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

JAN 0 9 2014

14-AMRP-0081

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 600-372, SEGMENT 4 OIL STAINS AND FILTER AREAS WASTE SITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2013-091 and supporting, "Remaining Sites Verification Package for the 600-372, Segment 4 Oil Stains and Filter Areas," 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, Federal Project Director
for the River Corridor Closure Project

AMRC:ETG

Attachment

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

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

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WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-2 **Control No.:** 2013-091

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

600-372, Segment 4 Oil Stains and Filter Areas
600-372:1, Segment 4 Oil Stain and Filter Area #1a
600-372:2, Segment 4 Oil Stain and Filter Area #1b

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 600-372, Segment 4 Oil Stains and Filter Areas waste site, located in the 100-IU-2 Operable Unit of the Hanford Site, consisted of two areas that had discarded oil filters and were devoid of vegetation. This waste site comprised two subsites: 600-372:1, Segment 4 Oil Stain and Filter Area #1a, and 600-372:2, Segment 4 Oil Stain and Filter Area #1b. Both of the 600-372:1 and 600-372:2 subsites are addressed in this waste site reclassification form and are discussed further as the 600-372 waste site. The site is located northeast of the intersection of Route 2N and H Avenue in the vicinity of the former White Bluffs townsite. The 600-372 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 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* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2009).

Remediation of the 600-372 waste site was performed on July 18 and September 10 and 11, 2013. The remediation resulted in approximately 26 bank cubic meters (34 bank cubic yards) of material being removed and disposed at the Environmental Restoration Disposal Facility (ERDF). Cleanup verification sampling was performed on July 23 and September 17, 2013, to determine if the waste site meets remedial action objectives (RAOs) and remedial action goals (RAGs) established by the Remaining Sites ROD (EPA 1999) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Areas* (100 Area RDR/RAWP), DOE/RL-97-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2009). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at ERDF at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-372 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 600-372, Segment 4 Oil Stains and Filter Areas Waste Site* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-2 **Control No.:** 2013-091

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

600-372, Segment 4 Oil Stains and Filter Areas
600-372:1, Segment 4 Oil Stain and Filter Area #1a
600-372:2, Segment 4 Oil Stain and Filter Area #1b

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	J P Neath	12/12/13
DOE Federal Project Director (printed)	Signature	Date
N/A		
Ecology Project Manager (printed)	Signature	Date
C. Guzzetti		12/18/13
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-372, SEGMENT 4 OIL STAINS AND FILTER AREAS WASTE SITE

Attachment to Waste Site Reclassification Form 2013-091

December 2013

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-372, SEGMENT 4 OIL STAINS AND FILTER AREAS WASTE SITE

EXECUTIVE SUMMARY

The 600-372 waste site is part of the 100-IU-2 Operable Unit and consisted of two areas that had discarded oil filters and were devoid of vegetation. 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 2013a) 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* (100 Area ESD) (EPA 2009).

Remediation of the 600-372 waste site occurred on July 18 and September 10 and 11, 2013, and resulted in approximately 26 bank cubic meters (34 bank cubic yards) of soil and debris being removed for disposal at the Environmental Restoration Disposal Facility (ERDF). No overburden soil was stockpiled to be used as backfill. Following remediation, verification sampling was performed for the 600-372 waste site on July 23 and September 17, 2013. These results indicated that residual contaminant concentrations met the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 600-372 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).

In accordance with this evaluation, the verification sampling results support a reclassification of the 600-372 waste site to interim closed out. The current site conditions achieve the RAOs and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (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 600-372 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.

Table ES-1. Summary of Remedial Action Goals for the 600-372 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 600-372 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient is (1.4×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	All individual carcinogens have an excess risk below 1×10^{-6}.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The cumulative excess cancer risk (1.8×10^{-8}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 600-372 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 residual concentrations of contaminants exceeded the soil RAGs for the protection of groundwater and/or the Columbia River. Therefore, residual concentrations achieve the remedial action goals for groundwater and river protection.	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and 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

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 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 cadmium, 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 the Columbia River corridor portion of the Hanford Site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-372, SEGMENT 4 OIL STAINS AND FILTER AREAS WASTE SITE

STATEMENT OF PROTECTIVENESS

The 600-372, Segment 4 Oil Stains and Filter Areas waste site verification sampling data, site evaluations, and supporting documentation demonstrate that the waste site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 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 600-372 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 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 cadmium, 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 the Columbia River corridor portion of the Hanford Site.

GENERAL SITE INFORMATION AND BACKGROUND

The 600-372 waste site is located within the 100-IU-2 Operable Unit. The 600-372 waste site consisted of two areas that had discarded oil filters and were devoid of vegetation. The 600-372:1 and 600-372:2 subsites are reported in the *100-F/IU-2/IU-6 Area-Segment 4 Orphan Sites Evaluation Report* (WCH 2011) under orphan site evaluation (OSE) identification numbers SG4-150 and SG4-155, respectively. There is no process history associated with the 600-372 waste site. The 600-372:1 and 600-372:2 subsites are both located northeast of the intersection of Route 2 North and H Avenue in the vicinity of the former White Bluffs townsite,

and are centered at Washington State Plane coordinates N 150323.91, E 578666.74, and N 150315.88, E 578082.80, respectively (Figure 1).

Geophysical Survey

The objective of the geophysical survey was to determine if any utilities were located in the area of the 600-372 waste site. The geophysical interpretation maps for the 600-372:1 and 600-372:2 subsites are included in Figures 2 and 3. No subsurface geophysical anomalies were identified by the geophysical investigation.

Waste Characterization Sampling

Waste characterization sampling was performed for waste disposal purposes. The resulting data was used to support the determination of the contaminants of potential concern for waste at the 600-372 site and to guide remedial efforts. The waste characterization sampling data are included in Appendix A.

REMEDIAL ACTION SUMMARY

The 600-372 waste site was recommended for remediation without confirmatory sampling based on the observed presence of stained soils, stressed vegetation, and barren ground at this site (WCH 2013c).

Remedial Action

Remediation of the 600-372 waste site occurred on July 18 and September 10 and 11, 2013, and resulted in approximately 26 bank cubic meters (34 bank cubic yards) of soil and debris being removed for disposal at the Environmental Restoration Disposal Facility (ERDF). Waste materials included oil filters and the underlying stained soil. All waste site materials were direct loaded, and no soil staging pile area or overburden areas were utilized. The waste site was excavated to an approximate depth of 0.6 m (2 ft). Photographs of the 600-372 waste site excavations are included in Figures 4 and 5.

Figures 6 and 7 show the walkaround boundaries of the 600-372:1 and 600-372:2 subsites, performed following remediation of the 600-372 waste site.

VERIFICATION SAMPLING ACTIVITIES

Verification sampling was performed at the 600-372 waste site on July 23 and September 17, 2013. Sampling was conducted to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999).

Figure 1. The 600-372 Waste Site Location Map.

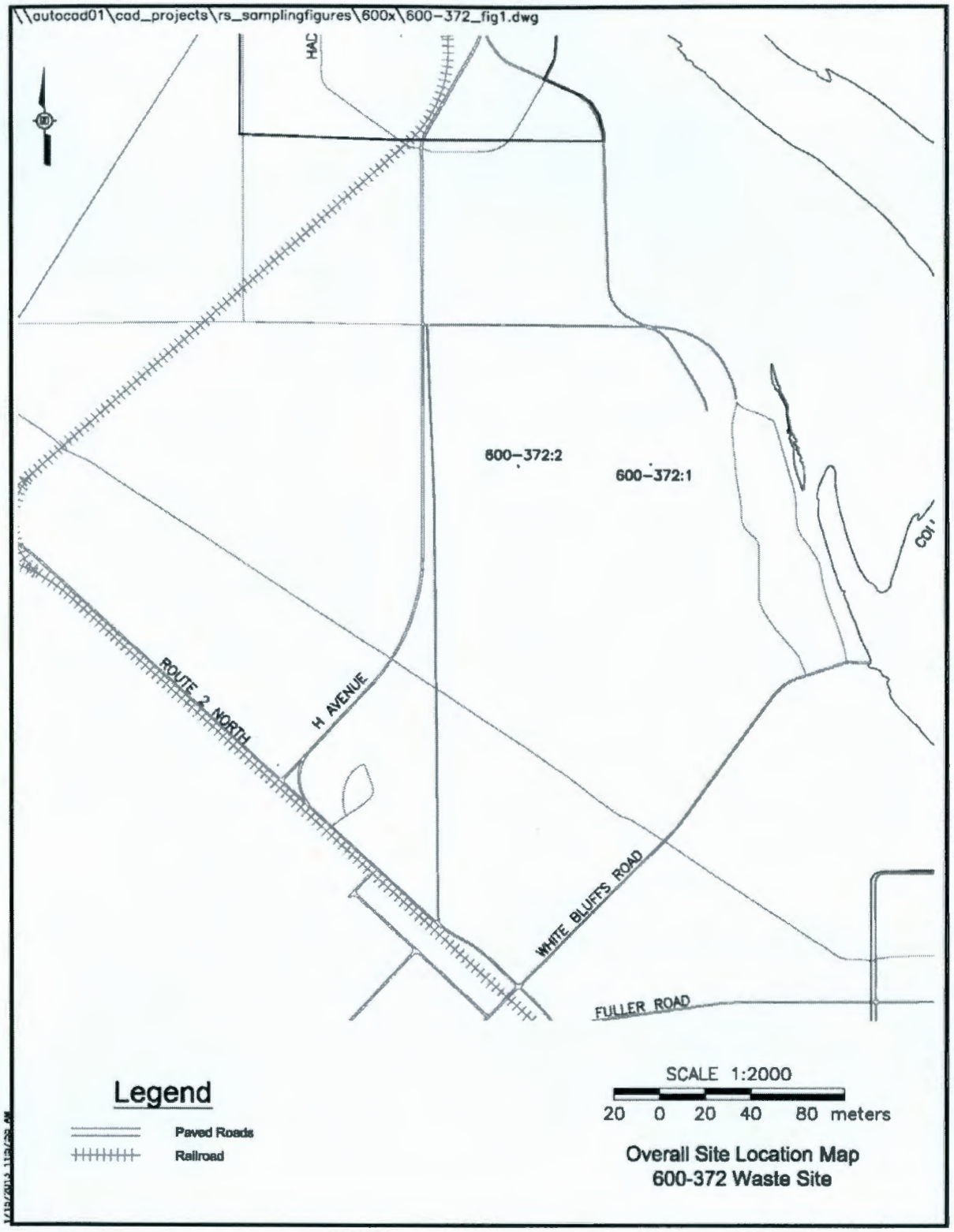


Figure 2. Geophysical Interpretation Map for the 600-372:1 Subsite.

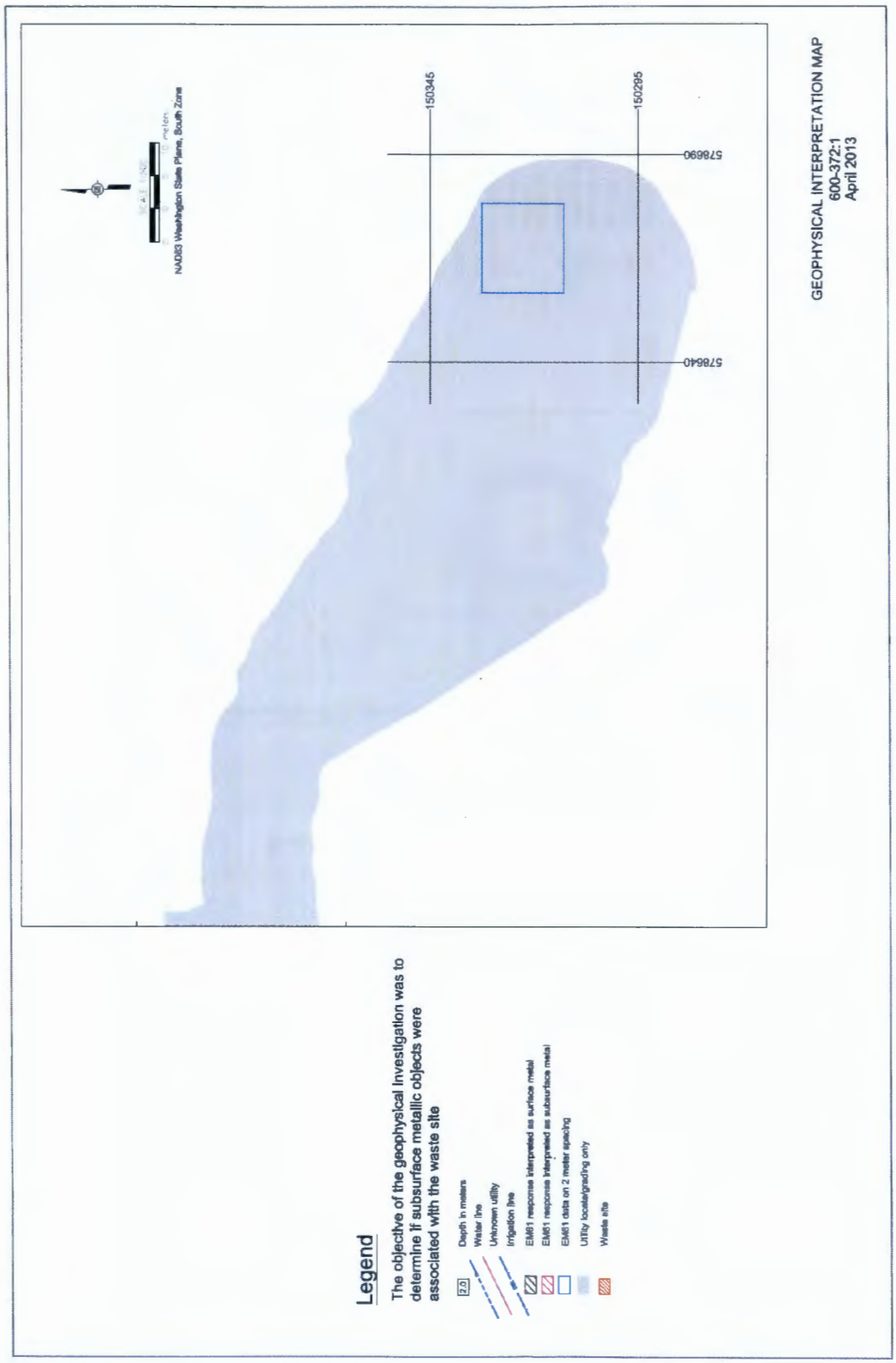


Figure 3. Geophysical Interpretation Map for the 600-372:2 Subsite.

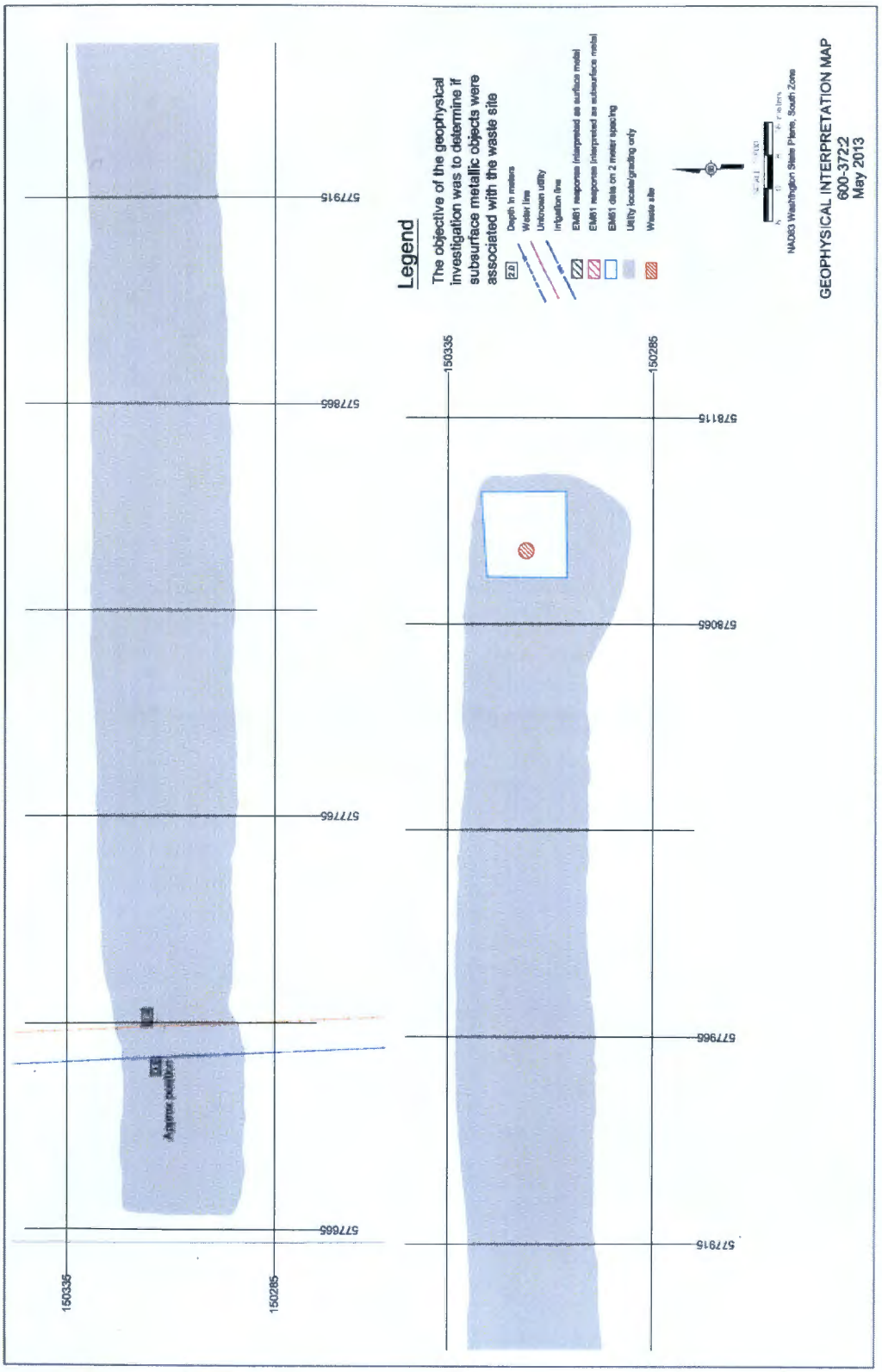


Figure 4. Photograph of the 600-372:1 Subsite Excavation Looking South (July 22, 2013).

Figure 5. Photograph of the 600-372:2 Subsite Excavation (September 11, 2013).

Figure 6. The 600-372:1 Waste Site Post-Excavation Boundary.

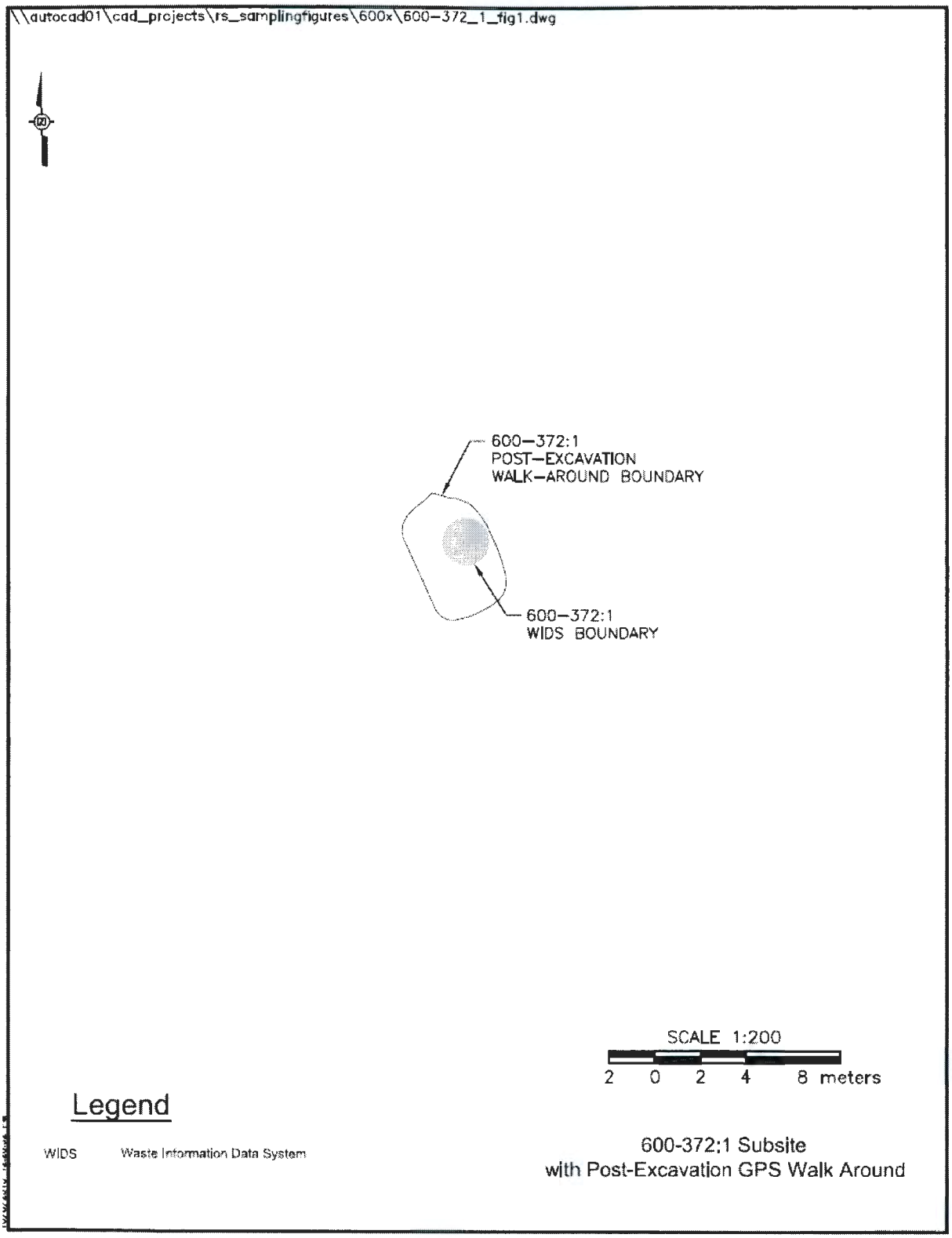
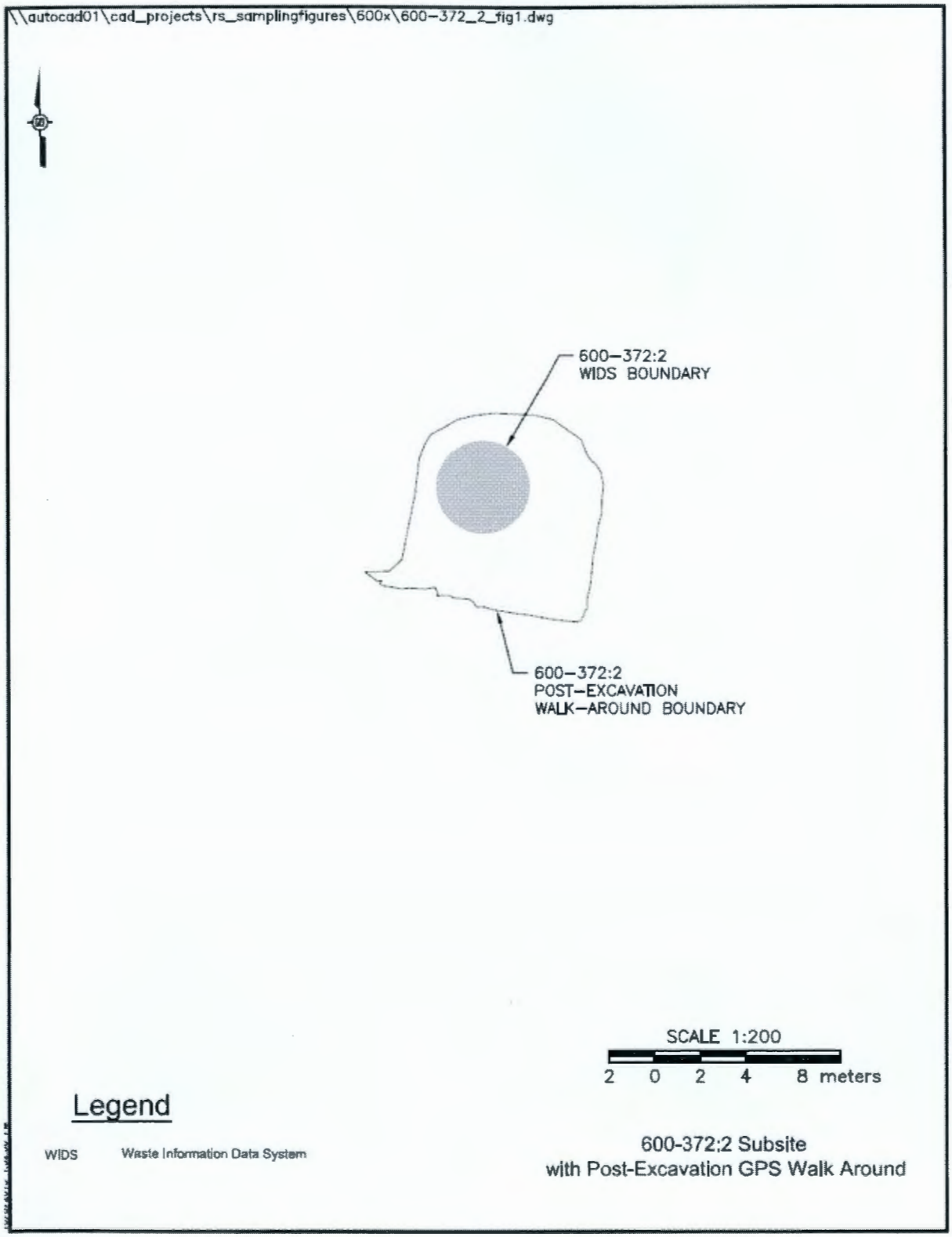


Figure 7. The 600-372:2 Waste Site Post-Excavation Boundary.



The verification sample results are provided in Appendix B and indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 600-372 waste site. The following subsections provide additional discussion of the information used to develop the verification sampling design. The maximum results of verification sampling are summarized to support interim closure of the site.

A more detailed discussion of the verification sampling can be found in the *Work Instruction for Verification Sampling of the 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).

Contaminants of Potential Concern

The COPCs identified for the 600-372 waste site were based on field observations, the results of waste characterization sampling, and the waste site description and included inductively coupled plasma (ICP) metals, mercury, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH). Analytes that were detected near or above RAGs during waste characterization sampling (Appendix A) were included as COPCs for verification sampling. The COPCs for verification sampling and the laboratory analytical methods are identified in Table 2. Radionuclides are not identified as COPCs for the 600-372 waste site.

Table 2. 600-372 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. All sampling was performed in accordance with the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009a). The number of composite samples was determined based on the size of the remediated area of the waste site in accordance with 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 - 1000 m^2	Four composite samples (quadrants)
>1,000 m^2	Statistical design using Visual Sample Plan

Source: WCH (2013d).

The 600-372:1 excavation resulted in a total excavated surface area of 16.5 m^2. The 600-372:2 total excavated area was 65.2 m^2. Due to the relatively small excavation surface area (<100 m^2) of each subsite, one composite sample was collected from each of the 600-372:1 and 600-372:2 excavation footprints. Figures 6 and 7 show the waste site excavation footprints. Each composite sample consisted of the collection of 25 aliquots of soil distributed across the surface of each excavated area. 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 logbooks (WCH 2013a, 2013b). A summary of the verification samples collected and laboratory analyses performed is provided in Table 4.

Table 4. Sample Summary Table for the 600-372 Waste Site.

Sample Location	HEIS Number	Sample Analysis
600-372:1	J1RVK3	ICP metals, mercury, PAH, PCBs, TPH
600-372:2	J1T118	
Duplicate of J1RVK3	J1RVK4	
Equipment blank	J1RVK2	ICP metals [a], mercury

[a] Analysis 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 in the analytical results package.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

Verification Sample Results

All verification samples were analyzed using analytical methods approved by EPA (DOE-RL 2009b). Evaluation of the verification data from the 600-372 waste site was performed by direct comparison of the maximum sample results for each COPC against cleanup criteria. The complete data set is provided in the *600-372 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation* in Appendix B.

Comparisons of the results for site COPCs with the RAGs for the 600-372 waste site are provided in Table 5.

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 2012) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in this table. The laboratory-reported data results for all constituents are stored in a Washington Closure Hanford (WCH) project-specific database prior to archival in the Hanford Environmental Information System, and are presented in an attachment to the relative percent difference calculation in Appendix B.

VERIFICATION SAMPLE DATA EVALUATION

This section demonstrates that contaminant concentrations at the 600-372 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 RDR/RAWP (DOE-RL 2009b).

Nonradionuclide Soil RAGs for Direct Exposure and Groundwater and River Protection Attained

Evaluation of the verification sampling results in Table 5 shows that all direct exposure, groundwater protection, and Columbia River protection RAGs are met for the 600-372 waste site. No verification sample analyses exceeded soil RAGs.

Table 5. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-372 Excavation Verification Sampling Data.

COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Maximum Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	5.36 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	92.8 (<BG)	5,600	200	400	No	--
Beryllium	0.549 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Boron [d]	1.99	7,200	320	-- [e]	No	--
Cadmium [f]	0.422 (<BG)	13.9 [c]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	13.5 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	8.12 (<BG)	24	15.7 [b]	-- [e]	No	--
Copper	14.0 (<BG)	2,960	59.2	22.0 [b]	No	--
Lead	10.0 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	359 (<BG)	3,760	512 [b]	512 [b]	No	--
Molybdenum [d]	0.430	400	8	-- [e]	No	--
Nickel	12.1 (<BG)	1,600	19.1 [b]	27.4	No	--
Silver	0.308 (<BG)	400	8	0.73 [b]	No	--
Vanadium	53.2 (<BG)	560	85.1 [b]	-- [e]	No	--
Zinc	46.3 (<BG)	24,000	480	67.8 [b]	No	--
TPH – motor oil	18.1	200	200	200	No	--
Benzo(a)anthracene	0.00194	1.37	0.015 [g]	0.015 [g]	No	--
Benzo(a)pyrene	0.00205	0.137	0.015 [g]	0.015 [g]	No	--
Benzo(b)fluoranthene	0.00140	1.37	0.015 [g]	0.015 [g]	No	--
Benzo(ghi)perylene [h]	0.00107	2,400	48	192	No	--
Chrysene	0.00180	13.7	0.12	0.1 [g]	No	--
Fluoranthene	0.00240	3,200	64	18.0	No	--
Pyrene	0.00329	2,400	48	192	No	--

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

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

[c] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3), 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

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

[e] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).

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

[g] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).

[h] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: benzo(ghi)perylene; surrogate: pyrene

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 600-372 waste site was determined by calculation of the hazard quotient and excess carcinogenic risk values for direct contact (Appendix B). 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 600-372 waste site in Appendix B using the highest of the maximum value. 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 600-372 waste site is 1.4×10^{-3}, and the cumulative excess carcinogenic risk value is 1.8×10^{-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 2013d), the field logbooks (WCH 2013a, 2013b), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 600-372 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 a WCH project-specific database for data evaluation prior to archival in the Hanford Environmental Information System and are summarized in an attachment to the relative percent difference calculation in Appendix B. The detailed DQA is presented in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 600-372 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2009b). Verification sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at this site met the RAGs and associated RAOs for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-372 waste site to Interim Closed Out. The 600-372 waste site contamination did 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.

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APPENDIX A

WASTE CHARACTERIZATION SAMPLING RESULTS

Table A-1. 600-372 Waste Site Characterization Data - Quick Turn Metals. (1 Page)

Sample Location	HEIS Number	Sample Date	Arsenic			Barium			Beryllium			Cadmium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-372:1	J1RFP1	2/21/13	2.42	U	10.1	79.7		2.01	0.265		0.101	0.206	U	2.01
600-372:2	J1RFP0	2/21/13	1.86	U	9.95	78.2		1.99	0.218		0.0995	0.247	U	1.99

Sample Location	HEIS Number	Sample Date	Chromium			Lead			Selenium			Silver		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-372:1	J1RFP1	2/21/13	8.98	U	10.1	8.79	U	10.1	-0.391	U	10.1	-0.0433	U	10.1
600-372:2	J1RFP0	2/21/13	8.12	U	9.95	8.01	U	9.95	0.382	U	9.95	-0.0696	U	9.95

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:

600-372 Waste Site Relative Percent Difference and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0600X-CA-V0149, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: IU 2/6 Area

Discipline: Environmental Calculation No: 0600X-CA-V0149

Subject: 600-372 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 5 Attachment = 2 Total = 8	N. K. Schiffern N K Schiffern	J. D. Skoglie	I. B. Berezovskiy I B Berezovskiy	D. F. Obenauer D. F. Obenauer	12/3/13

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/9/2013	Calc. No.:	0600X-CA-V0149	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	10/9/2013
Subject:	600-372 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 5	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 600-372 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 the 600-372 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 Area,* 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, 2013, *Remaining Sites Verification Package for the 600-372, Segment 4 Oil Stain and Filter Areas*, Attachment to Waste Site Reclassification Form 2013-091, 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:	N. K. Schiffern	Date:	10/8/2013	Calc. No.:	0600X-CA-V0149	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	10/8/2013
Subject:	600-372 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 600-372 waste site underwent verification composite sampling at two locations including one duplicate sample. The direct contact hazard quotient and carcinogenic risk calculations for the 600-372 waste site were conservatively calculated using the maximum results from the sample results in Attachment 1. Of the contaminants of potential concern (COPCs) and other analytes for this site, boron, molybdenum, and 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 (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 boron is 1.99 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 2.8×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values for COPCs is 1.4×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for benzo(a)anthracene is 0.00194 mg/kg, divided by 1.37 mg/kg, and multiplied as indicated, is 1.4×10^{-9}. 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 1.8×10^{-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:	N. K. Schiffern NS	Date:	10/8/2013	Calc. No.:	0600X-CA-V0149	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	J. D. Skoglie JS	Date:	10/8/2013
Subject:	600-372 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 cleanup verification of 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 600-372 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 600-372 waste site.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/8/2013	Calc. No.:	0600X-CA-V0149	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	10/8/2013
Subject:	600-372 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 600-372 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	1.99	7,200	2.8E-04	--	--
Molybdenum	0.430	400	1.1E-03	--	--
Polycyclic Aromatic Hydrocarbons					
Benzo(a)anthracene	0.00194	--	--	1.37	1.4E-09
Benzo(a)pyrene	0.00205	--	--	0.137	1.5E-08
Benzo(b)fluoranthene	0.00140	--	--	1.37	1.0E-09
Benzo(ghi)perylene [c]	0.00107	2,400	4.5E-07	--	--
Chrysene	0.00180	--	--	13.7	1.3E-10
Fluoranthene	0.00240	3,200	7.5E-07	--	--
Pyrene	0.00329	2,400	1.4E-06	--	--
Total Petroleum Hydrocarbons					
TPH - motor oil (high boiling) [d]	18.1	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**1.4E-03**		
Cumulative Excess Cancer Risk:					**1.8E-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 benzo(g,h,i)perylene is not available. The cleanup levels are based on use of surrogate chemical. 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. RPD Calculations for the 600-372 Waste Site. (2 pages)

Duplicate Analysis - 600-372 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
600-372:1	J1RVK3	7/23/2013	8520	NJ	6.91	4.79		0.508	89.1		0.102	0.426	B	0.102
Duplicate of J1RVK3	J1RVK4	7/23/2013	8660	NJ	6.84	5.36		0.503	92.8		0.101	0.429	B	0.101

Analysis:

TDL		5	10	2	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	1.6%		4.1%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable

Duplicate Analysis - 600-372 Waste Site

Sampling Area	Sample Number	Sample Date	Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-372:1	J1RVK3	7/23/2013	1.77	B	1.02	0.422	B	0.102	3380		8.13	12.7		0.152
Duplicate of J1RVK3	J1RVK4	7/23/2013	1.99	B	1.01	0.345	B	0.101	3310		8.05	13.5		0.151

Analysis:

TDL		2	0.2	100	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD			2.1%	6.1%
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	Not applicable

Washington Closure Hanford, Inc. CALCULATION SHEET

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Project:	600 Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	10/8/2013
Subject:	600-372 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 600-372 Waste Site. (2 pages)

Duplicate Analysis - 600-372 Waste Site

Sampling Area	Sample Number	Sample Date	Cobalt			Copper			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-372:1	J1RVK3	7/23/2013	8.10	D	1.52	14.0		0.305	22100		8.13	9.38	BD	3.35
Duplicate of J1RVK3	J1RVK4	7/23/2013	8.12	D	1.51	13.8		0.302	22200		8.05	10.0	BD	3.32

Analysis:

TDL		2	1	5	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		1.4%	0.5%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable

Duplicate Analysis - 600-372 Waste Site

Sampling Area	Sample Number	Sample Date	Magnesium			Manganese			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-372:1	J1RVK3	7/23/2013	4680		8.63	359		0.203	11.6		0.152	1970		6.50
Duplicate of J1RVK3	J1RVK4	7/23/2013	4700		8.55	348		0.201	12.1		0.151	1970		6.44

Analysis:

TDL		75	5	4	400
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	0.4%	3.1%		
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable

Duplicate Analysis - 600-372 Waste Site

Sampling Area	Sample Number	Sample Date	Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-372:1	J1RVK3	7/23/2013	339	NJ	1.52	0.308	B	0.102	134		7.11	53.2	D	1.02
Duplicate of J1RVK3	J1RVK4	7/23/2013	340	NJ	1.51	0.292	B	0.101	127		7.04	53.0	D	1.01

Analysis:

TDL		2	0.2	50	2.5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	0.3%			0.4%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 600-372 Waste Site

Sampling Area	Sample Number	Sample Date	Zinc			TPH - motor oil (high boiling)			Benzo(a)pyrene			Benzo(b)fluoranthene		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
600-372:1	J1RVK3	7/23/2013	46.3	D	4.06	5600	J	2200	0.979	J	0.541	0.753	J	0.541
Duplicate of J1RVK3	J1RVK4	7/23/2013	45.7	D	4.02	6640	J	2190	2.05		0.540	1.40	J	0.540

Analysis:

TDL		1	5000	15	15
Duplicate Analysis	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	1.3%			
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable

Duplicate Analysis - 600-372 Waste Site

Sampling Area	Sample Number	Sample Date	Benzo(ghi)perylene			Fluoranthene			Pyrene		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
600-372:1	J1RVK3	7/23/2013	0.600	JX	0.541	0.972	J	0.541	1.01	J	0.541
Duplicate of J1RVK3	J1RVK4	7/23/2013	1.07	JX	0.540	2.40		0.540	3.29		0.540

Analysis:

TDL		15	15	15
Duplicate Analysis	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 600-372 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.

600-372 Waste Site Verification Sample Results (Metals and TPH).

LOCATION	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-372:1	J1RVK3	7/23/2013	8520	NJ	6.91	3.35	DU	3.35	4.79		0.508	89.1		0.102	0.426	B	0.102
Duplicate of J1RVK3	J1RVK4	7/23/2013	8660	NJ	6.84	3.32	DU	3.32	5.36		0.503	92.8		0.101	0.429	B	0.101
600-372:2	J1T118	9/17/2013	6080	*	6.88	1.67	DU	1.67	2.80	B	0.506	70.0		0.101	0.549		0.101
Equipment Blank	J1RVK2	7/23/2013	151	NJ	6.68	0.324	U	0.324	0.685	B	0.491	1.87		0.0982	0.0982	U	0.0982

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
600-372:1	J1RVK3	7/23/2013	1.77	B	1.02	0.422	B	0.102	3380		8.13	12.7		0.152	8.10	D	1.52
Duplicate of J1RVK3	J1RVK4	7/23/2013	1.99	B	1.01	0.345	B	0.101	3310		8.05	13.5		0.151	8.12	D	1.51
600-372:2	J1T118	9/17/2013	1.11	B	1.01	0.230	B	0.101	2620	*	8.09	10.0		0.152	6.27	D	0.759
Equipment Blank	J1RVK2	7/23/2013	0.982	U	0.982	0.0982	U	0.0982	47.9		7.86	0.147	U	0.147	0.147	U	0.147

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
600-372:1	J1RVK3	7/23/2013	14.0		0.305	22100		8.13	9.38	BD	3.35	4680		8.63	359		0.203
Duplicate of J1RVK3	J1RVK4	7/23/2013	13.8		0.302	22200		8.05	10.0	BD	3.32	4700		8.55	348		0.201
600-372:2	J1T118	9/17/2013	11.4		0.303	16500		8.09	3.71	BD	1.67	3270		8.60	284		0.202
Equipment Blank	J1RVK2	7/23/2013	0.295	U	0.295	360		7.86	0.554	BCUJ	0.324	24.7	B	8.35	6.45		0.196

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
600-372:1	J1RVK3	7/23/2013	0.00407	U	0.00407	0.203	U	0.203	11.6		0.152	1970		6.50	0.508	U	0.508
Duplicate of J1RVK3	J1RVK4	7/23/2013	0.00387	U	0.00387	0.201	U	0.201	12.1		0.151	1970		6.44	0.503	U	0.503
600-372:2	J1T118	9/17/2013	0.00422	U	0.00422	0.430	B	0.202	8.83	M	0.152	1240		6.47	0.316	DU	0.316
Equipment Blank	J1RVK2	7/23/2013	0.00393	U	0.00393	0.196	U	0.196	0.147	U	0.147	40.8		6.29	0.491	U	0.491

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
600-372:1	J1RVK3	7/23/2013	339	NJ	1.52	0.308	B	0.102	134		7.11	53.2	D	1.02	46.3	D	4.06
Duplicate of J1RVK3	J1RVK4	7/23/2013	340	NJ	1.51	0.292	B	0.101	127		7.04	53.0	D	1.01	45.7	D	4.02
600-372:2	J1T118	9/17/2013	402	*N	1.52	0.101	U	0.101	81.2		7.08	45.7	D	0.506	38.6	D	2.02
Equipment Blank	J1RVK2	7/23/2013	146	NJ	1.47	0.0982	U	0.0982	6.88	U	6.88	0.302	B	0.0982	1.52	CUJ	0.393

LOCATION	HEIS Number	Sample Date	TPH - diesel range			TPH - motor oil (high boiling)		
			ug/kg	Q	PQL	ug/kg	Q	PQL
600-372:1	J1RVK3	7/23/2013	2200	U	2200	5600	J	2200
Duplicate of J1RVK3	J1RVK4	7/23/2013	2190	U	2190	6640	J	2190
600-372:2	J1T118	9/17/2013	2320	U	2320	18100	B	2320

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Note: Gray cells indicate not applicable.

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

C = analyte has been confirmed by GC/MS analysis.

D = results are reported from a dilutied 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 equot 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

X = a false positive due to matrix interference and/or comparison to the DAD generated spectrum.

600-372 Waste Site Verification Sample Results (Organics).

LOCATION	CLASS	J1RVK3, 600-372:1			J1RVK4, Duplicate of J1RVK3			J1T118, 600-372:2		
		7/23/2013			7/23/2013			9/17/2013		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	5.07	U	5.07	5.06	U	5.06	5.32	U	5.32
Acenaphthylene	PAH	5.07	U	5.07	5.06	U	5.06	5.32	U	5.32
Anthracene	PAH	1.69	U	1.69	1.69	U	1.69	1.77	U	1.77
Benzo(a)anthracene	PAH	0.541	U	0.541	1.94		0.540	0.749	J	0.568
Benzo(a)pyrene	PAH	0.979	J	0.541	2.05		0.540	1.30	J	0.568
Benzo(b)fluoranthene	PAH	0.753	J	0.541	1.40	J	0.540	0.666	J	0.568
Benzo(ghi)perylene	PAH	0.600	JX	0.541	1.07	JX	0.540	0.875	J	0.568
Benzo(k)fluoranthene	PAH	0.270	U	0.270	0.270	U	0.270	0.284	U	0.284
Chrysene	PAH	0.541	U	0.541	1.80		0.540	0.949	J	0.568
Dibenz[a,h]anthracene	PAH	0.541	U	0.541	0.540	U	0.540	0.568	U	0.568
Fluoranthene	PAH	0.972	J	0.541	2.40		0.540	0.983	J	0.568
Fluorene	PAH	5.07	U	5.07	5.06	U	5.06	5.32	U	5.32
Indeno(1,2,3-cd)pyrene	PAH	0.541	U	0.541	0.540	U	0.540	0.568	U	0.568
Naphthalene	PAH	5.07	U	5.07	5.06	U	5.06	5.32	U	5.32
Phenanthrene	PAH	5.07	U	5.07	5.06	U	5.06	5.32	U	5.32
Pyrene	PAH	1.01	J	0.541	3.29		0.540	1.55	J	0.568
Aroclor-1016	PCB	1.13	U	1.13	1.13	U	1.13	1.19	U	1.19
Aroclor-1221	PCB	1.13	U	1.13	1.13	U	1.13	1.19	U	1.19
Aroclor-1232	PCB	1.13	U	1.13	1.13	U	1.13	1.19	U	1.19
Aroclor-1242	PCB	1.13	U	1.13	1.13	U	1.13	1.19	U	1.19
Aroclor-1248	PCB	1.13	U	1.13	1.13	U	1.13	1.19	U	1.19
Aroclor-1254	PCB	1.13	U	1.13	1.13	U	1.13	1.19	U	1.19
Aroclor-1260	PCB	1.13	U	1.13	1.13	U	1.13	1.19	U	1.19

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APPENDIX C

DATA QUALITY ASSESSMENT

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DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING DATA QUALITY ANALYSIS

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 2013c). 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 2013c), the field logbooks (WCH 2013a, 2013b), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical analysis (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 600-372 waste site were provided by the laboratory in two sample delivery groups (SDGs): SDG XP0002 and XP0014. The SDG XP0002 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 600-372 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

SDG XP0002

This SDG comprises one composite soil sample (J1RVK3) collected from the 600-372:1 subsite excavation. This SDG includes one field duplicate pair (J1RVK3/J1RVK4). 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 a field equipment blank sample (J1RVK2) was collected and analyzed for ICP metals and mercury. SDG XP0002 was submitted for third-party validation. Minor deficiencies are as follows:

In the ICP metals analysis, lead and zinc were detected in the method blank (MB). Due to MB contamination, third-party validation qualified all lead and zinc results in equipment blank sample J1RKV2 as undetected with "UJ" flags. The data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recoveries are out of project acceptance criteria for two analytes (aluminum [155%] and silicon [131%]). 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. Aluminum and silicon did not have mismatched spike and native concentrations in the MS. All aluminum and silicon results for SDG XP0002 were qualified as estimated by third-party validation with "J" flags. Estimated data are usable for decision-making purposes.

SDG XP0014

This SDG comprises one composite soil sample (J1T118) collected from the 600-372:2 subsite excavation. This sample was analyzed for ICP metals, mercury, TPH, PAH, and PCBs. Minor deficiencies are as follows:

In the PAH analysis, the MS and matrix spike duplicate recoveries were outside the laboratory quality control (QC) limits for anthracene, at 92.8% and 91.2%, respectively. The laboratory qualified anthracene result with a "T" flag. However, the MS recovery for anthracene is within the project QC limits; therefore, there is no significant impact to the data. The data are usable for decision-making purposes.

In the TPH analysis, contamination was detected at less than twice the method detection limit in the MB for motor oil. Therefore, there is no significant impact to the sample data. Data are usable for decision-making purposes.

In the ICP metals analysis, the relative percent difference (RPD) calculations for lead (50.3%) and silicon (68.1%) from the laboratory duplicate analyses were above the QC limits. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. Data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery is outside of the project acceptance criteria for silicon. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery form the sample. Although not qualified for MS recovery outside of QC limits, all silicon results may be considered estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbooks (WCH 2013a, 2013b), are the 600-372 primary and duplicate samples (J1RVK3/J1RVK4). The main and QA/QC sample results are presented in Appendix B.

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

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

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 600-372 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 600-372 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in the Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix B.

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