Waste Site Reclassification Form

Date Submitted: 4/12/06 **Originator:** R. A. Carlson **Phone:** 373-1440	**Operable Unit(s):** 100-BC-~~1~~2 BCK 12/4/06 **Waste Site ID:** 118-C-3:3 **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number:** 2006-016 **Lead Agency:** EPA

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, interim closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List of no action, interim closed out, or closed-out sites will occur at a future date.

Description of current waste site condition:

The 118-C-3:3 french drains received condensate from the steam heating system in the 105-C Reactor Building. The operational lifetime of the 118-C-3:3 french drains began in 1952, just previous to the 105-C Reactor becoming operational, and ended on April 25, 1969, when the reactor was shut down. Confirmatory sampling and evaluation of this site have been performed in accordance with remedial action objectives and remedial action goals 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. The confirmatory sampling demonstrated that cleanup goals have been met.

Basis for reclassification:

The 118-C-3:3 french drains meets the remedial action objectives specified in the Remaining Sites ROD. The results demonstrate that residual contaminant concentrations do not preclude any future land uses (as bounded by a rural-residential scenario) and allows for unrestricted future use of shallow zone soils (i.e., surface to 4.6 m [15 ft]). The results also show that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The supporting documentation for the recommended reclassification is provided in the *Remaining Sites Verification Package for the 118-C-3:3, 105-C French Drains* (attached).

D. C. Smith DOE-RL Project Manager	Signature	4/13/06 Date
NA Ecology Project Manager	Signature	Date
D. A. Faulk EPA Project Manager	Signature	4/24/06 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 118-C-3:3, 105-C FRENCH DRAINS

Attachment to Waste Site Reclassification Form 2006-016

April 2006

REMAINING SITES VERIFICATION PACKAGE FOR THE 118-C-3:3, 105-C FRENCH DRAINS

EXECUTIVE SUMMARY

The 118-C-3 waste site consists of the 105-C Reactor Building and associated sites located in the 100-BC-1 Operable Unit, in the 100-B/C Area of the Hanford Site. The following three subsites have been designated in the Waste Information Data System for the 118-C-3 waste site:

- 118-C-3:1 105-C Reactor Core and Interim Safe Storage Project
- 118-C-3:2 105-C Reactor Building Below Grade Structures and Underlying Soils
- 118-C-3:3 105-C French Drains.

Only the 118-C-3:3 subsite of the 118-C-3 waste site is addressed in this document.

Four french drains make up the 118-C-3:3 site located, one each, to the northwest, northeast, southwest, and southeast of the current 105-C Reactor safe storage enclosure (105-C SSE). The 118-C-3:3 french drains likely received condensate from the steam heating system in neighboring rooms or areas around the 105-C Reactor Building. Locations of the 118-C-3:3 french drains were determined from Hanford Historical Site Drawing P-6045 dated August 1951 (GE 1951) and are presented in Table ES-1.

Table ES-1. 118-C-3:3 French Drain Locations Around the 105-C Reactor.

French Drain Number (General Location Relative to the Safe Storage Enclosure)	Northing	Easting	Proximal 105-C Reactor Room
1 (northwest)	144055	565344	Control room
2 (northeast)	144055	565376	Outer rod room
3 (southwest)	143991	565333	Electrical equipment room
4 (southeast)	143979	565390	Decontamination room

The operational lifetime of the 105-C Reactor and the 118-C-3:3 french drains began in 1952 and ended on April 25, 1969. Deactivation of the reactor was completed in 1971. Various remediation efforts around the reactor building took place beginning in 1983, when the exhaust stack was demolished, and ending in 1998, when the 105-C SSE was completed. The 105-C SSE excavations have been backfilled and leveled to grade.

Confirmatory sampling of the 118-C-3:3 french drains was conducted on January 4, 2006. Three of the four french drains were found partially intact. The southeast french drain (#4) was not found and is assumed to have been removed during previous remedial actions. Samples were collected at the base of the french drains located 3.1 m (~10 ft) below ground surface and at a depth of 4.6 m (15 ft) at the southeast location. The sample results indicate that all four areas are

in compliance with the remedial action objectives for the 118-C-3:3 site. A summary of the cleanup evaluation of the soil results against the applicable criteria is presented in Table ES-2. The results of the confirmation sampling are used to make reclassification decisions for the 118-C-3:3 subsite in accordance with the TPA-MP-14 (DOE-RL 1998) process.

In accordance with this evaluation, the confirmatory sampling results support a reclassification of this site to interim closed out. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) 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. This site does not have a deep zone; therefore, no deep zone institutional controls are required.

Soil cleanup levels were established in the Remaining Sites ROD based on a limited ecological risk assessment. Screening values were not exceeded for the contaminants of potential concern for this site with the exception of boron, mercury, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of residual boron, mercury, and vanadium contamination at these levels does not pose a risk to ecological receptors because concentrations of boron, mercury, and vanadium are part of natural site background. A baseline risk assessment for the river corridor portion of the Hanford Site began in 2004, which includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used as part of the final ROD for this site.

Table ES-2. Summary of Remedial Action Goals for the 118-C-3:3 French Drains.

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.	No radionuclide COPCs were detected above background levels.	Yes
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 hazard quotients are less than 1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (5.2×10^{-2}) is less than 1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for carcinogens is less than 1×10^{-6}.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The cumulative excess cancer risk (9.6×10^{-7}) is less than 1×10^{-5}.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river protection RAGs.	All single COPC groundwater and river RAGs have been attained.	Yes
	Attain national primary drinking water standards:[a] 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.	All detected radionuclides were below statistical background levels.	
	Meet drinking water standards for alpha emitters: the most stringent of 15 pCi/L MCL or 1/25th of the derived concentration guides from DOE Order 5400.5.[b]	All detected radionuclides were below statistical background levels.	
	Meet total uranium standard of 30 µg/L (21.2 pCi/L).[c]	Uranium statistical values are below background for this site.	
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Maximum detected results for copper and mercury are above the river protection RAGs. The maximum detected result for mercury is also above the groundwater protection RAG. However, RESRAD model results (BHI 2005a) indicate that copper and mercury will not reach groundwater (and therefore the Columbia River) within 1,000 years. Therefore, residual concentrations achieve the RAOs 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 the Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the 100 Areas, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).

COPC = contaminant of potential concern
MCL = maximum contaminant level (drinking water standard)
RAG = remedial action goal
RAO = remedial action objective
RESRAD = RESidual RADioactivity (dose model)

REMAINING SITES VERIFICATION PACKAGE FOR THE 118-C-3:3, 105-C FRENCH DRAINS

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 118-C-3:3 site meets the objectives for interim closed out as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) 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* (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. This site does not have a deep zone; therefore, no deep zone institutional controls are required.

GENERAL SITE INFORMATION AND BACKGROUND

The 105-C Reactor was the Hanford Site's sixth single-pass, graphite-moderated production reactor and was located in the 100-BC-1 Operable Unit, in the 100-B/C Area of the Hanford Site (Figure 1). Construction began in 1951 and was completed in 1952. After its shutdown in 1969, the reactor remained in a state of surveillance and maintenance until the Environmental Restoration Contractor's Facilities Decommissioning Project was initiated in 1996. With the bulk of the reactor building removed, the safe storage enclosure (SSE) was completed around the reactor core in 1998.

The 118-C-3:3 site is a collection of four french drains roughly located at the four corners of the 105-C Reactor Building (Figure 2). A typical view of the 118-C-3:3 french drains is presented in Figure 3. The exact locations of the french drains were determined from Hanford Historical Site Drawing P-6045 dated August 1951 (GE 1951).

The area around all four drains was disturbed and/or excavated during 105-C Reactor decommissioning activities. The area around the french drain to the southeast of the reactor was extensively excavated during the remediation of the 100-B/C south effluent pipelines (BHI 2004). The entire area was backfilled and smoothed to grade after the various excavations. Prior to confirmatory sampling no visual surface indicators of the french drains remained, but no record of their removal or remediation could be found. The 118-C-3:3 french drains were likely condensate drains from the sealed steam heating system that would not have been subject to contamination from within the reactor building. However, the exact history of the 118-C-3:3 drains is unknown, hence the need for the confirmatory sampling presented in this document.

Figure 1. 118-C-3:3 Site Location Map.

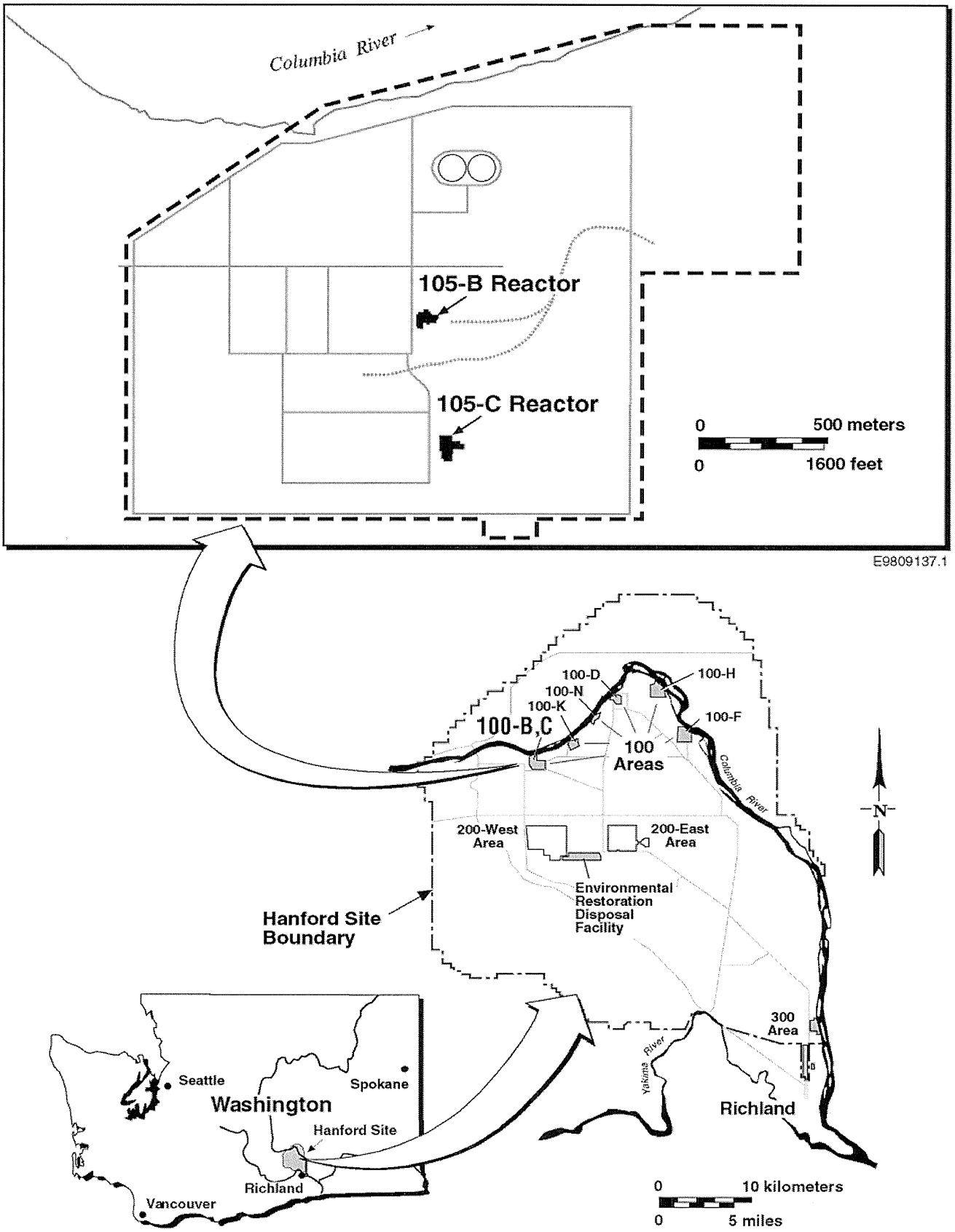


Figure 2. 118-C-3:3 Sample Location Map.

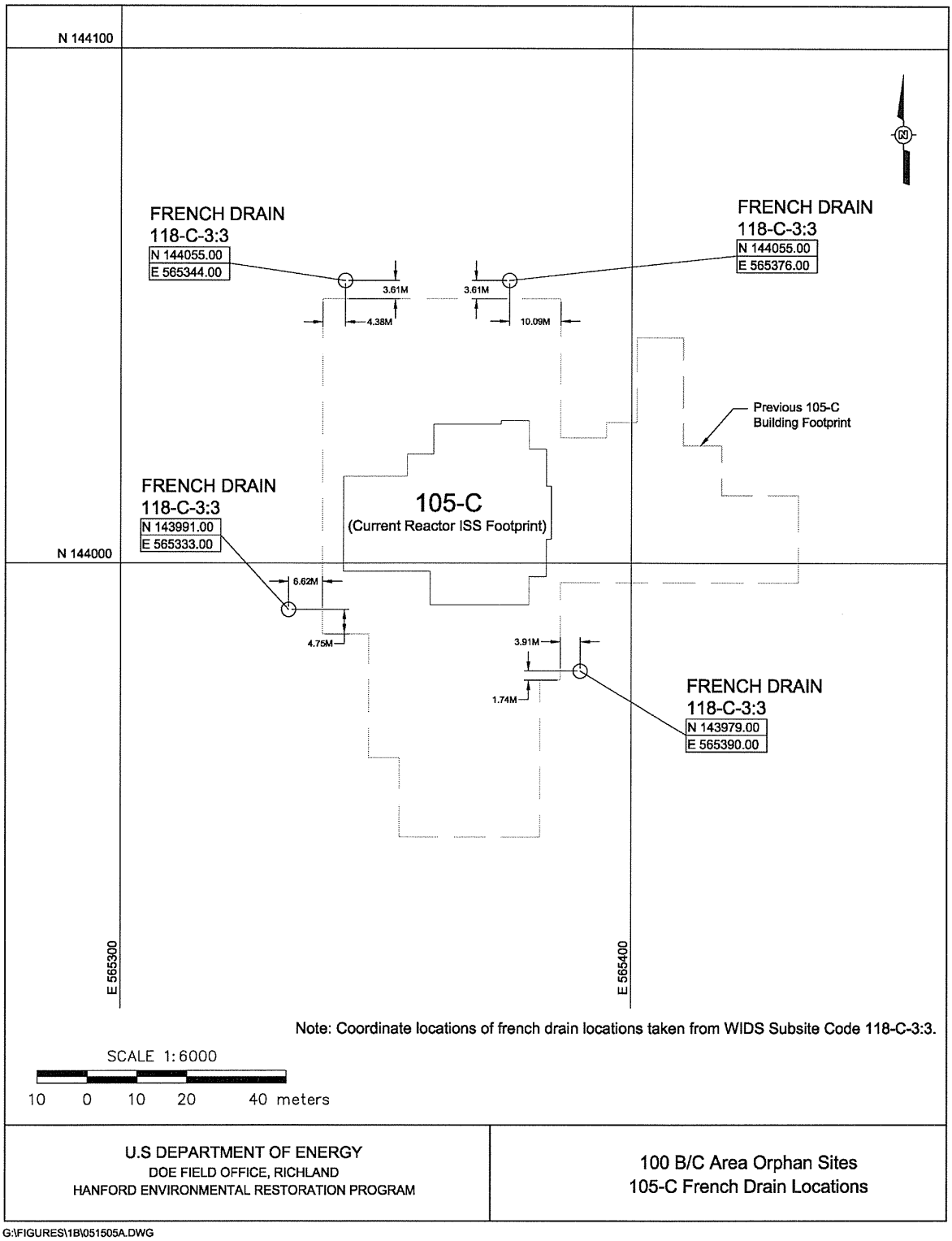
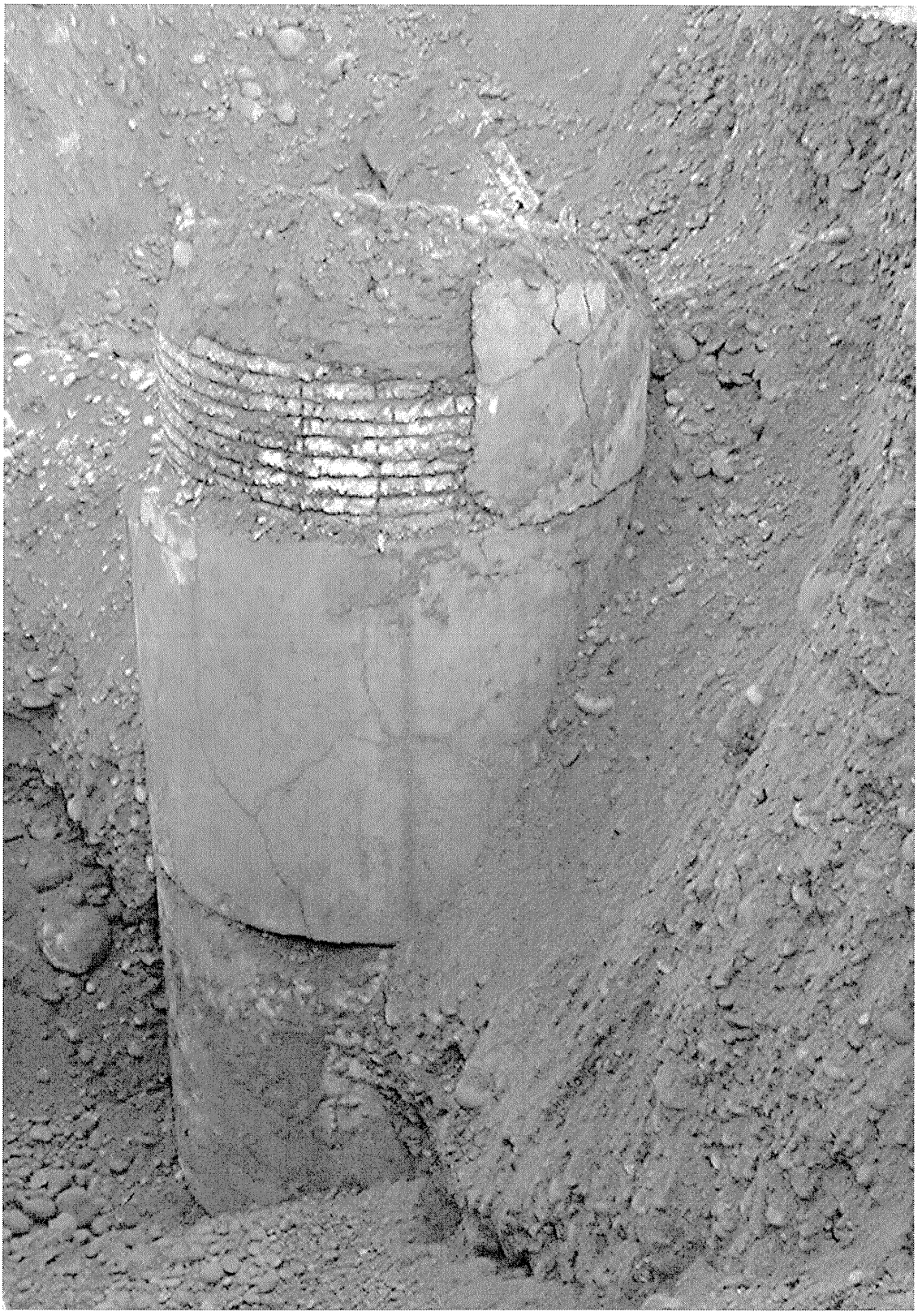


Figure 3. Typical 118-C-3:3 French Drain.
(Southwest french drain #3)



CONFIRMATORY SAMPLING ACTIVITIES

Confirmatory sampling was conducted at the 118-C-3:3 subsite on January 4, 2005. Excavation at the four french drain locations found three of the four drains partially intact. The fourth drain, #4 to the southeast, was not found in the excavation. The three french drains found were excavated and sampled just below the bottom of the drain. The southeast location was excavated to 4.6 m (15 ft) below ground surface and sampled at the bottom of the excavation. This sample design follows an agreement with the U.S. Environmental Protection Agency for sampling an analogous french drain at the 105-F Reactor, which was also removed during decontamination and decommissioning activities.

Contaminants of Potential Concern

The 118-C-3:3 french drain site was recently discovered during document searches conducted to ensure complete cleanup of the Hanford Site. As a potential liquid waste site, the contaminants of potential concern (COPCs) developed for the 100-B/C south effluent pipelines (BHI 2004), based on the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a), were adopted for the 118-C-3:3 site. The COPC list includes americium-241, cesium-137, cobalt-60, europium-152, europium-154, europium-155, plutonium-238, plutonium-239/240, strontium-90, uranium-238, lead, mercury, total chromium, and hexavalent chromium.

Because of some uncertainty and knowledge of previous investigations, the following analytical methods were also performed: polychlorinated biphenyls (PCBs), semivolatile organic analysis (SVOA), and the expanded inductively coupled plasma (ICP) metals list (antimony, arsenic, barium, beryllium, boron, cadmium, chromium [total], cobalt, copper, lead, manganese, molybdenum, nickel, silver, selenium, vanadium, and zinc).

During confirmatory sampling, field screening for volatile organic compounds was performed to assess the need for volatile organic analysis (VOA). No volatile organic compounds were detected (WCH 2006b), and VOA was not performed on any of the samples.

Confirmatory Sample Design

A focused sampling design was implemented on January 4, 2006, in accordance with the *Work Instruction for the 118-C-3:3 French Drains* (BHI 2005b). The 118-C-3:3 site was investigated through field observations, focused sampling, and analysis to determine if radiological or other hazardous contamination was present. The location of the 118-C-3:3 site was identified based on 105-C Reactor construction diagrams. It was unclear if decommissioning and demolition of the 105-C Reactor and/or remediation of the 100-B/C effluent pipelines had resulted in the removal and remediation of some or all of the french drains. Therefore, test pits were excavated at each of the drain locations to determine if a structure was present or not. Three of the four french drains were located during excavation. A sample was collected directly below each drain and analyzed according to the COPC list. The #4 french drain, southeast of the 105-C Reactor, was not located during excavation. It was assumed that the southeast french drain was previously removed, probably during the remediation of the 100-B/C pipelines. However, a sample was collected at 4.6 m (15 ft) below ground surface from the test pit at the southeast

french drain location. This sample was called for in the work instruction (BHI 2005b) to verify the adequacy of the remedial action performed during previous excavations.

Field quality control samples were collected as required in the SAP (DOE-RL 2005a). One equipment blank was collected to verify the cleanliness of equipment and supplies used for sample collection. The equipment blank was collected using silica sand (e.g., Colorado silica sand) poured over the sampling equipment and submitted for laboratory analysis. Analyses performed on the equipment blank included ICP metals, mercury, and SVOA. One field duplicate sample was collected to verify the precision (reproducibility) of the laboratory analysis. The field duplicate was collected at the base of the southwest french drain (#3). Analyses performed on the duplicate sample included gamma energy analysis (GEA), gross alpha, gross beta, hexavalent chromium, mercury, ICP metals, SVOA, and PCBs. No deviations from the planned quality assurance sampling were made (WCH 2006b).

Sample Summary

A summary of samples collected at the 118-C-3:3 site is provided in Table 1. Sample locations are the same as the french drain locations depicted in Figure 2. Analytical results are presented in Appendix A.

Table 1. Confirmatory Sample Summary for the 118-C-3:3 French Drains. (2 Pages)

Sample Location	Sample Media	Sample Number	Coordinate Locations	Depth (bgs)	Sample Analysis
Northwest french drain #1	Soil at base of french drain	J10V62	N 144055 E 565344	3.1 m	ICP metals,[a] mercury, PCB, SVOA, hexavalent chromium, iso-U, GEA, gross alpha, gross beta
Northeast french drain #2	Soil at base of french drain	J10V63	N 144055 E 565376	3.1 m	ICP metals,[a] mercury, PCB, SVOA, hexavalent chromium, iso-U, GEA, gross alpha, gross beta
Southeast french drain #4 (removed)	Soil at bottom of pothole	J10V64	N 143979 E 565390	4.6 m	ICP metals,[a] mercury, PCB, SVOA, hexavalent chromium, iso-U, GEA, gross alpha, gross beta
Southwest french drain #3	Soil at base of french drain	J10V66	N 143991 E 565333	3.1 m	ICP metals,[a] mercury, PCB, SVOA, hexavalent chromium, iso-U, GEA, gross alpha, gross beta
Southwest french drain #3	Soil at base of french drain	J10V67	N 143991 E 565333	3.1 m	ICP metals,[a] mercury, PCB, SVOA, hexavalent chromium, iso-U, GEA, gross alpha, gross beta

Table 1. Confirmatory Sample Summary for the 118-C-3:3 French Drains. (2 Pages)

Sample Location	Sample Media	Sample Number	Coordinate Locations	Depth (bgs)	Sample Analysis
Equipment blank	Silica sand	J10V65	NA	NA	ICP metals,[a] mercury, SVOA

Source: *Remaining Sites Field Sampling*, Logbook EL-1585-4 (WCH 2006b).

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

bgs = below ground surface
GEA = gamma energy analysis
ICP = inductively coupled plasma
iso-U = isotopic uranium (uranium-233/234, uranium-235, uranium-238)
NA = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis

Confirmatory Sampling Results

Confirmatory samples were analyzed using U.S. Environmental Protection Agency-approved analytical methods. A comparison of the maximum concentrations of the remaining detected analytes and the site remedial action goals (RAGs) is summarized in Table 2. Contaminants that were not detected by laboratory analysis are excluded from Table 2. Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected by GEA, but these isotopes are unrelated to the operational history of the site and were detected at levels below statistical background activities (based on an assumption of secular equilibrium, the background activities for radium-228 and thorium-228 are equal to the statistical background activity of 1.32 pCi/g for thorium-232 provided in DOE-RL [1996]). These isotopes are not considered further. The analytical results for all constituents are stored in the Environmental Restoration project-specific database prior to archiving in the Hanford Environmental Information System and are presented in Appendix A. Of the ICP metals analyzed, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not evaluated in the Cleanup Levels and Risk Calculations table under *Washington Administrative Code* (WAC) 173-340-740(3) and, therefore, are not considered COPCs.

DATA EVALUATION

All detected analytes, with the exception of copper and mercury, were reported at concentrations below the direct exposure, groundwater protection, and river protection soil RAGs. Mercury was detected at a concentration (0.8 mg/kg) exceeding the soil RAGs for protection of groundwater (0.33 mg/kg) and the Columbia River (0.33 mg/kg). Copper was detected at a concentration (38.3 mg/kg) that exceeded the soil RAG for the protection of the Columbia River (22 mg/kg). The mercury result is from the northeast french drain, while the copper result is from the northwest drain. All of the other copper and mercury results pass applicable RAGs. Based on a soil-partitioning coefficient (K_d value) of 22 mL/g for copper and 30 mL/g for mercury, the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a) indicate that these constituents will migrate no more than 3 m (10 ft) in 1,000 years. With a groundwater elevation of 121 m (397 ft) above mean sea level, a ground surface elevation of 151 m (492 ft) above mean sea level, and a sample depth of 3 m (10 ft), copper and mercury are not predicted to reach groundwater

(and therefore the Columbia River) within 1,000 years. Therefore, residual concentrations of these constituents satisfy the remedial action objectives.

Table 2. Comparison of Maximum Soil Values to Action Levels for the 118-C-3:3 French Drains.[a] (2 Pages)

COPC	Maximum Result (pCi/g)	Generic Site Lookup Values (pCi/g)			Does the Maximum Result Meet RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value[b]	Soil Concentration Protective of Groundwater	Soil Concentration Protective of the River		
Uranium-233/234	0.625 (<BG)	1.1[c]	1.1[c]	1.1[c]	Yes	--
Uranium-235	0.051 (<BG)	0.61	0.5[d]	0.5[d]	Yes	--
Uranium-238	0.676 (<BG)	1.1[c]	1.1[c]	1.1[c]	Yes	--
COPC	**Maximum Result (mg/kg)**	**Remedial Action Goals (mg/kg)**			**Does the Maximum Result Meet RAGs?**	**Does the Maximum Result Pass RESRAD Modeling?**
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.4 (<BG)	20[e]	20[e]	20[e]	Yes	--
Barium	80 (<BG)	16,000[f]	132[g]	400	Yes	--
Beryllium	0.69 (<BG)	10.4[h]	1.51[g]	1.51[g]	Yes	--
Boron[i]	1.4	16,000[f]	320	--[j]	Yes	--
Chromium	16.4 (<BG)	120,000[f]	18.5[g]	18.5[g]	Yes	--
Hexavalent chromium	0.54	2.1[f]	4.8	2	Yes	--
Cobalt	7.4 (<BG)	16,000[f]	32	--[j]	Yes	--
Copper	38.3	2,960[f]	59.2	22[g]	No	Yes[k]
Lead	7.9 (<BG)	353[l]	10.2[g]	10.2[g]	Yes	--
Manganese	297 (<BG)	11,200[f]	512[g]	--[j]	Yes	--
Mercury	0.8	24[f]	0.33[g]	0.33[g]	No	Yes[k]
Nickel	14.4 (<BG)	1,600[f]	1.91[g]	27.4	Yes	--
Selenium[m]	0.37 (<BG)	0.78	5	1	Yes	--
Vanadium	48.7 (<BG)	560[f]	85.1[g]	--[j]	Yes	--
Zinc	50.2 (<BG)	24,000[f]	480	67.8[g]	Yes	--
Aroclor-1254	0.0051	0.5[n]	0.017[o]	0.017[o]	Yes	--
Aroclor-1260	0.0065	0.5[n]	0.017[o]	0.017[o]	Yes	--
Benzo(a)anthracene	0.075	1.37[n]	0.33[o]	0.33[o]	Yes	--
Benzo(a)pyrene	0.073	0.137[n]	0.33[o]	0.33[o]	Yes	--
Benzo(b)fluoranthene	0.059	1.37[n]	0.33[o]	0.33[o]	Yes	--
Benzo(ghi)perylene[p]	0.059	2,400[f]	48	192	Yes	--
Benzo(k)fluoranthene	0.068	13.7[n]	0.33[o]	0.33[o]	Yes	--
Chrysene	0.10	137[n]	1.2	0.33[o]	Yes	--
Fluoranthene	0.16	3,200[f]	64	18	Yes	--
Indeno(1,2,3-cd) pyrene	0.052	1.37[n]	0.33[o]	0.33[o]	Yes	--
Phenanthrene[p]	0.11	24,000[f]	240	1,920	Yes	--

Table 2. Comparison of Maximum Soil Values to Action Levels for the 118-C-3:3 French Drains.[a] (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg)			Does the Maximum Result Meet RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Pyrene	0.17	2,400[f]	48	192	Yes	--
Bis(2ethylhexyl) phthalate	0.065	71.4[n]	0.6	0.36	Yes	--
Di-n-butylphthalate	0.026	8,000[f]	160	540	Yes	--

[a] RAG values presented reflect updates to carcinogenicity/toxicity information and analytical performance requirements since the latest revision to the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b).
[b] Activity corresponding to a single radionuclide 15 mrem/yr exposure as calculated using a generic RESRAD model (DOE-RL 2005b).
[c] The calculated lookup value is below the Hanford Site-specific soil background activity. The value presented is the Hanford Site-specific soil background activity.
[d] The calculated RAG is below the MDA. The value presented is the MDA.
[e] The cleanup value of 20 mg/kg has been agreed to by Tri-Party project managers. The basis for 20 mg/kg is provided in Section 2.1.2.1 of the *Remedial Design Report/Remedial Acton Work Plan for the 100 Area* (DOE-RL 2005b).
[f] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, 1996.
[g] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d], 1996).
[h] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996).
[i] No Hanford Site-specific or Washington State background value available.
[j] No cleanup level is available from the Ecology Cleanup Levels and Risk Calculations database, and no toxicity values are available to calculate cleanup levels (Ecology 2005).
[k] Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a),with the groundwater table elevation of 122 m above mean sea level, a ground surface elevation of 151 m above mean sea level, and sample depth of 3.5 m.
[l] This value is based on the *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children* (EPA 1994). A value for lead is not available in WAC 173-340-740(3) (1996).
[m] Hanford Site-specific background is not available; not evaluated during background study. Value used is from *Natural Background soil Metals Concentrations in Washington State* (Ecology 1994).
[n] Carcinogenic cleanup level calculated per WAC 173-340-740(3), Method B, 1996.
[o] Where cleanup levels are less than the RDL, cleanup levels default to the RDL (WAC 173-340-707[2], 1996).
[p] Toxicity data for this chemical are not available. RAGs for benzo(g,h,i) perylene and phenenthrene are based on the surrogate chemicals pyrene and anthracene, respectively.

- = not applicable
BG = background
COPC = contaminant of potential concern
MDA = minimum detectable activity
RAG = remedial action goal
RDL = required detection limit
RESRAD= RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Nonradionuclide risk requirements for the 118-C-3:3 site include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, individual contaminant carcinogenic risks 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 either not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients for noncarcinogenic constituents were less than 1.0. The cumulative hazard quotient for those noncarcinogenic constituents above background or detection levels is 5.2×10^{-2}. The individual carcinogenic risk values for carcinogenic constituents above

background or detection levels are all below 1 x 10^{-6}. The cumulative carcinogenic risk value for the site is 9.6 x 10^{-7}, which is below 1 x 10^{-5}.

When using a statistical sampling approach, a requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. However, this test is not applicable to the focused confirmatory sampling results because maximum detected concentrations are used as the compliance basis.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the sample locations, recorded in the field log, and the analytical data with the requirements specified by the project objectives and performance specifications. This review was used to determine if samples were collected in accordance with the sample design. The review also involves an evaluation of the analytical data to determine if they are the right type, quality, and quantity to support project decisions (i.e., remedial action needs, interim site closure). A DQA completes the data life cycle of planning, implementation, and assessment that was initiated by the data process (EPA 2000).

The data set for the 118-C-3:3 site consisted of sample delivery group K0164, which contains analytical data for four soil samples, a duplicate, and an equipment (field) blank. Third-party data validation was performed on sample delivery group K0164 (WCH 2006a). No major deficiencies were found, and all of the data were determined useable for decision-making purposes. Minor deficiencies and qualifications added during validation are as follows:

- Several GEA analytes had method detection activities above the required detection levels. However, they were well below the applicable RAGs, and there is no impact to the data.

- In the ICP metals analysis of the laboratory control sample, or blank spike, a low recovery was observed for silicon at 67%. All silicon results were qualified "J," as estimates, by third-party validation. Silicon was not evaluated in the Cleanup Levels and Risk Calculations table under WAC 173-340-740(3) and, therefore, is not considered a COPC.

- In the ICP metals analysis, antimony was found in the method blank and had a low matrix spike recovery at 48.5%. All antimony results were qualified "UJ," as nondetected estimates, by third-party validation.

- Molybdenum was also found in the ICP metals method blank. Third-party validation qualified the results in samples J10V63 and J10V67 as estimates with a "J."

- Calcium had a high matrix spike result (140.3%), and all of the calcium results were qualified as estimates with a "J."

- Also in the ICP metals analysis, four analytes (aluminum, calcium, iron, silicon) had high relative percent differences relative to the duplicate sample. High relative percent differences in soil samples are generally attributed to heterogeneities in the sample matrix

and are not an analytical problem. None of these analytes were evaluated in the Cleanup Levels and Risk Calculations table under WAC 173-340-740(3) and, therefore, are not considered COPCs.

- The analytes 2,4-dimethylphenol and 2,4-dinitrophenol had high RPDs of 35% and 57%, respectively. Third-party validation qualified all results for both of these analytes as estimates with a "J."

These deficiencies are considered minor and have resulted in qualifying the sample results as estimates. Under the statement of work, estimated data are still useable for decision-making purposes.

The DQA review was performed in accordance with WCH-EE-01, *Environmental Investigations Procedures*. Specific data quality objectives for the site are found in the SAP (DOE-RL 2005a). The SAP data quality assurance requirements were followed, where appropriate. The data review for the 118-C-3:3 waste site determined that the analytical data are the right type, quality, and quantity to support site remediation decisions within specified error tolerances. All analytical data were found acceptable for decision-making purposes. The data have been stored in the Environmental Restoration project-specific database pending final archiving in the Hanford Environmental Information System, pursuant to requirements in the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989).

SUMMARY FOR INTERIM CLOSURE

On January 4, 2006, focused confirmatory samples were collected from under three of the four 118-C-3:3 french drains and from a test pit at the original location of the fourth french drain. Examination of the data has led to the conclusion that the site passes the RAGs without further remedial action. In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 118-C-3:3 site to interim closed out. The analytical results were shown to meet the cleanup objectives for direct exposure, groundwater protection, and river protection.

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APPENDIX A

118-C-3:3 SAMPLE RESULTS
(7 Pages)

Table A-1. 118-C-3:3 Sampling Results. (7 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Northwest	J10V62	01/04/06	0.31	U	0.31	0.076	U	0.076	0.1	U	0.1	0.18	U	0.18	0.26	U	0.26	0.21	U	0.21
Northeast	J10V63	01/04/06	0.19	U	0.19	0.091	U	0.091	0.098	U	0.098	0.27	U	0.27	0.32	U	0.32	0.21	U	0.21
Southeast	J10V64	01/04/06	0.36	U	0.36	0.07	U	0.07	0.078	U	0.078	0.17	U	0.17	0.23	U	0.23	0.18	U	0.18
Southwest	J10V66	01/04/06	0.24	U	0.24	0.07	U	0.07	0.085	U	0.085	0.17	U	0.17	0.26	U	0.26	0.19	U	0.19
Duplicate of J01V66	J10V67	01/04/06	0.23	U	0.23	0.1	U	0.1	0.11	U	0.11	0.21	U	0.21	0.34	U	0.34	0.21	U	0.21

Sample Location	HEIS Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Silver-108 m		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Northwest	J10V62	01/04/06	3.91		3.7	18.7		6.5	9.42		0.9	0.474		0.15	0.717		0.3	0.054	U	0.054
Northeast	J10V63	01/04/06	7.05		3.4	18.5		5.5	6.86		0.92	0.21	U	0.21	0.42	U	0.42	0.069	U	0.069
Southeast	J10V64	01/04/06	8.11		3.4	22.6		5.6	9.14		0.76	0.437		0.15	1.1	U	1.1	0.051	U	0.051
Southwest	J10V66	01/04/06	11.4		3.7	18.5		7.9	14	U	14	0.56	U	0.56	0.99	U	0.99	0.048	U	0.048
Duplicate of J01V66	J10V67	01/04/06	7.94		4.1	19.3		5.9	10.1		1.2	0.39		0.19	0.384	U	0.41	0.066	U	0.066

Sample Location	HEIS Number	Sample Date	Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranium-235			Uranium-235 GEA			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Northwest	J10V62	01/04/06	0.617		0.12	0.717		0.3	0.482		0.033	0.015	U	0.028	0.31	U	0.31	0.564		0.023
Northeast	J10V63	01/04/06	0.15	U	0.15	0.42	U	0.42	0.625		0.031	0.051		0.026	0.33	U	0.33	0.58		0.031
Southeast	J10V64	01/04/06	0.63	U	0.63	1.1	U	1.1	0.62		0.032	0.02	U	0.031	0.29	U	0.29	0.564		0.032
Southwest	J10V66	01/04/06	0.464		0.12	0.99	U	0.99	0.587		0.029	0.022	U	0.028	0.24	U	0.24	0.602		0.029
Duplicate of J01V66	J10V67	01/04/06	0.532		0.16	0.384	U	0.41	0.595		0.032	0.028		0.027	0.33	U	0.33	0.676		0.022

Sample Location	HEIS Number	Sample Date	Uranium-238 GEA		
			pCi/g	Q	MDA
Northwest	J10V62	01/04/06	10	U	10
Northeast	J10V63	01/04/06	11	U	11
Southeast	J10V64	01/04/06	8.9	U	8.9
Southwest	J10V66	01/04/06	8.5	U	8.5
Duplicate of J01V66	J10V67	01/04/06	12	U	12

Acronyms and notes apply to all of the tables in this appendix.
Note: Data qualified with C and/or J are considered acceptable values.
C = blank contamination (inorganic constituents)
GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
J = estimate
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
U = undetected

Table A-1. 118-C-3:3 Sampling Results. (7 Pages)

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
Northwest	J10V62	01/04/06	5060		3	0.39	UJ	0.39	3		0.33	47.5		0.02	0.66		0.01	1		0.26
Northeast	J10V63	01/04/06	5090		2.9	0.57	UJ	0.39	2.7		0.33	50.8		0.02	0.69		0.01	0.64		0.26
Southeast	J10V64	01/04/06	7580		3.1	0.56	UJ	0.4	3.4		0.34	80		0.02	0.5		0.01	1.4		0.27
Equipment Blank	J10V65	01/04/06	55		2.7	0.36	UJ	0.36	0.31	U	0.31	1.3		0.02	0.009	U	0.01	0.24	U	0.24
Southwest	J10V66	01/04/06	4460		2.9	0.43	UJ	0.39	1.7		0.33	50.1		0.02	0.48		0.01	0.94		0.26
Duplicate of J10V66	J10V67	01/04/06	4600		2.98	0.59	UJ	0.38	2.2		0.33	68.2		0.02	0.54		0.01	0.98		0.26

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Northwest	J10V62	01/04/06	0.07	UC	0.07	7120	J	1.2	7.3		0.16	7.1		0.12	14.6		0.12	0.22		0.22
Northeast	J10V63	01/04/06	0.07	UC	0.07	7300	J	1.2	5.6		0.15	7.4		0.12	38.3		0.12	0.26		0.22
Southeast	J10V64	01/04/06	0.07	UC	0.07	6950	J	1.2	16.4		0.16	6.7		0.12	15.1		0.12	0.31		0.22
Equipment Blank	J10V65	01/04/06	0.06	UC	0.06	31.6	J	1.1	0.18		0.14	0.11	U	0.11	0.11	U	0.11			
Southwest	J10V66	01/04/06	0.07	UC	0.07	5140	J	1.1	6.8		0.15	5.6		0.12	13.6		0.12	0.54		0.21
Duplicate of J10V66	J10V67	01/04/06	0.07	UC	0.07	5160	J	1.1	7.4		0.15	5.8		0.11	14.1		0.11	0.42		0.22

Sample Location	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Northwest	J10V62	01/04/06	21000		3.1	5.7		0.3	4470		1.3	297		0.02	0.8		0.02	0.13	UC	0.13
Northeast	J10V63	01/04/06	22700		3.1	7.9		0.3	3830		1.3	291		0.02	0.02	U	0.02	0.25	UJ	0.13
Southeast	J10V64	01/04/06	18300		3.2	5.6		0.31	5510		1.4	287		0.02	0.02	U	0.02	0.13	UC	0.13
Equipment Blank	J10V65	01/04/06	562		2.9	0.28	U	0.28	8.8		1.2	9.2		0.02	0.02	U	0.02	0.12	UC	0.12
Southwest	J10V66	01/04/06	16600		3.1	5.4		0.3	3290		1.3	264		0.02	0.01	U	0.01	0.13	UC	0.13
Duplicate of J10V66	J10V67	01/04/06	16800		3.1	6.5		0.3	3470		1.3	265		0.02	0.02		0.02	0.27	UJ	0.12

Table A-1. 118-C-3:3 Sampling Results. (7 Pages)

Sample Location	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Northwest	J10V62	01/04/06	10.1		1.2	907		52.3	0.35	U	0.35	467	J	0.79	0.14	U	0.14	162		2.7
Northeast	J10V63	01/04/06	8.2		1.2	704		52.2	0.35	U	0.35	457	J	0.79	0.14	U	0.14	151		2.7
Southeast	J10V64	01/04/06	14.4		1.3	1150		54	0.36	U	0.36	736	J	0.82	0.14	U	0.14	172		2.8
Equipment Blank	J10V65	01/04/06	1.2	U	1.2	59		48.6	0.32	U	0.32	59.2	J	0.74	0.13	U	0.13	7.5		2.5
Southwest	J10V66	01/04/06	8.4		1.2	796		52.1	0.37		0.35	693	J	0.79	0.14	U	0.14	120		2.7
Duplicate of J10V66	J10V67	01/04/06	8.9		1.2	917		51.7	0.34	U	0.34	693	J	0.79	0.13	U	0.13	130		2.7

Sample Location	HEIS Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
Northwest	J10V62	01/04/06	48.7		0.09	50.2		0.05
Northeast	J10V63	01/04/06	46.8		0.09	41.6		0.05
Southeast	J10V64	01/04/06	32.8		0.09	45.2		0.05
Equipment Blank	J10V65	01/04/06	0.1		0.08	1.2		0.05
Southwest	J10V66	01/04/06	38.1		0.08	34.3		0.05
Duplicate of J10V66	J10V67	01/04/06	40.9		0.09	37.4		0.05

Table A-1. 118-C-3:3 Sampling Results. (7 Pages)

Constituent	J10V62 Northwest Sample Date 1/04/06			J10V63 Northeast Sample Date 1/04/06			J10V64 Southeast Sample Date 1/04/06			J10V65 Equipment Blank Sample Date 1/04/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls (PCBs)												
Aroclor-1016	14	U	14	14	U	14	15	U	15			
Aroclor-1221	14	U	14	14	U	14	15	U	15			
Aroclor-1232	14	U	14	14	U	14	15	U	15			
Aroclor-1242	14	U	14	14	U	14	15	U	15			
Aroclor-1248	14	U	14	14	U	14	15	U	15			
Aroclor-1254	5.1	J	14	14	U	14	15	U	15			
Aroclor-1260	14	U	14	14	U	14	15	U	15			
Semivolatile Organic Analytes (SVOAs)												
1,2,4-Trichlorobenzene	360	U	360	360	U	360	370	U	370	330	U	330
1,2-Dichlorobenzene	360	U	360	360	U	360	370	U	370	330	U	330
1,3-Dichlorobenzene	360	U	360	360	U	360	370	U	370	330	U	330
1,4-Dichlorobenzene	360	U	360	360	U	360	370	U	370	330	U	330
2,4,5-Trichlorophenol	900	U	900	890	U	890	940	U	940	830	U	830
2,4,6-Trichlorophenol	360	U	360	360	U	360	370	U	370	330	U	330
2,4-Dichlorophenol	360	U	360	360	U	360	370	U	370	330	U	330
2,4-Dimethylphenol	360	UJ	360	360	UJ	360	370	UJ	370	330	UJ	330
2,4-Dinitrophenol	900	UJ	900	890	UJ	890	940	UJ	940	830	UJ	830
2,4-Dinitrotoluene	360	U	360	360	U	360	370	U	370	330	U	330
2,6-Dinitrotoluene	360	U	360	360	U	360	370	U	370	330	U	330
2-Chloronaphthalene	360	U	360	360	U	360	370	U	370	330	U	330
2-Chlorophenol	360	U	360	360	U	360	370	U	370	330	U	330
2-Methylnaphthalene	360	U	360	360	U	360	370	U	370	330	U	330
2-Methylphenol (cresol, o-)	360	U	360	360	U	360	370	U	370	330	U	330
2-Nitroaniline	900	U	900	890	U	890	940	U	940	830	U	830
2-Nitrophenol	360	U	360	360	U	360	370	U	370	330	U	330
3+4 Methylphenol (cresol, m+p)	360	U	360	360	U	360	370	U	370	330	U	330
3,3'-Dichlorobenzidine	360	U	360	360	U	360	370	U	370	330	U	330
3-Nitroaniline	900	U	900	890	U	890	940	U	940	830	U	830
4,6-Dinitro-2-methylphenol	900	U	900	890	U	890	940	U	940	830	U	830
4-Bromophenylphenyl ether	360	U	360	360	U	360	370	U	370	330	U	330
4-Chloro-3-methylphenol	360	U	360	360	U	360	370	U	370	330	U	330
4-Chloroaniline	360	U	360	360	U	360	370	U	370	330	U	330
4-Chlorophenylphenyl ether	360	U	360	360	U	360	370	U	370	330	U	330
4-Nitroaniline	900	U	900	890	U	890	940	U	940	830	U	830
4-Nitrophenol	900	U	900	890	U	890	940	U	940	830	U	830
Acenaphthene	360	U	360	360	U	360	370	U	370	330	U	330
Acenaphthylene	360	U	360	360	U	360	370	U	370	330	U	330
Anthracene	360	U	360	360	U	360	370	U	370	330	U	330
Benzo(a)anthracene	360	U	360	360	U	360	370	U	370	330	U	330
Benzo(a)pyrene	360	U	360	360	U	360	370	U	370	330	U	330
Benzo(b)fluoranthene	360	U	360	360	U	360	370	U	370	330	U	330
Benzo(ghi)perylene	360	U	360	360	U	360	370	U	370	330	U	330
Benzo(k)fluoranthene	360	U	360	360	U	360	370	U	370	330	U	330
Bis(2-chloro-1-methylethyl)ether	360	U	360	360	U	360	370	U	370	330	U	330
Bis(2-Chloroethoxy)methane	360	U	360	360	U	360	370	U	370	330	U	330
Bis(2-chloroethyl) ether	360	U	360	360	U	360	370	U	370	330	U	330
Bis(2-ethylhexyl) phthalate	65	J	360	21	J	360	24	J	370	32	J	330
Butylbenzylphthalate	360	U	360	360	U	360	370	U	370	330	U	330

Table A-1. 118-C-3:3 Sampling Results. (7 Pages)

Constituent	J10V62 Northwest Sample Date 1/04/06			J10V63 Northeast Sample Date 1/04/06			J10V64 Southeast Sample Date 1/04/06			J10V65 Equipment Blank Sample Date 1/04/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
SVOAs (continued)												
Carbazole	360	U	360	360	U	360	370	U	370	330	U	330
Chrysene	360	U	360	360	U	360	370	U	370	330	U	330
Di-n-butylphthalate	19	J	360	360	U	360	370	U	370	26	J	26
Di-n-octylphthalate	360	U	360	360	U	360	370	U	370	330	U	330
Dibenz[a,h]anthracene	360	U	360	360	U	360	370	U	370	330	U	330
Dibenzofuran	360	U	360	360	U	360	370	U	370	330	U	330
Diethylphthalate	360	U	360	360	U	360	370	U	370	330	U	330
Dimethyl phthalate	360	U	360	360	U	360	370	U	370	330	U	330
Fluoranthene	18	J	360	360	U	360	370	U	370	330	U	330
Fluorene	360	U	360	360	U	360	370	U	370	330	U	330
Hexachlorobenzene	360	U	360	360	U	360	370	U	370	330	U	330
Hexachlorobutadiene	360	U	360	360	U	360	370	U	370	330	U	330
Hexachlorocyclopentadiene	360	U	360	360	U	360	370	U	370	330	U	330
Hexachloroethane	360	U	360	360	U	360	370	U	370	330	U	330
Indeno(1,2,3-cd)pyrene	360	U	360	360	U	360	370	U	370	330	U	330
Isophorone	360	U	360	360	U	360	370	U	370	330	U	330
N-Nitroso-di-n-dipropylamine	360	U	360	360	U	360	370	U	370	330	U	330
N-Nitrosodiphenylamine	360	U	360	360	U	360	370	U	370	330	U	330
Naphthalene	360	U	360	360	U	360	370	U	370	330	U	330
Nitrobenzene	360	U	360	360	U	360	370	U	370	330	U	330
Pentachlorophenol	900	U	900	890	U	890	940	U	940	830	U	830
Phenanthrene	360	U	360	360	U	360	370	U	370	330	U	330
Phenol	360	U	360	360	U	360	370	U	370	330	U	330
Pyrene	19	J	360	360	U	360	370	U	370	330	U	330

Table A-1. 118-C-3:3 Sampling Results. (7 Pages)

Constituent	J10V66 Southwest Sample Date 1/04/06			J10V67 Duplicate of J10V66 Sample Date 1/04/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL
PCBs						
Aroclor-1016	14	U	14	14	U	14
Aroclor-1221	14	U	14	14	U	14
Aroclor-1232	14	U	14	14	U	14
Aroclor-1242	14	U	14	14	U	14
Aroclor-1248	14	U	14	14	U	14
Aroclor-1254	14	U	14	14	U	14
Aroclor-1260	4.1	J	14	6.5	J	14
SVOAs						
1,2,4-Trichlorobenzene	360	U	360	360	U	360
1,2-Dichlorobenzene	360	U	360	360	U	360
1,3-Dichlorobenzene	360	U	360	360	U	360
1,4-Dichlorobenzene	360	U	360	360	U	360
2,4,5-Trichlorophenol	900	U	900	900	U	900
2,4,6-Trichlorophenol	360	U	360	360	U	360
2,4-Dichlorophenol	360	U	360	360	U	360
2,4-Dimethylphenol	360	U	360	360	U	360
2,4-Dinitrophenol	900	U	900	900	U	900
2,4-Dinitrotoluene	360	U	360	360	U	360
2,6-Dinitrotoluene	360	U	360	360	U	360
2-Chloronaphthalene	360	U	360	360	U	360
2-Chlorophenol	360	U	360	360	U	360
2-Methylnaphthalene	360	U	360	360	U	360
2-Methylphenol (cresol, o-)	360	U	360	360	U	360
2-Nitroaniline	900	U	900	900	U	900
2-Nitrophenol	360	U	360	360	U	360
3+4 Methylphenol (cresol, m+p)	360	U	360	360	U	360
3,3'-Dichlorobenzidine	360	U	360	360	U	360
3-Nitroaniline	900	U	900	900	U	900
4,6-Dinitro-2-methylphenol	900	U	900	900	U	900
4-Bromophenylphenyl ether	360	U	360	360	U	360
4-Chloro-3-methylphenol	360	U	360	360	U	360
4-Chloroaniline	360	U	360	360	U	360
4-Chlorophenylphenyl ether	360	U	360	360	U	360
4-Nitroaniline	900	U	900	900	U	900
4-Nitrophenol	900	U	900	900	U	900
Acenaphthene	360	U	360	360	U	360
Acenaphthylene	360	U	360	360	U	360
Anthracene	360	U	360	360	U	360
Benzo(a)anthracene	75	J	360	48	J	360
Benzo(a)pyrene	73	J	360	34	J	360
Benzo(b)fluoranthene	59	J	360	35	J	360
Benzo(ghi)perylene	59	J	360	38	J	360
Benzo(k)fluoranthene	68	J	360	43	J	360
Bis(2-chloro-1-methylethyl)ether	360	U	360	360	U	360
Bis(2-Chloroethoxy)methane	360	U	360	360	U	360
Bis(2-chloroethyl) ether	360	U	360	360	U	360
Bis(2-ethylhexyl) phthalate	39	J	360	44	J	360
Butylbenzylphthalate	360	U	360	360	U	360

Table A-1. 118-C-3:3 Sampling Results. (7 Pages)

Constituent	J10V66 Southwest Sample Date 1/04/06			J10V67 Duplicate of J10V66 Sample Date 1/04/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL
SVOAs (continued)						
Carbazole	360	U	360	360	U	360
Chrysene	100	J	360	60	J	360
Di-n-butylphthalate	360	U	360	360	U	360
Di-n-octylphthalate	360	U	360	360	U	360
Dibenz[a,h]anthracene	360	U	360	360	U	360
Dibenzofuran	360	U	360	360	U	360
Diethylphthalate	360	U	360	360	U	360
Dimethyl phthalate	360	U	360	360	U	360
Fluoranthene	160	J	360	85	J	360
Fluorene	360	U	360	360	U	360
Hexachlorobenzene	360	U	360	360	U	360
Hexachlorobutadiene	360	U	360	360	U	360
Hexachlorocyclopentadiene	360	U	360	360	U	360
Hexachloroethane	360	U	360	360	U	360
Indeno(1,2,3-cd)pyrene	52	J	360	34	J	360
Isophorone	360	U	360	360	U	360
N-Nitroso-di-n-dipropylamine	360	U	360	360	U	360
N-Nitrosodiphenylamine	360	U	360	360	U	360
Naphthalene	360	U	360	360	U	360
Nitrobenzene	360	U	360	360	U	360
Pentachlorophenol	900	U	900	900	U	900
Phenanthrene	110	J	360	59	J	360
Phenol	360	U	360	360	U	360
Pyrene	170	J	360	100	J	360

APPENDIX B

118-C-3:3 HAZARD QUOTIENT AND CARCINOGENIC RISK CALCULATION
(4 Pages)

CALCULATION COVER SHEET

Project Title 100-B/C Area Field Remediation **Job No.** 14655
Area 100-B/C
Discipline Environmental *Calc. No. 0100C-CA-V0027
Subject 118-C-3:3 French Drains Hazard Quotient and Carcinogenic Risk Calculations
Computer Program Excel **Program No.** Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These documents 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 = 3 Total = 4	J. M. Capron 3/29/06	T. M. Blakley 3/29/06	L. M. Dittmer 3/30/06	D. N. Strom	4-4-06

SUMMARY OF REVISION

*Obtain Calc. No. from DIS

DE01437.03 (12/09/2004)

Washington Closure Hanford CALCULATION SHEET

Originator:	J. M. Capron	Date:	03/29/06	Calc. No.:	0100C-CA-V0027	Rev.:	0
Project:	100-B/C Area Field Remediation	Job No:	14655	Checked:	T. M. Blakley	Date:	3/29/06
Subject:	118-C-3:3 French Drains Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and carcinogenic (excess cancer) risk values for the 118-C-3:3 subsite confirmatory sample results. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2005), 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, 2005, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas,* DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

3) WCH, 2006, Waste Site Reclassification Form 2006-016, and Attachment *Remaining Sites Verification Package for the 118-C-3:3 French Drains*, Washington Closure Hanford, Richland, Washington.

SOLUTION:

1) Calculate an HQ for each noncarcinogenic constituent detected above background and compare it to the individual HQ of <1.0 (DOE-RL 2005).

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

3) Calculate an excess cancer risk value for each carcinogenic constituent detected above background and compare it to the individual excess cancer risk criterion of $<1 \times 10^{-6}$ (DOE-RL 2005).

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

Washington Closure Hanford CALCULATION SHEET

Originator:	J. M. Capron	Date:	03/29/06	Calc. No.:	0100C-CA-V0027	Rev.:	0
Project:	100-B/C Area Field Remediation	Job No:	14655	Checked:	T. M. Blakley	Date:	3/29/06
Subject:	118-C-3:3 French Drains Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	2 of 3

METHODOLOGY:

Hazard quotient and carcinogenic risk calculations were computed for the 118-C-3:3 subsite as a whole, using the maximum value for each analyte in the data set of all locations sampled. Of the contaminants of potential concern for the site, boron and hexavalent chromium require the HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Copper and mercury are included because they were detected above their respective Hanford Site background values. Aroclor-1254, aroclor-1260, and multiple semivolatile organic compounds (as shown in Table 1, below) are included because they were detected by laboratory analysis and cannot be attributed to natural occurrence. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron is 1.4 mg/kg, divided by the noncarcinogenic RAG value of 16,000 mg/kg (boron is identified as a noncarcinogen in WAC 173-340-740[3]), is 8.8×10^{-5}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculations are completed for the appropriate analytes, the cumulative HQ is 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 5.2×10^{-2}. Comparing this values to the requirement of <1.0, this criterion is met.

3) To calculate the excess carcinogenic risk, the maximum value is divided by the carcinogenic RAG value, then multiplied by 1×10^{-6}. For example, the maximum value for benzo(a)anthracene is 0.075 mg/kg; divided by 1.37 mg/kg and multiplied as indicated is 5.5×10^{-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 carcinogenic risk 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 excess carcinogenic risk values is 9.6×10^{-7}. Comparing this value 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 calculations for the 118-C-3:3 subsite.

Washington Closure Hanford CALCULATION SHEET

Originator:	J. M. Capron	Date:	03/29/06	Calc. No.:	0100C-CA-V0027	Rev.:	0
Project:	100-B/C Area Field Remediation	Job No:	14655	Checked:	T. M. Blakley	Date:	3/29/06
Subject:	118-C-3:3 French Drains Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 3

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 118-C-3:3 Subsite.

Contaminants of Potential Concern[a]	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.4	16,000	8.8E-05	--	--
Chromium, hexavalent[c]	0.54	240	2.3E-03	2.1	2.6E-07
Copper	38.3	2,960	1.3E-02	--	--
Mercury	0.8	24	3.3E-02	--	--
Semivolatiles					
Benzo(a)anthracene	0.075	--	--	1.37	5.5E-08
Benzo(a)pyrene	0.073	--	--	0.137	5.3E-07
Benzo(b)fluoranthene	0.059	--	--	1.37	4.3E-08
Benzo(k)fluoranthene	0.068	--	--	13.7	5.0E-09
Benzo(ghi)perylene[d]	0.059	2,400	2.5E-05	--	--
Bis(2-ethylhexyl) phthalate	0.065	1,600	4.1E-05	71.4	9.1E-10
Chrysene	0.10	--	--	137	7.3E-10
Di-n-butylphthalate	0.026	8,000	3.3E-06	--	--
Fluoranthene	0.16	3,200	5.0E-05	--	--
Indeno(1,2,3-cd) pyrene	0.052	--	--	1.37	3.8E-08
Phenanthrene[d]	0.11	24,000	4.6E-06	--	--
Pyrene	0.17	2,400	7.1E-05	--	--
Polychlorinated Biphenyls					
Aroclor-1254	0.0051	1.6	3.2E-03	0.5	1.0E-08
Aroclor-1260	0.0065	--	--	0.5	1.3E-08
Totals					
Cumulative Hazard Quotient:			**5.2E-02**		
Cumulative Excess Cancer Risk:					**9.6E-07**

Notes:

RAG = remedial action goal

-- = not applicable

[a] = From (WCH 2006).

[b] = Value obtained from *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

[c] = Value for the carcinogen RAG calculated based on the inhalation exposure pathway (WAC) 173-340-750(3), 1996.

[d] = Toxicity data for this chemical are not available. RAGs for benzo(g,h,i)perylene and phenanthrene are based on the surrogate chemicals pyrene and anthracene, respectively.

CONCLUSION:

This calculation demonstrates that the 118-C-3:3 subsite meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk as identified in the RDR/RAWP (DOE-RL 2005).