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

14-AMRP-0290

SEP 19 2014

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

Dear Ms. Hedges:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 600-382, SEGMENT 4 OIL STAINS AND FILTER AREA #3 WASTE SITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2014-026 and supporting, "Remaining Sites Verification Package for the 600-382, Segment 4 Oil Stains and Filter Area #3 Waste Site," Rev. 0. If you have questions, please contact me or your staff may contact Jamie Zeisloft, of my staff, at (509) 372-0188.

Sincerely,

Mark S. French, Director
River Corridor Division

AMRP:JHZ

Attachment

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

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

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-HR-2 **Control No.:** 2014-026

Waste Site Code(s)/Subsite Code(s): 600-382 (all subsites)

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 600-382, Segment 4 Oil Stains and Filter Area #3 waste site, part of the 100-HR-2 Operable Unit, consisted of five locations with discarded oil filters and soil staining devoid of vegetation. The five locations were divided into subsites 600-382:1, 600-382:2, 600-382:3, 600-382:4, and 600-382:5. All of the subsites are addressed in this waste site reclassification form and are discussed further as the 600-382 waste site. The 600-382 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 2012,* U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2013). The 600-382 waste site was subsequently recommended for remove, treat, and dispose without confirmatory sampling based on the observed presence of stained soils, stressed vegetation, and barren ground and was dispositioned as a "plug-in" site in accordance with the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (100 Area ESD) (EPA 2009).

Remediation of the 600-382 waste site was performed from October 29, 2013, through March 10, 2014. No anomalies were encountered during the remediation. A total of approximately 85 bank cubic meters (111 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 February 4 and March 12, 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 Areas* (100 Area RDR/RAWP), DOE/RL-97-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2009b). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at ERDF in the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-382 waste site to Interim Closed Out. The current site conditions achieve the RAOs and RAGs established by the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). The results of verification sampling do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The analytical results and rationale presented in the attached remaining sites verification package also demonstrate that residual contaminant concentrations meet direct exposure cleanup criteria and are protective of groundwater and the Columbia River. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in 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 600-382, Segment 4 Oil Stains and Filter Area #3 Waste Site* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-HR-2 **Control No.:** 2014-026

Waste Site Code(s)/Subsite Code(s): 600-382 (all subsites)

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	8/14/14
DOE Federal Project Director (printed)	Signature	Date
N. Menard KIM WELSCH FOR	KIM WELSCH FOR	8/20/14
Ecology Project Manager (printed)	Signature	Date
N/A		
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-382, SEGMENT 4 OIL STAINS AND FILTER AREA #3 WASTE SITE

Attachment to Waste Site Reclassification Form 2014-026

September 2014

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-382, SEGMENT 4 OIL STAINS AND FILTER AREA #3 WASTE SITE

EXECUTIVE SUMMARY

The 600-382, Segment 4 Oil Stains and Filter Area #3 waste site, part of the 100-HR-2 Operable Unit, consisted of five subsites with discarded oil filters and soil staining devoid of vegetation. The 600-382 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 2012* (DOE-RL 2013). The 600-382 waste site was subsequently recommended for remove, treat, and dispose without confirmatory sampling based on the observed presence of stained soils, stressed vegetation, and barren ground (WCH 2013) and was dispositioned as a "plug-in" site in accordance with the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington* (100 Area ESD) (EPA 2009).

Remediation of the 600-382 waste site was performed from October 29, 2013, through March 10, 2014. No anomalies were encountered during the remediation. Approximately 85 bank cubic meters (111 bank cubic yards) of contaminated soil and debris was removed and direct loaded for disposal at the Environmental Restoration Disposal Facility. No overburden soil was stockpiled to be used as backfill.

Following remediation, cleanup verification sampling was conducted on February 4 and March 12, 2014. For the 600-382:1 subsite, the initial sample and duplicate sample both failed the 100 Area remedial action goals (RAGs) for total petroleum hydrocarbons. After further remediation of the entire 600-382:1 subsite, the verification sample results indicated that residual contaminant concentrations of all of the subsites met the remedial action objectives (RAOs) and RAGs for the 600-382 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 600-382 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 600-382 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain a dose rate of <15 mrem/yr above background over 1,000 years.	Radionuclides were not COPCs for the 600-382 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 (8.6×10^{-4}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	Excess cancer risk values for individual nonradionuclide COPCs are $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk for all sampling areas (1.2×10^{-8}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 600-382 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.	All nonradionuclide COPCs were quantified at less than groundwater and Columbia River cleanup requirements.	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
MCL = maximum contaminant level
NA = not applicable
RAG = remedial action goal

In accordance with this evaluation, the verification sampling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs established in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; 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 (Appendix A). Those constituents exceeding the ecological screening level in *Washington Administrative Code* 173-340, "Model Toxics Control Act – Cleanup," were barium, mercury, 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 barium, manganese, mercury, vanadium, and zinc are below Hanford Site or Washington State background levels, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as a part of the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-382, SEGMENT 4 OIL STAINS AND FILTER AREA #3 WASTE SITE

STATEMENT OF PROTECTIVENESS

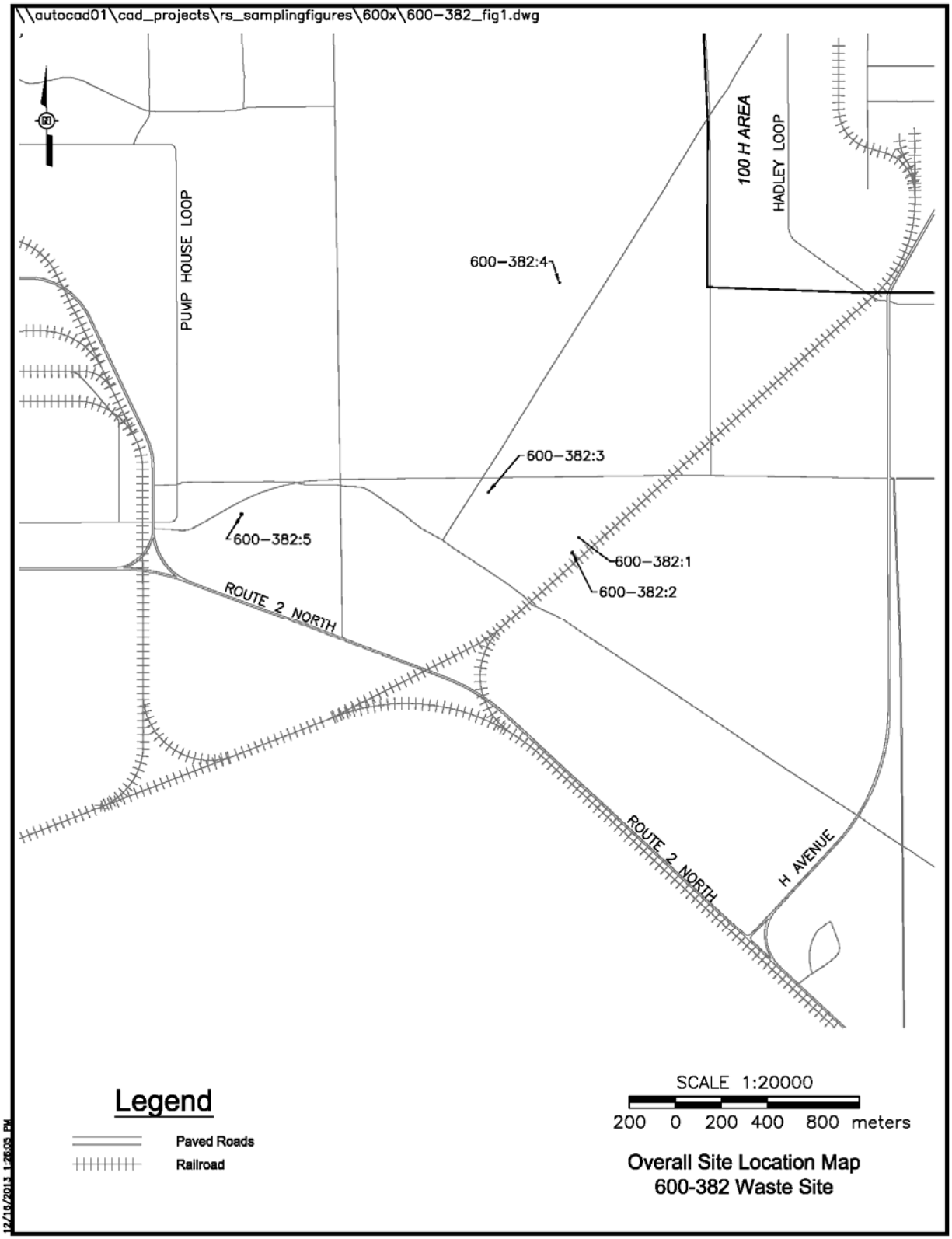
The 600-382, Segment 4 Oil Stains and Filter Area #3 waste site verification sampling data, site evaluations, and supporting documentation demonstrate that this waste site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 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 above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; 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 (Appendix A). Those constituents exceeding the ecological screening level in *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were barium, mercury, 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 barium, manganese, mercury, vanadium, and zinc are below Hanford Site or Washington State background levels, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as a part of the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 600-382 waste site, located within the 100-HR-2 Operable Unit, is reported in the Waste Information Data System (WIDS) general report as five locations that have discarded oil filters and ground staining devoid of vegetation. The 600-382 waste site has been divided into five subsites, and their locations are shown in Figure 1. The descriptions of each subsite are listed below. There is no process history associated with the 600-382 waste site.

Figure 1. The 600-382 Waste Site Location Map.



- **600-382:1, Segment 4 Oil Stains and Filter Area #3a** – Consisted of two oil filters surrounded by soil devoid of vegetation. The location is centered at Washington State Plane (WSP) coordinates N 150679.8, E 576315.9 (WIDS).

- **600-382:2, Segment 4 Oil Stains and Filter Area #3b** – Consisted of three oil filters and a small area of soil devoid of vegetation. The location is centered at WSP coordinates N 150613.7, E 576286.2 (WIDS).

- **600-382:3, Segment 4 Oil Stains and Filter Area #3c** – Consisted of an oil filter surrounded by soil devoid of vegetation. The location is centered at WSP coordinates N 150876.1, E 575923.4 (WIDS).

- **600-382:4, Segment 4 Oil Stains and Filter Area #3d** – Consisted of a 3-m^2 (32-ft^2) area devoid of vegetation containing discarded oil filters. The location is centered at WSP coordinates N 151788.5, E 576231.6 (WIDS).

- **600-382:5, Segment 4 Oil Stains and Filter Area #3e** – Consisted of three oil filters surrounded by soil devoid of vegetation. The location is centered at WSP coordinates N 150781.3, E 574850.4 (WIDS).

Waste Characterization Sampling

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

REMEDIAL ACTION SUMMARY

The 600-382 waste site was recommended for remediation without confirmatory sampling based on the observed presence of stained soils, stressed vegetation, and barren ground (WCH 2013).

Remediation of the 600-382 waste site was performed from October 29, 2013, through March 10, 2014. No anomalies were encountered during the remediation. Approximately 85 bank cubic meters (111 bank cubic yards) of excavated materials from the 600-382 waste site were removed and direct loaded for disposal at the Environmental Restoration Disposal Facility. The approximate depths of the excavations range from 0.3 m (1.0 ft) to 1.0 m (3.3 ft) below ground surface. A summary of the remediated subsites is provided in Table 1. Post-remediation photographs are provided in Figures 2 through 6. No waste staging pile area or overburden soil stockpiles are associated with the 600-382 waste site. Walkaround boundary surveys were conducted at each of the 600-382 subsites following their remediation. The boundary surveys are provided in Figures 7 through 11, along with the verification sample locations. The 600-382:1 verification sample location shown in Figure 7 appears to be on the side-slope of the excavation. However, the project analytical lead reported that none of the samples were taken on a side-slope (WCH 2014b).

Table 1. 600-382 Waste Site Remediation Summary.

Subsite	Remediation Date	Remediation Depth (bgs)	Volume of Material Removed	Anomalies
600-382:1	October 29, 2013 March 10, 2014	1 m (3.3 ft)	48 BCM	None
600-382:2	October 30, 2013	0.3 m (1 ft)	6 BCM	None
600-382:3	October 30, 2013	0.3 m (1 ft)	10 BCM	None
600-382:4	November 6, 2013	0.3 m (1 ft)	11 BCM	None
600-382:5	November 7, 2013	0.3 m (1 ft)	10 BCM	None

BCM = bank cubic meter
bgs = below ground surface

Figure 2. The 600-382:1 Subsite Post-Excavation Photograph (March 24, 2014).

Figure 3. The 600-382:2 Subsite Post-Excavation Photograph (March 24, 2014).

Figure 4. The 600-382:3 Subsite Post-Excavation Photograph (March 26, 2014).

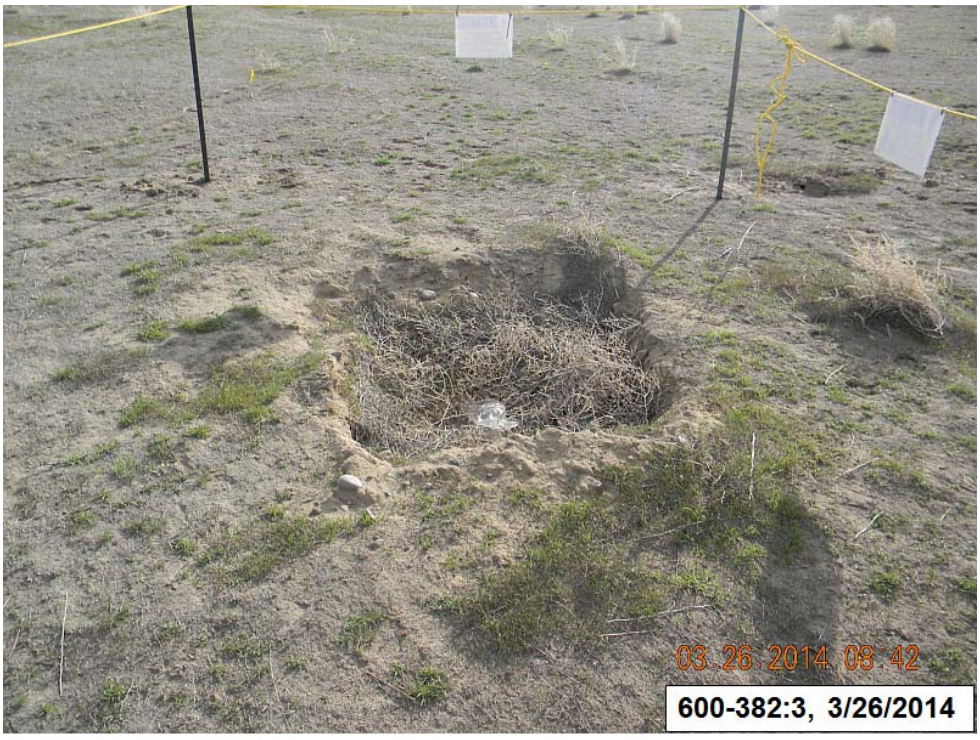


Figure 5. The 600-382:4 Subsite Post-Excavation Photograph (November 7, 2013).

Figure 6. The 600-382:5 Subsite Post-Excavation Photograph (November 7, 2013).

Figure 7. 600-382:1 Subsite Post-Remediation Boundary Surveys (March 2014).

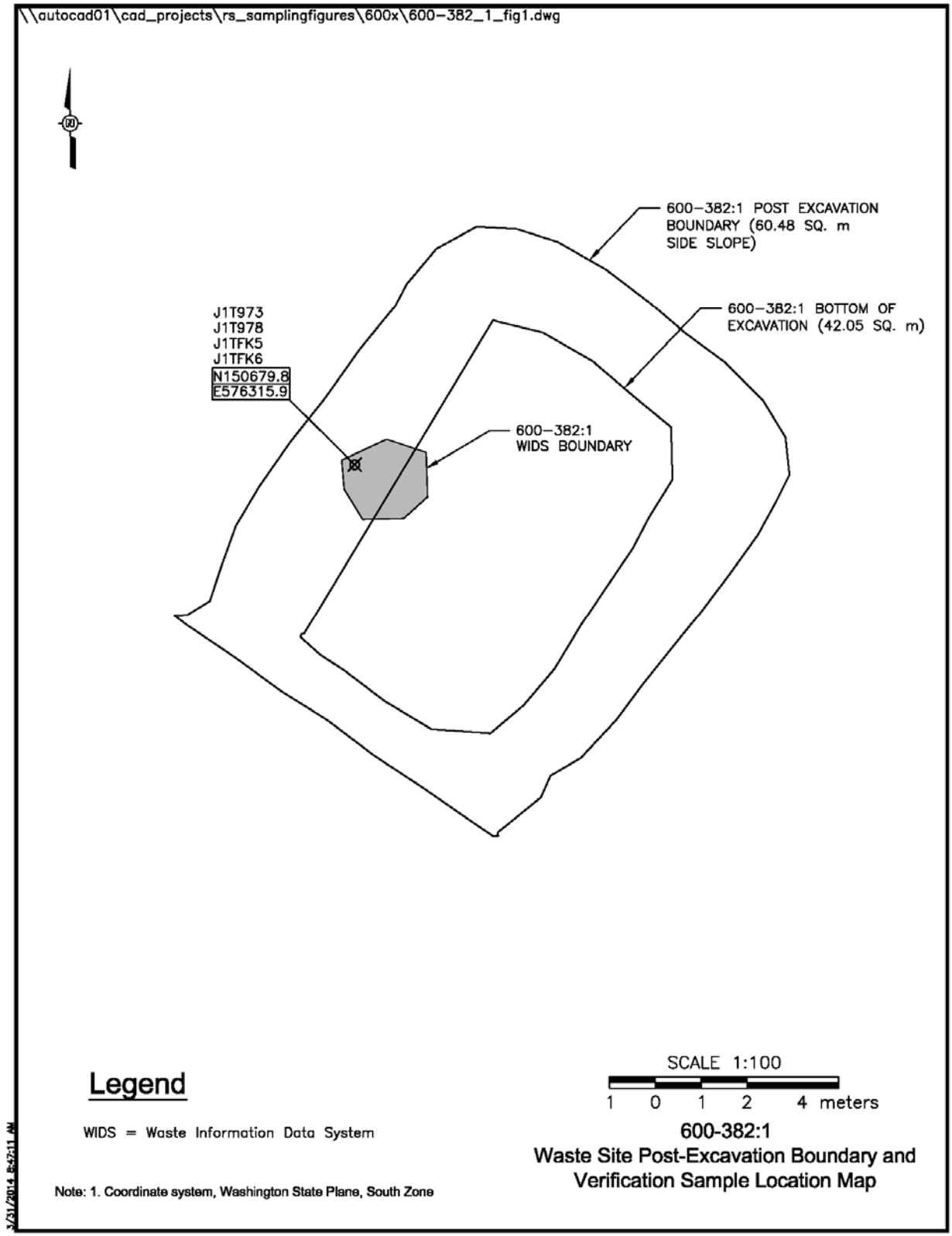


Figure 8. 600-382:2 Subsite Post-Remediation Boundary Survey (March 2014).

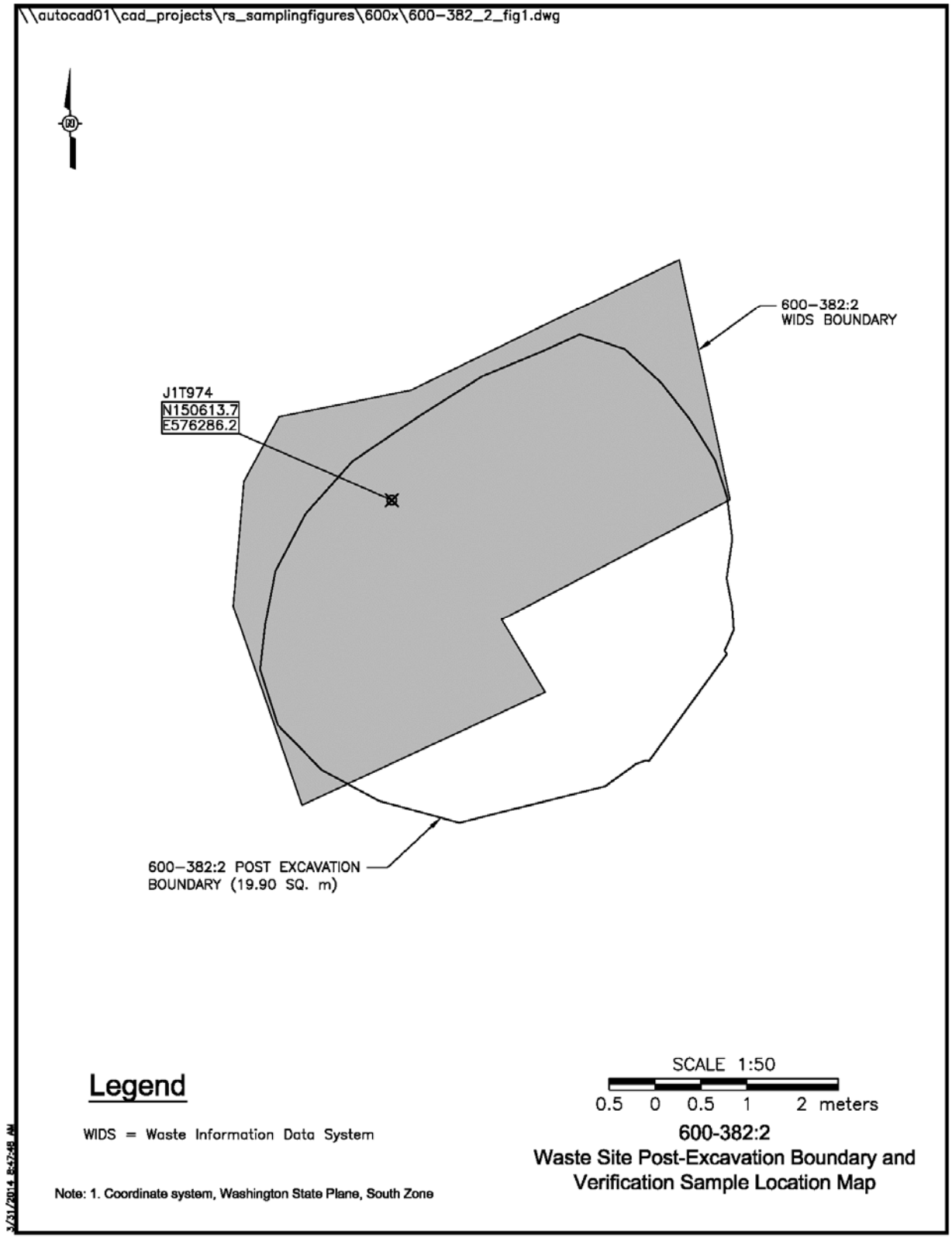


Figure 9. 600-382:3 Subsite Post-Remediation Boundary Survey (March 2014).

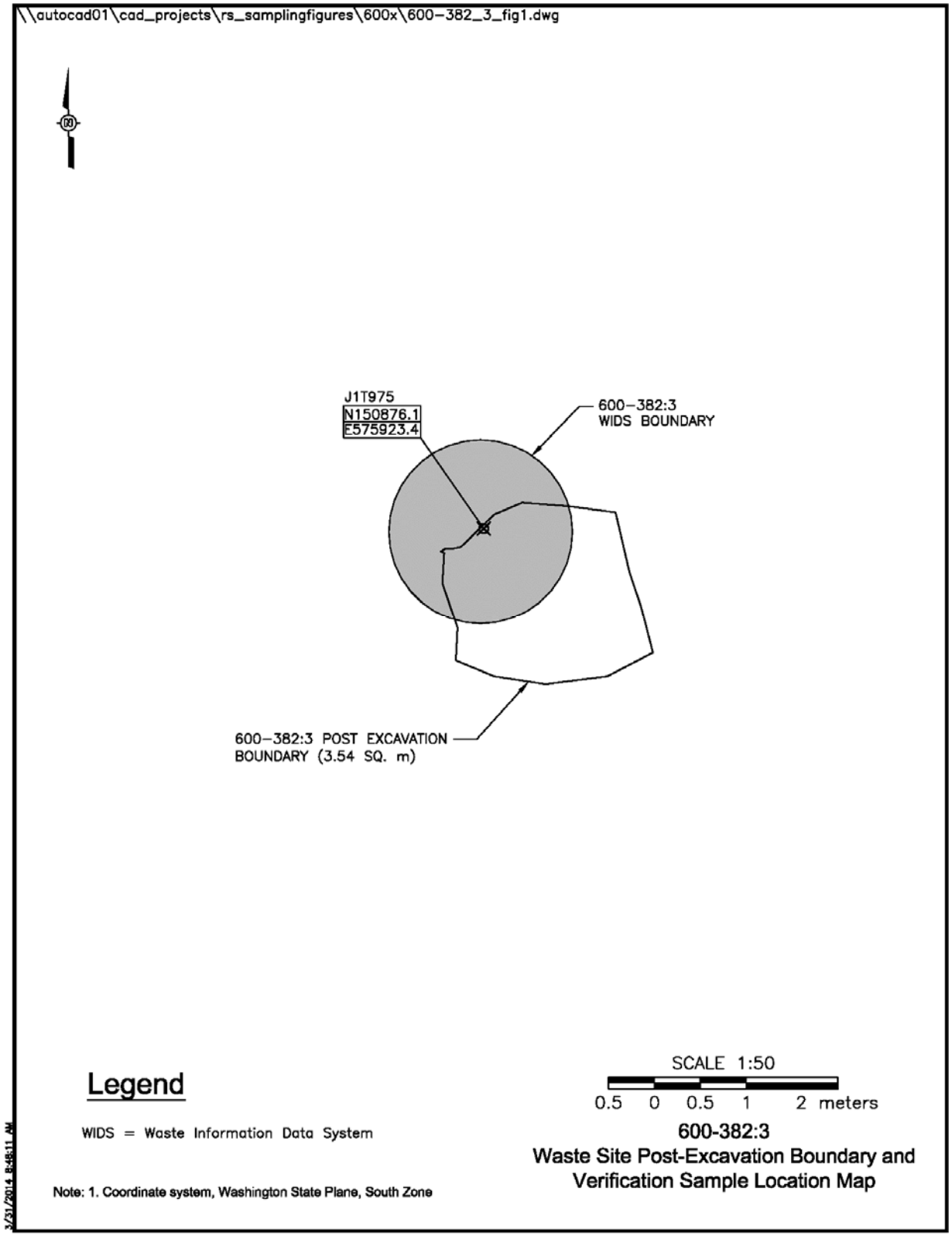


Figure 10. 600-382:4 Subsite Post-Excavation Boundary Survey (November 2013).

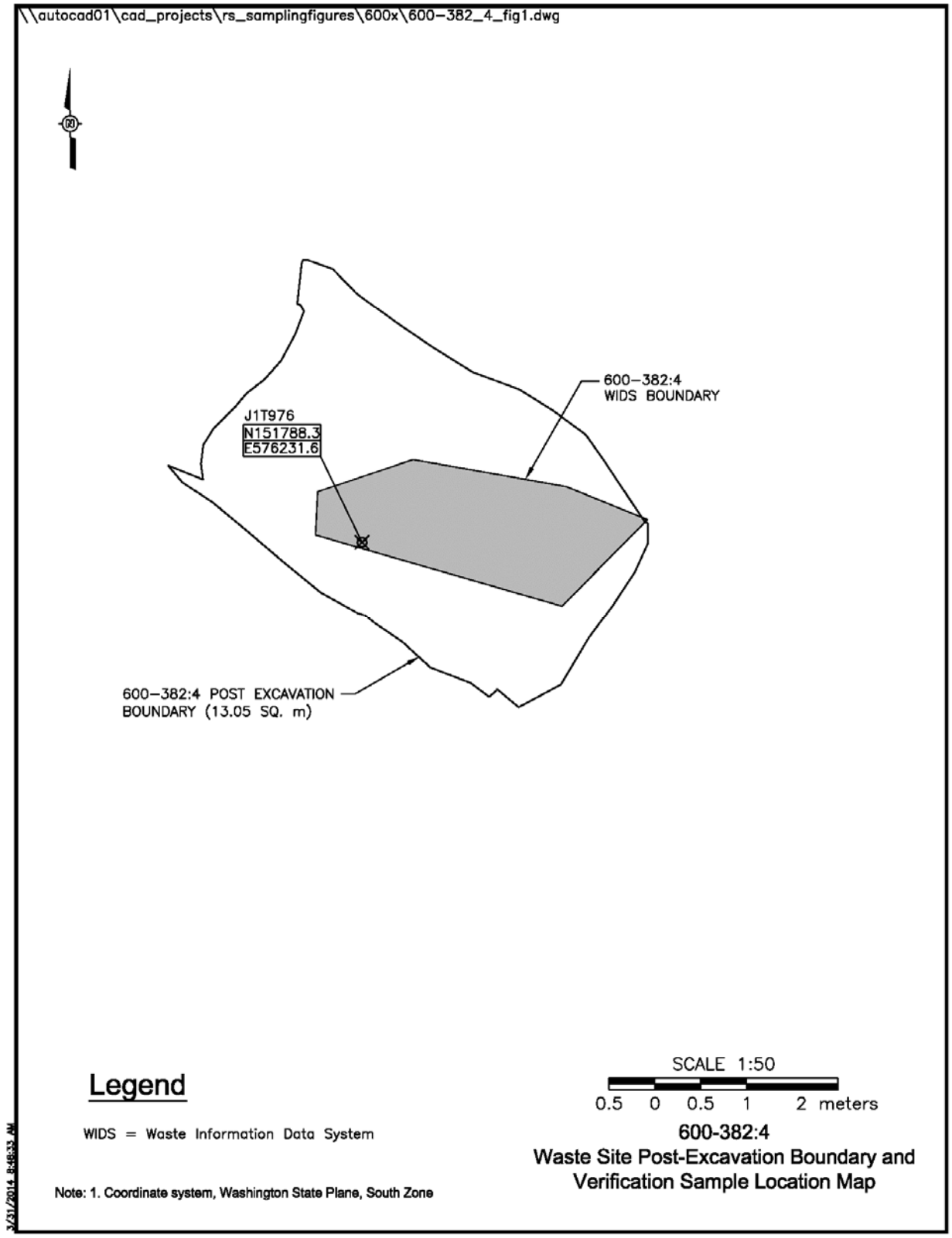
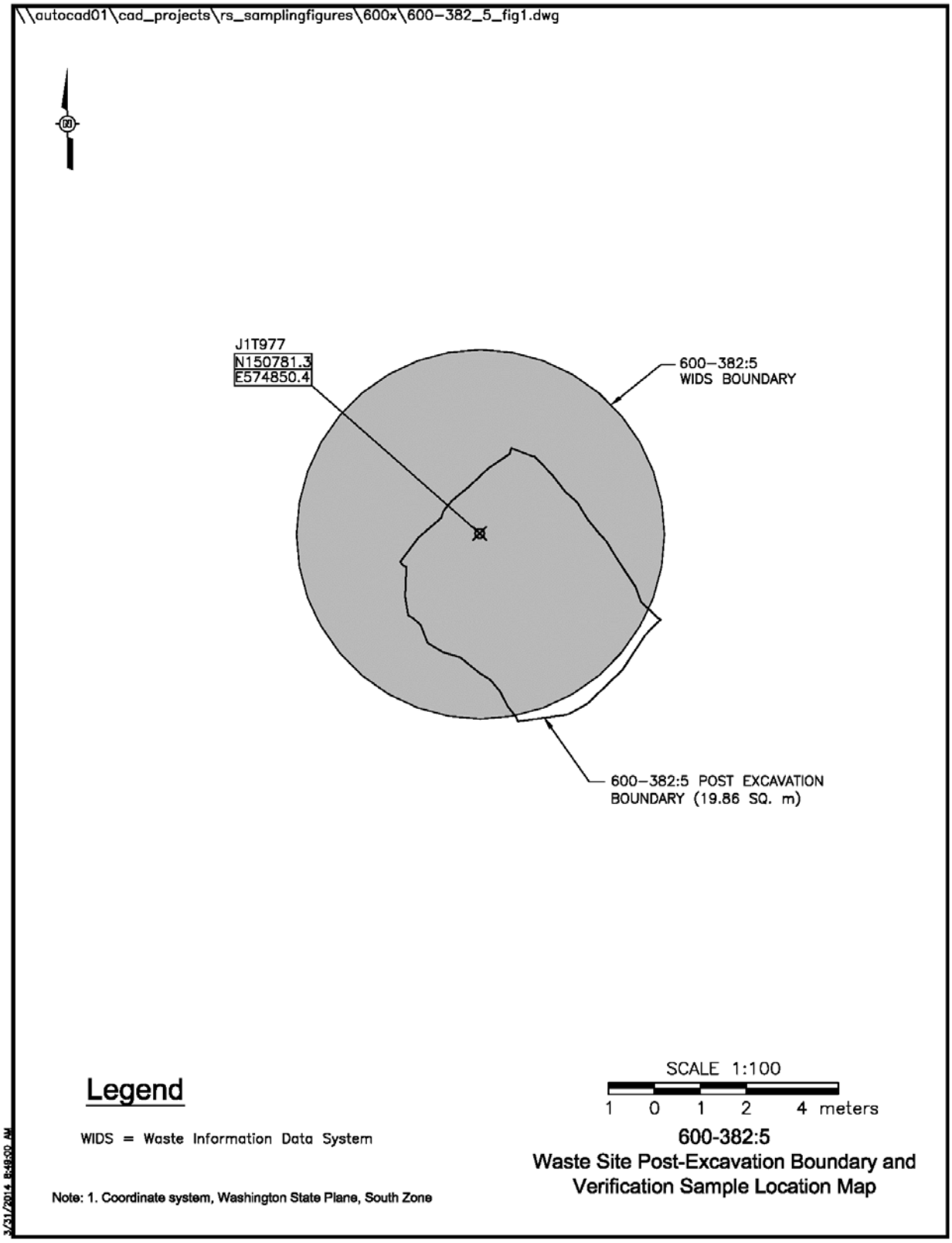


Figure 11. 600-382:5 Subsite Post-Excavation Boundary Survey (November 2013).



For some of the 600-382 subsites, the excavation boundary is smaller than or not centered over the WIDS boundary. This discrepancy occurs with smaller, miscellaneous sites that are given large WIDS boundaries during the orphan sites evaluation process. During the design and excavation phase, these sites are given a much more detailed examination and the excavation is adjusted accordingly. The extent of the excavations at these waste sites or subsites removed all staining and debris present.

VERIFICATION SAMPLING ACTIVITIES

Cleanup verification sampling was performed at the 600-382 waste site on February 4 and March 12, 2014, per the *Work Instruction for Verification Sampling of the 600-382, Segment 4 Oil Stains and Filter Area #3* (WCH 2014c). Sampling was conducted to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999).

The verification sample results are provided in Appendix C and indicate that the waste removal action achieved compliance with the remedial action objectives and remedial action goals (RAGs) for the 600-382 waste site.

Contaminants of Potential Concern

The COPCs for the 600-382 waste site were originally determined based on site descriptions, walkdown observations, the results of waste characterization sampling (Appendix B), and professional judgment. The COPCs for verification sampling were: inductively coupled plasma metals, mercury, total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons, pesticides, and polychlorinated biphenyls. The analytical methods that were performed to evaluate the site COPCs are provided in Table 2.

Verification Sample Design

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples that were collected. The number of discrete samples was determined based on the size of the remediated area of the waste site as described in the *Work Instruction for Verification Sampling of the 600-382, Segment 4 Oil Stains and Filter Area #3* (WCH 2014c) and is outlined in Table 3.

For the 600-382:1 subsite, the initial sample (J1T973) and the initial duplicate sample (J1T978) both failed the 100 Area RAGs for TPH specified in the 100 Area RDR/RAWP (DOE-RL 2009b). After further remediation, the final remediated area of 102.5 m^2, including the side slopes, was slightly more than the 100 m^2 criterion in Table 3. But since the area of the floor of the excavation was only 42.1 m^2, and the total remediated area was just slightly more than 100 m^2, the floor area was used to determine the final sample design of one discrete sample (not including the duplicate sample). Thus, after further remediation, a second sample (J1TFK5) and a duplicate sample (J1TFK6) were collected at the same sample location and analyzed for TPH. Both of the resample TPH results were less than the RAGs for TPH.

Table 2. Laboratory Analytical Methods for 600-382 Waste Site.

Analytical Method	Contaminant of Potential Concern
ICP metals [a] – EPA Method 6010	ICP metals
Mercury – EPA Method 7471	Mercury
TPH – NWTPH-Dx	TPH
PAH – EPA Method 8310	PAH
Pesticides – EPA Method 8081	Pesticides
PCB – EPA Method 8082	PCBs

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

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

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

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

Source: WCH (2014c).

Table 4 includes information from the verification sampling instructions (WCH 2014c) that estimated the dimensions of each subsite and correlated the number of samples to be collected to the estimated subsite size based on the information in Table 3.

The Hanford Environmental Information System (HEIS) numbers for each sample are provided in Table 5. Figures 7 through 11 show the waste site excavation footprints and the verification sampling locations. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). Additional information related to verification sampling can be found in the field sampling logbook (WCH 2014a).

Table 4. 600-382 Subsite Dimension and Sample Design Information.

Subsite	WSP Coordinate Easting (m)	WSP Coordinate Northing (m)	Estimated Remediation Dimensions [a] L x W x D (m)	Estimated Surface Area [a] (m^2)	Initial Sample Design [a]	Actual Surface Area [b] (m^2)	Actual Sample Design [c]
600-382:1	150679.8	576315.9	1 x 1 x 1	2.6	One discrete soil sample	Floor = 42.1 Total =102.5	One discrete soil sample, one discrete soil resample
600-382:2	150613.7	576286.2	5 x 5 x 1	17.6	One discrete soil sample	19.9	One discrete soil sample
600-382:3	150876.1	575923.4	1 x 1 x 1	1	One discrete soil sample	3.5	One discrete soil sample
600-382:4	151788.5	576231.6	3 x 3 x 1	9	One discrete soil sample	13.1	One discrete soil sample
600-382:5	150781.3	574850.4	4 x 4 x 1	16	One discrete soil sample	19.9	One discrete soil sample

[a] These are the estimated dimensions, surface area, and initial sample design from the verification work instruction (WCH 2014c).
[b] The actual waste site surface areas were determined after remediation activities.
[c] Duplicate samples are not in listed count. See field logbook EL-1666-01 (WCH 2014a).
WSP = Washington State Plane

Table 5. 600-382 Verification Sample Summary.

Sample Location	HEIS Sample Number	Sample Date	Washington State Plane Coordinates (m)		Sample Analysis
			Northing	Easting	
600-382:1	J1T973	2/4/2014	150679.8	576315.9	ICP metals [a], mercury, TPH, PAH, PCBs, pesticides
Duplicate of J1T973	J1T978				
600-382:1 resample	J1TFK5	3/12/2014			TPH
Duplicate of J1TFK5	J1TFK6				
600-382:2	J1T974	2/4/2014	150613.7	576286.2	ICP metals [a], mercury, TPH, PAH, PCBs, pesticides
600-382:3	J1T975		150876.1	575923.4	
600-382:4	J1T976		151788.3	576231.6	
600-382:5	J1T977		150781.3	574850.4	
Equipment blank	J1T979		NA	NA	ICP metals [a], mercury
Equipment blank	J1TFK8	3/12/2014			

Source: Field logbook EL-1666-01 (WCH 2014a).
[a] The expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc in the analytical results package.
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

Verification Sample Results

All verification samples were analyzed using EPA-approved analytical methods. Evaluation of the verification data from the 600-382 waste site was performed by direct comparison of the maximum sample results for each COPC against cleanup criteria. The *600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations* are provided in Appendix C.

Comparisons of the results for site COPCs with the RAGs for the 600-382 subsites are listed in Table 6. The maximum detected value for all of the subsites was used for comparison to the RAGs. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 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 HEIS, and are presented in the calculations (Appendix C).

DATA EVALUATION

This section demonstrates that contaminant concentrations at the 600-382 waste site achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the Remaining Sites ROD (EPA 1999) and documented in the 100 Area RDR/RAWP (DOE-RL 2009b).

Attainment of Nonradionuclide RAGs

Table 6 compares the cleanup verification sample values for the 600-382 waste site excavation to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. All COPCs were quantified below direct exposure RAGs. All COPCs were quantified below groundwater and river protection soil RAGs.

Attainment of Radionuclide RAGs

There were no radionuclide COPCs identified for the 600-382 waste site; therefore, no evaluation was conducted.

Table 6. Comparison of Maximum Contaminant Concentrations to Action Levels for the 600-382 Waste Site Focused Verification Soil Samples.

COPC	Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.96 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	107 (<BG)	5,600	200	400	No	--
Beryllium	0.766 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Cadmium [e]	0.124 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium	13.8 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	9.20 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	17.0 (<BG)	2,960	59.2	22.0 [c]	No	--
Lead	5.41 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	389 (<BG)	3,760	512 [c]	512 [c]	No	--
Mercury	0.169 (<BG)	24	0.33 [c]	0.33 [c]	No	--
Molybdenum [g]	0.326	400	8	-- [f]	No	--
Nickel	13.6 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	57.9 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	49.5 (<BG)	24,000	480	67.8 [c]	No	--
TPH – diesel	4	200	200	200	No	--
TPH – diesel extended	54	200	200	200	No	--
Acenaphthylene	0.195	4,800	96	129	No	--
Benzo(a)pyrene	0.00103	0.137	0.015 [h]	0.015 [h]	No	--
Benzo(b)fluoranthene	0.000926	1.37	0.015 [h]	0.015 [h]	No	--
Benzo(ghi)perylene	0.00216	2,400	48	192	No	--
Fluoranthene	0.00137	3,200	64	18	No	--
Indeno(1,2,3-cd) pyrene	0.00484	1.37	0.33 [h]	0.33 [h]	No	--
Pyrene	0.00172	2,400	48	192	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[b] Maximum result of all subsites as described in the *600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations* (Appendix C).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3]) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[f] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).
[g] No Hanford Site-specific or Washington State background value available.
[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).

-- = not applicable
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 (dose model)
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

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. However, no statistical samples were used for any 600-382 subsite verification sampling (WCH 2014c). The verification samples were all focused samples; therefore, the three-part test is not applicable to the data evaluation for the 600-382 subsites.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 600-382 waste site was determined by calculation of the hazard quotient and excess carcinogenic risk. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. The hazard quotient and excess carcinogenic risk calculations (Appendix C) for direct contact were conservatively performed for the 600-382 waste site using the highest of the focused sample analyses from all decision units. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients are less than 1.0. The cumulative hazard quotient is 8.6×10^{-4}, which is less than 1.0. Excess cancer risk values for individual nonradionuclide constituents are less than 1×10^{-6}. The total carcinogenic risk value for the carcinogenic constituents above background or detected levels is 1.2×10^{-8}, which is less than the criterion of 1×10^{-5}. Therefore, the nonradionuclide risk requirements are met.

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 600-382 waste site included a calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides. The requirements include an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. Risk values were calculated for constituents that were detected at concentrations above Hanford Site or Washington State background values or for which there is no background value. In addition, the soil-partitioning coefficients for these contaminants must be less than that necessary to show no migration to groundwater in 1,000 years based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b). Based on this model and a vadose zone of approximately 9.3 m (30.5 ft) in thickness, a distribution coefficient of 7.9 mL/g or greater is required to show no predicted migration to groundwater in 1,000 years. Only acenaphthylene is subject to the groundwater hazard quotient calculation. The acenaphthylene noncarcinogenic hazard quotient is 2.0×10^{-3}, which is less than 1.0. Thus, the cumulative hazard quotient for the 600-382 waste site is 2.0×10^{-3}, again less than 1.0. No carcinogenic soil constituents met the criteria for groundwater protection evaluation at the 600-382 waste site; therefore, no calculations of excess carcinogenic risk were performed and nonradionuclide risk requirements related to groundwater are met.

DATA QUALITY ASSESSMENT

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

The DQA for the 600-382 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 HEIS and are summarized in Appendix C. The detailed DQA is presented in Appendix D.

SUMMARY FOR INTERIM CLOSURE

The 600-382 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). Verification sampling was performed and the analytical results indicate that the residual concentrations of COPCs met the RAGs and associated remedial action objectives for direct exposure, groundwater protection, and river protection. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in 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 600-382 waste site to Interim Closed Out.

REFERENCES

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WCH, 2014a, *100-K and IU-2/6 Miscellaneous Restoration and Failed Remaining Sites Sampling*, Logbook EL-1666-01, pp. 79-81, 97-99, Washington Closure Hanford, Richland, Washington.

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APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Maximum Contaminant Concentrations that Exceed Ecological Screening Levels for the 600-382 Waste Site [a].

Hazardous Substance		2007 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Waste Site Analyses
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
Metals (mg/kg)									
	Background								
Barium	132	500	--	102	--	330	--	2,000	107 (<BG)
Manganese	512	1,100 [d]	--	1,500	220	450	4,300	4,000	389 (<BG)
Mercury	0.33	0.3	0.1	5.5	--	--	--	--	0.169 (<BG)
Vanadium	85.1	2	--	--	--	--	7.8	280	57.9 (<BG)
Zinc	67.8	86 [d]	200	360	160	120	46	79	49.5 (<BG)

NOTE: Shaded cells indicate an ecological screening level exceedance.

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

[b] Available on the Internet at www.epa.gov/ecotox/ecossl.

[c] Wildlife.

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

-- = no value exists
BG = background
EPA = U.S. Environmental Protection Agency
WAC = *Washington Administrative Code*

APPENDIX B

WASTE CHARACTERIZATION SAMPLING RESULTS

Table B-1. 600-382 Waste Characterization Data.

Sample Location	HEIS Number	Sample Date	Northing	Easting	Arsenic			Barium			Beryllium			Cadmium		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1RFP5	2/21/2013	150679	576316	1.69	U	9.93	65.7		1.99	0.211		0.1	0.473	U	1.99
600-382:2	J1RFP6	2/21/2013	150613	576286	1.7	U	9.89	74.5		1.98	0.264		0.1	0.44	U	1.98
600-382:3	J1RFP3	2/21/2013	150876	575923	2.2	U	9.89	83.7		1.98	0.297		0.1	0.17	U	1.98
600-382:4	J1RFP4	2/21/2013	151788	576232	1.65	U	10.1	86.4		2.02	0.303		0.1	0.221	U	2.02
600-382:5	J1RFP2	2/21/2013	150781	574850	1.49	U	10	62.1		2.01	0.198		0.1	0.195	U	2.01

Sample Location	HEIS Number	Sample Date	Northing	Easting	Chromium			Lead			Selenium			Silver		
					mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1RFP5	2/21/2013	150679	576316	8.08	U	9.93	5.9	U	9.93	-0.362	U	9.93	0.0064	U	9.93
600-382:2	J1RFP6	2/21/2013	150613	576286	11.7		9.89	5.21	U	9.89	-0.316	U	9.89	-0.036	U	9.89
600-382:3	J1RFP3	2/21/2013	150876	575923	10.5		9.89	5.35	U	9.89	-0.133	U	9.89	-0.066	U	9.89
600-382:4	J1RFP4	2/21/2013	151788	576232	10.7		10.1	4.61	U	10.1	-0.312	U	10.1	-0.023	U	10.1
600-382:5	J1RFP2	2/21/2013	150781	574850	10.8		10	4.08	U	10	-0.204	U	10	0.136	U	10

HEIS = Hanford Environmental Information System
PQL = practical quantitation limit
Q = qualifier
U = undetected

APPENDIX C

CALCULATIONS

APPENDIX C

CALCULATIONS

The calculations provided in this appendix are copies of originals that 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. These calculations have been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculations," Washington Closure Hanford, Richland, Washington. The calculations provided in this appendix include:

600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0600X-CA-V0179, Rev. 0, Washington Closure Hanford, Richland, Washington.

600-382 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0600X-CA-V0180, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

The calculations that are 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 in the administrative record.

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CALCULATION COVER SHEET

Project Title: 100 Area Field Remediation **Job No. 14655**

Area: 600

Discipline: Environmental *Calculation No: 0600X-CA-V0179

Subject: 600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2010

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 6 Attachment = 3 Total = 10	J. D. Skoglie	I. B. Berezovsky	H. M. Sulloway	S.G. Wilkinson ~~D. F. Obenauer~~	9/2/14

SUMMARY OF REVISION

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

*Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/17/2014	Calc. No.:	0600X-CA-V0179	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	4/17/2014
Subject:	600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 6	

PURPOSE:

Using sample data from Attachment 1 provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 600-382 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 600-382 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, 2014, *Remaining Sites Verification Package for the 600-382, Segment 4 Oil Stains and Filter Area #3 Waste Site,* Attachment to Waste Site Reclassification Form 2014-026, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

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

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/17/2014	Calc. No.:	0600X-CA-V0179	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	4/17/2014
Subject:	600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 6	

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

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

METHODOLOGY:

The 600-382 waste site was divided into five subsites; 600-382:1, :2, :3, :4, and :5. Each subsite was comprised of one discrete soil sample, for a total of 5 discrete soil samples and one duplicate sample for verification sampling. The direct contact hazard quotient and carcinogenic risk calculations for the 600-382 waste site were conservatively calculated using the maximum results from the sample results from Attachment 1. Of the contaminants of potential concern (COPCs) and other analytes for these sites, 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 (diesel range and motor oil) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for molybdenum is 0.326 mg/kg, divided by the noncarcinogenic RAG value of 400 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 8.2×10^{-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 8.6×10^{-4}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for benzo(a)pyrene is 0.00103 mg/kg, divided by 0.137 mg/kg, and multiplied as indicated, is 7.5×10^{-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 1.2×10^{-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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/17/2014	Calc. No.:	0600X-CA-V0179	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	4/17/2014
Subject:	600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 6	

evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

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

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

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

RESULTS:

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

Table 1 shows the results of the hazard quotient and excess cancer risk calculations for the 600-382 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 600-382 waste site.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/17/2014	Calc. No.:	0600X-CA-V0179	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	4/17/2014
Subject:	600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	4 of 6

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 600-382 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					
Molybdenum	0.326	400	8.2E-04	--	--
Polycyclic Aromatic Hydrocarbons					
Acenaphthylene [c]	0.195	4,800	4.1E-05	--	--
Benzo(a)pyrene	0.00103	--	--	0.137	7.5E-09
Benzo(b)fluoranthene	0.000926	--	--	1.37	6.8E-10
Benzo(ghi)perylene [c]	0.00216	2,400	9.0E-07	--	--
Fluoranthene	0.00137	3,200	4.3E-07	--	--
Indeno(1,2,3-cd)pyrene	0.00484	--	--	1.37	3.5E-09
Pyrene	0.00172	2,400	7.2E-07	--	--
Total Petroleum Hydrocarbons					
TPH - Diesel Range + Motor Oil [d]	58	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**8.6E-04**		
Cumulative Excess Cancer Risk:					**1.2E-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 these chemicals are not available. The cleanup levels are based on use of surrogate chemicals.
acenaphthylene surrogate: acenaphthene
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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/17/2014	Calc. No.:	0600X-CA-V0179	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	4/17/2014
Subject:	600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	5 of 6

Table 2. Relative Percent Difference Calculations for the 600-382 Waste Site (2 Pages).

Duplicate Analysis - 600-382 Waste Site

Sampling	Sample	Sample	Aluminum			Arsenic			Barium			Beryllium		
Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1T973	2/4/14	7160		5.89	1.63	B	0.433	78.4		0.0866	0.694		0.0866
Duplicate of J1T973	J1T978	2/4/14	6860		6.80	2.60	B	0.500	70.8		0.100	0.620		0.100

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	4.3%		10.2%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable

Duplicate Analysis - 600-382 Waste Site

Sampling	Sample	Sample	Calcium			Chromium			Cobalt			Copper		
Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1T973	2/4/14	2800		6.93	11.5		0.130	8.90	D	0.650	11.9		0.260
Duplicate of J1T973	J1T978	2/4/14	2570		8.00	11.3		0.150	7.76	D	0.750	11.5		0.300

Analysis:

TDL		100	1	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	8.6%	1.8%		3.4%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - 600-382 Waste Site

Sampling	Sample	Sample	Iron			Lead			Magnesium			Manganese		
Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1T973	2/4/14	21500		6.93	4.11	BD	1.43	3920		7.36	359		0.173
Duplicate of J1T973	J1T978	2/4/14	20600		8.00	4.40	BD	1.65	3780		8.50	308		0.200

Analysis:

TDL		5	5	75	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD	4.3%		3.6%	15.3%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable

Duplicate Analysis - 600-382 Waste Site

Sampling	HEIS	Sample	Molybdenum			Nickel			Potassium			Silicon		
Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1T973	2/4/14	0.248	B	0.173	11.3		0.130	1420		5.54	931	JN	1.30
Duplicate of J1T973	J1T978	2/4/14	0.305	B	0.200	10.4		0.150	1400		6.40	648	JN	1.50

Analysis:

TDL		2	4	400	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD				*35.8%*
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 600-382 Waste Site

Sampling	HEIS	Sample	Sodium			Vanadium			Zinc			Acenaphthylene		
Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL
600-382:1	J1T973	2/4/14	108		6.06	57.9	D	0.433	39.8	D	1.73	189	X	5.08
Duplicate of J1T973	J1T978	2/4/14	97.6		7.00	50.6	D	0.500	35.4	D	2.00	195	X	5.09

Analysis:

TDL		50	2.5	1	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD		13.5%	11.7%	3.1%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/17/2014	Calc. No.:	0600X-CA-V0179	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	4/17/2014
Subject:	600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 6 of 6	

Table 2. Relative Percent Difference Calculations for the 600-382 Waste Site (2 Pages).

Duplicate Analysis - 600-382 Waste Site

Sampling	HEIS	Sample	Benzo(ghi)perylene			Indeno(1,2,3-cd)pyrene			TPH - motor oil (high boiling)		
Area	Number	Date	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
600-382:1	J1T973	2/4/14	2.16	PX	0.542	4.43	X	0.542			
Duplicate of J1T973	J1T978	2/4/14	2.02	X	0.543	4.84	X	0.543			
Re-Sample of 600-382:1	J1TFK5	3/12/14							7400	JB	7490
Duplicate of J1TFK5	J1TFK6	3/12/14							7550	B	2450

Analysis:

TDL		15	15	5000
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	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 600-382 waste site meets the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk and RPDs, respectively, as identified in the RDR/RAWP (DOE-RL 2009b) and SAP (DOE-RL 2009a). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

Attachment 1. 600-382 Waste Site Verification Sample Results (Metals and TPH).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1T973	2/4/14	7160		5.89	1.43	UD	1.43	1.63	B	0.433	78.4		0.0866	0.694		0.0866
Duplicate of J1T973	J1T978	2/4/14	6860		6.80	1.65	UD	1.65	2.60	B	0.500	70.8		0.100	0.620		0.100
600-382:2	J1T974	2/4/14	9530		7.38	1.79	UD	1.79	2.92	B	0.543	107		0.109	0.766		0.109
600-382:3	J1T975	2/4/14	7370		7.22	1.75	UD	1.75	2.96	B	0.531	87.9		0.106	0.662		0.106
600-382:4	J1T976	2/4/14	7880		6.81	1.65	UD	1.65	2.26	B	0.501	94.7		0.100	0.654		0.100
600-382:5	J1T977	2/4/14	5600		6.38	1.55	UD	1.55	1.48	B	0.469	54.9		0.0938	0.441	B	0.0938
Equipment Blank	J1T979	2/4/14	128		6.49	0.315	U	0.315	0.477	U	0.477	2.22		0.0954	0.0954	U	0.0954
Equipment Blank	J1TFK8	3/12/14	131	N	6.6	0.320	U	0.320	1.24	B	0.485	2.96	*	0.0970	0.0970	U	0.0970

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1T973	2/4/14	0.866	U	0.866	0.113	B	0.0866	2800		6.93	11.5		0.130	8.90	D	0.650
Duplicate of J1T973	J1T978	2/4/14	1.00	U	1.00	0.100	U	0.100	2570		8.00	11.3		0.150	7.76	D	0.750
600-382:2	J1T974	2/4/14	1.09	U	1.09	0.124	B	0.109	3540		8.68	13.8		0.163	9.19	D	0.814
600-382:3	J1T975	2/4/14	1.06	U	1.06	0.106	B	0.106	2940		8.50	12.9		0.159	9.20	D	0.797
600-382:4	J1T976	2/4/14	1.00	U	1.00	0.103	B	0.100	3040		8.01	13.1		0.150	8.92	D	0.751
600-382:5	J1T977	2/4/14	0.938	U	0.938	0.0938	U	0.0938	2700		7.51	11.3		0.141	5.52		0.141
Equipment Blank	J1T979	2/4/14	0.954	U	0.954	0.0954	U	0.0954	99.2		7.64	0.143	U	0.143	0.143	U	0.143
Equipment Blank	J1TFK8	3/12/14	0.970	U	0.970	0.0970	U	0.0970	42.4		7.76	0.145	U	0.145	0.429	B	0.145

Sample Location	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1T973	2/4/14	11.9		0.260	21500		6.93	4.11	BD	1.43	3920		7.36	359		0.173
Duplicate of J1T973	J1T978	2/4/14	11.5		0.300	20600		8.00	4.40	BD	1.65	3780		8.50	308		0.200
600-382:2	J1T974	2/4/14	17.0		0.326	22600		8.68	4.62	BD	1.79	4940		9.22	389		0.217
600-382:3	J1T975	2/4/14	12.3		0.319	20900		8.50	4.58	BD	1.75	4240		9.03	376		0.212
600-382:4	J1T976	2/4/14	12.3		0.301	20700		8.01	5.41	D	1.65	4310		8.52	362		0.200
600-382:5	J1T977	2/4/14	8.95		0.281	16100		7.51	1.50		0.310	3530		7.98	257		0.188
Equipment Blank	J1T979	2/4/14	0.286	U	0.286	298		7.64	0.744	B	0.315	49.5		8.11	7.82		0.191
Equipment Blank	J1TFK8	3/12/14	0.291	U	0.291	1060	*N	7.76	1.20		0.320	17.5	B	8.24	20.6	*N	0.194

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

Gray cells indicate not applicable.

[a] Sample J1T973 exceeded direct exposure RAG for TPH, therefore this location underwent additional remediation and resampling.

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

* = Duplicate analysis not within control limits

B = blank contamination (organic constituents) = estimated (inorganic)

C = Sample was </= 5X the blank concentration

Comp = composite

D = results are reported from a diluted aliquot of sample.

HEIS = Hanford Environmental Information System

HERB = herbicides

J = estimated

N = recovery is outside the control limits.

P = aroclor target analyte with greater than 25% difference between column analyses.

PAH = polycyclic aromatic hydrocarbons

PCB = polychlorinated biphenyls

PEST = pesticides

PQL = practical quantitation limit

T = spike and/or spike duplicate sample recovery is outside control limits.

TPH = total petroleum hydrocarbons

Q = qualifier

U = undetected

X = serial dilution indicates that physical and chemical interferences are present.

Attachment	1	Sheet No.	1 of 3
Originator	J. D. Skoglie	Date	04/17/14
Checked	I. B. Berezovskiy	Date	04/17/14
Calc. No.	0600X-CA-V0179	Rev. No.	0

Attachment 1. 600-382 Waste Site Verification Sample Results (Metals and TPH).

Sample Location	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1T973	2/4/14	0.00398	*U	0.00398	0.248	B	0.173	11.3		0.130	1420		5.54	0.327	DU	0.327
Duplicate of J1T973	J1T978	2/4/14	0.00398	*U	0.00398	0.305	B	0.200	10.4		0.150	1400		6.40	0.334	DU	0.334
600-382:2	J1T974	2/4/14	0.00768	*B	0.00464	0.284	B	0.217	13.6		0.163	2440		6.95	0.381	DU	0.381
600-382:3	J1T975	2/4/14	0.169	*	0.00437	0.212	U	0.212	11.6		0.159	2010		6.80	0.350	DU	0.350
600-382:4	J1T976	2/4/14	0.00409	*U	0.00409	0.326	B	0.200	11.3		0.150	2210		6.41	0.341	DU	0.341
600-382:5	J1T977	2/4/14	0.00371	*U	0.00371	0.188	U	0.188	9.17		0.141	1150		6.01	0.331	DU	0.331
Equipment Blank	J1T979	2/4/14	0.00373	*U	0.00373	0.191	U	0.191	0.143	U	0.143	56.9		6.11	0.308	DU	0.308
Equipment Blank	J1TFK8	3/12/14	0.00397	U	0.00397	0.194	U	0.194	0.228	B	0.145	39.0		6.21	0.319	DU	0.319

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-382:1	J1T973	2/4/14	931	JN	1.30	0.0866	U	0.0866	108		6.06	57.9	D	0.433	39.8	D	1.73
Duplicate of J1T973	J1T978	2/4/14	648	JN	1.50	0.100	U	0.100	97.6		7.00	50.6	D	0.500	35.4	D	2.00
600-382:2	J1T974	2/4/14	698	JN	1.63	0.109	U	0.109	138		7.60	49.3	D	0.543	45.5	D	2.17
600-382:3	J1T975	2/4/14	567	JN	1.59	0.106	U	0.106	99.7		7.44	52.4	D	0.531	43.1	D	2.12
600-382:4	J1T976	2/4/14	558	JN	1.50	0.100	U	0.100	114		7.01	49.0	D	0.501	49.5	D	2.00
600-382:5	J1T977	2/4/14	430	JN	1.41	0.0938	U	0.0938	88.9		6.57	38.5		0.0938	32.5		0.375
Equipment Blank	J1T979	2/4/14	142	JN	1.43	0.0954	U	0.0954	6.68	U	6.68	0.387	B	0.0954	1.76	UJC	0.382
Equipment Blank	J1TFK8	3/12/14	189	N	1.45	0.0970	U	0.0970	9.07	B	6.79	0.579	*	0.0970	2.04	*	0.388

Sample Location	HEIS Number	Sample Date	TPH - Diesel Range			TPH - motor oil (high boiling)		
			ug/kg	Q	PQL	ug/kg	Q	PQL
Re-Sample of 600-382:1	J1TFK5	3/12/14	2430	U	2430	7400	JB	7490
Duplicate of J1TFK5	J1TFK6	3/12/14	2450	U	2450	7550	B	2450
600-382:2	J1T974	2/4/14	4060	J	2540	53800		2540
600-382:3	J1T975	2/4/14	2770	J	2400	39500		2400
600-382:4	J1T976	2/4/14	2240	U	2240	18100		2240
600-382:5	J1T977	2/4/14	2210	U	2210	5950	J	2210
600-382:1	J1T973 *	2/4/14	126000	DJ	55100	1660000	DJ	55100
Duplicate of J1T973	J1T978	2/4/14	80900	DJ	54700	1270000	DJ	54700

Attachment	1	Sheet No.	2 of 3
Originator	J. D. Skoglie	Date	04/17/14
Checked	I. B. Berezovskiy	Date	04/17/14
Calc. No.	0600X-CA-V0179	Rev. No.	0

Attachment 1. 600-382 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	600-382:1 - J1T973			Duplicate of J1T973 - J1T978			600-382:2 - J1T974			600-382:3 - J1T975			600-382:4 - J1T976			600-382:5 - J1T977		
		2/4/14			2/4/14			2/4/14			2/4/14			2/4/14			2/4/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Silvex (tp;2,4,5-)	HERB	16.9	UD	16.9	16.9	UD	16.9	19.4	UD	19.4	18.4	UD	18.4	17.2	UD	17.2	17.0	UD	17.0
MCPP	HERB	2040	UD	2040	2030	UD	2030	2340	UD	2340	2210	UD	2210	2070	UD	2070	2050	UD	2050
2,4,5-T	HERB	16.9	UD	16.9	16.9	UD	16.9	19.4	UD	19.4	18.4	UD	18.4	17.2	UD	17.2	17.0	UD	17.0
2,4-D	HERB	16.9	UD	16.9	16.9	UD	16.9	19.4	UD	19.4	18.4	UD	18.4	17.2	UD	17.2	17.0	UD	17.0
MCPA	HERB	2340	UD	2340	2340	UD	2340	2690	UD	2690	2540	UD	2540	2380	UD	2380	2360	UD	2360
Dinoseb	HERB	16.9	UD	16.9	16.9	UD	16.9	19.4	UD	19.4	18.4	UD	18.4	17.2	UD	17.2	17.0	UD	17.0
2,4-DB	HERB	16.9	UD	16.9	16.9	UD	16.9	19.4	UD	19.4	18.4	UD	18.4	17.2	UD	17.2	17.0	UD	17.0
Dalapon	HERB	357	UJTD	357	356	UJTD	356	410	UJTD	410	387	UJTD	387	363	UJTD	363	359	UJTD	359
Dicamba	HERB	20.4	UD	20.4	20.3	UD	20.3	23.4	UD	23.4	22.1	UD	22.1	20.7	UD	20.7	20.5	UD	20.5
Dichloroprop	HERB	23.0	UD	23.0	23.0	UD	23.0	26.5	UD	26.5	25.0	UD	25.0	23.4	UD	23.4	23.2	UD	23.2
Acenaphthene	PAH	5.08	U	5.08	5.09	U	5.09	5.87	U	5.87	5.53	U	5.53	5.17	U	5.17	5.14	U	5.14
Acenaphthylene	PAH	189	X	5.08	195	X	5.09	5.87	U	5.87	5.53	U	5.53	5.17	U	5.17	5.14	U	5.14
Anthracene	PAH	1.69	U	1.69	1.70	U	1.70	1.96	U	1.96	1.84	U	1.84	1.72	U	1.72	1.71	U	1.71
Benzo(a)anthracene	PAH	0.542	U	0.542	0.543	U	0.543	0.626	U	0.626	0.590	U	0.590	0.552	U	0.552	0.548	U	0.548
Benzo(a)pyrene	PAH	0.542	U	0.542	0.543	U	0.543	0.626	U	0.626	0.590	U	0.590	1.03	JP	0.552	0.548	U	0.548
Benzo(b)fluoranthene	PAH	0.542	U	0.542	0.543	U	0.543	0.626	U	0.626	0.590	U	0.590	0.926	J	0.552	0.548	U	0.548
Benzo(ghi)perylene	PAH	2.16	PX	0.542	2.02	X	0.543	0.685	J	0.626	0.590	U	0.590	0.859	J	0.552	0.548	U	0.548
Benzo(k)fluoranthene	PAH	0.271	U	0.271	0.271	U	0.271	0.313	U	0.313	0.295	U	0.295	0.276	U	0.276	0.274	U	0.274
Chrysene	PAH	0.542	U	0.542	0.543	U	0.543	0.626	U	0.626	0.590	U	0.590	0.552	U	0.552	0.548	U	0.548
Dibenz[a,h]anthracene	PAH	0.542	U	0.542	0.543	U	0.543	0.626	U	0.626	0.590	U	0.590	0.552	U	0.552	0.548	U	0.548
Fluoranthene	PAH	0.542	U	0.542	0.543	U	0.543	1.37	J	0.626	0.590	U	0.590	1.21	J	0.552	0.652	JP	0.548
Fluorene	PAH	5.08	U	5.08	5.09	U	5.09	5.87	U	5.87	5.53	U	5.53	5.17	U	5.17	5.14	U	5.14
Indeno(1,2,3-cd)pyrene	PAH	4.43	X	0.542	4.84	X	0.543	0.626	U	0.626	0.590	U	0.590	0.552	U	0.552	0.548	U	0.548
Naphthalene	PAH	5.08	U	5.08	5.09	U	5.09	5.87	U	5.87	5.53	U	5.53	5.17	U	5.17	5.14	U	5.14
Phenanthrene	PAH	5.08	U	5.08	5.09	U	5.09	5.87	U	5.87	5.53	U	5.53	5.17	U	5.17	5.14	U	5.14
Pyrene	PAH	0.542	U	0.542	0.543	U	0.543	1.72	J	0.626	0.590	U	0.590	1.06	J	0.552	1.01	J	0.548
Aroclor-1016	PCB	22.6	UD	22.6	22.5	UD	22.5	26.0	UD	26.0	24.5	UD	24.5	23.0	UD	23.0	22.8	UD	22.8
Aroclor-1221	PCB	22.6	UD	22.6	22.5	UD	22.5	26.0	UD	26.0	24.5	UD	24.5	23.0	UD	23.0	22.8	UD	22.8
Aroclor-1232	PCB	22.6	UD	22.6	22.5	UD	22.5	26.0	UD	26.0	24.5	UD	24.5	23.0	UD	23.0	22.8	UD	22.8
Aroclor-1242	PCB	22.6	UD	22.6	22.5	UD	22.5	26.0	UD	26.0	24.5	UD	24.5	23.0	UD	23.0	22.8	UD	22.8
Aroclor-1248	PCB	22.6	UD	22.6	22.5	UD	22.5	26.0	UD	26.0	24.5	UD	24.5	23.0	UD	23.0	22.8	UD	22.8
Aroclor-1254	PCB	22.6	UD	22.6	22.5	UD	22.5	26.0	UD	26.0	24.5	UD	24.5	23.0	UD	23.0	22.8	UD	22.8
Aroclor-1260	PCB	22.6	UD	22.6	22.5	UD	22.5	26.0	UD	26.0	24.5	UD	24.5	23.0	UD	23.0	22.8	UD	22.8
Aldrin	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
Alpha-BHC	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
alpha-Chlordane	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
beta-BHC	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
Delta-BHC	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
4-4'-DDD	PEST	3.39	UD	3.39	3.39	UD	3.39	3.91	UD	3.91	3.68	UD	3.68	3.45	UD	3.45	3.42	UD	3.42
4-4'-DDE	PEST	3.39	UD	3.39	3.39	UD	3.39	3.91	UD	3.91	3.68	UD	3.68	3.45	UD	3.45	3.42	UD	3.42
4-4'-DDT	PEST	3.39	UD	3.39	3.39	UD	3.39	3.91	UD	3.91	3.68	UD	3.68	3.45	UD	3.45	3.42	UD	3.42
Dieldrin	PEST	3.39	UD	3.39	3.39	UD	3.39	3.91	UD	3.91	3.68	UD	3.68	3.45	UD	3.45	3.42	UD	3.42
Endosulfan I	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
Endosulfan II	PEST	3.39	UD	3.39	3.39	UD	3.39	3.91	UD	3.91	3.68	UD	3.68	3.45	UD	3.45	3.42	UD	3.42
Endosulfan sulfate	PEST	3.39	UD	3.39	3.39	UD	3.39	3.91	UD	3.91	3.68	UD	3.68	3.45	UD	3.45	3.42	UD	3.42
Endrin	PEST	3.39	UD	3.39	3.39	UD	3.39	3.91	UD	3.91	3.68	UD	3.68	3.45	UD	3.45	3.42	UD	3.42
Endrin aldehyde	PEST	3.39	UD	3.39	3.39	UD	3.39	3.91	UD	3.91	3.68	UD	3.68	3.45	UD	3.45	3.42	UD	3.42
Endrin ketone	PEST	3.39	UD	3.39	3.39	UD	3.39	3.91	UD	3.91	3.68	UD	3.68	3.45	UD	3.45	3.42	UD	3.42
Gamma-BHC (Lindane)	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
gamma-Chlordane	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
Heptachlor	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
Heptachlor epoxide	PEST	1.70	UD	1.70	1.69	UD	1.69	1.95	UD	1.95	1.84	UD	1.84	1.72	UD	1.72	1.71	UD	1.71
Methoxychlor	PEST	17.0	UD	17.0	16.9	UD	16.9	19.5	UD	19.5	18.4	UD	18.4	17.2	UD	17.2	17.1	UD	17.1
Toxaphene	PEST	56.5	UJD	56.5	56.4	UJD	56.4	65.1	UJD	65.1	61.3	UJD	61.3	57.4	UJD	57.4	57.0	UJD	57.0

Attachment	1	Sheet No.	3 of 3
Originator	J. D. Skoglie	Date	04/17/14
Checked	I. B. Berezovskiy	Date	04/17/14
Calc. No.	0600X-CA-V0179	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 600

Discipline: Environmental *Calculation No: 0600X-CA-V0180

Subject: 600-382 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater

Computer Program: Excel Program No: Excel 2010

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 3 Total = 4	J. D. Stoglie	J. B. Berezovskiy	H. M. Sulloway	S.G. Wilkinson By F. Obenauer	9/2/14

SUMMARY OF REVISION

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

*Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/23/2014	Calc. No.:	0600X-CA-V0180	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	4/23/2014
Subject:	600-382 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for the 600-382 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009), the following criteria must be met:

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

GIVEN/REFERENCES:

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

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

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

4) WCH, 2014, *600-382 Waste Site Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Calculations*, 0600X-CA-V0179, Rev. 0, Washington Closure Hanford, LLC, Richland, Washington.

SOLUTION:

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

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

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/23/2014	Calc. No.:	0600X-CA-V0180	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	4/23/2014
Subject:	600-382 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No.	2 of 3

METHODOLOGY:

The 600-382 waste site was divided into five subsites; 600-382:1, 600-382:2, 600-382:3, 600-382:4, and 600-382:5. Each subsite was comprised of one discrete soil sample, for a total of 5 discrete soil samples and one duplicate sample for verification sampling. Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at the 600-382 waste site were conservatively calculated for the entire waste site using the greater of the maximum value for each analyte in all decision units from the 95% UCL calculation (WCH 2014). Of the contaminants of potential concern (COPCs) for this site, acenaphthylene is included because no Washington State or Hanford background value has been established and the distribution coefficient is less than that necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (BHI 2005). Based on this model and a vadose zone of approximately 9.3 m (30.5 ft) thickness, a K_d of 7.9 or greater is required to show no predicted migration to groundwater in 1,000 years. All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than or equal to 7.9. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (mg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720(3)(a)(ii)(A), 1996) x 100 x 1 mg/1000 mg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii)(A) (1996). For example, the maximum value for acenaphthylene of 0.195 mg/kg, divided by the noncarcinogenic RAG value of 96 mg/kg is 2.0×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The cumulative HQ for the 600-382 waste site is 2.0×10^{-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, and then multiplied by 1×10^{-6}. There were not any detected constituents with a carcinogenic RAG value. Therefore, comparing the value of zero to the requirement of $<1 \times 10^{-6}$, this criterion is met. Since there were not any individual carcinogenic RAG values, the criterion for cumulative excess cancer risk for carcinogens is also met.

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/23/2014	Calc. No.:	0600X-CA-V0180	Rev.:	0
Project:	600 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	4/23/2014
Subject:	600-382 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No.	3 of 3

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 calculations.

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 600-382 Waste Site.

Contaminants of Potential Concern[a]	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Polycyclic Aromatic Hydrocarbons					
Acenaphthylene[c]	0.195	96	2.0E-03	--	--
Totals					
Cumulative Hazard Quotient:			**2.0E-03**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:

[a] = From WCH (2014).

[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.

[c] = Toxicity data for this chemical is not available. Cleanup levels are based on surrogate chemicals. Contaminant: acenaphthylene; surrogate: acenaphthene

-- = not applicable

RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 600-382 waste site meets the requirements for the hazard quotient and excess carcinogenic risk for protection of groundwater as identified in the RDR/RAWP (DOE-RL 2009).

APPENDIX D

DATA QUALITY ASSESSMENT

APPENDIX D

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2014b). This DQA was performed in accordance with site-specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009).

A review of the sample design (WCH 2014b), the field logbook (WCH 2014a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the 100 Area SAP 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 600-382 waste site were provided by the laboratories in two sample delivery groups (SDGs): SDG XP0049 and SDG XP0058. SDG XP0049 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 600-382 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 XP0049

This SDG comprises seven focused soil samples (J1T973 through J1T979) collected from the 600-382 waste site excavation. This SDG includes one field duplicate pair (J1T973/J1T978). These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), pesticides, and herbicides. In addition, an equipment blank sample (J1T979) was analyzed for ICP metals and mercury. Minor deficiencies are as follows.

In the herbicides analysis, the matrix spike (MS) (0%) and matrix spike duplicate (MSD) (0%) recoveries for dalapon are outside quality control (QC) limits. Third-party validation qualified all dalapon results in SDG XP0049 as estimated with “J” flags. Herbicides were not identified as contaminants of concern in the site-specific sampling design for the 600-382 waste site and this analysis was inadvertent. Estimated data are usable for decision-making purposes.

In the pesticide analysis, the analyte toxaphene was not included in the MS, MSD, or laboratory control sample (LCS). Toxaphene is not mixture of compounds that could interfere with the

other analytes in the analysis, and the laboratory does not typically include it in the spiking mixture. Third-party validation qualified all toxaphene results in SDG XP0049 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, zinc was detected in the method blank (MB) at a low concentration. Zinc was detected at similar concentration in the equipment blank sample (J1T979). Third-party validation qualified the zinc result in sample J1T979 as undetected, with "UJ" flags. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery for silicon (0%) is outside QC limits. Third-party validation qualified all silicon results in SDG XP0049 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the TPH analysis, samples J1T973 and J1T978 required dilution prior to analysis due to a high concentration of the target analytes. The high TPH result observed in these samples initiated additional remediation in the impacted area. Subsequently, additional samples were collected, which are included in SDG XP0058. The dilution of samples J1T973 and J1T978 caused the surrogates not to recover from these samples. Third-party validation qualified all TPH (diesel/motor oil) results for these samples as estimated with "J" flags. Estimated data are usable for decision-making purposes.

SDG XP0058

This SDG comprises two focused soil samples (J1TFK5 and J1TFK6) collected from the 600-382 waste site excavation and one equipment blank (J1TFK8). This SDG includes one field duplicate pair (J1TFK5/J1TFK6). These soil samples were analyzed for TPH and the equipment blank sample (J1TFK8) was analyzed for ICP metals and mercury. The equipment blank results are reported in Appendix C for completeness. However, because sample J1TFK5 was not analyzed for ICP metals or mercury, the results of the equipment blank J1TFK8 will not be assessed. Minor deficiencies are as follows.

In the TPH analysis, no MS or MSD samples were prepared for this analysis due to limited sample volume. The LCS and laboratory control sample duplicate (LCSD) were used to confirm precision and accuracy for this batch. The TPH results in SDG XP0058 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the relative percent differences (RPDs) calculated by the laboratory for barium iron, manganese, vanadium, and zinc were above the acceptance limit. These results apply only to the equipment blank and not to the field sample data. There is no impact to the evaluation of the 600-382 waste site. The data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2014a), include two field duplicate sample pairs as indicated in Table D-1. The detailed sample results are presented in Appendix C.

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

Sample Location	Main Sample	Duplicate Sample
600-382:1	J1T973	J1T978
600-382:1 resample	J1TFK5	J1TFK6

Note: 600-382:1 resample was only analyzed for TPH.

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.

The calculated silicon (35.5%) RPD for the duplicate analysis is above the acceptance criteria of 30%. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. There is no indication that the analytical system was operating out of control. The data are usable for decision-making purposes.

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 C) to indicate that a visual check of the data is required by the reviewer. None of the data in the 600-382 data set exceeded this control limit. 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

600-382 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 600-382 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 C.

REFERENCES

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

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

EPA, 2006, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2014a, *100-K and IU-2/6 Miscellaneous Restoration and Failed Remaining Sites Sampling*, Logbook EL-1666-01, pp. 79-81, 97-99, Washington Closure Hanford, Richland, Washington.

WCH, 2014b, *Work Instruction for Verification Sampling of the 600-382, Segment 4 Oil Stains and Filter Area #3*, 0600X-WI-G0077, Rev. 0, Washington Closure Hanford, Richland, Washington.