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

14-AMRP-0232

JUL 10 2014

Mr. D. A. Faulk, Program Manager
Office of Environmental Cleanup
Hanford Project Office
U.S. Environmental Protection Agency
309 Bradley Boulevard, Suite 115
Richland, Washington 99352

Dear Mr. Faulk:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 100-B-35:2, 152-B1 SECONDARY SUBSTATION SUBSITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2014-054 and supporting "Remaining Sites Verification Package for the 100-B-35:2, 152-B1 Secondary Substation Subsite," Rev. 0. If you have questions, please contact me or your staff may contact Tom Post, of my staff, at (509) 376-3232.

Sincerely,

Mark S. French

Mark S. French, Director
River Corridor Division

AMRP:TCP

Attachment

cc w/attach:
Administrative Record, H6-08

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

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-BC-1 **Control No.:** 2014-054

Waste Site Code(s)/Subsite Code(s). 100-B-35:2

Reclassification Category: Interim ☒ Final ☐

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

Approvals Needed: DOE ☒ Ecology ☐ EPA ☒

Description of current waste site condition:

The 100-B-35:2, 152-B1 Secondary Substation subsite 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 by the Tri-Party Agreement Administrative Record 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), per the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2009). The 100-B-35:2 subsite, located within the 100-B/C Area's 100-BC-1 Operable Unit, consisted of a small fenced area surrounding utility poles and concrete pads that once supported six transformers. The 152-B1 substation was deactivated during or prior to 1991. The above-ground electrical structures, utility poles, and fencing were removed prior to confirmatory sampling as part of the decommissioning and miscellaneous restoration activities.

Confirmatory sampling was performed per the *Work Instruction for Confirmatory Sampling of the 100-B-35, 151-B Primary Substation and 152-B1 Secondary Electrical Substation,* Work Instruction No. 0100B-WI-G0039, Rev. 0, Washington Closure Hanford, Richland, Washington (WCH 2013b), on February 20, 2014, at the 152-B1 Secondary Substation area. Based on confirmatory sampling results, the 100-B-35 waste site was divided into two subsites: 100-B-35:1 and 100-B-35:2. The 100-B-35:1, 151-B Primary Substation subsite was recommended for remediation in April, 2014. The selected action for 100-B-35:2 subsite involved (1) evaluating the subsite using available process information, (2) demonstrating through confirmatory sampling that cleanup goals have been achieved, and (3) proposing the site for reclassification to No Action.

Basis for reclassification:

The confirmatory sampling results for the 100-B-35:2 subsite were evaluated in comparison to the remedial action objectives (RAOs) and remedial action goals (RAGs) of the Remaining Sites ROD (EPA 1999) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP), DOE/RL 96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2009b). In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 100-B-35:2 subsite to No Action. The current subsite 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 confirmatory sampling show 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. Subsite contamination did not extend into the deep zone soils. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-B-35:2, 152-B1 Secondary Substation Subsite* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-BC-1 **Control No.:** 2014-054

Waste Site Code(s)/Subsite Code(s). 100-B-35:2

Regulator comments:

Waste Site Controls:

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

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

J. P. Neath DOE Federal Project Director (printed)	Signature	6/2/14 Date
N/A Ecology Project Manager (printed)	Signature	Date
C. Guzzetti EPA Project Manager (printed)	Signature	6/23/14 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-B-35:2, 152-B1 SECONDARY SUBSTATION SUBSITE

Attachment to Waste Site Reclassification Form 2014-054

June 2014

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-B-35:2, 152-B1 SECONDARY SUBSTATION SUBSITE

EXECUTIVE SUMMARY

The 100-B-35:2, 152-B1 Secondary Substation subsite, located within the 100-BC-1 Operable Unit, consisted of a small fenced area surrounding utility poles and concrete pads that once supported six transformers. The 100-B-35 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 by the Tri-Party Agreement Administrative Record Fact Sheet *100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2012* (DOE-RL 2013) per the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington* (EPA 2009).

The 100-B-35:2 subsite confirmatory sampling was performed on February 20, 2014, per the *Work Instruction for Confirmatory Sampling of the 100-B-35, 151-B Primary Substation and 152-B1 Secondary Electrical Substation* (WCH 2013b), as required by the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). Based on the confirmatory sampling results, the 100-B-35 waste site was divided into two subsites: 100-B-35:1 and 100-B-35:2. The 100-B-35:1 subsite was identified for remediation in April 2014. Only the 100-B-35:2 subsite is being addressed in this remaining sites verification package.

The confirmatory sampling results indicated that the 100-B-35:2 subsite achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs) of the Remaining Sites ROD (EPA 1999) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b). Therefore, remediation was not necessary. A summary of the cleanup evaluation for the soil analyses against the applicable RAGs is presented in Table ES-1. The results of the confirmatory sampling are used to make reclassification decisions for the 100-B-35:2 subsite in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 100-B-35:2 subsite to No Action. The current site conditions achieve the RAOs and the corresponding RAGs established in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River. The 100-B-35:2 subsite contamination did not extend into the deep zone soils. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Table ES-1. Summary of Remedial Action Goals for the 100-B-35:2 Subsite.

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-B-35:2 subsite.	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 (2.3×10^{-1}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	All individual carcinogens have an excess risk below 1×10^{-6}.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The cumulative excess cancer risk is 8.3×10^{-7}.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 100-B-35:2 subsite.	NA
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [a].		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 21.2 pCi/L [c].		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Antimony, copper, lead, silver, zinc, aroclor-1260, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are present at concentrations above soil RAGs for groundwater and/or Columbia River protection. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), it is predicted that these constituents will not reach groundwater (and thus the Columbia River) within 1,000 years [d].	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).

[d] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), residual concentrations of antimony, copper, lead, silver, zinc, aroclor-1260, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are predicted not to migrate more than 2.6 m (8.5 ft) vertically within 1,000 years (based on the lowest distribution coefficient of the contaminants exceeding the RAGs, copper, with a distribution coefficient of 22 mL/g). The vadose zone underlying the soil below the waste site is approximately 12 m (39 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and consequently are protective of the Columbia River.

COPC = contaminant of potential concern
MCL = maximum contaminant level
NA = not applicable
RAG = remedial action goal
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)

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 100-B-35:2 subsite contaminants of potential concern and other constituents. Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for vanadium and zinc. The U.S. Environmental Protection Agency's ecological soil screening levels were exceeded for antimony, lead, manganese, vanadium, and zinc. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, and vanadium are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), 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 part of the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-B-35:2, 152-B1 SECONDARY SUBSTATION SUBSITE

STATEMENT OF PROTECTIVENESS

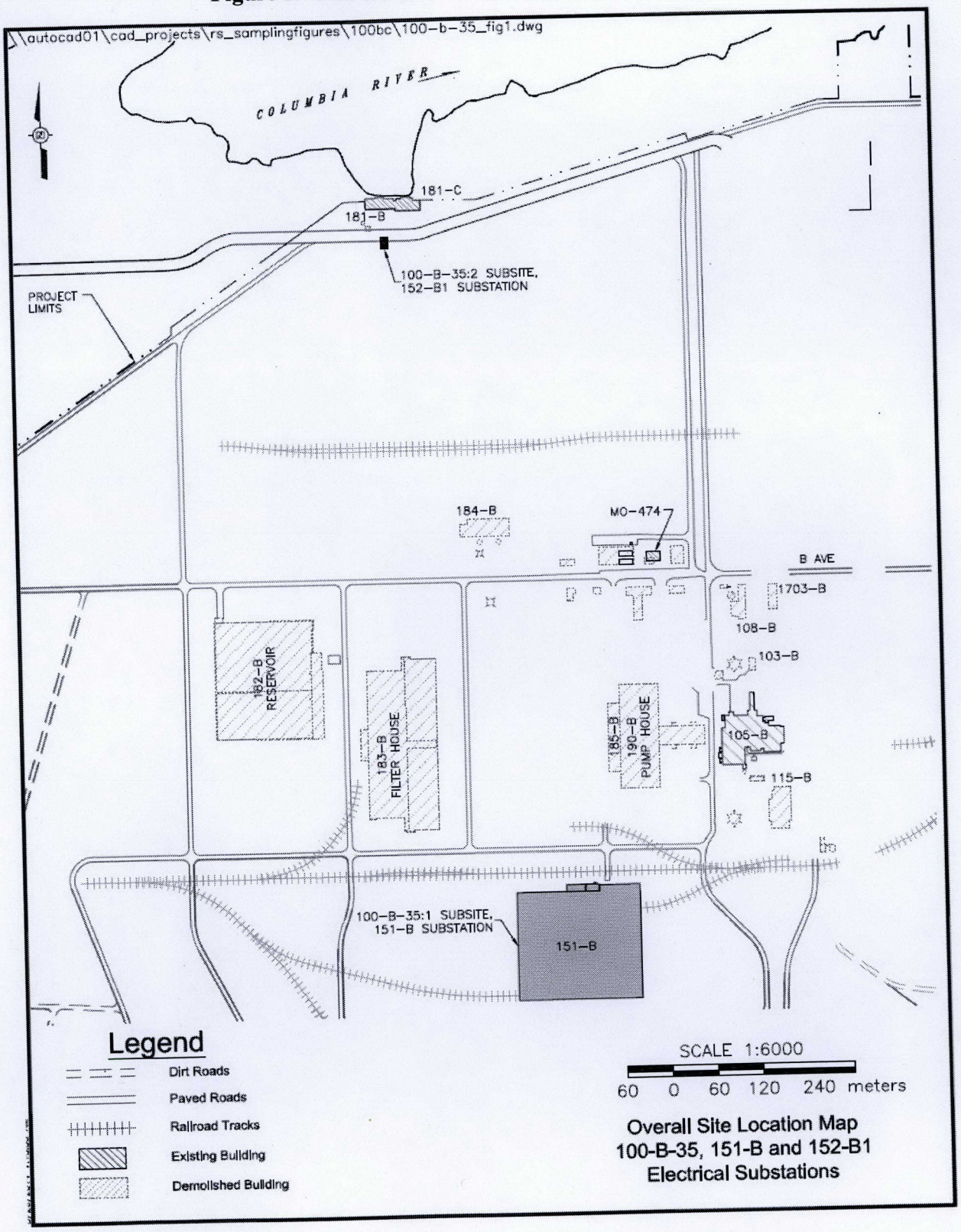
The 100-B-35:2, 152-B1 Secondary Substation subsite confirmatory data, site evaluations, and supporting documentation demonstrate that this site meets the remedial action goals (RAGs) and remedial action objectives (RAOs) established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]) and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Subsite contamination did not extend into the deep zone soils. 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 100-B-35:2 subsite contaminants of potential concern (COPCs) and other constituents. Ecological screening levels from *Washington Administrative Code* (WAC) 173-340 were exceeded for vanadium and zinc. The U.S. Environmental Protection Agency's (EPA's) ecological soil screening levels were exceeded for antimony, lead, manganese, vanadium, and zinc. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, and vanadium, are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), 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 part of the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-B-35:2 subsite, located within the 100-BC-1 Operable Unit, consisted of a small fenced area surrounding utility posed and concrete pads that once supported six transformers (Figure 1).

Figure 1. The 100-B-35 Waste Site Location Map.



The 152-B1 Secondary Electrical Substation was constructed in 1944 and provided power to the nearby 181-B Building. According to available photographs, there were originally four 1,500-kVA 12,800/2,300V single-phase transformers manufactured by the Kuhlman Electric Company. The 152-B1 Secondary Substation had a primary voltage of 13.8 kV and a secondary voltage of 2.3 kV. In the 1950s, two additional transformers were added to this substation.

Oil containing polychlorinated biphenyls (PCBs) was transferred, as needed, from oil trucks through over-ground hoses to smaller transformers at the secondary and distribution substations.

The above-ground electrical structures, utility poles, and fencing were removed prior to confirmatory sampling as part of the decommissioning and miscellaneous restoration activities (Figure 2).

Figure 2. 100-B-35:2 Subsite, 152-B1 Secondary Electrical Substation Following Completion of Miscellaneous Restoration (March 2013).

Ecological and Cultural Resources

An ecological and cultural resources review was performed for the 100-B-35 waste site on September 5, 2013, for the purposes of confirmatory sampling and remediation of the 100-B-35 waste site and demolition of the 151-B Building. The ecological resources survey and review indicated that no adverse impacts to ecological resources were anticipated during confirmatory sampling and remediation of the 100-B-35 waste site.

Although no cultural resources were anticipated within the project area, all workers were directed to watch for cultural materials (e.g., bones, stone tools, mussel shell) during all work activities. If any cultural materials were encountered, work in the vicinity of the discovery had to stop until a cultural resources specialist has been notified; the significance of the find assessed; the appropriate Tribes notified; and, if necessary, arrangements made for mitigation of the find (WCH 2013a). No ecologically or culturally significant materials were encountered during confirmatory sampling.

CONFIRMATORY SAMPLING SUMMARY

Confirmatory sampling was performed at the 100-B-35:2 subsite on February 20, 2014, per the *Work Instruction for Confirmatory Sampling of the 100-B-35, 151-B Primary Substation and 152-B1 Secondary Substation* (WCH 2013b). Confirmatory sampling of the 100-B-35:2 subsite was performed to support evaluation of the site against the RAGs specified in the Remaining Sites ROD (EPA 1999). The analytical results were evaluated against the cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b) to support a No Action or Remedial Action decision. The following sections describe the COPCs, sample design, sampling activities, and sample results.

Contaminants of Potential Concern

The COPCs for the 100-B-35:2 subsite were identified based on potential hazardous constituents associated with leaks and spills from the electrical transformers, circuit breakers, and transfer systems. The COPCs included the expanded list of inductively coupled plasma (ICP) metals, mercury, total petroleum hydrocarbons (TPH), and PCBs.

Field screening for volatile organic compounds (VOCs) was performed and no VOCs were detected; therefore, volatile organic analysis was not requested. Because no suspected asbestos-containing material was observed during confirmatory sampling, analysis was not performed for asbestos. Radiological activity was not detected in the field during confirmatory sampling activities; therefore, no analysis for radionuclides was performed.

Confirmatory samples were analyzed using EPA-approved methods. Tables 1 and 2 identify the location and analysis selected for confirmatory sampling.

Table 1. Laboratory Analytical Methods for the 100-B-35:2 Subsite.

Analytical Method	Contaminant of Potential Concern
ICP metals [a] – EPA Method 6010	Metals
Mercury – EPA Method 7471	Mercury
PCB – EPA Method 8082	Polychlorinated biphenyls
TPH – NWTPH-Dx	Total petroleum hydrocarbons

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

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

Table 2. 100-B-35:2 Subsite Confirmatory Sampling Summary Table.

Sample	Sample Location Description	Sample Media	HEIS Number	Approximate WSP Location Coordinates	Sample Analysis
152-B1 Secondary Electrical Substation - Surface Investigation					
FS-12	152-B1, north, between concrete pads	Soil	J1T9J5	N 145185.4, E 564822.4	ICP metals [a], mercury, PCBs, TPH
FS-13	152-B1, south, between concrete pads	Soil	J1T9J6	N 145177.8, E 564822.5	
SC-2	Concrete pad at 152-B1	Scabbled concrete	J1T9K5	East concrete pad	

[a] Sample analysis for ICP metals was performed and included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons
WSP = Washington State Plane

Confirmatory Sample Design

Two focused soil samples and one scabbled concrete sample was used to characterize the area of the 100-B-35:2 subsite. The sample locations and sample design details are discussed in the work instruction (WCH 2013b). Prior to confirmatory sampling at the 152-B1 substation, a walkdown of the area was performed to inspect the concrete pads and surrounding soils for any staining.

Confirmatory Sampling Activities

Confirmatory sampling was performed as described in the confirmatory sampling work instruction (WCH 2013b). 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). Field observations during sampling are

provided in the field logbook (WCH 2014). A summary of the samples collected for the 100-B-35:2 subsite confirmatory sampling is provided in Table 2.

Confirmatory sampling data for the 100-B-35:2 subsite are presented in Appendix A. The laboratory-reported confirmatory data results for all samples and constituents associated with the 100-B-35:2 subsite are stored in the Washington Closure Hanford (WCH) project-specific database prior to archival in the Hanford Environmental Information System (HEIS). A summary of field observations and sample collection at 100-B-35:2 subsite location is provided below.

Confirmatory sampling of the 100-B-35:2 subsite was performed on February 20, 2014. A walkdown of the 151-B2 substation was performed, and stained soil was not observed at the 100-B-35:2 subsite. Two focused soil samples were collected from the 100-B-35:2 subsite (Figure 3). In addition, one concrete scabble sample (J1T9K5) was collected from the east concrete slab. No staining was observed during soil and concrete scabble sampling.

No suspected asbestos-containing material was observed and no radiological activity was detected during confirmatory sampling at any of the sample locations.

Confirmatory Sample Results

Confirmatory samples were analyzed using EPA-approved analytical methods. Evaluation of the soil sample data was performed by direct comparison of the maximum detected value for each COPC against the RAGs. If no detections for a given COPC were reported in the data set, then no comparisons were performed for that COPC.

Comparisons of the maximum results for COPCs and the site RAGs for the 100-B-35:2 subsite are presented in Tables 3 and 4. 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* (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 Tables 3 or 4.

Figure 3. The 152-B1 Secondary Substation Sample Locations Map.

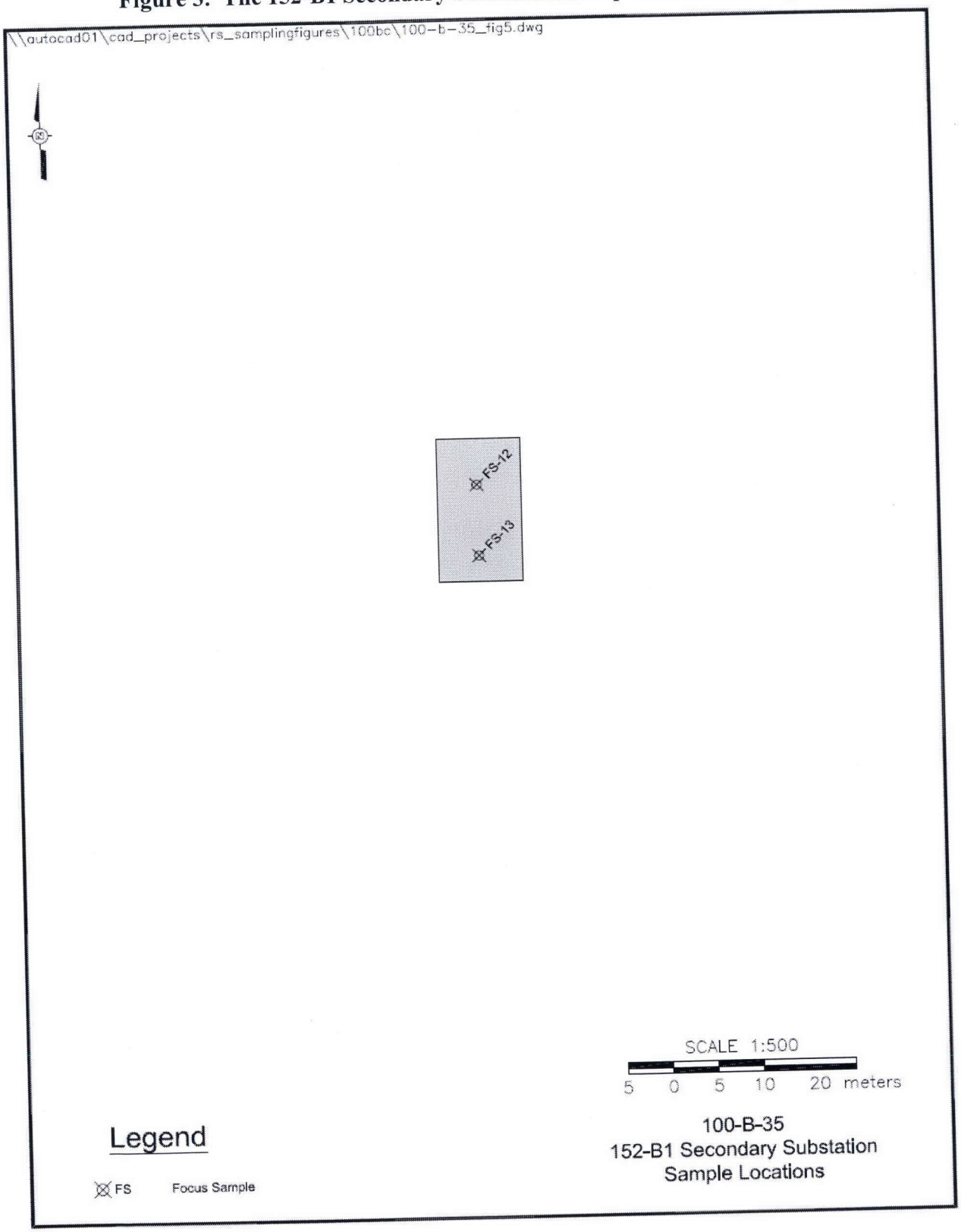


Table 3. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 100-B-35:2 Subsite Confirmatory Soil Sampling Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	3.57 (<BG)	32	5 [b]	5 [b]	No	--
Arsenic	1.62 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	51.6 (<BG)	5,600	200	400	No	--
Beryllium	0.318 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Chromium (total)	11.5 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	7.46 (<BG)	24	15.7 [b]	-- [d]	No	--
Copper	21.8 (<BG)	2,960	59.2	22.0 [b]	No	--
Lead	12.7	353	10.2 [b]	10.2 [b]	Yes	Yes [e]
Manganese	234 (<BG)	3,760	512 [b]	512 [b]	No	--
Mercury	0.00926 (<BG)	24	0.33 [b]	0.33 [b]	No	--
Nickel	9.66 (<BG)	1,600	19.1 [b]	27.4	No	--
Silver	0.569 (<BG)	400	8	0.73 [b]	No	--
Vanadium	48.4 (<BG)	560	85.1 [b]	-- [d]	No	--
Zinc	158	24,000	480	67.8 [b]	Yes	Yes [e]
TPH – diesel range	3.6	200	200	200	No	--
TPH – motor oil	19.3	200	200	200	No	--
Benzo(a)anthracene	0.067	1.37	0.015 [f]	0.015 [f]	Yes	Yes [e]
Benzo(a)pyrene	0.0768	0.137	0.015 [f]	0.015 [f]	Yes	Yes [e]
Benzo(b)fluoranthene	0.0741	1.37	0.015 [f]	0.015 [f]	Yes	Yes [e]
Benzo(ghi)perylene [g]	0.0678	2,400	48	192	No	--
Benzo(k)fluoranthene	0.0411	1.37	0.015 [f]	0.015 [f]	Yes	Yes [e]
Chrysene	0.0535	13.7	0.12	0.1 [f]	No	--
Dibenz[a,h]anthracene	0.00772	1.37	0.03 [f]	0.03 [f]	No	--
Fluoranthene	0.0629	3,200	64	18.0	No	--
Indeno(1,2,3-cd) pyrene	0.0631	1.37	0.33 [f]	0.33 [f]	No	--
Phenanthrene [g]	0.0118	24,000	240	1,920	No	--
Pyrene	0.0615	2,400	48	192	No	--

Table 3. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 100-B-35:2 Subsite Confirmatory Soil Sampling Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Aroclor-1260	0.0424	0.5	0.017 [f]	0.017 [f]	Yes	Yes [e]

[a] RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d)(1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[c] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3), 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[d] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[e] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead, zinc, aroclor-1260, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not predicted to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years (based on the contaminant with the lowest distribution coefficient (K_d), lead and/or zinc, with a K_d value of 30 mL/g). The vadose zone soil underlying the 100-B-35:2 subsite is approximately 12 m (39 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.
[f] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (1996) and the RDR/RAWP (DOE-RL 2009b).
[g] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:
contaminant: benzo(g,h,i)perylene; surrogate: pyrene
contaminant: phenathrene; surrogate: anthracene.

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

Table 4. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 100-B-35:2 Subsite Confirmatory Scabbled Concrete Sample Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [b]	5.34	32	5 [c]	5 [c]	Yes	Yes [d]
Arsenic	6.98	20 [c]	20 [c]	20 [c]	No	--
Barium	86.1 (<BG)	5,600	200	400	No	--
Beryllium	0.378 (<BG)	10.4 [e]	1.51 [c]	1.51 [c]	No	--
Boron [f]	3.73	7,200	320	-- [g]	No	--
Cadmium	0.753 (<BG)	13.9 [e]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	14.7 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.68 (<BG)	24	15.7 [c]	-- [g]	No	--
Copper	24.4	2,960	59.2	22.0 [c]	Yes	Yes [d]

Table 4. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 100-B-35:2 Subsite Confirmatory Scabbled Concrete Sample Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Lead	6.97 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	223 (<BG)	3,760	512 [c]	512 [c]	No	--
Nickel	11.2 (<BG)	1,600	19.1 [c]	27.4	No	--
Silver	18.9	400	8	0.73 [c]	Yes	Yes [d]
Vanadium	57.1 (<BG)	560	85.1 [c]	-- [g]	No	--
Zinc	106	24,000	480	67.8 [c]	Yes	Yes [d]
TPH – diesel range	20.2	200	200	200	No	--
TPH – motor oil	32.9	200	200	200	No	--
Fluoranthene	0.0014	3,200	64	18.0	No	--
Aroclor-1260	0.00424	0.5	0.017 [h]	0.017 [h]	No	--

[a] RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] Based on the discussion of distribution coefficient (K_d) for antimony in Appendix E of the RDR/RAWP (DOE-RL 2009b) and K_d value provided by the Cleanup Levels and Risk Calculations Database (Ecology 2014),a K_d value of 45 mL/g is applied for concrete media.
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d)(1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[d] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of antimony, copper, silver, and zinc are not predicted to migrate more than 2.6 m (8.5 ft) vertically in 1,000 years (based on the contaminant with the lowest distribution coefficient (K_d), copper, with a K_d value of 22 mL/g). The vadose zone soil underlying the 100-B-35:2 subsite is approximately 12 m (39 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.
[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3), 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[f] No Hanford Site-specific or Washington State background value available.
[g] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2014) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (1996) and the RDR/RAWP (DOE-RL 2009b).

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

The laboratory-reported data results for all constituents are stored in the WCH project-specific database prior to provision to the HEIS and are presented as an attachment to the 95% upper confidence limit calculation in Appendix A.

CONFIRMATORY SAMPLE DATA EVALUATION

This section demonstrates that contaminant concentrations at the 100-B-35:2 subsite achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the Remaining Sites ROD (EPA 1999) and documented in the RDR/RAWP (DOE-RL 2009b).

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

Table 3 compares the maximum detected confirmatory soil sample results to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. Table 4 compares the maximum detected scabbled concrete data results to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. All COPCs for all sampling areas were quantified below their respective direct exposure soil RAGs.

Antimony, copper, lead, silver, zinc, aroclor-1260, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are present at maximum concentrations above soil RAGs for groundwater and/or Columbia River protection. However, based on RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), it is predicted that these constituents will not migrate more than 2.6 m (8.5 ft) vertically in 1,000 years (based on the lowest distribution coefficients of the contaminants exceeding the RAGs, copper, with distribution coefficients of 22 mL/g). The vadose zone underlying the soil below the site is approximately 12 m (39 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

Arsenic was detected above the Hanford Site background value in the scabbled concrete sample, but below the WAC 173-340 Method A cleanup level of 20 mg/kg that has been agreed upon by the Tri-Parties in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b). Due to the intent of Method A cleanup values and the allowance to use such values for arsenic in the RDR/RAWP, arsenic concentrations below 20 mg/kg are excluded from groundwater and river protection evaluations and are excluded from evaluations of cumulative risk requirements.

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-B-35:2 subsite, 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 levels. The cumulative noncarcinogenic hazard quotient is 2.3×10^{-1} which is less than 1.0. All individual carcinogen risk values for carcinogenic constituents are less than 1×10^{-6}. The cumulative direct contact excess cancer risk is 8.3×10^{-7}. Therefore, nonradionuclide risk requirements are met.

DATA QUALITY ASSESSMENT

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

The DQA for the 100-B-35:2 subsite 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 confirmation. The confirmatory sample analytical data are stored in the WCH project-specific database for data evaluation prior to archival in the HEIS and are provided as an attachment to the relative percent difference and direct contact hazard quotient calculation in Appendix A. The detailed DQA is presented in Appendix B.

SUMMARY FOR NO ACTION DETERMINATION

The 100-B-35:2 subsite has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2009b). Confirmatory sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at this site meet the RAGs and associated RAOs for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 100-B-35:2 subsite to Interim No Action. The 100-B-35:2 subsite contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

REFERENCES

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DOE-RL, 2013, *100 Area "Plug-In" and Candidate Sites for Calendar Year 2012 - Annual Listing of Waste Sites Plugged into the Remove, Treat and Dispose Remedy in the 1999 Interim Action Record of Decision for the 100 Area*, AR/PIR Accession Number 0089957, January 2013, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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EPA, 2009, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

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

WCH, 2013a, *Supersedes CCN 172492: Ecological and Cultural Resources Review for Confirmatory Sampling and Remediation of the 100-B-35 Waste Site and Demolition of the 151-B Building and Switchyard in the 100-B Area (12-ER-052, HCRC#2013-100-023)*, CCN 172493 to I. B. Berezovskiy from J. E. Thomson, Washington Closure Hanford, Richland, Washington, September 5.

WCH, 2013b, *Work Instruction for Confirmatory Sampling of the 100-B-35, 151-B Primary Substation and 152-B1 Secondary Electrical Substation*, 0100B-WI-G0039, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014, *IU-2/6 and Segment 4 Miscellaneous Restoration Sites*, Logbook EL-1667-01, pp. 50-56, Washington Closure Hanford, Richland, Washington.

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

APPENDIX A

DIRECT CONTACT HAZARD QUOTIENT AND CARCINOGENIC RISK CALCULATION

APPENDIX A

CALCULATIONS

The calculations in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the files will be stored in a U.S. Department of Energy, Richland Operations Office, repository. The calculations have been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculations," Washington Closure Hanford, Richland, Washington. The following calculations are provided in this appendix:

100-B-35:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100B-CA-V0345, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-BC

Discipline: Environmental *Calculation No: 0100B-CA-V0345

Subject: 100-B-35:2 Subsite Direct 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 = 4 Attachment = 3 Total = 8	I. B. Berezovskiy	J. D. Skoglie	H. M. Sulloway	S.G. Wilkinson ~~D. F. Obenauer~~	6/24/14

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford CALCULATION SHEET

Originator:	I. B. Berezovskiy	Date:	4/30/2014	Calc. No.:	0100B-CA-V0345	Rev.:	0
Project:	100 Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	4/30/2014
Subject:	100-B-35:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 4	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 100-B-35:2 subsite. 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.

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

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).

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

METHODOLOGY:

The 100-B-35:2 subsite underwent confirmatory focused sampling at three locations. Two soil samples and one scabbled concrete sample was collected from the 100-B-35:2 subsite. The direct contact hazard quotient and carcinogenic risk calculations for the 100-B-35:2 subsite was conservatively calculated using the maximum results from the sample results in Attachment 1. Of the contaminants of potential concern (COPCs) and other analytes for this subsite, boron, detected polycyclic aromatic hydrocarbons

Washington Closure Hanford CALCULATION SHEET

Originator:	I. B. Berezovskiy	Date:	4/30/2014	Calc. No.:	0100B-CA-V0345	Rev.:	0
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Subject:	100-B-35:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 4	

and aroclor-1260 require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Antimony, copper, silver and zinc require HQ and risk calculations because these constituents were detected above a Washington State or Hanford Site background value. Lead was detected above background; however, lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake. Additionally, arsenic was detected above background; however, the arsenic standard is not toxicity based. Although total petroleum hydrocarbons (motor oil and diesel range) 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 zinc is 158 mg/kg, divided by the noncarcinogenic RAG value of 24,000 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 6.6×10^{-3}. 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 2.3×10^{-1}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for aroclor-1260 is 0.0424 mg/kg, divided by 0.5 mg/kg, and multiplied as indicated, is 8.5×10^{-8}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values for COPCs is 8.3×10^{-7}. Comparing these values to the requirement of $<1 \times 10^{-5}$, this criterion is met.

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 $>1 \times 10^{-6}$: None
4) List the cumulative excess cancer risk for carcinogens $>1 \times 10^{-5}$: None

Table 1 shows the results of the hazard quotient and excess cancer risk calculations for the 100-B-35:2 subsite.

CALCULATION SHEET

Washington Closure Hanford							
Originator:	I. B. Berezovskiy	Date:	4/30/2014	Calc. No.:	0100B-CA-V0345	Rev.:	0
Project:	100 Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	4/30/2014
Subject:	100-B-35:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 4

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-B-35:2 Subsite.

Contaminants of Potential Concern	Maximum Value [a] (mg/kg)	Noncarcinogen RAG [b] (mg/kg)	Hazard Quotient	Carcinogen RAG [b] (mg/kg)	Carcinogen Risk
Metals					
Antimony	5.34	32	1.7E-01	--	--
Arsenic [c]	6.98	20	--	--	--
Boron	3.73	7,200	5.2E-04	--	--
Copper	24.4	2,960	8.2E-03	--	--
Lead [d]	12.7	353	--	--	--
Silver	18.9	400	4.7E-02	--	--
Zinc	158	24,000	6.6E-03	--	--
Polycyclic Aromatic Hydrocarbons					
Benzo(a)anthracene	0.0670	--	--	1.37	4.9E-08
Benzo(a)pyrene	0.0768	--	--	0.137	5.6E-07
Benzo(b)fluoranthene	0.0741	--	--	1.37	5.4E-08
Benzo(ghi)perylene [e]	0.0678	2,400	2.8E-05	--	--
Benzo(k)fluoranthene	0.0411	--	--	1.37	3.0E-08
Chrysene	0.0535	--	--	13.7	3.9E-09
Dibenz(a,h)anthracene	0.00772	--	--	1.37	5.6E-09
Fluoranthene	0.0629	3,200	2.0E-05	--	--
Indeno(1,2,3-cd)pyrene	0.0631	--	--	1.37	4.6E-08
Phenanthrene [e]	0.0118	24,000	4.9E-07	--	--
Pyrene	0.0615	2,400	2.6E-05	--	--
Polychlorinated Biphenyls					
Aroclor-1260	0.0424	--	--	0.5	8.5E-08
Total Petroleum Hydrocarbons					
TPH - diesel range plus motor oil (high boiling) [f]	53.1	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**2.3E-01**		
Cumulative Excess Cancer Risk:					**8.3E-07**

Notes:

[a] = From Attachment 1

[b] = Value obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) or *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

[c] = The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).

[d] = Value for the noncarcinogenic RAG calculated using Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, EPA/540/R 93/081, Publication No. 9285.7, U.S. Environmental Protection Agency, Washington, D.C.

[e] = Toxicity data is not available. The cleanup levels are based on use of surrogate chemical.

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

phenanthrene surrogate: anthracene

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

-- = not applicable

RAG = remedial action goal

Washington Closure Hanford CALCULATION SHEET

Originator:	I. B. Berezovskiy	Date:	4/30/2014	Calc. No.:	0100B-CA-V0345	Rev.:	0
Project:	100 Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	4/30/2014
Subject:	100-B-35:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 4	

CONCLUSION:

The calculations in Tables 1 demonstrate that the 100-B-35:2 subsite meets the requirements for the direct contact hazard quotient and carcinogenic (excess cancer) risk, as identified in the RDR/RAWP (DOE-RL 2009b) and SAP (DOE-RL 2009a). The direct contact hazard quotient and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

Attachment 1. 100-B-35:2 Subsite Confirmatory Sample Results (Metals).

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
FS-12	J1T9J5	2/20/2014	3230	*M	6.64	1.61	DU	1.61	0.531	BNJ	0.488	37.3	*MN	0.0976	0.224	BNJ	0.0976
FS-13	J1T9J6	2/20/2014	5350	*M	7.29	3.57	BD	1.77	1.62	BNJ	0.536	51.6	*MN	0.107	0.318	BNJ	0.107
SC-2	J1T9K5	2/20/2014	11200	D	33.0	5.34	D	1.60	6.98	N	0.485	86.1	*MN	0.0971	0.378	BN	0.0971

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
FS-12	J1T9J5	2/20/2014	0.976	NUJ	0.976	0.0976	NUJ	0.0976	2250	M	7.81	7.17	MNJ	0.146	6.14	D	0.732
FS-13	J1T9J6	2/20/2014	1.07	NUJ	1.07	0.529	BNUJ	0.107	4090	M	8.58	11.5	MNJ	0.161	7.46	D	0.804
SC-2	J1T9K5	2/20/2014	3.73	BN	0.971	0.753	N	0.0971	132000	D	38.8	14.7	*MN	0.146	7.68	D	0.728

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
FS-12	J1T9J5	2/20/2014	11.6	*MNJ	0.293	11600	M	7.81	6.83	D	1.61	2240	*M	8.29	156	*M	0.195
FS-13	J1T9J6	2/20/2014	21.8	*MNJ	0.322	15800	M	8.58	12.7	D	1.77	3460	*M	9.11	234	*M	0.214
SC-2	J1T9K5	2/20/2014	24.4	MN	0.291	16200	M	7.77	6.97	D	1.60	5510	*M	8.25	223	M	0.194

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
FS-12	J1T9J5	2/20/2014	0.00586	B	0.00381	0.195	NUJ	0.195	6.71	*MNJ	0.146	761	MNJ	6.25	0.340	DU	0.340
FS-13	J1T9J6	2/20/2014	0.00926	B	0.00431	0.214	NUJ	0.214	9.66	*MNJ	0.161	1240	MNJ	6.86	0.350	DU	0.350
SC-2	J1T9K5	2/20/2014	0.00399	U	0.00399	0.194	NU	0.194	11.2	*MN	0.146	1300	*MN	6.21	0.485	NU	0.485

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

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

* duplicate analysis not within control limits.

B = blank contamination (inorganic constituents)

C = detected in both sample and associated QC blank, sample concentration </=5X blank concentration.

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

FS = focused sample

HEIS = Hanford Environmental Information System

J = estimate

M = sample duplicate precision not met.

N = recovery exceeds upper or lower control limit.

P = aroclor target analyte with greater than 20% difference between column analyses.

PAH = polycyclic aromatic hydrocarbons

PCB = polychlorinated biphenyls

PQL = practical quantitation limit

Q = qualifier

RAG = remedial action goal

SC = scabbled concrete

TPH = total petroleum hydrocarbons

U = not detected.

Attachment	1	Sheet No.	1 of 3
Originator	I. B. Berezovskiy	Date	4/30/2014
Checked	J. D. Skoglie	Date	4/30/2014
Calc. No.	0100B-CA-V0345	Rev. No.	0

Attachment 1. 100-B-35:2 Subsite Confirmatory Sample Results (Metals and TPH).

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
FS-12	J1T9J5	2/20/2014	527	*MNJ	1.46	0.246	BNJ	0.0976	105	*NJ	6.83	48.4	D	0.488	111	D	1.95
FS-13	J1T9J6	2/20/2014	941	*MNJ	1.61	0.569	NJ	0.107	127	*NJ	7.5	46.8	D	0.536	158	D	2.14
SC-2	J1T9K5	2/20/2014	1120	*MN	1.46	18.9	*D	0.485	1140	*MN	6.8	57.1	D	0.485	106	D	1.94

LOCATION	HEIS Number	Sample Date	TPH - Diesel range			TPH - motor oil (high boiling)		
			ug/kg	Q	PQL	ug/kg	Q	PQL
FS-12	J1T9J5	2/20/2014	2650	J	2330	18300		2330
FS-13	J1T9J6	2/20/2014	3580	J	2320	19300		2320
SC-2	J1T9K5	2/20/2014	20200		2160	32900		2160

Attachment	1	Sheet No.	2 of 3
Originator	I. B. Berezovskiy	Date	4/30/2014
Checked	J. D. Skoglie	Date	4/30/2014
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Attachment 1. 100-B-35:2 Subsite Confirmatory Sample Results (Organics).

CONSTITUENT	CLASS	J1T9J5, FS-12			J1T9J6, FS-13			J1T9K5, SC-2		
		2/20/2014			2/20/2014			2/20/2014		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	5.36	U	5.36	5.36	U	5.36	4.99	U	4.99
Acenaphthylene	PAH	5.36	U	5.36	5.36	U	5.36	4.99	U	4.99
Anthracene	PAH	1.79	U	1.79	1.79	U	1.79	1.66	U	1.66
Benzo(a)anthracene	PAH	7.01		0.572	67.0		0.572	0.532	U	0.532
Benzo(a)pyrene	PAH	4.5		0.572	76.8		0.572	0.532	U	0.532
Benzo(b)fluoranthene	PAH	11.5		0.572	74.1		0.572	0.532	U	0.532
Benzo(ghi)perylene	PAH	4.61		0.572	67.8		0.572	0.532	U	0.532
Benzo(k)fluoranthene	PAH	6.10		0.286	41.1		0.286	0.266	U	0.266
Chrysene	PAH	12.0		0.572	53.5		0.572	0.532	U	0.532
Dibenz[a,h]anthracene	PAH	0.746	J	0.572	7.72	P	0.572	0.532	U	0.532
Fluoranthene	PAH	22.9		0.572	62.9		0.572	1.40	J	0.532
Fluorene	PAH	5.36	U	5.36	5.36	U	5.36	4.99	U	4.99
Indeno(1,2,3-cd)pyrene	PAH	0.572	U	0.572	63.1	P	0.572	0.532	U	0.532
Naphthalene	PAH	5.36	U	5.36	5.36	U	5.36	4.99	U	4.99
Phenanthrene	PAH	9.31	J	5.36	11.8	J	5.36	4.99	U	4.99
Pyrene	PAH	19.5		0.572	61.5		0.572	0.532	U	0.532
Aroclor-1016	PCB	1.19	UJ	1.19	11.9	DUJ	11.9	1.11	U	1.11
Aroclor-1221	PCB	1.19	U	1.19	11.9	DU	11.9	1.11	U	1.11
Aroclor-1232	PCB	1.19	U	1.19	11.9	DU	11.9	1.11	U	1.11
Aroclor-1242	PCB	1.19	U	1.19	11.9	DU	11.9	1.11	U	1.11
Aroclor-1248	PCB	1.19	U	1.19	11.9	DU	11.9	1.11	U	1.11
Aroclor-1254	PCB	1.19	U	1.19	11.9	DU	11.9	1.11	U	1.11
Aroclor-1260	PCB	10.7		1.19	42.4	DP	11.9	4.24		1.11

Attachment	1	Sheet No.	3 of 3
Originator	I. B. Berezovskiy	Date	04/30/14
Checked	J. D. Skoglie	Date	04/30/14
Calc. No.	0100B-CA-V0345	Rev. No.	0

APPENDIX B

DATA QUALITY ASSESSMENT

APPENDIX B

DATA QUALITY ASSESSMENT

CONFIRMATORY SAMPLING

A data quality assessment (DQA) was performed to compare the confirmatory sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2013). This DQA was performed in accordance with site-specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009).

A review of the sample design (WCH 2013), the field logbook (WCH 2014), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. However, because the 100-B-35 subsite was divided into subsites after sample collection, a duplicate and an equipment blank are not associated with the 100-B-35:2 subsite. The lack of a duplicate and equipment blank does not impact the field sample data, which are usable for decision-making purposes. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Confirmatory sample data collected at the 100-B-35:2 subsite were provided by the laboratories in two sample delivery groups (SDGs): SDG XP0051 and SDG XP0052. SDG XP0051 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 100-B-35:2 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.

MAJOR DEFICIENCIES

None.

MINOR DEFICIENCIES

SDG XP0051

This SDG is composed of two soil samples (J1T9J5 and J1T9J6) collected during confirmatory sampling of the 100-B-35:2 subsite on February 20, 2014. All samples were analyzed for inductively coupled plasma (ICP) metals, mercury, polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH). Although not required in the sample design (WCH 2013),

analysis was also requested for polycyclic aromatic hydrocarbons (PAH). SDG XP0051 was submitted for third-party validation.

In the PCB analysis, the matrix spike (MS) and matrix spike duplicate (MSD) results for aroclor-1016 were outside of quality control (QC) limits at 0%. The failure was attributed to interference by the sample matrix. All aroclor-1016 results were considered estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, cadmium was detected in the method blank (MB). All cadmium results were considered estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, MS recoveries were outside of QC limits for arsenic (62.1%), beryllium (66.4%), boron (59.8%), cadmium (63.7%), chromium (60.8%), molybdenum (61.7%), nickel (60.7%), potassium (43.2%), silicon (0%), silver (64.7%), and sodium (66%). To confirm quantitation, a post-digestion spike (PDS) and serial dilution was prepared for all subject analytes. Recovery was acceptable for all analytes except for potassium (149%). All arsenic, beryllium, boron, cadmium, chromium, molybdenum, nickel, potassium, silicon, silver, and sodium results were considered estimated and flagged "J" by third-party validation due to the MS recoveries outside the QC limits. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the relative percent difference (RPD) calculations for copper (31%) and silicon (52.7%) from the laboratory duplicate analysis were above QC limits. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. All copper and silicon results were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

SDG XP0052

This SDG is composed of one other solid sample (scabbled concrete) (J1T9K5) collected during confirmatory sampling of the 100-B-35:2 subsite on February 20, 2014. The sample was analyzed for ICP metals, mercury, PCBs, and TPH. Although not required in the sample design (WCH 2013), analysis was also requested for PAH.

In the ICP metals analysis, cadmium and zinc were detected in the MB. Although not qualified for the contamination in the MB, the cadmium and zinc results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the RPD calculations for silicon (53.7%), silver (32.9%), and sodium (33.2%) from the laboratory duplicate analysis were above QC limits. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. Although not qualified for the elevated RPD calculations, the silicon, silver, and sodium results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, MS recoveries were outside of QC limits for arsenic (66.8%), barium (32.7%), beryllium (64.3%), boron (63.1%), cadmium (59.2%), chromium (55.4%), molybdenum (62.1%), nickel (52.8%), potassium (34.9%), selenium (63.2%), silicon (177%), and sodium (19.3%). To confirm quantitation, a PDS and serial dilution was prepared for all subject analytes. Recovery was acceptable for all analytes except for barium (132%), potassium (174%), and sodium (164%). Although not qualified due to the MS recoveries outside the QC limits, all results for arsenic, barium, beryllium, boron, cadmium, chromium, molybdenum, nickel, potassium, selenium, silicon, and sodium results may be considered estimated. Estimated 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-B-35:2 subsite confirmatory 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-B-35:2 subsite 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 confirmatory 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 (HEIS) database. The confirmatory sample analytical data are also summarized in Appendix A.

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