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

14-AMRP-0234

JUL 10 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 100-N-100, 100-N OIL FILTERS #4, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2014-052 and supporting, "Remaining Sites Verification Package for the 100-N-100, 100-N Oil Filters #4 Waste Site," Rev. 0. If you have questions, please contact me or your staff may contact Joanne Chance, of my staff, at (509) 376-0811.

Sincerely,

Mark S. French, Director
River Corridor Division

AMRC:JCC

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-NR-1 **Control No.:** 2014-052

Waste Site Code(s)/Subsite Code(s): 100-N-100; 100-N Oil Filters #4

Reclassification Category: Interim ☒ Final ☐

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

Approvals Needed: DOE ☒ Ecology ☒ EPA ☐

Description of current waste site condition:

The 100-N-100, 100-N Oil Filters #4 waste site, part of the 100-NR-1 Operable Unit, was added to the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999), as a remove, treat, and dispose (RTD) site by the *Explanation of Significant Differences for the 100-NR-1 and 100-NR-2 Operable Units Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2011).

The 100-N-100 waste site was approximately 190 m (627 ft) west of the northernmost point of the 116-N-1 waste site. The waste site consisted of four oil filters and petroleum-based material released to the ground surface and underlying soils. The soil was crusted and no vegetation was growing in the affected area.

The Field Remediation Closure Project performed remedial action at the 100-N-100 waste site on November 13, 2013. The excavation extended approximately 0.5 m (1.5 ft) below ground surface and resulted in the removal of less than 1.0 bank cubic meters (1.3 bank cubic yards) of soil and debris. No overburden pile or waste staging pile area was created, and no anomalous material was encountered during the waste site remediation

Following remediation, verification sampling was conducted on February 4, 2014 by obtaining two focused samples and one duplicate sample from the waste site. The main sample from Area 2 and the duplicate sample from Area 1 both failed direct exposure remedial action goals (RAGs) for petroleum hydrocarbons (TPH). Further remediation was conducted on February 27, 2014, and verification sampling was performed the same day.

Cleanup verification sampling was performed to determine if the waste site met the remedial action objectives (RAOs) and RAGs established by the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (100-N Area RDR/RAWP), DOE/RL-2005-93, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2013), and the 100-N Area ROD (EPA 1999). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification of Interim Closed Out.

Basis for reclassification:

The verification sampling results for the 100-N-100 waste site demonstrate that the site meets the RAOs and corresponding RAGs established in the 100-N Area RDR/RAWP (DOE-RL 2013) and the 100-N Area ROD (EPA 1999) and support a reclassification to Interim Closed Out. These sampling results established that residual contaminant concentrations 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 results also demonstrate that residual contaminant concentrations 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 soil are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-N-100, 100-N Oil Filters #4 Waste Site* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-NR-1 **Control No.:** 2014-052

Waste Site Code(s)/Subsite Code(s): 100-N-100; 100-N Oil Filters #4

Regulator comments:

Waste Site Controls:

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

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

J. P. Neath DOE Federal Project Director (printed)	J P Neath Signature	6/23/14 Date
N. Menard KIM WELSCH FOR Ecology Project Manager (printed)	KIM WELSCH FOR Signature	6/12/14 Date
N/A EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-N-100, 100-N OIL FILTERS #4 WASTE SITE

Attachment to Waste Site Reclassification Form 2014-052

June 2014

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-N-100, 100-N OIL FILTERS #4 WASTE SITE

EXECUTIVE SUMMARY

The 100-N-100, 100-N Oil Filters #4 waste site, part of the 100-NR-1 Operable Unit, was located approximately 190 m (627 ft) west of the northern most point of the 116-N-1 waste site. The waste site consisted of four oil filters and petroleum-based material released to the ground surface and underlying soils. The soil was crusted and no vegetation was growing in the area. The 100-N-100 waste site was added to the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD) (EPA 1999) as a remove, treat, and dispose (RTD) site for remedial action by the *Explanation of Significant Differences for the 100-NR-1 and 100-NR-2 Operable Units Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington* (EPA 2011).

The 100-N-100 waste site was remediated on November 13, 2013 (WCH 2014c). The excavation extended to approximately 0.5 m (1.5 ft) below ground surface, resulting in less than 1.0 bank cubic meters (1.3 bank cubic yards) of soil and debris being disposed at the Environmental Restoration Disposal Facility. No overburden pile or waste staging pile area was created, and no anomalous material was encountered during the waste site remediation.

Verification soil sampling was conducted on February 4, 2014. The sample results indicated direct exposure remedial action goals (RAGs) were exceeded for total petroleum hydrocarbons (TPH). Further remediation was conducted on February 27, 2014, and verification samples were collected that same day.

A summary of the cleanup evaluation for the soil sampling results against the applicable RAGs is presented in Table ES-1. The results of the verification sampling were used to make reclassification decisions for the 100-N-100 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 100-N-100 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15 mrem/yr above background over 1,000 years.	Radionuclides were not COPCs for the 100-N-100 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC direct exposure RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes

Table ES-1. Summary of Remedial Action Goals for the 100-N-100 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	No constituents subject to the hazard quotient calculations were detected above background levels.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	No constituents subject to the hazard quotient (or cancer risk) calculations were detected above background levels.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	No constituents subject to the cancer risk calculations were detected above background levels.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	No constituents subject to the cancer risk calculations were detected above background levels.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 100-N-100 site.	NA
	Attain National Primary Drinking Water Regulations [a]: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ.		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 30 µg/L (21.2 pCi/L) [c].		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	All individual COPC concentrations are below the groundwater and/or Columbia River protection criteria.	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 remedial action objectives and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (DOE-RL 2013) and the 100-N Area 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 sampling results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft] deep) 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 soil are not required.

Soil cleanup levels were established in the 100-N Area ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the 100-N Area ROD, a comparison against ecological risk screening levels has been made for the 100-N-100 waste site contaminants of potential concern and other constituents. Ecological screening levels from the *Washington Administrative Code* 173-340, "Model Toxics Control Act – Cleanup," were exceeded for vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for manganese and vanadium. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because the concentrations of manganese and vanadium are below the Hanford Site background values, 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 100-N-100, 100-N OIL FILTERS #4 WASTE SITE

STATEMENT OF PROTECTIVENESS

The 100-N-100 waste site cleanup verification sampling data, site evaluations, and supporting documentation demonstrate that this site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (100-N Area RDR/RAWP) (DOE-RL 2013) and the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD) (EPA 1999). The results of verification sampling show that residual soil concentrations 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 sampling results also demonstrate that residual contaminant concentrations 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 soil are not required.

Soil cleanup levels were established in the 100-N Area ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the 100-N Area ROD, a comparison against ecological risk screening levels has been made for the 100-N-100 waste site contaminants of potential concern (COPCs) and other constituents (Appendix A). Ecological screening levels from the *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were exceeded for vanadium. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for manganese and vanadium. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because the concentrations of manganese and vanadium are below the Hanford Site background values, 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 100-N-100, 100-N Oil Filters #4 waste site was located approximately 190 m (627 ft) west of the northernmost point of the 116-N-1 waste site at Washington State Plane Coordinates N 150010.8, E 571544.1 (Figure 1) (WCH 2009). The waste site consisted of four oil filters and petroleum based material released to the ground surface and underlying soils (Figure 2). The soil was crusted and no vegetation was growing in the area.

Figure 1. 100-N-100 Waste Site Location Map.

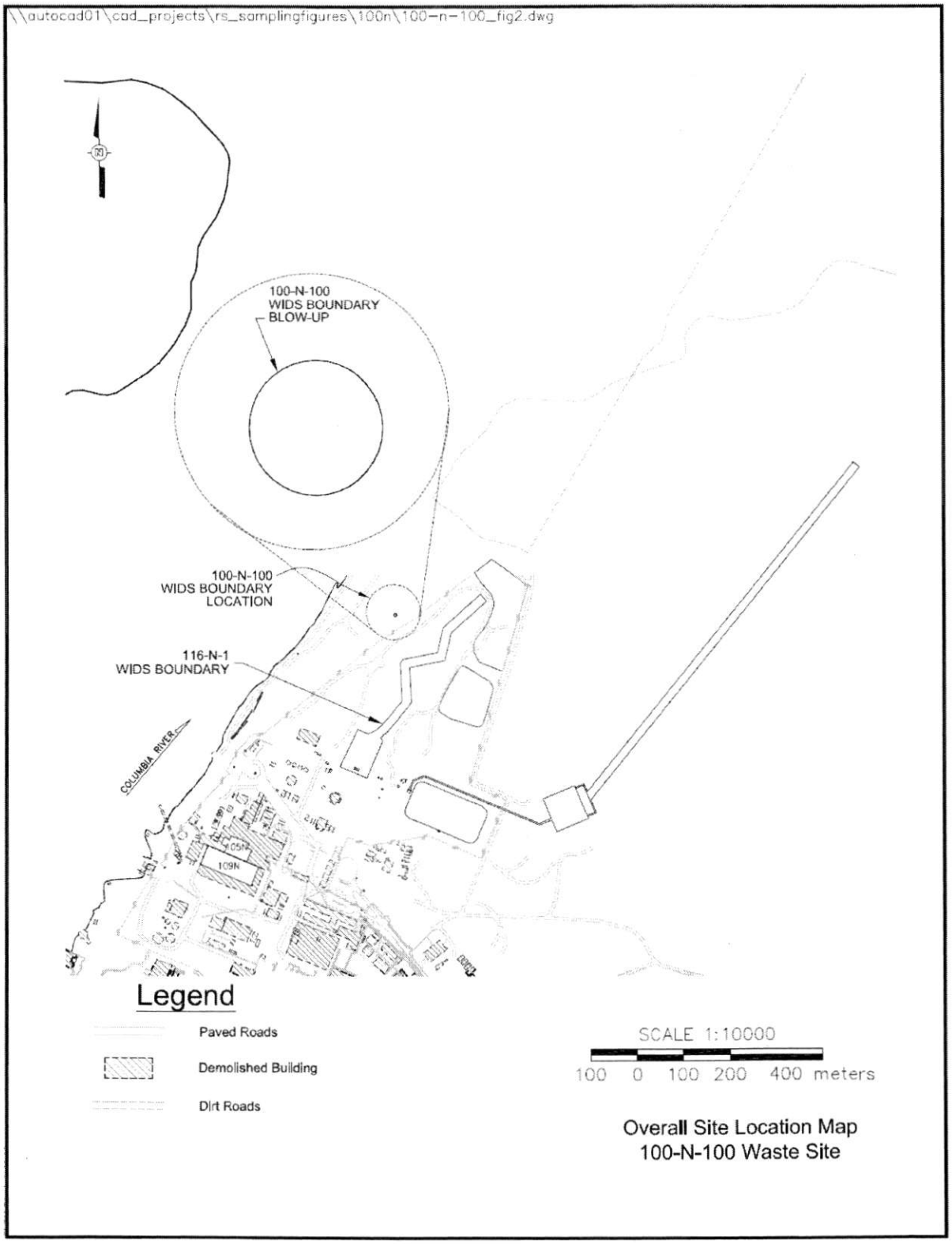


Figure 2. 100-N-100 Pre-Excavation Photograph (May 19, 2010).

REMEDIAL ACTION SUMMARY

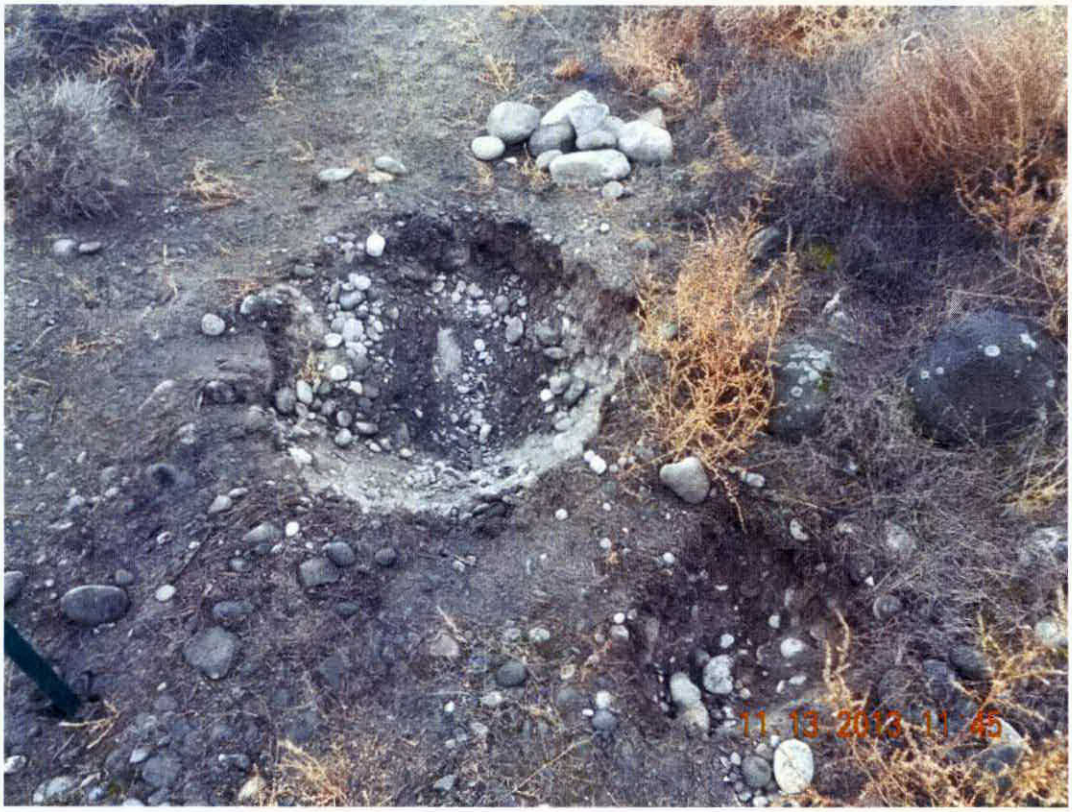
Remedial action of the 100-N-100 waste site was performed on November 13, 2013, and February 27, 2014. Due to cultural sensitivity of the area, the waste site was remediated by hand digging. The maximum depth of the excavation was 0.5 m (1.5 ft) below ground surface and resulted in the removal of less than 1.0 bank cubic meters (1.3 bank cubic yards) of soil and debris. The debris consisted of oil filters in two distinct locations. The contaminated soil and debris were directly loaded into plastic bags and carried out for disposal at the Environmental Restoration Disposal Facility (ERDF). Oil-stained soil was observed during the excavation, and all oil-stained soil was removed and disposed at ERDF. No anomalous material was encountered during excavation.

In-process sampling was conducted at the 100-N-100 waste site on November 13, 2014, following initial remediation activities. Two discrete soil samples (sample numbers J1T5R9 and J1T5T0) were collected, one from within each footprint of the 100-N-100 excavation. The samples were analyzed for inductively coupled plasma (ICP) metals, mercury, total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), and polychlorinated biphenyls (PCB) analysis. The in-process sample results are provided in Appendix B.

The waste site was not considered to have radiological contamination; therefore, a Global Positioning Environmental Radiological Surveyor (GPERS) survey was not conducted within the 100-N-100 excavation area.

A post-excavation civil survey was not performed as the waste site was very small and remediation activities consisted of two small adjacent excavations (Figure 3).

Figure 3. 100-N-100 Post-Excavation Photograph (November 13, 2013).



VERIFICATION SAMPLING ACTIVITIES

Verification soil sampling was conducted on February 4, 2014, per the *Work Instruction for Verification Sampling of the 100-N-100, 100-N Oil Filters #4 Waste Site* (WCH 2014c). Sampling was conducted to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the 100-N Area RDR/RAWP (DOE-RL 2013) and 100-N Area ROD (EPA 1999).

Additional Remedial Action and Verification Sampling

The results of verification sampling indicated exceedances of direct exposure remedial action goals (RAGs) for TPH. Through agreement with the Washington State Department of Ecology,

the entire waste site was remediated further on February 27, 2014, and re-sampled for the entire list of COPCs that same day (WCH 2014b).

Both sets of verification sample results are provided in Appendix C and indicate that the waste removal action achieved compliance with the remedial action objectives and RAGs for the 100-N-100 waste site. The following subsections provide additional discussion of the information used to develop the verification sampling design. The results of verification sampling are also summarized to support interim closure of the site.

Contaminants of Potential Concern

The 100-N-100 waste site is not listed in the *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites* (DOE-RL 2006a). The COPCs for the waste site were identified based on the visual observations of debris at the waste site during the orphan sites evaluation (WCH 2009). The expanded ICP metals list (including antimony, arsenic, barium, beryllium, boron, total chromium, cobalt, copper, manganese, magnesium, molybdenum, nickel, selenium, silver, vanadium, and zinc), mercury, PAH, PCBs, and TPH were identified as COPCs.

The analytical methods that were performed to evaluate the site COPCs are provided in Table 1.

Table 1. Laboratory Analytical Methods for the 100-N-100 Waste Site.

Analytical Method	Contaminants of Potential Concern
ICP metals – EPA Method 6010	ICP metals [a]
Mercury – EPA Method 7471	Mercury
PAH – EPA Method 8310	Polycyclic aromatic hydrocarbons
PCBs – EPA Method	Polychlorinated biphenyls
TPH – NWTPH-Dx Northwest	Total petroleum hydrocarbons

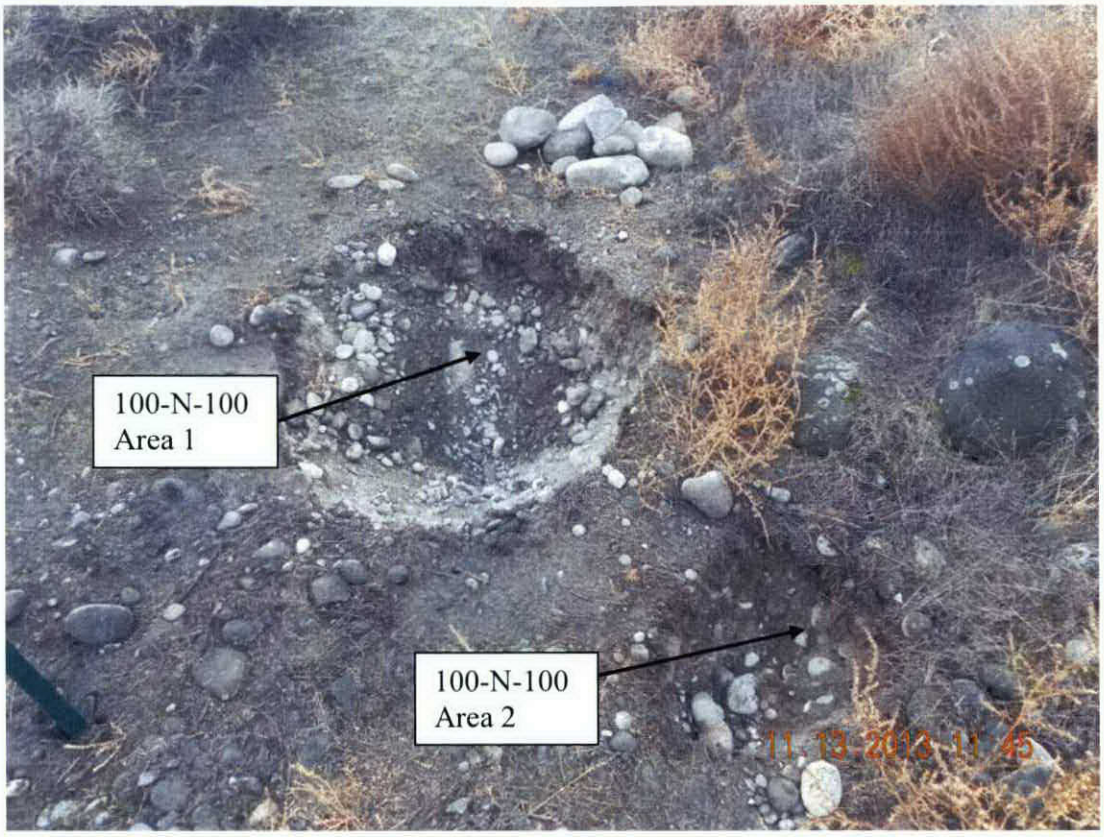
[a] Analyses for the expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

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

Verification Sample Design

Due to the small size of the excavated area (approximately 1 m^2 [10.8 ft^2]), a focused sampling plan was developed. Two discrete, focused grab samples were collected, one from each of the two excavation areas. Samples from Area 1 and Area 2 were collected from the center of each excavation, which corresponds to the oil filter locations (Figure 4). Also included in the sampling analysis were a duplicate, split, and equipment blank sample.

Figure 4. Sample Locations for the 100-N-100 Waste Site Areas 1 and 2.



All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites* (DOE-RL 2006a). All samples were grab samples collected from the center of each excavation corresponding to the oil filter locations, and were collected at the discretion of the project analytical lead. All sample location coordinates were surveyed at the time of the sample collection and recorded in the field sampling logbook (WCH 2014a). Additional information related to verification sampling can be found in the field sampling logbook. The verification sample summary is provided in Table 2.

The results of the initial verification sampling indicated exceedances of direct exposure RAGs for TPH. Therefore, additional remediation and sampling was conducted on February 27, 2014. The verification sample summary for this second event is provided in Table 3.

Table 2. 100-N-100 Verification Sample Summary Table (February 4, 2014).

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Northing	Easting	
Area 1	J1T922	150008.9	571543.8	ICP metals [a], mercury, PAH, PCBs, and TPH
Area 2	J1T923	180010.4	571543.3	
Duplicate [b]	J1T924	150008.9	571543.8	
Split [b]	J1T926	150008.9	571543.8	
Equipment blank	J1T925	NA	NA	ICP metals [a], mercury

[a] Analyses for the expanded list of ICP metals were performed to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.
[b] One duplicate and one split sample were collected. The split and the duplicate were collected at the same location; however, the location was at the discretion of the project analytical lead.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

Table 3. 100-N-100 Verification Sample Summary Table (February 27, 2014).

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Northing	Easting	
Area 1	J1TF29	150008.9	571543.8	ICP metals [a], mercury, PAH, PCBs, and TPH
Area 2	J1TF30	180010.4	571543.3	
Duplicate [b]	J1TF31	150008.9	571543.8	
Split [b]	J1TF37	150008.9	571543.8	
Equipment blank	J1TF32	NA	NA	ICP metals [a], mercury

[a] Analyses for the expanded list of ICP metals were performed to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.
[b] One duplicate and one split sample were collected. The split and the duplicate were collected at the same location; however, the location was at the discretion of the project analytical lead.

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 100-N-100 waste site was performed by direct comparison of the maximum sample results for each COPC against the cleanup criteria. All analyses are provided in Appendix C.

Comparisons of the results for each COPC against the RAGs for the February 27, 2014, sampling event at the 100-N-100 waste site are summarized in Table 4. Contaminants that were not detected by laboratory analysis were excluded from the table. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2014) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (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 the comparison table. The complete laboratory results for all constituents are stored in a Washington Closure Hanford (WCH) project-specific database prior to archival in the Hanford Environmental Information System (HEIS) and are presented in Attachment 1 of the calculations (Appendix C).

DATA EVALUATION

This section demonstrates that contaminant concentrations at the 100-N-100 waste site achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the 100-N Area ROD (EPA 1999) and documented in the 100-N Area RDR/RAWP (DOE-RL 2013).

Attainment of Nonradionuclide RAGS

Table 4 compares the cleanup verification sample values for the 100-N-100 waste site excavation to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. All COPCs were quantified below direct exposure, groundwater, and/or river protection soil RAGs.

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 in the 100-N-100 waste site sampling design (WCH 2014c). The verification samples were all focused samples; therefore, the three-part test is not applicable to the data evaluation for the 100-N-100 waste site.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Nonradionuclide risk 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 carcinogenic risk of less than 1×10^{-5}. For the 100-N-100 waste site, these risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background. All contaminant concentrations for constituents subject to the hazard quotient or cancer risk calculations for the 100-N-100 waste site were below background or the most stringent RAG values and, therefore, this waste site meets the requirements for the direct contact hazard quotient and excess carcinogenic risk as identified in the 100-N Area RDR/RAWP (DOE-RL 2013).

Table 4. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-N-100 Waste Site Focused Verification Samples.

COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.9 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	61.5 (<BG)	16,000	200	400	No	--
Beryllium	0.15 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Cadmium [d]	0.19 (<BG)	13.9 [c]	0.81 [b]	0.81 [b]	No	--
Chromium	10.2 (<BG)	120,000	18.5 [b]	18.5 [b]	No	--
Cobalt	7.3 (<BG)	1,600	32	-- [e]	No	--
Copper	18.7 (<BG)	2,960	59.2	22.0 [b]	No	--
Lead	3.6 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	321 (<BG)	11,200	512 [b]	-- [e]	No	--
Mercury	0.0099 (<BG)	24	0.33 [b]	0.33 [b]	No	--
Nickel	13.0 (<BG)	1,600	19.1 [b]	27.4	No	--
Vanadium	48.0 (<BG)	560	85.1 [b]	-- [e]	No	--
Zinc	38.8 (<BG)	24,000	480	67.8 [b]	No	--
TPH – Diesel	17	200	200	200	No	--
TPH – Diesel EXT	9.5	200	200	200	No	--

[a] RAGs obtained from the 100-N Area RDR/RAWP (DOE-RL 2013).

[b] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100-N Area RDR/RAWP (DOE-RL 2013).

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

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

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

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
Ecology = Washington State Department of Ecology
RAG = remedial action goal
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbon
WAC = *Washington Administrative Code*

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

A hazard quotient calculation for protection of groundwater was not performed for the 100-N-100 waste site because none of the constituents are predicted to migrate to groundwater within 1,000 years. There were no constituents with maximum results exceeding soil RAGs for direct exposure, groundwater and/or river protection.

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 100-N-100 waste site established that the data are of the right type, quality, and quantity to support site closeout decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in a WCH project-specific database for data evaluation prior to archival in the HEIS and are summarized in Appendix C. The detailed DQA is presented in Appendix D.

SUMMARY FOR INTERIM CLOSURE

The 100-N-100 waste site has been evaluated in accordance with the 100-N Area ROD (EPA 1999) and the 100-N Area RDR/RAWP (DOE-RL 2013). Verification sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at the site meet the RAOs for direct exposure, groundwater protection, and river protection.

In accordance with this evaluation, the verification sampling results support a reclassification of the 100-N-100 waste site to Interim Closed Out. Contamination above direct exposure levels was not observed in the 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 of the site are not required.

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APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Maximum Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-N-100 Waste Site [a].

Hazardous Substance		2001 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Maximum Result
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
	Background	Metals (mg/kg)							
Manganese	512	1,100 [d]	NA	1,500	220	450	4,300	4,000	321 (<BG)
Vanadium	85.1	2	NA	NA	NA	NA	7.8	280	48.0 (<BG)

NOTE: Shaded cells indicate screening values that are exceeded.

[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.

BG = background
EPA = U.S. Environmental Protection Agency
NA = not available
WAC= *Washington Administrative Code*

APPENDIX B

IN-PROCESS AND WASTE CHARACTERIZATION SAMPLE DATA

APPENDIX B

IN-PROCESS SAMPLE DATA

In-process sampling was conducted at the 100-N-100 waste site following remediation activities. Two discrete soil samples (sample numbers J1T5R9 and J1T5T0) were collected, one from within each footprint of the 100-N-100 excavation. The samples were analyzed for inductively coupled plasma metals, mercury, total petroleum hydrocarbons, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls analysis.

Table B-1. In-Process Samples for the 100-N-100 Waste Site (Metals and TPH)

SAMPLE NUMBER	SAMPLE DATE	SAMPLE AREA	Aluminum			Antimony			Arsenic			Barium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1T5R9	11/13/13	1	5890	X	1.6	0.40	U	0.40	2.3		0.70	63.7	X	0.08
J1T5T0	11/13/13	2	4910	X	1.6	0.39	U	0.39	2.3		0.67	50.0	X	0.077

SAMPLE NUMBER	SAMPLE DATE	SAMPLE AREA	Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1T5R9	11/13/13	1	0.18	B	0.035	1.0	U	1.0	0.13	B	0.043	5730	X	14.9
J1T5T0	11/13/13	2	0.16	B	0.034	1.0	U	1.0	0.13	B	0.042	6490	X	14.4

SAMPLE NUMBER	SAMPLE DATE	SAMPLE AREA	Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1T5R9	11/13/13	1	7.3	X	0.061	7.6	X	0.11	14.2		0.23	20400		4.0
J1T5T0	11/13/13	2	6.5	X	0.059	6.6	X	0.10	14.8		0.22	17900		3.9

SAMPLE NUMBER	SAMPLE DATE	SAMPLE AREA	Lead			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1T5R9	11/13/13	1	4.1		0.28	4230	X	3.9	326	X	0.11	0.006	UN	0.0058
J1T5T0	11/13/13	2	5.0	M	0.27	3860	X	3.8	252	X	0.10	0.006	U	0.0056

SAMPLE NUMBER	SAMPLE DATE	SAMPLE AREA	Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1T5R9	11/13/13	1	0.27	U	0.27	10.0	X	0.13	882		43.2	0.91	U	0.91
J1T5T0	11/13/13	2	0.26	U	0.26	10.0	X	0.13	841		41.7	0.88	U	0.88

SAMPLE NUMBER	SAMPLE DATE	SAMPLE AREA	Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1T5R9	11/13/13	1	165	N	6.0	0.17	U	0.17	191		62.2	50.1		0.099
J1T5T0	11/13/13	2	146	N	5.8	0.16	U	0.16	171	M	60.0	41.3		0.096

SAMPLE NUMBER	SAMPLE DATE	SAMPLE AREA	Zinc			TPH - Diesel Ext.			TPH - Diesel			Percent moisture (wet sample)		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	%	Q	PQL
J1T5R9	11/13/13	1	43.9	X	0.42	120000		1000	60000		700	5.1		0
J1T5T0	11/13/13	2	39.0	X	0.41	140000		1000	80000		700	3.7		0

Table B-2. In-Process Samples for the 100-N-100 Waste Site (Organics)

SAMPLE AREA		1			2		
SAMPLE NUMBER		J1T5R9			J1T5T0		
CONSTITUENT	CLASS	11/13/13			11/13/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	11	U	11	10	U	10
Acenaphthylene	PAH	9.5	U	9.5	9.1	U	9.1
Anthracene	PAH	3.2	U	3.2	3.1	U	3.1
Benzo(a)anthracene	PAH	3.4	UN	3.4	3.2	UN	3.2
Benzo(a)pyrene	PAH	6.7	U	6.7	6.5	U	6.5
Benzo(b)fluoranthene	PAH	4.4	U	4.4	4.2	U	4.2
Benzo(ghi)perylene	PAH	7.6	U	7.6	7.3	U	7.3
Benzo(k)fluoranthene	PAH	4.1	U	4.1	4.0	U	4.0
Chrysene	PAH	5.1	U	5.1	4.9	U	4.9
Dibenz[a,h]anthracene	PAH	12	U	12	11	U	11
Fluoranthene	PAH	14	U	14	13	U	13
Fluorene	PAH	5.5	U	5.5	5.3	U	5.3
Indeno(1,2,3-cd)pyrene	PAH	13	U	13	12	U	12
Naphthalene	PAH	13	U	13	12	U	12
Phenanthrene	PAH	13	U	13	12	U	12
Pyrene	PAH	13	U	13	12	U	12
Aroclor-1016	PCB	2.8	U	2.8	2.7	U	2.7
Aroclor-1221	PCB	8.1	U	8.1	7.9	U	7.9
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.7	U	4.7	4.6	U	4.6
Aroclor-1248	PCB	4.7	U	4.7	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6
Aroclor-1260	PCB	2.6	U	2.6	2.6	UN	2.6

APPENDIX C

CALCULATIONS

APPENDIX C

CALCULATION BRIEF

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 file will be stored in a U.S. Department of Energy, Richland Operations Office repository. These calculations has 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:

100-N-100 Waste Site Relative Percent Difference Calculations, 0100N-CA-V0260, 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.

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-N Area

Discipline: Environmental Calculation No: 0100N-CA-V0260

Subject: 100-N-100 Waste Site Relative Percent Difference 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 = 4 Attachment = 6 Total = 11	N. K. Schiffern N.K. Schiffern	I. B. Berezovskiy IB Berezovskiy	J. D. Skoglie J. D. Skoglie	D. F. Obenauer D.F. Obenauer	4/29/14

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	3/26/2014	Calc. No.:	0100N-CA-V0260	Rev.:	0
Project:	100-N Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	3/26/2014
Subject:	100-N-100 Waste Site Relative Percent Difference Calculations					Sheet No.	1 of 4

PURPOSE:

Calculate the relative percent difference (RPD) for the primary-duplicate sample pairs from the 100-N-100 waste site verification sampling, as necessary.

GIVEN/REFERENCES:

1) DOE-RL, 2006, *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites*, DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) 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.

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

4) WCH, 2014, *Remaining Sites Verification Package for the 100-N-100, 100-N Oil Filters #4 Waste Site,* Attachment to Waste Site Reclassification Form 2014-052, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

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

METHODOLOGY:

The RPD is calculated when both the primary value and the duplicate/split value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDLs are pre-determined values for analytical methods and constituents with cleanup levels as listed in Table 2-1 of the SAP (DOE-RL 2006). Table 2-1 includes nominal TDLs for identified methods based organic analyses. The nominal TDLs are also used in support of the RPD calculation for the methods based analytes. TDLs not included in Table 2-1 are based on the laboratory and/or methods used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate/split 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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	3/26/2014	Calc. No.:	0100N-CA-V0260	Rev.:	0
Project:	100-N Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	3/26/2014
Subject:	100-N-100 Waste Site Relative Percent Difference Calculations					Sheet No.	2 of 4

When an analyte is detected in the primary or duplicate/split 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/split 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. Both duplicate and split samples were collected for the verification sampling of the subject site. Additional discussion is provided in the data quality assessment section of the applicable RSVP (WCH 2014), as necessary.

RESULTS:

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

Table 1 shows the results of the RPD calculations for the 100-N-100 waste site.

Table 1. Relative Percent Difference Calculations for the 100-N-100 Waste Site. (3 Pages)

Duplicate Split Analysis - 100-N-100 Waste Site

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	6020	X	1.6	2.4		0.70	47.7	X	0.081	0.14	B	0.035
Duplicate of J1TF29	J1TF31	2/27/2014	6780	X	1.7	2.9		0.71	55.4	X	0.082	0.15	B	0.036
Split of J1TF29	J1TF37	2/27/2014	4250	*	6.84	2.25	BC	0.503	36.1	*	0.101	0.28	B	0.101

Analysis:

TDL		5	10	2	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	11.9%		14.9%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable
Split 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	34.5%		27.7%	
	Difference > 2 TDL?	Yes - assess further	No - acceptable	Yes - assess further	No - acceptable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	3/26/2014	Calc. No.:	0100N-CA-V0260	Rev.:	0
Project:	100-N Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	3/26/2014
Subject:	100-N-100 Waste Site Relative Percent Difference Calculations					Sheet No. 3 of 4	

Table 1. Relative Percent Difference Calculations for the 100-N-100 Waste Site. (3 Pages)

Duplicate Split Analysis - 100-N-100 Waste Site

Sampling Area	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	0.19	BM	0.044	4690	X	15.0	6.9	X	0.062	6.9	X	0.11
Duplicate of J1TF29	J1TF31	2/27/2014	0.16	B	0.044	19300	X	15.2	10.2	X	0.062	7.3	X	0.11
Split of J1TF29	J1TF37	2/27/2014	0.263	B	0.101	4950		8.05	7.81	*	0.151	6.13	D	0.782

Analysis:

TDL		0.2	100	1	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		*121.8%*	*38.6%*	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable
Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		5.4%	12.4%	
	Difference > 2 TDL?	No - acceptable	Yes - assess further	No - acceptable	No - acceptable

Duplicate Split Analysis - 100-N-100 Waste Site

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	18.7	X	0.23	18100	X	4.0	3.3		0.29	3980	X	3.9
Duplicate of J1TF29	J1TF31	2/27/2014	17.3	X	0.23	19800	X	4.1	3.6		0.29	4860	X	4.0
Split of J1TF29	J1TF37	2/27/2014	15.3		0.302	18800		8.05	4.95	*	0.344	3320	*	8.55

Analysis:

TDL		1	5	5	75
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	7.8%	9.0%		19.9%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable
Split 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	20.0%	3.8%		18.1%
	Difference > 2 TDL?	Yes - assess further	Yes - assess further	No - acceptable	Yes - assess further

Duplicate Split Analysis - 100-N-100 Waste Site

Sampling Area	HEIS Number	Sample Date	Manganese			Mercury			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	263	X	0.11	0.0093	B	0.0052	8.8	X	0.13	813		43.6
Duplicate of J1TF29	J1TF31	2/27/2014	321	X	0.11	0.0099	B	0.0054	13.0	X	0.13	981		44.1
Split of J1TF29	J1TF37	2/27/2014	278		0.201	0.00414	U	0.00414	8.89	*	0.151	664	*N	6.44

Analysis:

TDL		5	0.2	4	400
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	19.9%			
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable
Split Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)		No-Stop (acceptable)	No-Stop (acceptable)
	RPD	5.5%			
	Difference > 2 TDL?	Yes - assess further	Not applicable	No - acceptable	No - acceptable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	3/26/2014	Calc. No.:	0100N-CA-V0260	Rev.:	0
Project:	100-N Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	3/26/2014
Subject:	100-N-100 Waste Site Relative Percent Difference Calculations					Sheet No. 4 of 4	

Table 1. Relative Percent Difference Calculations for the 100-N-100 Waste Site. (3 Pages)

Duplicate Split Analysis - 100-N-100 Waste Site

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	201	J	6.0	247		62.7	44.1	X	0.10	38.1	X	0.42
Duplicate of J1TF29	J1TF31	2/27/2014	265	J	6.1	220		63.5	48.0	X	0.10	38.8	X	0.43
Split of J1TF29	J1TF37	2/27/2014	600	N	1.51	105		7.05	35.4	*D	0.521	26.3	*D	2.08

Analysis:

TDL		2	50	2.5	1
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	27.5%		8.5%	1.8%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable
Split 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	*99.6%*		21.9%	*36.6%*
	Difference > 2 TDL?	Yes - assess further	Yes - assess further	Yes - assess further	Yes - assess further

Duplicate Split Analysis - 100-N-100 Waste Site

Sampling Area	HEIS Number	Sample Date	TPH - Diesel Range EXT.			TPH - Diesel Range		
			ug/kg	Q	PQL	ug/kg	Q	PQL
Area 1	J1TF29	2/27/2014	17000		1100	9000		730
Duplicate of J1TF29	J1TF31	2/27/2014	17000		1100	9500		720
Split of J1TF29	J1TF37	2/27/2014				2280	TU	2280

Analysis:

TDL		5000	5000
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)
	RPD		
	Difference > 2 TDL?	No - acceptable	No - acceptable
Split Analysis	Both > PQL?	No-Stop (acceptable)	No-Stop (acceptable)
	Both >5xTDL?		
	RPD		
	Difference > 2 TDL?	Yes - assess further	Not applicable

CONCLUSION:

The calculations in Tables 1 demonstrate that the 100-N-100 waste site meets the RPD requirements as identified in the SAP (DOE-RL 2006). The RPD calculations are for use in the RSVP for this site.

Attachment 1. 100-N-100 Waste Site Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	6020	X	1.6	0.40	UJ	0.40	2.4		0.70	47.7	X	0.081
Duplicate of J1TF29	J1TF31	2/27/2014	6780	X	1.7	0.41	UJ	0.41	2.9		0.71	55.4	X	0.082
Area 2	J1TF30	2/27/2014	3300	X	1.5	0.36	UJ	0.36	1.6		0.62	61.5	X	0.072
Split of J1TF29	J1TF37	2/27/2014	4250	*	6.84	3.18	BD	1.72	2.25	BC	0.503	36.1	*	0.101
Equipment Blank	J1TF32	2/27/2014	190	X	1.4	0.35	UJ	0.35	0.61	U	0.61	1.8	X	0.070

Sample Location	HEIS Number	Sample Date	Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	0.14	B	0.035	1.0	U	1.0	0.19	BM	0.044	4690	X	15.0
Duplicate of J1TF29	J1TF31	2/27/2014	0.15	B	0.036	1.1	U	1.1	0.16	B	0.044	19300	X	15.2
Area 2	J1TF30	2/27/2014	0.067	B	0.031	0.93	U	0.93	0.090	B	0.039	7130	X	13.3
Split of J1TF29	J1TF37	2/27/2014	0.280	B	0.101	2.57	B	1.01	0.263	B	0.101	4950		8.05
Equipment Blank	J1TF32	2/27/2014	0.058	B	0.030	0.90	U	0.90	0.038	U	0.038	36.7	BX	12.9

Sample Location	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	6.9	X	0.062	6.9	X	0.11	18.7	X	0.23	18100	X	4.0
Duplicate of J1TF29	J1TF31	2/27/2014	10.2	X	0.062	7.3	X	0.11	17.3	X	0.23	19800	X	4.1
Area 2	J1TF30	2/27/2014	4.4	X	0.055	7.2	X	0.094	14.8	X	0.20	19700	X	3.6
Split of J1TF29	J1TF37	2/27/2014	7.81	*	0.151	6.13	D	0.782	15.3		0.302	18800		8.05
Equipment Blank	J1TF32	2/27/2014	0.21	X	0.053	0.15	BX	0.092	0.49	BX	0.20	722	X	3.5

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	3.3		0.29	3980	X	3.9	263	X	0.11	0.0093	B	0.0052
Duplicate of J1TF29	J1TF31	2/27/2014	3.6		0.29	4860	X	4.0	321	X	0.11	0.0099	B	0.0054
Area 2	J1TF30	2/27/2014	2.0		0.25	3340	X	3.5	263	X	0.094	0.0085	B	0.0053
Split of J1TF29	J1TF37	2/27/2014	4.95	*	0.344	3320	*	8.55	278		0.201	0.00414	U	0.00414
Equipment Blank	J1TF32	2/27/2014	0.32	B	0.25	31.1	X	3.4	5.7	X	0.092	0.0058	U	0.0058

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

Gray cells indicate not applicable. In-process sample results are provided for informational purposes only.

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

* = Duplicate analysis not within control limits.

B = estimate

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

D = dilution

HEIS = Hanford Environmental Information System

J = estimated

M = sample duplicate precision not met.

N = recovery is outside the control limits

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

PQL = practical quantitation limit

Q = qualifier

TPH = total petroleum hydrocarbons

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

U = undetected

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

Attachment	1	Sheet No.	1 of 6
Originator	N. K. Schiffern	Date	03/26/14
Checked	I. B. Berezovskiy	Date	03/26/14
Calc. No.	0100N-CA-V0260	Rev. No.	0

Attachment 1. 100-N-100 Waste Site Verification Sample Results (Metals, TPH, and Physical).

Sample Location	HEIS Number	Sample Date	Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	0.28	U	0.28	8.8	X	0.13	813		43.6	0.91	U	0.91
Duplicate of J1TF29	J1TF31	2/27/2014	0.28	U	0.28	13.0	X	0.13	981		44.1	0.93	U	0.93
Area 2	J1TF30	2/27/2014	0.25	U	0.25	5.8	X	0.12	563		38.7	0.81	U	0.81
Split of J1TF29	J1TF37	2/27/2014	0.201	U	0.201	8.89	*	0.151	664	*N	6.44	0.339	DU	0.339
Equipment Blank	J1TF32	2/27/2014	0.24	U	0.24	0.28	BX	0.11	54.8	B	37.6	0.79	U	0.79

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1TF29	2/27/2014	201	J	6.0	0.17	U	0.17	247		62.7	44.1	X	0.10
Duplicate of J1TF29	J1TF31	2/27/2014	265	J	6.1	0.17	U	0.17	220		63.5	48.0	X	0.10
Area 2	J1TF30	2/27/2014	144	J	5.3	0.15	U	0.15	168		55.7	39.0	X	0.089
Split of J1TF29	J1TF37	2/27/2014	600	N	1.51	0.380	B	0.101	105		7.05	35.4	*D	0.521
Equipment Blank	J1TF32	2/27/2014	124	J	5.2	0.15	U	0.15	54.1	U	54.1	0.84	BX	0.086

Sample Location	HEIS Number	Sample Date	Zinc			TPH - Diesel Ext.			TPH - Diesel Range			TPH - motor oil (high boiling)		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Area 1	J1TF29	2/27/2014	38.1	X	0.42	17000		1100	9000		730			
Duplicate of J1TF29	J1TF31	2/27/2014	38.8	X	0.43	17000		1100	9500		720			
Area 2	J1TF30	2/27/2014	34.0	X	0.38	3700	J	990	2500	J	670			
Split of J1TF29	J1TF37	2/27/2014	26.3	*D	2.08				2280	TU	2280	24600	T	2280
Equipment Blank	J1TF32	2/27/2014	1.6	XCUJ	0.37									

Sample Location	HEIS Number	Sample Date	% moisture (wet sample)		
			%	Q	PQL
Area 1	J1TF29	2/27/2014	6.8		0.10
Duplicate of J1TF29	J1TF31	2/27/2014	7.1		0.10
Area 2	J1TF30	2/27/2014	5.4		0.10
Split of J1TF29	J1TF37	2/27/2014	5.19		0.0100
Equipment Blank	J1TF32	2/27/2014	0.10	U	0.10

Attachment	1	Sheet No.	2 of 6
Originator	N. K. Schiffern	Date	03/26/14
Checked	I. B. Berezovskiy	Date	03/26/14
Calc. No.	0100N-CA-V0260	Rev. No.	0

Attachment 1. 100-N-100 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	J1TF29, Area 1			J1TF31, Duplicate of J1TF29			J1TF30, Area 2			J1TF37, Split of J1TF29		
		2/27/2014			2/27/2014			2/27/2014			2/27/2014		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	11	U	11	10	U	10	5.26	U	5.26
Acenaphthylene	PAH	9.3	U	9.3	9.6	U	9.6	9.1	U	9.1	5.26	U	5.26
Anthracene	PAH	3.1	U	3.1	3.2	U	3.2	3.1	U	3.1	1.75	U	1.75
Benzo(a)anthracene	PAH	3.3	U	3.3	3.4	U	3.4	3.2	U	3.2	0.561	U	0.561
Benzo(a)pyrene	PAH	6.6	U	6.6	6.8	U	6.8	6.5	U	6.5	0.561	U	0.561
Benzo(b)fluoranthene	PAH	4.3	U	4.3	4.5	U	4.5	4.3	U	4.3	0.561	U	0.561
Benzo(ghi)perylene	PAH	7.4	U	7.4	7.6	U	7.6	7.3	U	7.3	0.561	U	0.561
Benzo(k)fluoranthene	PAH	4.1	U	4.1	4.2	U	4.2	4.0	U	4.0	0.280	U	0.280
Chrysene	PAH	5.0	U	5.0	5.1	U	5.1	4.9	U	4.9	0.561	U	0.561
Dibenz[a,h]anthracene	PAH	11	U	11	12	U	12	11	U	11	0.561	U	0.561
Fluoranthene	PAH	13	U	13	14	U	14	13	U	13	0.561	U	0.561
Fluorene	PAH	5.4	U	5.4	5.6	U	5.6	5.4	U	5.4	5.26	U	5.26
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	13	U	13	12	U	12	0.561	U	0.561
Naphthalene	PAH	12	U	12	13	U	13	12	U	12	5.26	U	5.26
Phenanthrene	PAH	12	U	12	13	U	13	12	U	12	5.26	U	5.26
Pyrene	PAH	12	U	12	13	U	13	12	U	12	0.561	U	0.561
Aroclor-1016	PCB	3.0	U	3.0	3.0	U	3.0	2.9	U	2.9	1.16	U	1.16
Aroclor-1221	PCB	8.6	U	8.6	8.5	U	8.5	8.5	U	8.5	1.16	U	1.16
Aroclor-1232	PCB	2.1	U	2.1	2.1	U	2.1	2.1	U	2.1	1.16	U	1.16
Aroclor-1242	PCB	5.0	U	5.0	5.0	U	5.0	4.9	U	4.9	1.16	U	1.16
Aroclor-1248	PCB	5.0	U	5.0	5.0	U	5.0	4.9	U	4.9	1.16	U	1.16
Aroclor-1254	PCB	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	1.16	U	1.16
Aroclor-1260	PCB	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	1.16	U	1.16

Attachment	1	Sheet No.	3 of 6
Originator	N. K. Schiffern	Date	03/26/14
Checked	I. B. Berezovskiy	Date	03/26/14
Calc. No.	0100N-CA-V0260	Rev. No.	0

Attachment 1. 100-N-100 Waste Site In-process Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1T922	2/4/2014	7690	X	1.5	0.38	U	0.38	1.9	M	0.65	148	X	0.075
Duplicate of J1T922	J1T924	2/4/2014	5150	X	1.5	0.37	U	0.37	1.7		0.65	64.6	X	0.075
Area 2	J1T923	2/4/2014	4700	X	1.5	0.37	U	0.37	1.7		0.65	37.9	X	0.075
Split of J1T922	J1T926	2/4/2014	3630		7.01	1.7	DU	1.7	1.96	B	0.515	37.7	*	0.103
Equipment blank	J1T925	2/4/2014	182	X	1.5	0.36	U	0.36	0.63	U	0.63	1.9	X	0.072

Sample Location	HEIS Number	Sample Date	Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1T922	2/4/2014	0.32		0.033	0.97	U	0.97	0.47		0.04	41500	XM	13.9
Duplicate of J1T922	J1T924	2/4/2014	0.19	B	0.032	0.96	U	0.96	0.17	B	0.04	6460	X	13.9
Area 2	J1T923	2/4/2014	0.18	B	0.032	1.4	B	0.96	0.15	B	0.04	6020	X	13.8
Split of J1T922	J1T926	2/4/2014	0.568		0.103	1.03	U	1.03	0.103	U	0.103	6530	*	8.24
Equipment blank	J1T925	2/4/2014	0.039	B	0.031	0.93	U	0.93	0.039	U	0.039	38.2	BXC	13.4

Sample Location	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1T922	2/4/2014	8.9	XM	0.057	8.8	X	0.099	15.0	X	0.21	17700	X	3.8
Duplicate of J1T922	J1T924	2/4/2014	6.4	X	0.057	6.0	X	0.098	14.1	X	0.21	16800	X	3.7
Area 2	J1T923	2/4/2014	6.1	X	0.057	5.2	X	0.098	12.9	X	0.21	14100	X	3.7
Split of J1T922	J1T926	2/4/2014	5.31		0.155	10.6	D	0.773	13.3		0.309	17000	*	8.24
Equipment blank	J1T925	2/4/2014	0.11	BX	0.055	0.095	UX	0.095	0.21	UX	0.21	405	X	3.6

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1T922	2/4/2014	6.6		0.27	4240	X	3.7	867	XM	0.099	0.0061	U	0.0061
Duplicate of J1T922	J1T924	2/4/2014	3.4		0.27	3090	X	3.6	301	X	0.098	0.0056	U	0.0056
Area 2	J1T923	2/4/2014	4.0		0.27	3310	X	3.6	208	X	0.098	0.0068	U	0.0068
Split of J1T922	J1T926	2/4/2014	3.18	BD	1.7	3550		8.76	251	*	0.206	0.00405	U	0.00405
Equipment blank	J1T925	2/4/2014	0.37	B	0.26	20.8	X	3.5	6.2	X	0.095	0.0057	U	0.0057

Attachment	1	Sheet No.	4 of 6
Originator	N. K. Schiffern	Date	03/26/14
Checked	I. B. Berezovskiy	Date	03/26/14
Calc. No.	0100N-CA-V0260	Rev. No.	0

Attachment 1. 100-N-100 Waste Site In-process Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1T922	2/4/2014	0.26	U	0.26	10.8	X	0.12	1030		40.5	0.85	U	0.85
Duplicate of J1T922	J1T924	2/4/2014	0.26	U	0.26	7.3	X	0.12	852		40.3	0.85	U	0.85
Area 2	J1T923	2/4/2014	0.26	U	0.26	8.1	X	0.12	989		40.3	0.84	U	0.84
Split of J1T922	J1T926	2/4/2014	0.206	U	0.206	7.59		0.155	574		6.59	0.341	DU	0.341
Equipment blank	J1T925	2/4/2014	0.25	U	0.25	0.12	UX	0.12	47.7	B	39.1	0.82	U	0.82

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1	J1T922	2/4/2014	190		5.6	0.16	U	0.16	198		58.2	49.1	X	0.093
Duplicate of J1T922	J1T924	2/4/2014	127		5.6	0.16	U	0.16	272		58.1	48.7	X	0.093
Area 2	J1T923	2/4/2014	131		5.6	0.16	U	0.16	180		57.9	35.5	X	0.092
Split of J1T922	J1T926	2/4/2014	659	N	1.55	0.515	DU	0.515	281	*	7.21	53.1	D	0.515
Equipment blank	J1T925	2/4/2014	111		5.4	0.15	U	0.15	56.2	U	56.2	0.49	BX	0.09

Sample Location	HEIS Number	Sample Date	Zinc			TPH - Diesel Range			TPH - Diesel Ext.			TPH - motor oil (high boiling)		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Area 1	J1T922	2/4/2014	37.1	X	0.39	94000		690	180000		1000			
Duplicate of J1T922	J1T924	2/4/2014	32.3	X	0.39	110000		710	200000	N	1000			
Area 2	J1T923	2/4/2014	31.4	X	0.39	160000		690	270000		1000			
Split of J1T922	J1T926	2/4/2014	38.9	*D	2.06	5180	DJ	4480				150000	D	4480
Equipment blank	J1T925	2/4/2014	1.4	CX	0.38									

Sample Location	HEIS Number	Sample Date	% moisture (wet sample)		
			%	Q	PQL
Area 1	J1T922	2/4/2014	3.5		0.10
Duplicate of J1T922	J1T924	2/4/2014	4.1		0.10
Area 2	J1T923	2/4/2014	4.8		0.10
Equipment blank	J1T925	2/4/2014	0.10	U	0.10

Attachment	1	Sheet No.	5 of 6
Originator	N. K. Schiffern	Date	03/26/14
Checked	I. B. Berezovskiy	Date	03/26/14
Calc. No.	0100N-CA-V0260	Rev. No.	0

Attachment 1. 100-N-100 Waste Site In-process Sample Results (Organics).

CONSTITUENT	CLASS	J1T922, Area 2			J1T923, Area 2			J1T924, Duplicate of J1T922			J1T926, Split of J1T922		
		2/4/2014			2/4/2014			2/4/2014			2/4/2014		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	11	U	11	10	U	10	5.26	U	5.26
Acenaphthylene	PAH	9.3	U	9.3	9.6	U	9.6	9.1	U	9.1	5.26	U	5.26
Anthracene	PAH	3.1	U	3.1	3.2	U	3.2	3.1	U	3.1	1.75	U	1.75
Benzo(a)anthracene	PAH	3.3	U	3.3	3.4	U	3.4	3.2	U	3.2	0.561	U	0.561
Benzo(a)pyrene	PAH	6.6	U	6.6	6.8	U	6.8	6.5	U	6.5	0.561	U	0.561
Benzo(b)fluoranthene	PAH	4.3	U	4.3	4.5	U	4.5	4.3	U	4.3	0.561	U	0.561
Benzo(ghi)perylene	PAH	7.4	U	7.4	7.6	U	7.6	7.3	U	7.3	0.561	U	0.561
Benzo(k)fluoranthene	PAH	4.1	U	4.1	4.2	U	4.2	4.0	U	4.0	0.280	U	0.280
Chrysene	PAH	5.0	U	5.0	5.1	U	5.1	4.9	U	4.9	0.561	U	0.561
Dibenz[a,h]anthracene	PAH	11	U	11	12	U	12	11	U	11	0.561	U	0.561
Fluoranthene	PAH	13	U	13	14	U	14	13	U	13	0.561	U	0.561
Fluorene	PAH	5.4	U	5.4	5.6	U	5.6	5.4	U	5.4	5.26	U	5.26
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	13	U	13	12	U	12	0.561	U	0.561
Naphthalene	PAH	12	U	12	13	U	13	12	U	12	5.26	U	5.26
Phenanthrene	PAH	12	U	12	13	U	13	12	U	12	5.26	U	5.26
Pyrene	PAH	12	U	12	13	U	13	12	U	12	0.561	U	0.561
Aroclor-1016	PCB	3.0	U	3.0	3.0	U	3.0	2.9	U	2.9	1.16	U	1.16
Aroclor-1221	PCB	8.6	U	8.6	8.5	U	8.5	8.5	U	8.5	1.16	U	1.16
Aroclor-1232	PCB	2.1	U	2.1	2.1	U	2.1	2.1	U	2.1	1.16	U	1.16
Aroclor-1242	PCB	5.0	U	5.0	5.0	U	5.0	4.9	U	4.9	1.16	U	1.16
Aroclor-1248	PCB	5.0	U	5.0	5.0	U	5.0	4.9	U	4.9	1.16	U	1.16
Aroclor-1254	PCB	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	1.16	U	1.16
Aroclor-1260	PCB	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	1.16	U	1.16

Attachment	1	Sheet No.	6 of 6
Originator	N. K. Schiffern	Date	03/26/14
Checked	I. B. Berezovskiy	Date	03/26/14
Calc. No.	0100N-CA-V0260	Rev. No.	0

APPENDIX D

DATA QUALITY ASSESSMENT

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DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2014b). This DQA was performed in accordance with site-specific data quality objectives found in the *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites* (100-N Area SAP) (DOE-RL 2006).

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 SAP data assurance requirements and the data validation procedure for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification data from samples collected at the 100-N-100 waste site were provided by the laboratory in two sample delivery groups (SDGs): SDG JP0743 and SDG XP0054. SDG JP0743 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 100-N-100 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

MINOR DEFICIENCIES

SDG JP0743

This SDG comprises two focused soil samples (J1TF29, J1TF30) and a duplicate sample (J1TF29/J1TF31) collected from the 100-N-100 excavation area. These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH). In addition, one equipment blank (J1TF32) was collected and analyzed for ICP metals and mercury. SDG JP0743 was submitted for third-party validation. Minor deficiencies are as follows:

In the ICP metals analysis, a low level concentration of zinc was detected in the method blank (MB). A similar concentration of zinc was detected in the equipment blank (J1TF32). The laboratory qualified these results as estimated with "J" flags. Third-party validation qualified the zinc result for sample J17F32 as undetected and added "U" flag resulting in an overall qualification of "UJ." Undetected and estimated data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recoveries for antimony (66%) and silicon (32%) are outside the quality control (QC) limits. Additionally, the laboratory control sample recovery for silicon (15%) is also outside the QC limits. Third-party validation qualified all antimony and silicon results in SDG JP0743 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

SDG XP0054

This SDG comprises one split soil sample (J1TF37) collected from the 100-N-100 excavation area. This sample was analyzed for ICP metals, mercury, PAH, PCBs, and TPH. Minor deficiencies are as follows:

In the TPH analysis, the MS recoveries for diesel range (69.2%) and motor oil range (63.3%) organics are below the acceptance range. Similarly, the MSD recoveries for diesel range (69.7%) and motor oil range (56%) are below the acceptance range. The TPH results in SDG XP0054 may be considered estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

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

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

Sample Area	Main Sample	Duplicate Sample	Split Sample
100-N-100 Excavation	J1TF29	J1TF31	J1TF37

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern (COPC). Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the target detection limit (TDL). Relative percent differences of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. No major deficiencies in the RPD calculations were found for the duplicate sample.

Field split samples are used to determine systematic differences (bias) between laboratories. A statistical determination of systematic differences would require larger data sets than are presented here. Such a determination is complicated by variability introduced by the natural heterogeneities inherent in field soil samples and the analytical variability that each individual laboratory experiences. Therefore, when evaluating limited field split data relatively large RPDs are expected. No major deficiencies in the RPD calculations were found for the split sample.

The calculation brief in Appendix C provides details on duplicate pair evaluation and RPD calculation. Minor deficiencies for the field duplicate and split samples are as follows:

The RPDs calculated for calcium (121.8%) and chromium (38.6%) in the field duplicate analysis and aluminum (34.5%), silicon (99.6%), and zinc (36.6%) in the field split analysis are above the acceptance criteria. Elevated RPDs in environmental samples are generally attributed to natural heterogeneity in the sample matrix. 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. In the 100-N-100 data set calcium, copper, iron, magnesium, manganese, silicon, vanadium, and zinc met the criteria for this check. No additional deficiencies were noted due to the TDL initiated review. A visual inspection of all of the data is also performed. No additional 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 100-N-100 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 the 100-N-100 waste site data set 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.

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WCH, 2014a, *100-N Field Remediation and Sampling*, Logbook EL-1652-11, pp. 61-32, Washington Closure Hanford, Richland, Washington.

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