Date Submitted: 1/8/08 Originator: L. M. Dittmer Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-FR-1 Waste Site Code: 100-F-26:8 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2005-004

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 100-F-26:8 waste site consisted of the underground pipelines that conveyed sanitary waste water from the 1701-F Gatehouse, 1709-F Fire Station, and the 1720-F Administrative Office to the 1607-F1 septic tank. The site has been remediated and presently exists as an open excavation. Remediation and verification sampling 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, (2) remediating the site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification to Interim Closed Out.

Basis for reclassification:

In accordance with this evaluation, the verification sampling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the Remaining Sites ROD. The results of verification 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-F1 Septic Tank Waste Site and the 100-F-26:8 (1607-F1) Sanitary Sewer Pipelines Waste Site* (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	1/29/08 Date
N/A Ecology Project Manager (printed)	Signature	Date
R. A. Lobos EPA Project Manager (printed)	Signature	3/14/08 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-F1 SANITARY SEWER SYSTEM (124-F-1) AND THE 100-F-26:8 (1607-F1) SANITARY SEWER PIPELINES WASTE SITES

Attachment to Waste Site Reclassification Forms 2004-130 and 2005-004

January 2008

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-F1 SANITARY SEWER SYSTEM (124-F-1) AND THE 100-F-26:8 (1607-F1) SANITARY SEWER PIPELINES WASTE SITES

EXECUTIVE SUMMARY

This report discusses the reclassification of the 1607-F1 sanitary sewer system (124-F-1) and the 100-F-26:8 (1607-F1) sanitary sewer pipelines waste sites.

The 1607-F1 and 100-F-26:8 waste sites are located within the 100-FR-1 Operable Unit of the Hanford Site. The septic tank and associated pipeline serviced the 1701-F Gatehouse (security checkpoint), the 1709-F Fire Station, and the 1720-F Administrative Office and change room between 1944 and 1965. The septic tank was 6.5 m (21.33 ft) long and 2.64 m (8.67 ft) wide with a capacity of 16,561 liters (4,375 gallons). The sanitary sewer pipelines consisted of 200 m (660 ft) of 0.2 m (8-in.) vitrified clay pipe.

Confirmatory sampling was performed at the 1607-F1 septic tank waste site on October 7, 2004. Three sample locations were identified in the work instruction for this site. One sample was collected from soil under the septic tank. Two samples were collected from the septic drain field. No sample of tank contents was collected, as the inside of the tank was previously cleaned and backfilled. At the 1607-F1 septic tank site, contaminants in the drain field and in the soil beneath the septic tank were below the remedial action goals (RAGs).

Confirmatory sampling of the 100-F-26:8 waste site was conducted on January 5, 2005. Samples of the scale inside the pipe and the soil beneath the pipe were collected. A pipe matrix calculation was prepared using the analytical results of the pipe scale sample. An evaluation of the pipe matrix calculations showed that benzo(a)pyrene exceeded the direct exposure RAG. Concentrations of some polychlorinated biphenyl (PCB) congeners, pesticides, and semivolatile organic compounds (SVOCs) also exceeded the groundwater and river protection RAGs. These confirmatory sample results indicated that the 100-F-26:8 waste site required remedial action due to benzo(a)pyrene present at levels exceeding remedial action goals for direct exposure (Dittmer 2005).

The 1607-F1 septic tank waste site was initially considered for reclassification as a No Action site but an earlier agreement with the lead regulatory agency stated that samples from the pipelines associated with the septic tank (100-F-26:8) had to pass all the soil concentration RAGs for the tank to be considered clean. Because the 100-F-26:8 pipeline samples failed, the tank also required remediation (Feist 2005a, Feist 2005b). However, the septic drain field was clean and did not require remediation (Feist 2005b).

Remediation of the 1607-F1 and 100-F-26:8 waste sites was performed from January 8 to April 3, 2007. Remedial activities included removal of the septic tank and the associated piping. During remediation, a french drain associated with the pipeline excavation area on the west side of the former 1709-F facility was discovered. Although this french drain was independent of the 100-F-28:8 pipelines, it was removed along with the 100-F-26:8 pipelines. Overburden material and other soils presumed to contain no residual contamination above cleanup levels were stockpiled in several locations for post-remediation

verification sampling. Approximately 464 m^3 (607 yd^3) of piping, concrete material, and suspect contaminated adjacent soils were removed and disposed of to the Environmental Restoration Disposal Facility (ERDF).

A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 1607-F1 and 100-F-26:8 waste sites in accordance with the *Tri-Party Agreement Handbook Management Procedures* TPA-MP-14 (DOE-RL 2007) procedure.

Table ES-1. Summary of Remedial Action Goals for the 1607-F1 and 100-F-26:8 Waste Sites. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure Radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years.	Residual concentrations of radionuclide COC/COPCs were detected below statistical background levels.	Yes
Direct Exposure Nonradionuclides	Attain individual COC/COPCs RAGs.	All individual COC/COPCs 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 (3.9×10^{-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 (1.3×10^{-6}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river protection RAGs.	Residual concentrations of radionuclides were detected below statistical 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]		

Table ES-1. Summary of Remedial Action Goals for the 1607-F1 and 100-F-26:8 Waste Sites. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Residual concentrations of lead, selenium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, DDE, and total petroleum hydrocarbons are above the groundwater and river protection soil RAGs. However, RESRAD modeling predicts 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 2005a), these constituents are not predicted to migrate more than 2 m (6.6 ft) vertically in 1,000 years (based on the lowest soil-partitioning coefficient distribution [mercury] of 30 mL/g). The vadose zone underlying the remediation footprint is approximately 5 m (16 ft) thick.

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

Verification sampling for the 1607-F1 and 100-F-26:8 waste sites was performed in April and August 2007 (WCH 2007a, WCH 2007b, WCH 2007c) to collect data to determine if the RAGs had been met. The constituents that contributed to the exceedance of the cumulative hazard quotient requirement from confirmatory sampling were carried forward as contaminants of concern (COCs)/contaminants of potential concern (COPCs) for verification sampling. These included inductively coupled plasma (ICP) metals, hexavalent chromium, mercury, SVOCs, PCBs, and pesticides. Radionuclides were either not detected in any of the confirmatory samples or were detected below RAGs and therefore were eliminated as COC/COPCs for verification sampling in the excavated area and the below cleanup level (BCL) stockpile. As the road crossing portion of the waste site had not been previously characterized, gamma energy analysis, gross alpha, and gross beta analyses were requested for samples collected in this area of the waste site in addition to the site COC/COPCs.

In accordance with this evaluation, the verification sampling results support a reclassification of these sites 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). The results of verification 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.

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-F1 SANITARY SEWER SYSTEM (124-F-1) AND THE 100-F-26:8 (1607-F1) SANITARY SEWER PIPELINES WASTE SITES

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 1607-F1 sanitary sewer system and 100-F-26:8 sanitary sewer pipelines waste sites meet the objectives for interim closure 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 verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow-zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Site contamination did not extend into the deep-zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern (COCs) and contaminants of potential concern (COPCs). Screening levels were exceeded for antimony, boron, lead, manganese, mercury, selenium, vanadium, and total petroleum hydrocarbons (TPH). Exceedance of screening values does not necessarily indicate that a risk to ecological receptors exists. It is believed that the presence of these constituents does not pose a risk to ecological receptors because concentrations of antimony, manganese, mercury, and vanadium are below site background levels, lead and selenium 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). The TPH exceedance was due to a single sample result, which was also the only sample in which TPH was detected. A more complete quantitative ecological risk assessment will be presented in the baseline risk assessment for the river corridor portion of the Hanford Site and will be used to support the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 1607-F1 sanitary sewer system and 100-F-26:8 sanitary sewer pipelines waste sites are located within the 100-FR-1 Operable Unit of the Hanford Site approximately 730 m (2395 ft) south of the 105-F Reactor Building. The 1607-F1 septic tank serviced 1701-F Gatehouse (security checkpoint), the 1709-F Fire Station, and the 1720-F Administrative Office and change room for security patrol personnel between 1944 and 1965. The 100-F-26:8 pipelines conveyed sanitary waste water from the buildings to the 1607-F1 septic tank. Figure 1 shows the general configuration of the buildings, pipelines, septic tank, and drain field. Figure 2 shows the pre-excavation topography of this area.

Figure 1. 1607-F1 and 100-F-26:8 Waste Sites Location Map.

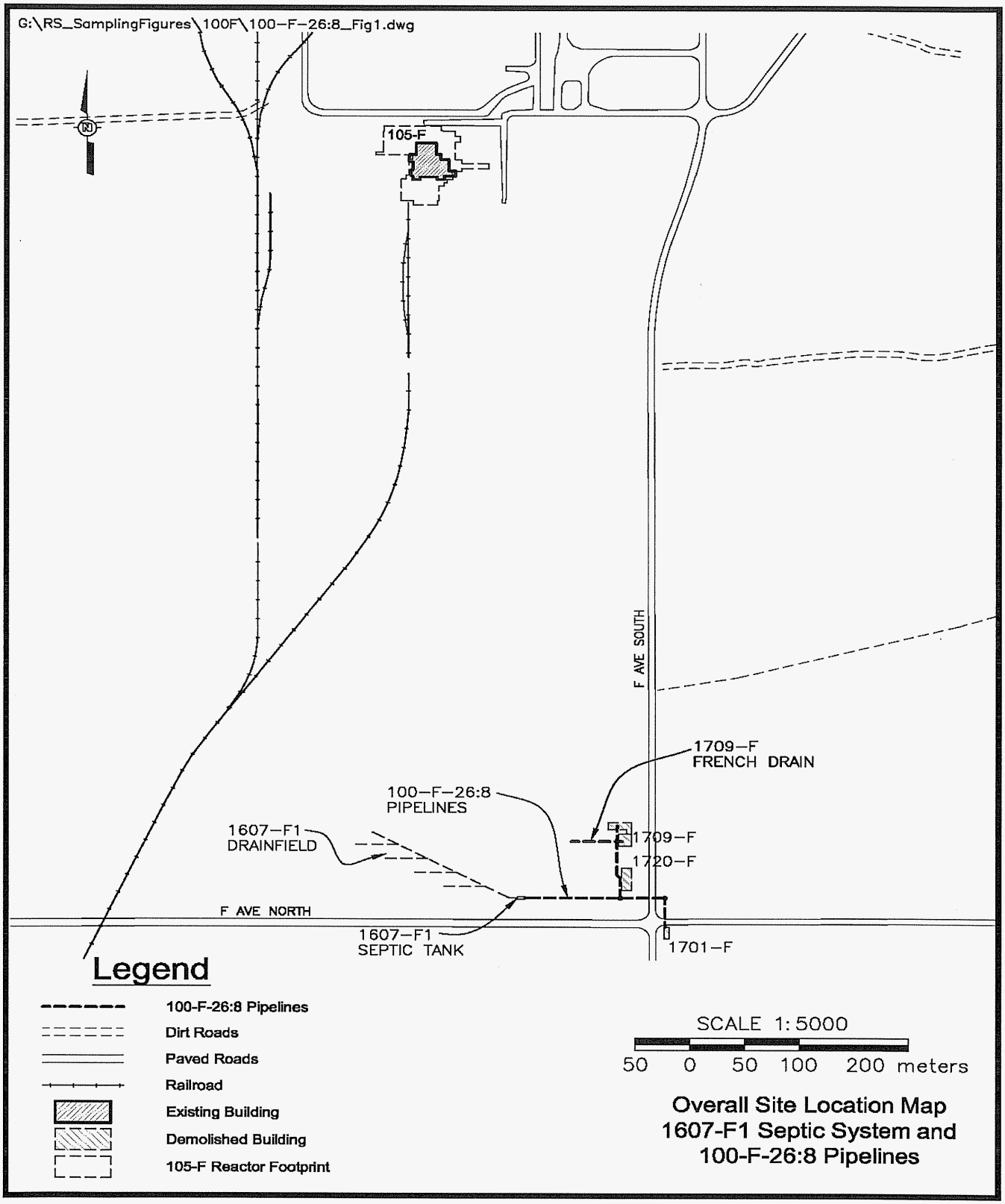
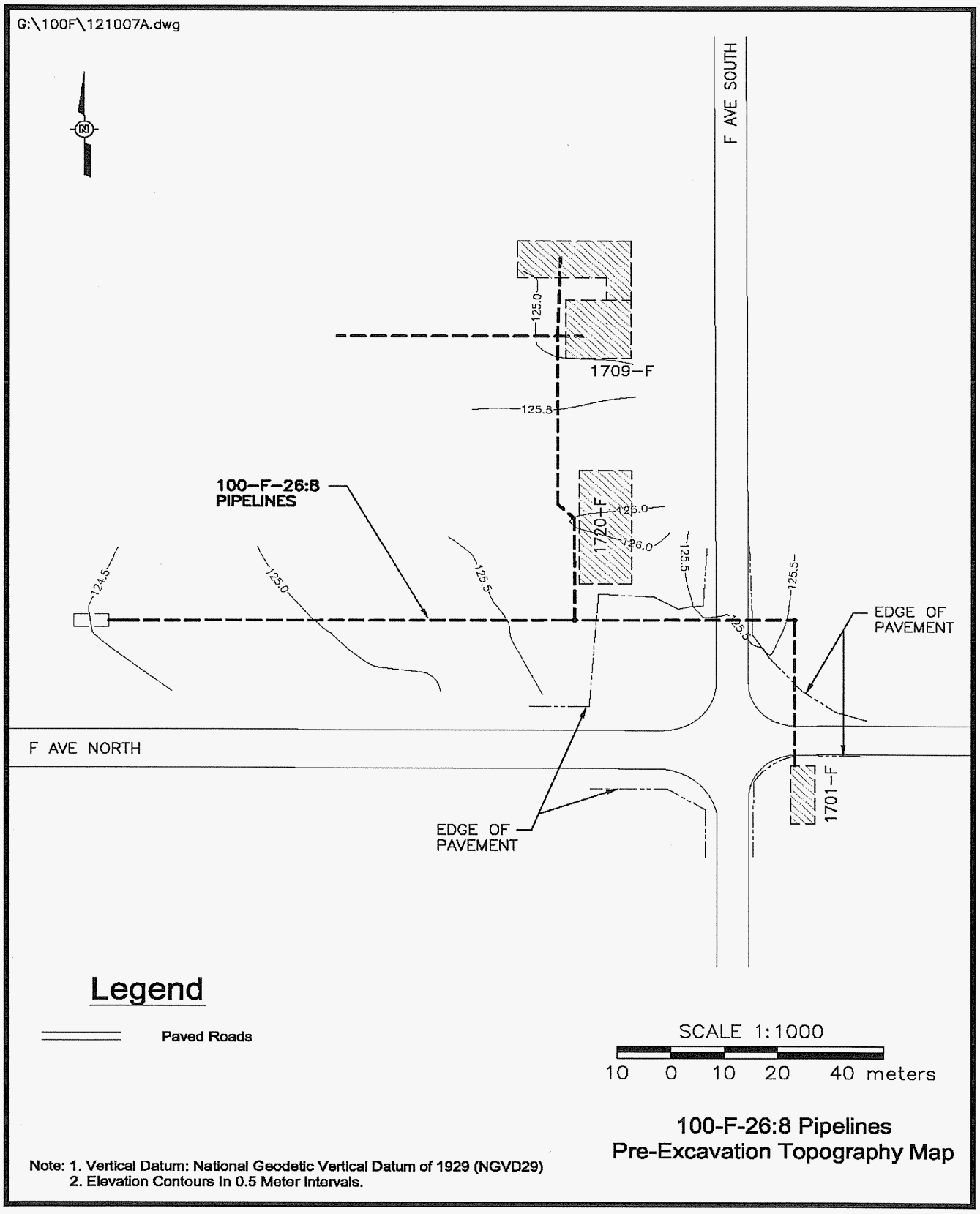


Figure 2. Pre-Excavation Topography of the 1607-F1 and 100-F-26:8 Waste Sites.



CONFIRMATORY SAMPLING ACTIVITIES

1607-F1: The 1607-F1 sanitary sewer system waste site was evaluated in October 2004 to determine if remedial action would be required. The septic tank, drain field, and the vitrified clay pipe (VCP) that carried the effluent were located and found to be intact. The septic tank had been previously decommissioned with access covers removed and the tank backfilled with soil. Because the tank was filled with soil, samples could not be taken from its interior. One sample was taken of soil from beneath the tank; one sample and one duplicate were taken of the material from inside the drain field tile; and a third sample was taken of the soil from beneath the drain field (Figure 3). Table 1a summarizes the samples taken and analyses performed for the 1607-F1 septic tank and drain field. Table 2 provides a comparison of the 1607-F1 confirmatory sampling results to the remedial action goals (RAGs).

100-F-26:8: The 100-F-26:8 sanitary sewer pipelines waste site was evaluated in January 2005 to determine if remedial action would be required. Sampling was performed at a junction of influent pipelines. One sample was taken of scale material inside the pipeline and one sample and one duplicate were taken of the soil beneath the pipeline (Figure 3). Table 1b summarizes the samples taken and analyses performed for the 100-F-26:8 waste site. Table 3 provides a comparison of the 100-F-26:8 waste site confirmatory sampling results to the RAGs.

Geophysical Investigation

A geophysical survey of the 1607-F1 sanitary sewer system waste site was performed in March 2004. This survey included the area to the west of the septic tank but did not include the area on the eastern side of the tank, where the influent pipelines were believed to be located. A geophysical survey of the 100-F-26:8 underground pipeline waste site was not performed because the septic tank and tile field had already been located at the approximate location depicted in historical drawings and literature. It was assumed that the associated pipelines would be located as shown in these historical records as well.

Contaminants of Potential Concern for Confirmatory Sampling

1607-F1: The COPCs for the 1607-F1 waste site were identified in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a) with additional COPCs added based on historical process information associated with the 1607-F1 waste site. The COPCs for this site were pesticides, polychlorinated biphenyls (PCBs), arsenic, barium, cadmium, total chromium, lead, selenium, silver, mercury, and semivolatile organic compounds (SVOCs).

Provisions were made in the work instruction (BHI 2004a) for the inclusion of additional COPCs based on observation during sampling. Field screening during sampling at 1607-F1 detected volatile organic compounds (VOCs) and, therefore, laboratory analysis was conducted for VOCs. Analyses for total petroleum hydrocarbons and polycyclic aromatic hydrocarbons were to be performed if stained soil was observed. Materials suspected of containing asbestos were not observed during field activities; therefore, asbestos was not added as a COPC.

Figure 3. Confirmatory Sampling Locations at the 1607-F1 and 100-F-26:8 Waste Sites.

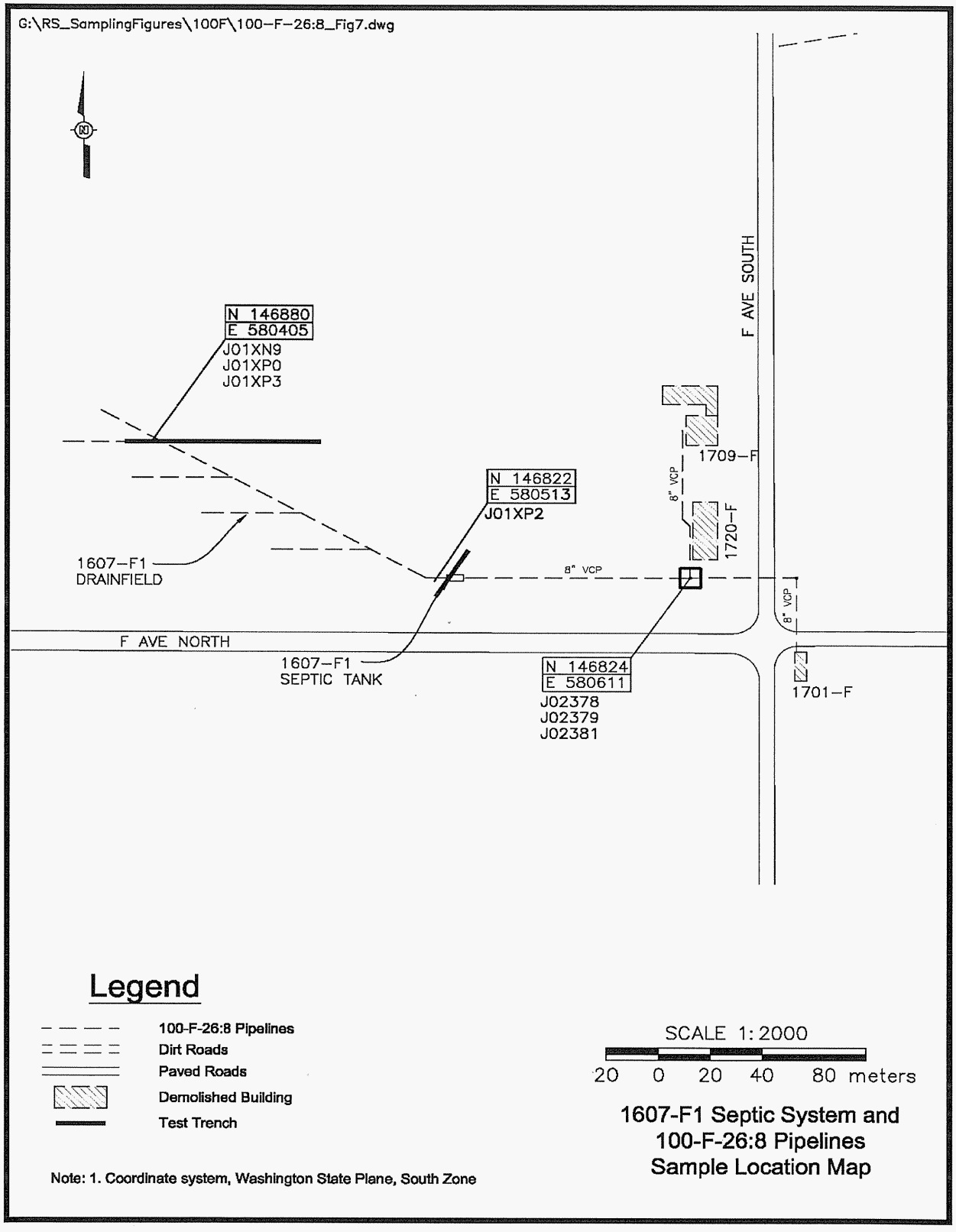


Table 1a. Confirmatory Sample Summary for the 1607-F1 Waste Site.

Sample Location	Sample Media	HEIS Number	Coordinate locations	Depth (bgs)	Sample Analysis
Septic tank (Area 1)	Soil under the septic tank	J01XP2	N 146822 E 580513	3.3 m (11 ft)	Pesticides, PCB, ICP metals, mercury, SVOA
Drain field (Area 2)	Septic drain field tile contents	J01XN9	N 146880 E 580405	1.1 m (3.6 ft)	Pesticides, PCB, ICP metals, mercury, SVOA
Drain field (Area 2)	Soil under VCP	J01XP3	N 146880 E 580405	1.2 m (3.9 ft)	Pesticides, PCB, ICP metals, mercury, SVOA, VOA
Equipment blank associated with J01XP2	Silica sand	J01XP1	N/A	N/A	Pesticides, PCB, ICP metals, mercury, SVOA
Duplicate of J01XN9	Septic drain field tile contents	J01XP0	N 146880 E 580405		Pesticides, PCB, ICP metals, mercury, SVOA

Source: Logbook EL-1578-3, pp. 7 and 41-42 (BHI 2003).

bgs = below ground surface
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
N/A = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
VOA = volatile organic analysis
VCP = vitrified clay pipe

Table 1b. Confirmatory Sample Summary for the 100-F-26:8 Waste Site.

Sample Location	Sample Media	HEIS Sample Number	Coordinate Locations	Depth (m bgs)	Sample Analyses
Test pit 1	Vitrified clay pipe scale	J02381	N146824 E580611	3.4 m (11 ft)	GEA, gross alpha, gross beta, ICP metals, mercury, PCB, pesticides, SVOC
	Soil	J02378		3.4 m (11 ft)	GEA, gross alpha, gross beta, ICP metals, mercury, PCB, pesticides, SVOC
Test pit 1 duplicate	Soil	J02379	N146824 E580611	3.4 m (11 ft)	GEA, gross alpha, gross beta, ICP metals, mercury, PCB, pesticides, SVOC
Equipment blank	Silica sand	J02380	N/A	N/A	ICP metals, mercury, PCB, pesticides, SVOC

Source: *Remaining Sites Field Sampling*, Logbook EL-1578-5, pp. 41 and 94-98 (BHI 2004c).

bgs = below ground surface
GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
N/A = not applicable
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound

Table 2. Comparison of Maximum Values to Action Levels at the1607-F1 Sanitary Sewer System Waste Site.

COPC	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum Result Exceed Lookup Values?	Does Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Groundwater Protection	River Protection		
Antimony	0.64 (<BG)	32	5	5	No	--
Arsenic	2 (<BG)	20	20	20	No	--
Barium	81.9 (<BG)	5,600	132	224	No	--
Beryllium	0.23(<BG)	10.4	1.51	1.51	No	--
Boron	1.4	16,000	320	--[b]	No	--
Cadmium[a]	0.25 (<BG)	13.9	0.81	0.81	No	--
Chromium	10.4 (<BG)	120,000	18.5	18.5	No	--
Cobalt	4.8 (<BG)	1,600	32	--[b]	No	--
Copper	15.6 (<BG)	2,960	59.2	22	No	--
Lead	5.2 (<BG)	353	10.2	10.2	No	--
Manganese	224 (<BG)	11,200	512	512	No	--
Mercury	0.06 (<BG)	24	0.33	0.33	No	--
Molybdenum	0.58	400	8	--[b]	No	--
Nickel	8.4 (<BG	1,600	19.1	27.4	No	--
Silver	0.40 (<BG)	400	8	0.73	No	--
Vanadium	59.4 (<BG)	560	85.1	--[b]	No	--
Zinc	116	24,000	480	67.8	Yes	Yes[c]
Bis(2-ethylhexyl) phthalate	0.043	71.4	0.625	0.36	No	--
Diethylphthalate	0.036	64,000	1,280	4,600	No	--
Di-n-butylphthalate	0.030	8,000	160	540	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b) or calculated per WAC-173-340-720, 173-340-730, and 173-340-740, Method B, 1996, unless otherwise noted.

[b] 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]).

[c] Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a), residual concentrations of zinc are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years based on the soil-partitioning distribution coefficient for zinc of 30 mL/g. The vadose zone underlying the remediation footprint is approximately 10 m (32.8 ft) thick. Therefore, residual concentrations of zinc are predicted to be protective of groundwater and the Columbia River.

-- = not applicable
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose assessment model)
WAC = *Washington Administrative Code*

100-F-26:8: The 100-F-26:8 waste site COPCs included inductively coupled plasma (ICP) metals, hexavalent chromium, pesticides, PCBs, and SVOCs (BHI 2004b). In addition, the samples were analyzed for gamma energy analysis (GEA), gross alpha, and gross beta to determine any need for further radiological analysis of the samples.

Confirmatory Sample Design

Historical data, process knowledge, geophysical survey results, site visit observations, and other available information were used to develop site-specific sample designs for the 1607-F1 and 100-F-26:8 waste sites (BHI 2004a, 2004b). This information was also used to identify boundaries of the 1607-F1 waste site and assist in identifying areas for excavation to locate the 1607-F1 septic tank and drain field for confirmatory sampling. A historic Hanford Site design drawing (GE 1965) showing the 1607-F1 septic tank and associated sanitary sewer lines was the basis for the sample design of the tank and pipelines. The sample design included focused samples at potential worst case locations: a junction of influent pipelines, underneath influent pipelines, inside the septic tank, inside the drain field tile, and underneath the drain field tiles (Figure 3).

1607-F1: A focused sampling approach was used for confirmatory sampling of the 1607-F1 septic system based on historical information and results of geophysical surveys (BHI 2004a). The septic tank was the primary focus of this sampling design. However, the contents of the tank were not sampled because the tank was not accessible. Therefore, a sample of the soil beneath the septic tank was collected. One sample of the septic drain field tile contents as well as a soil sample from under the drain field pipe were also collected. A duplicate sample from the drain field tile contents was also collected. The sampling was conducted on October 7, 2004, and is documented in the field logbook (BHI 2003). The sample results were evaluated against the cleanup criteria as specified in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RWP)(DOE-RL 2005b) to support a no action or remedial action decision.

100-F-26:8: Confirmatory sampling of the 100-F-26:8 waste site was conducted on January 5, 2005. Samples were obtained as directed by the 100-F-26:8 work instruction (BHI 2004b). The historic Hanford Site design drawing (GE 1954) showing the sanitary sewage lines within the 100-F-26:8 underground pipeline waste site and historical as well as process knowledge of buildings serviced by the 100-F-26:8 underground pipeline waste site were both used to assist in the development of the sampling design and identify the probable worst-case locations for sampling (Figure 3).

During trenching and sampling activities, no significant debris or other potentially contaminated waste was observed. No field radiation readings above background were reported during sampling of the waste sites (BHI 2003).

Confirmatory Sampling Activities

1607-F1 Sample Area 1: Based on historical documentation of the site, geophysical mapping data, and a site visit, Area 1 was determined to be the probable location of the septic tank (BHI 2004a). The overburden was scraped to locate and uncover the septic tank. The maximum depth of the excavation was 3.79 m (12.42 ft) below ground surface and extended from Washington State Plane (WSP) coordinates N 146835, E 580526 to N 146816, E580513. The dimensions of the tank were 2.64 m by

6.5 m (8.67 ft by 21.33 ft). The inside of the tank was not accessible; therefore, a soil sample was collected by excavating to the west end of the tank. A soil sample (J01XP2) was taken from beneath the septic tank at approximately 3.3 m (10.82 ft) depth. The distance from the soil surface to the bottom of the tank was approximately 3.4 m (11 ft).

1607-F1 Sample Area 2: A test trench was excavated to the depth of native soil and inspected for the presence of the drain field. A test trench was excavated from WSP coordinates N 146880, E 580395 to N 146880, E 580469. The drain field was located at 1.1 m (3.6 ft) below ground surface. The trench was expanded to remove two sections of VCP pipe. Each section was 0.3 m (1 ft) butted together and extensive sediments were found inside and under the pipe. The sampler used discretion to collect 15 aliquots of soil directly below the drain field tile that were combined into 1 sample (J01XP3) for laboratory analysis. Volatile organic analysis was added to the list of laboratory analyses for this sample. A sample and duplicate (J01XN9 and J01XP0) were taken from drain field tile contents.

100-F-26:8: Confirmatory sampling of the 100-F-26:8 waste site was conducted on January 5, 2005. A test pit was excavated at the intersection where the sanitary line from the 1709-F and 1720-F Buildings joined with the 0.2 m (8-in.) vitrified clay pipe collection main running to the septic tank (Figure 3). During excavation of the test pit, the pipe was encountered at 3 m (10 ft) below ground surface. Samples of the scale inside the pipe (J02381) and the soil beneath the pipe (J02378) were collected. A duplicate soil sample (J02379) was also collected.

Confirmatory Sample Results

Confirmatory samples were analyzed using analytical methods approved by the U.S. Environmental Protection Agency (DOE-RL 2005a). The sample results were evaluated against the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b) to support a no action or remedial action decision. The confirmatory sample results are stored in the Environmental Restoration (ENRE) project-specific database prior to archival in the Hanford Environmental Information System (HEIS) and are included in Appendix A.

1607-F1: A comparison of the maximum detected COPC results from the 1607-F1 waste site and the site RAGs is presented in Table 2. Contaminants that were not detected above practical quantitation limits or minimum detectable activities are excluded.

The 1607-F1 confirmatory sampling results (Table 2) show that all samples were below the soil concentration RAGs, with the exception of zinc which exceeded the Columbia River protection RAG. Data were not collected on the vertical extent of residual contamination but RESidual RADioactivity (RESRAD) modeling predicts that compounds having a soil-partitioning coefficient (K_d) greater than 8 mL/g will not migrate through the 10 m (32.8 ft) thick vadose zone between the shallow zone and groundwater at this site (BHI 2005a). The K_d for zinc is 30 ml/g indicating that this result is protective of the Columbia River.

100-F-26:8: A comparison of the maximum detected COPC results from the 100-F-26:8 waste site and the RAGs is presented in Table 3. Contaminants that were not detected above practical quantitation limits or minimum detectable activities are excluded.

A sample of scale was taken from inside of the vitrified clay pipe (J02381) and of the soil beneath the pipe (J02378). A duplicate (J02379) soil sample and an equipment blank (J02380) were also collected. The soil sample results were below all RAG lookup values.

For certain metals, SVOCs, PCBs, and pesticides, the pipe scale sample failed lookup values for direct exposure, groundwater protection or river protection RAGs. The scale values were evaluated as part of the pipe matrix with the following results:

- Failed direct exposure RAGs: benzo(a)pyrene (0.38 mg/kg), chrysene (0.44 mg/kg)

- Failed groundwater protection RAGs: barium (788 mg/kg), lead (43.7 mg/kg), aroclor-1260 (0.050 mg/kg), benzo(a)pyrene (0.38 mg/kg), benzo(k)fluoranthene (0.38 mg/kg), chrysene (0.44 mg/kg), dichlorodiphenyl-trichloroethane (4,4'-DDT) (0.068 mg/kg)

- Failed river protection RAGs: barium (788 mg/kg), lead (43.7 mg/kg), zinc (265.5 mg/kg), aroclor-1260 (0.050 mg/kg), benzo(a)pyrene (0.38 mg/kg), benzo(k)fluoranthene (0.38 mg/kg), chrysene (0.44 mg/kg), dichlorodiphenyl-dichloroethane (4,4'-DDD) (0.017 mg/kg), dichlorodiphenyl-dichloroethylene (4,4'-DDE) (0.020 mg/kg), and 4,4'-DDT (0.068 mg/kg).

RESRAD modeling predicts that compounds having a K_d greater than 8 mL/g will not migrate through the 10 m (33 ft) thick vadose zone between the shallow zone and groundwater at this site (BHI 2005a). The COPCs that failed groundwater and river protection RAGs at the 100-F-26:8 waste site have K_d values of at least 25 mL/g and are not predicted to reach groundwater or the Columbia River within 1,000 years.

Table 3. Comparison of Maximum Values and Pipe Matrix Results to Action Levels for Confirmatory Sampling at the 100-F-26:8 Waste Site. (2 Pages)

COPC	Maximum Result (mg/kg)		Remedial Action Goals[a] (mg/kg)			Does the Maximum Result Exceed RAGs?		Matrix Results		Does the Maximum Soil and Pipe Result Pass RESRAD Modeling?
	Soil	Pipe Scale	Direct Exposure	Groundwater Protection	River Protection	Soil	Pipe Scale	Pipe Matrix Value[b]	Does the Matrix Value Exceed RAGs?	
Antimony	0.86 (<BG)	1.3 (<BG)	32	5	5	No	No	--	--	--
Arsenic	2.1 (<BG)	8.4 (<BG)	20	20	20	No	No	--	--	--
Barium	66.6 (<BG)	3,950	5,600	132	224	No	Yes	788	Yes	Yes
Beryllium	0.58 (<BG)	0.36 (<BG)	10.4	1.51	1.51	No	No	--	--	--
Boron	1.8	4.1	16,000	320	--[d]	No	No	--	--	--
Cadmium	0.14 (<BG)	0.82	13.9	0.81	0.81	No	Yes	0.16	No	--
Chromium, total	10.6 (<BG)	17.9 (<BG)	80,000	18.5	18.5	No	No	--	--	--
Cobalt	6.1 (<BG)	14.1 (<BG)	1,600	320	--[d]	No	No	--	--	--
Copper	13.1 (<BG)	43.1	2,960	59.2	22	No	Yes	8.6	No	--
Lead	4.6 (<BG)	219	353	10.2	10.2	No	Yes	43.7	Yes	Yes
Manganese	297 (<BG)	451 (<BG)	11,200	512	512	No	No	--	--	--
Mercury	U	1.06	24	0.33	0.33	--	Yes	0.21	No	--
Molybdenum	0.47	0.9	400	8	--[d]	No	No	--	--	--
Nickel	10.3 (<BG)	18 (<BG)	1,600	19.1	27.4	No	No	---	--	--
Selenium	0.66	U	400	5	1	No	No	--	--	--
Silver	U	5.0	400	8	0.73	--	Yes	1.0	Yes	Yes
Vanadium	43.8 (<BG)	44.4 (<BG)	560	85.1	--[d]	No	No	--	--	--
Zinc	36.6 (<BG)	1,330	24,000	480	67.8	No	Yes	265	Yes	Yes
Acenaphthene	U	0.081	4,800	96	129	No	No	--	--	--
Acenaphthylene[e]	U	0.13	4,800	96	129	No	No	--	--	--
alpha-Chlordane	U	0.078	0.769	0.0165	0.0165	No	Yes	0.016	No	--
Anthracene	U	0.68	24,000	240	1,920	No	No	--	--	--
Aroclor-1260	U	0.25	0.5	0.017	0.017	No	Yes	0.050	Yes	Yes
Benzo(a)anthracene	0.023	2.2	0.137	0. 015	0.015	No	Yes	0.44	Yes	Yes
Benzo(ghi)perylene[e]	U	0.96	2,400	48	192	No	No	--	--	--
Benzo(a)pyrene	0.02	1.9	0.137	0.015	0.015	No	Yes	0.38	Yes	No
Benzo(b)fluoranthene	U	1.7	0.137	0.015	0.015	No	Yes	0.34	Yes	Yes
Benzo(k)fluoranthene	U	1.9	0.137	0.015	0.015	No	Yes	0.38	Yes	Yes
Bis(2-ethylhexyl)phthalate	0.018	0.048	71.4	0.625	0.36	No	No	--	--	--

Table 3. Comparison of Maximum Values and Pipe Matrix Results to Action Levels for Confirmatory Sampling at the 100-F-26:8 Waste Site. (2 Pages)

COPC	Maximum Result (mg/kg)		Remedial Action Goals[a] (mg/kg)			Does the Maximum Result Exceed RAGs?		Matrix Results		Does the Maximum Soil and Pipe Result Pass RESRAD Modeling?
	Soil	Pipe Scale	Direct Exposure	Groundwater Protection	River Protection	Soil	Pipe Scale	Pipe Matrix Value[b]	Does the Matrix Value Exceed RAGs?	
Carbazole	U	0.47	50	0.437	--[d]	No	Yes	0.094	No	--
Chrysene	0.031	2.2	0.137	0.1	0.1	No	Yes	0.44	Yes	No[f]
Di-n-butylphthalate	0.062	0.082	8,000	160	540	No	No	--	--	--
Dibenz[a,h]anthracene	U	0.42	0.33	0.33	0.33	No	Yes	0.084	No	--
Dibenzofuran	U	0.062	160	3.20	--[d]	No	No	--	--	--
DDD, 4,4'-	U	0.087	4.17	0.0365	0.005	No	Yes	0.017	Yes	Yes
DDE, 4,4'-	U	0.10	2.94	0.0257	0.005	No	Yes	0.020	Yes	Yes
DDT, 4,4'-	U	0.34	2.94	0.0257	0.005	No	Yes	0.068	Yes	Yes
Fluoranthene	0.046	4.0	3,200	64	18	No	No	--	--	--
Fluorene	U	0.17	3,200	64	260	No	No	--	--	--
gamma-Chlordane	U	0.067	0.769	0.0165	0.0165	No	Yes	0.013	No	--
Indeno(1,2,3-cd)pyrene	U	1.0	1.37	0.33	0.33	No	Yes	0.20	No	--
Methoxychlor	U	0.13	400	4	1.67	No	No	--	--	--
Naphthalene	U	0.062	1,600	16	988	No	No	--	--	--
Phenanthrene[e]	0.038	2.4	24,000[d]	240	1,920	No	No	--	--	--
Pyrene	0.064	3.3	2,400	48	192	No	No	--	--	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b) or calculated per WAC-173-340-720, 173-340-730, and 173-340-740, Method B, 1996, unless otherwise noted.

[b] The pipe matrix value was based on Calculation No. 0100B-CA-V0209 (BHI 2005b). The pipe matrix reduction factor for a 20-cm (8-in.) vitrified clay pipe is 5.01. Pipe matrix value = maximum result of pipe ÷ reduction factor.

[c] RESRAD modeling predicts that compounds having a K_d greater than 8 mL/g will not migrate through the 10-m (33 ft) thick vadose zone between the shallow zone and groundwater at this site (BHI 2005a). The COPCs that failed groundwater and river protection RAGs at the 100-F-26:8 waste site have K_d values of at least 25 mL/g and are not predicted to reach groundwater or the Columbia River within 1,000 years.

[d] 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]).

[e] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: [Contaminant: acenaphthylene; surrogate: acenapthene]; [Contaminant: benzo(ghi)perylene; surrogate: pyrene]; [Contaminant: phenanthrene; surrogate: anthracene]

[f] The direct exposure RAG of 137 mg/kg for chrysene was used in original comparison (Feist 2005a). The direct exposure RAG of 0.137 mg/kg for chrysene from the RDR/RAWP (DOE-RL 2005b) is used for comparison in this document.

-- = not applicable
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
U = undetected
WAC = *Washington Administrative Code*

CONFIRMATORY SAMPLING SUMMARY

At the 1607-F1 sanitary sewer system site, confirmatory sampling results showed that contaminants were below the soil concentration RAGs and the site initially was considered for reclassification as a No Action site. However, a previous agreement with the lead regulatory agency stated that the pipelines associated with septic system had to pass all the soil concentration RAGs for the 1607-F1 septic tank to be considered clean. The 100-F-26:8 waste site failed due to a direct exposure exceedance for benzo(a)pyrene (Dittmer 2005). As a result, the 1607-F1 septic tank was also considered contaminated and was slated for remediation (Feist 2005a, Feist 2005b).

All contaminants in the 1607-F1 septic tank and drain field were below the RAGs for both direct exposure and, with the exception of zinc, for river protection. The RESRAD modeling for analogous sites (BHI 2005a) has shown that this COPC will not reach groundwater or the Columbia River within 1,000 years. Therefore, the septic drain field was not considered to be contaminated and did not require remediation (Feist 2005b).

REMEDIAL ACTION SUMMARY

Remedial action at the 1607-F1 septic tank and the 100-F-26:8 sanitary sewer pipelines waste sites was performed between January 8 and April 3, 2007. Both sites were excavated to approximately 3.4 m (11 ft) below grade resulting in a combined volume of approximately 464 m^3 (607 yd^3) of material stockpiled for disposal at the Environmental Restoration Disposal Facility (ERDF). Approximately 266 m (872 ft) of pipeline were removed during remediation. The pipeline was encased in concrete beneath the road crossings and along most of pipeline length, with the exception of the portion referred to as the 1709-F french drain (see below) and the lateral along the former sites of the 1709-F and 1720-F Buildings. There were no anomalies or stained soil discovered during remediation. The post-excavation topography is shown in Figure 4.

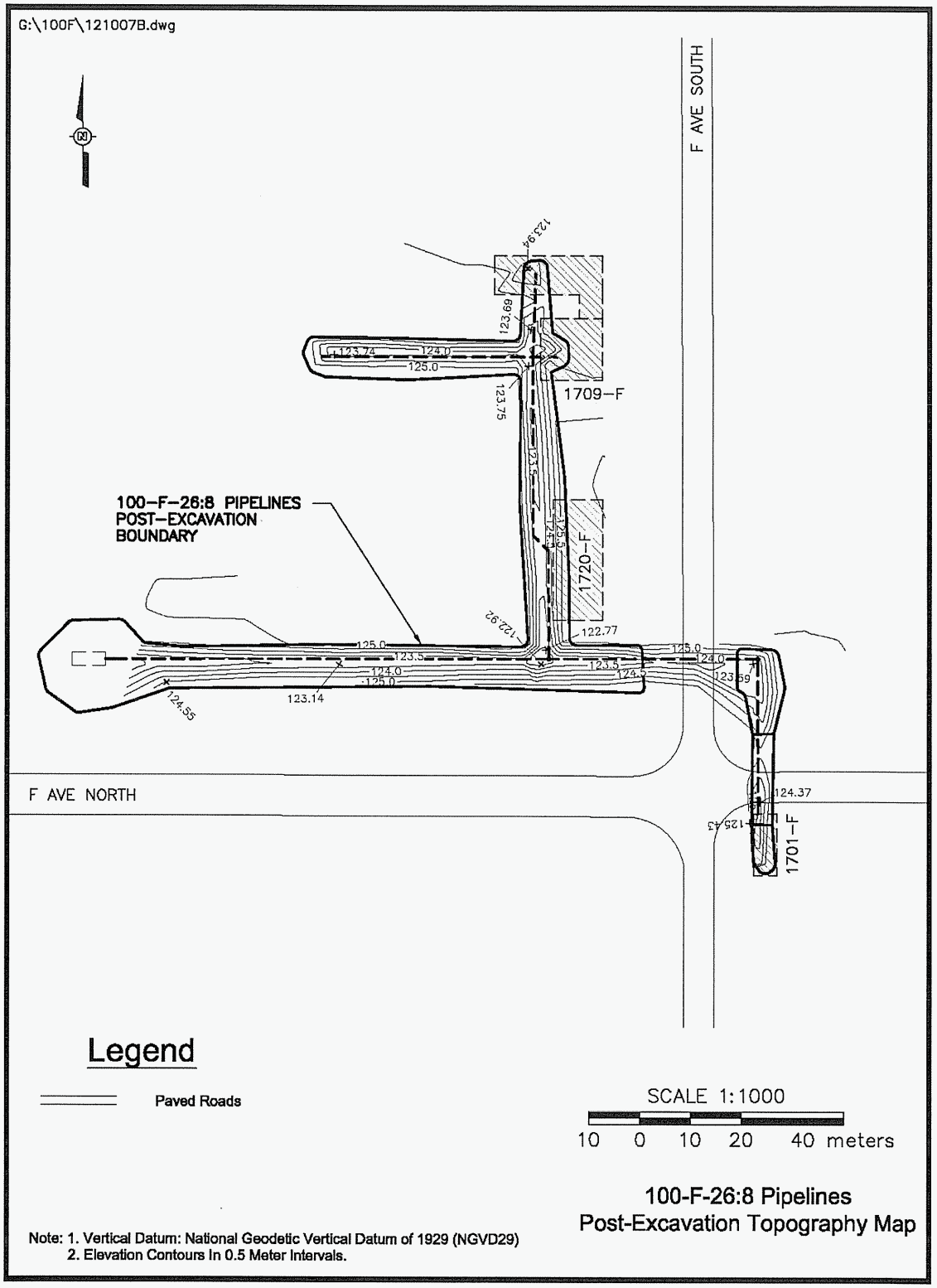
Pipeline Excavation Below Roadways

The 100-F-26:8 pipeline ran under major roadways in the 100-F Area at two locations. In order to accommodate site access, the locations were excavated, verification samples were collected, and the road crossings were backfilled as quickly as possible.

1709-F French Drain

A french drain was discovered during excavation of the 100-F-26:8 pipeline on the west side of the former 1709-F truck storage facility. The french drain was partially within the area of the 100-F-26:8 pipeline and was constructed of 10 cm (4-in.-) diameter vitrified clay pipe with 0.3 m (1 ft) sections joined end-to-end. The location of the pipe for the french drain is consistent with a historical drawing (GE 1965). The french drain was removed along with the 100-F-26:8 pipeline.

Figure 4. Post-Excavation Topography of the 1607-F1 and 100-F-26:8 Waste Sites.



Excavation Footprint

Figure 5 shows the extent of excavation for the 1607-F1 and 100-F-26:8 waste sites. The footprint of the excavation was used for developing the verification sampling design.

VERIFICATION SAMPLING ACTIVITIES

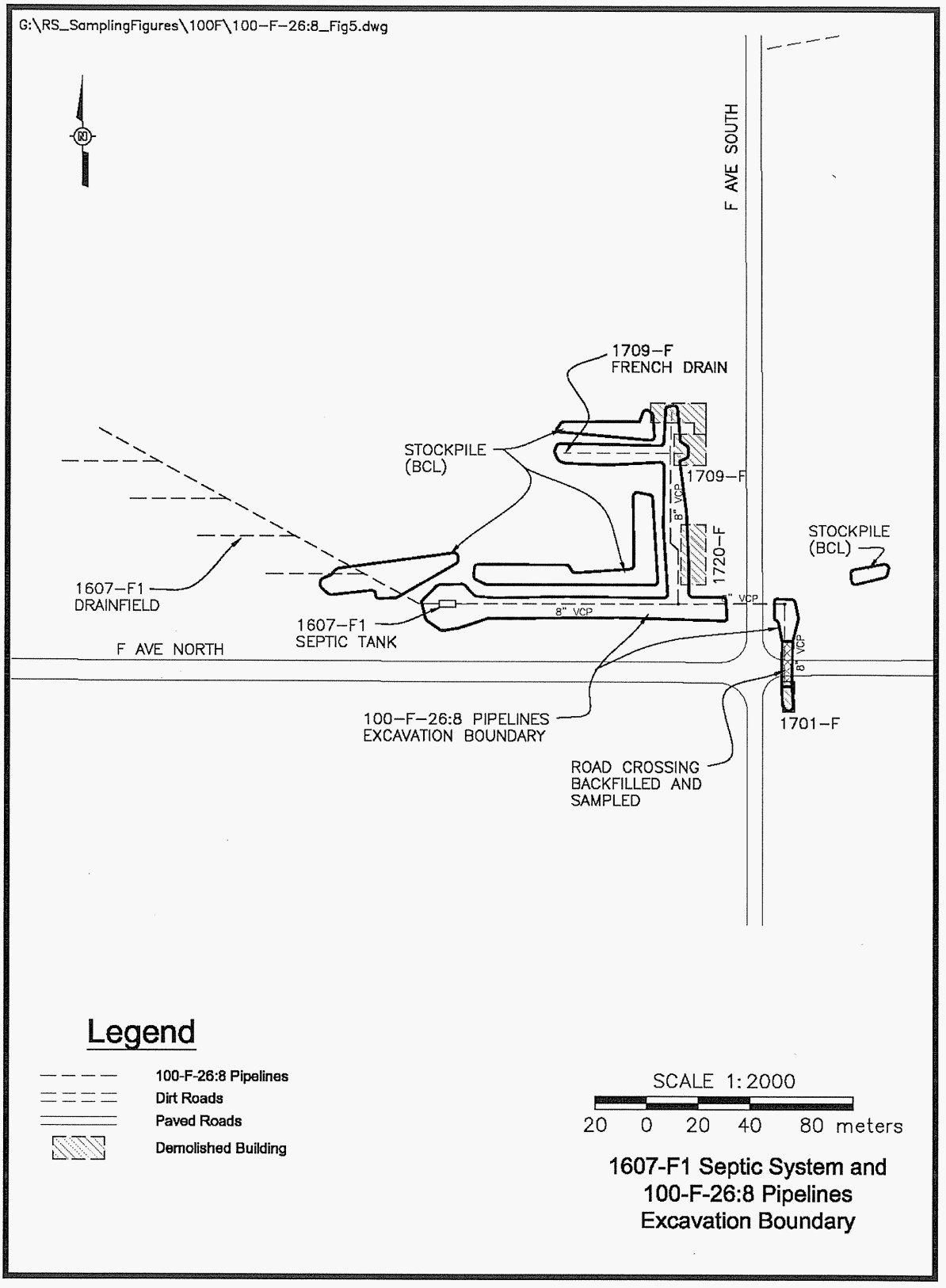
The RAGs are the specific numeric goals against which the cleanup verification data are evaluated to demonstrate attainment of the remedial action objectives for the site. A single verification sampling work instruction was prepared to cover sampling at both 1607-F1 septic tank and the 100-F-26:8 sanitary sewer pipeline waste sites (WCH 2007d). Verification sampling for the remediated 1607-F1 and the 100-F-26:8 waste sites was performed in September and October 2007 to collect data to determine if the RAGs had been met (WCH 2007a, WCH 2007b, and WCH 2007c). The following subsections provide additional discussion of the information used to develop the verification sampling design. The results of verification sampling are also summarized to support interim closure of the site.

Contaminants of Concern for Verification Sampling

The COCs/COPCs were established using the confirmatory sampling analytical results. Based on these results, the COC/COPCs for the 1607-F1 and 100-F-26:8 waste sites verification sampling design were ICP metals (barium, lead, and zinc), pesticides (dichlorodiphenyl-dichloroethane [DDD], dichlorodiphenyl-dichloroethylene [DDE], dichlorodiphenyl-trichloroethane [DDT]), SVOCs (benzo(a)pyrene, benzo(k)fluoranthene, and chrysene), and PCBs (aroclor-1260). Petroleum hydrocarbons and mercury were added as COCs/COPCs based on the discovery of the 1709-F french drain during remediation of the 100-F-26:8 pipelines. These additions were based on the assumption that the probable sources of effluent in the french drain were from hose drying and truck washing activities. Therefore, potential contaminants in the effluent were from motor oil leaks and broken mercury switches.

Asbestos-containing material was not observed during excavation and was not included as a COPC. An organic vapor monitor used to screen excavated soils did not detect VOCs during cleanup; therefore, VOCs were not included as COPCs.

Figure 5. 100-F-26:8 and 1607-F1 Waste Site Excavations, Road Crossings, and Stockpile Boundaries.



Sample Design Selection and Basis

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples to collect. The 100-F-26:8 waste site was divided into four decision units for the purpose of verification sampling. The first unit consists of the excavation shallow zone, the second unit consists of the french drain, and the third unit consists of the excavation shallow zone within the road crossing area and its associated overburden stockpile, and the fourth unit consists of the overburden stockpiles. Global positioning system survey instrumentation was used to delineate the boundaries of the pipeline excavation and the soil stockpiles as shown in Figure 5. A statistical sampling approach was used for evaluation of the 1607-F1 and 100-F-26:8 waste sites. A judgmental sampling design was used for the 1709-F french drain, pipeline road crossing, and overburden stockpiles. Details of the verification samples are summarized in Table 4, including the location and sample analyses performed. Specific verification sample locations are shown in Figure 6.

Verification Sample Design – Excavated Area, 1607-F1 and 100-F-26:8 Waste Sites

The decision rule for demonstrating compliance with the cleanup criteria requires comparison of the true population mean, as estimated by the 95% upper confidence limit on the sample mean, with the cleanup level. Therefore, a statistical sampling design is the preferred verification sampling approach for this site because the distribution of potential residual soil contamination over the site is uncertain. The Washington State Department of Ecology publication, *Guidance on Sampling and Data Analysis Methods* (Ecology 1995) recommends that systematic sampling with sample locations distributed over the entire study area be used. This sampling approach is referred to by the Washington State Department of Ecology as "area-wide sampling."

Statistical parameters (i.e., standard deviation within the population) for residual contaminant levels at the 1607-F1 and 100-F-26:8 waste sites were unknown, therefore, standard deviations of the residual contaminant populations were assumed to be less than 25% of the corresponding decision threshold for each population. This assumption was verified using the resulting verification sampling data and was considered in the data quality assessment for the data.

The sampling area was bounded at the base of the excavation by a distance of approximately 1 m (3.3 ft) on each side of the pipeline location as the soil directly below the pipe had the greatest potential for the presence of contamination. Visual Sample Plan[1] (VSP) was used to delineate the sampling area and apply a random-start systematic grid for verification soil sample collection. Ten verification soil samples were collected using the statistical sampling approach. Eight additional samples were taken using a focused approach as discussed in the following sections.

A triangular grid was selected for this investigation based on studies that indicate triangular grids are superior to square grids (Gilbert 1987). Additional details concerning the use of VSP to develop the statistical sampling design and derive the number of verification samples to collect are discussed in 1607-F1 and 100-F-26:8 waste sites verification sampling work instruction (WCH 2007d).

[1] Visual Sample Plan is a site map-based user-interface program that may be downloaded at http://dqo.pnl.gov.

Table 4. Verification Sample Summary for 1607-F1 and 100-F-26:8 Waste Sites. (2 Pages)

Location	Sample Number	Northing[a] (m)	Easting[a] (m)	Sample Analysis
Road Crossing	J14YW4	146802.1	580653.2	SVOA, PCBs, pesticides, ICP metals, mercury, hexavalent chromium, GEA, gross alpha, gross beta, strontium-90, isotopic plutonium and isotopic uranium.
Road Crossing Stockpile	J14YW5	N/A	N/A	SVOA, PCBs, pesticides, ICP metals, mercury, hexavalent chromium, GEA, gross alpha, gross beta, strontium-90, isotopic plutonium and isotopic uranium.
Road Crossing	J14YW6	146797.5	580653.2	SVOA, PCBs, pesticides, ICP metals, mercury, hexavalent chromium, GEA, gross alpha, gross beta, strontium-90, isotopic plutonium and isotopic uranium.
Duplicate	J14YW5	N/A	N/A	SVOA, PCBs, pesticides, ICP metals, mercury, hexavalent chromium, GEA, gross alpha, gross beta, strontium-90, isotopic plutonium and isotopic uranium.
Road Crossing	J15F90	146823.6	580633.1	SVOA, pesticides, ICP metals, TPH.
Road Crossing	J15F91	146823.6	580645.6	SVOA, pesticides, ICP metals, TPH.
Road Crossing	J15F92	146822.8	580641.6	SVOA, pesticides, ICP metals, TPH.
Road Crossing Stockpile	J15F93	N/A	N/A	SVOA, pesticides, ICP metals, TPH.
Excavation	J15F94	146823.5	580526.8	Pesticides, SVOAs, PCBs, ICP metals and mercury.
Excavation	J15F95	146823.0	580556.4	Pesticides, SVOAs, PCBs, ICP metals and mercury.
Excavation	J15F96	146824.2	580568.2	Pesticides, SVOAs, PCBs, ICP metals and mercury.
Excavation	J15F97	146822.5	580586.1	Pesticides, SVOAs, PCBs, ICP metals and mercury.
Excavation	J15F98	146823.6	580597.8	Pesticides, SVOAs, PCBs, ICP metals and mercury.
Excavation	J15F99	146823.6	580597.8	Pesticides, SVOAs, PCBs, ICP metals and mercury.
Excavation	J15FB0	146823.1	580627.4	Pesticides, SVOAs, PCBs, ICP metals and mercury.
Excavation	J15FB1	146811.8	580652.2	Pesticides, SVOAs, PCBs, ICP metals and mercury.
Excavation	J15FB2	146818.6	580651.6	Pesticides, SVOAs, PCBs, ICP metals and mercury.

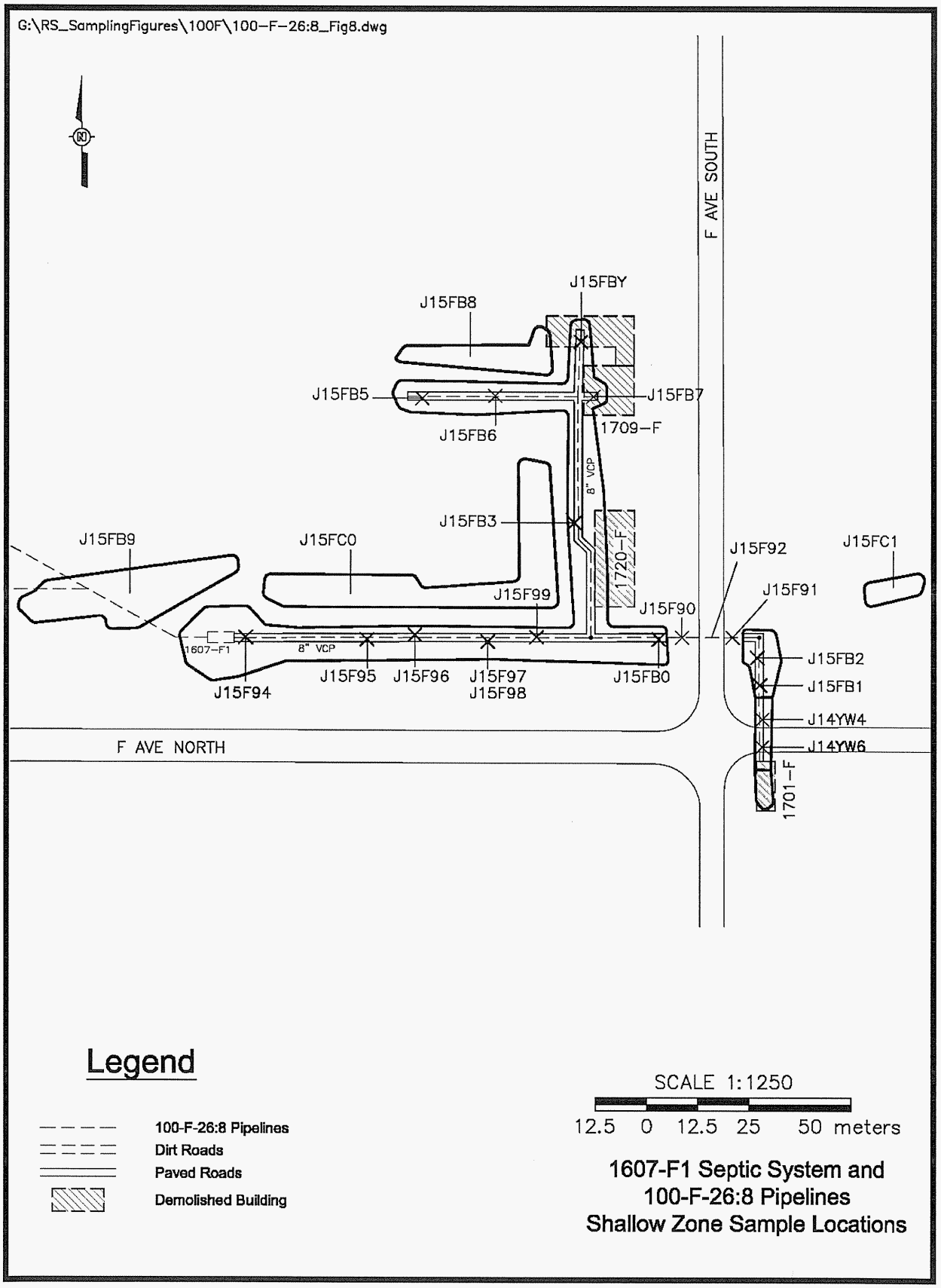
Table 4. Verification Sample Summary for 1607-F1 and 100-F-26:8 Waste Sites. (2 Pages)

Location	Sample Number	Northing[a] (m)	Easting[a] (m)	Sample Analysis
Excavation	J15FB3	146851.8	580606.9	Pesticides, SVOAs, PCBs, ICP metals and mercury.
Excavation	J15FB4	146896.4	580608.5	Pesticides, SVOAs, PCBs, ICP metals and mercury.
French Drain	J15FB5	146882.5	580570.0	TPH, pesticides, SVOAs, PCBs, ICP metals and mercury.
French Drain	J15FB6	146883.1	580587.8	TPH, pesticides, SVOAs, PCBs, ICP metals and mercury.
French Drain	J15FB7	146882.9	580611.5	TPH, pesticides, SVOAs, PCBs, ICP metals and mercury.
BCL-A	J15FB8	N/A		TPH, pesticides, SVOAs, PCBs, ICP metals and mercury.
BCL-B	J15FB9	N/A		Pesticides, SVOAs, PCBs, ICP metals and mercury.
BCL-C	J15FC0	N/A		Pesticides, SVOAs, PCBs, ICP metals and mercury.
BCL-D	J15FC1	N/A		Pesticides, SVOAs, PCBs, ICP metals and mercury.

[a] Washington State Plane (meters)

BCL = below cleanup leve
GEA = gamma energy analysis
ICP = inductively coupled plasma
N/A = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis

Figure 6. Verification Sampling Locations at the 1607-F1 and 100-F-26:8 Waste Sites.



Verification Sample Design – 1709-F French Drain

The french drain was 46 m (151 ft) long with gaps along most of its length where the pipes joined together end-to-end. The target population (i.e., strata) was defined as the soil directly below the pipeline, based on the presumption that this was where any residual contamination would most likely be found. Three soil samples were focused along the pipeline transect. Two of the samples were located near each end of the pipeline and the third was near the midpoint. The results of these soil samples were individually evaluated against the cleanup criteria.

Verification Sample Design – Pipeline Excavation Below Roadways

The 100-F-26:8 waste site pipeline ran beneath two sections of a major roadway in the 100-F Area (Figure 5). The 100-F-26:8 pipeline was removed from below F Avenue North prior to the development of the verification sampling design. Given that the road excavation needed to be reconstructed quickly, verification samples were collected from the F Avenue North road crossing on April 3, 2007 and the road was reconstructed prior to the development of the overall verification sampling design. Professional judgment was used to select two sample locations along the excavated pipeline transect. The target population (i.e., strata) was defined as the soil directly below the pipeline segment, based on the presumption that any contamination remaining in the soil after the remediation would most likely be present below the pipeline. Laboratory radiological screening analyses were also conducted on this set of roadway crossing samples, given that these were collected before the remediation was complete.

Three soil samples were focused at the second road crossing location on F Avenue South at approximately equidistant intervals along the excavated pipeline transect. These samples were obtained on August 27, 2007.

Verification sampling was also performed for each of the overburden stockpiles used to backfill the road crossings. Sampling of the overburden material consisted of collecting 25 aliquots of soil distributed across the surface of the pile and combining the aliquots into a single sample. The results of these soil samples were individually evaluated against the cleanup criteria.

Verification Sample Design – Overburden Stockpiles

The overburden stockpiles for the remedial excavation were identified as BCL-A, BCL-B, BCL-C and BCL-D. Sampling of the overburden stockpiles consisted of collecting 25 aliquots of soil distributed across the surface of each stockpile. The 25 aliquots were then combined into one sample for each stockpile and submitted for laboratory analysis. A total of four samples were collected and analyzed. The data was used to evaluate the suitability of the overburden soil for use as backfill.

Verification Sampling Results

Verification samples were analyzed using U.S. Environmental Protection Agency-approved analytical methods. The laboratory-reported data for all constituents are stored in the ENRE project-specific database, are archived in HEIS, and are presented in Appendix B.

As noted earlier, the 1607-F1 and 100-F-26:8 waste sites were divided into four decision units for verification sampling: 1) excavation footprint, 2) 1709-F french drain, 3) road crossing areas, and 4) overburden stock piles. Evaluation of the verification data from the excavation footprint was calculated using the 95% upper confidence limit on the true population mean for residual concentrations of COC/COPCs as specified by the RDR/RAWP (DOE-RL 2005b). These calculations are provided in Appendix B. When a nonradionuclide COC/COPCs was detected in fewer than 50% of the verification samples collected, the maximum detected value was used for comparison against the RAGs. If no detections for a given COC/COPCs were reported in the data set, then no statistical evaluation or calculations were performed for that COC/COPCs. Evaluations of the verification data from the french drain, road crossing, and stockpiles were performed by direct comparison of the sample results against cleanup criteria.

Comparisons of the statistical and maximum results for COC/COPCs with the shallow-zone RAGs for the excavation footprint, french drain, road crossings, and overburden stockpile areas are summarized in Tables 5a, 5b, 5c, and 5d, respectively. All four decision units are evaluated using the shallow-zone cleanup criteria. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the *Cleanup Levels and Risk Calculations Database* (Ecology 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 COCs. Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the site, but are not considered within statistical calculations or the following tables, as these isotopes are not related 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 5a. Comparison of Maximum or Statistical Contaminant Concentrations to Action Levels for the 1607-F1 Septic Tank and 100-F-26:8 Sanitary Sewer Pipelines Excavation Verification Sampling Event. (2 Pages)

COC/COPCs	Maximum or Statistical Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum or Statistical Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	1.1 (<BG)	32	5	5	No	--
Arsenic	2.2 (<BG)	20	20	20	No	--
Barium	62.6 (<BG)	5600	132	224	No	--
Beryllium	0.30 (<BG)	10.4	1.51	1.51	No	--
Boron	2.1	16,000	320	--[b]	No	--
Chromium (total)	12.0 (<BG)	80,000	18.5	18.5	No	--
Cobalt	5.6 (<BG)	1,600	32	--[b]	No	--
Copper	11.2 (<BG)	2,960	59.2	22.0	No	--
Lead	7.9 (<BG)	353	10.2	10.2	No	
Manganese	264 (<BG)	11,200	512	512	No	--
Mercury	0.16 (<BG)	24	0.33	0.33	No	--
Molybdenum	0.52	400	8	--[b]	No	--
Nickel	8.8 (<BG)	1,600	19.1	27.4	No	--
Selenium	1.4	400	5	1	Yes	Yes[c]
Silver	0.51 (<BG)	400	8	0.73	No	--
Vanadium	33.1 (<BG)	560	85.1	--[b]	No	--
Zinc	37.7 (<BG)	24,000	480	67.8	No	--
TPH	253	N/A	200[d]	200[d]	Yes	Yes[c]
Bis(2-ethylhexyl)phthalate	0.12	71.4	0.625	0.36	No	--
Dibenzo(a,h)anthracene	0.029	0.33	0.33	0.33	No	--
Fluoranthene	0.022	3,200	64	18.0	No	--
Phenanthrene[e]	0.018	24,000	240	1,920	No	--
Pyrene	0.029	2,400	48	192	No	--
BHC, beta	0.0006	0.556	0.00486	0.00554	No	--
alpha-Chlordane	0.0042	0.769	0.0165	0.0165	No	--
DDD, 4,4'-	0.0012	4.17	0.0365	0.005	No	--
DDE, 4,4'-	0.0110	2.94	0.0257	0.005	Yes	Yes[c]
DDT, 4,4'-	0.0030	2.94	0.0257	0.005	No	

Table 5a. Comparison of Maximum or Statistical Contaminant Concentrations to Action Levels for the 1607-F1 Septic Tank and 100-F-26:8 Sanitary Sewer Pipelines Excavation Verification Sampling Event. (2 Pages)

COC/COPCs	Maximum or Statistical Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum or Statistical Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
gamma-Chlordane	0.0025	0.769	0.0165	0.0165	No	--
Endosulfan I	0.00053	480	9.6	0.0112	No	--
Heptachlor epoxide	0.0006	0.11	0.002	0.002	No	--
Methoxychlor	0.0010	400	4	1.67	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b) or calculated per WAC-173-340-720, 173-340-730, and 173-340-740, Method B, 1996, unless otherwise noted.

[b] 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]).

[c] RESRAD modeling predicts that compounds having a K_d greater than 8 mL/g will not migrate through the 10-m (33 ft) thick vadose zone between the shallow zone and groundwater at this site (BHI 2005a). The COPCs that failed groundwater and river protection RAGs at the 100-F-26:8 waste site have K_d values of greater than 8 mL/g and are not predicted to reach groundwater or the Columbia River within 1,000 years.

[d] From WAC-173-340-740(2), Method B, 1996, Method A for soils.

[e] Toxicity data for this chemical is not available. Cleanup levels are based on surrogate chemicals: Contaminant: phenanthrene; surrogate: anthracene.

-- = not applicable
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose assessment model)
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Table 5b. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1709-F French Drain Verification Sampling Event.

COC/COPCs	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.6 (<BG)	20	20	20	No	--
Barium	85.2 (<BG)	5,600	132	224	No	--
Beryllium	0.46 (<BG)	10.4	1.51	1.51	No	--
Chromium (total)	9.6 (<BG)	80,000	18.5	18.5	No	--
Cobalt	7.3 (<BG)	1,600	32	--[b]	No	--
Copper	11.1 (<BG)	2,960	59.2	22.0	No	--
Lead	7.1 (<BG)	353	10.2	10.2	No	--
Manganese	364 (<BG)	11,200	512	512	No	--
Nickel	10.3 (<BG)	1,600	19.1	27.4	No	--
Vanadium	39.8 (<BG)	560	85.1	--[b]	No	--
Zinc	47.4 (<BG)	24,000	480	67.8	No	--
Bis(2-ethylhexyl)phthalate	0.063	71.4	0.625	0.36	No	--
Dibenzo(a,h)anthracene	0.022	0.33[c]	0.33[c]	0.33[c]	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP)(DOE-RL 2005b) or calculated per WAC-173-340-720, 173-340-730, and 173-340-740, Method B, 1996, unless otherwise noted.

[b] 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]).

[c] Where cleanup levels are less than RDLs, cleanup levels default to RDLs (WAC 173-340-707(2), 1996).

-- = not applicable
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose assessment model)
WAC = *Washington Administrative Code*

Table 5c. Comparison of Maximum Contaminant Concentrations to Action Levels for the 100-F-26:8 Sanitary Sewer Pipelines Road Crossing Verification Sampling Event.

COC/COPCs	Maximum Result (pCi/g)	Generic Site Lookup Values[a] (pCi/g)			Does the Maximum Result Exceed Lookup Values?	Does the Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Uranium-233/234	0.6 (<BG)	1.1[b]	1.1[b]	1.1[b]	No	--
Uranium-238	0.416 (<BG)	1.1[b]	1.1[b]	1.1[b]	No	--
COC/COPCs	**Maximum Result (mg/kg)**	**Remedial Action Goals[a] (mg/kg)**			**Does the Maximum Exceed RAGs?**	**Does the Result Pass RESRAD Modeling?**
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.9 (<BG)	20	20	20	No	--
Barium	48.2 (<BG)	5,600	132	224	No	--
Beryllium	0.28 (<BG)	10.4	1.51	1.51	No	--
Boron	1.6	16,000	320	--[c]	No	--
Chromium (total)	8.7 (<BG)	80,000	18.5	18.5	No	--
Chromium (hexavalent)	0.22	2.1	4.8[d]	2	No	--
Cobalt	5.6 (<BG)	1,600	32	--[f]	No	--
Copper	12.9 (<BG)	2,960	59.2	22.0	No	--
Lead	4.8 (<BG)	353	10.2	10.2	No	--
Manganese	272 (<BG)	11,200	512	512	No	--
Nickel	9.5 (<BG)	1,600	19.1	27.4	No	--
Vanadium	40.4 (<BG)	560	85.1	--[f]	No	--
Zinc	38.3 (<BG)	24,000	480	67.8	No	--
Bis(2-ethylhexyl)phthalate	0.084	71.4	0.625	0.36	No	-
Dibenzo(a,h)anthracene	0.021	0.33[e]	0.33[e]	0.33[e]	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP)(DOE-RL 2005b) or calculated per WAC-173-340-720, 173-340-730, and 173-340-740, Method B, 1996, unless otherwise noted.

[b] The calculated lookup value is below the Hanford-specific statistical soil background activity. The value presented is the Hanford-specific statistical soil background activity (DOE-RL 1996).

[c] No cleanup level is available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations 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]).

[d] 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).

[e] Where cleanup levels are less than RDLs, cleanup levels default to RDLs (WAC 173-340-707(2), 1996).

-- = not applicable
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 5d. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-F1 Septic Tank and 100-F-26:8 Overburden Stockpile Verification Sampling Event. (2 Pages)

COC/COPCs	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.1 (<BG)	20	20	20	No	--
Barium	76.2 (<BG)	5,600	132	224	No	--
Beryllium	0.45 (<BG)	10.4	1.51	1.51	No	--
Boron	1.3 (<BG)	16,000	320	--[b]	No	--
Chromium (total)	10.5 (<BG)	80,000	18.5	18.5	No	--
Cobalt	7.2 (<BG)	1,600	32	--[b]	No	--
Copper	11.4 (<BG)	2,960	59.2	22.0	No	--
Lead	11.5	353	10.2	10.2	Yes	Yes[c]
Manganese	332 (<BG)	11,200	512	512	No	--
Nickel	10.6 (<BG)	1,600	19.1	27.4	No	--
Vanadium	45.9 (<BG)	560	85.1	--[b]	No	--
Zinc	54 (<BG)	24,000	480	67.8	No	--
Benzo(a)anthracene	0.026	0.137	0.015	0.015	Yes	Yes[c]
Benzo(a)pyrene	0.038	0.137	0.015	0.015	Yes	Yes[c]
Benzo(b)fluoranthene	0.023	0.137	0.015	0.015	Yes	Yes[c]
Benzo(g,h,i)perylene[d]	0.023	2,400	48	192	No	--
Benzo(k)fluoranthene	0.030	0.137	0.015	0.015	Yes	Yes[c]
Bis(2-ethylhexyl)phthalate	0.062	71.4	0.625	0.36	No	--
Chrysene	0.037	0.137	0.1	0.1	No	--
Dibenz (a,h)anthracene	0.025	0.33	0.33	0.33	No	--
DDE, 4,4'-	0.0019	2.94	0.0257	0.005	No	--
DDT, 4,4'-	0.0014	2.94	0.0257	0.005	No	--
Fluoranthene	0.033	3,200	64	18.0	No	--
Indeno(1,2,3-cd) pyrene	0.019	1.37	0.33	0.33	No	--
Pyrene	0.057	2,400	48	192	No	--

Table 5d. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-F1 Septic Tank and 100-F-26:8 Overburden Stockpile Verification Sampling Event. (2 Pages)

COC/COPCs	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Methoxychlor	0.0018	400	4	1.67	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP)(DOE-RL 2005b) or calculated per WAC-173-340-720, 173-340-730, and 173-340-740, Method B, 1996, unless otherwise noted.

[b] No cleanup level is available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations 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]).

[c] RESRAD modeling predicts that compounds having a K_d greater than 8 mL/g will not migrate through the 10-m (33 ft) thick vadose zone between the shallow zone and groundwater at this site (BHI 2005a). The COPCs that failed groundwater and river protection RAGs at the 100-F-26:8 waste site have K_d values of greater than 8 mL/g and are not predicted to reach groundwater or the Columbia River within 1,000 years.

[d] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: Contaminant: benzo(g,h,i)perylene; surrogate: pyrene.

-- = not applicable
BCL = below cleanup level
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose assessment model)
WAC = *Washington Administrative Code*

VERIFICATION SAMPLE DATA EVALUATION

Evaluation of the verification sampling results in Tables 5a, 5b, 5c, and 5d show that all direct exposure cleanup levels are met for the four decision units of the 1607-F1 and 100-F-26:8 waste sites: the 1607-F1 septic tank and 100-F-26:8 pipelines excavation footprint, 1709-F french drain, road crossing areas, and overburden stockpiles.

In the excavation area of the 1607-F1 septic tank and 100-F-26:8 pipelines (Table 5a), groundwater and/or Columbia River protection RAGS were exceeded for selenium, TPHs, and 4,4'-DDE. Data were not collected on the vertical extent of residual contamination, but RESRAD modeling predicts that compounds having a soil-partitioning coefficient (K_d) greater than 8 mL/g will not migrate through the 10-m (32.8 ft)-thick vadose zone between the shallow zone and groundwater at this site (BHI 2005a). The K_d for each of these contaminants is greater than 8 ml/g.

In Table 5b, residual concentrations of all site COCs were below site background values or shallow zone clean-up values for the french drain excavation. Therefore, the remediation performed is protective of the groundwater and Columbia River.

In the overburden stockpiles (Table 5d), groundwater and/or Columbia River protection RAGS were exceeded for lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene. Each of these compounds has a K_d greater than 8 ml/g, and as discussed above, the contaminant is not expected to migrate through the vadose zone. Therefore, these results are protective of groundwater and the Columbia River.

All other COC/COPCs for the 1607-F1 and 100-F-26:8 waste sites were either not detected or quantified below RAGs.

Assessment of the risk requirements for the 1607-F1 and 100-F-26:8 waste sites is determined by calculation of the hazard quotient and carcinogenic (excess cancer) risk values for nonradionuclides (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 excess carcinogenic risk of less than 1×10^{-5}. These risk values were conservatively calculated for the combined waste sites using the highest values from each of the four decision units. 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 waste sites is 3.9×10^{-2}. All individual cumulative carcinogenic risk values are less than 1×10^{-6}. The cumulative carcinogenic risk value is 1.3×10^{-6}. 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. The application of the three-part test for the 1607-F1 and 100-F-26:8 remediation footprints of these waste sites is included in the statistical calculations (Appendix B). The three-part test is not applicable to the french drain, road crossing, or overburden stockpile results because direct evaluation of nonstatistical sampling results was used as the compliance basis. All residual COC/COPCs concentrations for the 1607-F1 and 100-F-26:8 waste site remediation footprint pass the three-part test.

DATA QUALITY ASSESSMENT

Confirmatory Sampling

A data quality assessment (DQA) review was performed to compare the confirmatory sampling approach and analytical data with the sampling and data requirements specified by the project objectives. This review involved 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 [EPA 2000]). The assessment review completed the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process.

The DQA review was performed in accordance with BHI-EE-01, *Environmental Investigations Procedures*. Specific data quality objectives for the site are found in the SAP (DOE-RL 2005a). All samples were collected per the sample design. The data quality requirements in the SAP were used for assessing data from statistical sampling and do not specifically apply to the data sets resulting from the

focused sampling performed for the remaining sites. However, to ensure quality data sets, the SAP data assurance requirements as well as the validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) were followed, where appropriate.

1607-F1: The SVOC analyses had the common laboratory contaminants bis(2ethylhexyl)phthalate and di-n-butylphthalate in the method blanks, in the other quality assurance (QA)/quality control (QC) samples, and in the field samples. The concentrations observed in the field samples were all similar to the associated method blanks, thus confirming that these results are caused by laboratory contamination and are not actually from the field samples themselves. All of the concentrations from field samples are below their required detection limits (RDLs) and should not otherwise impact the data. The data are useable for decision-making purposes.

The analysis for SVOCs had some minor issues with matrix interference. The matrix interference drove the method detection limits (MDLs) above the target detection limits on many of the analytes. However, other than a common laboratory contaminant, bis(2-ethylhexyl)phalate, the results were all nondetect. There is no reason to believe that any SVOCs are present in these samples. The matrix interference is not unexpected in a sample from a sewer system, and similar interference is also seen in the PCB and pesticide analyses from this site. The SVOCs also had some minor issues with some of the QA/QC samples that did not impact the data.

The analysis for PCBs reported all results as nondetect. All PCB analytes in sample J01XN9 were reported with MDLs of 0.068 mg/kg, and all PCB analytes in sample J01XP0 were reported with MDLs of 0.034 mg/kg. The RDL and groundwater lookup value for PCBs is 0.017 mg/kg. This sample was taken at 1.1 m (3.6 ft) below ground surface, leaving 8.5 m (27.9 ft) to groundwater. Generic model results indicate that any contaminant with a distribution coefficient (K_d) greater than 9.0 mL/g will not impact groundwater within the period of interest. All of the PCBs have K_d values well above 9.0 mL/g and, therefore, present no threat to groundwater within the period of interest.

All pesticide analytes were nondetect with MDLs greater than their RDLs. For most analytes, their MDLs are only slightly larger than their RDLs, but they are still below their groundwater lookup values. Five analytes had MDLs that were greater than their groundwater lookup values (alpha BHC, heptachlor, aldrin, heptachlor epoxide, and dieldrin). Generic model results indicate that any contaminant with a K_d greater than 9.0 mL/g will not reach groundwater within the period of interest. All of the pesticides of interest, except for alpha BHC, have K_d values above 9.0 mL/g and, therefore, present no threat to groundwater within the period of interest. There is no reason to believe that any pesticides are present in these samples. The matrix interference is not unexpected in a sample from a sewer system.

A common laboratory contaminant (methylene chloride) was found in the VOCs method blank and in all of the samples at levels below the MDL. There is no impact on sample data.

Limited, random, or sample matrix-specific-influenced batch quality control issues such as these are a potential challenge for any analysis. The number and types seen in these data sets were within expectations for the matrix types and analyses performed.

The DQA review for the 1607-F-1 site found the results to be accurate within the standard errors associated with the methods, including sampling and sample handling. The review for the 1607-F1 site concludes that the 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 quality assurance and quality control deficiencies. All analytical data were found to be acceptable for decision-making purposes. The confirmatory sample analytical data are stored in the Environmental Restoration project-specific database prior to archiving in the Hanford Environmental Information System and are summarized in Appendix A.

100-F-26:8: The laboratory double-spiked the laboratory control sample in the SVOC analyses. This problem was limited to the laboratory control sample. Field sample data remained useable for decision-making purposes.

Also in the SVOC analyses, there were elevated MDLs for many of the nondetected analytes. Most of the nondetected compounds would have been detected at their RDLs if those analytes were present in the field samples. For analytes that were detected the analytical data are acceptable. However, for undetected analytes, the data are unacceptable to determine if concentrations are below their action levels. Therefore, SVOCs are retained for verification sampling.

The soil samples J02378, J02379 (duplicate of J02378), and J02380 equipment blank collected for sample delivery group (SDG) H2960 and analyzed for chlorinated pesticides had MDLs that were slightly above their RDLs. The values involved were close enough to each other that if the target analytes were present in the field samples they would still have been detected. They were, however, nondetect, and no impact on the data was observed.

The sediments collected from inside the pipeline (SDG H2959) and analyzed for chlorinated pesticides required dilutions of their extracts in order to run on the analytical equipment. Because of the dilutions, the surrogates and matrix spikes were lost. This is a typical result when dilutions are required. The other QA/QC samples had no problems. While the accuracy of the data may be considered low, the data are still useable for decision-making purposes.

Also in the chlorinated pesticides, the analyte toxaphene is not supported by a QA/QC work up. The data are, therefore, estimated but useable for decision-making purposes.

In the PCB analyses for the 100-F-26:8 waste site, the MDLs all exceeded the RQLs by a small amount. The field sample MDLs were close enough to the RQLs that the analytes should have been detected at the RQLs if they had been present. The data are useable for decision-making purposes.

Because the matrix spikes and laboratory duplicates are prepared using actual material from the field samples, they are subject to natural heterogeneity stemming from those samples. In the metals analysis, the laboratory has performed post-digestion spikes and serial dilutions on matrix spike analytes that do not initially meet criteria to account for that heterogeneity and bring the recovery results back into criteria. For the laboratory duplicates, the heterogeneity is noted and no further action is required. There is no negative impact on the sample data.

The samples collected for the ICP metals analyses arrived at the laboratory at 11.7°C. The laboratory acceptance criteria is 4°C. All of the ICP metals are measured as totals rather than as specific species. None of the ICP metals could actually be lost from the sample and any possible shift in the distribution of these metals within the sample would have no effect on the total amounts present. Therefore, a slightly warm sample temperature will have no impact on these data.

Limited, random, or sample matrix specific influenced batch quality control issues such as these are a potential concern for any analysis. The number and types seen in these data sets were within expectations for the matrix types and analyses performed.

A comparison of the sample J02378 and its duplicate J02379 showed only slight variations between the two. The small differences can be accounted for as natural heterogeneity found in the sample media. No impact on the sample data is suggested by this result.

The DQA review for the 100-F-26:8 waste site found the results to be accurate within the standard errors associated with the methods, including sampling and sample handling. The DQA review for the 100-F-26:8 waste site concludes that the data were of the right type, quality, and quantity to support their intended use, except as noted above. 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/QC deficiencies. All analytical data were found acceptable for decision-making purposes. The confirmatory sample analytical data are stored in the ENRE project-specific database prior to archival in HEIS and are summarized in Appendix A.

VERIFICATION SAMPLING DATA QUALITY ASSESSMENT

A DQA was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample designs (DOE-RL 2005a, WCH 2007d). This DQA was performed in accordance with site-specific data quality objectives found in the SAP (DOE-RL 2005a).

To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., evaluate against cleanup criteria to support a no action or remedial action decision). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2000).

A review of the sample designs (DOE-RL 2005a, WCH 2007d), the field logbook (WCH 2007b, WCH 2007b, WCH 2007c), and applicable analytical data packages has been performed as part of this DQA. All samples were collected per the sample design.

The sample design included a statistical sampling approach for the shallow-zone excavated area of the 1607-F1 and the 100-F-26:8 waste site. In order to calculate the number of samples needed in the statistical sampling plan, the standard deviation for each COC/COPC in the then-unknown data set was

assumed to be less than 25% of the corresponding decision threshold for each population. Examination of the now-known data set shows that the assumptions in the sampling plan were valid.

The waste site comprises multiple decision units, which include the shallow-zone excavated area at the 1607-F1 and the 100-F-26:8 waste sites, the two road cross areas associated with the 100-F-26:8 pipeline excavation, the BCL stockpiles, and the 1709-F French Drain. Samples from several decision units may compose any one SDG. The verification sample data collected at the 100-F-26:8 waste site were provided by the laboratories in three SDGs: SDG K0755 and SDG K0931 from the pipeline excavation at the road-cross area, and SDG K0921 from the shallow zone, the 1709-F French Drain, and BCL stockpiles. SDG K0755 was submitted for third-party validation. No major deficiencies were identified in the analytical data sets. Minor deficiencies are discussed below.

SDG K0755

This SDG comprises three field samples from the road-cross area of the 100-F-26:8 site (J14YW4 through J14YW6). These samples were analyzed for ICP metals, mercury, hexavalent chromium, pesticides, PCBs, SVOCs, gross alpha and gross beta by proportional counting, and by gamma spectroscopy. In addition, sample J14YW4 was analyzed for total strontium and alpha spectroscopy, and sample J14YW6 was analyzed for total strontium. SDG K0755 was submitted for third-party validation. No major deficiencies were found in SDG K0755. Minor deficiencies are as follows:

In the ICP metals analysis, the laboratory control sample (LCS) recovery for silicon is below the QC limit, at 30.5%. Third-party validation qualified all silicon data in SDG K0755 as estimated and flagged "J." Estimated data are useable for decision-making purposes.

Also in the ICP metals analysis, the matrix spike (MS) recoveries for three ICP metals (aluminum, antimony, and silicon) are out of acceptance criteria. For aluminum and silicon, the spiking concentration is insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS result 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 (PDSs) and serial dilutions were prepared for all three analytes with acceptable results. Antimony did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 62.9%. Antimony results for all samples in SDG K0755 are qualified as estimated and flagged "J" by third-party validation. Estimated data are useable for decision-making purposes.

In the gross alpha analysis, an elevated LCS recovery is reported at 138% which indicates a possible high bias in the field data. The gross alpha data for SDG K0775 was qualified by third-party validation as estimated with "J" flags due to the high LCS recovery. High biased and estimated data, such as these, are useable for decision-making purposes.

Reported analytical detection levels are compared against the required quantitation limits (RQLs) to ensure that laboratory detection levels meet the required criteria. In the radiochemical analysis, 12 detection limits exceeded the RQL. Under the WCH statement of work, no qualification is required. If the analytes present in the field sample at the RQL concentrations, they would still be detected even though the RQL is below the MDL. Further, the reported MDLS for these undetected analytes are significantly below lookup values.

All of the toxaphene data in SDG K0755 was qualified by third-party validation as estimated with "J" flags, due to lack of a MS, matrix spike duplicate (MSD), or LCS analysis for the analyte. Estimated, or "J"-flagged, data are acceptable for decision-making purposes.

In the pesticide analysis, the MS recovery for endosulfan I is above the acceptance criteria, indicating a potential high bias in the data. All of the endosulfan I sample results in SDG K0755 were reported as non-detects at the detection limit. The elevated MS recovery has no impact on the field sample data and data are useable for decision-making purposes.

One surrogate recovery in the pesticide analysis, for sample J14YW5, is outside the initial criterion, with high results. However, this sample meets the secondary criterion for surrogate recoveries, as there is no more than one outlier. The data are acceptable for decision-making purposes.

In the SVOC analysis, the common laboratory contaminant bis(2-ethylhexyl)phthalate is detected in the method blank (MB). Third party validation raised the reported values for bis(2-ethylhexyl)phthalate for samples J14WY4 and J14YW5 to the required quantitation limit of 330 µg/kg and qualified them as undetected and flagged "U".

In the SVOC analysis, 15 of 128 MS recoveries are below the acceptance criteria. The MS for 1,2,4-trichlorobenzene is 42%, and the MSD is 54%. The nitrobenzene, isophorone, and 2-nitrophenol MS recoveries are 44%, 53%, and 48%, respectively. The 2,4-dimethylphenol MS recovery is 44%, and the 2-methylphenol MS recovery is 59%. The MS for 2-methylnaphthalene is 54%. The MS for bis(2-chloroethyl) ether and for 1,2 dichlorobenzene is 46%. The MS is 42% for 1,3-dichlorobenzene and for 1,4-dichlorobenzene. The LCS recoveries were outside QC limits for the analytes above, as well as phenol, 2-chlorophenol, 3,4-methylphenol, n-nitroso-di-n-propylamine, 2,4-dichlorophenol, 4-chloro-3-methylphenol, acenaphthylene, 2,6-dinitrotoluene, 2,4-dinitrophenol, dibenzofuran, fluorine, 4,6-dinitro-2-methylphenol, n-nitrosodiphenylamine, 4-bromophenyl-phenylether, hexachlorobenzene, pentachlorophenol, phenanthrene, and carbazol. The results for these analytes were qualified as estimates and flagged "J" by third party validation. Estimated data are useable for decision-making purposes.

The relative percent differences (RPDs) for bis(2-chloroethyl) ether, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichlorobenzene, 2,2'oxybis(1-chloropropane), hexachloroethane, hexachlorocyclopentadiene, 2,4,6-trichlorophenol, 2,4,5-trichlorophenol, and 3,3-dichlorobenzidine are outside QC limits. The results for these analytes were qualified as estimates and flagged "J" by third-party validation. Estimated data are useable for decision-making purposes.

SDG K0931

This SDG comprises four field samples from the road cross area of the 100-F-26:8 site (J15F90 through J15F93). These samples were analyzed for ICP metals, pesticides, PCBs, TPH, and SVOC. No major deficiencies were found in SDG K0931. Minor deficiencies are as follows:

Two surrogate recoveries in the SVOC analysis for sample J15F93 are outside the initial criterion, with low results. This sample does not meet the secondary criterion for surrogate recoveries, as there is more

than one outlier. The SVOC data for sample J15F93 may be considered estimated. Estimated data are acceptable for decision-making purposes.

In the SVOC analysis, three of 128 MS recoveries are below the acceptance criteria. The MSD for 1,3-dichlorobenzene is 48%, and the MSD for 1,4-dichlorobenzene and hexachloroethane are both 47%. Method blank recoveries are below the acceptance criteria for 2,4 dinitrophenol and 4,6-dinitro-2-methylphenol. The results for these analytes may be considered estimated. Estimated data are useable for decision-making purposes.

Due to lack of a MS, MSD, or LCS analysis for toxaphene in the pesticide analysis, all toxaphene results for SDG K0931 may be considered estimated. Estimated data are acceptable for decision-making purposes.

In the ICP metals analysis, sodium and zinc were reported in the MB at a concentration below the contract required quantitation limit (CRQL) but not less than 1/5th of the concentration reported in the field samples (i.e., the field sample concentration is low enough that the MB concentration is of similar magnitude). The sodium and zinc results may be considered estimated. The data are acceptable for decision-making purposes.

Also in the ICP metals analysis, the MS recoveries for three ICP metals (aluminum, iron, and silicon) are out of acceptance criteria. For these analytes, the spiking concentration is insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS result is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. To confirm quantitation, PDSs and serial dilutions were prepared for all three analytes with acceptable results. The data are useable for decision-making purposes.

The RPD for silicon is outside QC limits, at 45.6%. The elevated RPD is attributed to natural heterogeneity of the sample matrix. The silicon data are usable for decision-making purposes.

SDG K0921

This SDG comprises the 10 statistical field samples from the shallow-zone excavation of the 100-F-26:8 site (J15F94 - J15F99 and J15FB0 - J15FB4), three focused field samples from the 1709-F french drain (J15FB5 –J15FB7), four composite samples from the BCL stockpiles (J15FB8, J15FB9, J15FC0, and J15FC1), and an equipment blank (J15FC2). The samples include one field duplicate pair (J15F97/J15F98). These samples were analyzed for ICP metals, pesticides, PCBs, TPH, and SVOC. No major deficiencies were found in SDG K0921. Minor deficiencies are as follows:

In the TPH analysis, TPH is reported in the MB at a concentration approximately four times the reporting limit. All TPH sample results are reported as below the detection limit, except sample J15FB1. The sample J15FB1 TPH result may be considered estimated. The data are acceptable for decision-making purposes.

In the SVOC analysis, 20 of 128 MS recoveries are below the acceptance criteria. The MS for 1,2,4-trichlorobenzene is 47%, and the MSD is 50%. The 4-chloro-3-methylphenol MS is 44% and the MSD is 56%. The MS for 2-methylnaphthalene is 46%, and the MSD is 53%. The nitrobenzene MS is 41% and the MSD is 46%. The MS for isophorone is 48% and the MSD is 56%. The

2-methylphenol, 3,4-methylphenol, and 2-nitrophenol MS recoveries are 54%, 58%, and 48%, respectively. The 2,4-dimethylphenol MS recovery is 43%, and the 2-nitroanaline MS recovery is 57%. The MS recovery for 3-nitroaniline and n-nitrosodiphenylamine (1) are both 48%. The fluorine MS is 59%, and the 4-nitroaniline MS is 49%. Method blank recoveries are below the acceptance criteria for 2-methylphenol, 3,4-methylphenol, nitrobenzene, isophorone, 2-nitrophenol, 2,4 dimethylphenol, 2,4-dichlorophenol, 1,2,4-trichlorobenzene, 4-chloro-3-methylphenol, 2-nitroaniline, n-nitrosodiphenylamine (1) and 2-methylnaphthalene, as well. The results for these analytes may be considered estimated. Estimated data are useable for decision-making purposes.

Surrogate recoveries in the pesticide analysis are outside the initial criterion, with high results, for samples J15F97, J15FB1, J15FB2, J15FB3, J15FB5, J15FB7, J15FB8, J15FB9, and J15FC1. However, samples J15F97, J15FB2, J15FB3, J15FB5, J15FB8, and J15FB9 meet the secondary criterion for surrogate recoveries, as there is no more than one outlier. Both surrogate recoveries are outside for samples J15FB1, J15FB7, and J15FC1, and results for these samples may be considered estimated. The data are acceptable for decision-making purposes.

In the pesticide analysis, 4 of 40 MS recoveries are above the acceptance criteria. The MS for 4,4'-DDE is 121%, and the MSD is 132%. The MSD recoveries for aldrin and endosulfan I are both 124%. Method blank recoveries are above the acceptance criteria for these three analytes, as well. The results for these analytes may be considered estimated. Estimated data are useable for decision-making purposes.

Samples J15FB1, J15FB2, J15FB7, and J15FC1 required a four-fold instrument dilution in the pesticide analysis due to the sample matrix. The reporting limits were adjusted to reflect the necessary dilution.

All of the toxaphene data in SDG K0921 may be considered estimated due to lack of a MS, MSD, or LCS analysis for the analyte. Estimated data are acceptable for decision-making purposes.

In the ICP metals analysis, sodium is reported in the MB at a concentration below the CRQL but not less than 1/5th of the concentration reported in the field samples (i.e., the field sample concentration is low enough that the MB concentration is of similar magnitude). Calcium and zinc were reported in the MB at a concentration below the CRQL but not less than 1/5th of the concentration reported in sample J15FC2 (the equipment blank). The sodium results for all samples in SDG K0931 and the calcium and zinc results for sample J15F32 may be considered estimated. The data are acceptable for decision-making purposes.

Also in the ICP metals analysis, the MS recoveries for five ICP metals (aluminum, iron, manganese, antimony, and silicon) are out of acceptance criteria. For four analytes, the spiking concentration is insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS result is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. To confirm quantitation, PDSs and serial dilutions were prepared for all three analytes with acceptable results. Antimony did not have mismatched spike and native concentrations in the original MS. The analytical results for antimony in all samples in SDG K0931 may be considered estimated. Estimated data are useable for decision-making purposes.

The RPDs for silicon and arsenic are outside QC limits, at 85.9% and 46.2%, respectively. The elevated RPD is attributed to natural heterogeneity of the sample matrix. The silicon data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field QA/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. The field QA/QC samples for the 100-F-26:8 site, listed in the field logbook (WCH 2007b), are primary and duplicate field samples from the excavation shallow zone (J15F97/J15F98). 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 COC/COPCs. Only analytes with values above five times the detection limits for both the main and duplicate samples are compared. The 95% upper confidence limit (UCL) calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation. The RPDs calculated for aluminum, total chromium, iron, silicon, and vanadium in the excavation shallow-zone duplicate samples (J15F97/J15F98) are above the acceptance criteria (30%) at 31.9%, 36.9%, 36.7%, 92.4% and 51.1%, respectively. Elevated RPDs, such as these, in the analysis of environmental soil samples, are largely attributed to heterogeneities in the soil matrix and only in small part attributed to precision and accuracy issues at the laboratory. The data are useable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than 5 times the target detection limit (TDL), including undetected analytes. In these cases, a control limit of ± 2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. None of the 100-F-26:8 waste site results required this check.

An overall visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are suitable for the intended purpose of cleanup verification.

SUMMARY FOR INTERIM CLOSURE

The 1607-F1 and 100-F-26:8 waste sites have been evaluated and remediated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2005b). Because of the results of the confirmatory sampling, approximately 464 m^3 (607 yd^3) material, including the septic tank, piping, concrete material, and suspect contaminated adjacent soils, were removed and disposed of to ERDF. Sampling to verify the completeness of remediation was performed, and the analytical results indicated that the residual concentrations of COC/COPCs at this site meet the cleanup objectives for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the verification sampling results support a reclassification of the 1607-F1 and 100-F-26:8 waste sites to Interim Closed Out. 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.

REFERENCES

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.

BHI, 2000a, *Data Validation Procedure for Chemical Analysis*, BHI-01435, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000b, *Data Validation Procedure for Radiochemical Analysis*, BHI-01433, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001, *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2003, *Remaining Sites Field Sampling*, Logbook EL-1578-3, pp. 7 and 41-42, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2004a, *Work Instruction for 1607-F1 Sanitary Sewer System (124-F-1)*, 100F-WI-G0009, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2004b, *Work Instruction for 100-F-26:8, 1607-F1 Sanitary Sewer Piping*, 0100F-WI-G0023, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2004c, *Remaining Sites Field Sampling*, Logbook EL-1578-5, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2005a, *100 Area Analogous Sites RESRAD Calculations,* 0100X-CA-V0050, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2005b, *Pipe and Matrix Reduction Calculations*, 0100B-CA-V0209, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-01, *Environmental Investigations Procedures*, Bechtel Hanford, Inc., Richland, Washington.

Dittmer, L. M., 2005, *Benzo(a)pyrene in 100-F-26:8 & 1607-F1*, CCN 119017, email to L. Gadbois, EPA, dated February 11, 2005, Bechtel Hanford, Inc., Richland, Washington.

DOE Order 5400.5, *Radiation Protection of the Public and Environment*, as amended, U.S. Department of Energy, Washington, D.C.

DOE-RL, 1996, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, DOE/RL-96-12, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2005a, *100 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2005b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area,* DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2007, *Tri-Party Agreement Handbook Management Procedures,* RL-TPA-90-0001, Rev. 1, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1995, *Guidance on Sampling and Data Analysis Methods*, Publication No. 94-49, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2005, *Cleanup Levels and Risk Calculations (CLARC) Database*, Washington State Department of Ecology, Olympia, Washington, available at: <https://fortress.wa.gov/ecy/clarc.CLARCHome.aspx>.

EPA, 1999, *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,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2000, *Guidance for Data Quality Assessment*, EPA QA/G-9, QA00 Update, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

EPA, 2006, *Integrated Risk Information System (IRIS)*, U.S. Environmental Protection Agency, Washington, D.C., available at: <http://www.epa.gov/iris>.

Feist, E. T., 2005a, *100-F-26:8 Partial Remaining Site for Remedial Action,* CCN 119906, Interoffice Memorandum to R. A. Carlson, dated March 24, 2005, Bechtel Hanford, Inc., Richland, Washington.

Feist, E. T., 2005b, *1607-F1 Partial Remaining Site for Remedial Action,* CCN 119907, Interoffice Memorandum to R. A. Carlson, dated March 23, 2005, Bechtel Hanford, Inc., Richland, Washington.

GE, 1965, *Outside Lines - Sewers, 100-F Area,* M-1904-F, sheet 8, rev. 2, General Electric Company, Richland, Washington.

Gilbert, R. O., 1987, *Statistical Methods for Environmental Pollution Monitoring*, Wiley & Sons, Inc., New York, New York.

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

WCH, 2007a, *100-F Remedial Sampling*, Logbook ELF-1174-2, pp. 72-73, Washington Closure Hanford, Richland, Washington.

WCH, 2007b, *100-F Remedial Sampling*, Logbook ELF-1174-3, pp. 48-49, Washington Closure Hanford, Richland, Washington.

WCH, 2007c, *100-F Remedial Sampling*, Logbook ELF-1174-3, pp. 65-66, Washington Closure Hanford, Richland, Washington.

WCH, 2007d, *Work Instruction for Verification Sampling of the 1607-F1 Septic Tank and Pipelines (100-F-26:8)*, Work Instruction No. 0100F-WI-G0066, Rev 0, Washington Closure Hanford, Richland, Washington.

APPENDIX A

CONFIRMATORY SAMPLING AND WASTE CHARACTERIZATION RESULTS

Table A-1. 1607-F1 Inorganic Data Results.

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
Equipment Blank	J01XP1	10/07/04	48.5	C	0.65	0.24	U	0.24	0.29	U	0.29	1.6	C	0.02	0.03		0.008	0.41	U	0.41
Area 1 Soil	J01XP2	10/07/04	4790	C	0.83	0.31	U	0.31	2		0.37	58.4	C	0.02	0.18		0.01	0.69		0.52
Area 2 Soil	J01XP3	10/07/04	4360	C	0.77	0.32		0.28	1.7		0.34	46.9		0.02	0.19	C	0.009	0.8	C	0.48
Area 2 Tile Contents	J01XN9	10/07/04	6540	C	0.79	0.64		0.29	1.7		0.35	79	C	0.02	0.21		0.01	1.4		0.5
Duplicate of J01XN9	J01XP0	10/07/04	6620	C	0.69	0.26	U	0.26	2		0.31	81.9	C	0.02	0.23		0.009	1.1		0.44

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Equipment Blank	J01XP1	10/07/04	0.02	U	0.03	23.4	C	0.55	0.16	C	0.05	0.06	U	0.06	0.16		0.04	1090		1.8
Area 1 Soil	J01XP2	10/07/04	0.25		0.03	2300	C	0.71	9	C	0.06	3.9		0.08	13.2		0.05	15300		2.3
Area 2 Soil	J01XP3	10/07/04	0.1		0.03	2360		0.65	7.6	C	0.06	4.8		0.08	13		0.05	13800		2.2
Area 2 Tile Contents	J01XN9	10/07/04	0.22	C	0.03	2660		0.67	10.4	C	0.06	5		0.08	15.6		0.05	20200		2.2
Duplicate of J01XN9	J01XP0	10/07/04	0.17	C	0.03	2670		0.59	10	C	0.06	5		0.07	14.9		0.04	20200		1.9

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Equipment Blank	J01XP1	10/07/04	0.21		0.15	7.5	C	0.53	18.7	C	0.008	0.02	U	0.02	0.1	U	0.1	0.1	U	0.1
Area 1 Soil	J01XP2	10/07/04	3.7		0.19	3200	C	0.68	147	C	0.01	0.06		0.02	0.37		0.13	7		0.12
Area 2 Soil	J01XP3	10/07/04	3.9		0.18	3100	C	0.53	224	C	0.009	0.02	U	0.02	0.42		0.12	8.3		0.11
Area 2 Tile Contents	J01XN9	10/07/04	5.2		0.19	3590	C	0.64	155	C	0.01	0.02	U	0.02	0.58		0.13	8.4		0.12
Duplicate of J01XN9	J01XP0	10/07/04	5		0.16	3590	C	0.6	158	C	0.009	0.01	U	0.02	0.55		0.11	8.4		0.1

Sample Location	HEIS Number	Sample Date	Potassium			Selenium			Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Equipment Blank	J01XP1	10/07/04	17.1		2.8	0.31	U	0.31	38.5		0.4	0.07	U	0.07	7.3	C	0.18	0.15		0.05
Area 1 Soil	J01XP2	10/07/04	722		3.6	0.4	U	0.4	467		0.51	0.4		0.09	105	C	0.24	35.2		0.06
Area 2 Soil	J01XP3	10/07/04	634		3.3	0.37	U	0.37	452		0.47	0.09	U	0.09	84.9	C	0.22	31.6		0.06
Area 2 Tile Contents	J01XN9	10/07/04	1240		3.4	0.38	U	0.38	457		0.49	0.09	U	0.09	131	C	0.22	59.4		0.06
Duplicate of J01XN9	J01XP0	10/07/04	1250		3	0.33	U	0.33	336		0.43	0.08	U	0.08	132	C	0.2	58.7		0.05

Sample Location	HEIS Number	Sample Date	Zinc		
			mg/kg	Q	PQL
Equipment Blank	J01XP1	10/07/04	2	C	0.03
Area 1 Soil	J01XP2	10/07/04	100	C	0.04
Area 2 Soil	J01XP3	10/07/04	44.6	C	0.04
Area 2 Tile Contents	J01XN9	10/07/04	116	C	0.04
Duplicate of J01XN9	J01XP0	10/07/04	114	C	0.03

Acronyms and note apply to all tables in Appendix B.

Note: Data qualified with B, C, and/or J, are considered acceptable values.

B = blank contamination (organic constituents)

C = blank contamination (inorganic constituents)

HEIS = Hanford Environmental Information System

PQL = practical quantitation limit

Q = qualifier

U = undetected

J = estimate

Table A-2. 1607-F1 Organic Data Results. (3 Pages)

Constituent	J01XN9 Area 2 Tile Contents Sample Date 10/07/04			J01XP0 Duplicate of J01XN9 Sample Date 10/07/04			J01XP1 Equipment Blank Sample Date 10/07/04			J01XP2 Area 1 Soil Sample Date 10/07/04			J01XP3 Area 2 Soil Sample Date 10/07/04		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
PCBs (polychlorinated biphenyls)															
Aroclor-1016	68	U	68	34	U	34	13	U	13	14	U	14	14	U	14
Aroclor-1221	68	U	68	34	U	34	13	U	13	14	U	14	14	U	14
Aroclor-1232	68	U	68	34	U	34	13	U	13	14	U	14	14	U	14
Aroclor-1242	68	U	68	34	U	34	13	U	13	14	U	14	14	U	14
Aroclor-1248	68	U	68	34	U	34	13	U	13	14	U	14	14	U	14
Aroclor-1254	68	U	68	34	U	34	13	U	13	14	U	14	14	U	14
Aroclor-1260	68	U	68	34	U	34	13	U	13	14	U	14	14	U	14
Pesticides															
Aldrin	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Alpha-BHC	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
alpha-Chlordane	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Hexachlorocyclohexane	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Delta-BHC	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Dichlorodiphenyldichloroethane	6.7	U	6.7	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	1.9	J	1.9
Dichlorodiphenyldichloroethylene	6.7	U	6.7	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3
Dichlorodiphenyltrichloroethane	6.7	U	6.7	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3
Dieldrin	6.7	U	6.7	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3
Endosulfan I	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Endosulfan II	6.7	U	6.7	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3
Endosulfan sulfate	6.7	U	6.7	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3
Endrin	6.7	U	6.7	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3
Endrin aldehyde	6.7	U	6.7	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3
Endrin ketone	6.7	U	6.7	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3
Gamma-BHC (Lindane)	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
gamma-Chlordane	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Heptachlor	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Heptachlor epoxide	3.3	U	3.3	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Methoxychlor	33	U	33	17	U	17	17	U	17	17	U	17	17	U	17
Toxaphene	300	U	300	170	U	170	170	U	170	170	U	170	170	U	170
SVOA (semivolatile organic analyses)															
1,2,4-Trichlorobenzene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
1,2-Dichlorobenzene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
1,3-Dichlorobenzene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
1,4-Dichlorobenzene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2,4,5-Trichlorophenol	850	U	850	850	U	850	830	U	830	860	U	860	860	U	860
2,4,6-Trichlorophenol	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2,4-Dichlorophenol	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2,4-Dimethylphenol	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2,4-Dinitrophenol	850	U	850	850	U	850	830	U	830	860	U	860	860	U	860
2,4-Dinitrotoluene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2,6-Dinitrotoluene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2-Chloronaphthalene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2-Chlorophenol	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2-Methylnaphthalene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
2-Nitroaniline	850	U	850	850	U	850	830	U	830	860	U	860	860	U	860
2-Nitrophenol	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350

Table A-2. 1607-F1 Organic Data Results. (3 Pages)

Constituent	J01XN9 Area 2 Tile Contents Sample Date 10/07/04			J01XP0 Duplicate of J01XN9 Sample Date 10/07/04			J01XP1 Equipment Blank Sample Date 10/07/04			J01XP2 Area 1 Soil Sample Date 10/07/04			J01XP3 Area 2 Soil Sample Date 10/07/04		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
SVOA (semivolatile organic analyses) (continued)															
3,3'-Dichlorobenzidine	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
3-Nitroaniline	850	U	850	850	U	850	830	U	830	860	U	860	860	U	860
4,6-Dinitro-2-methylphenol	850	U	850	850	U	850	830	U	830	860	U	860	860	U	860
4-Bromophenylphenyl ether	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
4-Chloro-3-methylphenol	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
4-Chloroaniline	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
4-Chlorophenylphenyl ether	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
3+4-Methylphenol (cresol,m+p--)	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
4-Nitroaniline	850	U	850	850	U	850	830	U	830	860	U	860	860	U	860
4-Nitrophenol	850	U	850	850	U	850	830	U	830	860	U	860	860	U	860
Acenaphthene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Acenaphthylene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Anthracene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Benzo(a)anthracene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Benzo(a)pyrene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Benzo(b)fluoranthene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Benzo(ghi)perylene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Benzo(k)fluoranthene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Bis(2-chloro-1-methylethyl)ether	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Bis(2-Chloroethoxy)methane	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Bis(2-chloroethyl) ether	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Bis(2-ethylhexyl) phthalate	23	JB	340	18	JB	340	43	JB	330	18	JB	340	29	JB	350
Butylbenzylphthalate	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Carbazole	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Chrysene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Di-n-butylphthalate	340	U	340	340	U	340	36	J	330	340	U	340	22	J	350
Di-n-octylphthalate	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Dibenz[a,h]anthracene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Dibenzofuran	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Diethylphthalate	340	U	340	340	U	340	30	J	330	340	U	340	350	U	350
Dimethyl phthalate	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Fluoranthene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Fluorene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Hexachlorobenzene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Hexachlorobutadiene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Hexachlorocyclopentadiene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Hexachloroethane	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Isophorone	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
N-Nitrosodiphenylamine	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Naphthalene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Nitrobenzene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Pentachlorophenol	850	U	850	850	U	850	830	U	830	860	U	860	860	U	860
Phenanthrene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Phenol	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350
Pyrene	340	U	340	340	U	340	330	U	330	340	U	340	350	U	350

Table A-2. 1607-F1 Organic Data Results. (3 Pages)

Constituent	J01XP3 Area 2 Soil Sample Date 10/07/04		
	µg/kg	Q	PQL
VOA (volatile organic analysis)			
1,1,1-Trichloroethane	6	U	6
1,1,2,2-Tetrachloroethane	6	U	6
1,1,2-Trichloroethane	6	U	6
1,1-Dichloroethane	6	U	6
1,1-Dichloroethene	6	U	6
1,2-Dichloroethane	6	U	6
1,2-Dichloroethene(Total)	6	U	6
1,2-Dichloropropane	6	U	6
2-Butanone	11	U	11
2-Hexanone	11	U	11
4-Methyl-2-Pentanone	11	U	11
Acetone	11	U	11
Benzene	6	U	6
Bromodichloromethane	6	U	6
Bromoform	6	U	6
Bromomethane	11	U	11
Carbon disulfide	6	U	6
Carbon tetrachloride	6	U	6
Chlorobenzene	6	U	6
Chloroethane	11	U	11
Chloroform	6	U	6
Chloromethane	11	U	11
cis-1,3-Dichloropropene	6	U	6
Dibromochloromethane	6	U	6
Ethylbenzene	6	U	6
Methylenechloride	5	JB	5
Styrene	6	U	6
Tetrachloroethene	6	U	6
Toluene	6	U	6
trans-1,3-Dichloropropene	6	U	6
Trichloroethene	6	U	6
Vinyl chloride	11	U	11
Xylenes (total)	6	U	6

Table A-3. 100-F-26:8 Inorganic Data Results.

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
Test Pit 1 Soil	J02378	01/05/05	5700		3.3	0.86		0.3	2.1		0.28	66.6		0.04	0.58		0.01	1.8		0.32
Duplicate of J02378	J02379	01/05/05	6070		3.1	0.31		0.28	2.5		0.26	62.1		0.04	0.57		0.01	1.8		0.3
Equipment Blank	J02380	01/05/05	53		2.7	0.25	U	0.25	0.23	U	0.23	1.2		0.04	0.009	U	0.009	0.26	U	0.26
Pipe Sediment	J02381	01/05/05	7350		3.7	1.3		0.34	8.4	C	0.31	3950	C	0.05	0.36		0.01	4.1		0.36

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Test Pit 1 Soil	J02378	01/05/05	0.14		0.03	3870		3	10.1		0.06	6.1		0.07	13.1		0.09	17600		3
Duplicate of J02378	J02379	01/05/05	0.19		0.03	3790		2.7	10.6		0.08	6.1		0.07	13.2		0.08	18200		2.7
Equipment Blank	J02380	01/05/05	0.03	U	0.03	22.2		2.4	0.07	U	0.07	0.06	U	0.06	0.22		0.07	128		2.4
Pipe Sediment	J02381	01/05/05	0.82		0.04	4000	C	20	17.9	C	0.1	14.1		0.08	43.1	C	0.1	37200	C	3.3

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Test Pit 1 Soil	J02378	01/05/05	4.6		0.23	3900		0.73	297		0.03	0.02	U	0.02	0.47		0.24	10.3		0.13
Duplicate of J02378	J02379	01/05/05	4.2		0.22	4010		0.68	285		0.03	0.02	U	0.02	0.51		0.23	11.2		0.12
Equipment Blank	J02380	01/05/05	0.19	U	0.19	9.1		0.61	4.3		0.03	0.01	U	0.01	0.2	U	0.2	0.11	U	0.11
Pipe Sediment	J02381	01/05/05	219		0.26	3970	C	0.83	451	C	0.04	1.06		0.02	0.9		0.28	18		0.14

Sample Location	HEIS Number	Sample Date	Potassium			Selenium			Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Test Pit 1 Soil	J02378	01/05/05	1070		2	0.66		0.39	232		1.5	0.11	U	0.11	158		0.56	43.8		0.07
Duplicate of J02378	J02379	01/05/05	1380		1.9	0.9		0.36	106		1.4	0.1	U	0.1	160		0.5	42.8		0.07
Equipment Blank	J02380	01/05/05	25.1		1.7	0.32	U	0.32	40.4		1.2	0.09	U	0.09	9.7		0.45	0.076		0.06
Pipe Sediment	J02381	01/05/05	1400	C	2.3	0.44	U	0.44	609	C	1.7	5		0.12	188	C	0.61	44.4		0.08

Sample Location	HEIS Number	Sample Date	Zinc		
			mg/kg	Q	PQL
Test Pit 1 Soil	J02378	01/05/05	36.3	C	0.14
Duplicate of J02378	J02379	01/05/05	36.6	C	0.13
Equipment Blank	J02380	01/05/05	0.66	C	0.11
Pipe Sediment	J02381	01/05/05	1330	C	0.93

Note: Data qualified with B, C, and/or J, are considered real values.
B = blank contamination (organic constituents)
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-4. 100-F-26:8 Organic Data Results. (2 Pages)

Constituent	J02378 Test Pit 1 Soil Sample Date 01/05/05			J02379 Duplicate of J02378 Sample Date 01/05/05			J02380 Equipment Blank Sample Date 01/05/05			J02381 Pipe Sediment Sample Date 01/05/05		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
PCBs (polychlorinated biphenyls)												
Aroclor-1016	36	U	36	36	U	36	33	U	33	42	U	42
Aroclor-1221	36	U	36	36	U	36	33	U	33	42	U	42
Aroclor-1232	36	U	36	36	U	36	33	U	33	42	U	42
Aroclor-1242	36	U	36	36	U	36	33	U	33	42	U	42
Aroclor-1248	36	U	36	36	U	36	33	U	33	42	U	42
Aroclor-1254	36	U	36	36	U	36	33	U	33	42	U	42
Aroclor-1260	36	U	36	36	U	36	33	U	33	250		42
Pesticides												
Aldrin	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	42	U	42
Alpha-BHC	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	42	U	42
alpha-Chlordane	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	78		42
Hexachlorocyclohexane	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	42	U	42
Delta-BHC	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	42	U	42
Dichlorodiphenyldichloroethane	3.6	U	3.6	3.6	U	3.6	3.3	U	3.3	87		83
Dichlorodiphenyldichloroethylene	3.6	U	3.6	3.6	U	3.6	3.3	U	3.3	100		83
Dichlorodiphenyltrichloroethane	3.6	U	3.6	3.6	U	3.6	3.3	U	3.3	340		83
Dieldrin	3.6	U	3.6	3.6	U	3.6	3.3	U	3.3	83	U	83
Endosulfan I	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	42	U	42
Endosulfan II	3.6	U	3.6	3.6	U	3.6	3.3	U	3.3	83	U	83
Endosulfan sulfate	3.6	U	3.6	3.6	U	3.6	3.3	U	3.3	83	U	83
Endrin	3.6	U	3.6	3.6	U	3.6	3.3	U	3.3	83	U	83
Endrin aldehyde	3.6	U	3.6	3.6	U	3.6	3.3	U	3.3	83	U	83
Endrin ketone	3.6	U	3.6	3.6	U	3.6	3.3	U	3.3	83	U	83
Gamma-BHC (Lindane)	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	42	U	42
gamma-Chlordane	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	67		42
Heptachlor	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	42	U	42
Heptachlor epoxide	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	42	U	42
Methoxychlor	18	U	18	18	U	18	17	U	17	130	J	420
Toxaphene	180	U	180	180	U	180	170	U	170	4200	U	4200
SVOAs (semivolatile organic analyses)												
1,2,4-Trichlorobenzene	360	U	360	360	U	360	330	U	330	830	U	830
1,2-Dichlorobenzene	360	U	360	360	U	360	330	U	330	830	U	830
1,3-Dichlorobenzene	360	U	360	360	U	360	330	U	330	830	U	830
1,4-Dichlorobenzene	360	U	360	360	U	360	330	U	330	830	U	830
2,4,5-Trichlorophenol	900	U	900	900	U	900	840	U	840	2100	U	830
2,4,6-Trichlorophenol	360	U	360	360	U	360	330	U	330	830	U	830
2,4-Dichlorophenol	360	U	360	360	U	360	330	U	330	830	U	830
2,4-Dimethylphenol	360	U	360	360	U	360	330	U	330	830	U	830
2,4-Dinitrophenol	900	U	900	900	U	900	840	U	840	2100	U	830
2,4-Dinitrotoluene	360	U	360	360	U	360	330	U	330	830	U	830
2,6-Dinitrotoluene	360	U	360	360	U	360	330	U	330	830	U	830
2-Chloronaphthalene	360	U	360	360	U	360	330	U	330	830	U	830
2-Chlorophenol	360	U	360	360	U	360	330	U	330	830	U	830
2-Methylnaphthalene	360	U	360	360	U	360	330	U	330	830	U	830
2-Methylphenol (cresol, o-)	360	U	360	360	U	360	330	U	330	830	U	830
2-Nitroaniline	900	U	900	900	U	900	840	U	840	2100	U	830
2-Nitrophenol	360	U	360	360	U	360	330	U	330	830	U	830
3+4 Methylphenol (cresol, m+p)	360	U	360	360	U	360	330	U	330	830	U	830
3,3'-Dichlorobenzidine	360	U	360	360	U	360	330	U	330	830	U	830
3-Nitroaniline	900	U	900	900	U	900	840	U	840	2100	U	830

Table A-4. 100-F-26:8 Organic Data Results. (2 Pages)

Constituent	J02378 Test Pit 1 Soil Sample Date 01/05/05			J02379 Duplicate of J02378 Sample Date 01/05/05			J02380 Equipment Blank Sample Date 01/05/05			J02381 Pipe Sediment Sample Date 01/05/05		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
SVOAs (continued)												
4,6-Dinitro-2-methylphenol	900	U	900	900	U	900	840	U	840	2100	U	830
4-Bromophenylphenyl ether	360	U	360	360	U	360	330	U	330	830	U	830
4-Chloro-3-methylphenol	360	U	360	360	U	360	330	U	330	830	U	830
4-Chloroaniline	360	U	360	360	U	360	330	U	330	830	U	830
4-Chlorophenylphenyl ether	360	U	360	360	U	360	330	U	330	830	U	830
4-Nitroaniline	900	U	900	900	U	900	840	U	840	2100	U	2100
4-Nitrophenol	900	U	900	900	U	900	840	U	840	2100	U	2100
Acenaphthene	360	U	360	360	U	360	330	U	330	81	J	830
Acenaphthylene	360	U	360	360	U	360	330	U	330	130	J	830
Anthracene	360	U	360	360	U	360	330	U	330	680	J	830
Benzo(a)anthracene	23	J	360	36	J	360	330	U	330	2200		830
Benzo(a)pyrene	20	J	360	33	J	360	330	U	330	1900		830
Benzo(b)fluoranthene	360	U	360	23	J	360	330	U	330	1700		830
Benzo(ghi)perylene	360	U	360	360	U	360	330	U	330	960		830
Benzo(k)fluoranthene	360	U	360	28	J	360	330	U	330	1900		830
Bis(2-chloro-1-methylethyl)ether	360	U	360	360	U	360	330	U	330	830	U	830
Bis(2-Chloroethoxy)methane	360	U	360	360	U	360	330	U	330	830	U	830
Bis(2-chloroethyl) ether	360	U	360	360	U	360	330	U	330	830	U	830
Bis(2-ethylhexyl) phthalate	18	JB	360	19	JB	360	330	U	330	48	JB	830
Butylbenzylphthalate	360	U	360	360	U	360	330	U	330	830	U	830
Carbazole	360	U	360	360	U	360	330	U	330	470	J	830
Chrysene	31	J	360	42	J	360	330	U	330	2200		830
Di-n-butylphthalate	62	JB	360	39	JB	360	33.567	JB	330	82	JB	830
Di-n-octylphthalate	360	U	360	360	U	360	330	U	330	830	U	830
Dibenz[a,h]anthracene	360	U	360	360	U	360	330	U	330	420	J	830
Dibenzofuran	360	U	360	360	U	360	330	U	330	62	J	830
Diethylphthalate	360	U	360	360	U	360	330	U	330	830	U	830
Dimethyl phthalate	360	U	360	360	U	360	330	U	330	830	U	830
Fluoranthene	46	J	360	65	J	360	330	U	330	4000		830
Fluorene	360	U	360	360	U	360	330	U	330	170	J	830
Hexachlorobenzene	360	U	360	360	U	360	330	U	330	830	U	830
Hexachlorobutadiene	360	U	360	360	U	360	330	U	330	830	U	830
Hexachlorocyclopentadiene	360	U	360	360	U	360	330	U	330	830	U	830
Hexachloroethane	360	U	360	360	U	360	330	U	330	830	U	830
Indeno(1,2,3-cd)pyrene	360	U	360	360	U	360	330	U	330	1000		830
Isophorone	360	U	360	360	U	360	330	U	330	830	U	830
N-Nitroso-di-n-dipropylamine	360	U	360	360	U	360	330	U	330	830	U	830
N-Nitrosodiphenylamine	360	U	360	360	U	360	330	U	330	830	U	830
Naphthalene	360	U	360	360	U	360	330	U	330	62	J	830
Nitrobenzene	360	U	360	360	U	360	330	U	330	830	U	830
Pentachlorophenol	900	U	900	900	U	900	840	U	840	2100	U	2100
Phenanthrene	38	J	360	84	J	360	330	U	330	2400		830
Phenol	360	U	360	360	U	360	330	U	330	830	U	830
Pyrene	64	J	360	92	J	360	330	U	330	3300		830

APPENDIX B

95% UCL CALCULATIONS AND VERIFICATION SAMPLING RESULTS

APPENDIX B

95% UCL CALCULATIONS AND VERIFICATION SAMPLING RESULTS

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

100-F-26:8 Waste Site Cleanup Verification 95% UCL Calculations, 0100F-CA-V0290, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

The calculation that is 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: 100-F Field Remediation **Job No. 14655**

Area: 100-F

Discipline: Environmental *Calculation No: 0100F-CA-V0319

Subject: 100-F-26:8, 1607-F1 Cleanup Verification 95% UCL Calculation

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 8 Attm. 1 = 19 Total = 28	H. M. Sulloway	M. J. Appel	NA	S. W. Callison	11-6-07

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 H. M. Sulloway **Date** 11/05/07 **Calc. No.** 0100F-CA-V0319 **Rev. No.** 0
Project 100-F Field Remediation **Job No.** 14655 **Checked** M. J. Appel **Date** 11/5/07
Subject 100-F-26:8, 1607-F1 Cleanup Verification 95% UCL Calculation **Sheet No.** 1 of 8

Summary

Purpose:
Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the subject site. Also, perform the *Washington Administrative Code* (WAC) 173-340-740(7)(e) Model Toxics Control Act (MTCA) 3-part test for nonradionuclide analytes and calculate the relative percent difference (RPD) for primary-duplicate sample pairs for each contaminant of concern (COC) and contaminant of potential concern (COPC), as necessary.

Table of Contents:

Given/References:
1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2005b), DOE-RL (2001), and Ecology (1996).
3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2005a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) DOE-RL, 2005b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
6) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
7) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets),* Publication #92-54, Washington Department of Ecology, Olympia, Washington.
8) Ecology, 1996, *Model Toxic Control Act Cleanup Levels and Risk Calculations (CLARC II),* Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
9) Ecology, 2005, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
10) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-4/013. U.S. Environmental Protection Agency, Washington, D.C.
11) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code.*

Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2005b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).

Calculation Description:
The subject calculations were performed on data from soil verification samples (Attachment 1) from the 100-F-26:8 and 1607-F1 waste sites. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2005b) is documented by this calculation. In addition to the statistical soil samples collected at this site, nonstatistical data were collected, and the results are also included in Attachment 1. As the maximum detected values for these data sets are used instead of the 95% UCL (additional discussion is provided in the RSVP), calculations on these data sets are not included herein. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Washington Closure Hanford **CALCULATION SHEET**

Originator H. M. Sulloway **Date** 11/01/07 **Calc. No.** 0100F-CA-V0319 **Rev. No.** 0
Project 100-F Field Remediation **Job No.** 14655 **Checked** M. J. Appel **Date** 11/05/07
Subject 100-F-26:8, 1607-F1 Cleanup Verification 95% UCL Calculation **Sheet No.** 2 of 8

Summary (continued)

Methodology:

For nonradioactive analytes with ≤50% of the data below detection limits and all detected radionuclide analytes, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with >50% of the data below detection limits, as determined by direct inspection of the sample results (Attachment 1), the maximum detected value for the data set is used instead of the 95% UCL, and no further calculations are performed for those data sets. For convenience, these maximum detected values are included in the summary tables that follow. The 95% UCL was not calculated for data sets with no reported detections. Calculated cleanup levels are not available in Ecology (2005) under WAC 173-340-740(3) for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium; therefore, these constituents are not considered site COCs/COPCs and are also not included in these calculations. The 95% UCL values were also not calculated for radium-226, radium-228, thorium-228, thorium-232, and potassium-40, as these isotopes are not related to the operational history of the site and thus not considered COCs/COPCs.

All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics (Ecology 1993). For radionuclide data, calculation of the statistics was done on the reported value. In cases where the laboratory does not report a value below the minimal detectable activity (MDA), half of the MDA is used in the calculation. For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.

For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets ($n < 10$) and all radionuclide data sets, the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2005b) and MTCAStat coding and due to a limitation in the MTCAStat coding (no direct capability to address variable quantitation limits within a data set), substitutions for censored data are performed before software input and the resulting data set treated as uncensored.

The WAC 173-340-740(7)(e) 3-part test is performed for nonradionuclide analytes only and determines if:
1) the 95% UCL exceeds the most stringent cleanup limit for each COPC/COC,
2) greater than 10% of the raw data exceed the most stringent cleanup limit for each COPC/COC,
3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each COPC/COC.

The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed in Table II-1 of the SAP (DOE-RL 2005a). Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

where, M = Main Sample Value S = Split (or duplicate) Sample Value

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

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

Washington Closure Hanford **CALCULATION SHEET**

Originator H. M. Sulloway **Date** 11/01/07 **Calc. No.** 0100F-CA-V0319 **Rev. No.** 0
Project 100-F Field Remediation **Job No.** 14655 **Checked** M. J. Appel **Date** 11/5/07
Subject 100-F-26:8, 1607-F1 Cleanup Verification 95% UCL Calculation **Sheet No.** 3 of 8

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the shallow zone excavation, the WAC 173-340-740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the RSVP for this site.

Results Summary - Shallow Zone Excavation

Analyte	95% UCL Result[a]	Maximum Value[a]	Units
Arsenic	2.2		mg/kg
Barium	62.6		mg/kg
Beryllium	0.30		mg/kg
Chromium	12.0		mg/kg
Cobalt	5.6		mg/kg
Copper	11.2		mg/kg
Lead	7.9		mg/kg
Manganese	264		mg/kg
Nickel	8.8		mg/kg
Vanadium	33.1		mg/kg
Zinc	37.7		mg/kg
Bis (2-ethylhexyl) phthalate	0.12		mg/kg
Antimony		1.1	mg/kg
Boron		2.1	mg/kg
Mercury		0.16	mg/kg
Molybdenum		0.52	mg/kg
Selenium		1.4	mg/kg
Silver		0.51	mg/kg
Total Petroleum Hydrocarbons		253	mg/kg
Alpha-Chlordane		0.0042	mg/kg
Beta-BHC		0.0006	mg/kg
4,4'-DDD		0.0012	mg/kg
4,4'-DDE		0.011	mg/kg
4,4'-DDT		0.0030	mg/kg
Endosulfan I		0.00053	mg/kg
Gamma-Chlordane		0.0025	mg/kg
Heptachlor epoxide		0.0006	mg/kg
Methoxychlor		0.001	mg/kg
Dibenz(a,h)anthracene		0.029	mg/kg
Fluoranthene		0.022	mg/kg
Phenanthrene		0.018	mg/kg
Pyrene		0.029	mg/kg

WAC 173-340-740(7)(e) Evaluation:

WAC 173-340 3-Part Test for most stringent RAG:

95% UCL > Cleanup Limit?	NO
> 10% above Cleanup Limit?	NO
Any sample > 2x Cleanup Limit?	NO

[a]The 95% UCL result or maximum value, depending on data censorship, as described in the methodology section.
QA/QC = quality assurance/quality control
RSVP = remaining sites verification package

Relative Percent Difference Results[b] - QA/QC Analysis

Analyte	Duplicate Analysis[c]
Aluminum	31.9%
Barium	11.1%
Calcium	8.2%
Chromium	36.9%
Copper	7.3%
Iron	36.7%
Magnesium	29.7%
Manganese	14.7%
Silicon	92.4%
Vanadium	51.1%
Zinc	27.0%

[b]Relative percent difference evaluation was not required for analytes not included in this table.
[c]These values are discussed in the RSVP.

Abbreviations/Acronyms:
The following abbreviations and/or acronyms are used in this calculation:
B = blank contamination (organics)
BG = background
C = blank contamination (inorganics)
COC = contaminant of concern
COPC = contaminant of potential concern
DE = direct exposure
GW = groundwater
J = estimate
MDA = minimal detectable activity
MTCA = *Model Toxics Control Act*
PQL = practical quantitation limit
Q = qualifier
QA/QC = quality assurance/quality control
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
RSVP = remaining sites verification package
SAP = sampling and analysis plan
TDL = target detection limit
U = undetected
UCL = upper confidence limit
X = tentatively identified compound quantified relative to a response factor generated from a daily calibration standard
WAC = *Washington Administrative Code*

CALCULATION SHEET

Washington Closure Hanford

Originator H. M. Sulloway

Project 100-F Field Remediation

Subject 100-F-26:8, 1607-F1 Cleanup Verification 95% UCL Calculation

Date 11/05/07

Job No. 14655

Calc. No. 0100F-CA-V0319

Checked M. J. Appel

Rev. No. 0

Date 1/23/07

Sheet No. 4 of 8

1 100-F-26:8 Excavation Shallow Zone Statistical Calculations

2 Verification Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Manganese mg/kg	Q	PQL
4	J15F97	8/13/07	1.4		1.2	38.3	C	0.06	0.18		0.03	5.3	C	0.3	4.2		0.24	10.6		0.27	3.1		1.0	202		0.21
Duplicate of J15F97	J15F98	8/13/07	1.3		1.2	42.8	C	0.06	0.24		0.03	7.7	C	0.3	4.8		0.24	11.4		0.27	2.9		0.98	234		0.21
1	J15F94	8/13/07	1.5		1.2	90.8	C	0.06	0.27		0.03	7.8	C	0.29	6.0		0.24	10.9		0.26	4.6		0.97	283		0.21
2	J15F95	8/13/07	2.0		1.3	41.7	C	0.06	0.22		0.03	6.1	C	0.31	4.9		0.25	11.6		0.26	3.7		1.0	238		0.22
3	J15F96	8/13/07	1.9		1.2	58.9	C	0.06	0.29		0.03	8.3	C	0.29	6.0		0.23	11.5		0.26	4.2		0.94	277		0.2
5	J15F99	8/13/07	2.3		1.2	50.4	C	0.06	0.20		0.03	5.9	C	0.29	4.4		0.23	10.5		0.26	3.0		0.96	191		0.2
6	J15FB0	8/13/07	1.9		1.2	48.2	C	0.06	0.20		0.03	13.9	C	0.29	4.7		0.23	10.2		0.26	2.6		0.95	211		0.2
7	J15FB1	8/13/07	2.3		1.2	54.8	C	0.06	0.26		0.03	9.9	C	0.29	5.6		0.23	10.9		0.26	17.5		0.96	263		0.2
8	J15FB2	8/13/07	1.7		1.2	44.9	C	0.06	0.25		0.03	7.0	C	0.29	5.3		0.23	10.4		0.26	7.1		0.95	238		0.2
9	J15FB3	8/13/07	1.2	U	1.2	48.0	C	0.06	0.30		0.03	21.6	C	0.29	4.8		0.23	10.8		0.26	3.7		0.96	213		0.2
10	J15FB4	8/13/07	2.9		1.2	68.4	C	0.06	0.41		0.03	8.2	C	0.29	6.0		0.23	11.1		0.26	6.5		0.95	292		0.2

16 Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Lead mg/kg	Manganese mg/kg
4	J15F97/J15F98	8/13/07	1.4	40.6	0.2	6.5	4.5	11.0	3.0	218
1	J15F94	8/13/07	1.5	90.8	0.27	7.8	6	10.9	4.6	283
2	J15F95	8/13/07	2	41.7	0.22	6.1	4.9	11.6	3.7	238
3	J15F96	8/13/07	1.9	58.9	0.29	8.3	6	11.5	4.2	277
5	J15F99	8/13/07	2.3	50.4	0.2	5.9	4.4	10.5	3	191
6	J15FB0	8/13/07	1.9	48.2	0.2	13.9	4.7	10.2	2.6	211
7	J15FB1	8/13/07	2.3	54.8	0.26	9.9	5.6	10.9	17.5	263
8	J15FB2	8/13/07	1.7	44.9	0.25	7	5.3	10.4	7.1	238
9	J15FB3	8/13/07	0.6	48	0.3	21.6	4.8	10.8	3.7	213
10	J15FB4	8/13/07	2.9	68.4	0.41	8.2	6	11.1	6.5	292

29 Statistical Computations

95% UCL based on	Arsenic: Large data set (n ≥ 10), use MTCAStat normal distribution.	Barium: Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Beryllium: Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Chromium: Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Cobalt: Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Copper: Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Lead: Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Manganese: Large data set (n ≥ 10), use MTCAStat lognormal distribution.
N	10	10	10	10	10	10	10	10
% < Detection limit	10%	0%	0%	0%	0%	0%	0%	0%
Mean	1.8	54.7	0.26	9.5	5.2	10.9	5.6	242
Standard deviation	0.62	15.2	0.064	4.9	0.64	0.45	4.4	34.7
95% UCL on mean	2.2	62.6	0.30	12.0	5.9	11.2	7.9	264
Maximum value	2.9	90.8	0.41	21.6	6.0	11.6	17.5	292
Final Statistical Value	2.2	62.6	0.30	12.0	5.6	11.2	7.9	264
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 BG/DE/GW & River Protection	132 BG/GW Protection	1.51 BG/GW & River Protection	18.5 BG/GW & River Protection	32 GW Protection	22 BG/River Protection	10.2 BG/GW & River Protection	512 BG/GW Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	NA	NO	NA
> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NA	NO	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NA	NO	NA
WAC 173-340 Compliance? Yes	Because all values are below background (20 mg/kg), the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg), the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg), the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	Because all values are below background (32 mg/kg), the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 mg/kg), the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	Because all values are below background (512 mg/kg), the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford

Originator H. M. Sulloway
Project 100-F Field Remediation
Subject 100-F-26:8, 1607-F1 Cleanup Verification 95% UCL Calculation

Date 11/1/07
Job No. 14655

Calc. No. 0100F-CA-V0319
Checked M. J. Appel

Rev. No. 0
Date 11/05/07
Sheet No. 5 of 8

1 **100-F-26:8 Excavation Shallow Zone Statistical Calculations**

2 **Verification Data**

3				Nickel			Vanadium			Zinc			Bis(2-ethylhexyl) phthalate		
4	Sample Area	Sample Number	Sample Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	4	J15F97	8/13/07	7.0		0.82	19.8		0.24	23.1	C	0.12	0.036	J	0.35
6	Duplicate of J15F97	J15F98	8/13/07	8.7		0.8	33.4		0.24	30.3	C	0.12	0.022	J	0.33
7	1	J15F94	8/13/07	8.3		0.79	32.5		0.24	49.4	C	0.12	0.33	U	0.33
8	2	J15F95	8/13/07	7.7		0.84	26.3		0.25	27.7	C	0.12	0.022	J	0.35
9	3	J15F96	8/13/07	9.0		0.77	35.2		0.23	37.1	C	0.11	0.043	J	0.33
10	5	J15F99	8/13/07	7.2		0.79	26.1		0.23	24.2	C	0.12	0.044	J	0.33
11	6	J15FB0	8/13/07	8.1		0.78	29.3		0.23	27.1	C	0.12	0.036	J	0.33
12	7	J15FB1	8/13/07	8.7		0.79	35.7		0.23	33.6	C	0.12	0.27	J	0.33
13	8	J15FB2	8/13/07	8.5		0.77	32.3		0.23	31.1	C	0.11	0.074	J	0.33
14	9	J15FB3	8/13/07	8.4		0.79	30.0		0.23	32.9	C	0.12	0.027	J	0.33
15	10	J15FB4	8/13/07	9.8		0.78	33.6		0.23	39.2	C	0.12	0.022	J	0.33

16 **Statistical Computation Input Data**

17				Nickel			Vanadium			Zinc			Bis(2-ethylhexyl) phthalate		
18	Sample Area	Sample Number	Sample Date	mg/kg			mg/kg			mg/kg			mg/kg		
19	4	J15F97/J15F98	8/13/07	7.9			26.6			26.7			0.029		
20	1	J15F94	8/13/07	8.3			32.5			40.4			0.17		
21	2	J15F95	8/13/07	7.7			26.3			27.7			0.022		
22	3	J15F96	8/13/07	9.0			35.2			37.1			0.043		
23	5	J15F99	8/13/07	7.2			26.1			24.2			0.044		
24	6	J15FB0	8/13/07	8.1			29.3			27.1			0.036		
25	7	J15FB1	8/13/07	8.7			35.7			33.6			0.27		
26	8	J15FB2	8/13/07	8.5			32.3			31.1			0.074		
27	9	J15FB3	8/13/07	8.4			30.0			32.9			0.027		
28	10	J15FB4	8/13/07	9.8			33.6			39.2			0.022		

29 **Statistical Computations**

30		Nickel		Vanadium		Zinc		Bis(2-ethylhexyl) phthalate	
	95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.		Large data set (n ≥ 10), use MTCAStat lognormal distribution.		Large data set (n ≥ 10), use MTCAStat lognormal distribution.		Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	
31									
32	N	10		10		10		10	
33	% < Detection limit	0%		0%		0%		10%	
34	Mean	8.4		30.8		32.9		0.073	
35	Standard deviation	0.73		3.64		7.5		0.081	
36	95% UCL on mean	8.8		33.1		37.7		0.12	
37	Maximum value	9.8		35.7		49.4		0.27	
38	Final Statistical Value	8.8		33.1		37.7		0.12	
39	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	19.1	BG/GW Protection	85.1	BG/GW Protection	67.8	BG/River Protection	0.36	River Protection
40	**WAC 173-340 3-PART TEST**								
41	95% UCL > Cleanup Limit?	NA		NA		NA		NA	
42	> 10% above Cleanup Limit?	NA		NA		NA		NA	
43	Any sample > 2X Cleanup Limit?	NA		NA		NA		NA	
44	**WAC 173-340 Compliance?**	Because all values are below background (19.1 mg/kg), the WAC 173-340 3-part test is not required.		Because all values are below background (85.1 mg/kg), the WAC 173-340 3-part test is not required.		Because all values are below background (67.8 mg/kg), the WAC 173-340 3-part test is not required.		Because all values are below background (0.36 mg/kg), the WAC 173-340 3-part test is not required.	

CALCULATION SHEET

Washington Closure Hanford
Originator H. M. Sulloway
Project 100-F Field Remediation
Subject 100-F-26:8, 1607-F1 Cleanup Verification 95% UCL Calculation

Date 11/01/07
Job No. 14655

Calc. No. 0100F-CA-V0319
Checked M. J. Appel

Rev. No. 0
Date 11/9/07
Sheet No. 6 of 8

Duplicate Analysis

Sampling Area	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Calcium			Total Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	J15F97	8/13/07	3500		5.0	0.8	C	0.7	1.4		1.2	38.3	C	0.06	0.18		0.03	3530	C	2.2	5.3	C	0.3	4.2		0.24
Duplicate of J15F97	J15F98	8/13/07	4830		4.9	1.1	C	0.7	1.3		1.2	42.8	C	0.06	0.24		0.03	3830	C	2.1	7.7	C	0.3	4.8		0.24

Analysis:

	TDL	5	0.6	10	2	0.5	100	1	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	*31.9%*			11.1%		8.2%	*36.9%*	
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese			Nickel			Potassium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	J15F97	8/13/07	10.6		0.27	9040	C	7.3	3.1		1	2490	C	2.5	202		0.21	7		0.82	642	C	9.7	1940	C	2.6
Duplicate of J15F97	J15F98	8/13/07	11.4		0.27	13100	C	7.1	2.9		0.98	3360	C	2.4	234		0.21	8.7		0.8	766	C	9.5	714	C	2.6

Analysis:

	TDL	1	5	5	75	5	4	400	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	7.3%	*36.7%*		29.7%	14.7%			*92.4%*
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable

Sampling Area	HEIS Number	Sample Date	Sodium			Vanadium			Zinc			Bis(2-ethylhexyl) phthalate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	J15F97	8/13/07	109	C	2.1	19.8		0.24	23.1	C	0.12	0.036	J	0.35
Duplicate of J15F97	J15F98	8/13/07	120	C	2.1	33.4		0.24	30.3	C	0.12	0.022	J	0.33

Analysis:

	TDL	50	2.5	1	0.33
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	
	RPD		*51.1%*	27.0%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford
Originator H. M. Sulloway
Project 100-F Field Remediation
Subject 100-F-26:8, 1607-F1 Cleanup Verification 95% UCL Calculation

Date 11/01/07
Job No. 14655

Calc. No. 0100F-CA-V0319
Checked M. J. Appel

Rev. No. 0
Date 11/5/07
Sheet No. 7 of 8

Ecology Software (MTCAStat) Results

Arsenic 95% UCL Calculation

DATA	ID
	J15F97/J
1.35	15F98
1.5	J15F94
2.0	J15F95
1.9	J15F96
2.3	J15F99
1.9	J15FB0
2.3	J15FB1
1.7	J15FB2
0.6	J15FB3
2.9	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	1.85
Censored		Lognormal mean	1.89
Detection limit or PQL		Std. devn.	0.62
Method detection limit		Median	1.9
TOTAL	10	Min.	0.6
		Max.	2.9

Lognormal distribution? r-squared is: 0.824
Normal distribution? r-squared is: 0.952
Recommendations:
Use normal distribution.

UCL (Land's method) is 2.2

Barium 95% UCL Calculation

DATA	ID
40.55	J15F97/
	J15F98
90.8	J15F94
41.7	J15F95
58.9	J15F96
50.4	J15F99
48.2	J15FB0
54.8	J15FB1
44.9	J15FB2
48	J15FB3
68.4	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	54.67
Censored		Lognormal mean	54.71
Detection limit or PQL		Std. devn.	15.20
Method detection limit		Median	49.3
TOTAL	10	Min.	40.55
		Max.	90.8

Lognormal distribution? r-squared is: 0.899
Normal distribution? r-squared is: 0.819
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 62.6

Beryllium 95% UCL Calculation

DATA	ID
	J15F97/J
0.21	15F98
0.27	J15F94
0.22	J15F95
0.29	J15F96
0.2	J15F99
0.2	J15FB0
0.26	J15FB1
0.25	J15FB2
0.3	J15FB3
0.41	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	0.26
Censored		Lognormal mean	0.26
Detection limit or PQL		Std. devn.	0.064
Method detection limit		Median	0.255
TOTAL	10	Min.	0.2
		Max.	0.41

Lognormal distribution? r-squared is: 0.914
Normal distribution? r-squared is: 0.852
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.30

Chromium 95% UCL Calculation

DATA	ID
6.50	J15F97/J
	15F98
7.8	J15F94
6.1	J15F95
8.3	J15F96
5.9	J15F99
13.9	J15FB0
9.9	J15FB1
7	J15FB2
21.60	J15FB3
8.2	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	9.52
Censored		Lognormal mean	9.49
Detection limit or PQL		Std. devn.	4.85
Method detection limit		Median	8
TOTAL	10	Min.	5.9
		Max.	21.6

Lognormal distribution? r-squared is: 0.851
Normal distribution? r-squared is: 0.721
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 12.0

Cobalt 95% UCL Calculation

DATA	ID
4.5	J15F97/
	J15F98
6	J15F94
4.9	J15F95
6	J15F96
4.4	J15F99
4.7	J15FB0
5.6	J15FB1
5.3	J15FB2
4.8	J15FB3
5	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	5.22
Censored		Lognormal mean	5.22
Detection limit or PQL		Std. devn.	0.64
Method detection limit		Median	5.1
TOTAL	10	Min.	4.4
		Max.	6

Lognormal distribution? r-squared is: 0.914
Normal distribution? r-squared is: 0.906
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 5.6

Copper 95% UCL Calculation

DATA	ID
11.0	J15F97/J
	15F98
10.9	J15F94
11.6	J15F95
11.5	J15F96
10.5	J15F99
10.2	J15FB0
10.9	J15FB1
10.4	J15FB2
10.8	J15FB3
11.1	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	10.89
Censored		Lognormal mean	10.89
Detection limit or PQL		Std. devn.	0.45
Method detection limit		Median	10.9
TOTAL	10	Min.	10.2
		Max.	11.6

Lognormal distribution? r-squared is: 0.970
Normal distribution? r-squared is: 0.969
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.2

CALCULATION SHEET

Washington Closure Hanford
Originator H. M. Sulloway
Project 100-F Field Remediation
Subject 100-F-26:8, 1607-F1 Cleanup Verification 95% UCL Calculation

Date 11/01/07
Job No. 14655

Calc. No. 0100F-CA-V0319
Checked M. J. Appel 11/5/07

Rev. No. 0
Date 11/5/07
Sheet No. 8 of 8

Ecology Software (MTCAStat) Results

Lead 95% UCL Calculation

DATA	ID
3.0	J15F97/ J15F98
4.6	J15F94
3.7	J15F95
4.2	J15F96
3.0	J15F99
2.6	J15FB0
17.5	J15FB1
7.1	J15FB2
3.7	J15FB3
6.5	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	5.3
Censored		Lognormal mean	5.5
Detection limit or PQL		Std. devn.	4.4
Method detection limit		Median	4.0
TOTAL	10	Min.	2.6
		Max.	17.5

Lognormal distribution? r-squared is: 0.849
Normal distribution? r-squared is: 0.631
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 7.9

Manganese 95% UCL Calculation

DATA	ID
218	J15F97/ J15F98
293	J15F94
238	J15F95
277	J15F96
191	J15F99
211	J15FB0
283	J15FB1
238	J15FB2
213	J15FB3
292	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	242
Censored		Lognormal mean	243
Detection limit or PQL		Std. devn.	35
Method detection limit		Median	238
TOTAL	10	Min.	191
		Max.	292

Lognormal distribution? r-squared is: 0.957
Normal distribution? r-squared is: 0.954
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 264

Nickel 95% UCL Calculation

DATA	ID
7.9	J15F97/ J15F98
8.3	J15F94
7.7	J15F95
9.0	J15F96
7.2	J15F99
8.1	J15FB0
8.7	J15FB1
8.5	J15FB2
8.4	J15FB3
9.8	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	8.4
Censored		Lognormal mean	8.4
Detection limit or PQL		Std. devn.	0.7
Method detection limit		Median	8.4
TOTAL	10	Min.	7.2
		Max.	9.8

Lognormal distribution? r-squared is: 0.979
Normal distribution? r-squared is: 0.969
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.8

Vanadium 95% UCL Calculation

DATA	ID
26.6	J15F97/ J15F98
32.5	J15F94
26.3	J15F95
35.2	J15F96
26.1	J15F99
29.3	J15FB0
35.7	J15FB1
32.3	J15FB2
30.0	J15FB3
33.6	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	30.8
Censored		Lognormal mean	30.8
Detection limit or PQL		Std. devn.	3.6
Method detection limit		Median	31.2
TOTAL	10	Min.	26.1
		Max.	35.7

Lognormal distribution? r-squared is: 0.932
Normal distribution? r-squared is: 0.938
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 33.1

Zinc 95% UCL Calculation

DATA	ID
26.7	J15F97/ J15F98
49.4	J15F94
27.7	J15F95
37.1	J15F96
24.2	J15F99
27.1	J15FB0
33.6	J15FB1
31.1	J15FB2
32.9	J15FB3
39.2	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	32.9
Censored		Lognormal mean	32.9
Detection limit or PQL		Std. devn.	7.5
Method detection limit		Median	32.0
TOTAL	10	Min.	24.2
		Max.	49.4

Lognormal distribution? r-squared is: 0.953
Normal distribution? r-squared is: 0.904
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 37.7

Bis(2-ethylhexyl) phthalate 95% UCL Calculation

DATA	ID
0.029	J15F97/ J15F98
0.17	J15F94
0.022	J15F95
0.043	J15F96
0.044	J15F99
0.036	J15FB0
0.27	J15FB1
0.074	J15FB2
0.027	J15FB3
0.022	J15FB4

Number of samples		Uncensored values	
Uncensored	10	Mean	0.073
Censored		Lognormal mean	0.071
Detection limit or PQL		Std. devn.	0.081
Method detection limit		Median	0.040
TOTAL	10	Min.	0.022
		Max.	0.27

Lognormal distribution? r-squared is: 0.864
Normal distribution? r-squared is: 0.670
Recommendations:
Reject BOTH lognormal and normal distributions.
UCL (based on Z-statistic) is 0.12

Attachment 1. 100-F-26:8 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Gross alpha		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
S Road Crossing (north)	J14YW4	4/3/2007	0.12	U	0.12	0.11	U	0.11	0.13	U	0.13	0.31	U	0.31	0.37	U	0.37	0.2	U	0.2	57.2	J	7.8
Crossing BCL Stockpile	J14YW5	4/3/2007	0.39	U	0.39	0.11	U	0.11	0.14	U	0.14	0.28	U	0.28	0.42	U	0.42	0.29	U	0.29	14.8	J	7.6
S Road Crossing (south)	J14YW6	1/1/06	0.099	U	0.099	0.12	U	0.12	0.12	U	0.12	0.31	U	0.31	0.39	U	0.39	0.23	U	0.23	12.1	J	8.5

Sample Location	HEIS Number	Sample Date	Gross beta			Plutonium-238			Plutonium-239/240			Potassium-40			Radium-226			Radium-228			Silver 108-metastable		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
S Road Crossing (north)	J14YW4	4/3/2007	30.8		5.4	0.0322	U	0.25	0	U	0.25	8.24		0.93	0.232		0.19	0.52	U	0.52	0.086	U	0.086
Crossing BCL Stockpile	J14YW5	4/3/2007	18.2		5.5							12.3		0.92	0.432		0.17	0.756		0.43	0.085	U	0.085
S Road Crossing (south)	J14YW6	4/3/2007	27.6		5.9							16.9		0.69	0.302		0.25	0.778		0.53	0.084	U	0.084

Sample Location	HEIS Number	Sample Date	Thorium-228			Thorium-232			Total beta			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	pCi/g	Q	MDA
S Road Crossing (north)	J14YW4	4/3/2007	0.615		0.17	0.52	U	0.52	0.0197	U	0.23	0.6		0.088	0.014	U	0.11	0.35	U	0.35	0.416		0.088
S Road Crossing BCL Stockpile	J14YW5	4/3/2007	0.503		0.17	0.756		0.43										0.46	U	0.46			
S Road Crossing (south)	J14YW6	4/3/2007	0.343		0.2	0.778		0.53	0.0439	U	0.22							0.45	U	0.45			

Sample Location	HEIS Number	Sample Date	Uranium-238 GEA		
			pCi/g	Q	MDA
S Road Crossing (north)	J14YW4	4/3/2007	14	U	14
Crossing BCL Stockpile	J14YW5	4/3/2007	15	U	15
S Road Crossing (south)	J14YW6	4/3/2007	13	U	13

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

BHC = hexachlorocyclohexane
C = blank contamination
D = diluted
GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
I = interference
J = estimate
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
U = undetected
X = tentatively identified compound quantified relative to a response factor generated from a daily calibration standard

Attachment	1	Sheet No.	1 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	11/5/07
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	J15F97	8/13/2007	3500		5	0.79	C	0.67	1.4		1.2	38.3	C	0.06	0.18		0.03	1.1	U	1.1	0.15	U	0.15
Duplicate of J15F97	J15F98	8/13/2007	4830		4.9	1.1	C	0.65	1.3		1.2	42.8	C	0.06	0.24		0.03	1.1	U	1.1	0.15	U	0.15
1	J15F94	8/13/2007	5170		4.9	0.88	C	0.65	1.5		1.2	90.8	C	0.06	0.27		0.03	1.2		1.1	0.15	U	0.15
2	J15F95	8/13/2007	4430		5.2	0.69	U	0.69	2		1.3	41.7	C	0.06	0.22		0.03	1.1	U	1.1	0.16	U	0.16
3	J15F96	8/13/2007	5760		4.7	0.88	C	0.63	1.9		1.2	58.9	C	0.06	0.29		0.03	1.4		1	0.14	U	0.14
5	J15F99	8/13/2007	4140		4.8	0.64	U	0.64	2.3		1.2	50.4	C	0.06	0.2		0.03	2.1		1	0.15	U	0.15
6	J15FB0	8/13/2007	4880		4.8	0.63	U	0.63	1.9		1.2	48.2	C	0.06	0.2		0.03	1	U	1	0.14	U	0.14
7	J15FB1	8/13/2007	5310		4.8	0.64	U	0.64	2.3		1.2	54.8	C	0.06	0.26		0.03	1	U	1.1	0.15	U	0.15
8	J15FB2	8/13/2007	4790		4.8	0.63	U	0.63	1.7		1.2	44.9	C	0.06	0.25		0.03	1	U	1	0.14	U	0.14
9	J15FB3	8/13/2007	4520		4.8	0.64	U	0.64	1.2	U	1.2	48	C	0.06	0.3		0.03	1	U	1	0.15	U	0.15
10	J15FB4	8/13/2007	5650		4.8	0.64	U	0.64	2.9		1.2	68.4	C	0.06	0.41		0.03	1	U	1	0.14	U	0.14
French Drain 11	J15FB5	8/13/2007	5080		4.9	0.65	U	0.65	1.8		1.2	51.9	C	0.06	0.34		0.03	1.1	U	1.1	0.15	U	0.15
French Drain 12	J15FB6	8/13/2007	4560		5	0.66	U	0.66	2.2		1.2	48.3	C	0.06	0.34		0.03	1.1	U	1.1	0.15	U	0.15
French Drain 13	J15FB7	8/13/2007	6830		4.8	0.64	U	0.64	2.6		1.2	85.2	C	0.06	0.46		0.03	1	U	1	0.14	U	0.14
N Road Crossing 14	J15F90	8/27/2007	4090	C	5.1	0.67	U	0.67	1.2	U	1.2	30.7	C	0.06	0.16		0.03	1.1	U	1.1	0.15	U	0.15
N Road Crossing 15	J15F91	8/27/2007	4010	C	5	0.67	U	0.67	1.2	U	1.2	26.1	C	0.06	0.18		0.03	1.1	U	1.1	0.15	U	0.15
N Road Crossing 16	J15F92	8/27/2007	2990	C	5	0.67	U	0.97	1.2	U	1.2	22.1	C	0.06	0.13		0.03	1.1	U	1.1	0.15	U	0.15
N Road Crossing BCL	J15F93	8/27/2007	4190	C	5.1	0.68	U	0.68	1.3	U	1.3	46.4	C	0.06	0.19		0.03	1.6	C	1.1	0.16	U	0.16
BCL-A	J15FB8	8/13/2007	5040		4.9	0.65	U	0.65	1.2	U	1.2	60.2	C	0.06	0.34		0.03	1.1	U	1.1	0.15	U	0.15
BCL-B	J15FB9	8/13/2007	6920		5.2	0.69	U	0.69	3.1		1.3	76.2	C	0.06	0.45		0.03	1.1	U	1.1	0.16	U	0.16
BCL-C	J15FC0	8/13/2007	6070		4.8	0.63	U	0.63	1.7		1.2	58.4	C	0.06	0.4		0.03	1	U	1	0.14	U	0.15
BCL-D	J15FC1	8/13/2007	5800		4.8	0.63	U	0.63	1.6		1.2	60.4	C	0.06	0.38		0.03	1.3		1	0.14	U	0.14
Equipment Blank	J15FC2	8/13/2007	66.4		1.6	0.22	U	0.22	0.4	U	0.4	1.7	C	0.02	0.02		0.01	0.35	U	0.35	0.05	U	0.05
S Road Crossing (north)	J14YW4	4/3/2007	3990		8.4	1.9	UJ	1.9	2.4	U	2.4	25.3		0.12	0.17		0.06	2.2	U	2.2	0.17	U	0.17
S Road Crossing BCL Stockpile	J14YW5	4/3/2007	5840		8.6	1.9	UJ	1.9	3.9		2.4	48.2		0.12	0.28		0.06	2.2	U	2.2	0.18	U	0.18
S Road Crossing (south)	J14YW6	4/3/2007	4160		8.3	1.8	UJ	1.8	2.5		2.3	24.2		0.11	0.19		0.06	2.2	U	2.2	0.17	U	0.17

Attachment	1	Sheet No.	2 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	J15F97	8/13/2007	3530	C	2.2	5.3	C	0.3	4.2		0.24	10.6		0.27				9040	C	7.3	3.1		1
Duplicate of J15F97	J15F98	8/13/2007	3830	C	2.1	7.7	C	0.3	4.8		0.24	11.4		0.27				13100	C	7.1	2.9		0.98
1	J15F94	8/13/2007	2980	C	2.1	7.8	C	0.29	6		0.24	10.9		0.26				14100	C	7	4.6		0.97
2	J15F95	8/13/2007	3060	C	2.2	6.1	C	0.31	4.9		0.25	11.6		0.28				11600	C	7.5	3.7		1
3	J15F96	8/13/2007	3010	C	2	8.3	C	0.29	6		0.23	11.5		0.26				15600	C	6.8	4.2		0.94
5	J15F99	8/13/2007	3190	C	2.1	5.9	C	0.29	4.4		0.23	10.5		0.26				10600	C	7	3		0.96
6	J15FB0	8/13/2007	4430	C	2	13.9	C	0.29	4.7		0.23	10.2		0.26				12100	C	6.9	2.6		0.95
7	J15FB1	8/13/2007	3320	C	2.1	9.9	C	0.29	5.6		0.23	10.9		0.26				15200	C	7	17.5		0.96
8	J15FB2	8/13/2007	3200	C	2	7	C	0.29	5.3		0.23	10.4		0.26				13200	C	6.9	7.1		0.95
9	J15FB3	8/13/2007	3530	C	2.1	21.6	C	0.29	4.8		0.23	10.8		0.26				12700	C	7	3.7		0.96
10	J15FB4	8/13/2007	3250	C	2.1	8.2	C	0.29	6		0.23	11.1		0.26				15600	C	3.9	6.5		0.95
French Drain 11	J15FB5	8/13/2007	3660	C	2.1	7.2	C	0.29	5.3		0.24	10.7		0.27				14200	C	7	3.6		0.97
French Drain 12	J15FB6	8/13/2007	3600	C	2.1	7.3	C	0.3	5.4		0.24	10.9		0.27				13000	C	7.2	4.2		0.99
French Drain 13	J15FB7	8/13/2007	3700	C	2.1	9.6	C	0.29	7.3		0.23	11.1		0.26				19000	C	6.9	7.1		0.95
N Road Crossing 14	J15F90	8/27/2007	3680	C	2.2	6.1	C	0.3	4.3		0.24	12.2		0.27				10900		7.3	2.4		1
N Road Crossing 15	J15F91	8/27/2007	4970	C	2.2	6.4	C	0.3	4.1		0.24	11.4		0.27				10800		7.3	2.4		1
N Road Crossing 16	J15F92	8/27/2007	4230	C	2.2	4.3	C	0.3	3.7		0.04	10.8		0.27				8000		7.2	2.6		1
N Road Crossing BCL	J15F93	8/27/2007	3750	C	2.2	5.7	C	0.31	4.9		0.25	12.7		0.28				11500		7.4	4.8		1
BCL-A	J15FB8	8/13/2007	3060	C	2.1	7.3	C	0.29	5		0.24	8.9		0.26				13400	C	7	5.1		0.97
BCL-B	J15FB9	8/13/2007	4270	C	2.2	10.5	C	0.31	7.2		0.25	11.4		0.28				20300	C	7.5	11.5		1
BCL-C	J15FC0	8/13/2007	3540	C	2	9.5	C	0.29	6.2		0.23	10		0.26				17700	C	6.9	4.5		0.95
BCL-D	J15FC1	8/13/2007	3820	C	2	9	C	0.29	6.2		0.23	10.6		0.26				17000	C	9.8	9.2		0.95
Equipment Blank	J15FC2	8/13/2007	24.7	C	0.7	0.17	C	0.1	0.08	U	0.08	0.09	U	0.09				182	C	2.3	0.41		0.32
S Road Crossing (north)	J14YW4	4/3/2007	3770	C	4.3	7.6	C	0.46	4.2		0.52	11		0.69	0.21	U	0.21	11500		17.1	3		1.6
S Road Crossing BCL Stockpile	J14YW5	4/3/2007	4360	C	4.4	8.7	C	0.47	5.6		0.53	12.9		0.71	0.22		0.21	15700		17.4	3.9		1.6
S Road Crossing (south)	J14YW6	4/3/2007	4850	C	4.3	7.8	C	0.45	4.4		0.51	11.3		0.68	0.2	U	0.2	11900		16.8	2.7		1.6

Attachment	1	Sheet No.	3 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	J15F97	8/13/2007	2490	C	2.5	202		0.21	0.02	U	0.02	0.49	U	0.49	7.0		0.82	642	C	9.7	1.3	U	1.3
Duplicate of J15F97	J15F98	8/13/2007	3360	C	2.4	234		0.21	0.01	U	0.01	0.48	U	0.48	8.7		0.8	766	C	9.5	1.3	U	1.3
1	J15F94	8/13/2007	3190	C	2.4	283		0.21	0.16		0.02	0.47	U	0.47	8.3		0.79	1050	C	9.4	1.3		1.3
2	J15F95	8/13/2007	2980	C	2.5	238		0.22	0.02	U	0.02	0.5	U	0.5	7.7		0.84	819	C	10	1.3	U	1.3
3	J15F96	8/13/2007	3600	C	2.3	277		0.2	0.02		0.01	0.46	U	0.46	9.0		0.77	1300	C	9.1	1.2	U	1.2
5	J15F99	8/13/2007	2790	C	2.4	191		0.2	0.01	U	0.01	0.52		0.47	7.2		0.79	576	C	9.3	1.3	U	1.3
6	J15FB0	8/13/2007	3480	C	2.3	211		0.2	0.01	U	0.01	0.48		0.46	8.1		0.78	1030	C	9.2	1.2	U	1.2
7	J15FB1	8/13/2007	3430	C	2.4	263		0.2	0.01	U	0.01	0.47	U	0.47	8.7		0.79	892	C	9.2	1.4		1.2
8	J15FB2	8/13/2007	3280	C	2.3	238		0.2	0.02	U	0.02	0.46	U	0.46	8.5		0.77	773	C	9.2	1.2	U	1.2
9	J15FB3	8/13/2007	3040	C	2.4	213		0.2	0.02	U	0.02	0.49		0.47	8.4		0.79	725	C	9.3	1.3	U	1.3
10	J15FB4	8/13/2007	3530	C	2.3	292		0.2	0.01	U	0.01	0.46	U	0.46	9.8		0.78	1350	C	9.3	1.2	U	1.2
French Drain 11	J15FB5	8/13/2007	3270	C	2.4	267		0.21	0.01	U	0.01	0.47	U	0.47	8.4		0.8	915	C	9.4	1.3	U	1.3
French Drain 12	J15FB6	8/13/2007	3110	C	2.4	253		0.21	0.01	U	0.01	0.48	U	0.48	9.2		0.81	938	C	9.6	1.3	U	1.3
French Drain 13	J15FB7	8/13/2007	4050	C	2.3	364		0.2	0.02	U	0.02	0.46	U	0.46	10.3		0.78	1790	C	9.3	1.2	U	1.2
N Road Crossing 14	J15F90	8/27/2007	2890	C	2.5	192		0.21	0.02	U	0.02	0.49	U	0.49	7.2		0.82	605		9.8	1.3	U	1.3
N Road Crossing 15	J15F91	8/27/2007	3010	C	2.5	194		0.21	0.02	U	0.02	0.49	U	0.49	8.5		0.82	548		9.7	1.3	U	1.3
N Road Crossing 16	J15F92	8/27/2007	2220	C	2.5	156		0.21	0.02	U	0.02	0.48	U	0.48	7.5		0.82	467		9.7	1.3	U	1.3
N Road Crossing BCL	J15F93	8/27/2007	2980	C	2.5	220		0.22	0.02	U	0.02	0.5	U	0.5	8.4		0.84	725		9.9	1.3	U	1.3
BCL-A	J15FB8	8/13/2007	2960	C	2.4	244		0.21	0.01	U	0.01	0.47	U	0.47	7.7		0.79	1150	C	9.4	1.3	U	1.3
BCL-B	J15FB9	8/13/2007	4070	C	2.5	332		0.22	0.02	U	0.02	0.5	U	0.5	10.6		0.85	1380	C	10	1.3	U	1.2
BCL-C	J15FC0	8/13/2007	3580	C	2.3	293		0.2	0.01	U	0.01	0.46	U	0.46	9.5		0.78	1140	C	9.2	1.2	U	1.2
BCL-D	J15FC1	8/13/2007	3540	C	2.3	291		0.2	0.01	U	0.01	0.46	U	0.46	9.4		0.77	1030	C	9.2	1.2	U	1.2
Equipment Blank	J15FC2	8/13/2007	9	C	0.79	4.7		0.07	0.01	U	0.01	0.16	U	0.16	0.26	U	0.26	33.8	C	3.1	0.42	U	0.42
S Road Crossing (north)	J14YW4	4/3/2007	3080		4.2	208	C	0.12	0.02	U	0.02	0.75	U	0.75	9.5		1.1	535		28.2	2.1	U	2.1
S Road Crossing BCL Stockpile	J14YW5	4/3/2007	3810		4.3	272	C	0.12	0.02	U	0.02	0.76	U	0.76	9.2		1.1	949		28.7	2.2	U	2.2
S Road Crossing (south)	J14YW6	4/3/2007	3210		4.1	204	C	0.11	0.02	U	0.02	0.74	U	0.74	8.8		1.1	515		27.7	2.1	U	2.1

Attachment	1	Sheet No.	4 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc			Total petroleum hydrocarbons		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	J15F97	8/13/2007	1940	C	2.6	0.27	U	0.27	109	C	2.1	19.8		0.24	23.1	C	0.12	140	U	140
Duplicate of J15F97	J15F98	8/13/2007	714	C	2.6	0.27	U	0.27	120	C	2.1	33.4		0.24	30.3	C	0.12	134	U	134
1	J15F94	8/13/2007	1850	C	2.5	0.51		0.26	128	C	2.1	32.5		0.24	49.4	C	0.12	133	U	133
2	J15F95	8/13/2007	1480	C	2.7	0.28	U	0.28	138	C	2.2	26.3		0.25	27.7	C	0.12	137	U	137
3	J15F96	8/13/2007	1170	C	2.5	0.26	U	0.26	141	C	2	35.2		0.23	37.1	C	0.11	129	U	129
5	J15F99	8/13/2007	1530	C	2.5	0.26	U	0.26	142	C	2	26.1		0.23	24.2	C	0.12	131	U	131
6	J15FB0	8/13/2007	1720	C	2.5	0.26	U	0.26	172	C	2	29.3		0.23	27.1	C	0.12	133	U	133
7	J15FB1	8/13/2007	867	C	2.5	0.26	U	0.26	172	C	2	35.7		0.23	33.6	C	0.12	253		131
8	J15FB2	8/13/2007	801	C	2.5	0.26	U	0.26	122	C	2	32.3		0.23	31.1	C	0.11	134	U	134
9	J15FB3	8/13/2007	1430	C	2.5	0.26	U	0.26	130	C	2	30		0.23	32.9	C	0.12	133	U	133
10	J15FB4	8/13/2007	1720	C	2.5	0.26	U	0.26	119	C	2	33.6		0.23	39.2	C	0.12	133	U	133
French Drain 11	J15FB5	8/13/2007	1270	C	2.5	0.27	U	0.27	135	C	2.1	34.3		0.24	32.8	C	0.12	133	U	133
French Drain 12	J15FB6	8/13/2007	1620	C	2.6	0.27	U	0.27	118	C	2.1	29.4		0.24	32.4	C	0.12	133	U	133
French Drain 13	J15FB7	8/13/2007	1610	C	2.5	0.26	U	0.26	146	C	2	39.8		0.23	47.4	C	0.12	133	U	133
N Road Crossing 14	J15F90	8/27/2007	940	C	2.6	0.27	U	0.27	112	C	2.1	27.7		0.24	35.1	C	0.12	137	U	137
N Road Crossing 15	J15F91	8/27/2007	863	C	2.6	0.27	U	0.27	155	C	2.1	27.1		0.24	27.3	C	0.12	155	U	155
N Road Crossing 16	J15F92	8/27/2007	884	C	2.6	0.27	U	0.27	136	C	2.1	17.6		0.24	22.3	C	0.12	144	U	144
N Road Crossing BCL	J15F93	8/27/2007	1000	C	2.7	0.28	U	0.28	119	C	2.2	27.3		0.25	38.3	C	0.12	149	U	149
BCL-A	J15FB8	8/13/2007	2360	C	2.5	0.26	U	0.26	124	C	2.1	28.7		0.24	33	C	0.12	131	U	131
BCL-B	J15FB9	8/13/2007	896	C	2.7	0.28	U	0.28	160	C	2.2	45.9		0.25	54	C	0.13	144	U	144
BCL-C	J15FC0	8/13/2007	632	C	2.5	0.26	U	0.26	137	C	2	40.5		0.23	36.5	C	0.11	133	U	133
BCL-D	J15FC1	8/13/2007	1210	C	2.5	0.26	U	0.26	174	C	2	39.7		0.23	38	C	0.11	128	U	128
Equipment Blank	J15FC2	8/13/2007	97.5	C	0.84	0.09	U	0.09	13.9	C	0.69	0.11		0.08	2.1	C	0.04			
S Road Crossing (north)	J14YW4	4/3/2007	554	J	2.4	0.52	U	0.52	127	C	2.5	29.5		0.58	37.3	C	0.17			
S Road Crossing BCL Stockpile	J14YW5	4/3/2007	841	J	2.5	0.53	U	0.53	142	C	2.6	40.4		0.59	34.2	C	0.18			
S Road Crossing (south)	J14YW6	4/3/2007	508	J	2.4	0.51	U	0.51	150	C	2.5	31.9		0.57	26.1	C	0.17			

Attachment	1	Sheet No.	5 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15F97 Sample Location 4 Sample Date 8/13/07			J15F98 Duplicate of J15F97 Sample Date 8/13/07			J15F94 Sample Location 1 Sample Date 8/13/07			J15F95 Sample Location 2 Sample Date 8/13/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls												
Aroclor-1016	14	U	14	13	U	13	13	U	13	14	U	14
Aroclor-1221	14	U	14	13	U	13	13	U	13	14	U	14
Aroclor-1232	14	U	14	13	U	13	13	U	13	14	U	14
Aroclor-1242	14	U	14	13	U	13	13	U	13	14	U	14
Aroclor-1248	14	U	14	13	U	13	13	U	13	14	U	14
Aroclor-1254	14	U	14	13	U	13	13	U	13	14	U	14
Aroclor-1260	14	U	14	13	U	13	13	U	13	14	U	14
Pesticides												
Aldrin	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Alpha-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Alpha-Chlordane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Beta-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Delta-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Dichlorodiphenyldichloroethane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Dichlorodiphenyldichloroethylene	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Dichlorodiphenyltrichloroethane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Dieldrin	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Endosulfan I	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Endosulfan II	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Endosulfan sulfate	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Endrin	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Endrin aldehyde	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Endrin ketone	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Gamma-BHC (Lindane)	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
gamma-Chlordane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Heptachlor	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Heptachlor epoxide	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.8	U	1.8
Methoxychlor	1.7	U	1.7	1.7	U	1.7	0.5	JX	1.7	1.8	U	1.8
Toxaphene	17	U	17	17	U	17	17	U	17	18	U	18
Semivolatile Organic Analytes												
1,2,4-Trichlorobenzene	350	U	350	330	U	330	330	U	330	350	U	350
1,2-Dichlorobenzene	350	U	350	330	U	330	330	U	330	350	U	350
1,3-Dichlorobenzene	350	U	350	330	U	330	330	U	330	350	U	350
1,4-Dichlorobenzene	350	U	350	330	U	330	330	U	330	350	U	350
2,4,5-Trichlorophenol	870	U	870	830	U	830	830	U	830	880	U	880
2,4,6-Trichlorophenol	350	U	350	330	U	330	330	U	330	350	U	350
2,4-Dichlorophenol	350	U	350	330	U	330	330	U	330	350	U	350
2,4-Dimethylphenol	350	U	350	330	U	330	330	U	330	350	U	350
2,4-Dinitrophenol	870	U	870	830	U	830	830	U	830	880	U	880
2,4-Dinitrotoluene	350	U	350	330	U	330	330	U	330	350	U	350
2,6-Dinitrotoluene	350	U	350	330	U	330	330	U	330	350	U	350
2-Chloronaphthalene	350	U	350	330	U	330	330	U	330	350	U	350
2-Chlorophenol	350	U	350	330	U	330	330	U	330	350	U	350
2-Methylnaphthalene	350	U	350	330	U	330	330	U	330	350	U	350
2-Methylphenol (cresol, o-)	350	U	350	330	U	330	330	U	330	350	U	350
2-Nitroaniline	870	U	870	830	U	830	830	U	830	880	U	880
2-Nitrophenol	350	U	350	330	U	330	330	U	330	350	U	350

Attachment	1	Sheet No.	6 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15F97 Sample Location 4 Sample Date 8/13/07			J15F98 Duplicate of J15F97 Sample Date 8/13/07			J15F94 Sample Location 1 Sample Date 8/13/07			J15F95 Sample Location 2 Sample Date 8/13/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (continued)												
3,3'-Dichlorobenzidine	350	U	350	330	U	330	330	U	330	350	U	350
4-Methylphenol (p-cresol)	350	U	350	330	U	330	330	U	330	350	U	350
3-Nitroaniline	870	U	870	830	U	830	830	U	830	880	U	880
4,6-Dinitro-2-methylphenol	870	U	870	830	U	830	830	U	830	880	U	880
4-Bromophenyl-phenylether	350	U	350	330	U	330	330	U	330	350	U	350
4-Chloro-3-methylphenol	350	U	350	330	U	330	330	U	330	350	U	350
4-Chloroaniline	350	U	350	330	U	330	330	U	330	350	U	350
4-Chlorophenyl-phenylether	350	U	350	330	U	330	330	U	330	350	U	350
4-Nitroaniline	870	U	870	830	U	830	830	U	830	880	U	880
4-Nitrophenol	870	U	870	830	U	830	830	U	830	880	U	880
Acenaphthene	350	U	350	330	U	330	330	U	330	350	U	350
Acenaphthylene	350	U	350	330	U	330	330	U	330	350	U	350
Anthracene	350	U	350	330	U	330	330	U	330	350	U	350
Benzo(a)anthracene	350	U	350	330	U	330	330	U	330	350	U	350
Benzo(a)pyrene	350	U	350	330	U	330	330	U	330	350	U	350
Benzo(b)fluoranthene	350	U	350	330	U	330	330	U	330	350	U	350
Benzo(g,h,i)perylene	350	U	350	330	U	330	330	U	330	350	U	350
Benzo(k)fluoranthene	350	U	350	330	U	330	330	U	330	350	U	350
Bis(2-chloro-1-methylethyl)ether	350	U	350	330	U	330	330	U	330	350	U	350
Bis(2-chloroethoxy)methane	350	U	350	330	U	330	330	U	330	350	U	350
Bis(2-chloroethyl) ether	350	U	350	330	U	330	330	U	330	350	U	350
Bis(2-ethylhexyl) phthalate	36	J	350	22	J	330	330	U	330	22	J	350
Butylbenzylphthalate	350	U	350	330	U	330	330	U	330	350	U	350
Carbazole	350	U	350	330	U	330	330	U	330	350	U	350
Chrysene	350	U	350	330	U	330	330	U	330	350	U	350
Dibenz(a,h)anthracene	350	U	350	330	U	330	330	U	330	350	U	350
Dibenzofuran	350	U	350	330	U	330	330	U	330	350	U	350
Diethylphthalate	350	U	350	330	U	330	330	U	330	350	U	350
Dimethylphthalate	350	U	350	330	U	330	330	U	330	350	U	350
Di-n-butylphthalate	350	U	350	330	U	330	330	U	330	350	U	350
Di-n-octylphthalate	350	U	350	330	U	330	330	U	330	350	U	350
Fluoranthene	350	U	350	330	U	330	330	U	330	350	U	350
Fluorene	350	U	350	330	U	330	330	U	330	350	U	350
Hexachlorobenzene	350	U	350	330	U	330	330	U	330	350	U	350
Hexachlorobutadiene	350	U	350	330	U	330	330	U	330	350	U	350
Hexachlorocyclopentadiene	350	U	350	330	U	330	330	U	330	350	U	350
Hexachloroethane	350	U	350	330	U	330	330	U	330	350	U	350
Indeno(1,2,3-cd)pyrene	350	U	350	330	U	330	330	U	330	350	U	350
Isophorone	350	U	350	330	U	330	330	U	330	350	U	350
Naphthalene	350	U	350	330	U	330	330	U	330	350	U	350
Nitrobenzene	350	U	350	330	U	330	330	U	330	350	U	350
N-Nitroso-di-n-dipropylamine	350	U	350	330	U	330	330	U	330	350	U	350
N-Nitrosodiphenylamine	350	U	350	330	U	330	330	U	330	350	U	350
Pentachlorophenol	870	U	870	830	U	830	830	U	830	880	U	880
Phenanthrene	350	U	350	330	U	330	330	U	330	350	U	350
Phenol	350	U	350	330	U	330	330	U	330	350	U	350
Pyrene	350	U	350	330	U	330	330	U	330	350	U	350

Attachment	1	Sheet No.	7 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15F96 Sample Location 3 Sample Date 8/13/07			J15F99 Sample Location 5 Sample Date 8/13/07			J15FB0 Sample Location 6 Sample Date 8/13/07			J15FB1 Sample Location 7 Sample Date 8/13/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls												
Aroclor-1016	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1221	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1232	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1242	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1248	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1254	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1260	13	U	13	13	U	13	13	U	13	13	U	13
Pesticides												
Aldrin	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Alpha-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Alpha-Chlordane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Beta-BHC	0.4	JX	0.4	0.6	JX	1.7	1.7	U	1.7	6.7	U	6.7
Delta-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Dichlorodiphenyldichloroethane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Dichlorodiphenyldichloroethylene	1.7	U	1.7	1.2	JX	1.2	1.7	U	1.7	6.7	U	6.7
Dichlorodiphenyltrichloroethane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Dieldrin	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Endosulfan I	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Endosulfan II	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Endosulfan sulfate	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Endrin	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Endrin aldehyde	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Endrin ketone	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Gamma-BHC (Lindane)	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
gamma-Chlordane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Heptachlor	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Heptachlor epoxide	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	6.7	U	6.7
Methoxychlor	0.57	JX	1.7	1.0	J	1.7	1.7	U	1.7	6.7	U	6.7
Toxaphene	17	U	17	17	U	17	17	U	17	67	U	67
Semivolatile Organic Analytes												
1,2,4-Trichlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
1,2-Dichlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
1,3-Dichlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
1,4-Dichlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
2,4,5-Trichlorophenol	830	U	830	830	U	830	830	U	830	830	U	830
2,4,6-Trichlorophenol	330	U	330	330	U	330	330	U	330	330	U	330
2,4-Dichlorophenol	330	U	330	330	U	330	330	U	330	330	U	330
2,4-Dimethylphenol	330	U	330	330	U	330	330	U	330	330	U	330
2,4-Dinitrophenol	830	U	830	830	U	830	830	U	830	830	U	830
2,4-Dinitrotoluene	330	U	330	330	U	330	330	U	330	330	U	330
2,6-Dinitrotoluene	330	U	330	330	U	330	330	U	330	330	U	330
2-Chloronaphthalene	330	U	330	330	U	330	330	U	330	330	U	330
2-Chlorophenol	330	U	330	330	U	330	330	U	330	330	U	330
2-Methylnaphthalene	330	U	330	330	U	330	330	U	330	330	U	330
2-Methylphenol (cresol, o-)	330	U	330	330	U	330	330	U	330	330	U	330
2-Nitroaniline	830	U	830	830	U	830	830	U	830	830	U	830
2-Nitrophenol	330	U	330	330	U	330	330	U	330	330	U	330

Attachment	1	Sheet No.	8 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15F96 Sample Location 3 Sample Date 8/13/07			J15F99 Sample Location 5 Sample Date 8/13/07			J15FB0 Sample Location 6 Sample Date 8/13/07			J15FB1 Sample Location 7 Sample Date 8/13/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (continued)												
3,3'-Dichlorobenzidine	330	U	330	330	U	330	330	U	330	330	U	330
4-Methylphenol (p-cresol)	330	U	330	330	U	330	330	U	330	330	U	330
3-Nitroaniline	830	U	830	830	U	830	830	U	830	830	U	830
4,6-Dinitro-2-methylphenol	830	U	830	830	U	830	830	U	830	830	U	830
4-Bromophenyl-phenylether	330	U	330	330	U	330	330	U	330	330	U	330
4-Chloro-3-methylphenol	330	U	330	330	U	330	330	U	330	330	U	330
4-Chloroaniline	330	U	330	330	U	330	330	U	330	330	U	330
4-Chlorophenyl-phenylether	330	U	330	330	U	330	330	U	330	330	U	330
4-Nitroaniline	830	U	830	830	U	830	830	U	830	830	U	830
4-Nitrophenol	830	U	830	830	U	830	830	U	830	830	U	830
Acenaphthene	330	U	330	330	U	330	330	U	330	330	U	330
Acenaphthylene	330	U	330	330	U	330	330	U	330	330	U	330
Anthracene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(a)anthracene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(a)pyrene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(b)fluoranthene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(g,h,i)perylene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(k)fluoranthene	330	U	330	330	U	330	330	U	330	330	U	330
Bis(2-chloro-1-methylethyl)ether	330	U	330	330	U	330	330	U	330	330	U	330
Bis(2-chloroethoxy)methane	330	U	330	330	U	330	330	U	330	330	U	330
Bis(2-chloroethyl) ether	330	U	330	330	U	330	330	U	330	330	U	330
Bis(2-ethylhexyl) phthalate	43	J	330	44	J	330	36	J	330	270	J	330
Butylbenzylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Carbazole	330	U	330	330	U	330	330	U	330	330	U	330
Chrysene	330	U	330	330	U	330	330	U	330	330	U	330
Dibenz(a,h)anthracene	330	U	330	330	U	330	22	J	330	29	J	330
Dibenzofuran	330	U	330	330	U	330	330	U	330	330	U	330
Diethylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Dimethylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Di-n-butylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Di-n-octylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Fluoranthene	22	J	330	330	U	330	330	U	330	330	U	330
Fluorene	330	U	330	330	U	330	330	U	330	330	U	330
Hexachlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
Hexachlorobutadiene	330	U	330	330	U	330	330	U	330	330	U	330
Hexachlorocyclopentadiene	330	U	330	330	U	330	330	U	330	330	U	330
Hexachloroethane	330	U	330	330	U	330	330	U	330	330	U	330
Indeno(1,2,3-cd)pyrene	330	U	330	330	U	330	330	U	330	330	U	330
Isophorone	330	U	330	330	U	330	330	U	330	330	U	330
Naphthalene	330	U	330	330	U	330	330	U	330	330	U	330
Nitrobenzene	330	U	330	330	U	330	330	U	330	330	U	330
N-Nitroso-di-n-dipropylamine	330	U	330	330	U	330	330	U	330	330	U	330
N-Nitrosodiphenylamine	330	U	330	330	U	330	330	U	330	330	U	330
Pentachlorophenol	830	U	830	830	U	830	830	U	830	830	U	830
Phenanthrene	18	J	330	330	U	330	330	U	330	330	U	330
Phenol	330	U	330	330	U	330	330	U	330	330	U	330
Pyrene	29	J	330	18	J	330	330	U	330	330	U	330

Attachment	1	Sheet No.	9 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15FB2 Sample Location 8 Sample Date 8/13/07			J15FB3 Sample Location 9 Sample Date 8/13/07			J15FB4 Sample Location 10 Sample Date 8/13/07			J15FB5 Sample Location French Drain 11 Sample Date 8/13/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls												
Aroclor-1016	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1221	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1232	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1242	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1248	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1254	13	U	13	13	U	13	13	U	13	13	U	13
Aroclor-1260	13	U	13	13	U	13	13	U	13	13	U	13
Pesticides												
Aldrin	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Alpha-BHC	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Alpha-Chlordane	6.7	U	6.7	4.2		1.7	1.7	U	1.7	1.7	U	1.7
Beta-BHC	6.7	U	6.7	0.53	J	1.7	1.7	U	1.7	1.7	U	1.7
Delta-BHC	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Dichlorodiphenyldichloroethane	6.7	U	6.7	1.2	J	1.7	1.7	U	1.7	1.7	U	1.7
Dichlorodiphenyldichloroethylene	6.7	U	6.7	11.0		1.7	0.47	J	1.7	1.7	U	1.7
Dichlorodiphenyltrichloroethane	6.7	U	6.7	3.0		1.7	0.47	J	1.7	1.7	U	1.7
Dieldrin	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Endosulfan I	6.7	U	6.7	0.53	J	1.7	1.7	U	1.7	1.7	U	1.7
Endosulfan II	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Endosulfan sulfate	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Endrin	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Endrin aldehyde	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Endrin ketone	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Gamma-BHC (Lindane)	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
gamma-Chlordane	6.7	U	6.7	2.5		1.7	1.7	U	1.7	1.7	U	1.7
Heptachlor	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Heptachlor epoxide	6.7	U	6.7	0.6	J	1.7	1.7	U	1.7	1.7	U	1.7
Methoxychlor	6.7	U	6.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Toxaphene	67	U	67	17	U	17	17	U	17	17	U	17
Semivolatile Organic Analytes												
1,2,4-Trichlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
1,2-Dichlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
1,3-Dichlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
1,4-Dichlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
2,4,5-Trichlorophenol	840	U	840	830	U	830	840	U	840	840	U	840
2,4,6-Trichlorophenol	330	U	330	330	U	330	330	U	330	330	U	330
2,4-Dichlorophenol	330	U	330	330	U	330	330	U	330	330	U	330
2,4-Dimethylphenol	330	U	330	330	U	330	330	U	330	330	U	330
2,4-Dinitrophenol	840	U	840	830	U	830	840	U	840	840	U	840
2,4-Dinitrotoluene	330	U	330	330	U	330	330	U	330	330	U	330
2,6-Dinitrotoluene	330	U	330	330	U	330	330	U	330	330	U	330
2-Chloronaphthalene	330	U	330	330	U	330	330	U	330	330	U	330
2-Chlorophenol	330	U	330	330	U	330	330	U	330	330	U	330
2-Methylnaphthalene	330	U	330	330	U	330	330	U	330	330	U	330
2-Methylphenol (cresol, o-)	330	U	330	330	U	330	330	U	330	330	U	330
2-Nitroaniline	840	U	840	830	U	830	840	U	840	840	U	840
2-Nitrophenol	330	U	330	330	U	330	330	U	330	330	U	330

Attachment	1	Sheet No.	10 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15FB2 Sample Location 8 Sample Date 8/13/07			J15FB3 Sample Location 9 Sample Date 8/13/07			J15FB4 Sample Location 10 Sample Date 8/13/07			J15FB5 Sample Location French Drain 11 Sample Date 8/13/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (continued)												
3,3'-Dichlorobenzidine	330	U	330	330	U	330	330	U	330	330	U	330
4-Methylphenol (p-cresol)	330	U	330	330	U	330	330	U	330	330	U	330
3-Nitroaniline	840	U	840	830	U	830	840	U	840	840	U	840
4,6-Dinitro-2-methylphenol	840	U	840	830	U	830	840	U	840	840	U	840
4-Bromophenyl-phenylether	330	U	330	330	U	330	330	U	330	330	U	330
4-Chloro-3-methylphenol	330	U	330	330	U	330	330	U	330	330	U	330
4-Chloroaniline	330	U	330	330	U	330	330	U	330	330	U	330
4-Chlorophenyl-phenylether	330	U	330	330	U	330	330	U	330	330	U	330
4-Nitroaniline	840	U	840	830	U	830	840	U	840	840	U	840
4-Nitrophenol	840	U	840	830	U	830	840	U	840	840	U	840
Acenaphthene	330	U	330	330	U	330	330	U	330	330	U	330
Acenaphthylene	330	U	330	330	U	330	330	U	330	330	U	330
Anthracene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(a)anthracene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(a)pyrene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(b)fluoranthene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(g,h,i)perylene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(k)fluoranthene	330	U	330	330	U	330	330	U	330	330	U	330
Bis(2-chloro-1-methylethyl)ether	330	U	330	330	U	330	330	U	330	330	U	330
Bis(2-chloroethoxy)methane	330	U	330	330	U	330	330	U	330	330	U	330
Bis(2-chloroethyl) ether	330	U	330	330	U	330	330	U	330	330	U	330
Bis(2-ethylhexyl) phthalate	74	J	330	27	J	330	22	J	330	25	J	330
Butylbenzylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Carbazole	330	U	330	330	U	330	330	U	330	330	U	330
Chrysene	330	U	330	330	U	330	330	U	330	330	U	330
Dibenz(a,h)anthracene	330	U	330	330	U	330	21	J	330	22	J	330
Dibenzofuran	330	U	330	330	U	330	330	U	330	330	U	330
Diethylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Dimethylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Di-n-butylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Di-n-octylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Fluoranthene	330	U	330	330	U	330	330	U	330	330	U	330
Fluorene	330	U	330	330	U	330	330	U	330	330	U	330
Hexachlorobenzene	330	U	330	330	U	330	330	U	330	330	U	330
Hexachlorobutadiene	330	U	330	330	U	330	330	U	330	330	U	330
Hexachlorocyclopentadiene	330	U	330	330	U	330	330	U	330	330	U	330
Hexachloroethane	330	U	330	330	U	330	330	U	330	330	U	330
Indeno(1,2,3-cd)pyrene	330	U	330	330	U	330	330	U	330	330	U	330
Isophorone	330	U	330	330	U	330	330	U	330	330	U	330
Naphthalene	330	U	330	330	U	330	330	U	330	330	U	330
Nitrobenzene	330	U	330	330	U	330	330	U	330	330	U	330
N-Nitroso-di-n-dipropylamine	330	U	330	330	U	330	330	U	330	330	U	330
N-Nitrosodiphenylamine	330	U	330	330	U	330	330	U	330	330	U	330
Pentachlorophenol	840	U	840	830	U	830	840	U	840	840	U	840
Phenanthrene	330	U	330	330	U	330	330	U	330	330	U	330
Phenol	330	U	330	330	U	330	330	U	330	330	U	330
Pyrene	330	U	330	330	U	330	330	U	330	330	U	330

Attachment	1	Sheet No.	11 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15FB6 Sample Location French Drain 12 Sample Date 8/13/07			J15FB7 Sample Location French Drain 13 Sample Date 8/13/07			J15F90 Sample Location N Road Crossing 14 Sample Date 8/27/07			J15F91 Sample Location N Road Crossing 15 Sample Date 8/27/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls												
Aroclor-1016	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1221	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1232	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1242	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1248	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1254	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1260	13	U	13	13	U	13	14	U	14	14	U	14
Pesticides												
Aldrin	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Alpha-BHC	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Alpha-Chlordane	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Beta-BHC	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Delta-BHC	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Dichlorodiphenyldichloroethane	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Dichlorodiphenyldichloroethylene	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Dichlorodiphenyltrichloroethane	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Dieldrin	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endosulfan I	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endosulfan II	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endosulfan sulfate	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endrin	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endrin aldehyde	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endrin ketone	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Gamma-BHC (Lindane)	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
gamma-Chlordane	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Heptachlor	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Heptachlor epoxide	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Methoxychlor	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Toxaphene	17	U	17	67	U	67	14	UD	14	14	UD	14
Semivolatile Organic Analytes												
1,2,4-Trichlorobenzene	330	U	330	330	U	330	350	U	350	350	U	350
1,2-Dichlorobenzene	330	U	330	330	U	330	350	U	350	350	U	350
1,3-Dichlorobenzene	330	U	330	330	U	330	350	U	350	350	U	350
1,4-Dichlorobenzene	330	U	330	330	U	330	350	U	350	350	U	350
2,4,5-Trichlorophenol	840	U	840	840	U	840	860	U	860	870	U	870
2,4,6-Trichlorophenol	330	U	330	330	U	330	350	U	350	350	U	350
2,4-Dichlorophenol	330	U	330	330	U	330	350	U	350	350	U	350
2,4-Dimethylphenol	330	U	330	330	U	330	350	U	350	350	U	350
2,4-Dinitrophenol	840	U	840	840	U	840	860	U	860	870	U	870
2,4-Dinitrotoluene	330	U	330	330	U	330	350	U	350	350	U	350
2,6-Dinitrotoluene	330	U	330	330	U	330	350	U	350	350	U	350
2-Chloronaphthalene	330	U	330	330	U	330	350	U	350	350	U	350
2-Chlorophenol	330	U	330	330	U	330	350	U	350	350	U	350
2-Methylnaphthalene	330	U	330	330	U	330	350	U	350	350	U	350
2-Methylphenol (cresol, o-)	330	U	330	330	U	330	350	U	350	350	U	350
2-Nitroaniline	840	U	840	840	U	840	860	U	860	870	U	870
2-Nitrophenol	330	U	330	330	U	330	350	U	350	350	U	350

Attachment	1	Sheet No.	12 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15FB6 Sample Location French Drain 12 Sample Date 8/13/07			J15FB7 Sample Location French Drain 13 Sample Date 8/13/07			J15F90 Sample Location N Road Crossing 14 Sample Date 8/27/07			J15F91 Sample Location N Road Crossing 15 Sample Date 8/27/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (continued)												
3,3'-Dichlorobenzidine	330	U	330	330	U	330	350	U	350	350	U	350
4-Methylphenol (p-cresol)	330	U	330	330	U	330	350	U	350	350	U	350
3-Nitroaniline	840	U	840	840	U	840	860	U	860	870	U	870
4,6-Dinitro-2-methylphenol	840	U	840	840	U	840	860	U	860	870	U	870
4-Bromophenyl-phenylether	330	U	330	330	U	330	350	U	350	350	U	350
4-Chloro-3-methylphenol	330	U	330	330	U	330	350	U	350	350	U	350
4-Chloroaniline	330	U	330	330	U	330	350	U	350	350	U	350
4-Chlorophenyl-phenylether	330	U	330	330	U	330	350	U	350	350	U	350
4-Nitroaniline	840	U	840	840	U	840	860	U	860	870	U	870
4-Nitrophenol	840	U	840	840	U	840	860	U	860	870	U	870
Acenaphthene	330	U	330	330	U	330	350	U	350	350	U	350
Acenaphthylene	330	U	330	330	U	330	350	U	350	350	U	350
Anthracene	330	U	330	330	U	330	350	U	350	350	U	350
Benzo(a)anthracene	330	U	330	330	U	330	350	U	350	350	U	350
Benzo(a)pyrene	330	U	330	330	U	330	350	U	350	350	U	350
Benzo(b)fluoranthene	330	U	330	330	U	330	350	U	350	350	U	350
Benzo(g,h,i)perylene	330	U	330	330	U	330	350	U	350	350	U	350
Benzo(k)fluoranthene	330	U	330	330	U	330	350	U	350	350	U	350
Bis(2-chloro-1-methylethyl)ether	330	U	330	330	U	330	350	U	350	350	U	350
Bis(2-chloroethoxy)methane	330	U	330	330	U	330	350	U	350	350	U	350
Bis(2-chloroethyl) ether	330	U	330	330	U	330	350	U	350	350	U	350
Bis(2-ethylhexyl) phthalate	330	U	330	63	J	330	84	J	350	30	J	350
Butylbenzylphthalate	330	U	330	330	U	330	350	U	350	350	U	350
Carbazole	330	U	330	330	U	330	350	U	350	350	U	350
Chrysene	330	U	330	330	U	330	350	U	350	350	U	350
Dibenz(a,h)anthracene	330	U	330	21	J	330	350	U	350	350	U	350
Dibenzofuran	330	U	330	330	U	330	350	U	350	350	U	350
Diethylphthalate	330	U	330	330	U	330	350	U	350	350	U	350
Dimethylphthalate	330	U	330	330	U	330	350	U	350	350	U	350
Di-n-butylphthalate	330	U	330	330	U	330	350	U	350	350	U	350
Di-n-octylphthalate	330	U	330	330	U	330	350	U	350	350	U	350
Fluoranthene	330	U	330	330	U	330	350	U	350	350	U	350
Fluorene	330	U	330	330	U	330	350	U	350	350	U	350
Hexachlorobenzene	330	U	330	330	U	330	350	U	350	350	U	350
Hexachlorobutadiene	330	U	330	330	U	330	350	U	350	350	U	350
Hexachlorocyclopentadiene	330	U	330	330	U	330	350	U	350	350	U	350
Hexachloroethane	330	U	330	330	U	330	350	U	350	350	U	350
Indeno(1,2,3-cd)pyrene	330	U	330	330	U	330	350	U	350	350	U	350
Isophorone	330	U	330	330	U	330	350	U	350	350	U	350
Naphthalene	330	U	330	330	U	330	350	U	350	350	U	350
Nitrobenzene	330	U	330	330	U	330	350	U	350	350	U	350
N-Nitroso-di-n-dipropylamine	330	U	330	330	U	330	350	U	350	350	U	350
N-Nitrosodiphenylamine	330	U	330	330	U	330	350	U	350	350	U	350
Pentachlorophenol	840	U	840	840	U	840	860	U	860	870	U	870
Phenanthrene	330	U	330	330	U	330	350	U	350	350	U	350
Phenol	330	U	330	330	U	330	350	U	350	350	U	350
Pyrene	330	U	330	330	U	330	350	U	350	350	U	350

Attachment	1	Sheet No.	13 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15F92 Sample Location N Road Crossing 16 Sample Date 8/27/07			J15F93 Sample Location N Road Crossing BCL Sample Date 8/27/07			J15FB8 Sample Location BCL-A Sample Date 8/13/07			J15FB9 Sample Location BCL-B Sample Date 8/13/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls												
Aroclor-1016	14	U	14	14	U	14	13	U	13	14	U	14
Aroclor-1221	14	U	14	14	U	14	13	U	13	14	U	14
Aroclor-1232	14	U	14	14	U	14	13	U	13	14	U	14
Aroclor-1242	14	U	14	14	U	14	13	U	13	14	U	14
Aroclor-1248	14	U	14	14	U	14	13	U	13	14	U	14
Aroclor-1254	14	U	14	14	U	14	13	U	13	14	U	14
Aroclor-1260	14	U	14	14	U	14	13	U	13	14	U	14
Pesticides												
Aldrin	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Alpha-BHC	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Alpha-Chlordane	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Beta-BHC	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Delta-BHC	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Dichlorodiphenyldichloroethane	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Dichlorodiphenyldichloroethylene	1.4	U	1.4	1.4	U	1.4	1.9	X	1.7	1.2	J	1.2
Dichlorodiphenyltrichloroethane	1.4	U	1.4	1.4	U	1.4	0.7	J	1.7	0.47	J	1.2
Dieldrin	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Endosulfan I	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Endosulfan II	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Endosulfan sulfate	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Endrin	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Endrin aldehyde	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Endrin ketone	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Gamma-BHC (Lindane)	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
gamma-Chlordane	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Heptachlor	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Heptachlor epoxide	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	1.7	U	1.7
Methoxychlor	1.4	U	1.4	1.4	U	1.4	1.7	U	1.7	0.54	JX	1.7
Toxaphene	14	U	14	14	U	14	17	U	17	17	U	17
Semivolatile Organic Analytes												
1,2,4-Trichlorobenzene	350	U	350	360	U	360	330	U	330	360	U	360
1,2-Dichlorobenzene	350	U	350	360	U	360	330	U	330	360	U	360
1,3-Dichlorobenzene	350	U	350	360	U	360	330	U	330	360	U	360
1,4-Dichlorobenzene	350	U	350	360	U	360	330	U	330	360	U	360
2,4,5-Trichlorophenol	870	U	870	900	U	900	830	U	830	830	U	830
2,4,6-Trichlorophenol	350	U	350	360	U	360	330	U	330	360	U	360
2,4-Dichlorophenol	350	U	350	360	U	360	330	U	330	360	U	360
2,4-Dimethylphenol	350	U	350	360	U	360	330	U	330	360	U	360
2,4-Dinitrophenol	870	U	870	900	U	900	830	U	830	900	U	900
2,4-Dinitrotoluene	350	U	350	360	U	360	330	U	330	360	U	360
2,6-Dinitrotoluene	350	U	350	360	U	360	330	U	330	360	U	360
2-Chloronaphthalene	350	U	350	360	U	360	330	U	330	360	U	360
2-Chlorophenol	350	U	350	360	U	360	330	U	330	360	U	360
2-Methylnaphthalene	350	U	350	360	U	360	330	U	330	360	U	360
2-Methylphenol (cresol, o-)	350	U	350	360	U	360	330	U	330	360	U	360
2-Nitroaniline	870	U	870	900	U	900	830	U	830	900	U	900
2-Nitrophenol	350	U	350	360	U	360	330	U	330	360	U	360

Attachment	1	Sheet No.	14 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15F92 Sample Location N Road Crossing 16 Sample Date 8/27/07			J15F93 Sample Location N Road Crossing BCL Sample Date 8/27/07			J15FB8 Sample Location BCL-A Sample Date 8/13/07			J15FB9 Sample Location BCL-B Sample Date 8/13/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (continued)												
3,3'-Dichlorobenzidine	350	U	350	360	U	360	330	U	330	360	U	360
4-Methylphenol (p-cresol)	350	U	350	360	U	360	330	U	330	360	U	360
3-Nitroaniline	870	U	870	900	U	900	830	U	830	900	U	900
4,6-Dinitro-2-methylphenol	870	U	870	900	U	900	830	U	830	900	U	900
4-Bromophenyl-phenylether	350	U	350	360	U	360	330	U	330	360	U	360
4-Chloro-3-methylphenol	350	U	350	360	U	360	330	U	330	360	U	360
4-Chloroaniline	350	U	350	360	U	360	330	U	330	360	U	360
4-Chlorophenyl-phenylether	350	U	350	360	U	360	330	U	330	360	U	360
4-Nitroaniline	870	U	870	900	U	900	830	U	830	900	U	900
4-Nitrophenol	870	U	870	900	U	900	830	U	830	900	U	900
Acenaphthene	350	U	350	360	U	360	330	U	330	360	U	360
Acenaphthylene	350	U	350	360	U	360	330	U	330	360	U	360
Anthracene	350	U	350	360	U	360	330	U	330	360	U	360
Benzo(a)anthracene	350	U	350	360	U	360	330	U	330	360	U	360
Benzo(a)pyrene	350	U	350	360	U	360	330	U	330	360	U	360
Benzo(b)fluoranthene	350	U	350	360	U	360	330	U	330	360	U	360
Benzo(g,h,i)perylene	350	U	350	360	U	360	330	U	330	360	U	360
Benzo(k)fluoranthene	350	U	350	360	U	360	330	U	330	360	U	360
Bis(2-chloro-1-methylethyl)ether	350	U	350	360	U	360	330	U	330	360	U	360
Bis(2-chloroethoxy)methane	350	U	350	360	U	360	330	U	330	360	U	360
Bis(2-chloroethyl) ether	350	U	350	360	U	360	330	U	330	360	U	360
Bis(2-ethylhexyl) phthalate	20	J	350	360	U	360	42	J	330	62	J	360
Butylbenzylphthalate	350	U	350	360	U	360	330	U	330	360	U	360
Carbazole	350	U	350	360	U	360	330	U	330	360	U	360
Chrysene	350	U	350	360	U	360	330	U	330	360	U	360
Dibenz(a,h)anthracene	350	U	350	360	U	360	330	U	330	25	J	360
Dibenzofuran	350	U	350	360	U	360	330	U	330	360	U	360
Diethylphthalate	350	U	350	360	U	360	330	U	330	360	U	360
Dimethylphthalate	350	U	350	360	U	360	330	U	330	360	U	360
Di-n-butylphthalate	350	U	350	360	U	360	330	U	330	360	U	360
Di-n-octylphthalate	350	U	350	360	U	360	330	U	330	360	U	360
Fluoranthene	350	U	350	360	U	360	330	U	330	360	U	360
Fluorene	350	U	350	360	U	360	330	U	330	360	U	360
Hexachlorobenzene	350	U	350	360	U	360	330	U	330	360	U	360
Hexachlorobutadiene	350	U	350	360	U	360	330	U	330	360	U	360
Hexachlorocyclopentadiene	350	U	350	360	U	360	330	U	330	360	U	360
Hexachloroethane	350	U	350	360	U	360	330	U	330	360	U	360
Indeno(1,2,3-cd)pyrene	350	U	350	360	U	360	330	U	330	360	U	360
Isophorone	350	U	350	360	U	360	330	U	330	360	U	360
Naphthalene	350	U	350	360	U	360	330	U	330	360	U	360
Nitrobenzene	350	U	350	360	U	360	330	U	330	360	U	360
N-Nitroso-di-n-dipropylamine	350	U	350	360	U	360	330	U	330	360	U	360
N-Nitrosodiphenylamine	350	U	350	360	U	360	330	U	330	360	U	360
Pentachlorophenol	870	U	870	900	U	900	830	U	830	900	U	900
Phenanthrene	350	U	350	360	U	360	330	U	330	360	U	360
Phenol	350	U	350	360	U	360	330	U	330	360	U	360
Pyrene	350	U	350	360	U	360	330	U	330	22	J	360

Attachment	1	Sheet No.	15 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15FC0 Sample Location BCL-C Sample Date 8/13/07			J15FC1 Sample Location BCL-D Sample Date 8/13/07			J14YW4 Sample Location S Road Crossing (north) Sample Date 4/3/07			J14YW5 Sample Location S Road Crossing BCL Stockpile Sample Date 4/3/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls												
Aroclor-1016	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1221	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1232	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1242	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1248	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1254	13	U	13	13	U	13	14	U	14	14	U	14
Aroclor-1260	13	U	13	13	U	13	14	U	14	14	U	14
Pesticides												
Aldrin	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Alpha-BHC	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Alpha-Chlordane	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Beta-BHC	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Delta-BHC	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Dichlorodiphenyldichloroethane	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Dichlorodiphenyldichloroethylene	1.7	U	1.7	1.6	J	6.7	1.4	UD	1.4	1.4	UD	1.4
Dichlorodiphenyltrichloroethane	1.7	U	1.7	1.4	J	6.7	1.4	UD	1.4	1.4	UD	1.4
Dieldrin	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endosulfan I	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endosulfan II	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endosulfan sulfate	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endrin	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endrin aldehyde	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Endrin ketone	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Gamma-BHC (Lindane)	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
gamma-Chlordane	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Heptachlor	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Heptachlor epoxide	1.7	U	1.7	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Methoxychlor	1.8	X	1.8	6.7	U	6.7	1.4	UD	1.4	1.4	UD	1.4
Toxaphene	17	U	17	67	U	67	14	UJ	14	14	UJ	14
Semivolatile Organic Analytes												
1,2,4-Trichlorobenzene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
1,2-Dichlorobenzene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
1,3-Dichlorobenzene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
1,4-Dichlorobenzene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
2,4,5-Trichlorophenol	840	U	840	840	U	840	870	UJ	870	890	UJ	890
2,4,6-Trichlorophenol	340	U	340	330	U	330	350	UJ	350	360	UJ	360
2,4-Dichlorophenol	340	U	340	330	U	330	350	UJ	350	360	UJ	360
2,4-Dimethylphenol	340	U	340	330	U	330	350	UJ	350	360	UJ	360
2,4-Dinitrophenol	840	U	840	840	U	840	870	UJ	870	890	UJ	890
2,4-Dinitrotoluene	340	U	340	330	U	330	350	U	350	360	U	360
2,6-Dinitrotoluene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
2-Chloronaphthalene	340	U	340	330	U	330	350	U	350	360	U	360
2-Chlorophenol	340	U	340	330	U	330	350	UJ	350	360	UJ	360
2-Methylnaphthalene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
2-Methylphenol (cresol, o-)	340	U	340	330	U	330	350	UJ	350	360	UJ	360
2-Nitroaniline	840	U	840	840	U	840	870	U	870	890	U	890
2-Nitrophenol	340	U	340	330	U	330	350	UJ	350	360	UJ	360

Attachment	1	Sheet No.	16 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J15FC0 Sample Location BCL-C Sample Date 8/13/07			J15FC1 Sample Location BCL-D Sample Date 8/13/07			J14YW4 Sample Location S Road Crossing (north) Sample Date 4/3/07			J14YW5 Sample Location S Road Crossing BCL Stockpile Sample Date 4/3/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (continued)												
3,3'-Dichlorobenzidine	340	U	340	330	U	330	350	UJ	350	360	UJ	360
4-Methylphenol (p-cresol)	340	U	340	330	U	330	350	U	350	360	U	360
3-Nitroaniline	840	U	840	840	U	840	870	U	870	890	U	890
4,6-Dinitro-2-methylphenol	840	U	840	840	U	840	870	UJ	870	890	UJ	890
4-Bromophenyl-phenylether	340	U	340	330	U	330	350	UJ	350	360	UJ	360
4-Chloro-3-methylphenol	340	U	340	330	U	330	350	UJ	350	360	UJ	360
4-Chloroaniline	340	U	340	330	U	330	350	U	350	360	U	360
4-Chlorophenyl-phenylether	340	U	340	330	U	330	350	U	350	360	U	360
4-Nitroaniline	840	U	840	840	U	840	870	U	870	890	U	890
4-Nitrophenol	840	U	840	840	U	840	870	U	870	890	U	890
Acenaphthene	340	U	340	330	U	330	350	U	350	360	U	360
Acenaphthylene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Anthracene	340	U	340	330	U	330	350	U	350	360	U	360
Benzo(a)anthracene	26	J	340	330	U	330	350	U	350	360	U	360
Benzo(a)pyrene	38	J	340	330	U	330	350	U	350	360	U	360
Benzo(b)fluoranthene	23	J	340	330	U	330	350	U	350	360	U	360
Benzo(g,h,i)perylene	23	J	340	330	U	330	350	U	350	360	U	360
Benzo(k)fluoranthene	30	J	340	330	U	330	350	U	350	360	U	360
Bis(2-chloro-1-methylethyl)ether	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Bis(2-chloroethoxy)methane	340	U	340	330	U	330	350	U	350	360	U	360
Bis(2-chloroethyl) ether	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Bis(2-ethylhexyl) phthalate	57	J	340	30	J	330	72	U	350	44	U	360
Butylbenzylphthalate	340	U	340	330	U	330	350	U	350	360	U	360
Carbazole	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Chrysene	37	J	340	330	U	330	350	U	350	360	U	360
Dibenz(a,h)anthracene	23	J	340	25	J	330	350	U	350	21	J	360
Dibenzofuran	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Diethylphthalate	340	U	340	330	U	330	350	U	350	360	U	360
Dimethylphthalate	340	U	340	330	U	330	350	U	350	360	U	360
Di-n-butylphthalate	340	U	340	330	U	330	350	U	350	360	U	360
Di-n-octylphthalate	340	U	340	330	U	330	350	U	350	360	U	360
Fluoranthene	33	J	340	330	U	330	350	U	350	360	U	360
Fluorene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Hexachlorobenzene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Hexachlorobutadiene	340	U	340	330	U	330	350	U	350	360	U	360
Hexachlorocyclopentadiene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Hexachloroethane	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Indeno(1,2,3-cd)pyrene	19	J	340	330	U	330	350	U	350	360	U	360
Isophorone	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Naphthalene	340	U	340	330	U	330	350	U	350	360	U	360
Nitrobenzene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
N-Nitroso-di-n-dipropylamine	340	U	340	330	U	330	350	UJ	350	360	UJ	360
N-Nitrosodiphenylamine	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Pentachlorophenol	840	U	840	840	U	840	870	UJ	870	890	UJ	890
Phenanthrene	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Phenol	340	U	340	330	U	330	350	UJ	350	360	UJ	360
Pyrene	57	J	340	330	U	330	350	U	350	360	U	360

Attachment	1	Sheet No.	17 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

Attachment 1. 100-F-26:8 Verification Sampling Results.

Constituent	J14YW6 Sample Location S Road Crossing (south) Sample Date 4/3/07		
	µg/kg	Q	PQL
Polychlorinated Biphenyls			
Aroclor-1016	14	U	14
Aroclor-1221	14	U	14
Aroclor-1232	14	U	14
Aroclor-1242	14	U	14
Aroclor-1248	14	U	14
Aroclor-1254	14	U	14
Aroclor-1260	14	U	14
Pesticides			
Aldrin	1.4	UD	1.4
Alpha-BHC	1.4	UD	1.4
Alpha-Chlordane	1.4	UD	1.4
Beta-BHC	1.4	UD	1.4
Delta-BHC	1.4	UD	1.4
Dichlorodiphenyldichloroethane	1.4	UD	1.4
Dichlorodiphenyldichloroethylene	1.4	UD	1.4
Dichlorodiphenyltrichloroethane	1.4	UD	1.4
Dieldrin	1.4	UD	1.4
Endosulfan I	1.4	UD	1.4
Endosulfan II	1.4	UD	1.4
Endosulfan sulfate	1.4	UD	1.4
Endrin	1.4	UD	1.4
Endrin aldehyde	1.4	UD	1.4
Endrin ketone	1.4	UD	1.4
Gamma-BHC (Lindane)	1.4	UD	1.4
gamma-Chlordane	1.4	UD	1.4
Heptachlor	1.4	UD	1.4
Heptachlor epoxide	1.4	UD	1.4
Methoxychlor	1.4	UD	1.4
Toxaphene	14	UJ	14
Semivolatile Organic Analytes			
1,2,4-Trichlorobenzene	340	UJ	340
1,2-Dichlorobenzene	340	UJ	340
1,3-Dichlorobenzene	340	UJ	340
1,4-Dichlorobenzene	340	UJ	340
2,4,5-Trichlorophenol	850	UJ	850
2,4,6-Trichlorophenol	340	UJ	340
2,4-Dichlorophenol	340	UJ	340
2,4-Dimethylphenol	340	UJ	340
2,4-Dinitrophenol	850	UJ	850
2,4-Dinitrotoluene	340	U	340
2,6-Dinitrotoluene	340	UJ	340
2-Chloronaphthalene	340	U	340
2-Chlorophenol	340	UJ	340
2-Methylnaphthalene	340	UJ	340
2-Methylphenol (cresol, o-)	340	UJ	340
2-Nitroaniline	850	U	850
2-Nitrophenol	340	UJ	340

Attachment	1	Sheet No.	18 of 19
Originator	H. M. Sulloway	Date	11/01/07
Checked	M. J. Appel	Date	
Calc. No.	0100F-CA-V0319	Rev. No.	0

APPENDIX C

HAZARD QUOTIENT AND CARCINOGENIC RISK CALCULATIONS

APPENDIX C

HAZARD QUOTIENT AND CARCINOGENIC RISK CALCULATIONS

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

100-F-26:8 Waste Site Cleanup Verification Hazard Quotient and Carcinogenic Risk Calculation, 0100F-CA-V0306, Rev. 1, 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: 100-F Area Field Remediation **Job No. 14655**

Area: 100-F

Discipline: Environmental *Calculation No: 0100F-CA-V0320

Subject: 100-F-26:8, 1607-F1 Waste Site Cleanup Verification Hazard Quotient and Carcinogenic Risk Calculation

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 3	H. M. Sulloway	K. A. Anselm		S. W. Callison	11-6-07

SUMMARY OF REVISION

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	H. M. Sulloway		Date:	11/01/07	Calc. No.:	0100F-CA-V0320	Rev.: 0
Project:	100-F Area Field Remediation		Job No:	14655	Checked:	K. A. Anselm	Date: 11/1/07
Subject:	100-F-26:8, 1607-F1 Waste Site Cleanup Verification Hazard Quotient and Carcinogenic Risk Calculation						Sheet No. 1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and carcinogenic (excess cancer) risk for the 100-F-26:8 waste site. 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) EPA, 1994, *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children,* EPA/540/R-93/081, Publication No. 9285.7-15-1, U.S. Environmental Protection Agency, Washington, D.C.

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

4) WCH, 2007, *Remaining Sites Verification Package for the 1607-F1 Septic Tank and the 1607-F1 Sanitary Sewer Pipelines (100-F-26:8)*, Attachment to Waste Site Reclassification Forms 2004-130 and 2005-004, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate an HQ for each noncarcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the individual HQ of <1.0 (DOE-RL 2005).

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

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the excess cancer risk of $<1 \times 10^{-6}$ (DOE-RL 2005).

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	H. M. Sulloway	Date:	11/01/07	Calc. No.:	0100F-CA-V0320	Rev.:	0
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	K. A. Anselm	Date:	11/1/07
Subject:	100-F-26:8, 1607-F1 Waste Site Cleanup Verification Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	2 of 3

METHODOLOGY:

The 1607-F1 and 100-F-26:8 waste sites were divided into four areas for the purpose of verification sampling. The first area consisted of the excavation footprint of the 1607-F1 septic tank and 100-F-28:8 pipelines, the second area consisted of the 1709-F French Drain excavation footprint, the third area consisted of the BCL stockpiles, and the fourth area consisted of two road crossing excavations of the pipeline between the 1607-F1 septic tank and the 1701-F building. Hazard quotient and carcinogenic risk calculations for the 1607-F1 and 100-F-26:8 waste sites were conservatively calculated using the highest of the focused and statistically calculated results from these four areas for each analyte (WCH 2007). Boron, molybdenum, and hexavalent chromium require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead, selenium, and multiple organic contaminants of concern (COCs) (as listed in Table 1) are included because they were detected by laboratory analysis and cannot be attributed to natural occurrence. Total petroleum hydrocarbon (TPH) data are not included in the calculations since TPH includes a broad range of constituents rather than an individual contaminant. All other site nonradionuclide COCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron is 2.1 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 1.3×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criteria is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. The sum of the HQ values is 3.9×10^{-2}. Comparing this value to the requirement of <1.0, this criteria is met.

3) To calculate the excess cancer risk, the maximum value is divided by the carcinogenic RAG value, then multiplied by 1×10^{-6}. For example, the maximum value for hexavalent chromium is 0.22 mg/kg, divided by 2.1 mg/kg, and multiplied as indicated, is 1.0×10^{-7}. Comparing this value and all other individual values to the requirement of $<1 \times 10^{-6}$, this criteria is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. The sum of the excess cancer risk values is 1.3×10^{-6}. 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.

Washington Closure Hanford, Inc.		CALCULATION SHEET					
Originator:	H. M. Sulloway	Date:	11/01/07	Calc. No.:	0100F-CA-V0320	Rev.:	0
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	K. A. Anselm	Date:	11/1/07
Subject:	100-F-26:8, 1607-F1 Waste Site Cleanup Verification Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	3 of 3

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 100-F-26:8 Waste Site.

Contaminants of Concern[a]	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	2.1	16,000	1.3E-04	--	--
Chromium, hexavalent[c]	0.22	240	9.2E-04	2.1	1.0E-07
Lead[d]	12	353	3.3E-02	--	--
Molybdenum	0.52	400	1.3E-03	--	--
Selenium	1.4	400	3.5E-03	--	--
Semivolatiles					
Benzo(a)anthracene	0.026	--	--	0.137	1.9E-07
Benzo(a)pyrene	0.038	--	--	0.33[e]	1.2E-07
Benzo(b)fluoranthene	0.023	--	--	1.37	1.7E-08
Benzo(k)fluoranthene	0.030	--	--	0.137	2.2E-07
Benzo(ghi)perylene	0.023	2,400	9.6E-06	--	--
Bis(2-ethylhexyl) phthalate	0.15	1,600	9.4E-05	71.4	2.1E-09
Chrysene	0.037	--	--	0.137	2.7E-07
Dibenzo(a,h)anthracene	0.029	--	--	0.33[e]	8.8E-08
Fluoranthene	0.033	3,200	1.0E-05	--	--
Indeno(1,2,3-cd) pyrene	0.019	--	--	1.37	1.4E-08
Phenanthrene	0.018	24,000	7.5E-07	--	--
Pyrene	0.057	2,400	2.4E-05	--	--
Pesticides					
BHC, beta (Hexachlorocyclohexane)	0.0006	--	--	0.556	1.1E-09
Chlordane (alpha, gamma)	0.0067	40	1.7E-04	0.769	8.7E-09
DDD, 4,4'-	0.0012	--	--	4.17	2.9E-10
DDE, 4,4'-	0.011	--	--	2.94	3.7E-09
DDT, 4,4'-	0.0030	40	7.5E-05	2.94	1.0E-09
Endosulfan (I, II, sulfate)	0.00053	480	1.1E-06	--	--
Heptachlor epoxide	0.00060	1.04	5.8E-04	0.11	5.5E-09
Methoxychlor	0.0018	400	4.5E-06	--	--
Totals					
Cumulative Hazard Quotient:			**3.9E-02**		
Cumulative Excess Cancer Risk:					**1.3E-06**

Notes:
[a] = From WCH (2007).
[b] = Value obtained from the RDR/RAWP (DOE-RL 2005) or *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] = Value for the noncarcinogen RAG obtained from EPA (1994).
[e] = Carcinogen risk calculated using the cleanup level instead of the required detection limit, per WAC 173-340-740(3), Method B, 1996.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 100-F-26:8 waste site meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk as identified in the RDR/RAWP (DOE-RL 2005).