Date Submitted: 8/6/07 Originator: L. M. Dittmer Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-BC-1 Waste Site Code: 1607-B1 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☐ No Action ☒ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2007-015

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 1607-B1 Septic System includes a septic tank, drain field, and associated connecting pipelines and influent sanitary sewer lines. This septic system serviced the former 1701-B Badgehouse, 1720-B Patrol Building/Change Room, and 1709-B Fire Headquarters. The 1607-B1 waste site received unknown amounts of nonhazardous, nonradioactive sanitary sewage from these facilities during its operational history from 1944 to approximately 1970. Sampling and evaluation of this site have been performed in accordance with remedial action objectives and 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 selected action involved (1) evaluating the site using available process information and confirmatory sample data, (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 results support a reclassification of this site to No Action. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the Remaining Sites ROD. 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. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 1607-B1 Septic System* (attached).

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.

S. L. Charboneau DOE Federal Project Director (printed)	Stacy Charboneau Signature	8/28/07 Date
N/A Ecology Project Manager (printed)	Signature	Date
D. A. Faulk EPA Project Manager (printed)	Signature	8/30/07 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-B1 SEPTIC SYSTEM

Attachment to Waste Site Reclassification Form 2007-015

September 2007

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-B1 SEPTIC SYSTEM

EXECUTIVE SUMMARY

This remaining sites verification package documents evaluation of the confirmatory sampling results to support reclassification of the 1607-B1 waste site.

The 1607-B1 Septic System is located near the east entrance to the 100-B/C Area in the 100-BC-1 Operable Unit of the Hanford Site. It includes a septic tank, drain field, and associated connecting pipelines and influent sanitary sewer lines that serviced the former 1701-B Badgehouse, 1720-B Patrol Building/Change Room, and 1709-B Fire Headquarters. The 1607-B1 waste site received unknown amounts of nonhazardous, nonradioactive sanitary sewage from these facilities during its operational period from 1944 to approximately 1970.

Confirmatory sampling at the site was conducted on May 21, 2007. Excavation to the septic tank found that the top of the tank had been removed in its entirety and the interior filled with sand and nonhazardous debris (i.e., bollards, concrete debris, rebar, vitrified clay pipe pieces). Excavation at the drain field revealed vitrified clay pipe containing no sediment. Samples of the septic tank contents, soil underlying the tank, soil underlying pipelines, and the soil underlying the drain field were collected.

The analytical results indicated no elevated residual concentrations exceeding cleanup criteria, except barium, zinc, and dichlorodiphenyltrichloroethane (DDT) that exceeded their respective groundwater and/or river protection remedial action goals. However, the results of vertical migration modeling predict that none of these constituents will migrate to groundwater (and, thus, the Columbia River) within 1,000 years, and their residual concentrations are, therefore, protective (BHI 2005). A summary of the evaluation of the sampling results against the applicable criteria is presented in Table ES-1.

The results of confirmatory sampling are used to make reclassification decisions for the 1607-B1 site in accordance with the TPA-MP-14 (DOE-RL 2007b) procedure. In accordance with this evaluation, the confirmatory sampling results support a reclassification of this site to No Action. 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). 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.

Table ES-1. Summary of Remedial Action Goals for the 1607-B1 Site.

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 individual hazard quotients are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (3.2×10^{-2}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk values for individual carcinogens are $<1 \times 10^{-6}$.	
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk value (1.8×10^{-7}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river protection RAGs.	No radionuclide COPCs were detected above background levels.	Yes
	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.	Residual concentrations of barium, zinc, and DDT (138, 93.9, and 0.021 mg/kg, respectively) exceeded their respective soil RAGs for groundwater and/or river protection (132, 67.8, and 0.005 mg/kg, respectively). However, vertical migration modeling predicts that these constituents will not reach groundwater (and, therefore, the Columbia River) within 1,000 years.[d]	Yes

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

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

[c] Based on the isotopic distribution of uranium in the 100 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).

[d] Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), barium, zinc, and DDT are not predicted to migrate more than 3 m (10 ft) vertically in 1,000 years (based on the lowest soil-partitioning coefficient distribution [barium] of 25 mL/g). The vadose zone underlying this site is approximately 17 m (56 ft) thick.

COPC = contaminant of potential concern
DDT = dichlorodiphenyltrichloroethane
MCL = maximum contaminant level
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose model)

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based 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 1607-B1 contaminants of potential concern. Screening levels were not exceeded for the site constituents, with the exception of barium, boron, mercury, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of these constituents does not pose a risk to ecological receptors because the concentrations of mercury and vanadium are below site background levels, barium and zinc are within the range of Hanford Site background levels, and boron concentrations are consistent with those seen elsewhere at the Hanford Site (no established background value is available for boron). 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 closeout decision for this site. Draft A of the baseline risk assessment concludes that no ecological risks are associated with Hanford contaminants of potential concern at upland remediated waste sites and riparian operational soil areas (DOE-RL 2007a).

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-B1 SEPTIC SYSTEM

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 1607-B1 waste site meets the objectives for No Action as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (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). 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.

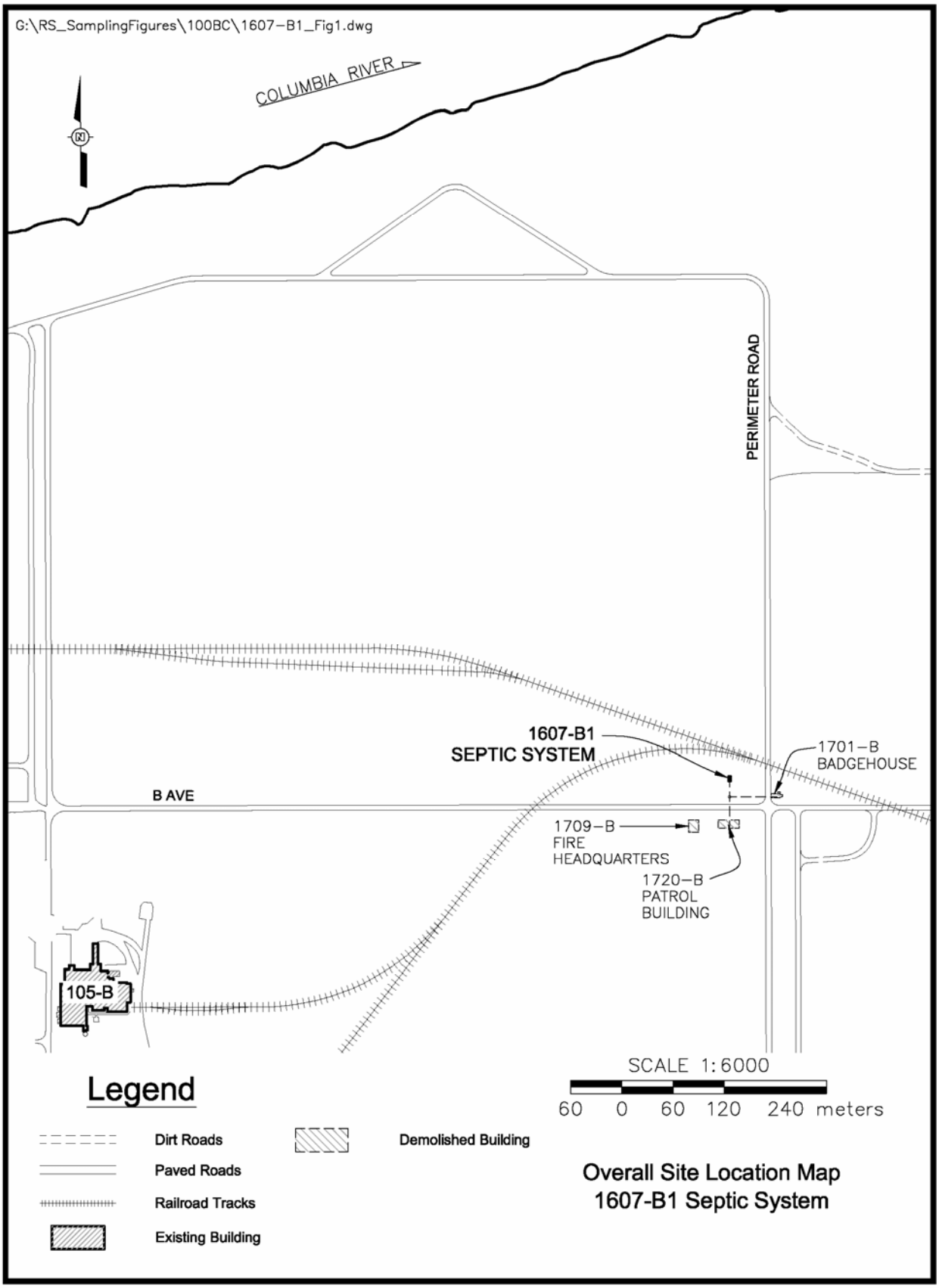
GENERAL SITE INFORMATION AND BACKGROUND

The 1607-B1 Septic System is located near the east entrance to the 100-B/C Area in the 100-BC-1 Operable Unit of the Hanford Site. It includes a septic tank, drain field, and associated connecting pipelines and influent sanitary sewer lines that serviced the former 1701-B Badgehouse, 1720-B Patrol Building/Change Room, and 1709-B Fire Headquarters (Figure 1). The Waste Information Data System (WIDS) (WCH 2007c) describes the septic tank as constructed of reinforced concrete with a 125-person capacity (132 L [35 gal] per capita, or approximately 16,504 L [4,360 gal] total capacity). The tank walls and floor are 25 cm (10 in.) thick, and the tank dimensions are 4.3 m (14 ft) long, 2.1 m (7 ft) wide, and 3.4 m (11 ft) deep (HEW 1943). The pipelines from the 1701-B Badgehouse and 1720-B Patrol Building/Change Room to the septic tank are constructed of 15-cm (6-in.) and 20-cm (8-in.)-diameter vitrified clay pipe (VCP) (GE 1955).

The WIDS describes the associated drain field as constructed of 10-cm (4-in.)-diameter VCP, concrete pipe, or drain tile, with a minimum of 2.4 m (8 linear ft) per capita. The laterals are open-jointed and spaced 2.4 m (8 ft) apart. The Hanford Site drawing W-71192 (HEW 1943) indicates that the tile field was "to be located in the field," and drawing M-2913 (HEW 1949) shows the tile field northwest of the septic tank and just south of the railroad spur going to the 105-B Reactor.

The 1607-B1 site received unknown amounts of nonhazardous, nonradioactive sanitary sewage from the 1701-B Badgehouse, 1720-B Patrol Building/Change Room, and 1709-B Fire Headquarters (WHC 1994). The operational period was from 1944 to approximately 1970 (based on aerial photographs). All of the facilities associated with the septic system have been removed, at least to grade.

Figure 1. Location of the 1607-B1 Septic System.



CONFIRMATORY SAMPLING ACTIVITIES

The 1607-B1 waste site was evaluated to determine a No Action or Remedial Action decision in accordance with the RDR/RAWP (DOE-RL 2005b), the Remaining Sites ROD (EPA 1999), and the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a). This evaluation included investigation of the site by conducting confirmatory sampling. The following sections describe the activities to support and conduct confirmatory sampling, including geophysical investigation results, contaminants of potential concern (COPCs), sample design, sampling activities, and sample results.

Geophysical Investigation

A geophysical survey was performed at the 1607-B1 site in October 2006 (Mitchell and Hudson 2006). Electromagnetic induction, magnetic total field/vertical gradient (magnetic), and ground penetrating radar were the geophysical methods used for this investigation. The survey identified subsurface anomalies consistent with the documented location of the septic tank but not the drain field. The geophysical survey results are shown on Figure 2 and were used to assist in identifying areas for further investigation by confirmatory sampling.

Contaminants of Potential Concern

The COPCs for the 1607-B1 Septic System were identified based on existing historical and analogous site information. Additional COPCs were identified and agreed upon as described in the site-specific sample design (WCH 2007c). The COPCs for this site include the following: the inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, pesticides, semivolatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs).

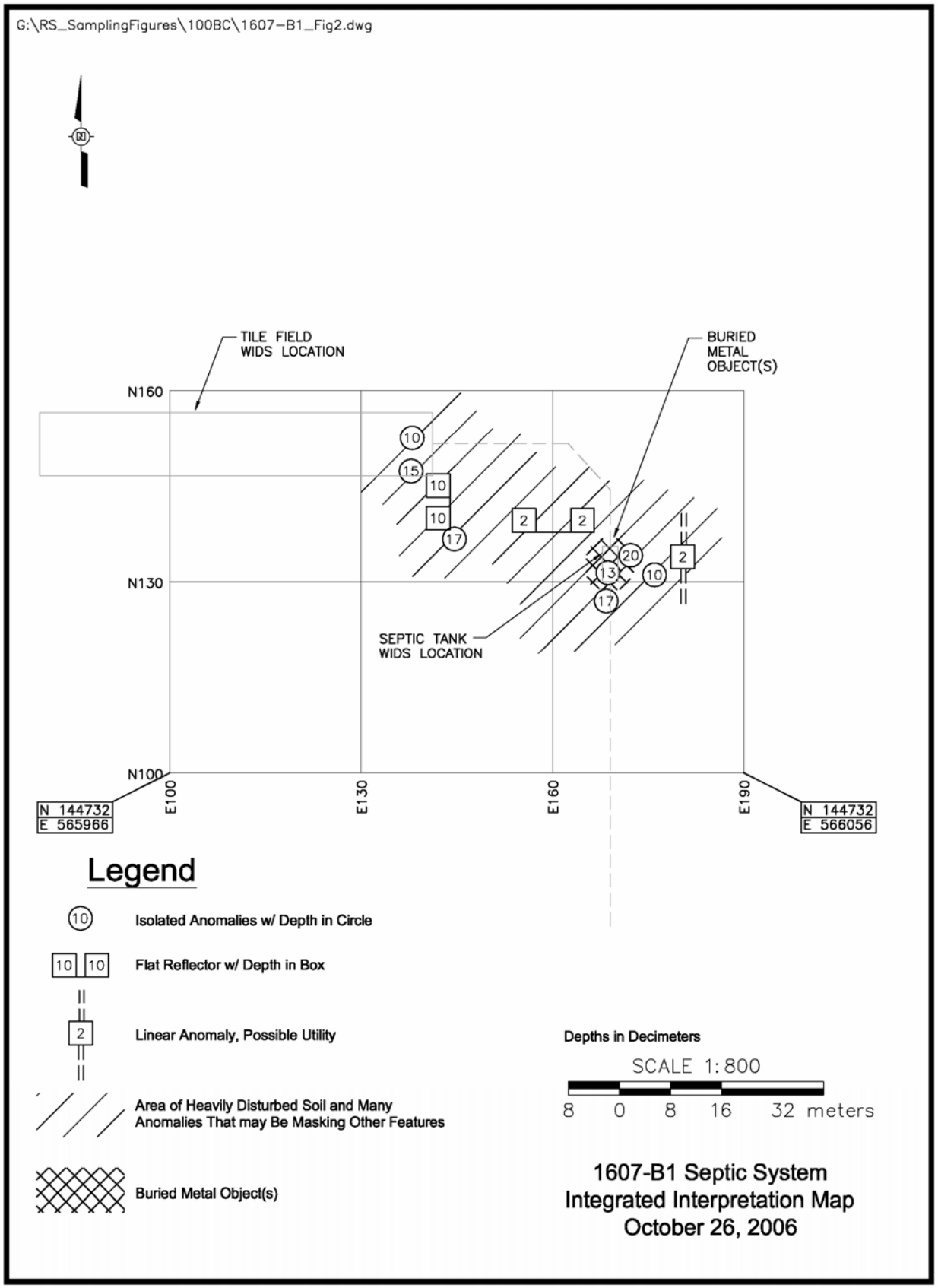
Radionuclides were not COPCs for this site; however, the presence of radiological contaminants was evaluated during excavation and sampling activities using field radiological survey instrumentation (capable of detecting alpha, beta, and gamma radiation). Although no elevated radiological activity was detected during field activities, samples were submitted for further radionuclide evaluation.

Field screening for volatile organic compounds using an organic vapor monitor was also performed during excavation and sampling activities. No elevated volatile organic readings were detected; therefore, volatile organic analysis was not included in the requested analyses. No oily soil, evidence of burning, or suspect asbestos-containing material was observed during field activities (WCH 2007a); therefore, additional analyses were not required.

Confirmatory Sample Design

Historical data, process knowledge of septic systems, geophysical survey results, and other available information were used to develop a site-specific confirmatory sample design (WCH 2007c). The design included three locations as the most likely areas to encounter hazardous constituents and to focus excavation and sampling efforts. These locations included the septic tank, the influent pipeline to the septic tank, and the drain field.

Figure 2. Geophysical Interpretation Map of the 1607-B1 Site.



Confirmatory Sampling Activities

Excavation and confirmatory sampling at the 1607-B1 waste site was conducted on May 21, 2007. Excavation began with a test pit at the suspected location of the septic tank. The septic tank was encountered less than 0.3 m (1 ft) below ground surface (bgs). The top of the tank was found to have been entirely removed and the tank contained mostly soil backfill with small quantities of miscellaneous, nonhazardous debris (i.e., bollards, concrete debris, rebar, and VCP pieces). Excavation continued to the bottom of the tank, which was reached at 3.4 m (11 ft) bgs. Since the tank was backfilled, a single sample was collected of the contents from the bottom of the tank.

Excavation continued at the south exterior wall of the septic tank where the inlet pipe (influent) to the tank was located. This pipe was located approximately 0.5 m (1.5 ft) bgs and found to be concrete-encased VCP. It was breached and found empty; therefore, a sample was collected from the soil underlying this pipe. Excavation then moved to the exterior north wall (effluent side) of the septic tank and continued to a depth of 3.7 m (12 ft) bgs, where the bottom of the tank was reached, and a sample was collected from the underlying soil. This excavation activity exposed the entire north wall of the tank, and two effluent pipes were revealed exiting this wall. One pipe was a 15-cm (6-in.)-diameter VCP, located 1.2 m (4 ft) bgs, and the other was a 20-cm (8-in.)-diameter VCP, located 2.4 m (8 ft) bgs.

Excavation continued toward the drain field by trenching along the deeper 20-cm (8-in.)-diameter VCP until the drain field was reached. The drain field was located just south of the railroad spur as indicated in Hanford Site drawing M-2913 (HEW 1949). The first lateral (discharge point to soil) of the drain field was then located and found to be open-jointed VCP. The pipe was empty; therefore an underlying soil sample was collected in accordance with the sample design (WCH 2007c). After sample collection was complete, the excavation was backfilled to grade.

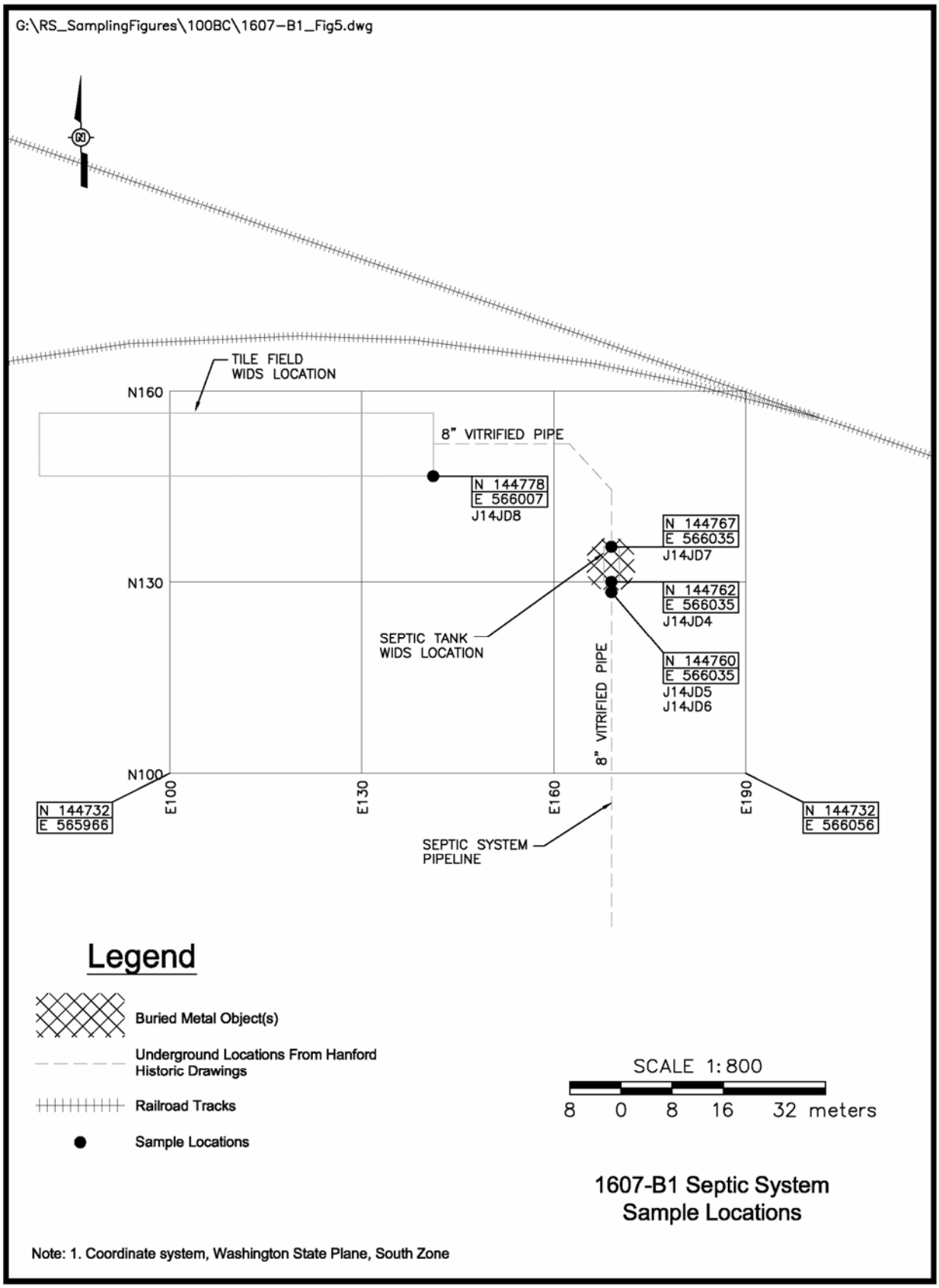
A summary of the samples collected, and the laboratory analyses performed, is provided in Table 1. Figure 3 identifies the sample locations and photographs of the excavation and confirmatory sampling activities are located in Appendix A.

Table 1. 1607-B1 Confirmatory Sample Summary Table.

Sample Media and Location	Sample Number	Coordinate Locations	Depth bgs	Sample Analysis
Contents of septic tank	J14JD4	N 144762 E 566035	3.4 m (11 ft)	ICP metals, mercury, hexavalent chromium, PCB, pesticides, SVOA, GEA, gross alpha, gross beta
Soil underlying septic tank influent pipe	J14JD5	N 144760 E 566035	0.5 m (1.5 ft)	
Soil underlying septic tank	J14JD7	N 144767 E 566035	3.7 m (12 ft)	
Soil underlying drain field	J14JD8	N 144778 E 566007	1.2 m (4 ft)	
Duplicate (soil underlying septic tank influent pipe)	J14JD6	N 144760 E 566035	0.5 m (1.5 ft)	
Equipment blank (silica sand)	J14JD9	N/A	N/A	ICP metals, SVOA, mercury

Source: Field logbook EFL-1173-12 (WCH 2007a)
bgs = below ground surface
GEA = gamma energy analysis
ICP = inductively coupled plasma
N/A = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis

Figure 3. Sample Locations at the 1607-B1 Waste Site.



Confirmatory Sample Results

Confirmatory samples were analyzed using analytical methods approved by the U.S. Environmental Protection Agency. The analytical results are stored in the Environmental Restoration project-specific database prior to being provided to the Hanford Environmental Information System and are included in Appendix B of this document.

The analytical results for the COPCs that were identified for the 1607-B1 waste site were compared to the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b). These results are shown 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 2005) under *Washington Administrative Code* (WAC) 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 Table 2. Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the site, but are not included in Table 2, as these isotopes are unrelated to the operational history of the site and were detected below background levels (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]).

Table 2. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-B1 Septic System. (2 Pages)

COPC	Maximum Result (pCi/g)	Generic Site Lookup Values[a] (pCi/g)			Does the Maximum Result Exceed Lookup Values?	Does the Maximum Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value[b]	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.122	6.2	1,465[c]	1,465[c]	No	--
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	4.2 (<BG)	20	20	20	No	--
Barium	138	5,600	132[d]	224	Yes	Yes[e]
Beryllium	0.27 (<BG)	10.4[f]	1.51[d]	1.51[d]	No	--
Boron[g]	2.4	16,000	320	--[h]	No	--
Cadmium[i]	0.12 (<BG)	13.9[f]	0.81[d]	0.81[d]	No	--
Chromium (hexavalent)	0.30	2.1[f]	4.8[j]	2	No	--
Chromium (total)	9.6 (<BG)	80,000	18.5[d]	18.5[d]	No	--
Cobalt	8.9 (<BG)	1,600	32	--[h]	No	--
Copper	20.2 (<BG)	2,960	59.2	22.0[d]	No	--

Table 2. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-B1 Septic System. (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		
Lead	8.6 (<BG)	353	10.2[d]	10.2[d]	No	--
Manganese	304 (<BG)	11,200	512[d]	512[d]	No	--
Mercury	0.23 (<BG)	24	0.33[d]	0.33[d]	No	--
Molybdenum[g]	0.57	400	8	--[h]	No	--
Nickel	11.6 (<BG)	1,600	19.1[d]	27.4	No	--
Vanadium	42.2 (<BG)	560	85.1[d]	--[h]	No	--
Zinc	93.9	24,000	480	67.8[d]	Yes	Yes[e]
Aroclor-1260	0.011	0.5	0.017[k]	0.017[k]	No	--
Alpha-BHC	0.00052	0.159	0.00165[k]	0.00165[k]	No	--
DDD, 4,4'-	0.0010	4.17	0.0365	0.005[k]	No	--
DDT, 4,4'-	0.021	2.94	0.0257	0.005[k]	Yes	Yes[e]
Bis(2-ethylhexyl)phthalate	0.098	71.4	0.625	0.36	No	--
Di-n-butylphthalate	0.026	8,000	160	540	No	--
Pyrene	0.021	2,400	48	192	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) or calculated per WAC-173-340-720, 173-340-730, and 173-340-740, Method B, 1996, unless otherwise noted.
[b] Activity corresponding to a single-radionuclide 15 mrem/yr exposure as calculated using the RESRAD model (DOE-RL 2005b).
[c] Cleanup level determined in *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004).
[d] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).
[e] Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), barium, zinc, and DDT are not predicted to migrate more than 3 m (10 ft) vertically in 1,000 years (based on the lowest soil-partitioning coefficient distribution [barium] of 25 mL/g). The vadose zone underlying this site is approximately 17 m (56 ft) thick.
[f] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3]) (1996) and an airborne particulate mass-loading rate of 0.0001 g/m^3 (WDOH 1997).
[g] No Hanford Site-specific or Washington State background value available.
[h] No cleanup level is available from the *Cleanup Levels and Risk Calculations (CLARC) Database* (Ecology 2005), and no bioconcentration factor or ambient water quality criteria values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[i] Hanford Site-specific background value is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[j] Calculated cleanup level (per WAC 173-340-720(3), 1996 [Method B for groundwater] and WAC 173-340-740(3)(a)(ii)(A), 1996 ["100 times rule"]) presented is lower than that presented in DOE-RL (2005b), based on updated oral reference dose value (as provided in the Integrated Risk Information System) (EPA 2006).
[k] Where cleanup levels are less than the RDL, cleanup levels default to the RDL (WAC 173-340-707[2], 1996, and DOE-RL 2005b).

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

DATA EVALUATION

Evaluation of the results listed in Table 2 from confirmatory sampling at the 1607-B1 waste site indicates that residual concentrations of all site COPCs are below soil RAGs, except for barium, zinc, and DDT. Residual concentrations of these contaminants exceed the soil RAGs for the protection of groundwater and/or the Columbia River. Data were not collected on the vertical extent of residual contamination, but given the soil-partitioning coefficient of barium (25 mL/g), zinc (30 mL/g), and DDT (678 mL/g) (per the RDR/RAWP [DOE-RL 2005b]), RESidual RADioactivity (RESRAD) modeling predicts that these contaminants will not migrate more than 3 m (10 ft) vertically in 1,000 years (BHI 2005). The vadose zone beneath the 1607-B1 excavation is approximately 17 m (56 ft) thick. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater. The only pathway for contamination to reach the Columbia River is via groundwater migration, so these contaminant concentrations are also protective of the Columbia River.

Assessment of the risk requirements for the 1607-B1 waste site is determined by calculation of the hazard quotient and excess cancer risk values for nonradionuclides. These calculations are located in Appendix C. 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 C) indicate that all individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the noncarcinogenic constituents is 3.2×10^{-2}. All individual carcinogen risk values for carcinogenic constituents are less than 1×10^{-6}. The cumulative carcinogenic risk value is 1.8×10^{-7}. Therefore, nonradionuclide risk requirements are met.

When using a statistical sampling approach, a RAG 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 and evaluated individually against the cleanup criteria.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) review was performed to compare the confirmatory sampling approach and resulting analytical data with the sampling and data requirements specified by the project objectives and performance specifications. 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 assessment review completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2000).

This DQA review was performed in accordance with the RDR/RAWP (DOE-RL 2005b). A review of the sample design (WCH 2007c), the field logbook (WCH 2007a), and the applicable analytical data package has been performed as part of this DQA. All available samples were collected per the sample design. A sample of the contents of a drain field pipe was specified in the sample design but not collected because no materials were present within the pipe to collect. To ensure quality data sets, the SAP (DOE-RL 2005a) data assurance requirements, as well as the validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b), are followed where appropriate. Data from

confirmatory samples collected at the 1607-B1 site were provided by the laboratory in sample delivery group (SDG) K0796 as described below.

SDG K0796

One equipment blank, analyzed for ICP metals, SVOCs, and mercury, was included in SDG K0796. An additional five field samples from the 1607-B1 waste site were also collected. These samples were analyzed for ICP metals, mercury, hexavalent chromium, PCBs, chlorinated pesticides, SVOCs, gamma spectroscopy, and both alpha and beta proportional counting. Of the five field samples collected, two samples comprise a field duplicate pair (J14JD5/J14JD6) for this sampling effort. SDG K0796 was submitted for formal third-party validation (WCH 2007b). No major deficiencies were found in SDG K0796. Minor deficiencies and validator-applied data flags are found below.

Inductively coupled plasma metal analysis (ICP metals)

In the ICP metals analysis, the matrix spike (MS) recoveries for five ICP metals (aluminum, calcium, iron, antimony, and silicon) are out of acceptance criteria. For aluminum, calcium, iron, and silicon, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. To confirm quantitation, post-digestion spikes and serial dilutions were prepared for all five analytes with results in the range of 97.8% to 103.9%. The analyte, antimony did not have mismatched spike and native concentrations in the original MS. The MS recovery for antimony was 48.8%. Third-party validation qualified all of the antimony data in SDG K0796 as estimated with "J" flags. Estimated data are useable for decision-making purposes.

The analytes calcium, chromium, copper, sodium, and zinc were reported in the method blank (MB) at low concentrations that were below the contract-required quantitation limits but not less than 1/5th of the concentrations reported in the equipment blank sample J14JD9 (i.e., the equipment blank concentrations for these analytes were low enough that the MB concentration is of similar magnitude). Third-party validation qualified the analytical data for these analytes in sample J14JD9 (equipment blank) as estimated nondetections with "UJ" flags. The data are useable for decision-making purposes.

Also in the ICP metals analysis, the laboratory control sample (LCS) recovery for silicon is below the acceptance criteria at 38%. Silicon was qualified by third-party validation as estimates with "J" flags for all samples in SDG K0796. Estimated, or "J"-flagged, data are considered acceptable for the intended use of the data.

Hexavalent chromium

No deficiencies were found in the hexavalent chromium analysis. The data are useable for decision-making purposes.

Polychlorinated biphenyls

In the PCB analysis, one of the MS surrogate recoveries was above the laboratory acceptance criteria (tetrachloro-m-xylene, 121%). However, this result meets the secondary acceptance criteria for PCB

analysis, which allows no more than one surrogate outlier per sample. Therefore, no data qualifiers were applied due to this result. The data are useable for decision-making purposes.

Chlorinated pesticides

In the chlorinated pesticide analysis, the analyte toxaphene was not included in the MS, matrix spike duplicate (MSD), or LCS samples. Toxaphene is actually a mixture of compounds rather than a discrete analyte. While the overall concentration of toxaphene can be calculated using several unobstructed peaks in the chromatography, the inclusion of toxaphene in the spiking mixture would be problematic for the other pesticide analytes. The laboratory typically quantitates toxaphene but does not include toxaphene in quality assurance/quality control (QA/QC) samples. Third-party validation qualified all of the toxaphene data from SDG K0796 as estimated with "J" flags. Estimated data are useable for decision-making purposes.

The MS recoveries for aldrin and gamma-chlordane were below the acceptance criteria at 51% and 59%, respectively. Third-party validation qualified all aldrin and gamma-chlordane data from SDG K0796 as estimated with "J" flags. Estimated data are useable for decision-making purposes.

The relative percent differences (RPDs) between the primary and laboratory duplicate samples calculated for all but five of the chlorinated pesticide analytes were outside of the acceptance criteria. Third-party validation qualified all of the data for all but five of the chlorinated pesticide analytes as estimated with "J" flags. Estimated data are useable for decision-making purposes. The five analytes that were not qualified as estimated were alpha-BHC, gamma-BHC, delta-BHC, endosulfan I, and 4,4'-DDE.

The MS and LCS samples prepared for the chlorinated pesticide analysis were inadvertently diluted four-fold (along with the field samples). This deficiency did not affect the field sample data. Also, third-party validation did not apply any qualifiers due to this result. The data are useable for decision-making purposes.

Semivolatile organic compounds

The common laboratory contaminants di-n-butylphthalate and bis(2-ethylhexyl)phthalate were detected in the MB. Because the analytical results for these compounds in samples J14JD4, J14JD6, and J14JD9 were less than five times the MB results, third-party validation raised the analytical results for these analytes in these samples to the required quantitation limit and qualified those data as non-detected with "U" flags. The data are useable for decision-making purposes.

The MS was prepared in a separate batch from samples J14JD5, J14JD7, and J14JD8. The MSD was prepared in a separate batch from samples J14JD4, J14JD6, and J14JD9. Because the MS and MSD were not prepared in the same sample batch, third-party validation qualified all of the SVOC data in SDG K0796 as estimated with "J" flags. Estimated data are useable for decision-making purposes.

Of the 128 MS and MSD recoveries, three were below the acceptance criteria. The recovery for indeno(1,2,3,-cd)pyrene was 59% in the MS and the recoveries for 1,2,4-trichlorobenzene were 52% and 56% in the MS and MSD, respectively. Third-party validation qualified all of the 1,2,4-trichlorobenzene results in SDG K0796 as estimated with "J" flags. Third-party validation also qualified the

indeno(1,2,3,-cd)pyrene data in samples J14JD4, J14JD6, and J14JD9 as estimated with "J" flags. Estimated data are useable for decision-making purposes.

Two LCSs were prepared and the analytical results for 2,4-dinitrophenol were below the acceptance criteria at 11% and 9%. The LCS results for 4,6-dinitro-2-methylphenol were also below the acceptance criteria at 22% and 14%. Third-party validation qualified all of the data for these analytes in SDG K0796 as estimated with "J" flags. Estimated data are useable for decision-making purposes.

One of the LCS recoveries for indeno(1,2,3,-cd)pyrene was below the acceptance criteria at 58%. Third-party validation qualified the indeno(1,2,3,-cd)pyrene data in the associated samples (J14JD4, J14JD6, and J14JD9) as estimated with "J" flags. Estimated data are useable for decision-making purposes.

One of the LCS recoveries for pentachlorophenol was also below the acceptance criteria at 26%. Third-party validation qualified the pentachlorophenol data in the associated samples (J14JD5, J14JD7, and J14JD8) as estimated with "J" flags. Estimated data are useable for decision-making purposes.

Gross alpha, gross beta, and gamma spectroscopy

In the confirmatory data set, the gross beta results were below the threshold level. However, a gross alpha result (16.6 pCi/g) was above the threshold level (15 pCi/g), which initiated further evaluation of the data set. Isotopic plutonium analysis was requested, and the results indicated no detectable presence of non-natural, alpha-emitting isotopes. The slight gross alpha exceedance is most likely due to sample homogeneity. The data set is sufficient to support the intended use (to make closeout decisions regarding residual COPC concentrations at this site).

For the radionuclide analyses, 24 analytes exceeded the required quantitation limit. Under the Washington Closure Hanford statement of work, no qualification is required, and these small exceedances were not qualified by third-party validation. The data are useable for decision-making purposes.

Field Quality Assurance/Quality Control

RPD evaluations of the 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 QA/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2007a), are J14JD5 (main) and J14JD6 (duplicate). The main and QA/QC sample results are presented in Appendix B.

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the duplicate samples for each COPC.

Radionuclides. For SDG K0796, none of the RPDs calculated for radionuclides in field duplicate pair (J14JD5/J14JD6) are above the acceptance criteria (30%). The data are useable for decision-making purposes.

Nonradionuclides. For SDG K0796, the third-party validation calculated the field duplicate (J14JD5/J14JD6) RPDs for barium at 33%, iron at 35%, and vanadium at 39%. These RPD results exceed the criteria (30%); however, there is no requirement to qualify the data and no qualifier flags were assigned. As elevated RPDs are attributed to heterogeneity naturally occurring in the soil matrix, the data are found to be useable for decision-making purposes.

QA/QC Conclusions

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 1607-B1 confirmatory sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. One sample, indicated in the sampling plan, was not collected because no sample material was found at the sample location. However, the DQA review for the 1607-B1 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/or QC deficiencies. The analytical data were found acceptable for decision-making purposes.

SUMMARY FOR NO ACTION

The 1607-B1 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2005b). 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 1607-B1 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

SITE PHOTOGRAPHY

Photograph A-1. Excavation at the 1607-B1 Septic Tank (taken 5/21/07).

Note: Moisture is from water applied for dust suppression during excavation.

Photograph A-2. Excavation to Bottom of 1607-B1 Septic Tank (taken 5/21/07).

Photograph A-3. Influent to 1607-B1 Septic Tank (taken 5/21/07).

Note: Moisture is from water applied for dust suppression during excavation.

Photograph A-4. 1607-B1 Septic Tank Wall (effluent to drain field) (taken 5/21/07).

Photograph A-5. Effluent Pipe to 1607-B1 Drain Field (taken 5/21/07).

Photograph A-6. 1607-B1 Drain Field Piping (taken 5/21/07).

Photograph A-7. Field Screening During Excavation at 1607-B1 Waste Site (taken 5/21/07).

Photograph A-8. Confirmatory Sampling at 1607-B1 Waste Site (taken 5/21/07).

APPENDIX B

CONFIRMATORY SAMPLING RESULTS

Table B-1. 1607-B1 Confirmatory Sampling Results. (7 Pages)

Sample Location	Sample 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
Tank contents	J14JD4	5/21/07	0.290	U	0.290	0.088	U	0.088	0.096	U	0.096	0.220	U	0.220	0.320	U	0.320	0.200	U	0.200
Under inlet pipe	J14JD5	5/21/07	0.270	U	0.270	0.122		0.085	0.079	U	0.079	0.170	U	0.170	0.270	U	0.270	0.180	U	0.180
Duplicate of J14JD5	J14JD6	5/21/07	0.310	U	0.310	0.094	U	0.094	0.110	U	0.110	0.230	U	0.230	0.360	U	0.360	0.230	U	0.230
Under tank	J14JD7	5/21/07	0.075	U	0.075	0.086	U	0.086	0.087	U	0.087	0.230	U	0.230	0.260	U	0.260	0.180	U	0.180
Drain field soil	J14JD8	5/21/07	0.270	U	0.270	0.071	U	0.071	0.075	U	0.075	0.180	U	0.180	0.260	U	0.260	0.170	U	0.170

Sample Location	Sample 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
Tank contents	J14JD4	5/21/07	10.5		10.0	20.8		5.50	12.7		0.770	0.374		0.160	0.673		0.350	0.064	U	0.064
Under inlet pipe	J14JD5	5/21/07	14.6		11.0	21.2		5.80	10.5		0.670	0.511		0.150	0.649		0.370	0.058	U	0.058
Duplicate of J14JD5	J14JD6	5/21/07	12.8		12.0	17.3		5.60	12.9		1.10	0.552		0.170	0.734		0.350	0.070	U	0.070
Under tank	J14JD7	5/21/07	12.5		11.0	19.9		5.90	8.22		0.750	0.246		0.160	0.663		0.360	0.060	U	0.060
Drain field soil	J14JD8	5/21/07	16.6		9.30	19.7		9.00	10.7		0.780	0.530		0.140	0.644		0.280	0.054	U	0.054

Sample Location	Sample Number	Sample Date	Thorium-228 GEA			Thorium-232 GEA			Uranium-235 GEA			Uranium-238 GEA			Plutonium-238			Plutonium-239/240		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Tank contents	J14JD4	5/21/07	0.480		0.130	0.673		0.350	0.320	U	0.320	11.0	U	11.0						
Under inlet pipe	J14JD5	5/21/07	0.684		0.120	0.649		0.370	0.300	U	0.300	9.10	U	9.10						
Duplicate of J14JD5	J14JD6	5/21/07	0.517		0.140	0.734		0.350	0.350	U	0.350	12.0	U	12.0						
Under tank	J14JD7	5/21/07	0.446		0.130	0.663		0.360	0.350	U	0.350	9.50	U	9.50						
Drain field soil	J14JD8	5/21/07	0.630		0.130	0.644		0.280	0.270	U	0.270	8.80	U	8.80	-0.032	U	0.241	0	U	0.241

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

Note: Data qualified with C, D, I, and/or J are considered acceptable values for decision-making purposes.

BHC = hexachlorocyclohexane

C = blank contamination (inorganic constituents)

D = diluted

GEA = gamma energy analysis

I = interference

J = estimate

MDA = minimum detectable activity

PQL = practical quantitation limit

Q = qualifier

U = undetected

Table B-1. 1607-B1 Confirmatory Sampling Results. (7 Pages)

Sample Location	Sample 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
Tank contents	J14JD4	5/21/07	4080	C	5.7	1.0	UJ	1.0	2.1		1.3	49.1	C	0.06	0.12		0.03	1.7		1.2
Under inlet pipe	J14JD5	5/21/07	5660	C	5.8	1.0	UJ	1.0	2.7		1.3	138	C	0.06	0.22		0.03	1.8		1.2
Duplicate of J14JD5	J14JD6	5/21/07	6950	C	6.1	1.1	UJ	1.1	4.2		1.4	99.5	C	0.07	0.22		0.03	1.8		1.3
Under tank	J14JD7	5/21/07	6140	C	5.5	0.99	UJ	0.99	3.1		1.3	131	C	0.06	0.27		0.03	2.4		1.2
Drain field soil	J14JD8	5/21/07	5350	C	5.4	0.97	UJ	0.97	3.0		1.2	138	C	0.06	0.24		0.03	1.4		1.1
Equipment blank	J14JD9	5/21/07	43.4	C	1.7	0.31	UJ	0.31	0.40	U	0.40	1.0	C	0.02	0.02		0.01	0.37	U	0.37

Sample Location	Sample 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
Tank contents	J14JD4	5/21/07	0.12		0.1	4650	C	2.4	7.5	C	0.26	5.6	C	0.29	13.1	C	0.38	0.22	U	0.22
Under inlet pipe	J14JD5	5/21/07	0.1	U	0.1	6820	C	2.4	8.6	C	0.26	6.0	C	0.29	15.2	C	0.39	0.29		0.22
Duplicate of J14JD5	J14JD6	5/21/07	0.10	U	0.10	8340	C	2.5	9.6	C	0.27	7.0	C	0.30	15.6	C	0.41	0.23	U	0.23
Under tank	J14JD7	5/21/07	0.09	U	0.09	5630	C	2.3	7.5	C	0.25	8.9	C	0.28	18.4	C	0.37	0.21	U	0.21
Drain field soil	J14JD8	5/21/07	0.09	U	0.09	4280	C	2.3	7.7	C	0.24	6.4	C	0.27	20.2	C	0.39	0.30		0.21
Equipment blank	J14JD9	5/21/07	0.03	U	0.03	27.4	UJ	0.73	0.1	UJ	0.08	0.1	C	0.09	0.13	UJ	0.12			

Sample Location	Sample 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
Tank contents	J14JD4	5/21/07	13300		9.5	2.9		0.90	3760	C	2.3	220	C	0.06	0.02	U	0.02	0.54		0.42
Under inlet pipe	J14JD5	5/21/07	12700		9.6	4.8		0.90	3920	C	2.4	264	C	0.06	0.23		0.01	0.42	U	0.42
Duplicate of J14JD5	J14JD6	5/21/07	17500		10.0	5.1		0.95	4740	C	2.5	304	C	0.07	0.04		0.01	0.44	U	0.44
Under tank	J14JD7	5/21/07	23000		9.1	7.6		0.86	4980	C	2.2	300	C	0.06	0.07		0.02	0.40	U	0.40
Drain field soil	J14JD8	5/21/07	15100		8.9	8.6		0.85	3460	C	2.2	264	C	0.06	0.1		0.01	0.57		0.39
Equipment blank	J14JD9	5/21/07	87.7		2.9	0.27	U	0.27	6.4	C	0.71	3.6	C	0.02	0.01	U	0.01	0.13	U	0.13

Table B-1. 1607-B1 Confirmatory Sampling Results. (7 Pages)

Sample Location	Sample 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
Tank contents	J14JD4	5/21/07	11.6		0.61	691		15.6	1.2	U	1.2	770	J	1.3	0.29	U	0.29	152	C	9.5
Under inlet pipe	J14JD5	5/21/07	10.1		0.61	978		15.8	1.2	U	1.2	1940	J	1.4	0.29	U	0.29	166	C	9.6
Duplicate of J14JD5	J14JD6	5/21/07	11.3		0.64	1150		16.5	1.3	U	1.3	1910	J	1.4	0.30	U	0.30	205	C	10.1
Under tank	J14JD7	5/21/07	10.3		0.59	1050		15.0	1.1	U	1.1	2080	J	1.3	0.28	U	0.28	253	C	9.2
Drain field soil	J14JD8	5/21/07	9.0		0.57	937		14.7	1.1	U	1.1	1260	J	1.3	0.27	U	0.27	146	C	9.0
Equipment blank	J14JD9	5/21/07	0.18	U	0.18	19.3		4.7	0.36	U	0.36	46.1	J	0.41	0.09	U	0.09	7.9	UJ	2.9

Sample Location	Sample Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
Tank contents	J14JD4	5/21/07	29.7		0.32	32.4	C	0.1
Under inlet pipe	J14JD5	5/21/07	23.7		0.32	35.7	C	0.1
Duplicate of J14JD5	J14JD6	5/21/07	34.6		0.34	44.8	C	0.10
Under tank	J14JD7	5/21/07	42.2		0.31	93.9	C	0.09
Drain field soil	J14JD8	5/21/07	31.3		0.30	70.5	C	0.09
Equipment blank	J14JD9	5/21/07	0.1	U	0.1	1.2	UJ	0.03

Table B-1. 1607-B1 Confirmatory Sampling Results. (7 Pages)

Constituent	J14JD4 Tank contents Sample Date 5/21/07			J14JD5 Under inlet pipe Sample Date 5/21/07			J14JD6 Duplicate of J14JD5 Sample Date 5/21/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls									
Aroclor-1016	15	U	15	15	U	15	15	U	15
Aroclor-1221	15	U	15	15	U	15	15	U	15
Aroclor-1232	15	U	15	15	U	15	15	U	15
Aroclor-1242	15	U	15	15	U	15	15	U	15
Aroclor-1248	15	U	15	15	U	15	15	U	15
Aroclor-1254	15	U	15	15	U	15	15	U	15
Aroclor-1260	15	U	15	15	U	15	15	U	15
Pesticides									
Aldrin	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Alpha-BHC	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
alpha-Chlordane	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
beta-1,2,3,4,5,6-Hexachlorocyclohexane	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Delta-BHC	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Dichlorodiphenyldichloroethane (DDD)	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Dichlorodiphenyldichloroethylene (DDE)	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Dichlorodiphenyltrichloroethane (DDT)	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Dieldrin	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Endosulfan I	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Endosulfan II	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Endosulfan sulfate	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Endrin	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Endrin aldehyde	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Endrin ketone	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Gamma-BHC (Lindane)	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
gamma-Chlordane	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Heptachlor	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Heptachlor epoxide	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Methoxychlor	1.5	UDJ	1.5	1.5	UDJ	1.5	1.5	UDJ	1.5
Toxaphene	15	UDJ	15	15	UDJ	15	15	UDJ	15
Semivolatile Organic Analytes									
1,2,4-Trichlorobenzene	370	UJ	370	380	UJ	380	380	UJ	380
1,2-Dichlorobenzene	370	UJ	370	380	UJ	380	380	UJ	380
1,3-Dichlorobenzene	370	UJ	370	380	UJ	380	380	UJ	380
1,4-Dichlorobenzene	370	UJ	370	380	UJ	380	380	UJ	380
2,4,5-Trichlorophenol	930	UJ	930	940	UJ	940	960	UJ	960
2,4,6-Trichlorophenol	370	UJ	370	380	UJ	380	380	UJ	380
2,4-Dichlorophenol	370	UJ	370	380	UJ	380	380	UJ	380
2,4-Dimethylphenol	370	UJ	370	380	UJ	380	380	UJ	380
2,4-Dinitrophenol	930	UJ	930	940	UJ	940	960	UJ	960
2,4-Dinitrotoluene	370	UJ	370	380	UJ	380	380	UJ	380
2,6-Dinitrotoluene	370	UJ	370	380	UJ	380	380	UJ	380
2-Chloronaphthalene	370	UJ	370	380	UJ	380	380	UJ	380
2-Chlorophenol	370	UJ	370	380	UJ	380	380	UJ	380
2-Methylnaphthalene	370	UJ	370	380	UJ	380	380	UJ	380
2-Methylphenol (cresol, o-)	370	UJ	370	380	UJ	380	380	UJ	380
2-Nitroaniline	930	UJ	930	940	UJ	940	960	UJ	960
2-Nitrophenol	370	UJ	370	380	UJ	380	380	UJ	380
3+4 Methylphenol (cresol, m+p)	370	UJ	370	380	UJ	380	380	UJ	380
3,3'-Dichlorobenzidine	370	UJ	370	380	UJ	380	380	UJ	380

Table B-1. 1607-B1 Confirmatory Sampling Results. (7 Pages)

Constituent	J14JD4 Tank contents Sample Date 5/21/07			J14JD5 Under inlet pipe Sample Date 5/21/07			J14JD6 Duplicate of J14JD5 Sample Date 5/21/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (cont.)									
3-Nitroaniline	930	UJ	930	940	UJ	940	960	UJ	960
4,6-Dinitro-2-methylphenol	930	UJ	930	940	UJ	940	960	UJ	960
4-Bromophenylphenyl ether	370	UJ	370	380	UJ	380	380	UJ	380
4-Chloro-3-methylphenol	370	UJ	370	380	UJ	380	380	UJ	380
4-Chloroaniline	370	UJ	370	380	UJ	380	380	UJ	380
4-Chlorophenylphenyl ether	370	UJ	370	380	UJ	380	380	UJ	380
4-Nitroaniline	930	UJ	930	940	UJ	940	960	UJ	960
4-Nitrophenol	930	UJ	930	940	UJ	940	960	UJ	960
Acenaphthene	370	UJ	370	380	UJ	380	380	UJ	380
Acenaphthylene	370	UJ	370	380	UJ	380	380	UJ	380
Anthracene	370	UJ	370	380	UJ	380	380	UJ	380
Benzo(a)anthracene	370	UJ	370	380	UJ	380	380	UJ	380
Benzo(a)pyrene	370	UJ	370	380	UJ	380	380	UJ	380
Benzo(b)fluoranthene	370	UJ	370	380	UJ	380	380	UJ	380
Benzo(ghi)perylene	370	UJ	370	380	UJ	380	380	UJ	380
Benzo(k)fluoranthene	370	UJ	370	380	UJ	380	380	UJ	380
Bis(2-chloro-1-methylethyl)ether	370	UJ	370	380	UJ	380	380	UJ	380
Bis(2-Chloroethoxy)methane	370	UJ	370	380	UJ	380	380	UJ	380
Bis(2-chloroethyl) ether	370	UJ	370	380	UJ	380	380	UJ	380
Bis(2-ethylhexyl) phthalate	660	UJ	660	77	J	380	660	UJ	660
Butylbenzylphthalate	370	UJ	370	380	UJ	380	380	UJ	380
Carbazole	370	UJ	370	380	UJ	380	380	UJ	380
Chrysene	370	UJ	370	380	UJ	380	380	UJ	380
Di-n-butylphthalate	660	UJ	660	26	J	380	660	UJ	660
Di-n-octylphthalate	370	UJ	370	380	UJ	380	380	UJ	380
Dibenz[a,h]anthracene	370	UJ	370	380	UJ	380	380	UJ	380
Dibenzofuran	370	UJ	370	380	UJ	380	380	UJ	380
Diethylphthalate	370	UJ	370	380	UJ	380	380	UJ	380
Dimethyl phthalate	370	UJ	370	380	UJ	380	380	UJ	380
Fluoranthene	370	UJ	370	380	UJ	380	380	UJ	380
Fluorene	370	UJ	370	380	UJ	380	380	UJ	380
Hexachlorobenzene	370	UJ	370	380	UJ	380	380	UJ	380
Hexachlorobutadiene	370	UJ	370	380	UJ	380	380	UJ	380
Hexachlorocyclopentadiene	370	UJ	370	380	UJ	380	380	UJ	380
Hexachloroethane	370	UJ	370	380	UJ	380	380	UJ	380
Indeno(1,2,3-cd)pyrene	370	UJ	370	380	UJ	380	380	UJ	380
Isophorone	370	UJ	370	380	UJ	380	380	UJ	380
N-Nitroso-di-n-dipropylamine	370	UJ	370	380	UJ	380	380	UJ	380
N-Nitrosodiphenylamine	370	UJ	370	380	UJ	380	380	UJ	380
Naphthalene	370	UJ	370	380	UJ	380	380	UJ	380
Nitrobenzene	370	UJ	370	380	UJ	380	380	UJ	380
Pentachlorophenol	930	UJ	930	940	UJ	940	960	UJ	960
Phenanthrene	370	UJ	370	380	UJ	380	380	UJ	380
Phenol	370	UJ	370	380	UJ	380	380	UJ	380
Pyrene	21	J	370	380	UJ	380	380	UJ	380

Table B-1. 1607-B1 Confirmatory Sampling Results. (7 Pages)

Constituent	J14JD7 Under tank Sample Date 5/21/07			J14JD8 Drain field soil Sample Date 5/21/07			J14JD9 Equipment blank Sample Date 5/21/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls									
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	6.4	J	14	11	J	14			
Pesticides									
Aldrin	1.4	UDJ	1.4	1.4	UDJ	1.4			
Alpha-BHC	0.52	JDI	1.4	1.4	UD	1.4			
alpha-Chlordane	1.4	UDJ	1.4	1.4	UDJ	1.4			
beta-1,2,3,4,5,6-Hexachlorocyclohexane	1.4	UDJ	1.4	1.4	UDJ	1.4			
Delta-BHC	1.4	UD	1.4	1.4	UD	1.4			
Dichlorodiphenyldichloroethane (DDD)	1.4	UDJ	1.4	1.0	JDI	1.4			
Dichlorodiphenyldichloroethylene (DDE)	1.4	UD	1.4	1.4	UD	1.4			
Dichlorodiphenyltrichloroethane (DDT)	21	DJ	1.4	1.4	UDJ	1.4			
Dieldrin	1.4	UDJ	1.4	1.4	UDJ	1.4			
Endosulfan I	1.4	UD	1.4	1.4	UD	1.4			
Endosulfan II	1.4	UDJ	1.4	1.4	UDJ	1.4			
Endosulfan sulfate	1.4	UDJ	1.4	1.4	UDJ	1.4			
Endrin	1.4	UDJ	1.4	1.4	UDJ	1.4			
Endrin aldehyde	1.4	UDJ	1.4	1.4	UDJ	1.4			
Endrin ketone	1.4	UDJ	1.4	1.4	UDJ	1.4			
Gamma-BHC (Lindane)	1.4	UD	1.4	1.4	UD	1.4			
gamma-Chlordane	1.4	UDJ	1.4	1.4	UDJ	1.4			
Heptachlor	1.4	UDJ	1.4	1.4	UDJ	1.4			
Heptachlor epoxide	1.4	UDJ	1.4	1.4	UDJ	1.4			
Methoxychlor	1.4	UDJ	1.4	1.4	UDJ	1.4			
Toxaphene	14	UDJ	14	14	UDJ	14			
Semivolatile Organic Analytes									
1,2,4-Trichlorobenzene	350	UJ	350	350	UJ	350	330	UJ	330
1,2-Dichlorobenzene	350	UJ	350	350	UJ	350	330	UJ	330
1,3-Dichlorobenzene	350	UJ	350	350	UJ	350	330	UJ	330
1,4-Dichlorobenzene	350	UJ	350	350	UJ	350	330	UJ	330
2,4,5-Trichlorophenol	870	UJ	870	870	UJ	870	830	UJ	830
2,4,6-Trichlorophenol	350	UJ	350	350	UJ	350	330	UJ	330
2,4-Dichlorophenol	350	UJ	350	350	UJ	350	330	UJ	330
2,4-Dimethylphenol	350	UJ	350	350	UJ	350	330	UJ	330
2,4-Dinitrophenol	870	UJ	870	870	UJ	870	830	UJ	830
2,4-Dinitrotoluene	350	UJ	350	350	UJ	350	330	UJ	330
2,6-Dinitrotoluene	350	UJ	350	350	UJ	350	330	UJ	330
2-Chloronaphthalene	350	UJ	350	350	UJ	350	330	UJ	330
2-Chlorophenol	350	UJ	350	350	UJ	350	330	UJ	330
2-Methylnaphthalene	350	UJ	350	350	UJ	350	330	UJ	330
2-Methylphenol (cresol, o-)	350	UJ	350	350	UJ	350	330	UJ	330
2-Nitroaniline	870	UJ	870	870	UJ	870	830	UJ	830
2-Nitrophenol	350	UJ	350	350	UJ	350	330	UJ	330
3+4 Methylphenol (cresol, m+p)	350	UJ	350	350	UJ	350	330	UJ	330
3,3'-Dichlorobenzidine	350	UJ	350	350	UJ	350	330	UJ	330

Table B-1. 1607-B1 Confirmatory Sampling Results. (7 Pages)

Constituent	J14JD7 Under tank Sample Date 5/21/07			J14JD8 Drain field soil Sample Date 5/21/07			J14JD9 Equipment blank Sample Date 5/21/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (cont.)									
3-Nitroaniline	870	UJ	870	870	UJ	870	830	UJ	830
4,6-Dinitro-2-methylphenol	870	UJ	870	870	UJ	870	830	UJ	830
4-Bromophenylphenyl ether	350	UJ	350	350	UJ	350	330	UJ	330
4-Chloro-3-methylphenol	350	UJ	350	350	UJ	350	330	UJ	330
4-Chloroaniline	350	UJ	350	350	UJ	350	330	UJ	330
4-Chlorophenylphenyl ether	350	UJ	350	350	UJ	350	330	UJ	330
4-Nitroaniline	870	UJ	870	870	UJ	870	830	UJ	830
4-Nitrophenol	870	UJ	870	870	UJ	870	830	UJ	830
Acenaphthene	350	UJ	350	350	UJ	350	330	UJ	330
Acenaphthylene	350	UJ	350	350	UJ	350	330	UJ	330
Anthracene	350	UJ	350	350	UJ	350	330	UJ	330
Benzo(a)anthracene	350	UJ	350	350	UJ	350	330	UJ	330
Benzo(a)pyrene	350	UJ	350	350	UJ	350	330	UJ	330
Benzo(b)fluoranthene	350	UJ	350	350	UJ	350	330	UJ	330
Benzo(ghi)perylene	350	UJ	350	350	UJ	350	330	UJ	330
Benzo(k)fluoranthene	350	UJ	350	350	UJ	350	330	UJ	330
Bis(2-chloro-1-methylethyl)ether	350	UJ	350	350	UJ	350	330	UJ	330
Bis(2-Chloroethoxy)methane	350	UJ	350	350	UJ	350	330	UJ	330
Bis(2-chloroethyl) ether	350	UJ	350	350	UJ	350	330	UJ	330
Bis(2-ethylhexyl) phthalate	98	J	350	66	J	350	660	UJ	660
Butylbenzylphthalate	350	UJ	350	350	UJ	350	330	UJ	330
Carbazole	350	UJ	350	350	UJ	350	330	UJ	330
Chrysene	350	UJ	350	350	UJ	350	330	UJ	330
Di-n-butylphthalate	23	J	350	20	J	350	660	UJ	660
Di-n-octylphthalate	350	UJ	350	350	UJ	350	330	UJ	330
Dibenz[a,h]anthracene	350	UJ	350	350	UJ	350	330	UJ	330
Dibenzofuran	350	UJ	350	350	UJ	350	330	UJ	330
Diethylphthalate	350	UJ	350	350	UJ	350	330	UJ	330
Dimethyl phthalate	350	UJ	350	350	UJ	350	330	UJ	330
Fluoranthene	350	UJ	350	350	UJ	350	330	UJ	330
Fluorene	350	UJ	350	350	UJ	350	330	UJ	330
Hexachlorobenzene	350	UJ	350	350	UJ	350	330	UJ	330
Hexachlorobutadiene	350	UJ	350	350	UJ	350	330	UJ	330
Hexachlorocyclopentadiene	350	UJ	350	350	UJ	350	330	UJ	330
Hexachloroethane	350	UJ	350	350	UJ	350	330	UJ	330
Indeno(1,2,3-cd)pyrene	350	UJ	350	350	UJ	350	330	UJ	330
Isophorone	350	UJ	350	350	UJ	350	330	UJ	330
N-Nitroso-di-n-dipropylamine	350	UJ	350	350	UJ	350	330	UJ	330
N-Nitrosodiphenylamine	350	UJ	350	350	UJ	350	330	UJ	330
Naphthalene	350	UJ	350	350	UJ	350	330	UJ	330
Nitrobenzene	350	UJ	350	350	UJ	350	330	UJ	330
Pentachlorophenol	870	UJ	870	870	UJ	870	830	UJ	830
Phenanthrene	350	UJ	350	350	UJ	350	330	UJ	330
Phenol	350	UJ	350	350	UJ	350	330	UJ	330
Pyrene	350	UJ	350	350	UJ	350	330	UJ	330

APPENDIX C

HAZARD QUOTIENT AND CARCINOGENIC RISK CALCULATIONS

APPENDIX C

HAZARD QUOTIENT AND CARCINOGENIC RISK CALCULATIONS

The following calculation is provided in this appendix:

1607-B1 Hazard Quotient and Carcinogenic Risk Calculations, 0100B-CA-V0305, Rev. 0, Washington Closure Hanford, Richland, Washington.

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 in the administrative record.

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: Field Remediation Job No. 14655

Area: 100-B/C

Discipline: Environmental *Calculation No: 0100B-CA-V0305

Subject: 1607-B1 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 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 Calcs. = 3 Total = 4	K. A. Anselm	S. W. Clark	N/A	J. M. Capron	8/3/07

SUMMARY OF REVISION

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

Washington Closure Hanford CALCULATION SHEET

Originator:	K. A. Anselm	Date:	07/26/07	Calc. No.:	0100B-CA-V0305	Rev.:	0
Project:	100-B/C Field Remediation	Job No:	14655	Checked:	S. W. Clark	Date:	7/26/07
Subject:	1607-B1 Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk values for the 1607-B1 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (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 carcinogenic risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess carcinogenic 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, 1996, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*.

3) WCH, 2007, Waste Site Reclassification Form 2007-015, and Attachment *Remaining Sites Verification Package for the 1607-B1 Septic System*, Washington Closure Hanford, Richland, Washington.

SOLUTION:

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

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

METHODOLOGY:

Hazard quotient and carcinogenic risk calculations for the 1607-B1 waste site were performed using the results of sampling at this site, as summarized in Table 2 of WCH (2007). Of the contaminants of potential concern for this site, barium and zinc are included because they were detected at concentrations

Washington Closure Hanford CALCULATION SHEET

Originator:	K. A. Anselm	Date:	07/26/07	Calc. No.:	0100B-CA-V0305	Rev.:	0
Project:	100-B/C Field Remediation	Job No:	14655	Checked:	S. W. Clark	Date:	7/26/07
Subject:	1607-B1 Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	2 of 3

above their respective Washington State or Hanford Site background value. Boron and molybdenum require the HQ and carcinogenic risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Several semivolatile analytes, pesticides, hexavalent chromium, and aroclor-1260 (as shown in Table 1 below) are included because they were detected above their required detection limit/practical quantitation limit and cannot be attributed to natural occurrence. All other nonradionuclide contaminants of potential concern for this site were either not detected or were quantified below background levels and are not included. An example of the HQ and carcinogenic risk calculations in Table 1 is presented below:

1) For example, the maximum detected value for barium is 138 mg/kg, divided by the noncarcinogenic RAG value of 5,600 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 2.5×10^{-2}. 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 3.2×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess carcinogenic risk, the maximum detected value for each carcinogenic analyte is divided by the carcinogenic RAG value, then multiplied by 1×10^{-6}. For example, the maximum detected value for hexavalent chromium is 0.30 mg/kg, divided by 2.1 mg/kg, and multiplied as indicated is 1.4×10^{-7}. 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 is obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual values prior to rounding are used for this calculation.) The sum of the excess carcinogenic risk values is 1.8×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

Table 1 shows the results of the HQ and excess carcinogenic risk calculations for this site.

CONCLUSION:

These calculations demonstrate that the 1607-B1 waste site meets the requirements for hazard quotient and excess carcinogenic risk as identified in the remedial design report/remedial action work plan (DOE-RL 2005).

Washington Closure Hanford		CALCULATION SHEET					
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Table 1. Hazard Quotient and Excess Cancer Risk Results for the 1607-B1 Waste Site.

COPC	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Barium	138	5,600	2.5E-02	--	--
Boron	2.4	16,000	1.5E-04	--	--
Chromium, hexavalent[c]	0.30	240	1.3E-03	2.1	1.4E-07
Molybdenum	0.57	400	1.4E-03	--	--
Zinc	93.9	24,000	3.9E-03	--	--
Semivolatiles					
Bis(2-ethylhexyl) phthalate	0.098	1,600	6.1E-05	71.4	1.4E-09
Di-n-butylphthalate	0.026	8,000	3.3E-06	--	--
Pyrene	0.021	2,400	8.8E-06	--	--
Pesticides					
Alpha-BHC	0.00052	--	--	0.159	3.3E-09
DDD, 4,4'-	0.0010	--	--	4.17	2.4E-10
DDT, 4,4'-	0.021	40	5.3E-04	2.94	7.1E-09
Polychlorinated Biphenyls					
Aroclor-1260	0.011	--	--	0.5	2.2E-08
Totals					
Cumulative Hazard Quotient:			**3.2E-02**		
Cumulative Excess Cancer Risk:					**1.8E-07**

[a] = From WCH (2007).

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

[c] = Value for the carcinogenic cleanup level calculated based on inhalation exposure pathway (WAC 173-340-750(3)) (1996).

-- = not applicable

COPC = contaminant of potential concern

RAG = remedial action goal