Date Submitted: 11/1/07 Originator: L. M. Dittmer Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-FR-1 Waste Site Code: 1607-F4 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2004-131

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

Description of current waste site condition:

The 1607-F4 waste site is the former location of the sanitary sewer system that serviced the former 115-F Gas Recirculation Building. The system included a septic tank, drain field, and associated pipeline that were in use from 1944 to 1965. The 1607-F4 waste site received unknown amounts of sanitary sewage from the 115-F Gas Recirculation Building and may have potentially contained hazardous and radioactive contamination. The site has been remediated and presently exists as an open excavation. Confirmatory evaluation, 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 and confirmatory sample data, (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-F4 Sanitary Sewer System* (attached).

Waste Site Controls:
Engineered Controls: Yes ☐ No ☒ Institutional Controls: Yes ☐ No ☒ O&M requirements: Yes ☐ No ☒
If any of the Waste Site Controls are checked Yes specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents.

S. L. Charboneau DOE Federal Project Director (printed)	Stacy Charboneau Signature	11/13/07 Date
N/A Ecology Project Manager (printed)	Signature	Date
R. A. Lobos EPA Project Manager (printed)	[signature] Signature	12-3-07 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-F4 SANITARY SEWER SYSTEM

Attachment to Waste Site Reclassification Form 2004-131

November 2007

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-F4 SANITARY SEWER SYSTEM

EXECUTIVE SUMMARY

The 1607-F4 Sanitary Sewer System is located in the 100-FR-1 Operable Unit of the Hanford Site. The Waste Information Data System (WIDS) describes this site as a septic tank, discharge pipe, and drain field, with a capacity of 795 L (210 gal). The 1607-F4 Sanitary Sewer System was in use from 1944 to 1965 and serviced the 115-F Gas Recirculation Building. The site is located 61 m (200 ft) west of the demolished 115-F Gas Recirculation Building and approximately 17 m (56 ft) west of the north-south-oriented railroad tracks that parallel the 105-F Reactor site.

The 1607-F4 waste site was evaluated during the October 2004 confirmatory sampling effort to determine if remedial action would be required. The maximum detected results for each contaminant of potential concern (COPC) from the confirmatory samples were directly compared against the cleanup criteria to support decisions concerning waste site reclassification. Detected levels of individual COPCs for the 1607-F4 Sanitary Sewer site have met the remedial action goals (RAGs). However, because multiple constituents were detected above background or above laboratory required detection limits, the cumulative hazard quotient for the noncarcinogenic constituents detected above background or detection limits was 1.1, thus exceeding the hazard quotient risk requirements. It was determined that remedial action was required for this site.

Remediation of the waste site was performed from April 3 through 5, 2007, and included removal of the septic tank, the drain field, and the associated piping. Overburden material and other soils presumed to contain no residual contamination above cleanup levels were stockpiled south of the excavation for post-remediation verification sampling. Approximately 707 m^3 (925 yd^3) of piping, concrete material, and suspect contaminated adjacent soils were removed and disposed of to the Environmental Restoration Disposal Facility.

Verification sampling for the 1607-F4 waste site was performed in April and August 2007 (WCH 2007a, 2007b) 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) for verification sampling. These included inductively coupled plasma (ICP) metals, hexavalent chromium, mercury, semivolatile organic compounds, polychlorinated biphenyls, and pesticides. Radionuclides were either not detected in any of the confirmatory samples, or were detected below RAGs and were, therefore, eliminated as COCs for verification sampling in the excavated area and 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, in addition to the site COCs, were requested for samples collected in this area of the waste site. 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-F4 waste site in accordance with the TPA-MP-14 (DOE-RL 2007) procedure.

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 *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.

Table ES-1. Summary of Remedial Action Goals for the 1607-F4 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure Radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years.	Residual concentrations of radionuclide COPCs were detected below statistical background levels.	Yes
Direct Exposure Nonradionuclides	Attain individual COC RAGs.	All individual COC 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 (8.2×10^{-2}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk values for individual carcinogens are $<1 \times 10^{-6}$.	
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk value (7.4×10^{-7}) 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-F4 Waste Site.

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 mercury, aroclor-1254, benzo(a) anthracene, and benzo(k)fluoranthene are above the groundwater and river protection 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 2001b).
[d] Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), 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
MCL = maximum contaminant level
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose model)

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern and other constituents. Screening levels were not exceeded for the site constituents, with the exception of antimony, barium, boron, cadmium, manganese, mercury, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of these constituents does not pose a risk to ecological receptors because concentrations of antimony, barium, cadmium, manganese, and vanadium are below site background levels, mercury is within the range of Hanford Site background levels, and boron concentrations are consistent with those seen elsewhere at the Hanford Site (no established background value is available for boron). A 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.

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-F4 SANITARY SEWER SYSTEM

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 1607-F4 waste site meets 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.

GENERAL SITE INFORMATION AND BACKGROUND

The 1607-F4 waste site is located in the 100-FR-1 Operable Unit of the Hanford Site, approximately 17 m (56 ft) west of the railroad tracks that parallel the 105-F Reactor (Figure 1). The waste site includes a septic tank, drain field, and associated pipeline. The Waste Information Data System (WIDS) (WCH 2007c) describes the septic tank as constructed of reinforced concrete with a capacity of 795 L (210 gal). The system could support six people assuming an input of 132 L (35 gal) per capita, per day, with a 1-day retention period. The dimensions of the tank were 1.6 m long by 1 m wide by 2.7 m deep (5.3 ft by 3.3 ft by 9.0 ft).

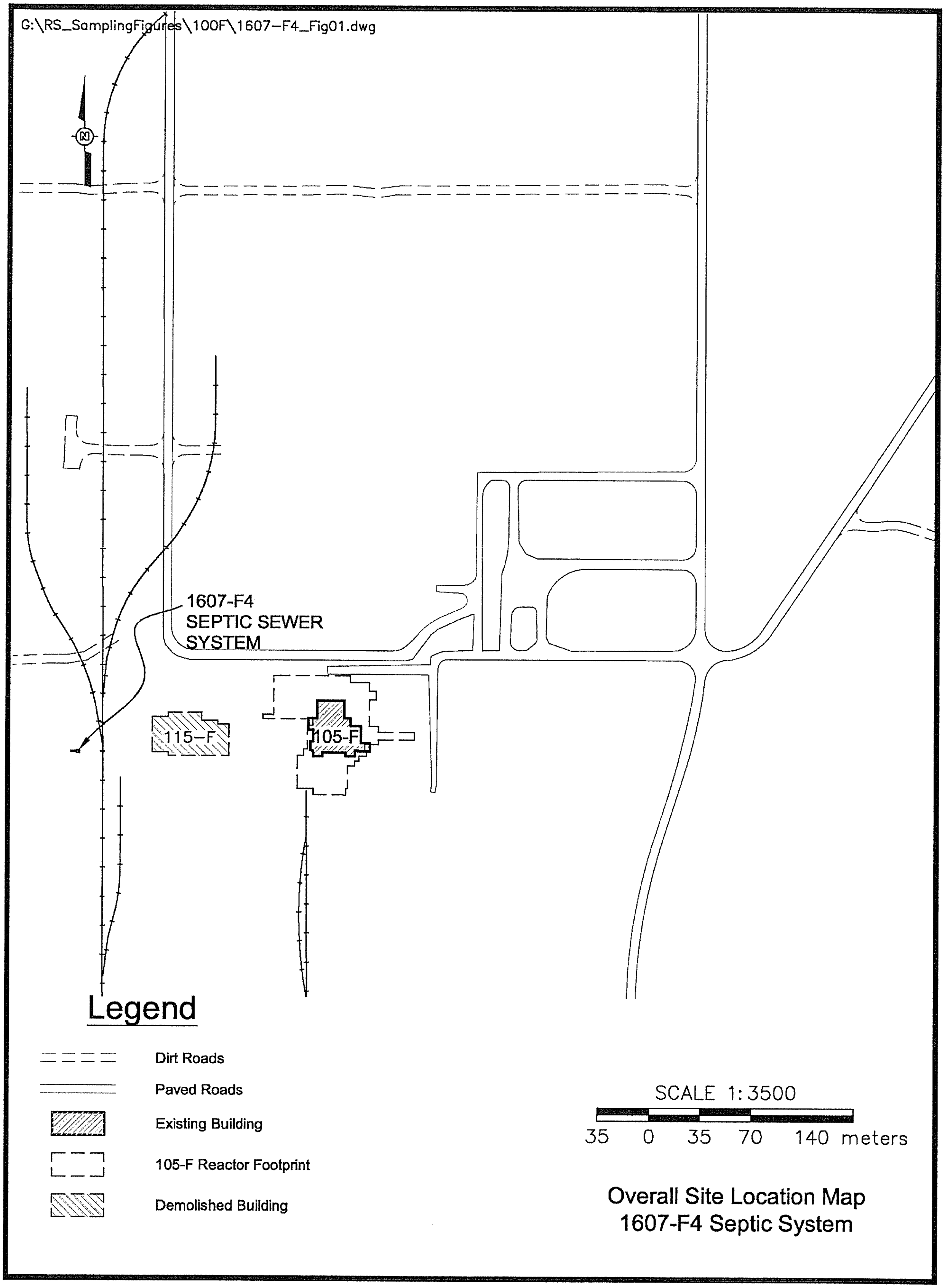
The drain field was constructed of 10-cm (4-in.)-diameter vitrified clay pipe (VCP), concrete pipe, or drain tile with a total of 15 linear m (48 linear ft) of piping (2 linear m [8 linear ft] per capita). The laterals were open jointed and spaced 2 m (8 ft) apart.

According to WIDS (WCH 2007c), the 1607-F4 Sanitary Sewer System was in use from 1944 to 1965 and serviced the former 115-F Gas Recirculation Building. As a result, the system received an unknown amount of sanitary sewage from the 115-F Gas Recirculation Building and may have potentially contained hazardous and radioactive contamination.

CONFIRMATORY SAMPLING ACTIVITIES

The 1607-F4 waste site was evaluated during the October 2004 confirmatory sampling efforts to determine if remedial action would be required. The following subsections provide additional discussion of the confirmatory sample design details and the results of the confirmatory sampling activities.

Figure 1. 1607-F4 Waste Site Location Map.



Geophysical Investigation

A geophysical survey was performed over the site in April 2004 (BHI 2004b) to locate and map the septic tank and associated drain field. The results indicated a notable geophysical anomaly in the documented location of the septic tank and a relatively vegetation-free area directly to the west of the septic tank, suspected as being the drain field area.

Contaminants of Potential Concern for Confirmatory Sampling

Contaminants of potential concern (COPCs) were identified during the data quality objectives process (BHI 2004c) based on historical process information associated with the 1607-F4 waste site. The COPCs for confirmatory sampling were: americium-241, cobalt-60, cesium-137, europium-152, europium-154, europium-155, plutonium-239/240, strontium-90, cadmium, total chromium, mercury, lead, hexavalent chromium, pesticides, and semivolatile organic compounds. Further evaluation of available historical information for the site resulted in the addition of polychlorinated biphenyls (PCBs) and carbon-14 as COPCs.

Confirmatory Sample Design and Sampling Activities

Historical data, process knowledge, and geophysical survey results were used to develop a site-specific confirmatory sample design for the 1607-F4 Septic System (BHI 2004d). The sample design included focused sampling at two locations: the septic tank (sample area 1) and the drain field (sample area 2) as shown on Figure 2.

Excavation and confirmatory sampling was conducted on October 6, 2004 (BHI 2004a). During excavation in sample area 1, the septic tank was discovered but was found to have been previously decommissioned and backfilled. The backhoe bucket used in the excavation was too large to enter the opening in the top of the tank. In addition, the septic tank was constructed of reinforced concrete and could not be penetrated with the excavation equipment. As a result, confirmatory samples of material inside the tank were not collected. Instead, a soil sample was collected underneath the septic tank at 2.9 m (9.5 ft) below ground surface.

In sample area 2, a section of the VCP from the drain field was revealed at 1 m (3 ft) below ground surface and samples of the pipe contents and underlying soil were collected. No elevated volatile organic compounds (VOCs) were detected and no radiological activity was detected above background levels by the field instrumentation used during confirmatory sampling activities (BHI 2004a). A summary of the confirmatory samples collected and the laboratory analyses performed is provided in Table 1.

Figure 2. Confirmatory Sampling Locations at the 1607-F4 Waste Site.

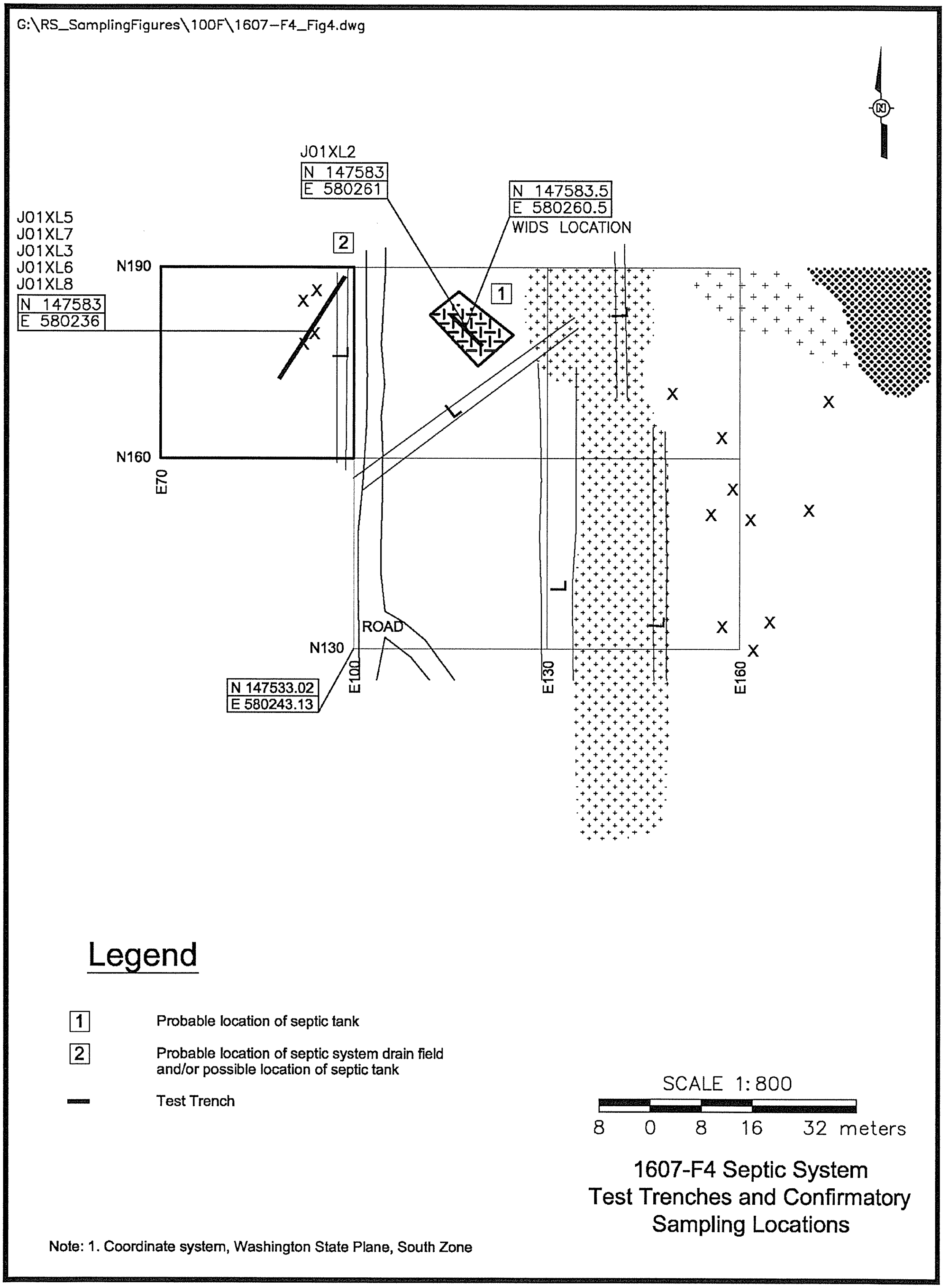


Table 1. Confirmatory Sample Summary for the 1607-F4 Waste Site.

Sample Location	Sample Media	Sample Number	Coordinate Locations	Depth (m bgs)	Sample Analyses
Sample area 1 (under septic tank)	Soil	J01XL2	N 147583 E 580261	2.9	GEA, gross alpha, gross beta, ICP metals, hexavalent chromium, pesticides, mercury, SVOA, and PCBs
Sample area 2 (drain field)	VCP contents	J01XL5	N 147583 E 580236	1	GEA, gross alpha, gross beta, ICP metals, pesticides, mercury, SVOA, PCBs, and TCLP metals[a]
		J01XL7			Hexavalent chromium
	Soil	J01XL3		1	GEA, gross alpha, gross beta, ICP metals, hexavalent chromium, pesticides, mercury, SVOA, PCBs, and TCLP metals[a]
Duplicate	VCP contents	J01XL6	N 147583 E 580236	1	GEA, gross alpha, gross beta, ICP metals, pesticides, mercury, SVOA, PCBs, and TCLP metals[a]
		J01XL8			Hexavalent chromium
Equipment blank	Silica sand	J01XL1	N/A	N/A	ICP metals, hexavalent chromium, pesticides, mercury, SVOA, and PCBs

[a] TCLP metals analysis was performed to support waste designation.
Source: *Remaining Sites Field Sampling*, Logbook El-1578-3 (BHI 2004a)
bgs = below ground surface
GEA = gamma energy analysis
ICP = inductively coupled plasma
N/A = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
TCLP = toxicity characteristic leachate procedure
VCP = vitrified clay pipe

Confirmatory Sample Results

Confirmatory samples were analyzed using analytical methods approved by the U.S. Environmental Protection Agency, and the results were compared against the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b). The 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 of this document.

The results of confirmatory sampling indicated that all COPCs were either not detected, or detected below cleanup levels, or, for those analytes that exceeded groundwater and/or river protection remedial action goals (RAGs), an evaluation using RESidual RADioactivity (RESRAD) modeling (BHI 2005) determined that these constituents would not migrate to groundwater in 1,000 years, thereby meeting the RAGs for the protection of groundwater and the Columbia River. However, the 1607-F4 waste site failed to meet one of the four nonradionuclide risk requirements as specified in the RDR/RAWP (DOE-RL 2005b). The four 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 x 10^{-6}, and a cumulative carcinogenic risk of less than 1 x 10^{-5}. The cumulative hazard quotient value for the 1607-F4 waste site was 1.1, thus exceeding the risk requirement of 1.0. Therefore, remedial action was necessary at this site (Feist 2005).

REMEDIAL ACTION SUMMARY

Remediation of the 1607-F4 waste site was performed from April 3 through 5, 2007, and included removal of the septic tank, the drain field, and the associated piping. Overburden material and other soils presumed to contain no residual contamination above cleanup levels (referred to collectively as "below cleanup levels" [BCL]) were stockpiled south of the excavation for post-remediation verification sampling. Approximately 707 m^3 (925 yd^3) of piping, concrete material, and suspect contaminated adjacent soils were removed and disposed of to the Environmental Restoration Disposal Facility (ERDF). Excavation depths at the 1607-F4 waste site ranged from 2.6 to 3.2 m (8.5 to 10.5 ft) below ground surface. The results of the radiological survey are shown in Figure 3.

Because a segment of this waste site (the discharge pipeline from the septic tank to the drain field) was beneath a heavily-used haul road, verification sampling of the soil below this portion of the removed pipeline was conducted immediately following remediation to allow for expedited backfill of the roadway. A verification soil sample was also collected from a portion of the BCL stockpile used for clean backfill. Once the samples were collected, the haul road was reconstructed using the soil from the sampled portion of the BCL stockpile. This process was expedited to limit disruption to transportation activities.

The pre-excavation topographical survey of the 1607-F4 waste site is provided as Figure 4. The boundary of the extent of excavation is shown in Figure 5 and was used for developing the verification sampling design.

VERIFICATION SAMPLING ACTIVITIES

Remedial action goals are the specific numeric goals against which the cleanup verification data are evaluated to demonstrate attainment of the remedial action objectives for the site. Verification sampling for the 1607-F4 waste site was performed in April and August 2007 (WCH 2007a, 2007b) to collect data to determine if the RAGs had been met. 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 contaminants of concern (COCs) for verification sampling were determined based on the confirmatory sampling results from the 1607-F4 waste site. The constituents that contributed to the exceedance of the cumulative hazard quotient requirement from confirmatory sampling were carried forward as COCs for verification sampling. These included inductively coupled plasma (ICP) metals, hexavalent chromium, mercury, semivolatile organic compounds, polychlorinated biphenyls, and pesticides. Radionuclides were either not detected in any of the confirmatory samples, or were detected below RAGs and were, therefore, eliminated as COCs for verification sampling in the excavated area and 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, in addition to the site COCs, were requested for samples collected in this area of the waste site.

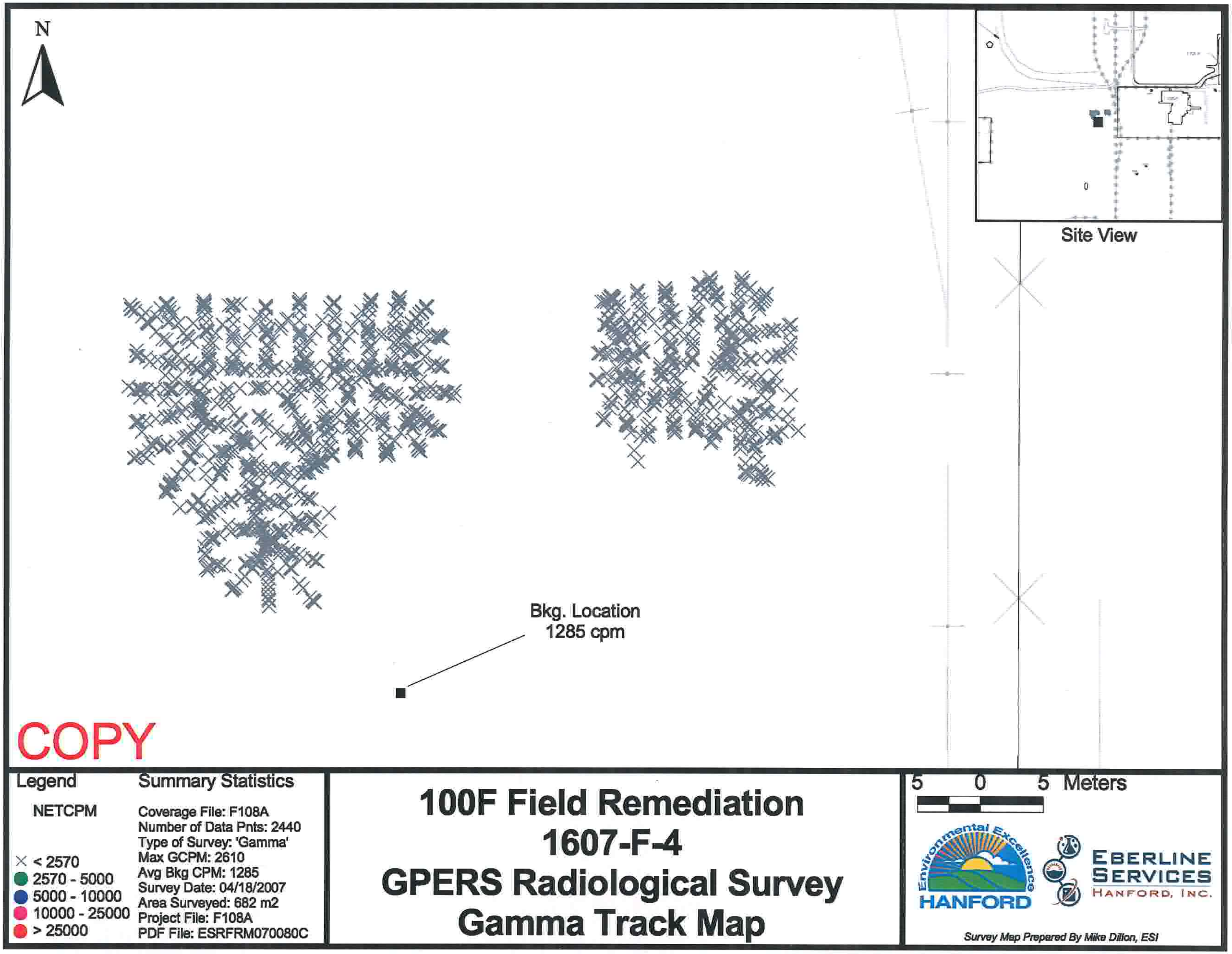


Figure 3. Radiological Survey of the 1607-F4 Waste Site.

Figure 4. Pre-Excavation Topographical Map of the 1607-F4 Waste Site.

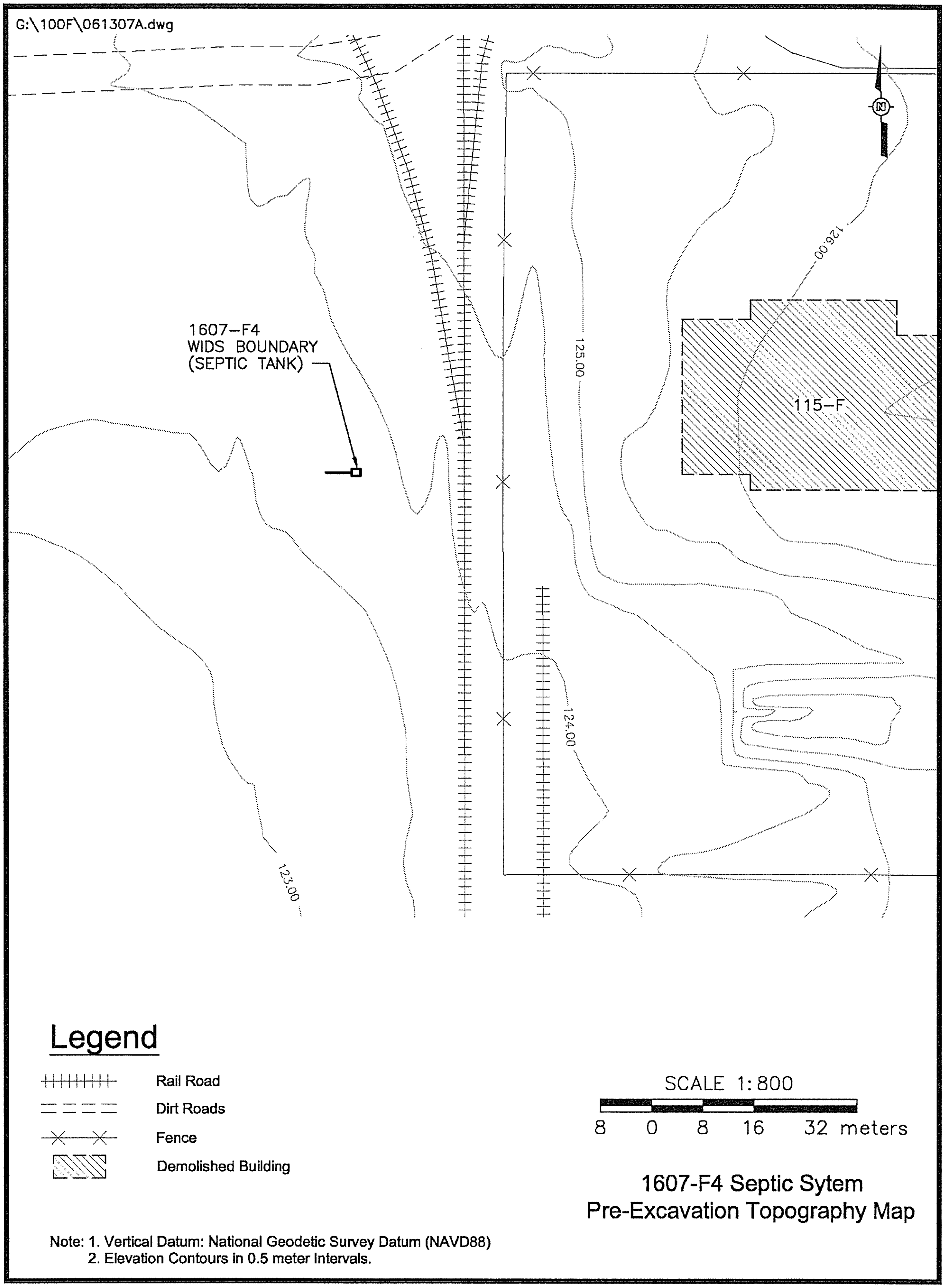
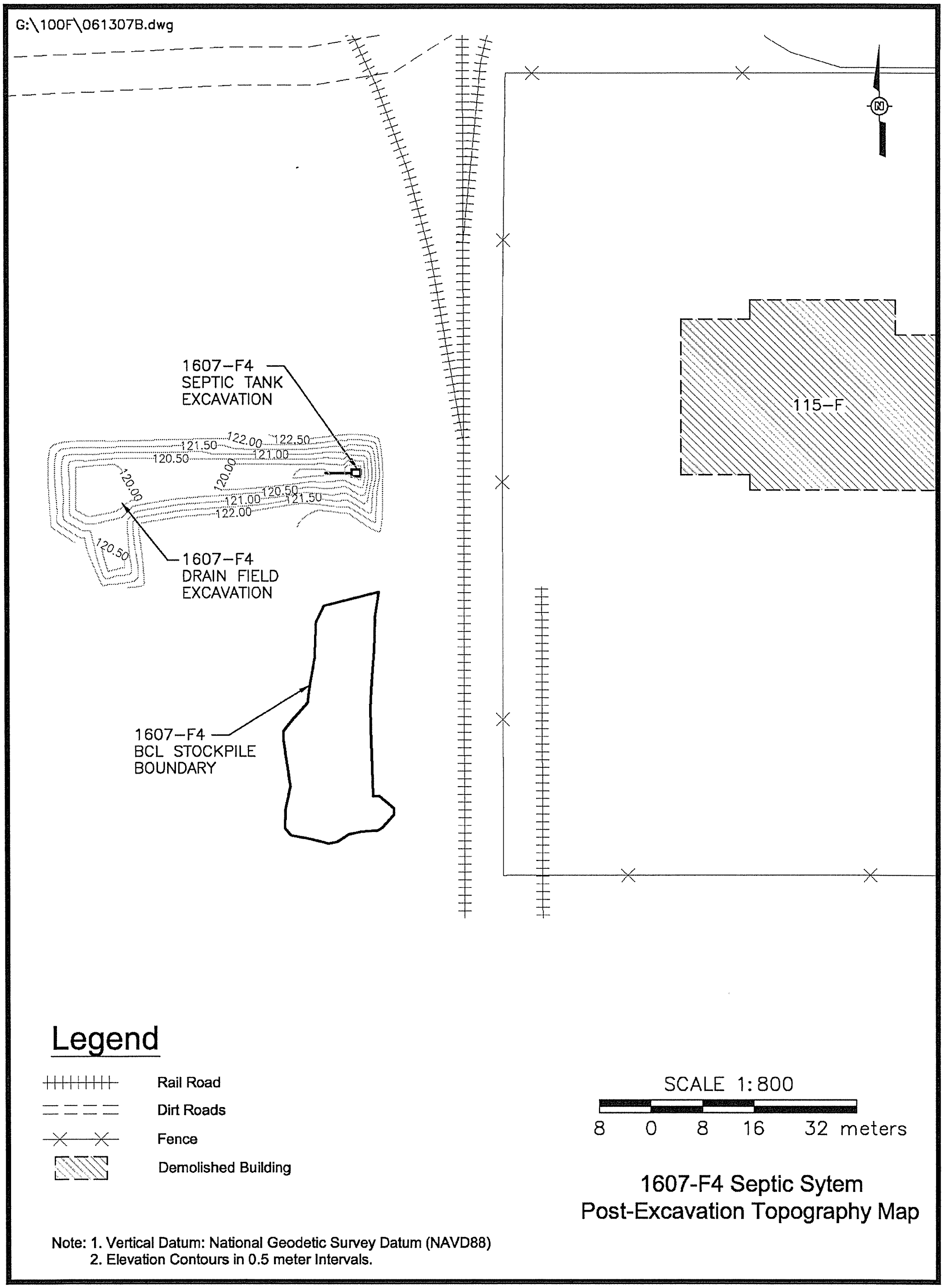


Figure 5. Excavation Boundary of the 1607-F4 Waste Site.



Verification Sampling Design

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples that were collected. The 1607-F4 waste site was divided into three decision units for the purpose of verification sampling. The first decision unit consisted of the excavation footprint of the septic tank and drain field, the second decision unit consisted of the BCL stockpile, and the third decision unit consisted of the area between the septic tank and drain field underlying the haul road (road-crossing area).

Verification Sampling – Excavation Footprint

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 was selected as the verification sampling approach for the excavation footprint because the distribution of potential residual soil contamination over this area was 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."

The excavation footprint (Figure 5) was delineated in Visual Sample Plan[1] (VSP) and used as the basis for location of a random-start systematic grid for verification soil sample collection locations. A total of 10 soil samples were collected on a random-start, triangular grid for this sampling area. A triangular grid was selected for this investigation based on studies that indicate triangular grids are superior to square grids (Gilbert 1987). Additional discussion of the development of the statistical verification design is provided in the 1607-F4 verification work instruction (WCH 2007c).

Verification Sampling – BCL Stockpile

Verification sampling of the BCL stockpile was performed to evaluate the suitability of the soil for use as clean backfill for the excavation. Because this material consists of overburden from the site and was not believed to have received discharges from the sanitary sewer system, a statistical sampling design was not warranted, and professional judgment was used to develop the sampling design. A soil sample was collected from the northern portion of the BCL stockpile during excavation activities to support backfill and reconstruction of the haul road running directly through this site. Additionally, sampling at the BCL stockpile consisted of the collection of 25 aliquots of soil distributed across the surface of the existing pile and combining those into one sample for laboratory analysis.

Verification Sampling – Road-Crossing Area

Verification sampling of the road-crossing area was performed after removal of the pipeline and prior to backfilling this portion of the excavation. No staining or releases from the pipeline at this location were observed. Because this segment of the pipeline underlies a heavily-used haul road, verification sampling was conducted immediately following pipeline removal to limit disruption to ongoing transportation activities. Two soil samples were collected at the base of this portion of the excavation. Once the samples were collected, the excavation was backfilled and the haul road reconstructed.

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

Summaries of the samples collected and the analyses performed for the verification sampling event are presented in Table 2 and the locations are shown in Figure 6. The soil sample locations were staked in the excavation footprint prior to sample collection. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a).

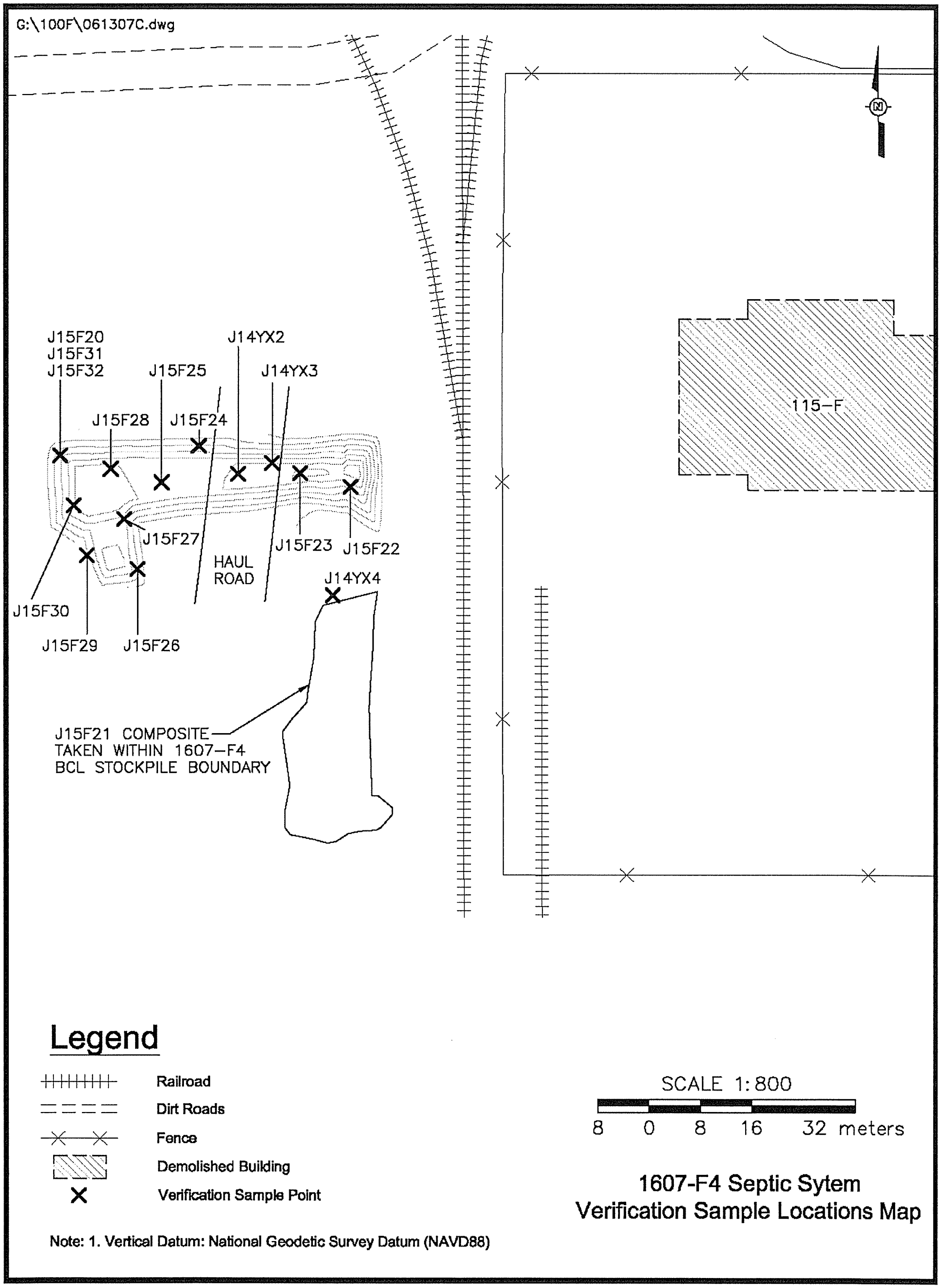
Table 2. Verification Sample Summary for the 1607-F4 Waste Site.[a] (2 Pages)

Sample Location	Sample Number	Coordinate Locations (Washington State Plane)	Sample Analysis
Excavation area, location 1	J15F22	N 147580.6 E 580261.8	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Excavation area, location 2	J15F23	N 147582.7 E 580253.9	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Excavation area, location 3	J15F24	N 147587.0 E 580238.2	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Excavation area, location 4	J15F25	N 147581.3 E 580232.4	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Excavation area, location 5	J15F26	N 147567.6 E 580228.7	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Excavation area, location 6	J15F27	N 147575.5 E 580226.6	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Excavation area, location 7	J15F28	N 147583.4 E 580224.5	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Excavation area, location 8	J15F29	N 147569.8 E 580220.8	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Excavation area, location 9	J15F30	N 147577.7 E 580218.8	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Excavation area, location 10	J15F31	N 147585.5 E 580216.7	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Equipment Blank	J15F32	N/A	ICP metals, mercury, SVOA
Duplicate of location 10	J15F20	N 147585.5 E 580216.7	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
BCL Stockpile	J15F21	N/A	ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Road crossing west	J14YX2	N 147582.4 E 580244.4	GEA, gross alpha,[b] gross beta,[b] ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
Road crossing east	J14YX3	N 147584.3 E 580249.6	GEA, gross alpha,[b] gross beta,[b] ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs
BCL stockpile	J14YX4	N 147563.5 E 580259.0	GEA, gross alpha, gross beta, ICP metals, mercury, hexavalent chromium, SVOA, pesticides, PCBs

[a] Source: Field logbooks EFL-1174-2 and EFL-1174-3 (WCH 2007a, WCH 2007b).
[b] Gross alpha and gross beta results were slightly above screening levels; therefore, strontium-90, isotopic uranium, and isotopic plutonium analyses were performed.

GEA = gamma spectroscopy
ICP = inductively coupled plasma
N/A = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis

Figure 6. Verification Sampling Locations at the 1607-F4 Waste Site.



Verification Sampling Results

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

As noted earlier, the 1607-F4 waste site was divided into three decision units for verification sampling: (1) excavation footprint, (2) BCL stockpile, and (3) road-crossing area. 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 COCs as specified by the RDR/RAWP (DOE-RL 2005b). These calculations are provided in Appendix B. When a nonradionuclide COC 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 were reported in the data set, then no statistical evaluation or calculations were performed for that COC. Evaluation of the verification data from the BCL stockpile and road crossing areas was performed by direct comparison of the sample results against cleanup criteria.

Comparisons of the statistical and maximum results for COCs with the shallow zone RAGs for the excavation footprint, BCL stockpile, and road crossing area are summarized in Tables 3a, 3b, and 3c, respectively. All three decision units are evaluated using the more restrictive 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 3a. Comparison of Maximum or Statistical Contaminant Concentrations to Action Levels for the 1607-F4 Excavation Footprint Verification Sampling Event. (2 Pages)

COC	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[b]	0.83 (<BG)	32	5[c]	5[c]	No	--
Arsenic	2.2 (<BG)	20	20	20	No	--
Barium	68.1 (<BG)	5,600	132[c]	224	No	--
Beryllium	0.34 (<BG)	10.4[d]	1.51[c]	1.51[c]	No	--
Cadmium[b]	0.38 (<BG)	13.9[d]	0.81[c]	0.81[c]	No	--
Chromium (total)	13.2 (<BG)	80,000	18.5[c]	18.5[c]	No	--
Cobalt	6.9 (<BG)	1,600	32	--[e]	No	--
Copper	14.7 (<BG)	2,960	59.2	22.0[c]	No	--
Hexavalent Chromium	0.23	2.1[d]	4.8[f]	2	No	--
Lead	5.5 (<BG)	353	10.2[c]	10.2[c]	No	--
Manganese	312 (<BG)	11,200	512[c]	512[c]	No	--
Mercury	1.2	24	0.33[c]	0.33[c]	Yes	Yes[g]
Molybdenum[h]	0.58	400	8	--[e]	No	--
Nickel	10.1 (<BG)	1,600	19.1[c]	27.4	No	--
Vanadium	43.0 (<BG)	560	85.1[c]	--[e]	No	--
Zinc	48.7 (<BG)	24,000	480	67.8[c]	No	--
Aroclor-1254	0.046	0.5	0.017[i]	0.017[i]	Yes	Yes[g]
Aroclor-1260	0.0067	0.5	0.017[i]	0.017[i]	No	--
alpha-Chlordane	0.0056	0.769	0.025	0.0165[i]	No	--
4,4'-DDE	0.0021	2.94	0.0257	0.005[i]	No	--
4,4'-DDT	0.0028	2.94	0.0257	0.005[i]	No	--
gamma-Chlordane	0.0045	0.769	0.025	0.0165[i]	No	--
Endrin aldehyde	0.0018	24	0.2	0.039	No	--
Endrin ketone	0.0029	24	0.2	0.039	No	--
Benzo(a)anthracene	0.022	0.137	0.015[i]	0.015[i]	Yes	Yes[g]
Benzo(k)fluoranthene	0.018	0.137	0.015[i]	0.015[i]	Yes	Yes[g]
Chrysene	0.026	0.137	0.1[i]	0.1[i]	No	--
Di-n-butylphthalate	0.050	8,000	160	540	No	--
Fluoranthene	0.044	3,200	64	18.0	No	--

Table 3a. Comparison of Maximum or Statistical Contaminant Concentrations to Action Levels for the 1607-F4 Excavation Footprint Verification Sampling Event. (2 Pages)

COC	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		
Phenol	0.029	24,000	480	4,200	No	--
Pyrene	0.038	2,400	48	192	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] Hanford Site-specific background not available. Value is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[c] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d], 1996).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996) and an airborne particulate mass-loading rate of 0.0001 g/m^3 (WDOH 1997).
[e] 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]).
[f] 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 the RDR/RAWP (DOE-RL 2005b), based on updated oral reference dose value (as provided in the Integrated Risk Information System) (EPA 2006).
[g] Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), residual concentrations are not expected 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.
[h] No Hanford Site-specific or Washington State background value available.
[i] 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
DDE = Dichlorodiphenyldichloroethylene
DDT = Dichlorodiphenyltrichloroethane
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)
RDL = required detection limit
RDR/RAWP = remedial design report/remedial action work plan
WAC = Washington Administrative Code

Table 3b. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-F4 BCL Stockpile Verification Sampling Event. (2 Pages)

COC	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.3 (<BG)	20	20	20	No	--
Barium	125.0 (<BG)	5,600	132[b]	224	No	--
Beryllium	0.43 (<BG)	10.4[c]	1.51[b]	1.51[b]	No	--
Boron[d]	5.8	16,000	320	--[e]	No	--
Chromium (total)	10.5 (<BG)	80,000	18.5[b]	18.5[b]	No	--

Table 3b. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-F4 BCL Stockpile Verification Sampling Event. (2 Pages)

COC	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Cobalt	7.2 (<BG)	1,600	32	--[e]	No	--
Copper	13.6 (<BG)	2,960	59.2	22.0[b]	No	--
Hexavalent Chromium	0.28	2.1[c]	4.81[h]	2	No	--
Lead	7.7 (<BG)	353	10.2[b]	10.2[b]	No	--
Manganese	334 (<BG)	11,200	512[b]	512[b]	No	--
Nickel	10.9 (<BG)	1,600	19.1[b]	27.4	No	--
Vanadium	47.9 (<BG)	560	85.1[b]	--[e]	No	--
Zinc	41.3 (<BG)	24,000	480	67.8[b]	No	--
Bis(2-ethylhexyl) phthalate	0.140	71.4	0.625	0.36	No	--
Di-n-butylphthalate	0.024	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] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d], 1996).
[c] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996) and an airborne particulate mass-loading rate of 0.0001 g/m^3 (WDOH 1997).
[d] No Hanford Site-specific or Washington State background value available.
[e] 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]).

-- = not applicable
BG = background
BCL = below contaminant level
COC = contaminant of concern
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)
WAC = Washington Administrative Code

Table 3c. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-F4 Road Crossing Verification Sampling Event. (2 Pages)

COPC	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	0.489 (<BG)	1.1[b]	1.1[b]	1.1[b]	No	--
Uranium-238	0.458 (<BG)	1.1[b]	1.1[b]	1.1[b]	No	--

Table 3c. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-F4 Road Crossing Verification Sampling Event. (2 Pages)

COC	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	1.4 (<BG)	20	20	20	No	--
Barium	29.6 (<BG)	5,600	132[d]	224	No	--
Beryllium	0.27 (<BG)	10.4[e]	1.51[d]	1.51[d]	No	--
Chromium (total)	7.0 (<BG)	80,000	18.5[d]	18.5[d]	No	--
Cobalt	4.5 (<BG)	1,600	32	--[g]	No	--
Copper	13.6 (<BG)	2,960	59.2	22.0[d]	No	--
Lead	3.4 (<BG)	353	10.2[d]	10.2[d]	No	--
Manganese	218 (<BG)	11,200	512[d]	512[d]	No	--
Molybdenum[f]	0.49	400	8	--[g]	No	--
Nickel	9.5 (<BG)	1,600	19.1[d]	27.4	No	--
Vanadium	27.3 (<BG)	560	85.1[d]	--[g]	No	--
Zinc	30.8 (<BG)	24,000	480	67.8[d]	No	--
Bis(2-ethylhexyl) phthalate	0.190	71.4	0.625	0.36	No	--
Di-n-butylphthalate	0.041	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] The value is below the Hanford-specific soil background concentration. The value presented is the Hanford-specific soil background concentration.

[c] Hanford Site-specific background not available. Value is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[d] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d], 1996).

[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996) and an airborne particulate mass-loading rate of 0.0001 g/m^3 (WDOH 1997).

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

[g] 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]).

[h] 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 the RDR/RAWP (DOE-RL 2005b), based on updated oral reference dose value (as provided in the Integrated Risk Information System) (EPA 2006).

-- = not applicable
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)
WAC = Washington Administrative Code

DATA EVALUATION

An evaluation of the results listed in Tables 3a, 3b, and 3c indicate that residual concentrations of site COCs in the BCL stockpile and the road crossing area (Tables 3b and 3c) are all below background values and/or below shallow zone cleanup requirements. In the excavation footprint (Table 3a), however, residual concentrations of five COCs exceed the soil RAGs for the protection of groundwater and/or the Columbia River as follows: mercury, aroclor-1254, benzo(a)anthracene, and benzo(k)fluoranthene. Data were not collected on the vertical extent of residual contamination, but, given the lowest soil-partitioning coefficient (mercury is the lowest, at 30 mL/g), RESRAD modeling (BHI 2005) predicts that these contaminants will not migrate more than 2 m (6.6 ft) vertically in 1,000 years. The vadose zone beneath the 1607-F4 excavation is approximately 5 m (16 ft) thick. Therefore, residual concentrations of these COCs are protective of groundwater. The only pathway for contamination to reach the Columbia River is via groundwater migration, so these contaminant concentrations are also protective of river water. All other COCs for the 1607-F4 waste site were either not detected or quantified below RAGs and lookup values.

Assessment of the risk requirements for the 1607-F4 waste site is determined by calculation of the hazard quotient and carcinogenic (excess cancer) risk values for nonradionuclides. These calculations are located in Appendix C. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. These risk values were conservatively calculated for the entire waste site using the highest values from each of the three 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 1607-F4 waste site is 8.2×10^{-2}. All individual cumulative carcinogenic risk values are less than 1×10^{-6}. The cumulative carcinogenic risk value is 7.4×10^{-7}. Therefore, nonradionuclide risk requirements are met.

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. The application of the three-part test for the 1607-F4 remediation footprint is included in the statistical calculations (Appendix B). The three-part test is not applicable to the BCL stockpile or the road crossing results because direct evaluation of nonstatistical sampling results was used as the compliance basis. All residual COC concentrations for the 1607-F4 remediation footprint pass the three-part test.

DATA QUALITY ASSESSMENT

A DQA review was performed to compare the confirmatory and verification sampling approaches and resulting analytical data with the sampling and data requirements specified by the project objectives and performance specifications. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions [EPA 2000]). The assessment review completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process.

This DQA review was performed in accordance with the RDR/RAWP (DOE-RL 2005b). Specific data quality objectives for the site are found in the *100 Area Remedial Action Sampling and Analysis Plan*

(SAP) (DOE-RL 2005a). To ensure quality data sets, the SAP data assurance requirements, as well as the validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b), are followed where appropriate. Further details of both the confirmatory and verification DQAs are described below.

Confirmatory Sampling Data Quality Assessment

All hexavalent chromium samples were analyzed outside of the holding time; an incorrect absorbance was used, and the samples were reanalyzed. Because of the nature of the sample matrix, holding times of one or two days past the 24-hour requirement should not adversely affect the data. The matrix spike (MS) is below laboratory limits due to sample matrix effect, and the laboratory control blank MSs are within recovery criteria limits. The laboratory duplicate relative percent difference (RPD) result of 69.7% is due to matrix effect nonhomogeneity of the sample. Field duplicate sample results are 0.35 mg/kg nondetect (ND), and the sample analysis results are 1.29 mg/kg. The sample results are not five times below the action level of 2.1 mg/kg and, because of low MS recoveries, might exceed the action level. Because of holding time and low MS recovery issues, the data have limited use and probably should not be used to remove this analyte from the COPC list. The data are valid for their intended use.

The PCB sample discrepancy report volume was decreased because of insufficient sample volume; 15 g was used rather than the standard 30 g. The SAP (DOE-RL 2005a) reporting detection limit of 0.017 mg/kg was exceeded because of reduced laboratory sample volume. Sample results of 0.042 mg/kg ND are five times below action levels. The sample result reproducibility between the field duplicate sample and the original shows the nonhomogeneity of the sample matrix. The data are valid for their intended use.

All metal analyses were conducted at trace levels well below the reporting detection limit (RDL). The minor problems listed in the laboratory case narrative are directly related to analytical performance at these low levels that are not required by the SAP (DOE-RL 2005a). High background levels for certain analytes cause matrix interference with surrogate and MS recoveries. The data are valid for their intended purpose.

Semivolatile samples are two-fold diluted because of high levels of nontarget compounds causing the required detection limits (RDLs) to be exceeded for some analytes. A common laboratory contaminant, bis(2-ethylhexyl)phthalate was found in the method blank and all of the samples at levels below the RDL. Three surrogate recoveries are below the acceptance criteria. Nine analytes recovered are outside of the EPA Contract Laboratory Program quality control (QC) limits in the MS for sample J01XL6, and the matrix spike duplicate (MSD) results are within acceptable limits. MS/MSD anomalies do not require data to be qualified by them, but may be used in conjunction with other observations and parameters to support the qualification of data. All sample analytes results are ND. Some of the analytes' minimum detection limits (MDLs) exceed the RDLs; and except for seven analytes, most of the MDLs are five times below action levels. Four of seven analytes have high or no K_d values. The following analytes had MDLs that were greater than their groundwater lookup values: nitroso-di-n-propylamine;n, bis(2-chloroethoxy) methane, and bis(2-chloroethyl)ether. There is no reason to believe that these analytes are present in the sample. Field duplicate sample results cannot be evaluated for ND values at these levels. The data are valid for their intended purpose.

For the pesticides analysis, all MS recoveries were unobtainable due to the dilution required for analysis. Both samples required a five-fold dilution because of high concentrations of target compounds. There were insufficient sample volumes to extract sample and QC aliquots. The standard 30-g sample and QC aliquots were reduced to 15 g each. These dilutions caused sample MDLs to exceed RDLs and most sample results to be ND. All positive sample results are five times below action levels. Field duplicate results on positive results show acceptable reproducibility. There is no reason to believe that the ND analytes are present in the sample. The data are valid for their intended use.

For the gamma spectroscopy analyses, the laboratory control sample MDA was slightly higher than the RDL for cobalt-60. The data are valid for their intended purpose. 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 conducted.

The confirmatory sampling DQA review for the 1607-F4 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 1607-F4 waste site concludes that the data are of the right type, quality, and quantity to support its 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 QC deficiencies. All analytical data were found to be acceptable for decision-making purposes. The confirmatory sample analytical data are stored in the ENRE project-specific database prior to archival in the HEIS and are provided 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 and WCH 2007c). A review of the sample designs (DOE-RL 2005a, WCH 2007c), the field logbooks (WCH 2007a and WCH 2007b), and applicable analytical data packages has been performed as part of this DQA. All samples were collected per the sample design.

The verification sample data collected at the 1607-F4 waste site were provided by the laboratories in two sample delivery groups (SDGs): SDG K0757 and SDG K0912. SDG K0912 was submitted for third-party validation. No major deficiencies were identified in the analytical data sets. Minor deficiencies are discussed below.

SDG K0757

This SDG comprises three field samples: two from the excavated road crossing area of the 1607-F4 waste site (J14YX2 and J14YX3), and one from the BCL stockpile (J14YX4). These samples were analyzed for ICP metals, mercury, hexavalent chromium, pesticides, PCBs, semivolatile organic compounds (SVOC), gross alpha and gross beta by proportional counting, and by alpha spectroscopy and gamma spectroscopy. No major deficiencies were found in SDG K0757. Minor deficiencies are as follows:

In the ICP metals analysis, the laboratory control sample (LCS) recovery for silicon was below QC limit, at 18%. The silicon data in SDG K0757 may be considered estimated. Estimated data are useable for decision-making purposes.

Also in the ICP metals analysis, the MS recoveries for three ICP metals (aluminum, antimony, and iron) are out of acceptance criteria. For aluminum and iron, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS 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 59.3%. Antimony results for all samples in SDG K0571 may be considered estimated. Estimated data are useable for decision-making purposes.

In the gross alpha analysis, an elevated RPD was reported from the laboratory duplicate analysis of sample J14YX2, at 72%. The laboratory duplicate sample results were near the detection limit. When the duplicate pair is near the detection limit, analysis of RPDs is not considered to be useful in the precision determination. The data are useable for decision-making purposes.

In the pesticide analysis, 17 of 40 MS recoveries are above the acceptance criteria, indicating a potential high bias for the data. All pesticide sample results were reported as the detection limits. The data are useable for decision-making purposes.

The surrogate recoveries in the pesticide analysis for all samples within SDG K0757 are outside the initial criterion, with high results. These samples do not meet the secondary criterion for surrogate recoveries, as there is more than one outlier for each sample. The results for these samples may be considered estimated. Estimated data are acceptable for decision-making purposes.

In the SVOC analysis, 9 of 128 MS recoveries are below the acceptance criteria. The MS for 1,2,4-trichlorobenzene is 47%, and the MSD is 56%. The nitrobenzene, isophorone, and 2-nitrophenol MS recoveries are 46%, 52%, and 48%, respectively. The 2,4-dimethylphenol MS recovery is 44%, and the 2-methylphenol MS recovery is 58%. The MS is 53% for 2-methylnaphthalene and for 4-chloro-3 methylphenol. The data for these analytes may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K0912

This SDG comprises 13 field samples from the 1607-F4 waste site, including one field duplicate pair (J15F31/J15F20), a composite sample from the BCL stockpile (J15F21) and one equipment blank (J15F32). The duplicate pair and the remaining samples are from the shallow zone excavation of the site (J15F22 – J15F30). These samples were analyzed for ICP metals, mercury, hexavalent chromium, pesticides, PCBs, and SVOC. SDG K0912 was submitted for third-party validation. No major deficiencies were found in SDG K0912. Minor deficiencies are as follows:

In the SVOC analysis, the common laboratory contaminant bis(2-ethylhexyl)phthalate is detected in the MB at 70 µg/kg, which is less than the contract required quantitation limit (CRQL). Third-party validation raised the reported values for bis(2-ethylhexyl)phthalate in the SDG K0912 field samples to the required quantitation limit of 330 µg/kg and qualified them as undetected and flagged "U."

One field blank was submitted for SVOC analysis. Di-n-butylphthalate was detected in the equipment blank. Under the Washington Closure Hanford (WCH) statement of work, no qualification is required. No other SVOCs were detected in the field blank.

In the SVOC analysis, 11 of 128 MS recoveries are below the acceptance criteria. The MS for 1,2,4-trichlorobenzene is 48%, and the MSD is 54%. The 4-chloro-3-methylphenol MS and MSD are both 54%. The MS for 2-methylnaphthalene is 56%, and the MSD is 59%. The trichlorophenol, nitrobenzene, isophorone, and 2,4-dimethylphenol MS recoveries are 49%, 48%, 59%, and 29%, respectively. The 4-chloranaline MS recovery is 18%, and the 3-nitroanaline MS recovery is 42%. Method blank recoveries are below the acceptance criteria for nitrobenzene, 1,2,4-trichlorobenzene, 4-chloranaline, 4-chloro-3-methylphenol, 3,3-dichlorobenzidine, 2,4,6-trichlorophenol, and 2-methylnaphthalene, as well. The results for these analytes are qualified as estimates by third-party validation, and flagged "J." Estimated data are useable for decision-making purposes.

Due to a nitrobenzene surrogate recovery of 21% in sample J15F22, below the QC limits, third-party validation qualified the 2-nitrophenol, 2,4-dinitrophenol, nitrobenzene, n-nitroso-di-n-propylamine, 4-chloroaniline, 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 2,6-dinitrotoluene, and n-nitrosodiphenylamine in sample J15F22 as estimated and flagged "J." Estimated data are useable for decision-making purposes.

The RPD for the laboratory duplicate samples for 2,4-dimethylphenol (62%) and 4-nitrophenol (57%) are outside the QC limits. Third-party validation has qualified all results for these analytes as estimated and flagged "J." Estimated data 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. One hundred four SVOCs exceeded the RQL. Under the WCH statement of work, no qualification is required. All other undetected analytes meet the RQL.

All of the toxaphene data in SDG K0912 was qualified by third-party validation as estimated with "J" flags, due to lack of a MS, MSD, or LCS analysis for the analyte. Estimated, or "J" flagged, data are acceptable for decision-making purposes.

All pesticide and PCB results for sample J15F23R were qualified by third-party validation as estimated with "J" flags, due to lack of a MS and MSD analysis for the sample. Estimated, or "J"-flagged, data are acceptable for decision-making purposes.

Third-party validation qualified all PCB results and all pesticide results in sample J15F23 as estimated and flagged "J", due to surrogate recoveries below the QC limits. Estimated, or "J"-flagged, data are acceptable for decision-making purposes.

In the PCB analysis, a surrogate recovery was above QC limits in sample J15F22, at 121%. Third-party validation qualified the aroclor-1260 results in sample J15F22 as estimated and flagged "J." Estimated, or "J"-flagged, data are acceptable for decision-making purposes.

Reported analytical detection levels are compared against the RQLs to ensure that laboratory detection levels meet the required criteria. In the pesticide analysis, toxaphene exceeded the RQL. Under the WCH statement of work, no qualification is required. All other undetected pesticide analytes meet the RQL.

In the ICP metals analysis, boron, calcium, copper, and magnesium were reported in the MB at a concentration below the CRQL but not less than 1/5th of the concentration reported in some of the field samples (i.e., the field sample concentration was low enough that the MB concentration is of similar magnitude). Third-party validation qualified the boron results in samples J15F22, J15F23, J15F24, J15F25, J15F26, J15F28, J15F30, J15F20, and J15F32 as undetected estimates and flagged "UJ." The selenium results in samples J15F22, J15F28, and J15F29 were qualified as undetected estimated and flagged as "UJ." The calcium, copper, and magnesium results in sample J15F32 (the equipment blank) were qualified as undetected estimated and flagged as "UJ." The data are acceptable for decision-making purposes.

Also in the ICP metals analysis, the MS recoveries for 13 ICP metals (aluminum, barium, calcium, chromium, copper, iron, potassium, magnesium, manganese, antimony, silicon, vanadium, and zinc) are out of acceptance criteria. For five analytes, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS 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. Calcium, chromium, copper, potassium, magnesium, antimony, vanadium, and zinc did not have mismatched spike and native concentrations in the original MS. The analytical results for these constituents in all samples in SDG K0912 are qualified as estimated by third-party validation and flagged "J." Estimated data 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 ICP metals analysis, all undetected selenium results (except J15F32) exceeded the RQL. Under the WCH statement of work, no qualification is required. All other undetected pesticide analytes meet the RQL.

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 quality assurance (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 1607-F4 waste site, listed in the field logbook (WCH 2007b), are primary and duplicate field samples from the excavation shallow zone (J15F31/J15F20). 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. 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. None of the RPDs calculated for the field duplicates are above the acceptance criteria (30%). 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 1607-F4 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.

Data Quality Assessment Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above, are a potential challenge for any analysis. The number and types observed in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the verification sampling data for the 1607-F4 waste site found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review concludes that the data are of the right type, quality, and quantity to support the intended use. The verification sampling analytical data are stored in the ENRE project-specific database prior to being submitted for inclusion in the HEIS database. The verification sampling analytical data are also summarized in Appendix B.

SUMMARY FOR INTERIM CLOSURE

The 1607-F4 waste site has 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 707 m^3 (925 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 COCs 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-F4 waste site 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.

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APPENDIX A

CONFIRMATORY SAMPLING AND WASTE CHARACTERIZATION RESULTS

Table A-1. 1607-F4 Confirmatory Sampling Results. (6 Pages)

Sample Location	Sample Number	Sample Date	Americium-241 GEA			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Drain field soil	J01XL3	10/06/04	0.027	U	0.027				0.027		0.008	0.007	U	0.007	0.017	U	0.017	0.025	U	0.025
Under septic tank	J01XL2	10/06/04	0.091	U	0.091				0.011	U	0.011	0.011	U	0.011	0.029	U	0.029	0.040	U	0.040
Drain field	J01XL5	10/06/04	0.12	U	0.12	0.802	U	4.9	0.132		0.059	0.094	U	0.094	0.32		0.12	0.17	U	0.17
Duplicate of J01XL5	J01XL6	10/06/04	0.097	U	0.097	-0.946	U	3.0	0.159		0.047	0.042	U	0.042	0.408		0.1	0.12	U	0.12

Sample Location	Sample Number	Sample Date	Europium-155			Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Drain field soil	J01XL3	10/06/04	0.035	U	0.035	11.5		3.2	19.9		5.5	12.7		0.065	0.482		0.013	0.696		0.032
Under septic tank	J01XL2	10/06/04	0.041	U	0.041	4.92		2.8	16.4		5.8	14.8		0.12	0.557		0.024	0.799		0.055
Drain field	J01XL5	10/06/04	0.12	U	0.12	7.97		3.1	19.7		5.2	9.28		0.59	0.554		0.12	0.667		0.26
Duplicate of J01XL5	J01XL6	10/06/04	0.086	U	0.086	8.59		3.0	13.3		5.4	8.51		0.41	0.668		0.084	0.485		0.15

Sample Location	Sample Number	Sample Date	Thorium-228 GEA			Thorium-232 GEA			Uranium-235 GEA			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Drain field soil	J01XL3	10/06/04	0.623		0.008	0.696		0.032	0.049	U	0.049	1.2	U	1.2
Under septic tank	J01XL2	10/06/04	0.664		0.014	0.799		0.055	0.045	U	0.045	1.5	U	1.5
Drain field	J01XL5	10/06/04	0.474		0.054	0.667		0.26	0.17	U	0.17	6.7	U	6.7
Duplicate of J01XL5	J01XL6	10/06/04	0.456		0.038	0.485		0.15	0.16	U	0.16	4.7	U	4.7

Note: The following acronyms and abbreviations apply to all tables in this appendix. Data qualified with B, C, and/or J, are considered acceptable values.
B = blank contamination (organic constituents)
C = blank contaminantion (inorganic constituents)
GEA = gamma energy analysis
MDA = minimum detectable activity
Q = qualifier
TCLP = toxicity characteristic leachate procedure
U = undetected
J = estimated

Table A-1. 1607-F4 Confirmatory Sampling Results. (6 Pages)

Sample Location	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Drain field soil	J01XL3	10/6/04	5650		0.69	0.26	UJ	0.26	2.3		0.31	74.6		0.02	0.37		0.009	1.5		0.44
Equipment blank	J01XL1	10/6/04	54.4		0.76	0.28	UJ	0.28	0.34	U	0.34	1.3		0.02	0.04		0.009	0.48	U	0.48
Under septic tank	J01XL2	10/6/04	5920		0.79	0.29	UJ	0.29	2.5		0.35	66.7		0.02	0.35		0.01	1.4		0.50
Drain field	J01XL5	10/6/04	7510		4.9	2.4		1.8	4.7		2.2	170		0.12	0.44		0.06	3.5		3.1
Duplicate of J01XL5	J01XL6	10/6/04	8370		5.9	6.2		2.2	7.0		2.6	220		0.15	0.43		0.07	4.7		3.7

Sample Location	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Drain field soil	J01XL3	10/6/04	0.03		0.03	3160		0.59	8.5		0.05	6.8		0.07	12.4		0.04	0.26		0.20
Equipment blank	J01XL1	10/6/04	0.03	U	0.03	26.9		0.65	0.29	UJ	0.06	0.08		0.07	0.16		0.05	0.20	U	0.20
Under septic tank	J01XL2	10/6/04	0.14		0.03	2960		0.68	9.3		0.06	6.1		0.08	14.1		0.05	0.27		0.21
Drain field	J01XL5	10/6/04	4.9		0.18	3760	C	4.1	202	C	0.36	6.5		0.48	140	C	0.30			
Duplicate of J01XL5	J01XL6	10/6/04	6.0		0.22	4180	C	5.0	260		0.44	7.3		0.58	140	C	0.36			
Drain field	J01XL7*	10/6/04																1.29		0.35
Duplicate of J01XL7	J01XL8*	10/6/04																0.35	U	0.35

* Analyzed for hexavalent chromium only.

Sample Location	Sample Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Drain field soil	J01XL3	10/6/04	19000		2.0	5.1		0.16	3680		0.57	360		0.009	0.02		0.01	0.36		0.11
Equipment blank	J01XL1	10/6/04	1620		2.1	0.29		0.18	11.6		0.62	24.1		0.009	0.02	U	0.02	0.24		0.12
Under septic tank	J01XL2	10/6/04	17100		2.2	5.0		0.19	3710		0.65	282		0.01	0.02	U	0.02	0.35		0.13
Drain field	J01XL5	10/6/04	21200		13.7	67.0		1.1	3760		4.0	292		0.06	3.9		0.09	3.0	C	0.78
Duplicate of J01XL5	J01XL6	10/6/04	24100		16.6	91.4		1.4	3980		4.8	303		0.07	16.8		0.37	4.3		0.94

Table A-1. 1607-F4 Confirmatory Sampling Results. (6 Pages)

Sample Location	Sample Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Drain field soil	J01XL3	10/6/04	9.8		0.10	1040		3.0	0.33	U	0.33	376	J	0.43	0.08	U	0.08	123		0.20
Equipment blank	J01XL1	10/6/04	0.26		0.11	19.4		3.3	0.37	U	0.37	54.0	J	0.47	0.08	U	0.08	8.5	UJ	0.22
Under septic tank	J01XL2	10/6/04	9.7		0.12	1190		3.4	0.38	U	0.38	456	J	0.49	0.09	U	0.09	118		0.23
Drain field	J01XL5	10/6/04	10.0		0.72	1350	C	21.0	2.3	U	2.3	454	C	3.0	0.54	U	0.54	126		1.4
Duplicate of J01XL5	J01XL6	10/6/04	11.9		0.87	1300	C	25.4	3.4		2.8	557	C	3.6	1.5		0.65	147	C	1.7

Sample Location	Sample Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
Drain field soil	J01XL3	10/6/04	48.9		0.05	49.2		0.03
Equipment blank	J01XL1	10/6/04	0.17		0.06	2.5		0.04
Under septic tank	J01XL2	10/6/04	40.4		0.36	84.0		0.04
Drain field	J01XL5	10/6/04	53.6		0.36	303		0.24
Duplicate of J01XL5	J01XL6	10/6/04	62.4		0.44	349		0.29

Table A-1. 1607-F4 Confirmatory Sampling Results. (6 Pages)

Constituent	J01XL1 Equipment blank Sample Date 10/6/04			J01XL2 Under septic tank Sample Date 10/6/04			J01XL3 Drain field soil Sample Date 10/6/04			J01XL5 Drain field Sample Date 10/6/04			J01XL6 Duplicate of J01XL5 Sample Date 10/6/04		
	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	13	U	13	14	U	14	14	U	14	80	U	80	42	U	42
Aroclor-1221	13	U	13	14	U	14	14	U	14	80	U	80	42	U	42
Aroclor-1232	13	U	13	14	U	14	14	U	14	80	U	80	42	U	42
Aroclor-1242	13	U	13	14	U	14	14	U	14	80	U	80	42	U	42
Aroclor-1248	13	U	13	14	U	14	14	U	14	150		80	89		42
Aroclor-1254	13	U	13	14	U	14	14	U	14	80	U	80	42	U	42
Aroclor-1260	13	U	13	14	U	14	14	U	14	100		80	71		42
Pesticides															
Aldrin	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	11	U	11
Alpha-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	11	U	11
alpha-Chlordane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	17		11
beta-1,2,3,4,5,6-Hexachlorocyclohexane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	11	U	11
Delta-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	11	U	11
Dichlorodiphenyldichloroethane	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4	64		40	59		21
Dichlorodiphenyldichloroethylene	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4	150		40	110		21
Dichlorodiphenyltrichloroethane	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4	40	U	40	21	U	21
Dieldrin	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4	40	U	40	21	U	21
Endosulfan I	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	11	U	11
Endosulfan II	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4	40	U	40	21	U	21
Endosulfan sulfate	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4	40	U	40	21	U	21
Endrin	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4	40	U	40	21	U	21
Endrin aldehyde	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4	40	U	40	21	U	21
Endrin ketone	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4	40	U	40	21	U	21
Gamma-BHC (Lindane)	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	11	U	11
gamma-Chlordane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	23		11
Heptachlor	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	11	U	11
Heptachlor epoxide	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	20	U	20	11	U	11
Methoxychlor	17	U	17	17	U	17	17	U	17	200	U	200	110	U	110
Toxaphene	170	UJ	170	170	UJ	170	170	UJ	170	2000	U	2000	1100	U	1100
SVOAs (semivolatile organics)															
1,2,4-Trichlorobenzene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
1,2-Dichlorobenzene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
1,3-Dichlorobenzene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
1,4-Dichlorobenzene	330	U	330	350	U	350	340	U	340	73	J	800	79	J	840
2,4,5-Trichlorophenol	830	U	830	860	U	860	850	U	850	2000	U	2000	2100	U	2100
2,4,6-Trichlorophenol	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
2,4-Dichlorophenol	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
2,4-Dimethylphenol	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
2,4-Dinitrophenol	830	U	830	860	U	860	850	U	850	2000	U	2000	2100	U	2100
2,4-Dinitrotoluene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
2,6-Dinitrotoluene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
2-Chloronaphthalene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
2-Chlorophenol	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
2-Methylnaphthalene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840

Table A-1. 1607-F4 Confirmatory Sampling Results. (6 Pages)

Constituent	J01XL1 Equipment blank Sample Date 10/6/04			J01XL2 Under septic tank Sample Date 10/6/04			J01XL3 Drain field soil Sample Date 10/6/04			J01XL5 Drain field Sample Date 10/6/04			J01XL6 Duplicate of J01XL5 Sample Date 10/6/04		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
2-Methylphenol (cresol, o-)	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
2-Nitroaniline	830	U	830	860	U	860	850	U	850	2000	U	2000	2100	U	2100
2-Nitrophenol	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
3,3'-Dichlorobenzidine	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
3-Nitroaniline	830	U	830	860	U	860	850	U	850	2000	U	2000	2100	U	2100
4,6-Dinitro-2-methylphenol	830	U	830	860	U	860	850	U	850	2000	U	2000	2100	U	2100
4-Bromophenylphenyl ether	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
4-Chloro-3-methylphenol	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
4-Chloroaniline	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
4-Chlorophenylphenyl ether	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
4-Methylphenol (cresol, p-)	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
4-Nitroaniline	830	U	830	860	U	860	850	U	850	2000	U	2000	2100	U	2100
4-Nitrophenol	830	U	830	860	U	860	850	U	850	2000	U	2000	2100	U	2100
Acenaphthene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Acenaphthylene	330	U	330	350	U	350	340	U	340	56	J	800	64	J	840
Anthracene	330	U	330	350	U	350	340	U	340	47	J	800	48	J	840
Benzo(a)anthracene	330	U	330	350	U	350	340	U	340	130	J	800	120	J	840
Benzo(a)pyrene	330	U	330	350	U	350	340	U	340	210	J	800	200	J	840
Benzo(b)fluoranthene	330	U	330	350	U	350	340	U	340	120	J	800	840	U	840
Benzo(ghi)perylene	330	U	330	350	U	350	340	U	340	150	J	800	150	J	840
Benzo(k)fluoranthene	330	U	330	350	U	350	340	U	340	140	J	800	840	U	840
Bis(2-chloro-1-methylethyl)ether	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Bis(2-Chloroethoxy)methane	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Bis(2-chloroethyl) ether	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Bis(2-ethylhexyl) phthalate	660	U	660	660	U	660	660	U	660	92	JB	800	170	JB	840
Butylbenzylphthalate	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Carbazole	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Chrysene	330	U	330	350	U	350	340	U	340	200	J	800	240	J	840
Di-n-butylphthalate	27	J	330	20	J	350	340	U	340	800	U	800	840	U	840
Di-n-octylphthalate	330	U	330	19	J	350	340	U	340	56	J	800	840	U	840
Dibenz[a,h]anthracene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Dibenzofuran	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Diethylphthalate	35	J	35	350	U	350	340	U	340	800	U	800	840	U	840
Dimethyl phthalate	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Fluoranthene	330	U	330	350	U	350	340	U	340	110	J	800	130	J	840
Fluorene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Hexachlorobenzene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Hexachlorobutadiene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Hexachlorocyclopentadiene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Hexachloroethane	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Indeno(1,2,3-cd)pyrene	330	U	330	350	U	350	340	U	340	110	J	800	120	J	840
Isophorone	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
N-Nitroso-di-n-dipropylamine	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
N-Nitrosodiphenylamine	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Naphthalene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840

Table A-1. 1607-F4 Confirmatory Sampling Results. (6 Pages)

Constituent	J01XL1 Equipment blank Sample Date 10/6/04			J01XL2 Under septic tank Sample Date 10/6/04			J01XL3 Drain field soil Sample Date 10/6/04			J01XL5 Drain field Sample Date 10/6/04			J01XL6 Duplicate of J01XL5 Sample Date 10/6/04		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Nitrobenzene	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Pentachlorophenol	830	U	830	860	U	860	850	U	850	2000	U	2000	2100	U	2100
Phenanthrene	330	U	330	350	U	350	340	U	340	59	J	800	50	J	840
Phenol	330	U	330	350	U	350	340	U	340	800	U	800	840	U	840
Pyrene	330	U	330	350	U	350	340	U	340	170	J	800	210	J	840

Table A-2. 1607-F4 Waste Characterization Sampling Results.

Sample Location	Sample Number	Sample Date	Arsenic TCLP			Barium TCLP			Cadmium TCLP			Chromium TCLP			Lead TCLP			Selenium TCLP		
			µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL
Drain field	J01XL3-A	10/6/04	17.4	U	17.4	278		1.2	2.4	U	2.4	2.4	U	2.4	11.4	U	11.4	24.0	U	24.0
Drain field	J01XL5-A	10/6/04	29.2		17.4	220		1.2	134		2.4	20.9		2.4	24.2		11.4	24.0	U	24.0
Duplicate	J01XL6-A	10/6/04	17.4	U	17.4	251		1.2	106		2.4	28.3		2.4	104		11.4	24.0	U	24.0

Sample Location	Sample Number	Sample Date	Silver TCLP		
			µg/L	Q	PQL
Drain field	J01XL3-A	10/6/04	3.0	U	3.0
Drain field	J01XL5-A	10/6/04	5.3		3.0
Duplicate	J01XL6-A	10/6/04	5.8		3.0

Sample Location	Sample Number	Sample Date	Mercury TCLP		
			µg/L	Q	PQL
Duplicate	J01XL6-A	10/6/04	0.10	U	0.10

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:

1607-F4 Waste Site Cleanup Verification 95% UCL Calculations, 0100F-CA-V0290, Rev. 1, 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: Field Remediation **Job No. 14655**

Area: 100-F

Discipline: Environmental *Calculation No: 0100F-CA-V0290

Subject: 1607-F4 Waste Site Cleanup Verification 95% UCL Calculations

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation [X] Preliminary [ ] Superseded [ ] Voided [ ]

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Total = 25	*K. A. Anselm*	*J. M. Capron*	*M. J. Appel*	*S. W. Callison*	9/27/07
1	Total = 25	K. A. Anselm	S. W. Clark	N/A	S. W. Callison	10-18-07

SUMMARY OF REVISION

1	Revised to add "J" flagged qualifiers and update bis(2-ethylhexyl) phthalate based on results of final validation package. Sheets revised: 3 (removed selenium), and Attachment 1 sheets 2-6, 8-9, 11-12, and 14-15.

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

*Obtain Calc. No. from Document Control and Form from Intranet

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm *KAA*	**Date** 09/26/07	**Calc. No.** 0100F-CA-V0290	**Rev. No.** 0
Project Field Remediation	**Job No.** 14655	**Checked** J. M. Capron *JMC*	**Date** 9/27/07
Subject 1607-F4 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 1 of 8

Summary

Purpose:

Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the shallow zone excavation of the subject site. Also, perform the *Washington Administrative Code* (WAC) 173-340-740(7)(e) 3-part test for nonradionuclide contaminants of concern (COCs) and contaminants of potential concern (COPCs) and calculate the relative percent difference (RPD) for primary-duplicate sample pairs, as necessary.

Table of Contents:

Given/References:

1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are from DOE-RL (2005b), DOE-RL (2001), and Ecology (2005).
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, 2005, *Cleanup Levels and Risk Calculations (CLARC) Database*, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
9) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013. U.S. Environmental Protection Agency, Washington, D.C.
10) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code.*

Solution:

Calculation methodology is described in Ecology publication #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 primary-duplicate sample pairs, as required. 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 subject waste site. 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.

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm *KCA*	**Date** 09/26/07	**Calc. No.** 0100F-CA-V0290	**Rev. No.** 0
Project Field Remediation	**Job No.** 14655	**Checked** J. M. Capron *JMC*	**Date** 9/27/0
Subject 1607-F4 Waste Site Cleanup Verification 95% UCL Calculations			**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 and calculation of the 95% UCL 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

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

For quality assurance/quality control (QA/QC) 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.

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm **Date** 10/17/07 **Calc. No.** 0100F-CA-V0290 **Rev. No.** 1
Project Field Remediation **Job No.** 14655 **Checked** S. W. Clark **Date** 10/17/07
Subject 1607-F4 Waste Site Cleanup Verification 95% UCL Calculations **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
Antimony	0.83		mg/kg
Arsenic	2.2		mg/kg
Barium	68.1		mg/kg
Beryllium	0.34		mg/kg
Chromium	13.2		mg/kg
Cobalt	6.9		mg/kg
Copper	14.7		mg/kg
Lead	5.5		mg/kg
Manganese	312		mg/kg
Nickel	10.1		mg/kg
Vanadium	43.0		mg/kg
Zinc	48.7		mg/kg
Di-n-butylphthalate	0.031		mg/kg
Cadmium		0.38	mg/kg
Hexavalent chromium		0.23	mg/kg
Mercury		1.2	mg/kg
Molybdenum		0.58	mg/kg
Aroclor-1254		0.046	mg/kg
Aroclor-1260		0.0067	mg/kg
alpha-Chlordane		0.0056	mg/kg
4,4'-DDE		0.0021	mg/kg
4,4'-DDT		0.0028	mg/kg
Endrin aldehyde		0.0018	mg/kg
Endrin ketone		0.0029	mg/kg
gamma-Chlordane		0.0045	mg/kg
Benzo(a)anthracene		0.022	mg/kg
Benzo(k)fluoranthene		0.018	mg/kg
Chrysene		0.026	mg/kg
Fluoranthene		0.044	mg/kg
Phenol		0.029	mg/kg
Pyrene		0.038	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

All data sets evaluated meet the 3-part test criteria when compared to the most stringent cleanup limit.

[a]The 95% UCL result or maximum value, depending on data censorship, as described in the methodology section.

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

Analyte	Duplicate Analysis[c]
Aluminum	14%
Barium	9.6%
Calcium	3.4%
Chromium	8.6%
Copper	13.1%
Iron	10.1%
Magnesium	14.2%
Manganese	8.3%
Silicon	0.8%
Vanadium	8.3%
Zinc	4.0%

[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
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
WAC = *Washington Administrative Code*

CALCULATION SHEET

Washington Closure Hanford

Originator	K. A. Anselm KAA	Date	09/26/07	Calc. No.	0100F-CA-V0290
Project	Field Remediation	Job No.	14655	Checked	J. M. Capron JMC
Subject	1607-F4 Waste Site Cleanup Verification 95% UCL Calculations	Rev. No.	0	Date	9/27/07
				Sheet No.	4 of 8

1 **Shallow Zone Excavation Verification Data**

	Sampling Area	Sample Number	Sample Date	Antimony mg/kg	Q	PQL	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
4	10	J15F31	8/7/07	1.0	J	0.64	2.1		1.2	84.8	C	0.06	0.43		0.03	9.7	J	0.29	7.8		0.23
5	Duplicate of J15F31	J15F20	8/7/07	0.65	UJ	0.65	1.5		1.2	77.0	C	0.06	0.37		0.03	8.9	J	0.29	6.9		0.24
6	1	J15F22	8/7/07	0.78	J	0.65	1.3		1.2	69.8	C	0.06	0.19		0.03	29.6	J	0.30	4.4		0.24
7	2	J15F23	8/7/07	0.70	J	0.66	2.4		1.2	72.5	C	0.06	0.31		0.03	7.8	J	0.30	6.8		0.24
8	3	J15F24	8/7/07	0.64	UJ	0.64	1.7		1.2	27.4	C	0.06	0.18		0.03	5.1	J	0.29	3.0		0.23
9	4	J15F25	8/7/07	0.95	J	0.64	1.4		1.2	62.2	C	0.06	0.26		0.03	7.5	J	0.29	5.4		0.23
10	5	J15F26	8/7/07	1.2	J	0.65	2.3		1.2	42.9	C	0.06	0.27		0.03	9.9	J	0.29	6.4		0.24
11	6	J15F27	8/7/07	0.64	UJ	0.64	1.3		1.2	32.1	C	0.06	0.21		0.03	3.3	J	0.29	3.7		0.23
12	7	J15F28	8/7/07	0.64	UJ	0.64	2.8		1.2	70.8	C	0.06	0.33		0.03	6.5	J	0.29	6.4		0.23
13	8	J15F29	8/7/07	0.65	UJ	0.65	1.3		1.2	31.4	C	0.06	0.24		0.03	6.3	J	0.30	4.3		0.24
14	9	J15F30	8/7/07	1.0	J	0.65	2.2		1.2	80.3	C	0.06	0.41		0.03	8.5	J	0.29	7.5		0.24

15 **Statistical Computation Input Data**

	Sampling Area	Sample Number	Sample Date	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Chromium mg/kg	Cobalt mg/kg
18	10	J15F31/ J15F20	8/7/07	0.66	1.8	80.9	0.40	9.3	7.4
19	1	J15F22	8/7/07	0.78	1.3	69.8	0.19	29.6	4.4
20	2	J15F23	8/7/07	0.70	2.4	72.5	0.31	7.8	6.8
21	3	J15F24	8/7/07	0.32	1.7	27.4	0.18	5.1	3.0
22	4	J15F25	8/7/07	0.95	1.4	62.2	0.26	7.5	5.4
23	5	J15F26	8/7/07	1.2	2.3	42.9	0.27	9.9	6.4
24	6	J15F27	8/7/07	0.32	1.3	32.1	0.21	3.3	3.7
25	7	J15F28	8/7/07	0.32	2.8	70.8	0.33	6.5	6.4
26	8	J15F29	8/7/07	0.33	1.3	31.4	0.24	6.3	4.3
27	9	J15F30	8/7/07	1.0	2.2	80.3	0.41	8.5	7.5

28 **Statistical Computations**

		Antimony	Arsenic	Barium	Beryllium	Chromium	Cobalt
30	95% UCL value based on	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
31	N	10	10	10	10	10	10
32	% < Detection limit	40%	0%	0%	0%	0%	0%
33	Mean	0.66	1.9	57.0	0.28	9.4	5.5
34	Standard deviation	0.33	0.5	21.3	0.08	7.4	1.6
35	95% UCL on mean	0.83	2.2	68.1	0.34	13.2	6.9
36	Maximum detected value	1.2	2.8	84.8	0.43	29.6	7.8
37	Statistical value	0.83	2.2	68.1	0.34	13.2	6.9
38	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	5 BG/GW & River Protection	20 Direct Exposure/GW & River Protection	132 BG/GW Protection	1.51 BG/GW & River Protection	18.5 BG/GW & River Protection	32 GW Protection
39	**WAC 173-340 3-PART TEST**						
40	95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NA
41	> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NA
42	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NA
43	**WAC 173-340 Compliance?** Yes	Because all values are below background (5 mg/kg), the WAC 173-340 3-part test is not required.	Because all values are below background (6.5 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 (15.7 mg/kg), the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm *KAA*	**Date** 09/26/07	**Calc. No.** 0100F-CA-V0290	**Rev. No.** 0
Project Field Remediation	**Job No.** 14655	**Checked** J. M. Capron *JMC*	**Date** 9/27/07
Subject 1607-F4 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 5 of 8

1 **Shallow Zone Excavation Verification Data (continued)**

	Sampling Area	Sample Number	Sample Date	Copper mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL	Di-n-butylphthalate mg/kg	Q	PQL
4	10	J15F31	8/7/07	13.8	CJ	0.26	4.7		0.97	351		0.20	12.7		0.79	47.8	J	0.23	39.5	CJ	0.12	0.031	J	0.330
5	Duplicate of	J15F20	8/7/07	12.1	CJ	0.27	4.8		0.97	323		0.21	9.9		0.80	44.0	J	0.24	41.1	CJ	0.12	0.050	J	0.330
6	1	J15F22	8/7/07	21.7	CJ	0.27	6.8		0.98	165		0.21	6.8		0.80	26.3	J	0.24	93.0	CJ	0.12	0.028	J	0.350
7	2	J15F23	8/7/07	9.6	CJ	0.27	5.3		0.99	313		0.21	9.3		0.81	45.9	J	0.24	39.6	CJ	0.12	0.025	J	0.340
8	3	J15F24	8/7/07	6.4	CJ	0.26	2.1		0.97	243		0.20	5.3		0.79	18.3	J	0.23	24.7	CJ	0.12	0.024	J	0.330
9	4	J15F25	8/7/07	9.1	CJ	0.26	4.5		0.96	233		0.20	7.3		0.79	35.8	J	0.23	33.3	CJ	0.12	0.027	J	0.330
10	5	J15F26	8/7/07	15.3	CJ	0.27	2.3		0.97	270		0.21	11.0		0.80	34.1	J	0.24	31.9	CJ	0.12	0.020	J	0.330
11	6	J15F27	8/7/07	9.4	CJ	0.26	1.5		0.97	144		0.20	5.7		0.79	19.9	J	0.23	19.4	CJ	0.12	0.028	J	0.330
12	7	J15F28	8/7/07	9.1	CJ	0.26	4.2		0.95	302		0.20	8.5		0.78	36.9	J	0.23	35.2	CJ	0.12	0.024	J	0.330
13	8	J15F29	8/7/07	11.2	CJ	0.27	2.3		0.98	192		0.21	7.4		0.80	26.6	J	0.24	23.1	CJ	0.12	0.035	J	0.330
14	9	J15F30	8/7/07	12.3	CJ	0.27	4.0		0.97	340		0.21	11.1		0.80	47.8	J	0.24	38.7	CJ	0.12	0.022	J	0.330

15 **Statistical Computation Input Data**

	Sampling Area	Sample Number	Sample Date	Copper mg/kg	Lead mg/kg	Manganese mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	Di-n-butylphthalate mg/kg
18	10	J15F31/ J15F20	8/7/07	13.0	4.8	337	11.3	45.9	40.3	0.041
19	1	J15F22	8/7/07	21.7	6.8	165	6.8	26.3	93.0	0.028
20	2	J15F23	8/7/07	9.6	5.3	313	9.3	45.9	39.6	0.025
21	3	J15F24	8/7/07	6.4	2.1	243	5.3	18.3	24.7	0.024
22	4	J15F25	8/7/07	9.1	4.5	233	7.3	35.8	33.3	0.027
23	5	J15F26	8/7/07	15.3	2.3	270	11.0	34.1	31.9	0.020
24	6	J15F27	8/7/07	9.4	1.5	144	5.7	19.9	19.4	0.028
25	7	J15F28	8/7/07	9.1	4.2	302	8.5	36.9	35.2	0.024
26	8	J15F29	8/7/07	11.2	2.3	192	7.4	26.6	23.1	0.035
27	9	J15F30	8/7/07	12.3	4.0	340	11.1	47.8	38.7	0.022

28 **Statistical Computations**

		Copper	Lead	Manganese	Nickel	Vanadium	Zinc	Di-n-butylphthalate
30	95% UCL value 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), 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.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
31	N	10	10	10	10	10	10	10
32	% < Detection limit	0%	0%	0%	0%	0%	0%	0%
33	Mean	11.7	3.8	254	8.4	33.8	37.9	0.027
34	Standard deviation	4.3	1.7	70.5	2.2	10.8	20.7	0.0062
35	95% UCL on mean	14.7	5.5	312	10.1	43.0	48.7	0.031
36	Maximum detected value	21.7	6.8	351	12.7	47.8	93.0	0.050
37	Statistical value	14.7	5.5	312	10.1	43.0	48.7	0.031
38	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	22.0 BG/River Protection	10.2 BG/GW & River Protection	512 BG/GW & River Protection	19.1 BG/River Protection	85.1 BG/River Protection	67.8 BG/River Protection	160 River Protection
39	**WAC 173-340 3-PART TEST**							
40	95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NO	NO
41	> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NO	NO
42	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NO	NO
43	**WAC 173-340 Compliance?** Yes	Because all values are below background (22.0 mg/kg), the WAC 173-340 3-part test is not required.	Because all values are below background (10.2 mg/kg), the WAC 173-340 3-part test is not required.	Because all values are below background (512 mg/kg), the WAC 173-340 3-part test is not required.	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.	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.

CALCULATION SHEET

Washington Closure Hanford

Originator	K. A. Anselm *KAA*	Date	09/26/07	Calc. No.	0100F-CA-V0290
Project	Field Remediation	Job No.	14655	Checked	J. M. Capron *JMC*
Subject	1607-F4 Waste Site Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 9/27/07
Sheet No. 6 of 8

Ecology Software (MTCAStat) Results

Antimony 95% UCL Calculation

DATA	ID
0.66	J15F31/J15F20
0.78	J15F22
0.70	J15F23
0.32	J15F24
0.95	J15F25
1.2	J15F26
0.32	J15F27
0.32	J15F28
0.33	J15F29
1.0	J15F30

Number of samples		Uncensored values	
Uncensored	10	Mean	0.66
Censored		Lognormal mean	0.67
Detection limit or PQL		Std. devn.	0.33
Method detection limit		Median	0.68
TOTAL	10	Min.	0.32
		Max.	1.2

Lognormal distribution? r-squared is: 0.864
Normal distribution? r-squared is: 0.899
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (Land's method) is 0.83

Arsenic 95% UCL Calculation

DATA	ID
1.8	J15F31/J15F20
1.3	J15F22
2.4	J15F23
1.7	J15F24
1.4	J15F25
2.3	J15F26
1.3	J15F27
2.8	J15F28
1.3	J15F29
2.2	J15F30

Number of samples		Uncensored values	
Uncensored	10	Mean	1.9
Censored		Lognormal mean	1.9
Detection limit or PQL		Std. devn.	0.5
Method detection limit		Median	1.8
TOTAL	10	Min.	1.3
		Max.	2.8

Lognormal distribution? r-squared is: 0.912
Normal distribution? r-squared is: 0.908
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.2

Barium 95% UCL Calculation

DATA	ID
80.9	J15F31/J15F20
69.8	J15F22
72.5	J15F23
27.4	J15F24
62.2	J15F25
42.9	J15F26
32.1	J15F27
70.8	J15F28
31.4	J15F29
80.3	J15F30

Number of samples		Uncensored values	
Uncensored	10	Mean	57.0
Censored		Lognormal mean	57.9
Detection limit or PQL		Std. devn.	21.3
Method detection limit		Median	66.0
TOTAL	10	Min.	27.4
		Max.	80.9

Lognormal distribution? r-squared is: 0.860
Normal distribution? r-squared is: 0.884
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (Land's method) is 68.1

Beryllium 95% UCL Calculation

DATA	ID
0.40	J15F31/J15F20
0.19	J15F22
0.31	J15F23
0.18	J15F24
0.26	J15F25
0.27	J15F26
0.21	J15F27
0.33	J15F28
0.24	J15F29
0.41	J15F30

Number of samples		Uncensored values	
Uncensored	10	Mean	0.28
Censored		Lognormal mean	0.28
Detection limit or PQL		Std. devn.	0.08
Method detection limit		Median	0.27
TOTAL	10	Min.	0.18
		Max.	0.41

Lognormal distribution? r-squared is: 0.971
Normal distribution? r-squared is: 0.949
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.34

Chromium 95% UCL Calculation

DATA	ID
9.3	J15F31/J15F20
29.6	J15F22
7.8	J15F23
5.1	J15F24
7.5	J15F25
9.9	J15F26
3.3	J15F27
6.5	J15F28
6.3	J15F29
8.5	J15F30

Number of samples		Uncensored values	
Uncensored	10	Mean	9.4
Censored		Lognormal mean	9.3
Detection limit or PQL		Std. devn.	7.4
Method detection limit		Median	7.7
TOTAL	10	Min.	3.3
		Max.	29.6

Lognormal distribution? r-squared is: 0.853
Normal distribution? r-squared is: 0.598
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 13.2

Cobalt 95% UCL Calculation

DATA	ID
7.4	J15F31/J15F20
4.4	J15F22
6.8	J15F23
3.0	J15F24
5.4	J15F25
6.4	J15F26
3.7	J15F27
6.4	J15F28
4.3	J15F29
7.5	J15F30

Number of samples		Uncensored values	
Uncensored	10	Mean	5.5
Censored		Lognormal mean	5.6
Detection limit or PQL		Std. devn.	1.6
Method detection limit		Median	5.9
TOTAL	10	Min.	3.0
		Max.	7.5

Lognormal distribution? r-squared is: 0.927
Normal distribution? r-squared is: 0.946
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.9

Copper 95% UCL Calculation

DATA	ID
13.0	J15F31/J15F20
21.7	J15F22
9.6	J15F23
6.4	J15F24
9.1	J15F25
15.3	J15F26
9.4	J15F27
9.1	J15F28
11.2	J15F29
12.3	J15F30

Number of samples		Uncensored values	
Uncensored	10	Mean	11.7
Censored		Lognormal mean	11.7
Detection limit or PQL		Std. devn.	4.3
Method detection limit		Median	10.4
TOTAL	10	Min.	6.4
		Max.	21.7

Lognormal distribution? r-squared is: 0.940
Normal distribution? r-squared is: 0.856
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 14.7

Lead 95% UCL Calculation

DATA	ID
4.8	J15F31/J15F20
6.8	J15F22
5.3	J15F23
2.1	J15F24
4.5	J15F25
2.3	J15F26
1.5	J15F27
4.2	J15F28
2.3	J15F29
4.0	J15F30

Number of samples		Uncensored values	
Uncensored	10	Mean	3.8
Censored		Lognormal mean	3.8
Detection limit or PQL		Std. devn.	1.7
Method detection limit		Median	4.1
TOTAL	10	Min.	1.5
		Max.	6.8

Lognormal distribution? r-squared is: 0.936
Normal distribution? r-squared is: 0.945
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 5.5

Manganese 95% UCL Calculation

DATA	ID
337	J15F31/J15F20
165	J15F22
313	J15F23
243	J15F24
233	J15F25
270	J15F26
144	J15F27
302	J15F28
192	J15F29
340	J15F30

Number of samples		Uncensored values	
Uncensored	10	Mean	254
Censored		Lognormal mean	256
Detection limit or PQL		Std. devn.	70.5
Method detection limit		Median	257
TOTAL	10	Min.	144
		Max.	340

Lognormal distribution? r-squared is: 0.935
Normal distribution? r-squared is: 0.957
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 312

CALCULATION SHEET

Washington Closure Hanford			
Originator: K. A. Anselm (signature)	Date: 09/26/07	Calc. No.: 0100F-CA-V0290	Rev. No.: 0
Project: Field Remediation	Job No.: 14655	Checked: J. M. Capron (signature)	Date: 9/27/07
Subject: 1607-F4 Waste Site Cleanup Verification 95% UCL Calculations			Sheet No.: 7 of 8

Ecology Software (MTCAStat) Results

Nickel 95% UCL Calculation

DATA	ID				
11.3	J15F31/J15F20				
6.8	J15F22				
9.3	J15F23	Number of samples		Uncensored values	
5.3	J15F24	Uncensored	10	Mean	8.4
7.3	J15F25	Censored		Lognormal mean	8.4
11.0	J15F26	Detection limit or PQL		Std. devn.	2.2
5.7	J15F27	Method detection limit		Median	8.0
8.5	J15F28	TOTAL	10	Min.	5.3
7.4	J15F29			Max.	11.3
11.1	J15F30				

Lognormal distribution? r-squared is: 0.947
Normal distribution? r-squared is: 0.939
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.1

Vanadium 95% UCL Calculation

DATA	ID				
45.9	J15F31/J15F20				
26.3	J15F22				
45.9	J15F23	Number of samples		Uncensored values	
18.3	J15F24	Uncensored	10	Mean	33.8
35.8	J15F25	Censored		Lognormal mean	34.0
34.1	J15F26	Detection limit or PQL		Std. devn.	10.8
19.9	J15F27	Method detection limit		Median	35.0
36.9	J15F28	TOTAL	10	Min.	18.3
26.6	J15F29			Max.	47.8
47.8	J15F30				

Lognormal distribution? r-squared is: 0.932
Normal distribution? r-squared is: 0.944
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 43.0

Zinc 95% UCL Calculation

DATA	ID				
40.3	J15F31/J15F20				
93.0	J15F22				
39.6	J15F23	Number of samples		Uncensored values	
24.7	J15F24	Uncensored	10	Mean	37.9
33.3	J15F25	Censored		Lognormal mean	37.8
31.9	J15F26	Detection limit or PQL		Std. devn.	20.7
19.4	J15F27	Method detection limit		Median	34.3
35.2	J15F28	TOTAL	10	Min.	19.4
23.1	J15F29			Max.	93.0
38.7	J15F30				

Lognormal distribution? r-squared is: 0.864
Normal distribution? r-squared is: 0.674
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 48.7

Di-n-butylphthalate 95% UCL Calculation

DATA	ID				
0.041	J15F31/J15F20				
0.028	J15F22				
0.025	J15F23	Number of samples		Uncensored values	
0.024	J15F24	Uncensored	10	Mean	0.027
0.027	J15F25	Censored		Lognormal mean	0.027
0.020	J15F26	Detection limit or PQL		Std. devn.	0.006
0.028	J15F27	Method detection limit		Median	0.026
0.024	J15F28	TOTAL	10	Min.	0.020
0.035	J15F29			Max.	0.041
0.022	J15F30				

Lognormal distribution? r-squared is: 0.935
Normal distribution? r-squared is: 0.883
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.031

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm *KAA* Date 09/26/07 Calc. No. 0100F-CA-V0290 Rev. No. 0
Project Field Remediation Job No. 14655 Checked J. M. Capron *JMC* Date 9/27/07
Subject 1607-F4 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 8 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
10	J15F31	08/07/07	7820		4.9	1.0	J	0.64	2.1		1.2	84.8	C	0.06	0.43		0.03	3850	CJ	2.1	9.7	J	0.29	7.8		0.23
Duplicate of J15F31	J15F20	08/07/07	6800		4.9	0.65	UJ	0.65	1.5		1.2	77.0	C	0.06	0.37		0.03	3720	CJ	2.1	8.9	J	0.29	6.9		0.24

Analysis:

		Aluminum	Antimony	Arsenic	Barium	Beryllium	Calcium	Total Chromium	Cobalt
	TDL	5	0.6	10	2	0.5	100	1	2
Duplicate Analysis	Both > PQL?	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**		No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)
	RPD	14.0%			9.6%		3.4%	8.6%	
	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			Molybdenum			Nickel			Potassium		
			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
10	J15F31	08/07/07	13.8	CJ	0.26	20900	C	7.0	4.7		0.97	4540	C	2.4	351		0.20	0.52		0.47	12.7		0.79	1220	J	9.4
Duplicate of J15F31	J15F20	08/07/07	12.1	CJ	0.27	18900	C	7.0	4.8		0.97	3940	C	2.4	323		0.21	0.47	U	0.47	9.9		0.80	1350	J	9.4

Analysis:

		Copper	Iron	Lead	Magnesium	Manganese	Molybdenum	Nickel	Potassium
	TDL	1	5	5	75	5	2	4	400
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	No-Stop (acceptable)	**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)
	RPD	13.1%	10.1%		14.2%	8.3%			
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc			Di-n-butylphthalate			Phenol		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
10	J15F31	08/07/07	1210	C	2.5	196	C	2.0	47.8	J	0.23	39.5	CJ	0.12	0.031	J	0.33	0.34	U	0.34
Duplicate of J15F31	J15F20	08/07/07	1200	C	2.5	176	C	2.1	44.0	J	0.24	41.1	CJ	0.12	0.05	J	0.33	29	J	0.33

Analysis:

		Silicon	Sodium	Vanadium	Zinc	Di-n-butylphthalate	Phenol
	TDL	2	50	2.5	1	330	330
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	No-Stop (acceptable)	No-Stop (acceptable)
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**		
	RPD	0.8%		8.3%	4.0%		
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

Attachment 1. 1607-F4 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Road West	J14YX2	04/04/07	0.16	U	0.16	0.16	U	0.16	0.17	U	0.17	0.41	U	0.41	0.54	U	0.54
Road East	J14YX3	04/04/07	0.26	U	0.26	0.077	U	0.077	0.090	U	0.090	0.21	U	0.21	0.31	U	0.31
BCL Stockpile	J14YX4	04/04/07	0.096	U	0.096	0.11	U	0.11	0.10	U	0.10	0.27	U	0.27	0.34	U	0.34

Sample Location	HEIS Number	Sample Date	Europium-155			Gross alpha			Gross beta			Plutonium-238			Plutonium-239/240		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Road West	J14YX2	04/04/07	0.26	U	0.26	18.6		8.9	29.2		9.5	0.0331	U	0.25	0	U	0.25
Road East	J14YX3	04/04/07	0.21	U	0.21	11.3		7.7	25.2		5.4						
BCL Stockpile	J14YX4	04/04/07	0.21	U	0.21	10.6		7.7	21.0		5.5						

Sample Location	HEIS Number	Sample Date	Potassium-40			Radium-226			Radium-228			Silver-108m			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Road West	J14YX2	04/04/07	6.94		1.7	0.35	U	0.35	1.3	U	1.3	0.12	U	0.12	0.359		0.22
Road East	J14YX3	04/04/07	15.2		0.81	0.300		0.12	0.671		0.37	0.061	U	0.061	0.524		0.12
BCL Stockpile	J14YX4	04/04/07	13.6		0.94	0.521		0.19	0.895		0.44	0.079	U	0.079	0.670		0.22

Sample Location	HEIS Number	Sample Date	Thorium-232 GEA			Total beta radiostrontium			Uranium-233/234			Uranium-235			Uranium-235 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Road West	J14YX2	04/04/07	1.3	U	1.3	0.0528	U	0.22	0.489		0.12	0.0555	U	0.14	0.45	U	0.45
Road East	J14YX3	04/04/07	0.671		0.37	0.0624	U	0.20							0.31	U	0.31
BCL Stockpile	J14YX4	04/04/07	0.895		0.44										0.43	U	0.43

Sample Location	HEIS Number	Sample Date	Uranium-238			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA
Road West	J14YX2	04/04/07	0.458		0.12	18	U	18
Road East	J14YX3	04/04/07				10	U	10
BCL Stockpile	J14YX4	04/04/07				11	U	11

Note: The following abbreviations apply to all Attachment 1 tables. Data qualified with B, C, D, I, and/or J are considered acceptable values.

B = blank contamination (organics)
BCL = below cleanup level
C = blank contamination (inorganics)
D = diluted
GEA = gamma energy analysis
I = interference
J = estimated
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
U = undetected

Attachment	1	Sheet No.	1 of 16
Originator	K. A. Anselm *KAA*	Date	09/26/07
Checked	J. M. Capron *JMC*	Date	9/27/07
Calc. No.	0100F-CA-V0290	Rev. No.	0

Attachment 1. 1607-F4 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
10	J15F31	08/07/07	7820		4.9	1.0	J	0.64	2.1		1.2	84.8	C	0.06	0.43		0.03
Duplicate of J15F31	J15F20	08/07/07	6800		4.9	0.65	UJ	0.65	1.5		1.2	77.0	C	0.06	0.37		0.03
1	J15F22	08/07/07	4640		4.9	0.78	J	0.65	1.3		1.2	69.8	C	0.06	0.19		0.03
2	J15F23	08/07/07	6280		5.0	0.70	J	0.66	2.4		1.2	72.5	C	0.06	0.31		0.03
3	J15F24	08/07/07	4030		4.9	0.64	UJ	0.64	1.7		1.2	27.4	C	0.06	0.18		0.03
4	J15F25	08/07/07	5500		4.9	0.95	J	0.64	1.4		1.2	62.2	C	0.06	0.26		0.03
5	J15F26	08/07/07	5640		4.9	1.2	J	0.65	2.3		1.2	42.9	C	0.06	0.27		0.03
6	J15F27	08/07/07	2760		4.9	0.64	UJ	0.64	1.3		1.2	32.1	C	0.06	0.21		0.03
7	J15F28	08/07/07	5450		4.8	0.64	UJ	0.64	2.8		1.2	70.8	C	0.06	0.33		0.03
8	J15F29	08/07/07	4270		4.9	0.65	UJ	0.65	1.3		1.2	31.4	C	0.06	0.24		0.03
9	J15F30	08/07/07	7330		4.9	1.0	J	0.65	2.2		1.2	80.3	C	0.06	0.41		0.03
Equipment Blank	J15F32	08/07/07	49.6		1.6	0.21	UJ	0.21	0.39	U	0.39	1.3	C	0.02	0.02		0.01
BCL Stockpile	J15F21	08/07/07	7700		4.9	0.65	UJ	0.65	2.3		1.2	74.7	C	0.06	0.33		0.03
Road West	J14YX2	04/04/07	4200	C	4.3	0.94	U	0.94	1.4		1.2	29.6		0.06	0.26		0.03
Road East	J14YX3	04/04/07	4490	C	4.2	0.92	U	0.92	2.0		1.2	36.1		0.06	0.27		0.03
BCL Stockpile	J14YX4	04/04/07	5510	C	4.4	0.97	U	0.97	1.9		1.2	125		0.06	0.43		0.03

Sample Location	Sample Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
10	J15F31	08/07/07	1.1	U	1.1	0.15	U	0.15	3850	CJ	2.1	9.7	J	0.29	7.8		0.23
Duplicate of J15F31	J15F20	08/07/07	1.8	CUJ	1.1	0.15	U	0.15	3720	CJ	2.1	8.9	J	0.29	6.9		0.24
1	J15F22	08/07/07	1.8	CUJ	1.1	0.38		0.15	2730	CJ	2.1	29.6	J	0.30	4.4		0.24
2	J15F23	08/07/07	2.3	CUJ	1.1	0.15	U	0.15	3610	CJ	2.1	7.8	J	0.30	6.8		0.24
3	J15F24	08/07/07	1.4	CUJ	1.1	0.15	U	0.15	2330	CJ	2.1	5.1	J	0.29	3.0		0.23
4	J15F25	08/07/07	2.1	CUJ	1.1	0.15	U	0.15	3000	CJ	2.1	7.5	J	0.29	5.4		0.23
5	J15F26	08/07/07	1.9	CUJ	1.1	0.15	U	0.15	3720	CJ	2.1	9.9	J	0.29	6.4		0.24
6	J15F27	08/07/07	1.1	U	1.1	0.15	U	0.15	1900	CJ	2.1	3.3	J	0.29	3.7		0.23
7	J15F28	08/07/07	1.2	CUJ	1.0	0.14	U	0.14	3240	CJ	2.1	6.5	J	0.29	6.4		0.23
8	J15F29	08/07/07	1.1	CU	1.1	0.15	U	0.15	2270	CJ	2.1	6.3	J	0.30	4.3		0.24
9	J15F30	08/07/07	1.6	CUJ	1.1	0.15	U	0.15	3810	CJ	2.1	8.5	J	0.29	7.5		0.24
Equipment Blank	J15F32	08/07/07	0.65	CUJ	0.34	0.05	U	0.05	22.2	CUJ	0.68	0.1	UJ	0.1	0.09		0.08
BCL Stockpile	J15F21	08/07/07	2.7	C	1.1	0.15	U	0.15	4350	CJ	2.1	10.5	J	0.30	7.2		0.24
Road West	J14YX2	04/04/07	1.1	U	1.1	0.09	U	0.09	2880	C	2.2	6.6		0.24	4.3		0.27
Road East	J14YX3	04/04/07	1.1	U	1.1	0.09	U	0.09	2630	C	2.2	7.0		0.23	4.5		0.26
BCL Stockpile	J14YX4	04/04/07	5.8		1.1	0.09	U	0.09	4400	C	2.3	7.4		0.24	6.7		0.27

Attachment	1	Sheet No.	2 of 16
Originator	K. A. Anselm KAA	Date	10/17/07
Checked	S. W. Clark SWC	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
10	J15F31	08/07/07	13.8	CJ	0.26	0.20	U	0.20	20900	C	7.0	4.7		0.97	4540	CJ	2.4
Duplicate of J15F31	J15F20	08/07/07	12.1	CJ	0.27	0.20	U	0.20	18900	C	7.0	4.8		0.97	3940	CJ	2.4
1	J15F22	08/07/07	21.7	CJ	0.27	0.21	U	0.21	12600	C	7.1	6.8		0.98	3050	CJ	2.4
2	J15F23	08/07/07	9.6	CJ	0.27	0.20	U	0.20	19100	C	7.2	5.3		0.99	3800	CJ	2.4
3	J15F24	08/07/07	6.4	CJ	0.26	0.20	U	0.20	9250	C	7.0	2.1		0.97	2590	CJ	2.4
4	J15F25	08/07/07	9.1	CJ	0.26	0.20	U	0.20	15200	C	7.0	4.5		0.96	3090	CJ	2.4
5	J15F26	08/07/07	15.3	CJ	0.27	0.20	U	0.20	15200	C	7.0	2.3		0.97	4190	CJ	2.4
6	J15F27	08/07/07	9.4	CJ	0.26	0.20	U	0.20	7760	C	7.0	1.5		0.97	1870	CJ	2.4
7	J15F28	08/07/07	9.1	CJ	0.26	0.20		0.20	16300	C	6.9	4.2		0.95	3480	CJ	2.3
8	J15F29	08/07/07	11.2	CJ	0.27	0.20	U	0.20	10900	C	7.1	2.3		0.98	2920	CJ	2.4
9	J15F30	08/07/07	12.3	CJ	0.27	0.23		0.20	20600	C	7.0	4.0		0.97	4400	CJ	2.4
Equipment Blank	J15F32	08/07/07	0.11	CUJ	0.09				97.3	C	2.3	0.31	U	0.31	6.5	CUJ	0.77
BCL Stockpile	J15F21	08/07/07	13.6	CJ	0.27	0.21	U	0.21	20400	C	7.1	7.7		0.98	4320	CJ	2.4
Road West	J14YX2	04/04/07	13.5		0.35	0.21	U	0.21	10900		8.7	2.8		0.83	3040		2.2
Road East	J14YX3	04/04/07	13.6		0.34	0.20	U	0.20	11800		8.5	3.4		0.80	3250		2.1
BCL Stockpile	J14YX4	04/04/07	12.2		0.36	0.28		0.22	17100		9.0	4.9		0.85	3660		2.2

Attachment 1. 1607-F4 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Manganese			Mercury			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
10	J15F31	08/07/07	351		0.20	0.01	U	0.01	0.52		0.47	12.7		0.79	1220	J	9.4
Duplicate of J15F31	J15F20	08/07/07	323		0.21	0.01	U	0.01	0.47	U	0.47	9.9		0.80	1350	J	9.4
1	J15F22	08/07/07	165		0.21	1.2		0.01	0.58		0.47	6.8		0.80	477	J	9.5
2	J15F23	08/07/07	313		0.21	0.01	U	0.01	0.48	U	0.48	9.3		0.81	1230	J	9.6
3	J15F24	08/07/07	243		0.20	0.01	U	0.01	0.47	U	0.47	5.3		0.79	553	J	9.4
4	J15F25	08/07/07	233		0.20	0.01	U	0.01	0.47	U	0.47	7.3		0.79	1140	J	9.4
5	J15F26	08/07/07	270		0.21	0.01	U	0.01	0.47	U	0.47	11.0		0.80	748	J	9.4
6	J15F27	08/07/07	144		0.20	0.02	U	0.02	0.47	U	0.47	5.7		0.79	322	J	9.4
7	J15F28	08/07/07	302		0.20	0.01	U	0.01	0.52		0.46	8.5		0.78	1120	J	9.3
8	J15F29	08/07/07	192		0.21	0.01	U	0.01	0.48	U	0.48	7.4		0.80	512	J	9.5
9	J15F30	08/07/07	340		0.21	0.01	U	0.01	0.47	U	0.47	11.1		0.80	1140	J	9.4
Equipment Blank	J15F32	08/07/07	4.8		0.07	0.02	U	0.02	0.15	U	0.15	0.26	U	0.26	23.0	J	3.0
BCL Stockpile	J15F21	08/07/07	334		0.21	0.01	U	0.01	0.48	U	0.48	10.9		0.80	1280	J	9.5
Road West	J14YX2	04/04/07	199		0.06	0.01	U	0.01	0.38	U	0.38	8.4		0.56	516		14.4
Road East	J14YX3	04/04/07	218		0.06	0.01	U	0.01	0.49		0.37	9.5		0.55	572		14.0
BCL Stockpile	J14YX4	04/04/07	306		0.06	0.02	U	0.02	0.39	U	0.39	9.4		0.57	1040		14.8

Attachment	1	Sheet No.	3 of 16
Originator	K. A. Anselm	Date	10/17/07
Checked	S. W. Clark	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	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
10	J15F31	08/07/07	1.3	U	1.3	1210	C	2.5	0.26	U	0.26	196	C	2.0	47.8	J	0.23
Duplicate of J15F31	J15F20	08/07/07	1.3	U	1.3	1200	C	2.5	0.27	U	0.27	176	C	2.1	44.0	J	0.24
1	J15F22	08/07/07	2.2	UJ	1.3	1460	C	2.5	0.27	U	0.27	141	C	2.1	26.3	J	0.24
2	J15F23	08/07/07	1.3	U	1.3	1980	C	2.6	0.27	U	0.27	179	C	2.1	45.9	J	0.24
3	J15F24	08/07/07	1.3	U	1.3	1480	C	2.5	0.26	U	0.26	80.7	C	2.0	18.3	J	0.23
4	J15F25	08/07/07	1.3	U	1.3	1640	C	2.5	0.26	U	0.26	160	C	2.0	35.8	J	0.23
5	J15F26	08/07/07	1.3	U	1.3	1110	C	2.5	0.27	U	0.27	141	C	2.1	34.1	J	0.24
6	J15F27	08/07/07	1.3	U	1.3	1020	C	2.5	0.26	U	0.26	83.6	C	2.0	19.9	J	0.23
7	J15F28	08/07/07	1.3	UJ	1.2	1460	C	2.5	0.26	U	0.26	140	C	2.0	36.9	J	0.23
8	J15F29	08/07/07	1.5	UJ	1.3	798	C	2.6	0.27	U	0.27	95.4	C	2.1	26.6	J	0.24
9	J15F30	08/07/07	1.3	U	1.3	1270	C	2.5	0.27	U	0.27	198	C	2.1	47.8	J	0.24
Equipment Blank	J15F32	08/07/07	0.41	U	0.41	72.8	C	0.82	0.09	U	0.09	10.5	UJ	0.67	0.08	UJ	0.08
BCL Stockpile	J15F21	08/07/07	1.3	U	1.3	838	C	2.6	0.27	U	0.27	202	C	2.1	47.9	J	0.24
Road West	J14YX2	04/04/07	1.1	U	1.1	364	C	1.2	0.27	U	0.27	90.5	C	8.8	25.6		0.30
Road East	J14YX3	04/04/07	1.1	U	1.1	365	C	1.2	0.26	U	0.26	92.5	C	8.6	27.3		0.29
BCL Stockpile	J14YX4	04/04/07	1.1	U	1.1	484	C	1.3	0.27	U	0.27	148	C	9.0	40.6		0.30

Sample Location	Sample Number	Sample Date	Zinc		
			mg/kg	Q	PQL
10	J15F31	08/07/07	39.5	CJ	0.12
Duplicate of J15F31	J15F20	08/07/07	41.1	CJ	0.12
1	J15F22	08/07/07	93.0	CJ	0.12
2	J15F23	08/07/07	39.6	CJ	0.12
3	J15F24	08/07/07	24.7	CJ	0.12
4	J15F25	08/07/07	33.3	CJ	0.12
5	J15F26	08/07/07	31.9	CJ	0.12
6	J15F27	08/07/07	19.4	CJ	0.12
7	J15F28	08/07/07	35.2	CJ	0.12
8	J15F29	08/07/07	23.1	CJ	0.12
9	J15F30	08/07/07	38.7	CJ	0.12
Equipment Blank	J15F32	08/07/07	1.7	UJ	0.04
BCL Stockpile	J15F21	08/07/07	41.3	CJ	0.12
Road West	J14YX2	04/04/07	26.1	C	0.09
Road East	J14YX3	04/04/07	30.8	C	0.09
BCL Stockpile	J14YX4	04/04/07	37.2	C	0.09

Attachment	1	Sheet No.	4 of 16
Originator	K. A. Anselm	Date	10/17/07
Checked	S. W. Clark	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F31 Location 10 Sample Date 8/7/07			J15F20 Duplicate of J15F31 Sample Date 8/7/07			J15F22 Location 1 Sample Date 8/7/07			J15F23 Location 2 Sample Date 8/7/07		
	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	UJ	14
Aroclor-1221	13	U	13	13	U	13	14	U	14	14	UJ	14
Aroclor-1232	13	U	13	13	U	13	14	U	14	14	UJ	14
Aroclor-1242	13	U	13	13	U	13	14	U	14	14	UJ	14
Aroclor-1248	13	U	13	13	U	13	14	U	14	14	UJ	14
Aroclor-1254	13	U	13	13	U	13	14	U	14	14	UJ	14
Aroclor-1260	13	U	13	13	U	13	6.7	J	14	3.9	J	14
Pesticides												
Aldrin	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Alpha-BHC	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
alpha-Chlordane	1.3	UD	1.3	1.3	UD	1.3	5.6	JD	1.4	1.4	UDJ	1.4
beta-BHC	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
delta-BHC	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Dichlorodiphenyldichloroethane	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Dichlorodiphenyldichloroethylene	1.3	UD	1.3	1.3	UD	1.3	2.1	JD	1.4	1.4	UDJ	1.4
Dichlorodiphenyltrichloroethane	1.3	UD	1.3	1.3	UD	1.3	2.8	JDI	1.4	1.4	UDJ	1.4
Dieldrin	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Endosulfan I	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Endosulfan II	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Endosulfan sulfate	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Endrin	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Endrin aldehyde	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Endrin ketone	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Gamma-BHC (Lindane)	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
gamma-Chlordane	1.3	UD	1.3	1.3	UD	1.3	4.5	JD	1.4	1.4	UDJ	1.4
Heptachlor	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Heptachlor epoxide	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Methoxychlor	1.3	UD	1.3	1.3	UD	1.3	1.4	UD	1.4	1.4	UDJ	1.4
Toxaphene	13	UDJ	13	13	UDJ	13	14	UDJ	14	14	UDJ	14
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	340	UJ	340	330	UJ	330	350	UJ	350	340	UJ	340
1,2-Dichlorobenzene	340	U	340	330	U	330	350	U	350	340	U	340
1,3-Dichlorobenzene	340	U	340	330	U	330	350	U	350	340	U	340
1,4-Dichlorobenzene	340	U	340	330	U	330	350	U	350	340	U	340
2,4,5-Trichlorophenol	840	U	840	840	U	840	860	U	860	850	U	850
2,4,6-Trichlorophenol	340	UJ	340	330	UJ	330	350	UJ	350	340	UJ	340
2,4-Dichlorophenol	340	U	340	330	U	330	350	U	350	340	U	340
2,4-Dimethylphenol	340	UJ	340	330	UJ	330	350	UJ	350	340	UJ	340
2,4-Dinitrophenol	840	U	840	840	U	840	860	UJ	860	850	U	850
2,4-Dinitrotoluene	340	U	340	330	U	330	350	U	350	340	U	340
2,6-Dinitrotoluene	340	U	340	330	U	330	350	UJ	350	340	U	340
2-Chloronaphthalene	340	U	340	330	U	330	350	U	350	340	U	340
2-Chlorophenol	340	U	340	330	U	330	350	U	350	340	U	340

Attachment	1	Sheet No.	5 of 16
Originator	K. A. Anselm KAA	Date	10/17/07
Checked	S. W. Clark SWC	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F31 Location 10 Sample Date 8/7/07			J15F20 Duplicate of J15F31 Sample Date 8/7/07			J15F22 Location 1 Sample Date 8/7/07			J15F23 Location 2 Sample Date 8/7/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
2-Methylnaphthalene	340	UJ	340	330	UJ	330	350	UJ	350	340	UJ	340
2-Methylphenol (cresol, o-)	340	U	340	330	U	330	350	U	350	340	U	340
2-Nitroaniline	840	U	840	840	U	840	860	UJ	860	850	U	850
2-Nitrophenol	340	U	340	330	U	330	350	UJ	350	340	U	340
3+4 Methylphenol (cresol, m+p)	340	U	340	330	U	330	350	U	350	340	U	340
3,3'-Dichlorobenzidine	340	UJ	340	330	UJ	330	350	UJ	350	340	UJ	340
3-Nitroaniline	840	UJ	840	840	UJ	840	860	UJ	860	850	UJ	850
4,6-Dinitro-2-methylphenol	840	U	840	840	U	840	860	U	860	850	U	850
4-Bromophenylphenyl ether	340	U	340	330	U	330	350	U	350	340	U	340
4-Chloro-3-methylphenol	340	UJ	340	330	UJ	330	350	UJ	350	340	UJ	340
4-Chloroaniline	340	UJ	340	330	UJ	330	350	UJ	350	340	UJ	340
4-Chlorophenylphenyl ether	340	U	340	330	U	330	350	U	350	340	U	340
4-Nitroaniline	840	U	840	840	U	840	860	UJ	860	850	U	850
4-Nitrophenol	840	UJ	840	840	UJ	840	860	UJ	860	850	UJ	850
Acenaphthene	340	U	340	330	U	330	350	U	350	340	U	340
Acenaphthylene	340	U	340	330	U	330	350	U	350	340	U	340
Anthracene	340	U	340	330	U	330	350	U	350	340	U	340
Benzo(a)anthracene	340	U	340	330	U	330	350	U	350	340	U	340
Benzo(a)pyrene	340	U	340	330	U	330	350	U	350	340	U	340
Benzo(b)fluoranthene	340	U	340	330	U	330	350	U	350	340	U	340
Benzo(ghi)perylene	340	U	340	330	U	330	350	U	350	340	U	340
Benzo(k)fluoranthene	340	U	340	330	U	330	350	U	350	340	U	340
Bis(2-chloro-1-methylethyl)ether	340	U	340	330	U	330	350	U	350	340	U	340
Bis(2-Chloroethoxy)methane	340	U	340	330	U	330	350	U	350	340	U	340
Bis(2-chloroethyl) ether	340	U	340	330	U	330	350	U	350	340	U	340
Bis(2-ethylhexyl) phthalate	660	U	660	660	U	660	660	U	660	660	U	660
Butylbenzylphthalate	340	U	340	330	U	330	350	U	350	340	U	340
Carbazole	340	U	340	330	U	330	350	U	350	340	U	340
Chrysene	340	U	340	330	U	330	350	U	350	340	U	340
Di-n-butylphthalate	31	J	340	50	J	330	28	J	350	25	J	340
Di-n-octylphthalate	340	U	340	330	U	330	350	U	350	340	U	340
Dibenz[a,h]anthracene	340	U	340	330	U	330	350	U	350	340	U	340
Dibenzofuran	340	U	340	330	U	330	350	U	350	340	U	340
Diethylphthalate	340	U	340	330	U	330	350	U	350	340	U	340
Dimethyl phthalate	340	U	340	330	U	330	350	U	350	340	U	340
Fluoranthene	340	U	340	330	U	330	350	U	350	340	U	340
Fluorene	340	U	340	330	U	330	350	U	350	340	U	340
Hexachlorobenzene	340	U	340	330	U	330	350	U	350	340	U	340
Hexachlorobutadiene	340	U	340	330	U	330	350	U	350	340	U	340
Hexachlorocyclopentadiene	340	U	340	330	U	330	350	U	350	340	U	340
Hexachloroethane	340	U	340	330	U	330	350	U	350	340	U	340

Attachment	1	Sheet No.	6 of 16
Originator	K. A. Anselm KAA	Date	10/17/07
Checked	S. W. Clark SWC	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F31 Location 10 Sample Date 8/7/07			J15F20 Duplicate of J15F31 Sample Date 8/7/07			J15F22 Location 1 Sample Date 8/7/07			J15F23 Location 2 Sample Date 8/7/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
Indeno(1,2,3-cd)pyrene	340	U	340	330	U	330	350	U	350	340	U	340
Isophorone	340	UJ	340	330	UJ	330	350	UJ	350	340	UJ	340
N-Nitroso-di-n-dipropylamine	340	U	340	330	U	330	350	UJ	350	340	U	340
N-Nitrosodiphenylamine	340	U	340	330	U	330	350	UJ	350	340	U	340
Naphthalene	340	U	340	330	U	330	350	U	350	340	U	340
Nitrobenzene	340	UJ	340	330	UJ	330	350	UJ	350	340	UJ	340
Pentachlorophenol	840	U	840	840	U	840	860	U	860	850	U	850
Phenanthrene	340	U	340	330	U	330	350	U	350	340	U	340
Phenol	340	U	340	29	J	29	350	U	350	340	U	340
Pyrene	340	U	340	330	U	330	350	U	350	340	U	340

Attachment	1	Sheet No.	7 of 16
Originator	K. A. Anselm	Date	09/26/07
Checked	J. M. Capron	Date	
Calc. No.	0100F-CA-V0290	Rev. No.	0

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F24 Location 3 Sample Date 8/7/07			J15F25 Location 4 Sample Date 8/7/07			J15F26 Location 5 Sample Date 8/7/07			J15F27 Location 6 Sample Date 8/7/07		
	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	46		13	13	U	13	13	U	13
Aroclor-1260	13	U	13	13	U	13	13	U	13	13	U	13
Pesticides												
Aldrin	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Alpha-BHC	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
alpha-Chlordane	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
beta-BHC	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
delta-BHC	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Dichlorodiphenyldichloroethane	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Dichlorodiphenyldichloroethylene	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Dichlorodiphenyltrichloroethane	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Dieldrin	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Endosulfan I	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Endosulfan II	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Endosulfan sulfate	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Endrin	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Endrin aldehyde	1.3	UD	1.3	1.8	JD	1.3	1.3	UD	1.3	1.3	UD	1.3
Endrin ketone	1.3	UD	1.3	2.9	JD	1.3	1.3	UD	1.3	1.3	UD	1.3
Gamma-BHC (Lindane)	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
gamma-Chlordane	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Heptachlor	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Heptachlor epoxide	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Methoxychlor	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3
Toxaphene	13	UDJ	13	13	UDJ	13	13	UDJ	13	13	UDJ	13
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	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	840	U	840	840	U	840	840	U	840
2,4,6-Trichlorophenol	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
2,4-Dichlorophenol	330	U	330	330	U	330	330	U	330	330	U	330
2,4-Dimethylphenol	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
2,4-Dinitrophenol	840	U	840	840	U	840	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

Attachment	1	Sheet No.	8 of 16
Originator	K. A. Anselm KAA	Date	10/17/07
Checked	S. W. Clark SWC	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F24 Location 3 Sample Date 8/7/07			J15F25 Location 4 Sample Date 8/7/07			J15F26 Location 5 Sample Date 8/7/07			J15F27 Location 6 Sample Date 8/7/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
2-Methylnaphthalene	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
2-Methylphenol (cresol, o-)	330	U	330	330	U	330	330	U	330	330	U	330
2-Nitroaniline	840	U	840	840	U	840	840	U	840	840	U	840
2-Nitrophenol	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
3+4 Methylphenol (cresol, m+p)	330	U	330	330	U	330	330	U	330	330	U	330
3,3'-Dichlorobenzidine	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
3-Nitroaniline	840	UJ	840	840	UJ	840	840	UJ	840	840	UJ	840
4,6-Dinitro-2-methylphenol	840	U	840	840	U	840	840	U	840	840	U	840
4-Bromophenylphenyl ether	330	U	330	330	U	330	330	U	330	330	U	330
4-Chloro-3-methylphenol	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
4-Chloroaniline	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
4-Chlorophenylphenyl ether	330	U	330	330	U	330	330	U	330	330	U	330
4-Nitroaniline	840	U	840	840	U	840	840	U	840	840	U	840
4-Nitrophenol	840	UJ	840	840	UJ	840	840	UJ	840	840	UJ	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	22	J	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(ghi)perylene	330	U	330	330	U	330	330	U	330	330	U	330
Benzo(k)fluoranthene	330	U	330	18	J	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	660	U	660	660	U	660	660	U	660	660	U	660
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	26	J	330	330	U	330	330	U	330
Di-n-butylphthalate	24	J	330	27	J	330	20	J	330	28	J	330
Di-n-octylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Dibenz[a,h]anthracene	330	U	330	330	U	330	330	U	330	330	U	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
Dimethyl phthalate	330	U	330	330	U	330	330	U	330	330	U	330
Fluoranthene	330	U	330	44	J	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

Attachment	1	Sheet No.	9 of 16
Originator	K. A. Anselm KAA	Date	10/17/07
Checked	S. W. Clark SWC	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F24 Location 3 Sample Date 8/7/07			J15F25 Location 4 Sample Date 8/7/07			J15F26 Location 5 Sample Date 8/7/07			J15F27 Location 6 Sample Date 8/7/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
Indeno(1,2,3-cd)pyrene	330	U	330	330	U	330	330	U	330	330	U	330
Isophorone	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	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
Naphthalene	330	U	330	330	U	330	330	U	330	330	U	330
Nitrobenzene	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
Pentachlorophenol	840	U	840	840	U	840	840	U	840	840	U	840
Phenanthrene	330	U	330	330	U	330	330	U	330	330	U	330
Phenol	330	U	330	19		330	330	U	330	330	U	330
Pyrene	330	U	330	38	J	330	330	U	330	330	U	330

Attachment	1	Sheet No.	10 of 16
Originator	K. A. Anselm	Date	09/26/07
Checked	J. M. Capron	Date	
Calc. No.	0100F-CA-V0290	Rev. No.	0

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F28 Location 7 Sample Date 8/7/07			J15F29 Location 8 Sample Date 8/7/07			J15F30 Location 9 Sample Date 8/7/07			J15F32 Equipment Blank Sample Date 8/7/07		
	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			
Aroclor-1221	13	U	13	13	U	13	13	U	13			
Aroclor-1232	13	U	13	13	U	13	13	U	13			
Aroclor-1242	13	U	13	13	U	13	13	U	13			
Aroclor-1248	13	U	13	13	U	13	13	U	13			
Aroclor-1254	13	U	13	13	U	13	13	U	13			
Aroclor-1260	13	U	13	13	U	13	13	U	13			
Pesticides												
Aldrin	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Alpha-BHC	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
alpha-Chlordane	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
beta-BHC	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
delta-BHC	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Dichlorodiphenyldichloroethane	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Dichlorodiphenyldichloroethylene	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Dichlorodiphenyltrichloroethane	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Dieldrin	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Endosulfan I	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Endosulfan II	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Endosulfan sulfate	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Endrin	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Endrin aldehyde	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Endrin ketone	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Gamma-BHC (Lindane)	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
gamma-Chlordane	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Heptachlor	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Heptachlor epoxide	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Methoxychlor	1.3	UD	1.3	1.3	UD	1.3	1.3	UD	1.3			
Toxaphene	13	UDJ	13	13	UDJ	13	13	UDJ	13			
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	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	830	U	830
2,4,6-Trichlorophenol	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
2,4-Dichlorophenol	330	U	330	330	U	330	330	U	330	330	U	330
2,4-Dimethylphenol	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
2,4-Dinitrophenol	840	U	840	830	U	830	840	U	840	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

Attachment	1	Sheet No.	11 of 16
Originator	K. A. Anselm KAA	Date	10/17/07
Checked	S. W. Clark SWC	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F28 Location 7 Sample Date 8/7/07			J15F29 Location 8 Sample Date 8/7/07			J15F30 Location 9 Sample Date 8/7/07			J15F32 Equipment Blank Sample Date 8/7/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
2-Methylnaphthalene	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	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	830	U	830
2-Nitrophenol	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
3+4 Methylphenol (cresol, m+p)	330	U	330	330	U	330	330	U	330	330	U	330
3,3'-Dichlorobenzidine	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
3-Nitroaniline	840	UJ	840	830	UJ	830	840	UJ	840	830	UJ	830
4,6-Dinitro-2-methylphenol	840	U	840	830	U	830	840	U	840	830	U	830
4-Bromophenylphenyl ether	330	U	330	330	U	330	330	U	330	330	U	330
4-Chloro-3-methylphenol	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
4-Chloroaniline	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
4-Chlorophenylphenyl ether	330	U	330	330	U	330	330	U	330	330	U	330
4-Nitroaniline	840	U	840	830	U	830	840	U	840	830	U	830
4-Nitrophenol	840	UJ	840	830	UJ	830	840	UJ	840	830	UJ	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(ghi)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	660	U	660	660	U	660	660	U	660	660	U	660
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
Di-n-butylphthalate	24	J	330	35	J	330	22	J	330	95	J	330
Di-n-octylphthalate	330	U	330	330	U	330	330	U	330	330	U	330
Dibenz[a,h]anthracene	330	U	330	330	U	330	330	U	330	330	U	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
Dimethyl phthalate	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

Attachment	1	Sheet No.	12 of 16
Originator	K. A. Anselm	Date	10/17/07
Checked	S. W. Clark	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F28 Location 7 Sample Date 8/7/07			J15F29 Location 8 Sample Date 8/7/07			J15F30 Location 9 Sample Date 8/7/07			J15F32 Equipment Blank Sample Date 8/7/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
Indeno(1,2,3-cd)pyrene	330	U	330	330	U	330	330	U	330	330	U	330
Isophorone	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	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
Naphthalene	330	U	330	330	U	330	330	U	330	330	U	330
Nitrobenzene	330	UJ	330	330	UJ	330	330	UJ	330	330	UJ	330
Pentachlorophenol	840	U	840	830	U	830	840	U	840	830	U	830
Phenanthrene	330	U	330	330	U	330	330	U	330	330	U	330
Phenol	330	U	330	330	U	330	17	J	330	330	U	330
Pyrene	330	U	330	330	U	330	330	U	330	330	U	330

Attachment	1	Sheet No.	13 of 16
Originator	K. A. Anselm	Date	09/26/07
Checked	J. M. Capron	Date	
Calc. No.	0100F-CA-V0290	Rev. No.	0

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F21 BCL Stockpile Sample Date 8/7/07			J14YX2 Road West Sample Date 4/4/07			J14YX3 Road East Sample Date 4/4/07			J14YX4 BCL Stockpile Sample Date 4/4/07		
	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	14	U	14	14	U	14
Aroclor-1221	14	U	14	14	U	14	14	U	14	14	U	14
Aroclor-1232	14	U	14	14	U	14	14	U	14	14	U	14
Aroclor-1242	14	U	14	14	U	14	14	U	14	14	U	14
Aroclor-1248	14	U	14	14	U	14	14	U	14	14	U	14
Aroclor-1254	14	U	14	14	U	14	14	U	14	14	U	14
Aroclor-1260	14	U	14	14	U	14	14	U	14	14	U	14
Pesticides												
Aldrin	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Alpha-BHC	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
alpha-Chlordane	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
beta-BHC	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
delta-BHC	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Dichlorodiphenyldichloroethane	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Dichlorodiphenyldichloroethylene	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Dichlorodiphenyltrichloroethane	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Dieldrin	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Endosulfan I	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Endosulfan II	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Endosulfan sulfate	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Endrin	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Endrin aldehyde	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Endrin ketone	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Gamma-BHC (Lindane)	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
gamma-Chlordane	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Heptachlor	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Heptachlor epoxide	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Methoxychlor	1.4	UD	1.4	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4
Toxaphene	14	UDJ	14	14	U	14	14	U	14	14	U	14
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	350	UJ	350	350	U	350	340	U	340	360	U	360
1,2-Dichlorobenzene	350	U	350	350	U	350	340	U	340	360	U	360
1,3-Dichlorobenzene	350	U	350	350	U	350	340	U	340	360	U	360
1,4-Dichlorobenzene	350	U	350	350	U	350	340	U	340	360	U	360
2,4,5-Trichlorophenol	870	U	870	870	U	870	860	U	860	900	U	900
2,4,6-Trichlorophenol	350	UJ	350	350	U	350	340	U	340	360	U	360
2,4-Dichlorophenol	350	U	350	350	U	350	340	U	340	360	U	360
2,4-Dimethylphenol	350	UJ	350	350	U	350	340	U	340	360	U	360
2,4-Dinitrophenol	870	U	870	870	U	870	860	U	860	900	U	900
2,4-Dinitrotoluene	350	U	350	350	U	350	340	U	340	360	U	360
2,6-Dinitrotoluene	350	U	350	350	U	350	340	U	340	360	U	360
2-Chloronaphthalene	350	U	350	350	U	350	340	U	340	360	U	360
2-Chlorophenol	350	U	350	350	U	350	340	U	340	360	U	360

Attachment	1	Sheet No.	14 of 16
Originator	K. A. Anselm *KAA*	Date	10/17/07
Checked	S. W. Clark *SWC*	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F21 BCL Stockpile Sample Date 8/7/07			J14YX2 Road West Sample Date 4/4/07			J14YX3 Road East Sample Date 4/4/07			J14YX4 BCL Stockpile Sample Date 4/4/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
2-Methylnaphthalene	350	UJ	350	350	U	350	340	U	340	360	U	360
2-Methylphenol (cresol, o-)	350	U	350	350	U	350	340	U	340	360	U	360
2-Nitroaniline	870	U	870	870	U	870	860	U	860	900	U	900
2-Nitrophenol	350	UJ	350	350	U	350	340	U	340	360	U	360
3+4 Methylphenol (cresol, m+p)	350	U	350	350	U	350	340	U	340	360	U	360
3,3'-Dichlorobenzidine	350	UJ	350	350	U	350	340	U	340	360	U	360
3-Nitroaniline	870	UJ	870	870	U	870	860	U	860	900	U	900
4,6-Dinitro-2-methylphenol	870	U	870	870	U	870	860	U	860	900	U	900
4-Bromophenylphenyl ether	350	U	350	350	U	350	340	U	340	360	U	360
4-Chloro-3-methylphenol	350	UJ	350	350	U	350	340	U	340	360	U	360
4-Chloroaniline	350	UJ	350	350	U	350	340	U	340	360	U	360
4-Chlorophenylphenyl ether	350	U	350	350	U	350	340	U	340	360	U	360
4-Nitroaniline	870	U	870	870	U	870	860	U	860	900	U	900
4-Nitrophenol	870	UJ	870	870	U	870	860	U	860	900	U	900
Acenaphthene	350	U	350	350	U	350	340	U	340	360	U	360
Acenaphthylene	350	U	350	350	U	350	340	U	340	360	U	360
Anthracene	350	U	350	350	U	350	340	U	340	360	U	360
Benzo(a)anthracene	350	U	350	350	U	350	340	U	340	360	U	360
Benzo(a)pyrene	350	U	350	350	U	350	340	U	340	360	U	360
Benzo(b)fluoranthene	350	U	350	350	U	350	340	U	340	360	U	360
Benzo(ghi)perylene	350	U	350	350	U	350	340	U	340	360	U	360
Benzo(k)fluoranthene	350	U	350	350	U	350	340	U	340	360	U	360
Bis(2-chloro-1-methylethyl)ether	350	U	350	350	U	350	340	U	340	360	U	360
Bis(2-Chloroethoxy)methane	350	U	350	350	U	350	340	U	340	360	U	360
Bis(2-chloroethyl) ether	350	U	350	350	U	350	340	U	340	360	U	360
Bis(2-ethylhexyl) phthalate	660	U	660	190	JB	350	17	JB	340	140	JB	360
Butylbenzylphthalate	350	U	350	350	U	350	340	U	340	360	U	360
Carbazole	350	U	350	350	U	350	340	U	340	360	U	360
Chrysene	350	U	350	350	U	350	340	U	340	360	U	360
Di-n-butylphthalate	350	U	350	41	J	350	340	U	340	24	J	360
Di-n-octylphthalate	350	U	350	350	U	350	340	U	340	360	U	360
Dibenz[a,h]anthracene	350	U	350	350	U	350	340	U	340	360	U	360
Dibenzofuran	350	U	350	350	U	350	340	U	340	360	U	360
Diethylphthalate	350	U	350	350	U	350	340	U	340	360	U	360
Dimethyl phthalate	350	U	350	350	U	350	340	U	340	360	U	360
Fluoranthene	350	U	350	350	U	350	340	U	340	360	U	360
Fluorene	350	U	350	350	U	350	340	U	340	360	U	360
Hexachlorobenzene	350	U	350	350	U	350	340	U	340	360	U	360
Hexachlorobutadiene	350	U	350	350	U	350	340	U	340	360	U	360
Hexachlorocyclopentadiene	350	U	350	350	U	350	340	U	340	360	U	360
Hexachloroethane	350	U	350	350	U	350	340	U	340	360	U	360

Attachment	1	Sheet No.	15 of 16
Originator	K. A. Anselm *KAA*	Date	10/17/07
Checked	S. W. Clark *SWC*	Date	10/17/07
Calc. No.	0100F-CA-V0290	Rev. No.	1

Attachment 1. 1607-F4 Verification Sampling Results.

Constituents	J15F21 BCL Stockpile Sample Date 8/7/07			J14YX2 Road West Sample Date 4/4/07			J14YX3 Road East Sample Date 4/4/07			J14YX4 BCL Stockpile Sample Date 4/4/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
Indeno(1,2,3-cd)pyrene	350	U	350	350	U	350	340	U	340	360	U	360
Isophorone	350	UJ	350	350	U	350	340	U	340	360	U	360
N-Nitroso-di-n-dipropylamine	350	U	350	350	U	350	340	U	340	360	U	360
N-Nitrosodiphenylamine	350	U	350	350	U	350	340	U	340	360	U	360
Naphthalene	350	U	350	350	U	350	340	U	340	360	U	360
Nitrobenzene	350	UJ	350	350	U	350	340	U	340	360	U	360
Pentachlorophenol	870	U	870	870	U	870	860	U	860	900	U	900
Phenanthrene	350	U	350	350	U	350	340	U	340	360	U	360
Phenol	350	U	350	350	U	350	340	U	340	360	U	360
Pyrene	350	U	350	350	U	350	340	U	340	360	U	360

Attachment	1	Sheet No.	16 of 16
Originator	K. A. Anselm	Date	09/26/07
Checked	J. M. Capron	Date	
Calc. No.	0100F-CA-V0290	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:

1607-F4 Waste Site Cleanup Verification Hazard Quotient and Carcinogenic Risk Calculation, 0100F-CA-V0306, Rev. 2, Washington Closure Hanford, Richland, Washington.

<u>DISCLAIMER FOR CALCULATIONS</u>

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-V0306

Subject: 1607-F4 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	Total = 4	*E. J. Farris*	*S. W. Clark*	*M. J. Appel*	*S. W. Callison*	*9/27/07*
1	Total = 4	*E. J. Farris*	*K. A. Anselm*	*N/A*	*S. W. Callison*	*10/11/07*
2	Total = 4	K. A. Anselm	S. W. Clark	N/A	S. W. Callison	10/18/07
		K A Anselm	S W Clark		SWCallison	

SUMMARY OF REVISION

1	Revised to correct typographical errors and update Table 1.
2	Revised to remove selenium based on results of data validation package and update the sum of the HQ values. All sheets revised except sheet 1 of 3.

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	E. J. Farris	Date:	10/10/07	Calc. No.:	0100F-CA-V0306	Rev.:	1
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	K. A. Anselm	Date:	10/10/07
Subject:	1607-F4 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 1607-F4 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) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

3) WCH, 2007, *Remaining Sites Verification Package for the 1607-F4 Sanitary Sewer System*, Attachment to Waste Site Reclassification Form 2004-131, 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 $<1 \times 10^{-5}$.

METHODOLOGY:

The 1607-F4 waste site was divided into three areas for the purpose of verification sampling. The first area consisted of the excavation footprint of the septic tank and drain field, the second area consisted of the BCL stockpile, and the third area consisted of the pipeline between the septic tank and drain field

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	K. A. Anselm *[signature]*	Date:	10/17/07	Calc. No.:	0100F-CA-V0306	Rev.:	2
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	S. W. Clark *[signature]*	Date:	10/17/07
Subject:	1607-F4 Waste Site Cleanup Verification Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	2 of 3

underlying the haul road (road-crossing area). Hazard quotient and carcinogenic risk calculations for the 1607-F4 waste site were conservatively calculated for the entire waste site using the highest of the focused and statistically calculated results from these three areas for each analyte (WCH 2007). Of the contaminants of concern (COCs), mercury was the only analyte that required the HQ and risk calculations because it was quantified above background. Boron and molybdenum require the HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Hexavalent chromium and multiple organic COCs (as listed in Table 1) are included because they were detected by laboratory analysis and cannot be attributed to natural occurrence. 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 5.8 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 3.6×10^{-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 8.2×10^{-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 0.28 mg/kg; divided by 2.1 mg/kg, and multiplied as indicated, is 1.3×10^{-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 7.4×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

Table 1 shows the results of the calculations.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	K. A. Anselm *[initials]*	Date:	10/17/07	Calc. No.:	0100F-CA-V0306	Rev.:	2
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	S. W. Clark *[initials]*	Date:	10/17/07
Subject:	1607-F4 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 1607-F4 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	5.8	16,000	3.6E-04	--	--
Chromium, hexavalent[c]	0.28	240	1.2E-03	2.1	1.3E-07
Mercury	1.2	24	5.0E-02	--	--
Molybdenum	0.58	400	1.5E-03	--	--
Semivolatiles					
Benzo(a)anthracene	0.022	--	--	0.137	1.6E-07
Benzo(k)fluoranthene	0.018	--	--	0.137	1.3E-07
Bis(2-ethylhexyl) phthalate	0.19	1,600	1.2E-04	71.4	2.7E-09
Chrysene	0.026	--	--	0.137	1.9E-07
Di-n-butylphthalate	0.041	8,000	5.1E-06	--	--
Fluoranthene	0.044	3,200	1.4E-05	--	--
Phenol	0.029	24,000	1.2E-06	--	--
Pyrene	0.038	2,400	1.6E-05	--	--
Pesticides					
Chlordane (alpha, gamma)	0.0101	40	2.5E-04	0.769	1.3E-08
DDE, 4,4'-	0.0021	--	--	2.94	7.1E-10
DDT, 4,4'-	0.0028	40	7.0E-05	2.94	9.5E-10
Endrin ketone and Endrin aldehyde	0.0047	24	2.0E-04	--	--
Polychlorinated Biphenyls					
Aroclor-1254	0.046	1.6	2.9E-02	0.5	9.2E-08
Aroclor-1260	0.0067	--	--	0.5	1.3E-08
Totals					
Cumulative Hazard Quotient:			**8.2E-02**		
Cumulative Excess Cancer Risk:					**7.4E-07**

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.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 1607-F4 waste site meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk as identified in the RDR/RAWP (DOE-RL 2005).