0097856

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

11-AMRC-0181

JUL 24 2011

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-H-50, 100-H STEAM CONDENSATE FRENCH DRAINS, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2009-009 and supporting "Remaining Sites Verification Package for the 100-H-50, 100-H Steam Condensate French Drains," Revision 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

Mark S. French, Federal Project Director
for the River Corridor Closure Project

AMRC:JCC

Attachment

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

cc w/o attach:
R. D. Cantwell, WCH
S. A. Christman, CHPRC
S. L. Feaster, WCH
T. A. Harris, WCH
M. L. Proctor, WCH

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EDMC

100-HR-1

Date Submitted: 01/06/2011 Originator: M. L Proctor Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-HR-1 Waste Site Code: 100-H-50 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☐ No Action ☒ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2009-009

This form documents agreement among parties listed authorizing classification of the subject unit as Closed Out, Interim Closed Out, No Action, RCRA Postclosure, Rejected, or Consolidated. This form also authorizes backfill of the waste management unit, if appropriate, for Closed Out and Interim Closed Out units. Final removal from the NPL of No Action and Closed Out waste management units will occur at a future date.

Description of current waste site condition:
The site of the 100-H-50, 100-H Steam Condensate French Drains is comprised of 14 steam condensate french drains that were identified during the orphan site evaluation process. The 100-H-50 waste site was included in 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) as a candidate site for confirmatory sampling. Confirmatory sampling was performed in accordance with the *Work Instruction for Confirmatory Sampling of the 100-H-50, 100-H Steam Condensate French Drains,* Work Instruction No. 0100H-WI-G0050, Rev. 0, Washington Closure Hanford, Richland, Washington (WCH 2010c). The results of confirmatory sampling were used to determine if the waste site meets remedial action objectives (RAOs) and remedial action goals (RAGs) established by 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). The selected action involved (1) evaluating the site 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:
In accordance with this evaluation, the confirmatory sampling evaluation (which may include modeling) of all data collected from the waste site resulted in a determination of reclassification of this site to No Action. The 100-H-50, 100-H Steam Condensate French Drains waste site achieves the RAOs and the corresponding RAGs established in the Remaining Sites ROD (EPA 1999). 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 evaluation (which may include modeling) of all data collected from the waste site resulted in a determination that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Site contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-H-50, 100-H Steam Condensate French Drains* (attached).

Regulator Comments:
Approval of this WSRF documents regulator agreement that the 100-H-50 waste site qualifies for "No Action" under this Interim Action ROD. In addition, Ecology has evaluated the data for this site against WAC 173-340 (2007) clean-up levels for direct contact, groundwater protection, and river protection. This evaluation is documented in the letter transmitting Ecology's approval of the site's interim reclassification to "No Action."

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.

M. French DOE Federal Project Director (printed)	M. French Signature	6/7/11 Date
N. Menard Ecology Project Manager (printed)	Nina M. Menard Signature	6/16/11 Date
N/A EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-H-50, 100-H STEAM CONDENSATE FRENCH DRAINS

Attachment to Waste Site Reclassification Form 2009-009

January 2011

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-H-50, 100-H STEAM CONDENSATE FRENCH DRAINS

EXECUTIVE SUMMARY

The 100-H-50, 100-H Steam Condensate French Drains waste site includes 14 individual french drain locations, the underlying soil, and the associated below-grade piping components for steam condensate french drains. The 100-H-50 waste site is located in the 100-HR-1 Operable Unit of the Hanford Site, near the 182-H reservoir and pumphouse, 190-H process pumphouse, 1703-H and 1704-H office buildings, 184-H powerhouse, and 1901-H soft water tank. The site was identified during the orphan sites evaluation process.

Confirmatory sampling activities at the 100-H-50 waste site were performed from October 5 to 11, 2010, in accordance with the *Work Instruction for Confirmatory Sampling of the 100-H-50, 100-H Steam Condensate French Drains* (WCH 2010c). The analytical results indicated no residual concentrations exceeding cleanup criteria, except for lead, that exceeded the soil remedial action goals (RAGs) for the protection of groundwater and/or the Columbia River. However, based on RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP)(DOE-RL 2009b), lead is not predicted to migrate to groundwater or to the Columbia River within 1,000 years, and the residual concentration is, therefore, protective of groundwater and the Columbia River. A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1.

Table ES-1. Summary of Remedial Action Goals for the 100-H-50 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct exposure radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years.	There were no radionuclide COPCs for this site.	NA
Direct exposure nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk requirements – nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	All individual hazard quotients are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (1.2×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	No carcinogenic contaminants were detected above background levels.	
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.		

Table ES-1. Summary of Remedial Action Goals for the 100-H-50 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/river protection – radionuclides	Attain single COPC groundwater and river protection RAGs.	There were no radionuclide COPCs for this site.	NA
	Attain national primary drinking water regulations [a]: 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide from DOE Order 5400.5 [b].		
	Meet total uranium standard of 21.2 pCi/L.[c]		
Groundwater/river protection – nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Lead is present at concentrations above soil RAGs for groundwater and/or river protection. However, vertical migration modeling predicts that lead will not reach groundwater (and, therefore, the Columbia River) within 1,000 years [d]. Therefore, the residual concentrations achieve the remedial action objectives for groundwater and river protection.	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).

[b] *Radiation Protection of the Public and Environment* (DOE Order 5400.5).

[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).

[d] Based on the RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), lead is not predicted to migrate through the 10-m (33-ft)-thick vadose zone to the groundwater in 1,000 years (based on the lead soil-partitioning distribution coefficient of 30 mL/g).

COPC = contaminant of potential concern
DOE = U.S. Department of Energy
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)

The results of confirmatory sampling are used to make reclassification decisions for the 100-H-50 waste site in accordance with the TPA-MP-14 (DOE-RL 2007) procedure. In accordance with this evaluation, the confirmatory sampling evaluation (which may include modeling) of all data collected from the waste site resulted in a determination of a reclassification of this site to No Action. The current site conditions achieve the remedial action objectives and the corresponding RAGs established in the (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). 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 evaluation (which may include modeling) of all data collected from the waste site resulted in a determination e that residual contaminant concentrations are protective of groundwater and the Columbia River. Site contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of potential concern and other constituents. *Washington Administrative Code* 173-340 (2007) ecological screening levels were exceeded for boron and vanadium. The U. S. Environmental Protection Agency ecological soil screening levels were exceeded for lead, manganese, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the maximum detected levels of manganese and vanadium values are below 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 ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site. A table showing contaminant concentrations from the 100-H-50 waste site that exceed ecological screening levels is provided in Appendix A.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-H-50, 100-H STEAM CONDENSATE FRENCH DRAINS

STATEMENT OF PROTECTIVENESS

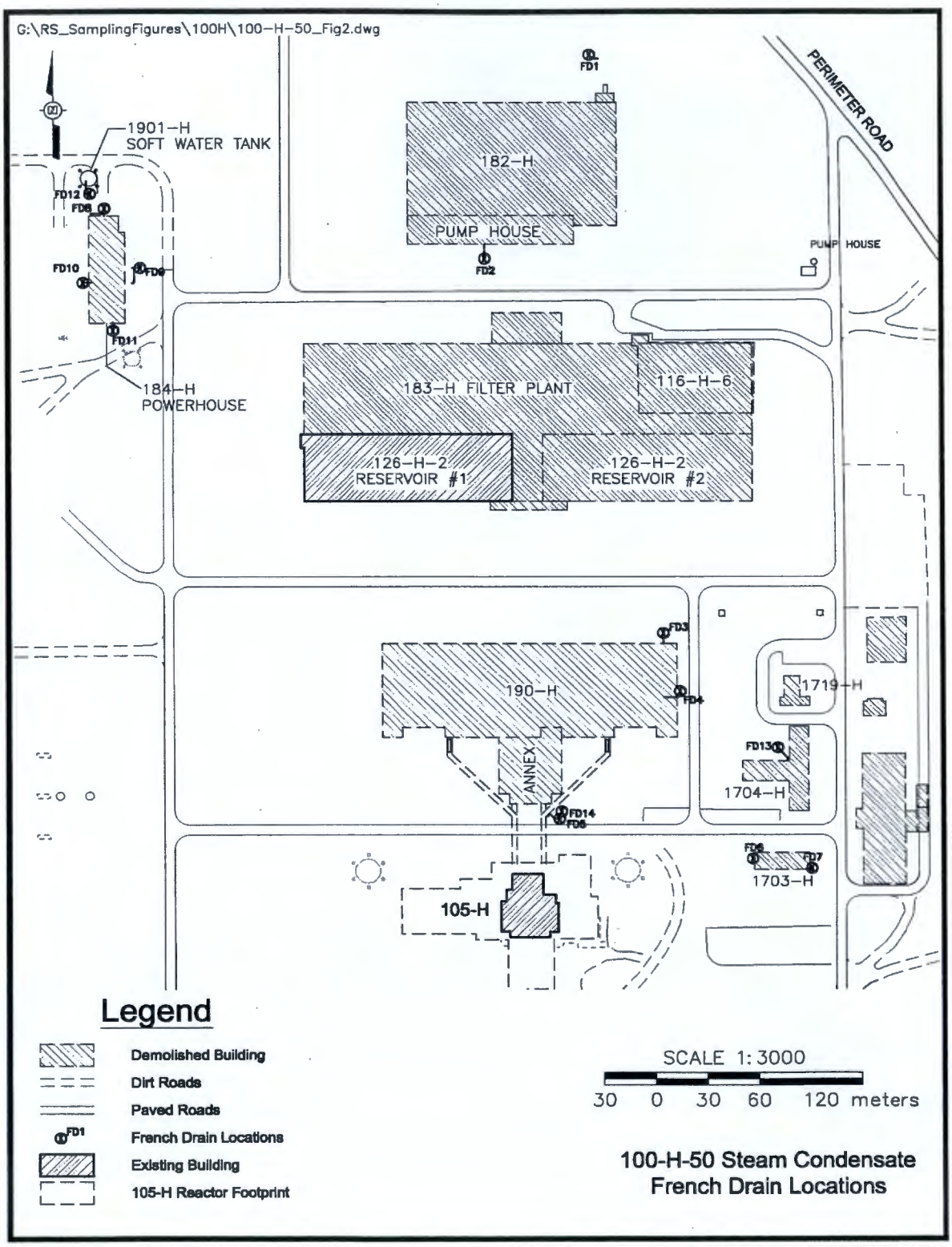
This report demonstrates that the 100-H-50, 100-H Steam Condensate French Drains waste site meets the objectives for reclassification to No Action as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision 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). 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. Site contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of potential concern and other constituents. *Washington Administrative Code* 173-340 (2007) ecological screening levels were exceeded for boron and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for lead, manganese, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the maximum detected levels of manganese and vanadium values are below 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 ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site. A table showing contaminant concentrations from the 100-H-50 waste site that exceed ecological screening levels is provided in Appendix A.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-H-50 Steam Condensate French Drains are located in the 100-HR-1 Operable Unit of the Hanford Site, near the 182-H reservoir and pumphouse, 190-H process pumphouse, 1703-H and 1704-H office buildings, 184-H powerhouse, and 1901-H soft water tank (Figure 1). The buildings listed above were demolished between 1974 and 1977, with the exception of the 184-H powerhouse, which was demolished between 1968 and 1973, based on site photographs.

Figure 1. Locations of the 14 Steam Condensate French Drains Within the 100-H-50 Waste Site.



The following are site descriptions for each of the 14 steam condensate french drains, which were identified during the orphan sites evaluation process (WCH 2009). Thirteen of the french drains were identified through an examination of historical building drawings as part of the orphan site evaluation process. During an orphan site field walkdown, one additional french drain (14) was identified; however, a subsequent review of the location and description of the additional french drain concluded it is a redundant identification of french drain 5.

1. The site is a 1.22-m (48-in.) reinforced-concrete pipe french drain with 0.1-m (4-in.) clay tile that is 6.1 m (20 ft) long and at a 1% slope (2.54 cm [1 in.] of slope per linear foot of pipe) from the 1.1-m (42-in.) raw water line. The site is associated with the 182-H Reservoir (north end) (GE 1957a, 1957b).

2. The site is a 0.9-m (36-in.) french drain with a 0.1-m (4-in.)-diameter cast iron pipeline from the 182-H Reservoir (south side) heater systems to the french drain (GE 1949c, 1966).

3. The site is a 0.46-m (18-in.) dry well with a 2.54-cm (1-in.) steam condensate pipeline from the 190-H Building (north side) (VEC 1965a, 1965b, 1965c).

4. The site is a 0.46-m (18-in.) dry well with a 0.05-m (2-in.) steam condensate pipeline from the 190-H Building (east side) (VEC 1965a, 1965b, 1965c).

5. The site is a 0.61-m (24-in.) french drain filled with soil/gravel that is 1.4-m (4.6-ft) deep with a 2.54-cm (1-in.) steam condensate pipeline from the 190-H Building to the french drain (VEC 1965a, 1965b, 1965c). French drain 5 is the same structure as french drain 14.

6. The site is a 0.61-m (24-in.) dry well with a steam condensate pipeline from the 1703-H Office Building (west side) to the dry well (GE 1957c).

7. The site is a 0.61-m (24-in.) french drain with a ventilation drainage pipeline from the 1703-H Office Building (east side) to the french drain (GE 1957c).

8. The site is a 0.9-m (36-in.) french drain from the north side of the 184-H building that used steam radiator unit heaters with 1.9-cm (0.75-in.) condensate blow-off traps and drip legs that discharged to french drains with 0.1-m (4-in.)-diameter vitrified-clay (VC) inlet piping to the french drain (GE 1949d).

9. The site is a 0.9-m (36-in.) french drain with a 0.1-m (4-in.)-diameter VC pipeline from a return riser and steam supply riser from the 184-H boiler house (east side) to the french drain (GE 1949d).

10. The site is a 0.9-m (36-in.) french drain with a 0.1-m (4-in.)-diameter VC condensate pipeline from the west side of the 184-H boiler house to the french drain (GE 1949d).

11. The site is a 0.61-m (24-in.) french drain with a 0.1-m (4-in.)-diameter VC pipeline from a return riser and steam supply riser from the 184-H boiler house (south side) to the french drain (GE 1949d).

12. The site is a 1-m (36-in.) french drain with a 9.4-m (31-ft) long, 2.54-cm (1-in.)-diameter line connecting from the 1901-H water tower trap discharge to the french drain (GE 1949e). There is an additional pipeline to the french drain that is a 8.8-m (29-ft)-long, 3.81-cm (1.5-in.)-diameter line connecting from the 1901-H water tower ejector discharge to the french drain (GE 1949e). The pipelines are soft water trap discharge lines (GE 1949b, 1949e).

13. The site is a 0.9-m (36-in.) french drain with a 0.1-m (4-in.) VC pipeline connecting from the 1704-H office building to the french drain (P-1237) (GE 1949a).

14. The site is a 0.61-m (24-in.) french drain filled with soil/gravel. The drain was discovered in the field during the orphan sites evaluation (photograph number 08212007-071-664 in the Waste Information Data System general summary report). Subsequent review of the location and description of the french drain concluded it is a redundant identification of french drain 5.

Steam condensate discharge sites, such as the subject french drains, are located intermittently along the routes of steam transfer lines. The 184-H powerhouse boiler facility supplied high-pressure steam to area buildings through an above-grade pipeline system. The boiler facility utilized clean filtered water from the 183-H Filter Building. As steam moves through pipes, a portion condenses to liquid and needs to be removed. The condensate was typical blow-off from the above-grade piping system into a below-grade covered french drain. Without removal of the condensed water, the steam system loses efficiency, and pipes can be damaged from accumulated, fast-moving water driven by the steam. Therefore, condensate water was collected and discharged at multiple locations along the steam pipelines.

CONFIRMATORY SAMPLING

The 100-H-50 waste site was evaluated to determine a No Action or Remedial Action decision in accordance with the RDR/RAWP (DOE-RL 2009b), the Remaining Sites ROD (EPA 1999), and the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). This evaluation included investigation of the site by conducting confirmatory sampling. The following sections describe the contaminants of potential concern, sample design, sampling activities, and sample results.

Contaminants of Potential Concern

The contaminants of potential concern (COPCs) for the 100-H-50 waste site were identified based on the process history of the 184-H powerhouse that supplied the high-pressure steam of which a portion condensed to liquid and discharged to the below-grade, covered french drains that comprise the 100-H-50 waste site. The COPC list includes the expanded list of inductively coupled plasma (ICP) metals and mercury. No reference source was provided to substantiate the presence of sodium dichromate in the 184-H building; however, to be conservative, hexavalent chromium is included in the COPC list for the 100-H-50 waste site.

Confirmatory Sample Design

Information provided through an examination of historical building drawings as part of the orphan site evaluation process was used to develop a site-specific sample design for the 100-H-50 waste site. This sample design included focused sampling of the french drain contents, influent pipeline contents, underlying soil, and potentially hazardous substances, if any, discovered during sampling activities. One french drain from each of the building locations within the 100-H-50 waste site were selected for sampling, for a total of five french drain test pits.

Confirmatory Sampling Activities

Confirmatory sampling activities at the 100-H-50 waste site were performed from October 5 to 11, 2010, in accordance with the *Work Instruction for Confirmatory Sampling of the 100-H-50, 100-H Steam Condensate French Drains* (WCH 2010c). One french drain from each of the building locations within the 100-H-50 waste site was selected for sampling, for a total of five french drain test pits. The french drains were selected based on confidence in the location, as determined by surface visibility and/or details from the historical building drawings. The five french drains that were selected for sampling are 2, 5, 6, 11, and 13. Active pump and treat lines were observed at the french drain 2 location during confirmatory sampling, and no excavation or sampling was conducted at the location because of the resulting surface interference. At the location for french drain 13, an area approximately 3 by 3 m (12 by 12 ft) was excavated. Based on the absence of debris and rubble observed in the excavated area, it was determined that there is no french drain at the location, and the excavation was backfilled. The remaining 100-H-50 waste site french drain locations were excavated and sampled. Table 1 provides the summary of the confirmatory samples.

Table 1. 100-H-50 Confirmatory Soil Sampling Summary Table.

Sample Location	HEIS Sample Number	Washington State Plane Coordinates		Depth (m bgs)	Sample Analysis
		Northing (m)	Easting (m)		
French drain 5	J1C325	152586	577801	5.0	ICP metals [a], mercury, hexavalent chromium
French drain 6	J1C330	152557	577971	1.0	
French drain 11	J1C332	152880	577541	1.0	
Duplicate of J1C330 (french drain 6)	J1C331	152557	577971	1.0	
Equipment blank	J1C333	NA	NA	NA	ICP metals [a], mercury

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

bgs = below ground surface
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable

Confirmatory Sample Results

All confirmatory samples were analyzed using analytical methods approved by the U.S. Environmental Protection Agency (DOE-RL 2009b). Evaluation of the confirmatory data from the test pits was performed by direct comparison of the maximum sample results for each COPC against cleanup criteria.

Comparisons of the results for each COPC against site remedial action goals (RAGs) are summarized in Table 2. Contaminants that were not detected by laboratory analysis are excluded from this table. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2009) under *Washington Administrative Code* 173-340-740(3) for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium; therefore, these constituents are not considered site COPCs and are also not included in these tables. The complete laboratory results are stored in the Environmental Restoration (ENRE) project-specific database prior to submitting to the Hanford Environmental Information System (HEIS) for archiving and are provided in Appendix B.

Table 2. Comparison of the Maximum Contaminant Concentrations to the Remedial Action Goals for the 100-H-50 Confirmatory Sampling Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	4.86 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	62.0 (<BG)	5,600	200	400	No	--
Beryllium	0.272 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Boron [d]	2.42	7,200	320	-- [e]	No	--
Cadmium	0.140 (<BG)	13.9 [c]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	15.1 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	6.13 (<BG)	24	15.7 [b]	-- [e]	No	--
Copper	13.7 (<BG)	2,960	59.2	22.0 [b]	No	--
Lead	12.6	353	10.2 [b]	10.2 [b]	Yes	Yes [f]
Manganese	284 (<BG)	3,760	512 [b]	512 [b]	No	--
Mercury	0.0343 (<BG)	24	0.33 [b]	0.33 [b]	No	--
Molybdenum [d]	0.361	400	8	-- [e]	No	--
Nickel	13.6 (<BG)	1,600	19.1 [b]	27.4	No	--
Selenium	0.257 (<BG)	400	5	1	No	--
Vanadium	53.2 (<BG)	560	85.1 [b]	-- [e]	No	--

Table 2. Comparison of the Maximum Contaminant Concentrations to the Remedial Action Goals for the 100-H-50 Confirmatory Sampling Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Zinc	45.1 (<BG)	24,000	480	67.8 [b]	No	--

[a] RAGs obtained from the RDR/RAWP (DOE-RL 2009b) or calculated per WAC 173-340-720, 730, and 740, Method B, 1996, unless otherwise noted.

[b] Where cleanup levels are less than background, cleanup levels default to background (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 Sect. 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).

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

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

[e] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of 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]).

[f] Based on the RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), lead is not predicted to migrate through the 10-m (33-ft)-thick vadose zone to the groundwater in 1,000 years (based on the lead soil-partitioning distribution coefficient of 30 mL/g).

-- = not applicable
BG = background (obtained from *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes* [DOE-RL 2001], unless otherwise stated)
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

DATA EVALUATION

Evaluation of the results listed in Table 2 from confirmatory sampling at the 100-H-50 waste site indicates that residual concentrations of all site COPCs are below soil RAGs, except for lead. Residual concentrations of lead exceed the soil RAGs for the protection of groundwater and the Columbia River. Data were not collected on the vertical extent of residual contamination, but RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) predicts that compounds with a soil-partitioning coefficient (K_d) greater than 5.6 mL/g will not migrate through the 10-m (33-ft)-thick vadose zone between the shallow zone and groundwater at this site. The K_d for lead is 30 mL/g. The only pathway for contamination to reach the Columbia River is via groundwater migration, so the contaminant concentration is also protective of the Columbia River.

Assessment of the risk requirements for the 100-H-50 waste site is determined by calculation of the hazard quotient and excess cancer risk values for nonradionuclides. These calculations are located in Appendix B. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. These risk values were not calculated for constituents that were not detected or were detected at concentrations below

Hanford Site or Washington State background values. The results (Appendix B) indicate that all individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the noncarcinogenic constituents is 1.2×10^{-3}. No carcinogenic constituents met the criteria for evaluation. Therefore, the individual and total excess cancer risk limits of 1×10^{-6} and 1×10^{-5}, respectively, are met.

An additional calculation of the hazard quotient and carcinogenic (excess cancer) risk values for the potential impact to groundwater was performed for nonradionuclides. The comparisons for the groundwater pathway include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. Risk values were not calculated for constituents that were not detected, were detected at concentrations below Hanford Site background values, or were not predicted to reach groundwater in 1,000 years according to fate and transport modeling. One individual constituent (boron) met the criteria for calculation of a protection of groundwater hazard quotient for noncarcinogenic constituents. The maximum value of 2.42 mg/kg for boron was divided by the noncarcinogenic RAG value of 320 mg/kg to obtain the result of 7.6×10^{-3}. Therefore, the cumulative hazard quotient for the 100-H-50 waste site is less than 1.0. No carcinogenic constituents from groundwater met the criteria for evaluation at the 100-H-50 waste site; therefore, no calculations of excess carcinogenic risk were performed. Nonradionuclide risk requirements related to groundwater are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the confirmatory sampling approach (WCH 2010c), the field logbooks (WCH 2010a and WCH 2010b), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 100-H-50 waste site established that the data are of the right type, quality, and quantity to support site confirmatory decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site confirmation. The cleanup confirmatory sample analytical data are stored in the ENRE project-specific database for data evaluation prior to its archival in the HEIS and are summarized in Appendix B. The detailed DQA is presented in Appendix C.

SUMMARY FOR NO ACTION

The 100-H-50 waste site 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 remedial action objectives for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 100-H-50 waste site to No Action. Site contamination did not extend into the deep zone

soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

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APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Maximum Contaminant Concentrations that Exceed Ecological Screening Level for the 100-H-50 Waste Site [a].

Hazardous Substance		2007 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Maximum Determined Confirmatory Result [d]
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
Metals	**Background**	(mg/kg)							
Boron	NA	0.5	NA	NA	NA	NA	NA	NA	2.42
Lead	10.2	50	500	118	120	1,700	11	56	12.6
Manganese	512	1,100 [e]	NA	1,500	220	450	4,300	4,000	284 (<BG)
Vanadium	85.1	2	NA	NA	NA	NA	7.8	280	53.6 (<BG)

Note: Shaded cells are exceeded by the maximum result.

[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] Based on consideration of maximum values for all focused samples.

[e] Benchmark replaced by Washington State natural background concentration.

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

APPENDIX B

CALCULATIONS

APPENDIX B

CALCULATIONS

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

100-H-50 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100H-CA-V0145, Rev. 0.

DISCLAIMER FOR CALCULATIONS

The calculation provided in this appendix has been generated to document compliance with established cleanup levels. This calculation should be used in conjunction with other relevant documents.

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-H

Discipline: Environmental Calculation No: 0100H-CA-V0145

Subject: 100-H-50 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 6 Attachment 1 = 1 Total = 8	D. I. Rollosson	J. D. Skoglie	T. E. Queen	D. F. Obenauer	1/10/11

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	D. I. Rollosson	Date:	11/29/2010	Calc. No.:	0100H-CA-V0145	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	11/29/2010
Subject:	100-H-50 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 6	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 100-H-50 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009a), the following criteria must be met:

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

Also, calculate the relative percent difference (RPD) for primary-duplicate sample pairs from 100-H-50 confirmatory sampling, as necessary.

GIVEN/REFERENCES:

1) DOE-RL, 2009a, *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.

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

3) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013. U.S. Environmental Protection Agency, Washington, D.C.

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

5) WCH, 2010, *Remaining Sites Verification Package for the 100-H-50, 100-H Steam Condensate French Drains*, Attachment to Waste Site Reclassification Form 2009-009, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

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

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 2009a).

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	D. I. Rollosson	Date:	11/29/2010	Calc. No.:	0100H-CA-V0145	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	11/29/2010
Subject:	100-H-50 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 6	

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

5) Use data from WCH (2010) to perform the RPD calculations for primary-duplicate sample pairs, as required.

METHODOLOGY:

The 100-H-50 data set is from three french drains at the 100-H-50 waste site excavation that underwent confirmatory sampling. Three focused samples were collected from french drains 5, 6, and 11. A duplicate sample was collected from french drain 6. The direct contact hazard quotient and carcinogenic risk calculations for the 100-H-50 waste site were conservatively calculated for the entire waste site using the greatest of the maximum soil sample results (WCH 2010). Of the contaminants of potential concern (COPCs) for this site, boron and molybdenum require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead was quantitated at a concentration above Hanford Site background; however, lead is not included in the calculation based on modeling of child blood levels, which is fundamentally different from the oral reference dose and cancer slope factors used to calculate typical cleanup levels and associated HQs and cancer risks. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron is 2.42 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 3.4×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 1.2×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) No carcinogenic constituents met the criteria for evaluation at the 100-H-50 waste site; therefore, no calculations of excess carcinogenic risk were performed.

4) The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed for certain analytes in Table II-1 of the SAP (DOE-RL 2009b). Other analytes will have their own pre-determined constituents and will have their own TDLs based on the laboratory and method used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	D. I. Rollosson	Date:	11/29/2010	Calc. No.:	0100H-CA-V0145	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	11/29/2010
Subject:	100-H-50 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 6	

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

For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. No split samples were collected for cleanup verification of the subject site. Additional discussion is provided in the data quality assessment section of the applicable RSVP (WCH 2010), as necessary.

RESULTS:

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

Table 1 shows the results of the hazard quotient and excess cancer risk calculations.

5) None of the RPDs calculated in the field duplicate pair for the 100-H-50 waste site are above the acceptance criteria (30%). The evaluation of the QA/QC duplicate RPD calculations is performed within the data quality assessment section of the RSVP.

Table 2 shows the results of the RPD calculations for the 100-H-50 waste site.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	D. I. Rollosson	Date:	11/29/2010	Calc. No.:	0100H-CA-V0145	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	11/29/2010
Subject:	100-H-50 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 6	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-H-50 Waste Site.

Contaminants of Potential Concern	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	2.42	7,200	3.4E-04	--	--
Lead[c]	12.6	353	--	--	--
Molybdenum	0.361	400	9.0E-04	--	--
Totals					
Cumulative Hazard Quotient:			**1.2E-03**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:

[a] = From WCH (2010).

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

[c] = 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.

-- = not applicable

RAG = remedial action goal

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	D. I. Rollosson	Date:	12/7/2010	Calc. No.:	0100H-CA-V0145	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	12/7/2010
Subject:	100-H-50 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 5 of 6	

Table 2. Relative Percent Difference Calculations for the 100-H-50 Waste Site. (2 Pages)

100-H-50 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	5420		3.85	1.69		0.770	39.8		0.385	0.186		0.154
Duplicate of French Drain 6	J1C331	10/11/10	5170		3.70	1.89		0.740	36.1		0.370	0.179		0.148

Analysis:

TDL		5	10	2	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	4.7%		9.7%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable

100-H-50 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	0.836	B	1.54	0.124	B	0.154	5940		77.0	7.58	J	0.154
Duplicate of French Drain 6	J1C331	10/11/10	0.661	B	1.48	0.109	B	0.148	5480		74.0	9.95	J	0.148

Analysis:

TDL		2	0.2	100	1
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?			Yes (calc RPD)	Yes (calc RPD)
	RPD			8.1%	27.0%
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	Not applicable

100-H-50 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	5.65		1.54	12.3		0.770	17900		15.4	3.00		0.385
Duplicate of French Drain 6	J1C331	10/11/10	5.35		1.48	12.8		0.740	17100		14.8	2.90		0.370

Analysis:

TDL		2	1	5	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		4.0%	4.6%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable

100-H-50 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Magnesium			Manganese			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	3740	J	57.7	234		3.85	0.293	B	1.54	8.38		3.08
Duplicate of French Drain 6	J1C331	10/11/10	3850	J	55.5	247		3.70	0.251	B	1.48	9.55		2.96

Analysis:

TDL		75	5	2	4
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)
	RPD	2.9%	5.4%		
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable

100-H-50 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Potassium			Selenium			Silicon			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	608		308	0.257		0.231	344		1.54	255		38.5
Duplicate of French Drain 6	J1C331	10/11/10	567		296	0.250		0.222	288		1.48	230		37.0

Analysis:

TDL		400	10	2	50
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD			17.7%	
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	No - acceptable

Note: Gray cells indicate not applicable.

B = estimated result. Result is less than the RL but greater than the MDL.
D = analyte reported from a dilution
J = estimated result.
HEIS = Hanford Environmental Information System
PQL = practical quantitation limit.
Q = qualifier.
RPD = relative percent difference.
TDL = target detection limit

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	D. I. Rollosson	Date:	12/7/2010	Calc. No.:	0100H-CA-V0145	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	12/7/2010
Subject:	100-H-50 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 6 of 6	

Table 2. Relative Percent Difference Calculations for the 100-H-50 Waste Site. (2 Pages)

100-H-50 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	53.2	J	1.92	35.6		7.70
Duplicate of French Drain 6	J1C331	10/11/10	48.6	J	1.85	33.2		7.40

Analysis:

TDL		2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)
	RPD	9.0%	7.0%
	Difference > 2 TDL?	Not applicable	Not applicable

CONCLUSION:

The calculations in Tables 1 and 2 demonstrate that the 100-H-50 waste site meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk and RPDs, respectively, as identified in the RDR/RAWP (DOE-RL 2009a) and SAP (DOE-RL 2009b). The hazard quotients and carcinogenic (excess cancer) risk and RPD calculations are for use in the RSVP for this site.

Attachment 1. 100-H-50 Waste Site Confirmatory Sampling Results (Metals).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	5420		3.85	0.462	UJ	0.462	1.69		0.770	39.8		0.385	0.186		0.154	0.836	B	1.54
Duplicate of French Drain 6	J1C331	10/11/10	5170		3.70	0.444	UJ	0.444	1.89		0.740	36.1		0.370	0.179		0.148	0.661	B	1.48
French Drain 5	J1C325	10/7/10	5030		4.21	0.506	U	0.506	1.61		0.843	29.5		0.421	0.155	B	0.169	0.877	B	1.69
French Drain 11	J1C332	10/5/10	7700		4.33	0.520	U	0.520	4.86		0.866	62.0		0.433	0.272		0.173	2.42		1.73
Equipment Blank	J1C333	10/11/10	236		4.55	0.546	UJ	0.546	0.910	U	0.910	2.37		0.455	0.182	U	0.182	1.82	U	1.82

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	0.124	B	0.154	5940		77.0	7.58	J	0.154	5.65		1.54	12.3		0.770	17900		15.4
Duplicate of French Drain 6	J1C331	10/11/10	0.109	B	0.148	5480		74.0	9.95	J	0.148	5.35		1.48	12.8		0.740	17100		14.8
French Drain 5	J1C325	10/7/10	0.0902	B	0.169	5070		84.3	9.48		0.169	4.93		1.69	11.6		0.843	15300		16.9
French Drain 11	J1C332	10/5/10	0.140	B	0.173	7250		86.6	15.1		0.173	6.13		1.73	13.7		0.866	18800		17.3
Equipment Blank	J1C333	10/11/10	0.182	U	0.182	53.8	B	91.0	0.200	J	0.182	1.82	U	1.82	0.910	U	0.910	268		18.2

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	3.00		0.385	3740	J	57.7	234		3.85	0.0281	U	0.0281	0.293	B	1.54	8.38		3.08
Duplicate of French Drain 6	J1C331	10/11/10	2.90		0.370	3850	J	55.5	247		3.70	0.0252	U	0.0252	0.251	B	1.48	9.55		2.96
French Drain 5	J1C325	10/7/10	3.07		0.421	3650		63.2	219		4.21	0.0264	U	0.0264	0.212	B	1.69	8.20		3.37
French Drain 11	J1C332	10/5/10	12.6		0.433	4960		65.0	284		4.33	0.0343		0.0343	0.361	B	1.73	13.6		3.46
Equipment Blank	J1C333	10/11/10	0.472		0.455	32.8	BJ	68.3	5.17		4.55	0.0237	U	0.0237	1.82	U	1.82	3.64	U	3.64

Sample Location	HEIS Number	Sample Date	Potassium			Selenium			Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	608		308	0.257		0.231	344		1.54	0.154	U	0.154	255		38.5	53.2	J	1.92
Duplicate of French Drain 6	J1C331	10/11/10	567		296	0.250		0.222	288		1.48	0.148	U	0.148	230		37.0	48.6	J	1.85
French Drain 5	J1C325	10/7/10	598		337	0.253	U	0.253	311		1.69	0.169	U	0.169	178		42.1	44.9		2.11
French Drain 11	J1C332	10/5/10	1130		346	0.260	U	0.260	465		1.73	0.173	U	0.173	180		43.3	42.2		2.17
Equipment Blank	J1C333	10/11/10	55.8	B	364	0.273	U	0.272	255		1.82	0.182	U	0.182	9.37	B	45.5	0.354	BJ	2.28

Sample Location	HEIS Number	Sample Date	Zinc			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL
French Drain 6	J1C330	10/11/10	35.6		7.70	0.52	U	0.52
Duplicate of French Drain 6	J1C331	10/11/10	33.2		7.40	0.52	U	0.52
French Drain 5	J1C325	10/7/10	30.8		8.43	0.51	U	0.51
French Drain 11	J1C332	10/5/10	45.1		8.66	0.51	U	0.51
Equipment Blank	J1C333	10/11/10	1.05	B	9.10			

Acronyms and notes apply to all of the tables in this attachment.
Gray cells indicate not applicable.
Note: Data qualified with B, C, and/or J are considered acceptable values.
B = blank contamination (organic constituents) = Estimated (inorganic)
HEIS=Hanford Environmental Information System

J = estimated
PQL = practical quantitation limit
Q = qualifier
U = undetected

	Attachment 1	Sheet No.	1 of 1
Originator	D. L. Rollosson	Date	12/7/10
Checked	J. D. Skoglie	Date	12/7/10
Calc. No.	0600X-CA-V0145	Rev. No.	0

APPENDIX C

DATA QUALITY ASSESSMENT

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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 (WHC 2010c). 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 2010c), the field logbooks (WCH 2010a and WCH 2010b), 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).

Sample data collected at the 100-H-50 waste site were provided by the laboratories in three sample delivery groups (SDGs): SDG K2434, K2446, and K2450. SDG K2450 was submitted for third-party validation. Samples in the 100-H-50 data set were analyzed using U.S. Environmental Protection Agency (EPA) method 6010 (inductively coupled plasma [ICP] metals), EPA method 7471 (cold vapor atomic absorption [mercury]), and EPA method 7196 (hexavalent chromium). The ICP metals include: antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

No major deficiencies were found in any of the SDGs. Minor deficiencies are discussed by SDG as follows below. If no comments are made about a specific analysis it should be assumed that no deficiencies in the quality of the data were found. Unless otherwise noted deficiencies listed below are specific to the individual SDG, but apply to all samples within that SDG.

SDG K2434

Sample delivery group K2434 comprises a single focused soil sample (J1C332) from the underlying soil of french drain 11 at the 100-H-50 waste site. Minor deficiencies are as follows:

In the ICP metals analysis, the matrix spike (MS) recoveries for four analytes were out of project acceptance criteria (70 to 130%). For all of the analytes with MS recoveries outside the acceptance criteria, except antimony, the initial matrix spike concentrations were not significantly large when compared to the native concentration in the sample. To confirm

quantitation the laboratory performed post-digestion spikes (PDSs) for these analytes. The PDS results were all within the range of 78.5 to 127.2%. Therefore, heterogeneity in the sample matrix was a likely cause of the analytical variability indicated in the MS recoveries rather than problems in the extraction process. The original MS recovery for antimony was 47%. The antimony results in SDG K2434 may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K2446

This SDG comprises a single soil sample (J1C325) from the underlying soil of french drain 5 at the 100-H-50 waste site. Minor deficiencies are as follows:

In the ICP metals analysis, the MS recoveries for five analytes were out of project acceptance criteria (70 to 130%). For all of the analytes with MS recoveries outside the acceptance criteria, except antimony, the initial MS concentrations were not significantly large when compared to the native concentration in the sample. To confirm quantitation the laboratory performed PDSs for these analytes. The PDS results were all within the range of 70.4 to 100.9%. Therefore, heterogeneity in the sample matrix was a likely cause of the analytical variability indicated in the MS recoveries rather than problems in the extraction process. The original MS recovery for antimony was 63%. The antimony results in SDG K2446 may be considered estimated. Estimated data are usable for decision-making purposes.

SDG K2450

This SDG comprises three field samples (J1C330, J1C331, and J1C333) collected from the underlying soil of french drain 6 at the 100-H-50 waste site. Sample J1C331 is the field duplicate of sample J1C330. Sample J1C333 is an equipment blank (EB). SDG K2450 was submitted for formal third-party validation. Minor deficiencies found in SDG K2450 are as follows:

In the ICP metals analysis, the MS recoveries for eight analytes were out of project acceptance criteria (70 to 130%). For all of the analytes with MS recoveries outside the acceptance criteria, except antimony, magnesium, and vanadium, the initial matrix spike concentrations were not significantly large when compared to the native concentration in the sample. To confirm quantitation the laboratory performed PDSs for these analytes. The PDS results were all within the range of 68.5 to 101.9%. Therefore, heterogeneity in the sample matrix was a likely cause of the analytical variability indicated in the MS recoveries rather than problems in the extraction process. The original MS recoveries for antimony (54%), magnesium (59%), and vanadium (55%) cannot be attributed to insufficient spike amounts. Third-party validation has qualified the antimony, magnesium, and vanadium results in SDG K2450 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the relative percent differences (RPDs) calculated using the laboratory duplicate, for arsenic and chromium were above the acceptable range (0 to 30%) at 96% and 42%, respectively. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix rather than to analytical variability in the sample

extraction or analysis process. Third-party validation has qualified the chromium results in SDG K2450 as estimated with "J" flags. However, third-party validation did not qualify arsenic based on the RPD results. The arsenic results in SDG K2450 may be considered estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance/quality control (QA/QC) measures are used to assess potential sources of error and cross contamination of samples that could bias results. A single set of field QA/QC samples (main sample and duplicate) was collected, as documented in the field logbooks (WCH 2010a and WCH 2010b). Sample J1C330 is the main sample and J1C331 is the duplicate.

The relative percent differences for the main and field duplicate samples have been calculated and are presented in Appendix B. The entire sample data set including the duplicate sample data are presented as an attachment to the RPD calculation.

Field duplicate samples 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 concern. No major or minor deficiencies in the RPD calculations were found for the duplicate samples.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than 5 times the target detection limit (TDL), including undetected analytes. In these cases, a control limit of ± 2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the review. This case did not apply to any of the sample results. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

SUMMARY

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 100-H-50 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-H-50 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be

rejected as a result of QA and QC deficiencies. The analytical data were found acceptable for decision-making purposes. The confirmatory sample analytical data are stored in the Environmental Restoration (ENRE) 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 B.

REFERENCES

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