET					
Originator:	N. K. Schiffern <i>W</i>	Date:	3/6/2014	Calc. No.:	0600X-CA-V0169	Rev.:	0
Project:	600 Field Remediation	Job No.:	14655	Checked:	I. B. Berezovskiy <i>W</i>	Date:	3/6/2014
Subject:	600-377 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 5	

- 1 4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.
- 2
- 3 5) Use data from Attachment 1 to perform the RPD calculations for primary-duplicate sample pairs, as
- 4 required.
- 5
- 6

7 **METHODOLOGY:**

8

9 The 600-377 waste site underwent composite verification sampling at one decision unit. One composite

10 and a duplicate sample were collected from the excavation area. The direct contact hazard quotient and

11 carcinogenic risk calculations for the 600-377 waste site were conservatively calculated using the

12 maximum results from the sample results in Attachment 1. Of the contaminants of potential concern

13 (COPCs) and other analytes for this site, boron, molybdenum, and aroclor-1260 require HQ and risk

14 calculations because these analytes were detected and a Washington State or Hanford Site background

15 value is not available. Although total petroleum hydrocarbons (motor oil and diesel range) were

16 detected and no background value is available, the risk associated with total petroleum hydrocarbons do

17 not contribute to the cumulative toxicity calculation. All other site nonradionuclide COPCs were not

18 detected or were quantified below background levels. An example of the HQ and risk calculations is

19 presented below:

20

- 21 1) For example, the maximum value for boron is 1.21 mg/kg, divided by the noncarcinogenic RAG
- 22 value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in
- 23 WAC 173-340-740[3]), is 1.7×10^{-4} . Comparing this value, and all other individual values, to the
- 24 requirement of <1.0 , this criterion is met.
- 25
- 26 2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be
- 27 obtained by summing the individual values. To avoid errors due to intermediate rounding, the
- 28 individual HQ values prior to rounding are used for this calculation. The sum of the HQ values for
- 29 COPCs is 1.3×10^{-3} . Comparing this value to the requirement of <1.0 , this criterion is met.
- 30
- 31 3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic
- 32 RAG value, then multiplied by 1.0×10^{-6} . For example, the maximum value for aroclor-1260 is
- 33 0.0386 mg/kg, divided by 0.5 mg/kg, and multiplied as indicated, is 7.7×10^{-8} . Comparing this
- 34 value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.
- 35
- 36 4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer
- 37 risk can be obtained by summing the individual values. To avoid errors due to intermediate
- 38 rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum
- 39 of the excess cancer risk values for COPCs is 7.7×10^{-8} . Comparing these values to the requirement
- 40 of $<1 \times 10^{-5}$, this criterion is met.
- 41
- 42 5) The RPD is calculated when both the primary value and the duplicate value for a given analyte are
- 43 above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a
- 44 laboratory detection limit pre-determined for each analytical method and is listed for certain analytes
- 45 in Table II-1 of the SAP (DOE-RL 2009a). Other analytes will have their own pre-determined
- 46 constituents and will have their own TDLs based on the laboratory and method used. Where direct
- 47 evaluation of the attached sample data showed that a given analyte was not detected in the primary

Washington Closure Hanford, Inc.		CALCULATION SHEET					
Originator:	N. K. Schiffen	Date:	3/6/2014	Calc. No.:	0600X-CA-V0169	Rev.:	0
Project:	600 Field Remediation	Job No.:	14655	Checked:	I. B. Berezovskiy	Date:	3/6/2014
Subject:	600-377 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 5	

1 and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD
2 calculations use the following formula:

$$3 \text{ RPD} = [|M-D| / ((M+D)/2)] * 100$$

4
5
6 where, M = main sample value D = duplicate sample value

7
8 When an analyte is detected in the primary or duplicate sample, but was quantified at less than 5 times
9 the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference
10 between the primary and duplicate results exceeds a control limit of 2 times the TDL, further assessment
11 regarding the usability of the data is performed. This assessment is provided in the data quality
12 assessment section of the RSVP.

13
14 For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30%
15 indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If
16 the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the
17 usability of the data is performed. No split samples were collected for cleanup verification of the subject
18 site. Additional discussion is provided in the data quality assessment section of the applicable RSVP
19 (WCH 2014), as necessary.

20
21
22 **RESULTS:**

- 23
24 1) List individual noncarcinogens and corresponding HQs >1.0: None
25 2) List the cumulative noncarcinogenic HQ >1.0: None
26 3) List individual carcinogens and corresponding excess cancer risk >1 x 10⁻⁶: None
27 4) List the cumulative excess cancer risk for carcinogens >1 x 10⁻⁵: None

28
29 Table 1 shows the results of the hazard quotient and excess cancer risk calculations for the 600-377
30 waste site.

- 31
32 5) The evaluation of the QA/QC duplicate RPD calculations are performed within the data quality
33 assessment section of the RSVP.

34
35 Table 2 shows the results of the RPD calculations for the 600-377 waste site.
36
37
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47

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern (N)	Date:	3/6/2014	Calc. No.:	0600X-CA-V0169	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	3/6/2014
Subject:	600-377 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 600-377 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	1.21	7,200	1.7E-04	--	--
Molybdenum	0.465	400	1.2E-03	--	--
Polychlorinated Biphenyls					
Aroclor-1260	0.0386	--	--	0.5	7.7E-08
Total Petroleum Hydrocarbons					
TPH - motor oil plus diesel range ^c	27.6	200	--	--	--
Totals					
Cumulative Hazard Quotient:			1.3E-03		
Cumulative Excess Cancer Risk:					7.7E-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 = The risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation.

-- = not applicable

RAG = remedial action goal

Table 2. RPD Calculations for the 600-377 Waste Site. (2 pages)

Duplicate Analysis - 600-377 Waste Site

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J11714	1/6/2014	8510	M	6.69	3.87		0.492		0.100		0.803		0.0984
Duplicate of J11714	J11715	1/6/2014	9270	M	7.39	3.40		0.544		84.2		0.105		0.876

Analysis:

Duplicate Analysis	TDL	5	10	2	0.2
	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	8.5%		2.8%	
Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	

Duplicate Analysis - 600-377 Waste Site

Sampling Area	Sample Number	Sample Date	Boron			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J11714	1/6/2014	1.17	B	0.984	3470	M	7.87	13.0	M	0.148	9.77	D	0.738
Duplicate of J11714	J11715	1/6/2014	1.21	B	1.09	3710	M	8.70	14.1	M	0.163	9.93	D	0.816

Analysis:

Duplicate Analysis	TDL	2	100	1	2
	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		6.7%	8.1%	
Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	3/6/2014	Calc. No.:	0600X-CA-V0169	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	3/6/2014
Subject:	600-377 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 5 of 5	

Table 2. RPD Calculations for the 600-377 Waste Site. (2 pages)

Duplicate Analysis - 600-377 Waste Site

Sampling Area	Sample Number	Sample Date	Copper			Iron			Lead			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J11714	1/6/2014	17.9		0.295	22400	M	7.87	9.35	D	1.62	4560		8.36
Duplicate of J11714	J11715	1/6/2014	19.7		0.326	23500	M	8.70	10.0	D	1.79	4800		9.24

Analysis:

Duplicate Analysis	TDL	1	5	5	75
	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	9.6%	4.8%		5.1%
Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	

Duplicate Analysis - 600-377 Waste Site

Sampling Area	Sample Number	Sample Date	Manganese			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J11714	1/6/2014	379		0.197	0.314	B	0.197	11.6		0.148	1990	M	6.30
Duplicate of J11714	J11715	1/6/2014	405		0.217	0.465	B	0.217	12.6		0.163	2210	M	6.96

Analysis:

Duplicate Analysis	TDL	5	2	4	400
	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	6.6%			
Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	

Duplicate Analysis - 600-377 Waste Site

Sampling Area	Sample Number	Sample Date	Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J11714	1/6/2014	491	MNJ	1.48	157		6.89	54.0	D	0.492	48.2	D	1.97
Duplicate of J11714	J11715	1/6/2014	481	MNJ	1.63	168		7.61	56.3	D	0.544	50.0	D	2.17

Analysis:

Duplicate Analysis	TDL	2	50	2.5	1
	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	2.1%		4.2%	3.7%
Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	

Duplicate Analysis - 600-377 Waste Site

Sampling Area	Sample Number	Sample Date	TPH - diesel range			TPH - motor oil (high boiling)			Aroclor-1260		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
COMP-1	J11714	1/6/2014	3230	J	2350	16000		2350	33.1	D	6.03
Duplicate of J11714	J11715	1/6/2014	4830	J	2370	22800		2370	38.6	D	6.07

Analysis:

Duplicate Analysis	TDL	5000	5000	20
	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD			
Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	

CONCLUSION:

The calculations in Tables 1 and 2 demonstrate that the 600-377 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.

600-377 Waste Site Verification Sample Results (Metals and TPH)

LOCATION	HEIS Number	Sample Date	Aluminum		Antimony		Arsenic		Barium		Beryllium	
			mg/kg	Q	PQL	Q	PQL	mg/kg	Q	PQL	mg/kg	Q
COMP-1	J1T714	1/6/2014	8510	M	6.69	DU	1.62	DU	3.87	0.492	81.9	0.100
Duplicate of J1T714	J1T715	1/6/2014	9270	M	7.39	DU	1.79	DU	3.40	0.544	84.2	0.105
Equipment Blank	J1T716	1/6/2014	233	M	6.69	U	0.325	U	1.58	0.492	162	0.0903

LOCATION	HEIS Number	Sample Date	Boron		Cadmium		Calcium		Chromium		Cobalt	
			mg/kg	Q	PQL	Q	PQL	mg/kg	Q	PQL	mg/kg	Q
COMP-1	J1T714	1/6/2014	1.17	B	0.984	U	0.0984	3470	M	7.87	13.0	0.148
Duplicate of J1T714	J1T715	1/6/2014	1.21	B	1.09	B	0.109	3710	M	8.70	14.1	0.163
Equipment Blank	J1T716	1/6/2014	0.984	U	0.984	U	0.0984	45.7	M	7.87	0.297	0.148

LOCATION	HEIS Number	Sample Date	Copper		Iron		Lead		Magnesium		Manganese	
			mg/kg	Q	PQL	Q	PQL	mg/kg	Q	PQL	mg/kg	Q
COMP-1	J1T714	1/6/2014	17.9	U	0.295	M	7.87	9.35	D	1.62	4560	8.36
Duplicate of J1T714	J1T715	1/6/2014	19.7	U	0.326	M	8.70	10.0	D	1.79	4800	9.24
Equipment Blank	J1T716	1/6/2014	0.853	B	0.295	M	7.87	0.559	B	0.325	69.6	8.37

LOCATION	HEIS Number	Sample Date	Mercury		Molybdenum		Nickel		Potassium		Selenium	
			mg/kg	Q	PQL	Q	PQL	mg/kg	Q	PQL	mg/kg	Q
COMP-1	J1T714	1/6/2014	0.00592	BUJ	0.00405	B	0.197	11.6	0.148	1990	M	6.3
Duplicate of J1T714	J1T715	1/6/2014	0.00421	U	0.00421	B	0.217	12.6	0.163	2210	M	6.96
Equipment Blank	J1T716	1/6/2014	0.00398	U	0.00398	U	0.197	0.735	CUJ	91.4	M	6.3

LOCATION	HEIS Number	Sample Date	Silicon		Silver		Sodium		Vanadium		Zinc	
			mg/kg	Q	PQL	Q	PQL	mg/kg	Q	PQL	mg/kg	Q
COMP-1	J1T714	1/6/2014	491	MNJ	1.48	U	0.0984	157	6.89	54.0	D	48.2
Duplicate of J1T714	J1T715	1/6/2014	481	MNJ	1.63	U	0.109	168	7.61	56.3	D	50.0
Equipment Blank	J1T716	1/6/2014	123	MNJ	1.48	U	0.0984	6.89	U	2.91	0.0984	3.42

LOCATION	HEIS Number	Sample Date	TPH - diesel range		TPH - motor oil (high boiling)		
			ug/kg	Q	PQL	Q	PQL
COMP-1	J1T714	1/6/2014	3230	J	2350	16000	2350
Duplicate of J1T714	J1T715	1/6/2014	4830	J	2370	22800	2370

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B = estimated result, result is less than the PL but greater than the MDL
 C = analyte has been confirmed by GC/MS analysis.
 COMP = composite
 D = results are reported from a diluted aliquot of sample.
 HEIS = Hanford Environmental Information System
 J = estimated result, analyte was detected at a value less than the contract RDL, but greater than or equal to MDL.
 M = sample duplicate precision not met.
 N = spike sample recovery is outside control limits.
 * = duplicate analysis not within control limits.
 PAH = polycyclic aromatic hydrocarbons
 PCB = polychlorinated biphenyls
 PQL = practical quantitation limit
 Q = qualifier
 TPH = total petroleum hydrocarbons
 U = undetected

600-377 Waste Site Verification Sample Results (Organics).

LOCATION	CLASS	J1T714, COMP-1			J1T715, Duplicate of J1T714		
		7/23/2013			7/23/2013		
		ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	5.43	U	5.43	5.45	U	5.45
Acenaphthylene	PAH	5.43	U	5.43	5.45	U	5.45
Anthracene	PAH	1.81	U	1.81	1.82	U	1.82
Benzo(a)anthracene	PAH	0.579	U	0.579	0.581	U	0.581
Benzo(a)pyrene	PAH	0.579	U	0.579	0.581	U	0.581
Benzo(b)fluoranthene	PAH	0.579	U	0.579	0.581	U	0.581
Benzo(ghi)perylene	PAH	0.579	U	0.579	0.581	U	0.581
Benzo(k)fluoranthene	PAH	0.289	U	0.289	0.291	U	0.291
Chrysene	PAH	0.579	U	0.579	0.581	U	0.581
Dibenz[a,h]anthracene	PAH	0.579	U	0.579	0.581	U	0.581
Fluoranthene	PAH	0.579	U	0.579	0.581	U	0.581
Fluorene	PAH	5.43	U	5.43	5.45	U	5.45
Indeno(1,2,3-cd)pyrene	PAH	0.579	U	0.579	0.581	U	0.581
Naphthalene	PAH	5.43	U	5.43	5.45	U	5.45
Phenanthrene	PAH	5.43	U	5.43	5.45	U	5.45
Pyrene	PAH	0.579	U	0.579	0.581	U	0.581
Aroclor-1016	PCB	6.03	DU	6.03	6.07	DU	6.07
Aroclor-1221	PCB	6.03	DU	6.03	6.07	DU	6.07
Aroclor-1232	PCB	6.03	DU	6.03	6.07	DU	6.07
Aroclor-1242	PCB	6.03	DU	6.03	6.07	DU	6.07
Aroclor-1248	PCB	6.03	DU	6.03	6.07	DU	6.07
Aroclor-1254	PCB	6.03	DU	6.03	6.07	DU	6.07
Aroclor-1260	PCB	33.1	D	6.03	38.6	D	6.07

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APPENDIX B
DATA QUALITY ASSESSMENT

APPENDIX B

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 (SAP)* (DOE-RL 2009).

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

Verification sample data collected at the 600-377 waste site were provided by the laboratories in sample delivery group SDG XP0033. SDG XP0033 was submitted for third-party validation. No major deficiencies were noted for these data sets. Minor deficiencies are discussed for the 600-377 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 XP0033

This SDG comprises one composite soil sample (J1T714) collected from the 600-377 waste site excavation. This SDG includes one field duplicate pair (J1T714/J1T715). 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 (J1T716) was collected and analyzed for ICP metals and mercury. SDG XP0033 was submitted for third-party validation. Minor deficiencies are as follows.

In the ICP metals analysis, chromium and nickel were detected in the method blank (MB) and in sample J1T716 at similar concentrations. Third-party validation qualified chromium and nickel results as estimated nondetected with "UJ" flags. The data are usable for decision-making purposes.

In the ICP metals analysis, mercury was detected in the MB and in sample J1T714. The result for sample J1T714 was less than five times that found in the MB. Third-party validation qualified the mercury result in sample J1T714 as estimated nondetected with “UJ” flags. The data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recovery for silicon (46.5%) is outside the quality control (QC) limits. Third-party validation qualified all silicon results for SDG KP0033 as estimated 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 (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 B-1. The main and QA/QC sample results are presented in Appendix A.

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

Sample Area	Main Sample	Duplicate Sample
600-377 waste site excavation	J1T714	J1T715

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern (COPC). 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 A 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 A) 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 600-377 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 600-377 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes.

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

REFERENCES

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