Date Submitted: 3/27/07 Originator: L. M. Dittmer Phone: 372-9664	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-FR-1 Waste Site Code: 1607-F3 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2006-047

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-F3 waste site is the former location of the sanitary sewer system that supported the 182-F Pump Station, the 183-F Water Treatment Plant, and the 151-F Substation. The sanitary sewer system included a septic tank, drain field, and associated pipeline, all in use between 1944 and 1965. 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 as 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. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 1607-F3 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.

K. D. Bazzell DOE Federal Project Director (printed)	Signature	4/26/2007 Date
NA Ecology Project Manager (printed)	Signature	Date
R. A. Lobos EPA Project Manager (printed)	Signature	4-26-07 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-F3 SANITARY SEWER SYSTEM

Attachment to Waste Site Reclassification Form 2006-047

April 2007

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-F3 SANITARY SEWER SYSTEM

EXECUTIVE SUMMARY

The site of the former 1607-F3 sanitary sewer system, part of the 100-FR-1 Operable Unit, was located approximately 180 m (600 ft) west of the 183-F Water Treatment Plant. The sewer system supported the 182-F Pump Station, the 183-F Water Treatment Plant, and the 151-F Substation from 1944 to 1965. The sanitary sewer system included a septic tank, drain field, and associated pipeline.

The 1607-F3 waste site was evaluated during the October 2004 confirmatory sampling efforts to determine if remedial action would be required at the site. The analytical results indicated elevated concentrations of metals, polychlorinated biphenyls, and pesticides exceeding cleanup criteria. Therefore, it was determined that the site required remedial action. Remediation of the 1607-F3 waste site was performed in September 2005 and consisted of the removal of the septic system, drain field, associated piping, and overburden material. Approximately 2,798 metric tons (3,085 US tons) of material was excavated, staged onsite, and subsequently disposed of at the Environmental Restoration Disposal Facility.

Following excavation of the 1607-F3 waste site, verification sampling was performed to determine if the remedial action was adequate to support site closure. Verification sampling of the excavation and staging area footprint was conducted in March 2006. The analytical results indicated the excavation contained residual arsenic and lead concentrations exceeding cleanup criteria. Additional remediation of the excavation was performed in December 2006 and consisted of the removal of an additional 3,791 metric tons (4,179 US tons) of material. A second set of verification samples was collected from the excavation and analyzed for arsenic and lead. The combined results of the two sampling events indicated that the waste removal action achieved compliance with the remedial action objectives and goals for the 1607-F3 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-F3 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. This site does not have a deep zone; therefore, no deep zone institutional controls are required.

Table ES-1. Summary of Remedial Action Goals for the 1607-F3 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 COCs and COPCs were detected below statistical background levels.	Yes
Direct Exposure Nonradionuclides	Attain individual COC/COPC RAGs.	All individual COC/COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	All individual hazard quotients are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (9.5×10^{-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 (2.8×10^{-7}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COC/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]		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	The selenium and lead concentrations (4.2 and 29 mg/kg, respectively) 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), selenium and lead are not predicted to migrate more than 1 m (3.3 ft) vertically in 1,000 years. The vadose zone underlying the remediation footprint is approximately 6 m (20 ft) thick, based on nearby borehole 199-F7-2.

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 based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern, contaminants of potential concern, and other constituents. Screening levels were not exceeded for the site constituents, with the exception of arsenic, cadmium, lead, selenium, 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 cadmium and vanadium are within the range of Hanford Site background levels, and selenium concentrations are consistent with those seen elsewhere at the Hanford Site. The presence of arsenic and lead is believed to be due to historic application of lead-arsenate pesticides. The exceedance of soil screening values by arsenic, lead, and selenium concentrations at the site will be evaluated in the context of additional lines of evidence for ecological effects. A baseline risk assessment for the river corridor portion of the Hanford Site began in 2004, which includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used to support the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-F3 SANITARY SEWER SYSTEM

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 1607-F3 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. This site does not have a deep zone; therefore, no deep zone institutional controls are required.

GENERAL SITE INFORMATION AND BACKGROUND

The 1607-F3 waste site is located in the 100-FR-1 Operable Unit of the Hanford Site. The Waste Information Data System describes the 1607-F3 sanitary sewer system as a septic tank, drain field, and associated pipeline that were used from 1944 to 1965. The sewer system was located approximately 183 m (600 ft) west of the 183-F Water Treatment Plant (Figure 1). The septic system serviced the 182-F Pump Station, 183-F Water Treatment Plant, and 151-F Substation.

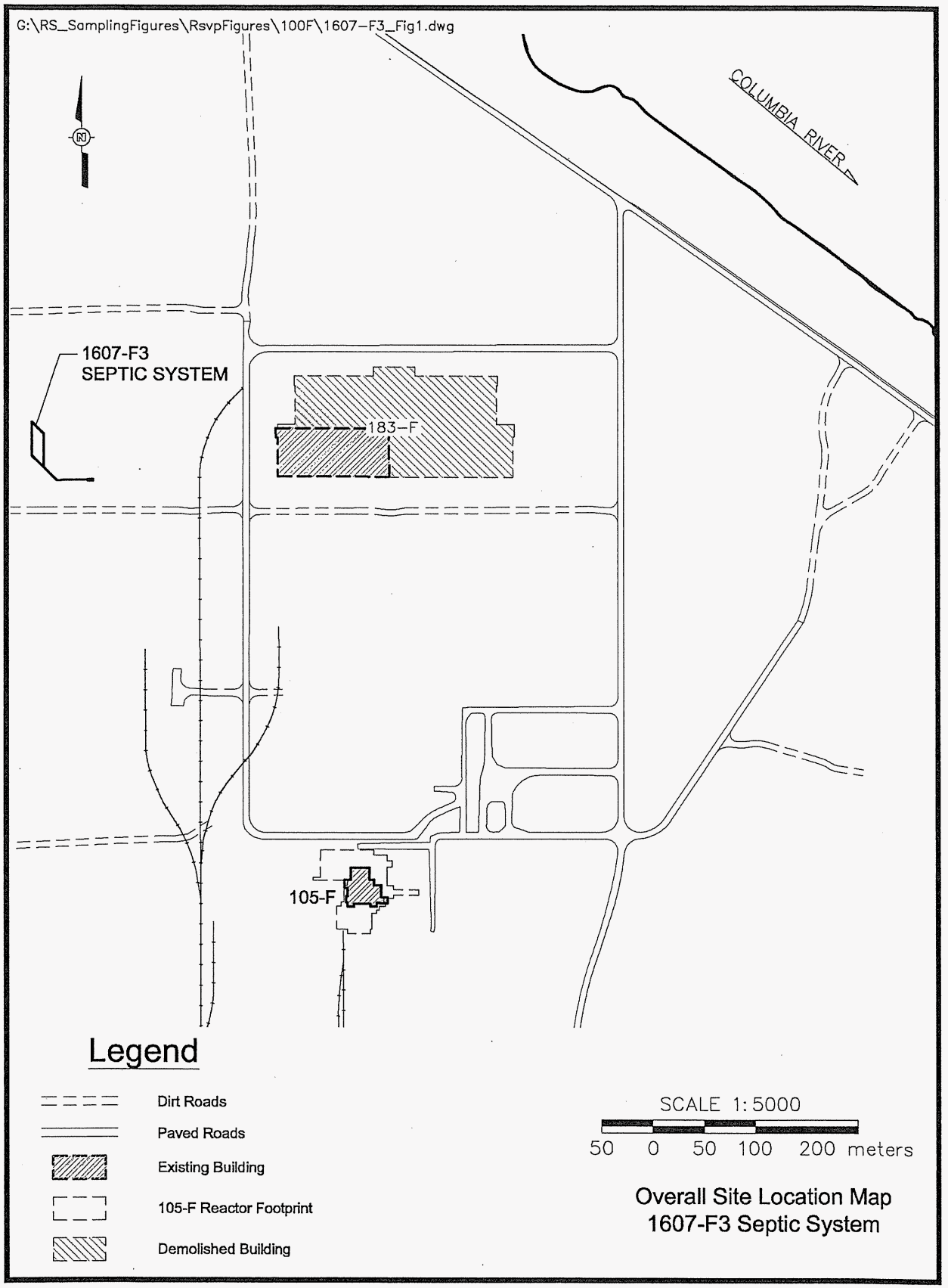
The tank was constructed of reinforced concrete, and the walls and floor were 25 cm (10 in.) thick. The tank dimensions were 1.8 by 4.6 by 4.0 m (6 by 15 by 13 ft) deep (BHI 2004a), and the top roughly at grade. The septic tank had a capacity of 5,432 L (1,435 gal) and could support 41 people assuming an input of 132 L (35 gal) per capita per day and a 1-day retention period.

The drain field was about 40 m (131 ft) west of the septic tank. The drain field consisted of 64.9 m (213 ft) of 20.3-cm (8-in.)-diameter vitrified clay pipe that branched into two linear sections of 20.3-cm (8-in.)-diameter vitrified clay pipe 33.2 m (109 ft) long and one linear section of 15.2-cm (6-in.)-diameter vitrified clay pipe 33.2 m (109 ft) long (GE no date).

CONFIRMATORY SAMPLING ACTIVITIES

The 1607-F3 waste site was evaluated during the October 2004 confirmatory sampling efforts to determine if remedial action would be required. Based on visual observations, the geophysical survey information, and the results of confirmatory sampling, a decision was made that remedial action at the site was necessary. The following subsections provide additional discussion of the information used to develop the confirmatory sampling design. The results of the confirmatory sampling are also summarized to provide support for development of the remedial action strategy and verification sample design.

Figure 1. 1607-F3 Site Location Map.



Geophysical Investigation

A geophysical survey was performed at the 1607-F3 waste site in April 2004 using electromagnetic induction and magnetic total field and gradient (magnetometer) instrumentation (BHI 2004c). The survey identified surface features and subsurface anomalies consistent with the documented location of the septic tank but not the drain field. The geophysical survey results are shown on Figure 2 and were used to assist in identifying areas for further investigation by confirmatory sampling.

Contaminants of Potential Concern for Confirmatory Sampling

Contaminants of potential concern (COPCs) were identified based on existing analytical data and historical process information associated with the 1607-F3 site. The COPCs were pesticides, polychlorinated biphenyls (PCBs), arsenic, barium, cadmium, total chromium, lead, selenium, silver, mercury, and semivolatile organic compounds (SVOCs) (BHI 2004d). Additionally, *100-F Reactor Area Underground Pipeline Historical Information Summary* (BHI 2001a) stated that undetermined radionuclides could be present at this site. Therefore, gamma energy analysis and gross alpha and gross beta analyses were added to verify the presence or absence of radionuclides.

Confirmatory Sample Design

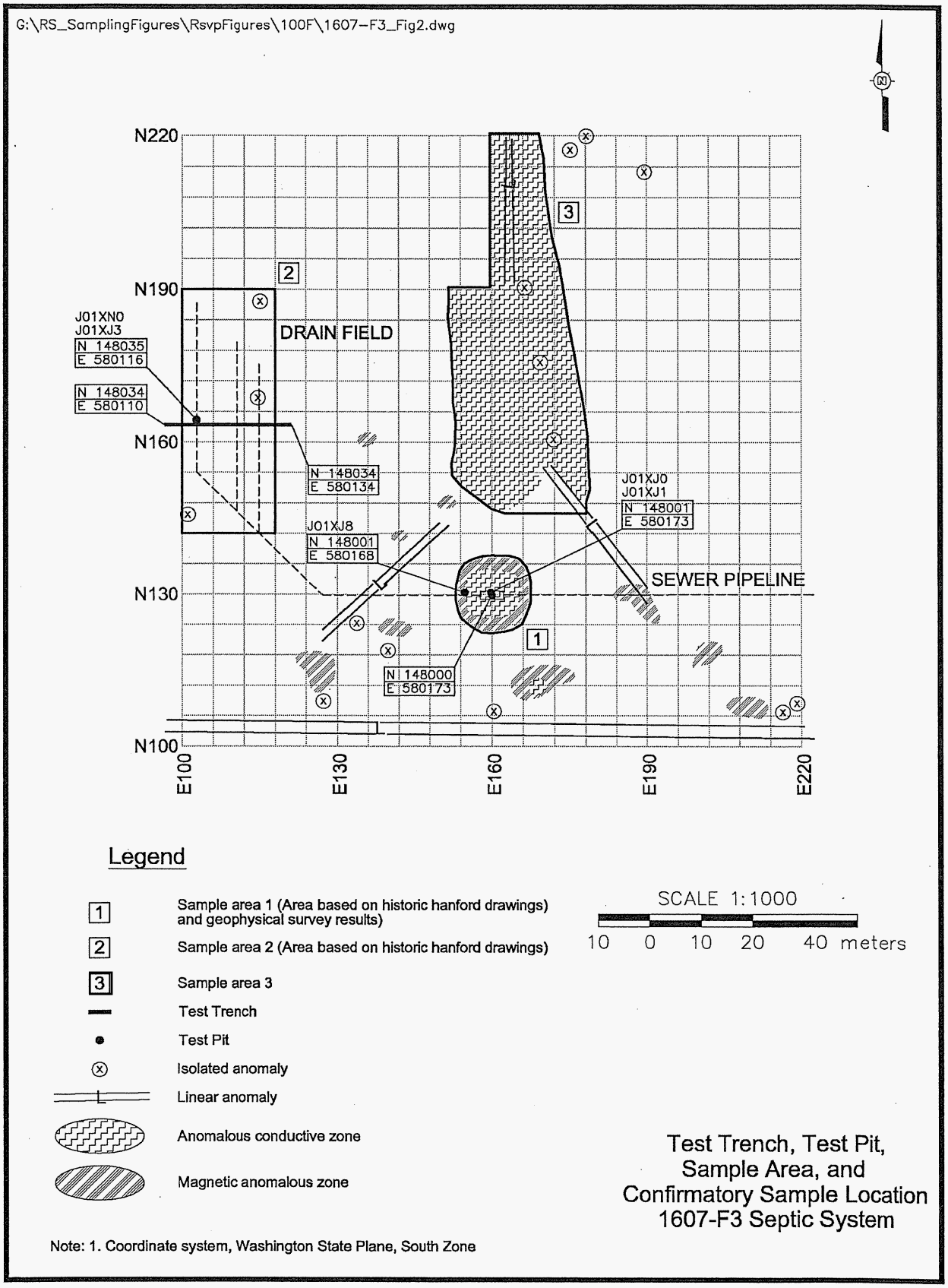
Historical data, process knowledge, and geophysical survey results were used to develop a site-specific confirmatory sample design (BHI 2004d) with focused sampling in three areas (Figure 2) as follows:

- Area 1: Subsurface geophysical anomaly thought to be the probable location of the septic tank
- Area 2: Area northwest of the probable septic tank location based on Hanford-era engineering drawing (GE no date) coordinates thought to be the location of the septic drain field
- Area 3: Subsurface geophysical anomaly area, north of area 1, thought to be an alternate location of the septic drain field.

Excavation and confirmatory sampling was performed in October 2004, as described in the sampler's field logbooks (BHI 2004a, 2004b). During field activities, the septic tank and drain field were found to be located in Areas 1 and 2, respectively; therefore, no trenching or sampling was performed in Area 3, in accordance with the sample design (BHI 2004d). The geophysical anomaly that was not part of the septic system (Area 3) was not investigated at this time but later submitted for further evaluation as a possible discovery site (Feist 2005b) and is not addressed further in this report.

Confirmatory sampling in Area 1, the septic tank area, consisted of collecting a soil sample (and duplicate) from beneath the tank because the tank could not be breached. A sample was also collected of the septic tank drain pipe because it did not contain any sediment. Sampling in Area 2, the drain field area, consisted of collecting a soil sample under the drain field pipe and a sediment sample from inside the pipe. Field screening for volatile organic compounds (VOCs) was not performed during part of the sampling of this site. Therefore, volatile organic analysis (VOA) was performed on the samples that were taken with no organic vapor monitor (OVM) field screening. Total petroleum hydrocarbon and polycyclic aromatic hydrocarbon analyses were not performed because no stained soil or evidence of

Figure 2. Geophysical Survey and Confirmatory Sampling Locations at the 1607-F3 Site.



burned areas were observed during excavation. No building materials or industrial components suspected to contain asbestos were observed during field activities. Therefore, asbestos was also excluded as a COPC.

A summary of the samples collected and the laboratory analyses performed is provided in Table 1. Figure 2 identifies the sample locations.

Table 1. Confirmatory Sample Summary for the 1607-F3 Septic System.

Sample Location	Sample Media	Sample Number	Coordinate Locations	Depth (m bgs)	Sample Analysis
Area 1: septic tank	Soil under tank	J01XJ0	N 148001 E 580173	4	VOA, pesticides, PCBs, ICP metals, mercury, SVOA, gross alpha, gross beta, and GEA
	VCP	J01XJ8	N 148001 E 580168	2	VOA, pesticides, PCBs, ICP metals, mercury, SVOA, gross alpha, gross beta, and GEA
Area 2: drain field	VCP sediment	J01XN0	N 148035 E 580116	1	Pesticides, PCBs, ICP metals, mercury, SVOA, gross alpha, gross beta, and GEA
	Soil under VCP	J01XJ3		1	Pesticides, PCBs, ICP metals, mercury, SVOA, gross alpha, gross beta, and GEA
Equipment blank	Silica sand	J01XJ2	NA	NA	GEA, ICP metals, mercury, PCBs, SVOA, pesticides
Duplicate of J01XJ0	Soil under tank	J01XJ1	N 148001 E 580173	4	VOA, pesticides, PCBs, ICP metals, mercury, SVOA, gross alpha, gross beta, and GEA

Source: Field Logbooks EL-1578-2, and EL-1578-3 (BHI 2004a, 2004b).

bgs = below ground surface
GEA = gamma energy analysis
ICP = inductively coupled plasma
NA = not applicable
PCB = polychlorinated biphenyl
SVOA = emivolatile organic analysis
VCP = Vitrified clay pipe
VOA = volatile organic analysis

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 being provided to the Hanford Environmental Information System (HEIS) and are included in Appendix A of this document.

Analytical results of the samples collected from the 1607-F3 site indicated that contaminant concentrations of arsenic, lead, aroclor-1260, and multiple pesticides failed the direct exposure remedial action goals (RAGs). In addition, numerous metals, pesticides, and other organics (VOCs, PCBs, and SVOCs) were detected above the soil RAGs for the protection of groundwater and the Columbia River. Cesium-137 and europium-152 were the only radionuclides detected at the 1607-F3 waste site; however, they were not detected at concentrations exceeding the dose-equivalence lookup values.

Based on the results of this confirmatory sampling, it was determined that remedial action was necessary at the site due to numerous contaminant concentrations exceeding the cleanup criteria (Feist 2005a).

REMEDIAL ACTION SUMMARY

Remediation of the 1607-F3 sanitary sewer system waste site was performed in September 2005 and consisted of the removal of the septic tank, drain field, associated piping, and overburden material. Approximately 2,798 metric tons (3,085 US tons) of material was excavated, staged onsite, and subsequently disposed of at the Environmental Restoration Disposal Facility (ERDF). The depth of the excavation was approximately 4 m (13 ft) below ground surface for the septic tank and approximately 2 m (7 ft) below ground surface for the drain field and pipe corridor. The pre-excavation topographic survey for the 1607-F3 site is provided in Figure 3. The boundary of the extent of excavation is shown in Figure 4. Figures 5 and 6 are photographs of the open excavation after the removal of the septic tank and drain field.

Following excavation of the 1607-F3 waste site, verification sampling was performed in March 2006 in accordance with the *Work Instruction for Verification Sampling of the 1607-F3 Waste Site* (WCH 2006d). Analytical results from the verification soil samples indicated that the excavation contained residual arsenic and lead contamination. Arsenic and lead were detected at maximum concentrations of 38 mg/kg and 206 mg/kg, respectively. Only arsenic exceeded its direct exposure RAG (20 mg/kg).

Additional remediation was performed in December 2006 and consisted of removing a total of 3,791 metric tons (4,179 US tons) of soil from the sidewalls and bottom of the excavation. Figure 7 shows the results of the radiological survey at the 1607-F3 site. A second set of verification samples were collected on December 18, 2006, and were analyzed for arsenic and lead to verify that the subsequent remediation efforts had successfully removed the contamination. Within this remaining sites verification package, Phase I verification sampling refers to the soil samples collected in March 2006, after completion of the initial remediation efforts. The Phase II verification sampling refers to the arsenic and lead sampling conducted in December 2006.

VERIFICATION SAMPLING ACTIVITIES

RAGs are the specific numeric goals against which the cleanup verification data are evaluated to demonstrate attainment of the remedial action objectives for the site. Verification sampling for the 1607-F3 waste site was performed in March 2006 (WCH 2006b) to collect data to determine if the RAGs had been met. Based on statistical evaluation of the resulting data, the residual contaminant concentrations meet the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b) and the Remaining Sites ROD (EPA 1999). 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 and Contaminants of Potential Concern

The results of confirmatory sampling were used to determine the contaminants of concern (COCs) and COPCs for verification sampling. The COCs include those constituents that were detected above direct exposure RAGs by confirmatory sampling. The COPCs include constituents that were detected above background levels and were further evaluated during verification sampling. The COCs/COPCs for site verification sampling are summarized in Table 2.

Figure 3. Pre-Excavation Civil Survey of the 1607-F3 Site.

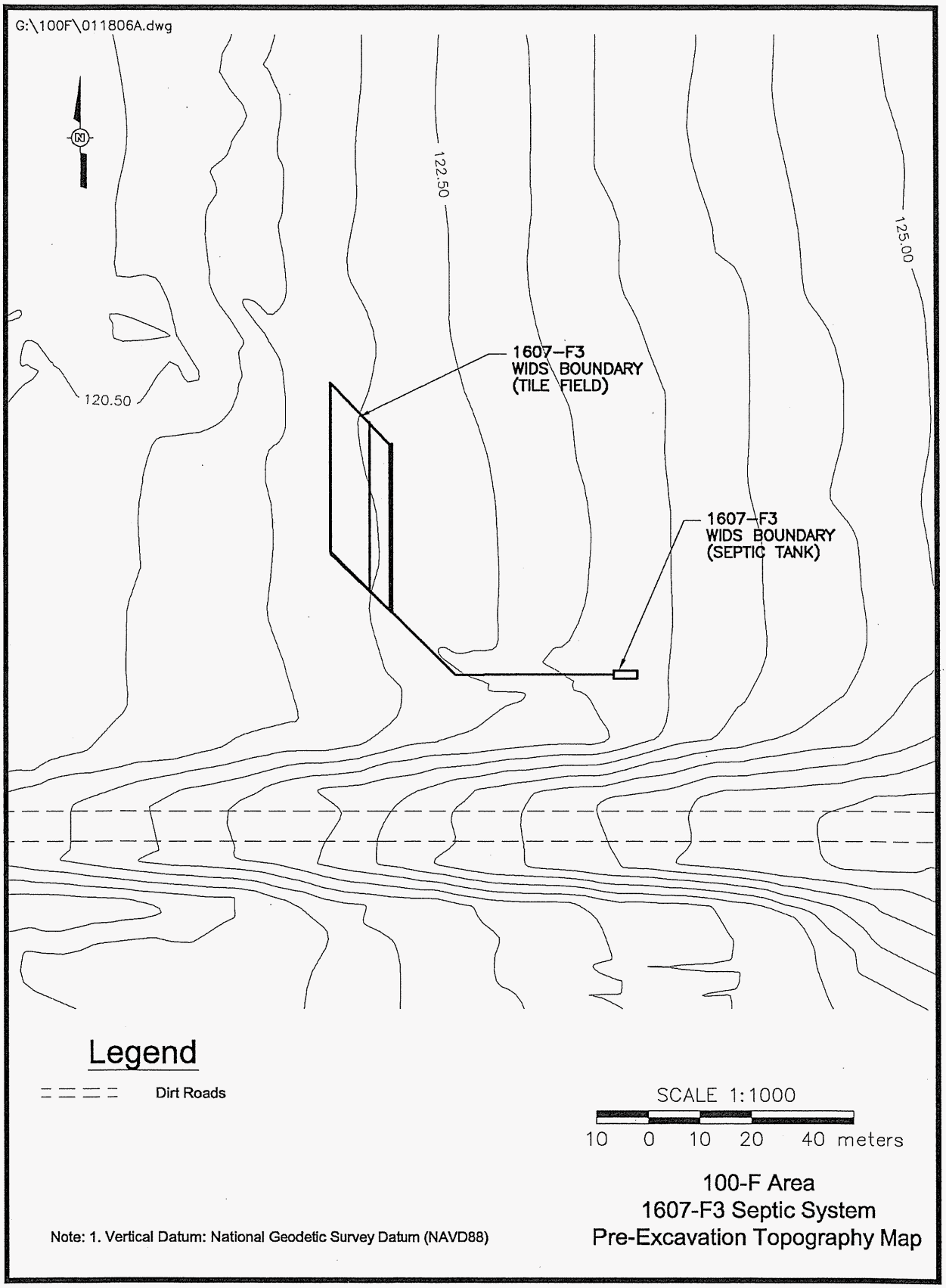


Figure 4. Excavation Boundary of the 1607-F3 Site.

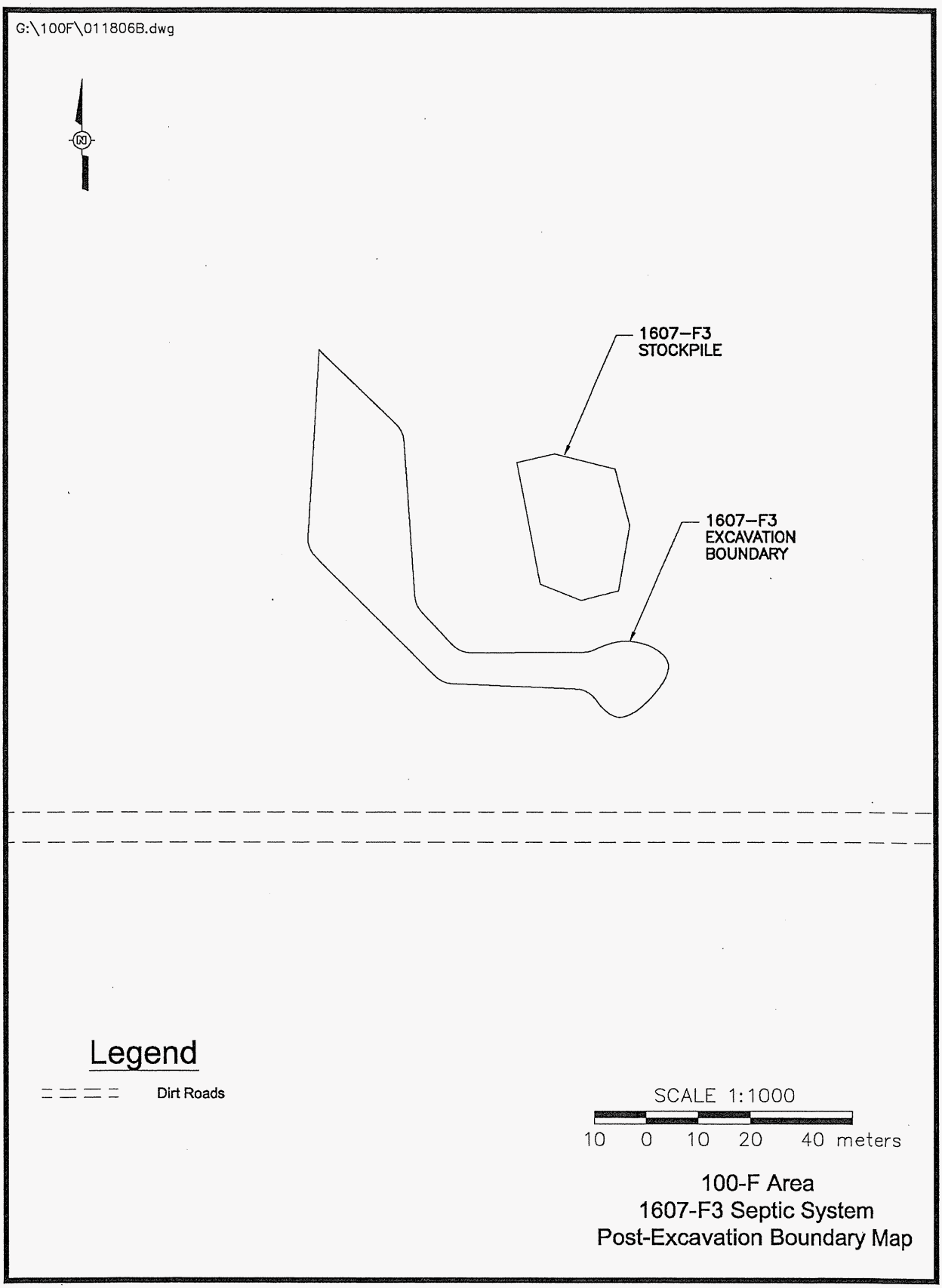


Figure 5. View Looking West at the Former 1607-F3 Septic Tank Site (Foreground) (taken February 14, 2007).

Figure 6. View Looking North/Northwest at the Former 1607-F3 Drain Field Site (taken February 14, 2007).

Figure 7. Radiological Survey of the 1607-F3 Waste Site.

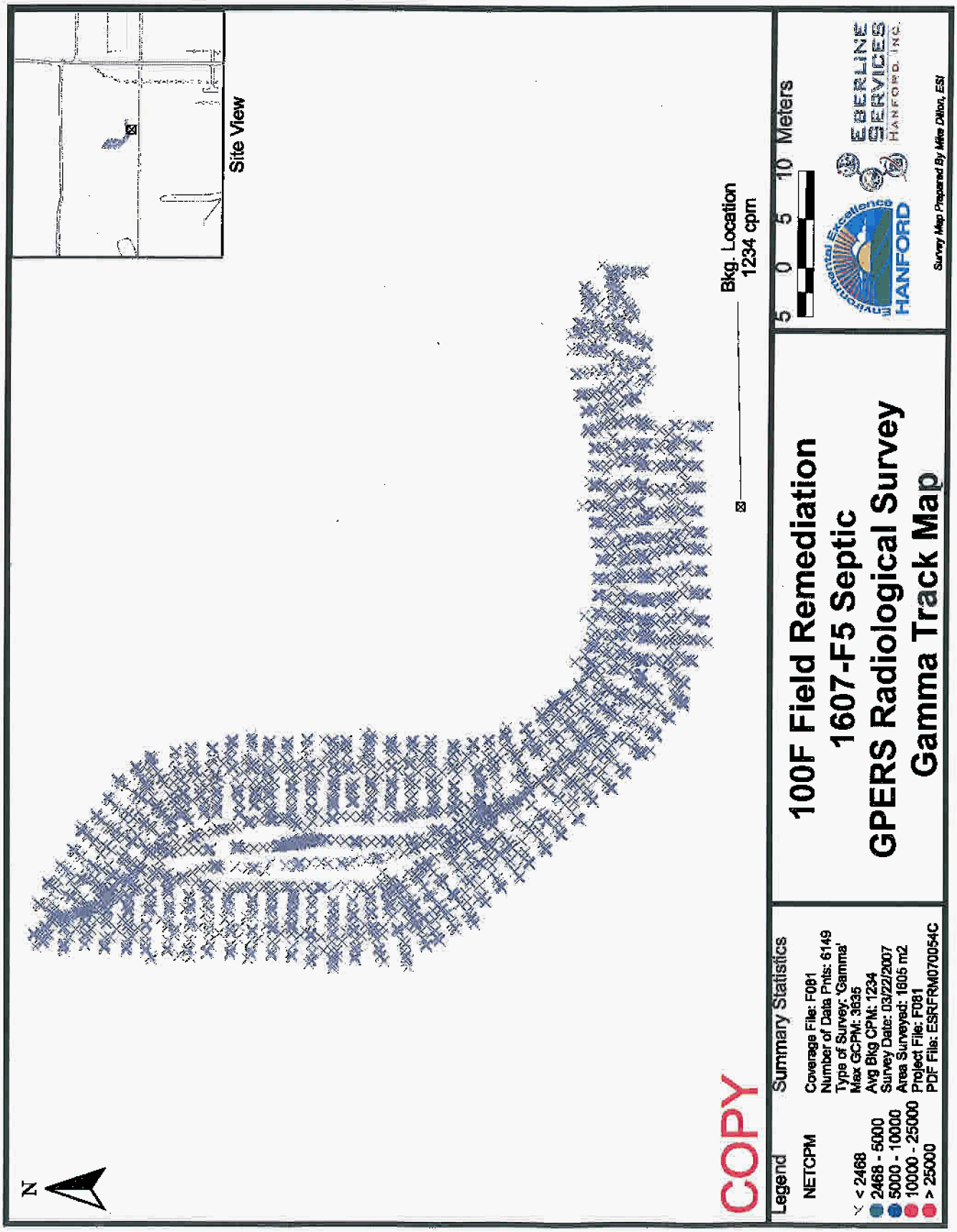


Table 2. Contaminants of Concern/Contaminants of Potential Concern for Verification Sampling of the 1607-F3 Sanitary Sewer Site.

Metals[a]	Pesticides	Other
Antimony[b]	Dichlorodiphenyldichloroethane[b]	Europium-152[c] (Radionuclides)
Arsenic[b]	Dichlorodiphenyldichloroethylene[b]	Cesium-137[c] (Radionuclides)
Barium[b]	Dichlorodiphenyltrichloroethane[b]	Arochlor-1260[b] (PCBs)
Boron[c,d]	Endrin keytone[b]	Methylene chloride (VOCs)[c]
Cadmium[b]	Heptachlor[b]	Dibenz[a,h]anthracene[b] (SVOCs)
Chromium[b]		
Copper[b]		
Lead[b]		
Silver[b]		
Zinc[b]		
Mercury[b]		

[a] Samples were analyzed for the expanded ICP metal list including antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, vanadium, silver, and zinc.
[b] Contaminant detected in confirmatory soil samples greater than cleanup criteria.
[c] Contaminant detected in confirmatory soil samples at concentration/activity greater than background but less than cleanup criteria.
[d] Hanford Site-specific background value not available.
ICP = inductively coupled plasma
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
VOC = volatile organic compound

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 post-excavation topographic survey was used to determine the boundaries of the 1607-F3 remedial action for the purpose of verification sampling. The 1607-F3 waste site was sampled in two phases as a result of the elevated levels of arsenic and lead detected during the first verification sampling event. Additional remediation did not significantly alter the Phase I remediation footprint; therefore, the existing post-excavation survey was used for the Phase II verification sample design. Figure 4 was used to divide the 1607-F3 site into two decision units for the purpose of verification sampling. The first decision unit was delineated based on the surveyed limits of material removed (excavated area), and the second decision unit was composed of the footprint of the staging pile area. Phase I and Phase II verification sample designs are presented in Figures 8 and 9, respectively.

Verification Sampling Design – Excavated Area

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. A statistical sampling design is the preferred verification sampling approach for this site because the distribution of potential residual soil contamination over the site is uncertain. The Washington State Department of Ecology publication *Guidance on Sampling and Data Analysis Methods* (Ecology 1995) recommends that systematic sampling with sample locations distributed over the entire study area be used. This sampling approach is referred to by the Washington State Department of Ecology as "area-wide sampling."

Figure 8. Verification Soil Sampling Locations (Phase I).

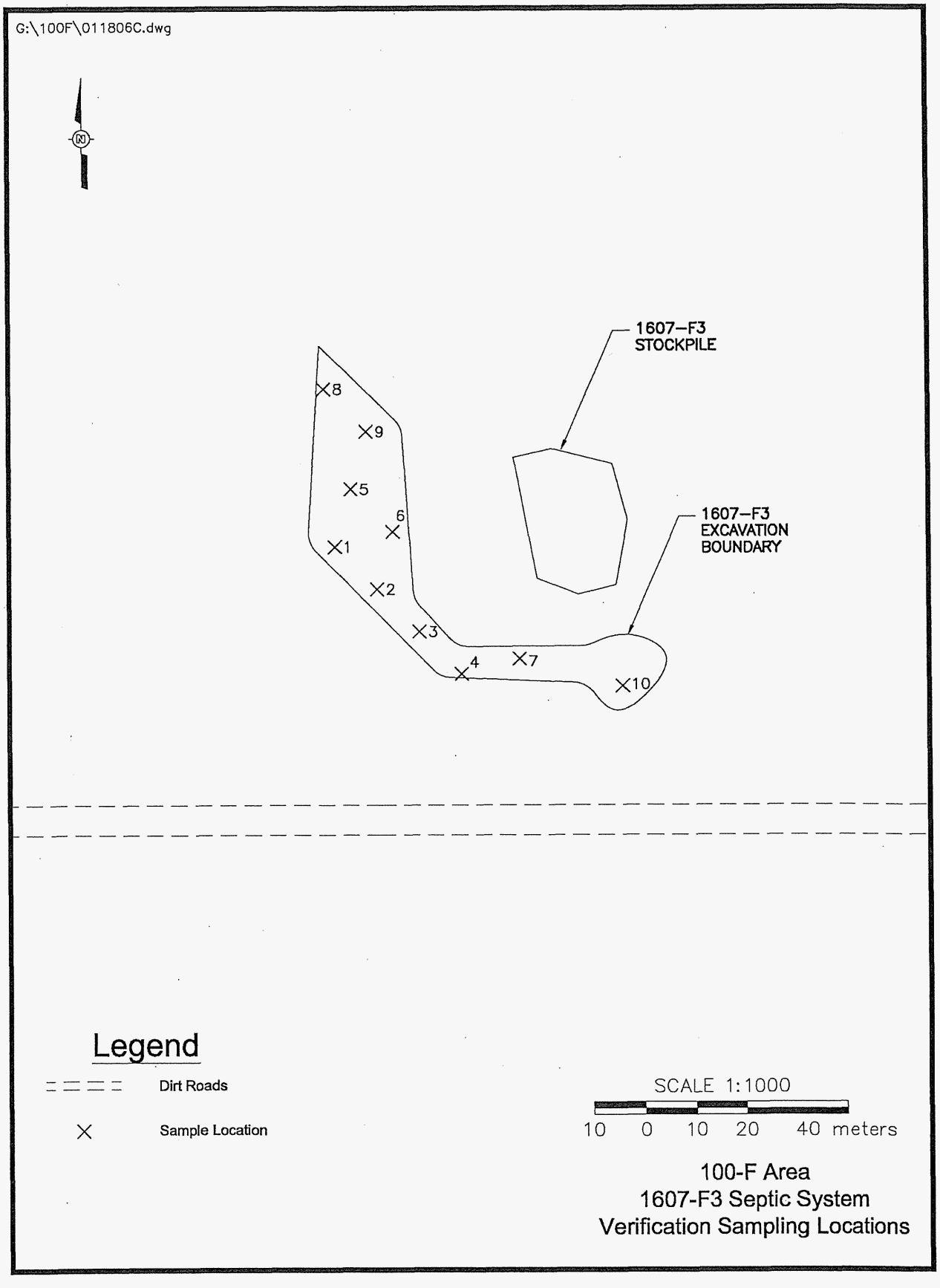
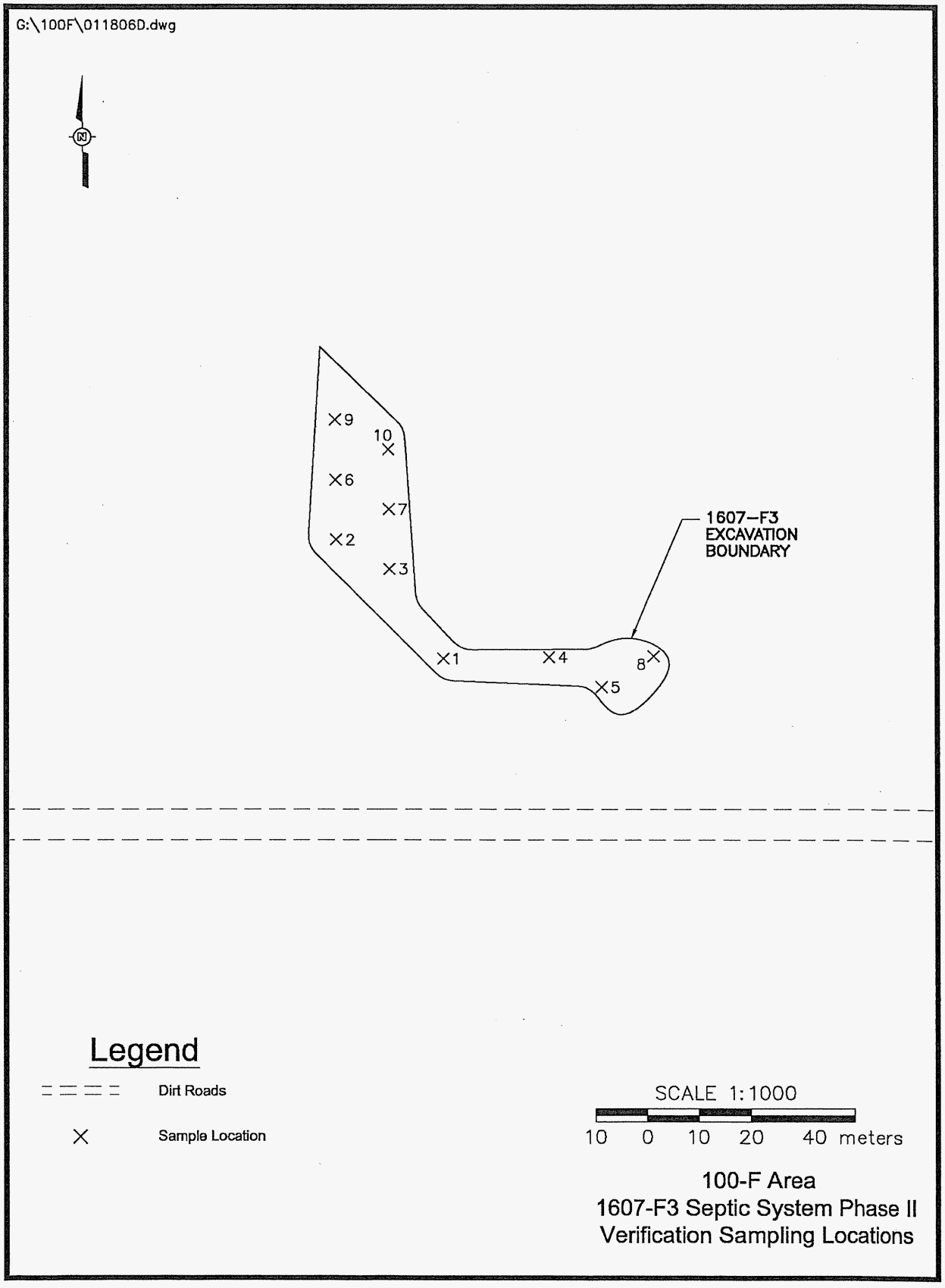


Figure 9. Verification Soil Sampling Locations (Phase II).



Visual Sample Plan[1] (VSP) was used as a tool to develop the statistical sampling design for both Phase I and Phase II verification sampling efforts. The remediation footprint (excavated area) was delineated in VSP and used as the basis for location of a random-start systematic grid for verification soil sample collection. A total of 10 soil samples were collected on this grid within the remediation footprint for each phase of verification sampling. 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 sample designs is provided in the 1607-F3 verification work instruction (WCH 2006d).

Verification Sample Design – Staging Pile Area

Waste staged onsite during remedial activities consisted of soil and debris and was disposed of at ERDF. There was no potential for contaminant migration into soils underlying the former staging pile; therefore, a statistical sampling design was not warranted for the staging pile footprint and professional judgment was used to develop the sampling design. The sampling consisted of collecting 30 aliquots of soil distributed across the surface of the staging area footprint and combining into one sample for laboratory analysis.

Summaries of the samples collected for both verification sampling events and the analyses performed are presented in Tables 3 and 4. The soil sample locations were surveyed and staked prior to sample collection. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the SAP (DOE-RL 2005a).

Table 3. Verification Sample Summary for the 1607-F3 Phase I Sampling. (2 Pages)

Sample	Sample Number	Coordinate Locations (Washington State Plane)	Sample Analysis
Excavated area, location 1	J11JN8	N 148025.0 E 580117.0	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Duplicate of location 1	J11JP8	N 148025.0 E 580117.0	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Excavated area, location 2	J11JN9	N 148016.5 E 580125.4	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Excavated area, location 3	J11JP0	N 148008.0 E 580133.7	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Excavated area, location 4	J11JP1	N 147999.6 E 580142.1	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Excavated area, location 5	J11JP2	N 148036.4 E 580120.2	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Excavated area, location 6	J11JP3	N 148027.9 E 580128.5	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Excavated area, location 7	J11JP4	N 148002.6 E 580153.6	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA

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

Table 3. Verification Sample Summary for the 1607-F3 Phase I Sampling. (2 Pages)

Sample	Sample Number	Coordinate Locations (Washington State Plane)	Sample Analysis
Excavated area, location 8	J11JP5	N 148056.3 E 580115.0	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Excavated area, location 9	J11JP6	N 148047.8 E 580123.3	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Excavated area, location 10	J11JP7	N 147997.2 E 580173.4	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Staging pile footprint	J11L17	N 148031 E 580164 (approximate center)	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA
Equipment blank	J11JN7	NA	Pesticides, PCBs, ICP metals, mercury, VOA, SVOA, GEA

Source: Field Logbooks EFL-1174-1, and EFL-11174-2 (WCH 2006b, WCH 2006c).
GEA = gamma spectroscopy
ICP = inductively coupled plasma
NA = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
VOA = volatile organic analysis

Table 4. Verification Sample Summary for the 1607-F3 Phase II Sampling. (2 Pages)

Sample	Sample Number	Coordinate Locations (Washington State Plane)	Sample Analysis
Excavated area, location 1	J13W53	N 148003.3 E 580137.9	Arsenic and lead
Excavated area, location 2	J13W51	N 148026.8 E 580117.2	Arsenic and lead
Excavated area, location 3	J13W52	N 148021.0 E 580127.5	Arsenic and lead
Excavated area, location 4	J13W54	N 148003.6 E 580158.4	Arsenic and lead
Excavated area, location 5	J13W55	N 147997.7 E 580168.7	Arsenic and lead
Excavated area, location 6	J13W48	N 148038.6 E 580117.1	Arsenic and lead
Duplicate of location 6	J13W49	N 148038.6 E 580117.1	Arsenic and lead
Excavated area, location 7	J13W50	N 148032.8 E 580127.4	Arsenic and lead

Table 4. Verification Sample Summary for the 1607-F3 Phase II Sampling. (2 Pages)

Sample	Sample Number	Coordinate Locations (Washington State Plane)	Sample Analysis
Excavated area, location 8	J13W56	N 148003.8 E 580178.9	Arsenic and lead
Excavated area, location 9	J13W46	N 148050.5 E 580117.0	Arsenic and lead
Excavated area, location 10	J13W47	N 148044.6 E 580127.3	Arsenic and lead

Source: Field Logbooks EFL-1174-1, and EFL-1174-2 (WCH 2006b, WCH 2006c).

Verification Sampling Results

Verification samples were analyzed using U.S. Environmental Protection Agency-approved analytical methods. The 95% upper confidence limit on the true population mean for residual concentrations of COCs and COPCs was calculated for the excavation area as specified by the RDR/RAWP (DOE-RL 2005b), with calculations provided in Appendix B. When a nonradionuclide COC or COPC 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/COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COC/COPC. Evaluation of the verification data from the staging pile footprint was performed by direct comparison of the sample result for each COC/COPC against cleanup criteria.

Comparisons of the statistical and maximum results for COCs and COPCs with the site RAGs for the excavation area and the staging pile footprint are summarized in Tables 4a and 4b, respectively. 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 COPCs. 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 Tables 4a and 4b, 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]). 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.

Table 4a. Comparison of Maximum or Statistical Contaminant Concentrations to Action Levels for the 1607-F3 Excavation Area Verification Sampling Event. (2 Pages)

COC/COPC	Statistical Result (pCi/g)	Generic Site Lookup Values[a] (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value[b]	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.067 (<BG)	6.2	1,465	1,465	No	--
COC/COPC	**Maximum or Statistical Result (mg/kg)**	**Remedial Action Goals[a] (mg/kg)**			**Does the Maximum or Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	8.2[c]	20[d]	20[d]	20[d]	No	--
Barium	73.3 (<BG)	5,600[e]	132[f,g]	224[h]	No	--
Beryllium	0.26 (<BG)	10.4[i]	1.51[g]	1.51[g]	No	--
Boron[j]	0.38	16,000	320	--[k]	No	--
Cadmium[l]	0.46 (<BG)	13.9	0.81[g]	0.81[g]	No	--
Chromium (total)	9.6 (<BG)	80,000[e]	18.5[g]	18.5[g]	No	--
Cobalt	6.0 (<BG)	1,600	32	--[k]	No	--
Copper	13.2 (<BG)	2,960	59.2	22.0[g]	No	--
Lead	29[c]	353	10.2[g]	10.2[g]	Yes	Yes[m]
Manganese	275 (<BG)	11,200	512[g]	512[g]	No	--
Mercury	0.04 (<BG)	24	0.33[g]	0.33[g]	No	--
Nickel	10.2 (<BG)	1,600	19.1[g]	27.4	No	--
Selenium[l]	4.2	400	5	1	Yes	Yes[m]
Vanadium	34.1 (<BG)	560	85.1[g]	--[k]	No	--
Zinc	41.9 (<BG)	24,000	480	67.8[g]	No	--
Aroclor-1260	0.0035	0.5	0.017[n]	0.017[n]	No	--
alpha-Chlordane	0.0010	0.769	0.02[n]	0.02[n]	No	--
gamma-Chlordane	0.0026	0.769	0.02[n]	0.02[n]	No	--
Benzo(a)pyrene	0.033	0.33[n]	0.33[n]	0.33[n]	No	--
Benzo(g,h,i)perylene[o]	0.023	2,400	48	192	No	--
Benzo(k)fluoranthene	0.029	13.7[p]	0.33[n]	0.33[n]	No	--
Chrysene	0.022	137[p]	1.2[p]	0.33[n]	No	--
Di-n-butylphthalate	0.025	8,000	160	540	No	--
Indeno(1,2,3-cd) pyrene	0.022	1.37	0.33[n]	0.33[n]	No	--
Ethylbenzene	0.002	8,000	70	620	No	--

Table 4a. Comparison of Maximum or Statistical Contaminant Concentrations to Action Levels for the 1607-F3 Excavation Area Verification Sampling Event. (2 Pages)

COC/COPC	Statistical Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Methylene chloride	0.043	133	0.5	0.94	No	--
Tetrachloroethene	0.002	1.85	0.0081	0.039	No	--
Toluene	0.001	6,400	64	1,360	No	--
Xylenes (total)	0.006[q]	16,000	160	--[k]	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] Activity corresponding to a single-radionuclide 15 mrem/yr exposure as calculated using the RESRAD model (DOE-RL 2005b).
[c] Result based on Phase II verification sampling.
[d] The cleanup value of 20 mg/kg has been agreed to by Tri-Party project managers. The basis for 20 mg/kg is provided in Section 2.1.2.1 of DOE-RL (2005b).
[e] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) (as presented in the RDR/RAWP [DOE-RL 2005b]). Updated oral reference dose values (as provided in the Integrated Risk Information System) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and chromium, respectively.
[f] Barium soil cleanup level for groundwater protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule") and WAC 173-340-720(3), 1996 (Method B for groundwater) is 112 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). The updated oral reference dose value (as provided in the Integrated Risk Information System) yields a Method B groundwater cleanup criteria of 7 mg/L, as compared to the more restrictive maximum contaminant level of 2 mg/L (40 *Code of Federal Regulations* 141). Per WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), the most restrictive updated soil cleanup level for groundwater protection would be 200 mg/kg.
[g] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).
[h] Barium soil cleanup level for river protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), a dilution attenuation factor of 2, and WAC 173-340-720(3), 1996 (Method B for groundwater) is 224 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). No surface water bioconcentration factor is available for barium and no ambient water quality criteria value exists; therefore no WAC 173-340-730(3), 1996 (Method B for surface waters) value can be determined.
[i] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750[3], 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (WDOH 1997).
[j] No Hanford Site-specific or Washington State background value available.
[k] No cleanup level is available from the *Cleanup Levels and Risk Calculations Database* (Ecology 2005), and no bioconcentration factor or ambient water quality criteria values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[l] Hanford Site-specific background value is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[m] Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), lead and selenium are not expected to migrate more than 1 m (3.3 ft) vertically in 1,000 years. The vadose zone underlying the remediation footprint is approximately 6 m (20 ft) thick, based on nearby borehole 199-F7-2.
[n] Where cleanup levels are less than the RDL, cleanup levels default to the RDL (WAC 173-340-707[2], 1996 and DOE-RL 2005b).
[o] Toxicity data for benzo(g,h,i)perylene are not available. RAGs are based on the surrogate chemical pyrene.
[p] Value listed in the RDR/RAWP (DOE-RL 2005b) is based on the use of benzo(a)pyrene as a surrogate. Compound-specific carcinogenic cleanup level calculated per WAC 173-340-740(3), 1996 (Method B for soils) using the Oak Ridge National Laboratory oral cancer potency factor.
[q] Analytical laboratory also quantitated m&p-xylene (0.004 mg/kg) and o-xylene (0.002 mg/kg). RAG evaluation is performed based on the most restrictive available toxicity data (total xylenes).

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

Table 4b. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-F3 Staging Pile Footprint Verification Sampling Event. (2 Pages)

COC/COPC	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	12.1	20[b]	20[b]	20[b]	No	--
Barium	60.2 (<BG)	5,600[c]	132[d,e]	224[f]	No	--
Beryllium	0.02 (<BG)	10.4[g]	1.51[e]	1.51[e]	No	--
Boron[h]	1.7	16,000	320	--[i]	No	--
Cadmium[j]	0.27 (<BG)	13.9	0.81[e]	0.81[e]	No	--
Chromium (total)	9.4 (<BG)	80,000[c]	18.5[e]	18.5[e]	No	--
Cobalt	5.2 (<BG)	1,600	32	--[i]	No	--
Copper	14.5 (<BG)	2,960	59.2	22.0[i]	No	--
Lead	54.9	353	10.2[e]	10.2[e]	Yes	Yes[k]
Manganese	255 (<BG)	11,200	512[e]	512[e]	No	--
Mercury	0.03 (<BG)	24	0.33[e]	0.33[e]	No	--
Nickel	9.6 (<BG)	1,600	19.1[e]	27.4	No	--
Vanadium	28.2 (<BG)	560	85.1[e]	--[i]	No	--
Zinc	38.4 (<BG)	24,000	480	67.8[e]	No	--
4,4'-DDE	0.00049	2.94	0.0257	0.005[l]	No	--
4,4'-DDT	0.00035	2.94	0.0257	0.005[l]	No	--
Acetone	0.005	72,000	720	--[i]	No	--
Aroclor-1254	0.0034	0.5	0.017[l]	0.017[l]	No	--
Chloroform	0.001	164	0.72	1.14	No	--
Di-n-butylphthalate	0.12	8,000	160	540	No	--

Table 4b. Comparison of Maximum Contaminant Concentrations to Action Levels for the 1607-F3 Staging Pile Footprint Verification Sampling Event. (2 Pages)

COC/COPC	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
gamma-Chlordane	0.00083	0.769	0.02[l]	0.02[l]	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 cleanup value of 20 mg/kg has been agreed to by Tri-Party project managers. The basis for 20 mg/kg is provided in Section 2.1.2.1 of DOE-RL (2005b).

[c] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) (as presented in the RDR/RAWP [DOE-RL 2005b]). Updated oral reference dose values (as provided in the Integrated Risk Information System) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and chromium, respectively.

[d] Barium soil cleanup level for groundwater protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule") and WAC 173-340-720(3), 1996 (Method B for groundwater) is 112 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). The updated oral reference dose value (as provided in the Integrated Risk Information System) yields a Method B groundwater cleanup criteria of 7 mg/L, as compared to the more restrictive maximum contaminant level of 2 mg/L (40 CFR 141). Per WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), the most restrictive updated soil cleanup level for groundwater protection would be 200 mg/kg.

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

[f] Barium soil cleanup level for river protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), a dilution attenuation factor of 2, and WAC 173-340-720(3), 1996 (Method B for groundwater) is 224 mg/kg (as presented in the RDR/RAWP [DOE-RL 2005b]). No surface water bioconcentration factor is available for barium and no ambient water quality criteria value exists; therefore, no WAC 173-340-730(3), 1996 (Method B for surface waters) value can be determined.

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

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

[i] No cleanup level is available from the *Cleanup Levels and Risk Calculations Database* (Ecology 2005), and no bioconcentration factor or ambient water quality criteria values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).

[j] Hanford Site-specific background value is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[k] Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), lead is not expected to migrate more than 1 m (3.3 ft) vertically in 1,000 years. The vadose zone underlying the remediation footprint is approximately 6 m (20 ft) thick, based on nearby borehole 199-F7-2.

[l] Where cleanup levels are less than the RDL, cleanup levels default to the RDL (WAC 173-340-707[2], 1996 and DOE-RL 2005b).

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

DATA EVALUATION

Residual concentrations of lead and selenium within the 1607-F3 excavation area as well as lead in the staging pile footprint exceed the soil RAGs for the protection of groundwater and/or the Columbia River. Data were not collected on the vertical extent of residual contamination, but, given the soil-partitioning coefficient of lead (30 mL/g) and selenium (150 mL/g), RESRAD modeling (BHI 2005) predicts that these contaminants will not migrate more than 1 m (3.3 ft) vertically in 1,000 years. The vadose zone beneath the 1607-F3 excavation is approximately 6 m (20 ft) thick. Therefore, residual concentrations of lead and selenium 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/COPCs for the 1607-F3 waste site were either not detected or quantified below RAGs and lookup values.

Nonradionuclide risk requirements include a hazard quotient of less than 1.0 for all individual noncarcinogens, 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 using the higher of the remediation footprint statistical value and the staging pile footprint maximum value for each constituent. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients were less than 1.0, and all individual cumulative excess carcinogenic risk values were less than 1×10^{-6} (Appendix C). The cumulative hazard quotient for the 1607-F3 waste site is 9.5×10^{-2}, and the cumulative excess carcinogenic risk value is 2.8×10^{-7}. Therefore, nonradionuclide risk requirements are met.

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. The application of the three-part test for the 1607-F3 remediation footprint is included in the statistical calculations (Appendix B). The three-part test is not applicable to the staging pile footprint results because direct evaluation of nonstatistical sampling results was used as the compliance basis. All residual COC/COPC concentrations for the 1607-F3 remediation footprint pass the three-part test, except for lead, which fails the three-part test in comparison against soil RAGs for the protection of groundwater and the Columbia River. However, as described above, lead is not predicted to reach groundwater (and, thus, the Columbia River) within 1,000 years. Residual concentrations are, therefore, protective of groundwater and the Columbia River.

DATA QUALITY ASSESSMENT

A data quality assessment (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 ENV-1, *Environmental Monitoring & Management*. Specific data quality objectives for the site are found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a). All samples were collected per the sample design. 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

In the VOC analysis the common laboratory contaminant methylene chloride was found in the matrix spike (MS)/matrix spike duplicate (MSD) (where it was not spiked) and in all of the samples, all at similar levels, but was not found in the method blank (MB). All were at levels below the required detection limit. There was no impact on the sample data.

In the SVOC analyses, several issues were observed in the data. None of the issues impacted any of the positive results for SVOCs, and those results were useful for decision-making purposes. The method detection limits (MDLs) on the nondetects were not low enough to be useful for decision-making purposes. Therefore, SVOCs remained as COPCs for verification sampling at this site.

In the pesticide analyses, no quality assurance (QA)/quality control (QC) information was generated for the analyte toxaphene. In some of the analyses, the pesticide data was reported with high MDLs. All pesticides remained as COPCs for verification sampling at this site.

In the PCB analyses, several issues were observed in the data. None of the issues impacted any of the positive results for PCBs and those results were useful for decision-making purposes. However, the MDLs on the nondetects were not low enough to be useful for decision-making purposes. Therefore, PCBs remained as COPCs for verification sampling at this site.

For the metals analyses, minor issues were observed in the MSs, laboratory duplicates, and MBs. However, none of these were significant problems, and there was no impact on the sample data.

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

The DQA review for the 1607-F3 site found the confirmatory sampling results to be accurate within the standard errors associated with the methods, including sampling and sample handling. The DQA review for the 1607-F3 site concluded that the data are of the right type, quality, and quantity to support the intended use, except as noted above. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of QA and QC deficiencies. All analytical data were found to be acceptable for decision-making purposes.

Verification Sampling Data Quality Assessment

A DQA was performed to compare the sampling approach and analytical data with the sampling and data requirements specified in the site-specific work instruction (WCH 2006d). A review of the verification work instruction, the field logbooks (WCH 2006b, 2006c), and applicable analytical data packages (WCH 2006a) was performed as part of this DQA.

Gross alpha and gross beta were inadvertently indicated in Table 3 (analytical methods) of the verification work instruction (WCH 2006d). In the confirmatory data set, the gross beta results were below the threshold level. However, the gross alpha results (20.8 pCi/g) were above the threshold level (15 pCi/g), which initiated further evaluation of the data set. Further evaluation of the confirmatory data showed that the gross alpha results were due to detections of thorium-228 and radium-226. Therefore, no further gross alpha or gross beta analysis was needed for this site. The data set is sufficient to support the intended use (to make closeout decisions regarding the COCs/COPCs indicated for the 1607-F3 site).

Data from verification samples collected at the 1607-F3 site were provided by the laboratory in sample delivery group (SDG) K0259, SDG K0262, and SDG K0320. No major deficiencies were found in the data. Minor deficiencies are presented in the following descriptions of the SDGs. Third-party validation of SDG K0259 and SDG K0262 is also presented in the following descriptions.

SDG K0259

SDG K0259 consists of 12 samples (J11JN7, J11JN8, J11JP8, J11JN9, J11JP0, J11JP1, J11JP2, J11JP3, J11JP4, J11JP5, J11JP6, J11JP7) analyzed for SVOCs, VOCs, pesticides, PCBs, metals by inductively coupled plasma (ICP) analysis, and radionuclides. Sample J11JN7 is the equipment blank. SVOCs and ICP metals analysis were performed on the equipment blank. Sample J11JP8 is a field duplicate of sample J11JN8.

SVOC Analysis

The common laboratory contaminant bis(2-ethylhexyl)phthalate was found in the MB at concentrations below the contract required detection limit (CRDL). Due to the MB contamination, third-party validation raised all bis(2-ethylhexyl)phthalate results to the required quantitation limit (RQL) (660 mg/kg) and flagged them with a "U" as undetected. The data are useable for decision-making purposes.

Two of the 96 surrogate recoveries were outside of acceptance criteria, both in the MSD. The analysis of the associated MS sample fulfills the reanalysis requirement of the MSD. The data are useable for decision-making purposes.

The MS recoveries for 19 analytes were above the laboratory established acceptance criteria, ranging from 116% to 166%. There may have been a high bias in the field sample data for these analytes; however, the data are useable for decision-making purposes.

The MS recoveries for three analytes were below the laboratory-established acceptance criteria, ranging from 48% to 59%. The sample results for nitrobenzene, isophorone, and 1,2,4-trichlorobenzene are considered estimated, but are useable for decision-making purposes.

The MS and MSD recoveries for isophorone and 1,2,4-trichlorobenzene were below the acceptance criteria. Third-party validation qualified the isophorone and 1,2,4-trichlorobenzene results as estimates with "J" flags.

The laboratory control sample (LCS) recovery for 2,4-dinitrophenol was below criteria at 14%. The MS and MSD recoveries for 2,4-dinitophenol were 69% and 70%, respectively. Third-party validation qualified all of the 2,4-dinitrophenol results as estimates with "J" flags.

The laboratory investigated a deficiency with an internal standard in the MSD and the LCS. The gas chromatograph/mass spectrometer instrument was inspected for malfunction and was found to be functioning properly. This deficiency was not noted in, nor should it impact, the field sample data.

VOA

The internal standard criteria were not met for sample J11JP0. The sample was reanalyzed, but beyond its holding time. Due to the holding time being exceeded, all volatile organic results in sample J11JP0 were qualified as estimates with "J" flags.

The common laboratory contaminant methylene chloride was detected in the MB at less than two times the CRDL. There may have been a high bias in the field sample data for methylene chloride. A high bias is acceptable for the intended use of the data. Third-party validation qualified the methylene chloride results in all samples (except J11JP0 and J11JP7) as undetected and flagged "U."

Because samples J11JP0, J11JP0R, J11JN9, J11JP3, J11JP7, and J11JP8 were prepared in a separate batch from the MS and MSD, the organic results for these samples were qualified as estimates with "J" flags. With the exception of sample J11JP0R, these samples were also prepared without an associated LCS.

Pesticide Analysis

The analyte toxaphene is routinely quantitated by the laboratory but not included in the QA/QC samples associated with each sample batch. Third-party validation qualified all of the toxaphene results as estimated with "J" flags.

PCB Analysis

Five of 30 surrogate recoveries were outside of the primary acceptance criteria. However, the secondary acceptance criteria allowing "no more than one outlier per sample" was met in all five cases and, with the exception of sample J11JP2, no analytes were detected in the field samples.

Aroclor-1260 was detected in sample J11JP2. Third-party validation qualified the aroclor-1260 result in sample J11JP2 as estimated with a "J" flag because of the deficiency in the surrogate recovery.

ICP Metals Analysis

The LCS recovery for silicon was below acceptance criteria at 57.1%. Associated sample results for silicon may have been biased low. Silicon is not a COPC for the 1607-F3 waste site. The silicon data are considered estimated but useable for decision-making purposes.

MS recoveries for aluminum, boron, iron, manganese, antimony, and silicon (351.2%, 63.3%, 390%, 60.1%, 39.5%, and 72.6%, respectively) were outside of the laboratory's acceptance criteria. Serial dilutions and post-digestion spikes were performed for these analytes with results in the range of 79% to 108%. Third-party validation qualified all boron, antimony, and silicon results as estimates with a "J" flag because of the low MS recoveries for these analytes.

The relative percent difference (RPD) for boron was above the laboratory's acceptance criteria but within the project's acceptance criteria, at 21%. Elevated RPDs are attributed to natural heterogeneity of the sample matrices. The data are useable for decision-making purposes.

Radionuclide Analyses

No deficiencies were found.

SDG K0262

SDG K0262 consists of one sample (J11L17) from the 1607-F3 staging area, which was analyzed for SVOCs, VOCs, pesticides, PCBs, ICP metals, and radionuclides. The results of third-party validation of SDG K0262 are also presented in the following descriptions.

SVOC Analysis

In the SVOC analysis, the common laboratory contaminant bis(2-ethylhexyl)phthalate was found in the MB at a concentration below the CRDL. Third-party validation qualified all of the bis(2-ethylhexyl) phthalate results as undetected with "U" flags and raised the reporting value to the RQL (660 mg/kg).

MS and MSD recoveries for 4-chloroanaline were above acceptance criteria at 129% and 130%, respectively. This suggests a high bias in the field samples. A high bias in the field sample data is acceptable for decision-making purposes.

VOA

Two of 15 surrogate recoveries were above the acceptance criteria. In sample J11L17 and the MS prepared from J11L17, the surrogate bromofluorobenzene recoveries were 129% and 130%, respectively. The analysis of the MS and MSD fulfills the reanalysis requirement for these samples. The MS recovery for 1,1,2,2-tetrachloroethane was above the acceptance criteria at 133%. There may have been a high bias in the field sample data for 1,1,2,2-tetrachloroethane. High-bias data are acceptable for decision-making purposes. In the MB, the common laboratory contaminant methylene chloride was detected at less than two times the CRDL and 2-hexanone was detected at less than the CRDL. Third-party validation requalified the methylene chloride result as undetected with a "U" flag and raised the reporting value to the RQL (10 mg/kg).

Pesticide Analysis

The analyte toxaphene is routinely quantitated by the laboratory but not included in the QA/QC samples associated with each sample batch. Third-party validation qualified all of the toxaphene results as estimates with "J" flags.

PCB Analysis

One of 12 surrogate recoveries was out of the primary acceptance criteria. However, there was no more than one outlier per sample; therefore, all samples met the secondary acceptance criteria.

ICP Metals

The MB result for silver was greater than the practical quantitation limit and, therefore, above the method criteria. However, all of the sample results were less than the instrument detection limit; therefore, the MB result is irrelevant.

The LCS for silicon was below acceptance criteria at 23.5%. Third-party validation qualified all silicon results in SDG K0262 with "J" flags as estimates. Silicon is not a COPC at the 1607-F3 waste site, and the data are usable for decision-making purposes.

The MS recoveries for four ICP metals (aluminum, iron, antimony, and silicon) were out of acceptance criteria. Serial dilutions and post-digestion spikes were performed, and all four had good results. With the exception of antimony, the MS recoveries were out of acceptance criteria because the added spike was insignificant compared to the concentrations in the samples. Third-party validation qualified all antimony results as estimates with "J" flags because the added spike was greater than the initial concentration in the sample and the MS result is actually a poor recovery.

The RPDs for barium and beryllium were above the acceptance criteria at 33.7% and 92.1%, respectively. Elevated RPDs are attributed to the natural heterogeneity of the sample matrices. Third-party validation qualified all barium results as estimates with "J" flags.

Radionuclide Analysis

Due to an RPD above QC limits at 32%, all thorium-238 results were qualified as estimates with "J" flags. Elevated RPDs are attributed to the natural heterogeneity of the sample matrices.

SDG K0320

SDG K0320 consists of three samples (J11X05, J11X06, and J11X07) analyzed for ICP metals.

ICP Metals

The samples were received by the laboratory at a temperature of 20.5°C. The laboratory temperature criterion for sample acceptance is 4°C. This increase in temperature would not have affected the metals within the sample. The data are usable for decision-making purposes.

The LCS for silicon (54.8%) was below acceptance criteria. Third-party validation qualified all silicon results in SDG K0320 with "J" flags as estimates.

MS recoveries for aluminum, iron, antimony, and silicon (605.6%, 924.6%, 51.2%, and 338%, respectively) were outside of acceptance criteria. Serial dilutions and post-digestion spikes were performed with good results for these analytes with the exception of iron (58.6%). Iron is not a COPC for the 1607-F3 waste site. The data are useable for decision-making purposes.

The RPD for cadmium and silicon was above the laboratory acceptance criteria at 23.3% and 20.6%, respectively. Elevated RPDs are attributed to the natural heterogeneity of the sample matrices.

SDG K0665

SDG K0665 consists of 11 samples (J13W46 through J13W56) analyzed for arsenic and lead.

ICP Metals (Arsenic and Lead)

The RPD for arsenic was above the laboratory acceptance criteria at 37.5%. Elevated RPDs are attributed to the natural heterogeneity of the sample matrices.

Conclusions

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

The DQA of the verification data for the 1607-F3 site found the results to be accurate within the standard errors associated with the methods, including the sampling and sample handling. This DQA concludes that the 1607-F3 verification data reviewed are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of QA and QC deficiencies. All analytical data were found acceptable for decision-making purposes.

SUMMARY FOR INTERIM CLOSURE

The 1607-F3 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 2,798 metric tons (US 3,085 tons) of material was excavated, staged onsite, and subsequently disposed of at ERDF. Sampling to verify the completeness of remediation was performed, and the analytical results indicated that the excavation contained residual arsenic and lead concentrations exceeding cleanup criteria. Additional remediation of the excavation was performed and consisted of removing an additional 3,791 metric tons (4,179 US tons) of material. Additional sampling was conducted and the results of both sampling events were shown to 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-F3 site to Interim Closed Out. This site does not have a deep zone; therefore, no deep zone institutional controls are required.

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APPENDIX A

CONFIRMATORY SAMPLING RESULTS

Note: This appendix contains the sample results that lead to a decision that remediation was necessary. Verification sampling results, to support site closeout, are provided in Appendix B.

Table A-1. 1607-F3 Confirmatory Sampling Results. (7 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Euopium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Equipment blank	J01XJ2	10/01/04	0.18	U	0.18	0.023	U	0.023	0.022	U	0.022	0.053	U	0.053	0.077	U	0.077	0.075	U	0.075
Soil from Area 1	J01XJ0	10/01/04	0.18	U	0.18	0.052	U	0.052	0.053	U	0.053	0.11	U	0.11	0.21	U	0.21	0.13	U	0.13
Duplicate of J01XJ0	J01XJ1	10/01/04	0.11	U	0.11	0.032	U	0.032	0.032	U	0.032	0.073	U	0.073	0.11	U	0.11	0.084	U	0.084
Soil from Area 2	J01XJ3	10/06/04	0.058	U	0.058	0.141		0.015	0.018	U	0.018	0.038	U	0.038	0.056	U	0.056	0.063	U	0.063
VCP from Area 1	J01XJ8	10/01/04	0.38	U	0.38	0.072	U	0.072	0.068	U	0.068	0.19	U	0.19	0.22	U	0.22	0.2	U	0.2
Septic Drain Field Area 2	J01XN0	10/06/04	0.094	U	0.094	0.317		0.046	0.043	U	0.043	0.417		0.088	0.12	U	0.12	0.08	U	0.08

Sample Location	HEIS Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Equipment blank	J01XJ2	10/01/04							6		0.25	0.149		0.044	0.231		0.11	0.144		0.028
Soil from Area 1	J01XJ0	10/01/04	7.48		2.6	18.1		5.2	14		0.56	0.577		0.11	0.748		0.27	0.669		0.062
Duplicate of J01XJ0	J01XJ1	10/01/04	10.3		2.9	20.4		5.4	15.4		0.28	0.554		0.056	0.724		0.13	0.648		0.036
Soil from Area 2	J01XJ3	10/06/04	9.09		3.3	19		5.5	14.6		0.21	0.676		0.033	0.884		0.083	0.824		0.017
VCP from Area 1	J01XJ8	10/01/04	20.8		2.5	23.5		5.2	9.32		0.67	1.26		0.14	1.47		0.29	1.32		0.084
Septic Drain Field Area 2	J01XN0	10/06/04	14		2.9	17.4		5.5	4.09		0.4	0.737		0.064	0.503		0.16	0.475		0.041

Sample Location	HEIS Number	Sample Date	Thorium-232 GEA			Uranium-235 GEA			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Equipment blank	J01XJ2	10/01/04	0.231		0.11	0.093	U	0.093	3	U	3
Soil from Area 1	J01XJ0	10/01/04	0.748		0.27	0.18	U	0.18	6.4	U	6.4
Duplicate of J01XJ0	J01XJ1	10/01/04	0.724		0.13	0.11	U	0.11	3.8	U	3.8
Soil from Area 2	J01XJ3	10/06/04	0.884		0.083	0.058	U	0.058	1.9	U	1.9
VCP from Area 1	J01XJ8	10/01/04	1.47		0.29	0.29	U	0.29	8.1	U	8.1
Septic Drain Field Area 2	J01XN0	10/06/04	0.503		0.16	0.29	U	0.29	4.9	U	4.9

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

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

B = blank contamination (organic constituents)

C = blank contamination (inorganic constituents)

GEA = gamma energy analysis

HEIS = Hanford Environmental Information System

J = estimated

MDA = minimum detectable activity

PQL = practical quantitation limit

Q = qualifier

VCP = vitrified clay pipe

U = undetected

Table A-1. 1607-F3 Confirmatory Sampling Results. (7 Pages)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Equipment blank	J01XJ2	10/1/04	36.5		0.66	0.25	U	0.25	0.3	U	0.3	0.85		0.02	0.008		0.008	0.42		0.42
Soil from Area 1	J01XJ0	10/1/04	6130		0.86	0.47		0.32	14.4		0.38	62.3		0.02	0.32		0.01	1.1		0.54
Duplicate of J01XJ0	J01XJ1	10/1/04	6130		0.82	0.33		0.3	14.1		0.36	57.2		0.02	0.31		0.01	1		0.52
Soil from Area 2	J01XJ3	10/6/04	7780	C	0.85	0.44		0.32	18.4		0.38	99.2	C	0.02	0.37		0.01	1.6		0.54
VCP from Area 1	J01XJ8	10/1/04	885		0.74	0.272	U	0.27	1.8		0.33	11.9		0.02	0.045		0.009	5.9		0.46
Septic Drain Field Area 2	J01XN0	10/6/04	18600		6	7.2		2.2	53.2		2.7	1860		0.15	0.4		.0.07	5.5		3.8

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Equipment blank	J01XJ2	10/1/04	0.02	U	0.02	31.1	C	0.57	0.17	C	0.05	0.08		0.07	0.08		0.04	76.5		1.9
Soil from Area 1	J01XJ0	10/1/04	0.11		0.03	3130	C	0.73	10.8	C	0.06	5.9		0.07	12.4		0.05	15900		2.4
Duplicate of J01XJ0	J01XJ1	10/1/04	0.16		0.03	2930	C	0.7	10.7	C	0.06	5.8		0.08	13.2		0.05	15700		2.3
Soil from Area 2	J01XJ3	10/6/04	0.25		0.03	3270	C	0.73	26.7	C	0.06	6.2		0.08	16.7		0.05	17800		2.4
VCP from Area 1	J01XJ8	10/1/04	0.027	U	0.03	1170	C	0.63	1.3	C	0.05	0.99		0.07	1.9		0.05	1710		2.1
Septic Drain Field Area 2	J01XN0	10/6/04	13.1		0.22	8470	C	5.1	334	C	0.44	6		0.59	215	C	0.37	19900		16.8

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Equipment blank	J01XJ2	10/1/04	0.16	U	0.16	5.8	C	0.54	2.8	C	0.008	0.01	U	0.01	0.11	U	0.11	0.1	U	0.1
Soil from Area 1	J01XJ0	10/1/04	50.6		0.2	3850	C	0.7	230	C	0.01	0.04		0.02	0.51		0.14	9.8		0.13
Duplicate of J01XJ0	J01XJ1	10/1/04	47		0.19	3760	C	0.67	231	C	0.01	0.07		0.02	0.29		0.13	9.6		0.12
Soil from Area 2	J01XJ3	10/6/04	108	C	0.2	4230	C	0.69	261	C	0.01	0.29		0.02	0.45	C	0.14	12.8		0.13
VCP from Area 1	J01XJ8	10/1/04	3.1		0.17	405	C	0.6	43.7	C	0.009	0.016	U	0.02	0.145		0.12	1.4		0.11
Septic Drain Field Area 2	J01XN0	10/6/04	458		1.4	3900		4.9	233		0.07	21.5		0.42	4.5		0.96	16.5		0.88

Table A-1. 1607-F3 Confirmatory Sampling Results. (7 Pages)

Sample Location	HEIS Number	Sample Date	Potassium			Selenium			Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Equipment blank	J01XJ2	10/1/04	17.3		2.9	0.32	U	0.32	30.7		0.41	0.07	U	0.07	8.5		0.19	0.05	U	0.05
Soil from Area 1	J01XJ0	10/1/04	977		3.7	0.41	U	0.41	370		0.53	0.1	U	0.1	134		0.24	33.9		0.06
Duplicate of J01XJ0	J01XJ1	10/1/04	939		3.5	0.39	U	0.39	369		0.5	0.09	U	0.09	129		0.23	34.3		0.06
Soil from Area 2	J01XJ3	10/6/04	1360		3.7	0.41	U	0.41	471		0.53	0.09	U	0.09	134		0.24	37		0.06
VCP from Area 1	J01XJ8	10/1/04	148		3.2	0.354	U	0.35	281		0.45	0.082	U	0.08	85.9		0.21	4.4		0.05
Septic Drain Field Area 2	J01XN0	10/6/04	1350	C	25.7	2.9	U	2.9	698	C	3.7	6.9		0.66	191	C	1.7	50.4		0.44

Sample Location	HEIS Number	Sample Date	Zinc		
			mg/kg	Q	PQL
Equipment blank	J01XJ2	10/1/04	5.8		0.03
Soil from Area 1	J01XJ0	10/1/04	53.1		0.04
Duplicate of J01XJ0	J01XJ1	10/1/04	51.8		0.04
Soil from Area 2	J01XJ3	10/6/04	120	C	0.04
VCP from Area 1	J01XJ8	10/1/04	5.4		0.04
Septic Drain Field Area 2	J01XN0	10/6/04	1880		0.29

Table A-1. 1607-F3 Confirmatory Sampling Results. (7 Pages)

Constituent	J01XJ0 Soil from Area 1 Sample Date 10/01/04			J01XJ1 Duplicate of J01XJ0 Sample Date 10/01/04			J01XJ2 Equipment blank Sample Date 10/01/04			J01XJ3 Soil from Area 2 Sample Date 10/06/04			J01XJ8 VCP from Area 1 Sample Date 10/01/04			J01XN0 Septic Drain Field Area 2 Sample Date		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls (PCBs)																		
Aroclor-1016	14	U	14	14	U	14	13	U	13	14	U	14	14	U	14	930	U	930
Aroclor-1221	14	U	14	14	U	14	13	U	13	14	U	14	14	U	14	930	U	930
Aroclor-1232	14	U	14	14	U	14	13	U	13	14	U	14	14	U	14	930	U	930
Aroclor-1242	14	U	14	14	U	14	13	U	13	14	U	14	14	U	14	930	U	930
Aroclor-1248	14	U	14	14	U	14	13	U	13	14	U	14	14	U	14	930	U	930
Aroclor-1254	14	U	14	14	U	14	13	U	13	14	U	14	14	U	14	930	U	930
Aroclor-1260	14	U	14	14	U	14	13	U	13	51		14	14	U	14	2900		930
Pesticides																		
Aldrin	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	23	U	23
Alpha-BHC	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	23	U	23
alpha-Chlordane	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	1100		23
beta-1,2,3,4,5,6-Hexachlorocyclohexane	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	23	U	23
Delta-BHC	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	23	U	23
Dichlorodiphenyldichloroethane	3.5	U	3.5	3.5	U	3.5	3.3	U	3.3	70	U	70	3.4	U	3.4	690		46
Dichlorodiphenyldichloroethylene	3.5	U	3.5	3.5	U	3.5	3.3	U	3.3	70	U	70	3.4	U	3.4	520		46
Dichlorodiphenyltrichloroethane	3.5	U	3.5	3.5	U	3.5	3.3	U	3.3	70	U	70	3.4	U	3.4	480		46
Dieldrin	3.5	U	3.5	3.5	U	3.5	3.3	U	3.3	70	U	70	3.4	U	3.4	46	U	46
Endosulfan I	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	23	U	23
Endosulfan II	3.5	U	3.5	3.5	U	3.5	3.3	U	3.3	70	U	70	3.4	U	3.4	46	U	46
Endosulfan sulfate	3.5	U	3.5	3.5	U	3.5	3.3	U	3.3	70	U	70	3.4	U	3.4	46	U	46
Endrin	3.5	U	3.5	3.5	U	3.5	3.3	U	3.3	70	U	70	3.4	U	3.4	46	U	46
Endrin aldehyde	3.5	U	3.5	3.5	U	3.5	3.3	U	3.3	70	U	70	3.4	U	3.4	46	U	46
Endrin ketone	3.5	U	3.5	3.5	U	3.5	3.3	U	3.3	70	U	70	3.4	U	3.4	34	J	46
Gamma-BHC (Lindane)	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	23	U	23
gamma-Chlordane	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	3000		23
Heptachlor	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	27		23
Heptachlor epoxide	1.8	U	1.8	1.8	U	1.8	1.7	U	1.7	35	U	35	1.7	U	1.7	540		23
Methoxychlor	18	U	18	18	U	18	17	U	17	350	U	350	17	U	17	82	J	230
Toxaphene	180	U	180	180	U	180	170	U	170	3500	U	3500	170	U	170	2300	U	2300

Table A-1. 1607-F3 Confirmatory Sampling Results. (7 Pages)

Constituent	J01XJ0 Soil from Area 1 Sample Date 10/01/04			J01XJ1 Duplicate of J01XJ0 Sample Date 10/01/04			J01XJ2 Equipment blank Sample Date 10/01/04			J01XJ3 Soil from Area 2 Sample Date 10/06/04			J01XJ8 VCP from Area 1 Sample Date 10/01/04			J01XN0 Septic Drain Field Area 2 Sample Date 10/06/04		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (SVOAs)																		
1,2,4-Trichlorobenzene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
1,2-Dichlorobenzene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
1,3-Dichlorobenzene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
1,4-Dichlorobenzene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	2100	J	19000
2,4,5-Trichlorophenol	880	U	880	890	U	890	840	U	840	1800	U	1800	860	U	860	46000	U	46000
2,4,6-Trichlorophenol	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
2,4-Dichlorophenol	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
2,4-Dimethylphenol	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
2,4-Dinitrophenol	880	U	880	890	U	890	840	U	840	1800	U	1800	860	U	860	46000	U	46000
2,4-Dinitrotoluene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
2,6-Dinitrotoluene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
2-Chloronaphthalene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
2-Chlorophenol	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
2-Methylnaphthalene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
2-Methylphenol (cresol, o-)	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
2-Nitroaniline	880	U	880	890	U	890	840	U	840	1800	U	1800	860	U	860	46000	U	46000
2-Nitrophenol	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
3+4 Methylphenol (cresol, m+p)	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
3,3'-Dichlorobenzidine	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
3-Nitroaniline	880	U	880	890	U	890	840	U	840	1800	U	1800	860	U	860	46000	U	46000
4,6-Dinitro-2-methylphenol	880	U	880	890	U	890	840	U	840	1800	U	1800	860	U	860	46000	U	46000
4-Bromophenylphenyl ether	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
4-Chloro-3-methylphenol	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
4-Chloroaniline	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
4-Chlorophenylphenyl ether	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
4-Nitroaniline	880	U	880	890	U	890	840	U	840	1800	U	1800	860	U	860	46000	U	46000
4-Nitrophenol	880	U	880	890	U	890	840	U	840	1800	U	1800	860	U	860	46000	U	46000
Acenaphthene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Acenaphthylene	54	J	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Anthracene	63	J	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Benzo(a)anthracene	200	J	350	360	U	360	330	U	330	700	U	700	22.016	J	340	19000	U	19000
Benzo(b)fluoranthene	140	J	350	360	U	360	330	U	330	700	U	700	17.492	J	340	19000	U	19000
Benzo(ghi)perylene	136	J	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000

Table A-1. 1607-F3 Confirmatory Sampling Results. (7 Pages)

Constituent	J01XJ0 Soil from Area 1 Sample Date 10/01/04			J01XJ1 Duplicate of J01XJ0 Sample Date 10/01/04			J01XJ2 Equipment blank Sample Date 10/01/04			J01XJ3 Soil from Area 2 Sample Date 10/06/04			J01XJ8 VCP from Area 1 Sample Date 10/01/04			J01XN0 Septic Drain Field Area 2 Sample Date 10/06/04		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
SVOAs (continued)																		
Benzo(k)fluoranthene	150	J	350	360	U	360	330	U	330	700	U	700	17	J	340	19000	U	19000
Bis(2-chloro-1-methylethyl)ether	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Bis(2-Chloroethoxy)methane	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Bis(2-chloroethyl) ether	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Bis(2-ethylhexyl) phthalate	25	J	350	31	J	360	35	J	330	700	U	700	36	J	340	1000	J	19000
Butylbenzylphthalate	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Carbazole	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Chrysene	220	J	350	360	U	360	330	U	330	700	U	700	22	J	340	19000	U	19000
Di-n-butylphthalate	20	JB	350	21	JB	360	37	JB	330	700	U	700	18	JB	340	19000	U	19000
Di-n-octylphthalate	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Dibenz[a,h]anthracene	31	J	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Dibenzofuran	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Diethylphthalate	350	U	350	360	U	360	40	J	330	700	U	700	340	U	340	19000	U	19000
Dimethyl phthalate	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Fluoranthene	400		350	360	U	360	330	U	330	700	U	700	33	J	340	19000	U	19000
Fluorene	21	J	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Hexachlorobenzene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Hexachlorobutadiene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Hexachlorocyclopentadiene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Hexachloroethane	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Indeno(1,2,3-cd)pyrene	111	J	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Isophorone	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
N-Nitroso-di-n-dipropylamine	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
N-Nitrosodiphenylamine	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Naphthalene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Nitrobenzene	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Pentachlorophenol	880	U	880	890	U	890	840	U	840	1800	U	1800	860	U	860	46000	U	46000
Phenanthrene	277	J	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Phenol	350	U	350	360	U	360	330	U	330	700	U	700	340	U	340	19000	U	19000
Pyrene	430		350	19	J	360	330	U	330	700	U	700	38	J	340	19000	U	19000

Table A-1. 1607-F3 Confirmatory Sampling Results. (7 Pages)

Constituent	J01XJ0 Soil from Area 1 Sample Date 10/01/04			J01XJ1 Duplicate of J01XJ0 Sample Date 10/01/04			J01XJ8 VCP from Area 1 Sample Date 10/01/04		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Volatile Organic Analytes									
1,1,1-Trichloroethane	6	U	6	6	U	6	6	U	6
1,1,2,2-Tetrachloroethane	6	U	6	6	U	6	6	U	6
1,1,2-Trichloroethane	6	U	6	6	U	6	6	U	6
1,1-Dichloroethane	6	U	6	6	U	6	6	U	6
1,1-Dichloroethene	6	U	6	6	U	6	6	U	6
1,2-Dichloroethane	6	U	6	6	U	6	6	U	6
1,2-Dichloroethene(Total)	6	U	6	6	U	6	6	U	6
1,2-Dichloropropane	6	U	6	6	U	6	6	U	6
2-Butanone	11	U	11	12	U	12	11	U	11
2-Hexanone	11	U	11	12	U	12	11	U	11
4-Methyl-2-Pentanone	11	U	11	12	U	12	11	U	11
Acetone	11	U	11	12	U	12	11	U	11
Benzene	6	U	6	6	U	6	6	U	6
Bromodichloromethane	6	U	6	6	U	6	6	U	6
Bromoform	6	U	6	6	U	6	6	U	6
Bromomethane	11	U	11	12	U	12	11	U	11
Carbon disulfide	6	U	6	6	U	6	6	U	6
Carbon tetrachloride	6	U	6	6	U	6	6	U	6
Chlorobenzene	6	U	6	6	U	6	6	U	6
Chloroethane	11	U	11	12	U	12	11	U	11
Chloroform	6	U	6	6	U	6	6	U	6
Chloromethane	11	U	11	12	U	12	11	U	11
cis-1,3-Dichloropropene	6	U	6	6	U	6	6	U	6
Dibromochloromethane	6	U	6	6	U	6	6	U	6
Ethylbenzene	6	U	6	6	U	6	6	U	6
Methylenechloride	14	B	6	14	B	6	13		6
Styrene	6	U	6	6	U	6	6	U	6
Tetrachloroethene	6	U	6	6	U	6	6	U	6
Toluene	6	U	6	6	U	6	6	U	6
trans-1,3-Dichloropropene	6	U	6	6	U	6	6	U	6
Trichloroethene	6	U	6	6	U	6	6	U	6
Vinyl chloride	11	U	11	12	U	12	11	U	11
Xylenes (total)	6	U	6	6	U	6	6	U	6

APPENDIX B

95% UCL CALCULATIONS AND VERIFICATION SAMPLING RESULTS

APPENDIX B

95% UCL CALCULATIONS AND VERIFICATION SAMPLING RESULTS

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

1607-F3 Waste Site Cleanup Verification 95% UCL Calculations, 0100F-CA-V0263, Rev. 0, Washington Closure Hanford, Richland, Washington.

1607-F3 Phase II Cleanup Verification 95% UCL Calculations, 0100F-CA-V0275, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

The calculations that are provided in this appendix 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.

CALCULATION COVER SHEET

Project Title:	100-F Area Field Remediation	**Job No.**	14655
Area	100-F		
Discipline	Environmental	***Calc. No.**	0100F-CA-V0263
Subject	1607-F3 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 ☒ **Preliminary** ☐ **Superseded** ☐ **Voided** ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 9 Attm. 1 = 16 Total = 26	7/10/06 J. M. Capron	7/12/06 T. M. Blakley	7/12/06 L. M. Dittmer	7-12-06 S. W. Callison	7-12-06

SUMMARY OF REVISIONS

WCH-DE-018 (4/14/06) * Obtain Calc No. from R&DC and Form from Intranet

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC **Date** 07/10/06 **Calc. No.** 0100F-CA-V0263 **Rev. No.** 0
Project 100-F Area Field Remediation **Job No.** 14655 **Checked** T. M. Blakley TMB **Date** 7/12/06
Subject 1607-F3 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 1 of 9

Summary

Purpose:
Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the remediation footprint 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 taken 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 Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2005b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC, 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 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. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron **Date** 07/10/06 **Calc. No.** 0100F-CA-V0263 **Rev. No.** 0
Project 100-F Area Field Remediation **Job No.** 14655 **Checked** T. M. Blakley **Date** 9/12/06
Subject 1607-F3 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 2 of 9

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. The 95% UCL was not calculated for radionuclide or nonradionuclide data sets with no reported detections. 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 COPCs. For nonradioactive analytes with >50% of the data below detection limits, the maximum detected value for the data set is used instead of the 95% UCL. The evaluation of the portion of each analyte's data set below detection limits was performed by direct inspection of the attached sample results, and no further calculations were performed for those data sets where >50% of the data was below detection limits. The 95% UCL values were not calculated for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium, as no cleanup values are published in Ecology (2005) under WAC 173-340-740(3), and these constituents are thus not considered site 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 WAC 173-340-740(7)(e) 3-part test is not performed for COPCs/COCs where the statistical value defaults to the maximum value in the data set. Instead, direct comparison of the maximum value against site RAGs (within the RSVP) is used as the compliance basis.

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, listed in Table II-1 of the SAP (DOE-RL 2005a). Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

where, M = main sample value S = split (or duplicate) sample value

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

In addition to the statistical samples collected from the remediation footprint at the subject site, a multi-aliquot sample was collected from the remediation waste staging area. Statistical methodology is not applicable to non-statistical sampling, and direct evaluation of maximum detected values within this decision unit will be used as the compliance basis. These maximum detected values are presented in the results summary for use in the RSVP.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC **Date** 07/10/06 **Calc. No.** 0100F-CA-V0263 **Rev. No.** 0
Project 100-F Area Field Remediation **Job No.** 14655 **Checked** T. M. Blakley TMB **Date** 7/12/06
Subject 1607-F3 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 3 of 9

Summary (continued)

Results:
The results presented in the summary tables that follow are for use in risk analysis and the RSVP for this site.

Results Summary - Remediation Footprint			
Analyte	95% UCL[a]	Maximum[b]	Units
Cesium-137	0.067		pCi/g
Arsenic	38.0		mg/kg
Barium	73.3		mg/kg
Beryllium	0.26		mg/kg
Boron	0.38		mg/kg
Cadmium		0.46	mg/kg
Chromium	9.6		mg/kg
Cobalt	6.0		mg/kg
Copper	13.2		mg/kg
Lead	206		mg/kg
Manganese	275		mg/kg
Mercury		0.04	mg/kg
Nickel	10.2		mg/kg
Selenium		4.2	mg/kg
Vanadium	34.1		mg/kg
Zinc	41.9		mg/kg
Aroclor-1260		0.0035	mg/kg
alpha-Chlordane		0.0010	mg/kg
gamma-Chlordane		0.0026	mg/kg
Benzo(a)pyrene		0.033	mg/kg
Benzo(g,h,i)perylene		0.023	mg/kg
Benzo(k)fluoranthene		0.029	mg/kg
Chrysene		0.022	mg/kg
Di-n-butylphthalate		0.025	mg/kg
Indeno(1,2,3-cd)pyrene		0.022	mg/kg
Ethylbenzene		0.002	mg/kg
m&p-Xylene		0.004	mg/kg
Methylene chloride		0.043	mg/kg
o-Xylene		0.002	mg/kg
Tetrachloroethene		0.002	mg/kg
Toluene		0.001	mg/kg
Xylenes (total)		0.006	mg/kg

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

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

95% UCL > Cleanup Limit?	YES
> 10% above Cleanup Limit?	YES
Any sample > 2x Cleanup Limit?	YES

Because of the "yes" answers to the WAC 173-340 3-part test for lead and arsenic, additional evaluation of the attainment of cleanup criteria will be performed.

Results Summary - Waste Staging Area		
Analyte	Maximum[a]	Units
Arsenic	12.1	mg/kg
Barium	60.2	mg/kg
Beryllium	0.02	mg/kg
Boron	1.7	mg/kg
Cadmium	0.27	mg/kg
Chromium	9.4	mg/kg
Cobalt	5.2	mg/kg
Copper	14.5	mg/kg
Lead	54.9	mg/kg
Manganese	255	mg/kg
Mercury	0.03	mg/kg
Nickel	9.6	mg/kg
Vanadium	28.2	mg/kg
Zinc	38.4	mg/kg
Aroclor-1254	0.0034	mg/kg
4,4'-DDE	0.00049	mg/kg
4,4'-DDT	0.00035	mg/kg
gamma-Chlordane	0.00083	mg/kg
Di-n-butylphthalate	0.12	mg/kg
Acetone	0.005	mg/kg
Chloroform	0.001	mg/kg

[a]Verification sampling at the waste staging area was based on multi-aliquot, rather than statistical, sampling.

[a]For nonradionuclides, where ≤ 50% of a data set is censored (below detection limits), the 95% UCL value is used for a given analyte.

[b]For nonradionuclides, where > 50% of a data set is censored, the statistical value defaults to the maximum detected value in the data set (Attachment 1).

RAG = remedial action goal

UCL = upper confidence level

WAC = *Washington Adminstrative Code*

Relative Percent Difference Results[a] - QA/QC Analysis			
Analyte	Duplicate Analysis[b]	Analyte	Duplicate Analysis[b]
Potassium-40	14%	Lead	2.9%
Aluminum	6.9%	Magnesium	5.1%
Barium	4.2%	Manganese	3.5%
Calcium	9.8%	Silicon	0.81%
Chromium	3.0%	Vanadium	9.3%
Copper	9.7%	Zinc	6.9%
Iron	7.6%		

[a]Relative percent difference evaluation was not required for analytes not included in this table.

[b]The significance of relative percent difference values are discussed within the RSVP for the subject site.

QA/QC = quality assurance/quality control

RSVP = remaining sites verification package

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron Date 07/10/06 Calc. No. 0100F-CA-V0263 Rev. No. 0
Project 100-F Area Field Remediation Job No. 14655 Checked T. M. Blakley Date 11/2/06
Subject 1607-F3 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 4 of 9

Remediation Footprint Verification Data

Sampling Area	HEIS Number	Sample Date	Cesium-137			Arsenic			Barium			Beryllium			Boron			Chromium			Cobalt		
			pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J11JN8	3/9/2006	0.094	U	0.094	26.4		2.5	81.8		0.31	0.29		0.02	0.53	J	0.26	10.0		0.65	5.8		0.56
Duplicate of J11JN8	J11JP8	3/9/2006	0.140		0.074	27.5		2.6	78.4		0.31	0.29		0.02	0.67	J	0.27	10.3		0.67	6.2		0.57
2	J11JN9	3/9/2006	0.084	U	0.084	23.7		2.5	63.7		0.30	0.23		0.02	0.26	UJ	0.26	8.0		0.64	5.4		0.55
3	J11JP0	3/9/2006	0.112		0.093	53.9		2.5	71.2		0.31	0.21		0.02	0.28	J	0.27	7.9		0.66	5.4		0.56
4	J11JP1	3/9/2006	0.073	U	0.073	31.7		2.5	60.7		0.31	0.23		0.02	0.29	J	0.27	7.9		0.66	5.5		0.57
5	J11JP2	3/9/2006	0.062	U	0.062	7.1		2.4	58.6		0.29	0.18		0.02	0.25	UJ	0.25	9.6		0.63	4.8		0.54
6	J11JP3	3/9/2006	0.072	U	0.072	16.5		2.5	67.6		0.30	0.25		0.02	0.26	UJ	0.26	9.5		0.65	6.7		0.56
7	J11JP4	3/9/2006	0.075	U	0.075	18.1		2.5	72.2		0.30	0.26		0.02	0.40	J	0.26	8.7		0.65	5.8		0.56
8	J11JP5	3/9/2006	0.089	U	0.089	27.7		2.5	79.7		0.30	0.23		0.02	0.41	J	0.26	9.7		0.64	5.4		0.55
9	J11JP6	3/9/2006	0.088	U	0.088	15.4		2.5	56.1		0.30	0.20		0.02	0.26	UJ	0.26	10.2		0.64	5.8		0.55
10	J11JP7	3/9/2006	0.11	U	0.11	26.1		2.6	70.1		0.31	0.26		0.02	0.41	J	0.27	9.9		0.67	5.9		0.57

Statistical Computation Input Data

Sampling Area	HEIS Number	Sample Date	Cesium-137 pCi/g	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Chromium mg/kg	Cobalt mg/kg
1	J11JN8/J11JP8	3/9/2006	0.094	27.0	80.1	0.29	0.60	10.2	6.0
2	J11JN9	3/9/2006	0.042	23.7	63.7	0.23	0.13	8.0	5.4
3	J11JP0	3/9/2006	0.112	53.9	71.2	0.21	0.28	7.9	5.4
4	J11JP1	3/9/2006	0.037	31.7	60.7	0.23	0.29	7.9	5.5
5	J11JP2	3/9/2006	0.031	7.1	58.6	0.18	0.13	9.6	4.8
6	J11JP3	3/9/2006	0.036	16.5	67.6	0.25	0.13	9.5	6.7
7	J11JP4	3/9/2006	0.038	18.1	72.2	0.26	0.40	8.7	5.8
8	J11JP5	3/9/2006	0.045	27.7	79.7	0.23	0.41	9.7	5.4
9	J11JP6	3/9/2006	0.044	15.4	56.1	0.20	0.13	10.2	5.8
10	J11JP7	3/9/2006	0.055	26.1	70.1	0.26	0.41	9.9	5.9

Statistical Computations

	Cesium-137	Arsenic	Barium	Beryllium	Boron	Chromium	Cobalt
95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.	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), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
N	10	10	10	10	10	10	10
% < Detection limit	80%	0%	0%	0%	40%	0%	0%
Mean	0.053	24.7	68.0	0.23	0.29	9.2	5.7
Standard deviation	0.027	12.6	8.3	0.03	0.16	0.9	0.5
Z-statistic	1.645	NA*	NA*	NA*	NA*	NA*	NA*
95% UCL on mean	0.067	38.0	73.3	0.26	0.38	9.6	6.0
Maximum detected value	0.140	53.9	81.8	0.29	0.67	10.3	6.7
Statistical value	0.067	38.0	73.3	0.26	0.38	9.6	6.0
Most Stringent Cleanup Limit for nonradionuclide and RAG type		20 Direct Exposure/GW & River Protection	132 BG/GW Protection	1.51 BG/GW & River Protection	320 GW Protection	18.5 BG/GW & River Protection	32 GW Protection
WAC 173-340 3-PART TEST							
95% UCL > Cleanup Limit?		YES	NA	NA	NO	NA	NA
> 10% above Cleanup Limit?		YES	NA	NA	NO	NA	NA
Any sample > 2X Cleanup Limit?		YES	NA	NA	NO	NA	NA
WAC 173-340 Compliance? **Further evaluation required**		The data set does not meet the 3-part test criteria when compared to the most stringent cleanup limit. Further evaluation is 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 (18.5 mg/kg), the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg), the WAC 173-340 3-part test is not required.

*Calculation of 95% UCL for nonradionuclides performed using MTCAStat software.

BG = background
GW = groundwater
HEIS = Hanford Environmental Information System
J = estimated
MDA = minimum detectable activity
NA = not applicable
PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
U = undetected
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron **Date** 07/10/06 **Calc. No.** 0100F-CA-V0263 **Rev. No.** 0
Project 100-F Area Field Remediation **Job No.** 14655 **Checked** T. M. Blakley **Date** 9/12/2006
Subject 1607-F3 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 5 of 9

Remediation Footprint Verification Data (continued)

Sampling Area	HEIS Number	Sample Date	Copper			Lead			Manganese			Nickel			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J11JN8	3/9/2006	14.0		0.22	139		2.6	294		0.33	10.9		0.91	35.9		0.32	44.8		0.16
Duplicate of J11JN8	J11JP8	3/9/2006	12.7		0.23	135		2.7	284		0.33	10.5		0.93	32.7		0.32	41.8		0.17
2	J11JN9	3/9/2006	13.7		0.22	106		2.6	243		0.32	9.4		0.89	28.4		0.31	35.4		0.16
3	J11JP0	3/9/2006	10.3		0.23	277		2.7	254		0.33	8.6		0.91	27.2		0.32	37.8		0.16
4	J11JP1	3/9/2006	12.0		0.23	115		2.7	262		0.33	10.2		0.92	30.1		0.32	33.9		0.17
5	J11JP2	3/9/2006	12.5		0.22	27.2		2.5	210		0.31	8.6		0.87	33.9		0.30	41.0		0.16
6	J11JP3	3/9/2006	14.7		0.22	34.9		2.6	280		0.32	10.6		0.90	37.4		0.31	36.3		0.16
7	J11JP4	3/9/2006	11.5		0.22	25.5		2.6	276		0.32	9.1		0.90	31.2		0.31	34.8		0.16
8	J11JP5	3/9/2006	12.0		0.22	93.3		2.6	255		0.32	10.0		0.90	29.6		0.31	52.1		0.16
9	J11JP6	3/9/2006	12.6		0.22	71.4		2.6	238		0.32	10.5		0.89	34.5		0.31	38.2		0.16
10	J11JP7	3/9/2006	11.0		0.23	106		2.7	282		0.33	9.8		0.93	33.7		0.32	38.0		0.17

Statistical Computation Input Data

Sampling Area	HEIS Number	Sample Date	Copper mg/kg			Lead mg/kg			Manganese mg/kg			Nickel mg/kg			Vanadium mg/kg			Zinc mg/kg		
1	J11JN8/J11JP8	3/9/2006	13.4			137			289			10.7			34.3			43.3		
2	J11JN9	3/9/2006	13.7			106			243			9.4			28.4			35.4		
3	J11JP0	3/9/2006	10.3			277			254			8.6			27.2			37.8		
4	J11JP1	3/9/2006	12.0			115			262			10.2			30.1			33.9		
5	J11JP2	3/9/2006	12.5			27.2			210			8.6			33.9			41.0		
6	J11JP3	3/9/2006	14.7			34.9			280			10.6			37.4			36.3		
7	J11JP4	3/9/2006	11.5			25.5			276			9.1			31.2			34.8		
8	J11JP5	3/9/2006	12.0			93.3			255			10.0			29.6			52.1		
9	J11JP6	3/9/2006	12.6			71.4			238			10.5			34.5			38.2		
10	J11JP7	3/9/2006	11.0			106			282			9.8			33.7			38.0		

Statistical Computations

	Copper			Lead			Manganese			Nickel			Vanadium			Zinc		
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.		
N	10			10			10			10			10			10		
% < Detection limit	0%			0%			0%			0%			0%			0%		
Mean	12.4			99			259			9.8			32.0			39.1		
Standard deviation	1.3			74			24			0.8			3.2			5.4		
95% UCL on mean	13.2			206			275			10.2			34.1			41.9		
Maximum detected value	14.7			277			294			10.9			37.4			52.1		
Statistical value	13.2			206			275			10.2			34.1			41.9		
Most Stringent Cleanup Limit for nonradionuclide and RAG type	22.0		BG/River Protection	10.2		BG/GW & River Protection	512		BG/GW Protection	19.1		BG/GW Protection	85.1		BG/GW Protection	67.8		BG/River Protection
WAC 173-340 3-PART TEST																		
95% UCL > Cleanup Limit?	NA			YES			NA			NA			NA			NA		
> 10% above Cleanup Limit?	NA			YES			NA			NA			NA			NA		
Any sample > 2X Cleanup Limit?	NA			YES			NA			NA			NA			NA		
WAC 173-340 Compliance? **Further evaluation required**	Because all values are below background (22.0 mg/kg), the WAC 173-340 3-part test is not required.			The data set does not meet the 3-part test criteria when compared to the most stringent cleanup limit. Further evaluation is 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.			Because all values are below background (67.8 mg/kg), the WAC 173-340 3-part test is not required.		

BG = background
GW = groundwater
HEIS = Hanford Environmental Information System
NA = not applicable
PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
UCL = upper confidence limit
WAC = *Washington Administrative Code*

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron **Date** 07/10/06 **Calc. No.** 0100F-CA-V0263 **Rev. No.** 0

Project 100-F Area Field Remediation **Job No.** 14655 **Checked** T. M. Blakley **Date** 7/12/06

Subject 1607-F3 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 6 of 9

Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Cesium-137			Potassium-40			Radium-226			Radium-228			Thorium-228			Thorium-232			Aluminum		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
1	J11JN8	3/9/2006	0.094	U	0.094	10.6		0.74	0.437		0.13	0.626		0.34	0.667		0.12	0.626		0.34	7380		2.4
Duplicate of J11JN8	J11JP8	3/9/2006	0.140		0.074	12.2		0.53	0.372		0.14	0.508		0.32	0.615		0.078	0.508		0.32	6890		2.5

Analysis:

TDL		0.1	0.5	0.1	0.2	1	1	5
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?		**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD		14%					6.9%

Sampling Area	HEIS Number	Sample Date	Arsenic			Barium			Beryllium			Boron			Calcium			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
1	J11JN8	3/9/2006	26.4		2.5	81.8		0.31	0.29		0.02	0.53	J	0.26	3530		2.2	10.0		0.65	5.8		0.56
Duplicate of J11JN8	J11JP8	3/9/2006	27.5		2.6	78.4		0.31	0.29		0.02	0.67	J	0.27	3200		2.3	10.3		0.67	6.2		0.57

Analysis:

TDL		10	2	0.5	2	100	1	2
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)
	RPD		4.2%			9.8%	3.0%	

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese			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
1	J11JN8	3/9/2006	14.0		0.22	16400		0.55	139		2.6	4050		4.0	294		0.33	10.9		0.91	1530		78.5
Duplicate of J11JN8	J11JP8	3/9/2006	12.7		0.23	15200		0.56	135		2.7	3850		4.1	284		0.33	10.5		0.93	1510		80.3

Analysis:

TDL		1	5	5	75	5	4	400
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	9.7%	7.6%	2.9%	5.1%	3.5%		

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J11JN8	3/9/2006	490	J	0.91	109		2.6	35.9		0.32	44.8		0.16
Duplicate of J11JN8	J11JP8	3/9/2006	494	J	0.93	98.7		2.6	32.7		0.32	41.8		0.17

Analysis:

TDL		2	50	2.5	1
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	0.81%		9.3%	6.9%

HEIS = Hanford Environmental Information System
J = estimated
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
RPD = relative percent difference
TDL = target detection limit
U = undetected

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC Date 07/10/06 Calc. No. 0100F-CA-V0263 Rev. No. 0

Project 100-F Area Field Remediation Job No. 14655 Checked T. M. Blakley TMB Date 7/12/06

Subject 1607-F3 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 7 of 9

Ecology Software (MTCAStat) Results

Arsenic 95% UCL Calculation

DATA	ID
27.0	J11JN8/J11JP8
23.7	J11JN9
53.9	J11JP0
31.7	J11JP1
7.1	J11JP2
16.5	J11JP3
18.1	J11JP4
27.7	J11JP5
15.4	J11JP6
26.1	J11JP7

Number of samples		Uncensored values	
Uncensored	10	Mean	24.7
Censored		Lognormal mean	25.3
Detection limit or PQL		Std. devn.	12.6
Method detection limit		Median	24.9
TOTAL	10	Min.	7.1
		Max.	53.9

Lognormal distribution? Normal distribution?
r-squared is: 0.921 r-squared is: 0.875
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 38.0

Barium 95% UCL Calculation

DATA	ID
80.1	J11JN8/J11JP8
63.7	J11JN9
71.2	J11JP0
60.7	J11JP1
58.6	J11JP2
67.6	J11JP3
72.2	J11JP4
79.7	J11JP5
56.1	J11JP6
70.1	J11JP7

Number of samples		Uncensored values	
Uncensored	10	Mean	68.0
Censored		Lognormal mean	68.1
Detection limit or PQL		Std. devn.	8.3
Method detection limit		Median	68.9
TOTAL	10	Min.	56.1
		Max.	80.1

Lognormal distribution? Normal distribution?
r-squared is: 0.969 r-squared is: 0.966
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 73.3

Beryllium 95% UCL Calculation

DATA	ID
0.29	J11JN8/J11JP8
0.23	J11JN9
0.21	J11JP0
0.23	J11JP1
0.18	J11JP2
0.25	J11JP3
0.26	J11JP4
0.23	J11JP5
0.20	J11JP6
0.26	J11JP7

Number of samples		Uncensored values	
Uncensored	10	Mean	0.23
Censored		Lognormal mean	0.23
Detection limit or PQL		Std. devn.	0.03
Method detection limit		Median	0.23
TOTAL	10	Min.	0.18
		Max.	0.29

Lognormal distribution? Normal distribution?
r-squared is: 0.969 r-squared is: 0.974
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.26

Boron 95% UCL Calculation

DATA	ID
0.60	J11JN8/J11JP8
0.13	J11JN9
0.28	J11JP0
0.29	J11JP1
0.13	J11JP2
0.13	J11JP3
0.40	J11JP4
0.41	J11JP5
0.13	J11JP6
0.41	J11JP7

Number of samples		Uncensored values	
Uncensored	10	Mean	0.29
Censored		Lognormal mean	0.30
Detection limit or PQL		Std. devn.	0.16
Method detection limit		Median	0.29
TOTAL	10	Min.	0.13
		Max.	0.60

Lognormal distribution? Normal distribution?
r-squared is: 0.867 r-squared is: 0.882
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.38

PQL = practical quantitation limit
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC | Date 07/10/06 | Calc. No. 0100F-CA-V0263 | Rev. No. 0

Project 100-F Area Field Remediation | Job No. 14655 | Checked T. M. Blakley TMB | Date 7/12/06

Subject 1607-F3 Waste Site Cleanup Verification 95% UCL Calculations | Sheet No. 8 of 9

Ecology Software (MTCAStat) Results

Chromium 95% UCL Calculation

DATA	ID
10.2	J11JN8/J11JP8
8.0	J11JN9
7.9	J11JP0
7.9	J11JP1
9.6	J11JP2
9.5	J11JP3
8.7	J11JP4
9.7	J11JP5
10.2	J11JP6
9.9	J11JP7

Number of samples		Uncensored values	
Uncensored	10	Mean	9.2
Censored		Lognormal mean	9.2
Detection limit or PQL		Std. devn.	0.9
Method detection limit		Median	9.6
TOTAL	10	Min.	7.9
		Max.	10.2

Lognormal distribution? r-squared is: 0.866

Normal distribution? r-squared is: 0.876

Recommendations:

Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 9.6

Cobalt 95% UCL Calculation

DATA	ID
6.0	J11JN8/J11JP8
5.4	J11JN9
5.4	J11JP0
5.5	J11JP1
4.8	J11JP2
6.7	J11JP3
5.8	J11JP4
5.4	J11JP5
5.8	J11JP6
5.9	J11JP7

Number of samples		Uncensored values	
Uncensored	10	Mean	5.7
Censored		Lognormal mean	5.7
Detection limit or PQL		Std. devn.	0.5
Method detection limit		Median	5.7
TOTAL	10	Min.	4.8
		Max.	6.7

Lognormal distribution? r-squared is: 0.920

Normal distribution? r-squared is: 0.913

Recommendations:

Use lognormal distribution.

UCL (Land's method) is 6.0

Copper 95% UCL Calculation

DATA	ID
13.4	J11JN8/J11JP8
13.7	J11JN9
10.3	J11JP0
12.0	J11JP1
12.5	J11JP2
14.7	J11JP3
11.5	J11JP4
12.0	J11JP5
12.6	J11JP6
11.0	J11JP7

Number of samples		Uncensored values	
Uncensored	10	Mean	12.4
Censored		Lognormal mean	12.4
Detection limit or PQL		Std. devn.	1.3
Method detection limit		Median	12.3
TOTAL	10	Min.	10.3
		Max.	14.7

Lognormal distribution? r-squared is: 0.991

Normal distribution? r-squared is: 0.987

Recommendations:

Use lognormal distribution.

UCL (Land's method) is 13.2

Lead 95% UCL Calculation

DATA	ID
137	J11JN8/J11JP8
106	J11JN9
277	J11JP0
115	J11JP1
27.2	J11JP2
34.9	J11JP3
25.5	J11JP4
93.3	J11JP5
71.4	J11JP6
106	J11JP7

Number of samples		Uncensored values	
Uncensored	10	Mean	99
Censored		Lognormal mean	104
Detection limit or PQL		Std. devn.	74
Method detection limit		Median	100
TOTAL	10	Min.	25.5
		Max.	277

Lognormal distribution? r-squared is: 0.925

Normal distribution? r-squared is: 0.822

Recommendations:

Use lognormal distribution.

UCL (Land's method) is 206

PQL = practical quantitation limit

UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC — Date 07/10/06 — Calc. No. 0100F-CA-V0263 — Rev. No. 0

Project 100-F Area Field Remediation — Job No. 14655 — Checked T. M. Blakley — Date 7/12/06

Subject 1607-F3 Waste Site Cleanup Verification 95% UCL Calculations — Sheet No. 9 of 9

Ecology Software (MTCAStat) Results

DATA	ID	Manganese 95% UCL Calculation			
289	J11JN8/J11JP8				
243	J11JN9				
254	J11JP0	Number of samples		Uncensored values	
262	J11JP1	Uncensored	10	Mean	259
210	J11JP2	Censored		Lognormal mean	259
280	J11JP3	Detection limit or PQL		Std. devn.	24
276	J11JP4	Method detection limit		Median	259
255	J11JP5	TOTAL	10	Min.	210
238	J11JP6			Max.	289
282	J11JP7				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.924		r-squared is: 0.943	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		275	

DATA	ID	Nickel 95% UCL Calculation			
10.7	J11JN8/J11JP8				
9.4	J11JN9				
8.6	J11JP0	Number of samples		Uncensored values	
10.2	J11JP1	Uncensored	10	Mean	9.8
8.6	J11JP2	Censored		Lognormal mean	9.8
10.6	J11JP3	Detection limit or PQL		Std. devn.	0.8
9.1	J11JP4	Method detection limit		Median	9.9
10.0	J11JP5	TOTAL	10	Min.	8.6
10.5	J11JP6			Max.	10.7
9.8	J11JP7				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.931		r-squared is: 0.938	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		10.2	

DATA	ID	Vanadium 95% UCL Calculation			
34.3	J11JN8/J11JP8				
28.4	J11JN9				
27.2	J11JP0	Number of samples		Uncensored values	
30.1	J11JP1	Uncensored	10	Mean	32.0
33.9	J11JP2	Censored		Lognormal mean	32.0
37.4	J11JP3	Detection limit or PQL		Std. devn.	3.2
31.2	J11JP4	Method detection limit		Median	32.5
29.6	J11JP5	TOTAL	10	Min.	27.2
34.5	J11JP6			Max.	37.4
33.7	J11JP7				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.961		r-squared is: 0.961	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		34.1	

DATA	ID	Zinc 95% UCL Calculation			
43.3	J11JN8/J11JP8				
35.4	J11JN9				
37.8	J11JP0	Number of samples		Uncensored values	
33.9	J11JP1	Uncensored	10	Mean	39.1
41.0	J11JP2	Censored		Lognormal mean	39.1
36.3	J11JP3	Detection limit or PQL		Std. devn.	5.4
34.8	J11JP4	Method detection limit		Median	37.9
52.1	J11JP5	TOTAL	10	Min.	33.9
38.2	J11JP6			Max.	52.1
38.0	J11JP7				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.858		r-squared is: 0.812	
		Recommendations:			
		Reject BOTH lognormal and normal distributions.			
		UCL (based on Z-statistic) is		41.9	

PQL = practical quantitation limit

UCL = upper confidence limit

Attachment 1. 1607-F3 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Americium-241			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
1	J11JN8	3/9/06	0.26	U	0.26	0.094	U	0.094	0.079	U	0.079	0.16	U	0.16	0.25	U	0.25
Duplicate of J11JN8	J11JP8	3/9/06	0.29	U	0.29	0.140		0.074	0.063	U	0.063	0.14	U	0.14	0.21	U	0.21
2	J11JN9	3/9/06	0.20	U	0.20	0.084	U	0.084	0.075	U	0.075	0.17	U	0.17	0.27	U	0.27
3	J11JP0	3/9/06	0.35	U	0.35	0.112		0.093	0.084	U	0.084	0.18	U	0.18	0.28	U	0.28
4	J11JP1	3/9/06	0.24	U	0.24	0.073	U	0.073	0.083	U	0.083	0.17	U	0.17	0.22	U	0.22
5	J11JP2	3/9/06	0.23	U	0.23	0.062	U	0.062	0.064	U	0.064	0.14	U	0.14	0.22	U	0.22
6	J11JP3	3/9/06	0.20	U	0.20	0.072	U	0.072	0.088	U	0.088	0.16	U	0.16	0.21	U	0.21
7	J11JP4	3/9/06	0.37	U	0.37	0.075	U	0.075	0.090	U	0.090	0.19	U	0.19	0.25	U	0.25
8	J11JP5	3/9/06	0.28	U	0.28	0.089	U	0.089	0.10	U	0.10	0.19	U	0.19	0.24	U	0.24
9	J11JP6	3/9/06	0.31	U	0.31	0.088	U	0.088	0.10	U	0.10	0.18	U	0.18	0.28	U	0.28
10	J11JP7	3/9/06	0.27	U	0.27	0.11	U	0.11	0.11	U	0.11	0.26	U	0.26	0.40	U	0.40
Waste staging area	J11L17	3/20/06	0.30	U	0.30	0.13	U	0.13	0.071	U	0.071	0.15	U	0.15	0.22	U	0.22

Note: The following abbreviations apply to all Attachment 1 tables.

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

B = method blank contamination (organic constituents)
C = method blank contamination (inorganic constituents)
D = diluted
HEIS = Hanford Environmental Information System
J = estimated
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
U = undetected

Attachment	1	Sheet No.	1 of 16
Originator	J. M. Capron JMC	Date	07/10/06
Checked	T. M. Blakley TMB	Date	7/12/06
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Europium-155			Potassium-40			Radium-226			Radium-228			Silver-108m		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
1	J11JN8	3/9/06	0.17	U	0.17	10.6		0.74	0.437		0.13	0.626		0.34	0.050	U	0.050
Duplicate of J11JN8	J11JP8	3/9/06	0.15	U	0.15	12.2		0.53	0.372		0.14	0.508		0.32	0.047	U	0.047
2	J11JN9	3/9/06	0.17	U	0.17	10.4		0.92	0.339		0.17	0.307	U	0.35	0.059	U	0.059
3	J11JP0	3/9/06	0.19	U	0.19	13.6		0.65	0.604		0.13	0.833		0.26	0.053	U	0.053
4	J11JP1	3/9/06	0.16	U	0.16	11.6		0.85	0.342		0.13	0.609		0.29	0.042	U	0.042
5	J11JP2	3/9/06	0.15	U	0.15	12.0		0.65	0.320		0.12	0.504		0.27	0.045	U	0.045
6	J11JP3	3/9/06	0.18	U	0.18	9.18		0.73	0.433		0.15	0.776		0.29	0.056	U	0.056
7	J11JP4	3/9/06	0.20	U	0.20	12.9		0.88	0.471		0.16	0.526		0.36	0.057	U	0.057
8	J11JP5	3/9/06	0.20	U	0.20	10.8		0.79	0.484		0.14	0.863		0.32	0.049	U	0.049
9	J11JP6	3/9/06	0.21	U	0.21	13.1		0.72	0.397		0.15	0.825		0.38	0.055	U	0.055
10	J11JP7	3/9/06	0.25	U	0.25	12.4		1.3	0.598		0.17	1.30		0.37	0.084	U	0.084
Waste staging area	J11L17	3/20/06	0.16	U	0.16	12.2		0.61	0.451		0.12	0.525		0.28	0.046	U	0.046

Sample Location	HEIS Number	Sample Date	Thorium-228			Thorium-232			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
1	J11JN8	3/9/06	0.667		0.12	0.626		0.34	0.25	U	0.25	8.5	U	8.5
Duplicate of J11JN8	J11JP8	3/9/06	0.615		0.078	0.508		0.32	0.24	U	0.24	7.7	U	7.7
2	J11JN9	3/9/06	0.642		0.13	0.307	U	0.35	0.26	U	0.26	9.3	U	9.3
3	J11JP0	3/9/06	0.628		0.088	0.833		0.26	0.31	U	0.31	10	U	10
4	J11JP1	3/9/06	0.402		0.076	0.609		0.29	0.26	U	0.26	8.3	U	8.3
5	J11JP2	3/9/06	0.482		0.11	0.504		0.27	0.23	U	0.23	7.4	U	7.4
6	J11JP3	3/9/06	0.606		0.13	0.776		0.29	0.28	U	0.28	9.8	U	9.8
7	J11JP4	3/9/06	0.829		0.14	0.526		0.36	0.31	U	0.31	11	U	11
8	J11JP5	3/9/06	0.575		0.12	0.863		0.32	0.30	U	0.30	10	U	10
9	J11JP6	3/9/06	0.667		0.14	0.825		0.38	0.29	U	0.29	9.8	U	9.8
10	J11JP7	3/9/06	0.651		0.11	1.30		0.37	0.37	U	0.37	13	U	13
Waste staging area	J11L17	3/20/06	0.549	J	0.078	0.525		0.28	0.25	U	0.25	8.2	U	8.2

Attachment	1	Sheet No.	2 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Sample Location	HEIS 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
1	J11JN8	3/9/06	7380		2.4	3.2	UJ	3.2	26.4		2.5	81.8		0.31	0.29		0.02
Duplicate of J11JN8	J11JP8	3/9/06	6890		2.5	3.3	UJ	3.3	27.5		2.6	78.4		0.31	0.29		0.02
2	J11JN9	3/9/06	5380		2.4	3.2	UJ	3.2	23.7		2.5	63.7		0.30	0.23		0.02
3	J11JP0	3/9/06	5290		2.4	3.2	UJ	3.2	53.9		2.5	71.2		0.31	0.21		0.02
4	J11JP1	3/9/06	5530		2.4	3.3	UJ	3.3	31.7		2.5	60.7		0.31	0.23		0.02
5	J11JP2	3/9/06	5610		2.3	3.1	UJ	2 of 16			2.4	58.6		0.29	0.18		0.02
6	J11JP3	3/9/06	6550		2.4	3.2	UJ	3.2	16.5		2.5	67.6		0.30	0.25		0.02
7	J11JP4	3/9/06	6540		2.4	3.2	UJ	3.2	18.1		2.5	72.2		0.30	0.26		0.02
8	J11JP5	3/9/06	6320		2.4	3.2	UJ	3.2	27.7		2.5	79.7		0.30	0.23		0.02
9	J11JP6	3/9/06	6130		2.4	3.2	UJ	3.2	15.4		2.5	56.1		0.30	0.20		0.02
10	J11JP7	3/9/06	6500		2.5	3.3	UJ	3.3	26.1		2.6	70.1		0.31	0.26		0.02
Waste staging area	J11L17	3/20/06	5460	C	2.9	0.45	UJ	0.45	12.1		0.62	60.2	CJ	0.02	0.02		0.02
Equipment blank	J11JN7	3/9/06	70.1		2.2	3.0	UJ	3.0	2.3	U	2.3	2.0		0.28	0.11		0.02

Sample Location	HEIS 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
1	J11JN8	3/9/06	0.53	J	0.26	0.43	U	0.43	3530		2.2	10.0		0.65	5.8		0.56
Duplicate of J11JN8	J11JP8	3/9/06	0.67	J	0.27	0.44	U	0.44	3200		2.3	10.3		0.67	6.2		0.57
2	J11JN9	3/9/06	0.26	UJ	0.26	0.42	U	0.42	2980		2.2	8.0		0.64	5.4		0.55
3	J11JP0	3/9/06	0.28	J	0.27	0.43	U	0.43	2910		2.2	7.9		0.66	5.4		0.56
4	J11JP1	3/9/06	0.29	J	0.27	0.46		0.43	3400		2.3	7.9		0.66	5.5		0.57
5	J11JP2	3/9/06	0.25	UJ	0.25	0.41	U	0.41	2600		2.1	9.6		0.63	4.8		0.54
6	J11JP3	3/9/06	0.26	UJ	0.26	0.42	U	0.42	3850		2.2	9.5		0.65	6.7		0.56
7	J11JP4	3/9/06	0.40	J	0.26	0.43	U	0.43	3500		2.2	8.7		0.65	5.8		0.56
8	J11JP5	3/9/06	0.41	J	0.26	0.42	U	0.42	3160		2.2	9.7		0.64	5.4		0.55
9	J11JP6	3/9/06	0.26	UJ	0.26	0.42	U	0.42	3210		2.2	10.2		0.64	5.8		0.55
10	J11JP7	3/9/06	0.41	J	0.27	0.44	U	0.44	3480		2.3	9.9		0.67	5.9		0.57
Waste staging area	J11L17	3/20/06	1.7	C	0.24	0.27		0.07	4180		1.7	9.4		0.13	5.2		0.14
Equipment blank	J11JN7	3/9/06	0.24	UJ	0.24	0.39	U	0.39	30.6		2.0	0.60	U	0.60	0.51	U	0.51

Attachment	1	Sheet No.	3 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J11JN8	3/9/06	14.0		0.22	16400		0.55	139		2.6	4050		4.0	294		0.33
Duplicate of J11JN8	J11JP8	3/9/06	12.7		0.23	15200		0.56	135		2.7	3850		4.1	284		0.33
2	J11JN9	3/9/06	13.7		0.22	12900		0.54	106		2.6	3370		3.9	243		0.32
3	J11JP0	3/9/06	10.3		0.23	12600		0.55	277		2.7	3200		4.0	254		0.33
4	J11JP1	3/9/06	12.0		0.23	13600		0.56	115		2.7	3520		4.0	262		0.33
5	J11JP2	3/9/06	12.5		0.22	13900		0.53	27.2		2.5	3400		3.8	210		0.31
6	J11JP3	3/9/06	14.7		0.22	16700		0.55	34.9		2.6	4230		4.0	280		0.32
7	J11JP4	3/9/06	11.5		0.22	14800		0.55	25.5		2.6	3700		4.0	276		0.32
8	J11JP5	3/9/06	12.0		0.22	14000		0.54	93.3		2.6	3530		3.9	255		0.32
9	J11JP6	3/9/06	12.6		0.22	14700		0.54	71.4		2.6	3750		3.9	238		0.32
10	J11JP7	3/9/06	11.0		0.23	15200		0.56	106		2.7	3740		4.1	282		0.33
Waste staging area	J11L17	3/20/06	14.5		0.12	13000	C	3.5	54.9		0.31	3430		0.98	255		0.03
Equipment blank	J11JN7	3/9/06	2.0		0.21	2890		0.50	2.4	U	2.4	13.6		3.7	20.4		0.30

Sample Location	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J11JN8	3/9/06	0.02	U	0.02	0.51	U	0.51	10.9		0.91	1530		78.5	3.7	U	3.7
Duplicate of J11JN8	J11JP8	3/9/06	0.02	U	0.02	0.52	U	0.52	10.5		0.93	1510		80.3	3.8	U	3.8
2	J11JN9	3/9/06	0.02	U	0.02	0.50	U	0.50	9.4		0.89	1050		77.1	3.6	U	3.6
3	J11JP0	3/9/06	0.02	U	0.02	0.51	U	0.51	8.6		0.91	1340		79.0	3.7	U	3.7
4	J11JP1	3/9/06	0.02	U	0.02	0.52	U	0.52	10.2		0.92	1060		79.7	3.8	U	3.8
5	J11JP2	3/9/06	0.04		0.02	0.49	U	0.49	8.6		0.87	682		75.5	3.6	U	3.6
6	J11JP3	3/9/06	0.02	U	0.02	0.51	U	0.51	10.6		0.90	918		77.9	4.2		3.7
7	J11JP4	3/9/06	0.02	U	0.02	0.51	U	0.51	9.1		0.90	1150		78.1	3.7	U	3.7
8	J11JP5	3/9/06	0.02	U	0.02	0.50	U	0.50	10.0		0.90	1330		77.6	3.7	U	3.7
9	J11JP6	3/9/06	0.02		0.02	0.50	U	0.50	10.5		0.89	1070		77.2	3.7	U	3.7
10	J11JP7	3/9/06	0.02	U	0.02	0.52	U	0.52	9.8		0.93	1420		80.3	3.8	U	3.8
Waste staging area	J11L17	3/20/06	0.03		0.02	0.29	U	0.29	9.6		0.24	1160	C	2.3	0.48	UC	0.48
Equipment blank	J11JN7	3/9/06	0.02	U	0.02	0.47	U	0.47	0.83	U	0.83	72.1	U	72.1	3.4	U	3.4

Attachment	1	Sheet No.	4 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J11JN8	3/9/06	490	J	0.91	0.57	U	0.57	109		2.6	35.9		0.32	44.8		0.16
Duplicate of J11JN8	J11JP8	3/9/06	494	J	0.93	0.58	U	0.58	98.7		2.6	32.7		0.32	41.8		0.17
2	J11JN9	3/9/06	653	J	0.89	0.56	U	0.56	82.2		2.5	28.4		0.31	35.4		0.16
3	J11JP0	3/9/06	581	J	0.91	0.57	U	0.57	81.6		2.6	27.2		0.32	37.8		0.16
4	J11JP1	3/9/06	643	J	0.92	0.58	U	0.58	86.5		2.6	30.1		0.32	33.9		0.17
5	J11JP2	3/9/06	443	J	0.87	0.55	U	0.55	110		2.5	33.9		0.30	41.0		0.16
6	J11JP3	3/9/06	504	J	0.90	0.57	U	0.57	115		2.5	37.4		0.31	36.3		0.16
7	J11JP4	3/9/06	618	J	0.90	0.57	U	0.57	118		2.5	31.2		0.31	34.8		0.16
8	J11JP5	3/9/06	465	J	0.90	0.56	U	0.56	99.1		2.5	29.6		0.31	52.1		0.16
9	J11JP6	3/9/06	391	J	0.89	0.56	U	0.56	102		2.5	34.5		0.31	38.2		0.16
10	J11JP7	3/9/06	804	J	0.93	0.58	U	0.58	98.7		2.6	33.7		0.32	38.0		0.17
Waste staging area	J11L17	3/20/06	630	J	2.3	0.07	UC	0.07	100	C	0.77	28.2		0.09	38.4		0.16
Equipment blank	J11JN7	3/9/06	64.6	J	0.83	0.52	U	0.52	8.5		2.3	0.29	U	0.29	4.9		0.15

Attachment	1	Sheet No.	5 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JN8 Location 1 Sample Date 3/9/06			J11JP8 Duplicate of J11JN8 Sample Date 3/9/06			J11JN9 Location 2 Sample Date 3/9/06			J11JP0 Location 3 Sample Date 3/9/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls												
Aroclor-1016	15	U	15	15	U	15	14	U	14	15	U	15
Aroclor-1221	15	U	15	15	U	15	14	U	14	15	U	15
Aroclor-1232	15	U	15	15	U	15	14	U	14	15	U	15
Aroclor-1242	15	U	15	15	U	15	14	U	14	15	U	15
Aroclor-1248	15	U	15	15	U	15	14	U	14	15	U	15
Aroclor-1254	15	U	15	15	U	15	14	U	14	15	U	15
Aroclor-1260	15	U	15	15	U	15	14	U	14	15	U	15
Pesticides												
Aldrin	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
alpha-BHC	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
alpha-Chlordane	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
beta-BHC	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
delta-BHC	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Dichlorodiphenyldichloroethane	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Dichlorodiphenyldichloroethylene	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Dichlorodiphenyltrichloroethane	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Dieldrin	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endosulfan I	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endosulfan II	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endosulfan sulfate	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endrin	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endrin aldehyde	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endrin ketone	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
gamma-BHC (Lindane)	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
gamma-Chlordane	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Heptachlor	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Heptachlor epoxide	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Methoxychlor	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Toxaphene	15	UDJ	15	15	UDJ	15	14	UDJ	14	15	UDJ	15
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	360	UJ	360	370	UJ	370	360	UJ	360	360	UJ	360
1,2-Dichlorobenzene	360	U	360	370	U	370	360	U	360	360	U	360
1,3-Dichlorobenzene	360	U	360	370	U	370	360	U	360	360	U	360
1,4-Dichlorobenzene	360	U	360	370	U	370	360	U	360	360	U	360
2,4,5-Trichlorophenol	910	U	910	930	U	930	900	U	900	910	U	910
2,4,6-Trichlorophenol	360	U	360	370	U	370	360	U	360	360	U	360
2,4-Dichlorophenol	360	U	360	370	U	370	360	U	360	360	U	360
2,4-Dimethylphenol	360	U	360	370	U	370	360	U	360	360	U	360
2,4-Dinitrophenol	910	UJ	910	930	UJ	930	900	UJ	900	910	UJ	910
2,4-Dinitrotoluene	360	U	360	370	U	370	360	U	360	360	U	360
2,6-Dinitrotoluene	360	U	360	370	U	370	360	U	360	360	U	360
2-Chloronaphthalene	360	U	360	370	U	370	360	U	360	360	U	360
2-Chlorophenol	360	U	360	370	U	370	360	U	360	360	U	360
2-Methylnaphthalene	360	U	360	370	U	370	360	U	360	360	U	360
2-Methylphenol (cresol, o-)	360	U	360	370	U	370	360	U	360	360	U	360
2-Nitroaniline	910	U	910	930	U	930	900	U	900	910	U	910
2-Nitrophenol	360	U	360	370	U	370	360	U	360	360	U	360

Attachment	1	Sheet No.	6 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JN8 Location 1 Sample Date 3/9/06			J11JP8 Duplicate of J11JN8 Sample Date 3/9/06			J11JN9 Location 2 Sample Date 3/9/06			J11JP0 Location 3 Sample Date 3/9/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)												
3,3'-Dichlorobenzidine	360	U	360	370	U	370	360	U	360	360	U	360
3-Nitroaniline	910	U	910	930	U	930	900	U	900	910	U	910
4,6-Dinitro-2-methylphenol	910	U	910	930	U	930	900	U	900	910	U	910
4-Bromophenyl-phenylether	360	U	360	370	U	370	360	U	360	360	U	360
4-Chloro-3-methylphenol	360	U	360	370	U	370	360	U	360	360	U	360
4-Chloroaniline	360	U	360	370	U	370	360	U	360	360	U	360
4-Chlorophenyl-phenylether	360	U	360	370	U	370	360	U	360	360	U	360
4-Methylphenol (p-cresol)	360	U	360	370	U	370	360	U	360	360	U	360
4-Nitroaniline	910	U	910	930	U	930	900	U	900	910	U	910
4-Nitrophenol	910	U	910	930	U	930	900	U	900	910	U	910
Acenaphthene	360	U	360	370	U	370	360	U	360	360	U	360
Acenaphthylene	360	U	360	370	U	370	360	U	360	360	U	360
Anthracene	360	U	360	370	U	370	360	U	360	360	U	360
Benzo(a)anthracene	360	U	360	370	U	370	360	U	360	360	U	360
Benzo(a)pyrene	360	U	360	33	J	370	360	U	360	360	U	360
Benzo(b)fluoranthene	360	U	360	370	U	370	360	U	360	360	U	360
Benzo(g,h,i)perylene	360	U	360	23	J	370	360	U	360	360	U	360
Benzo(k)fluoranthene	360	U	360	29	J	370	360	U	360	360	U	360
bis(2-Chloro-1-methylethyl)ether	360	U	360	370	U	370	360	U	360	360	U	360
bis(2-Chloroethoxy)methane	360	U	360	370	U	370	360	U	360	360	U	360
bis(2-Chloroethyl)ether	360	U	360	370	U	370	360	U	360	360	U	360
bis(2-Ethylhexyl)phthalate	660	U	660	660	U	660	660	U	660	660	U	660
Butylbenzylphthalate	360	U	360	370	U	370	360	U	360	360	U	360
Carbazole	360	U	360	370	U	370	360	U	360	360	U	360
Chrysene	360	U	360	22	J	370	360	U	360	360	U	360
Di-n-butylphthalate	360	U	360	370	U	370	360	U	360	25	J	360
Di-n-octylphthalate	360	U	360	370	U	370	360	U	360	360	U	360
Dibenz(a,h)anthracene	360	U	360	370	U	370	360	U	360	360	U	360
Dibenzofuran	360	U	360	370	U	370	360	U	360	360	U	360
Diethylphthalate	360	U	360	370	U	370	360	U	360	360	U	360
Dimethylphthalate	360	U	360	370	U	370	360	U	360	360	U	360
Fluoranthene	360	U	360	370	U	370	360	U	360	360	U	360
Fluorene	360	U	360	370	U	370	360	U	360	360	U	360
Hexachlorobenzene	360	U	360	370	U	370	360	U	360	360	U	360
Hexachlorobutadiene	360	U	360	370	U	370	360	U	360	360	U	360
Hexachlorocyclopentadiene	360	U	360	370	U	370	360	U	360	360	U	360
Hexachloroethane	360	U	360	370	U	370	360	U	360	360	U	360
Indeno(1,2,3-cd)pyrene	360	U	360	22	J	370	360	U	360	360	U	360
Isophorone	360	UJ	360	370	UJ	370	360	UJ	360	360	UJ	360
N-Nitroso-di-n-dipropylamine	360	U	360	370	U	370	360	U	360	360	U	360
N-Nitrosodiphenylamine	360	U	360	370	U	370	360	U	360	360	U	360
Naphthalene	360	U	360	370	U	370	360	U	360	360	U	360
Nitrobenzene	360	U	360	370	U	370	360	U	360	360	U	360
Pentachlorophenol	910	U	910	930	U	930	900	U	900	910	U	910
Phenanthrene	360	U	360	370	U	370	360	U	360	360	U	360
Phenol	360	U	360	370	U	370	360	U	360	360	U	360
Pyrene	360	U	360	370	U	370	360	U	360	360	U	360

Attachment	1	Sheet No.	7 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JN8 Location 1 Sample Date 3/9/06			J11JP8 Duplicate of J11JN8 Sample Date 3/9/06			J11JN9 Location 2 Sample Date 3/9/06			J11JP0 Location 3 Sample Date 3/9/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Volatile Organic Compounds												
1,1,1-Trichloroethane	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
1,1,2,2-Tetrachloroethane	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
1,1,2-Trichloroethane	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
1,1-Dichloroethane	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
1,1-Dichloroethene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
1,2-Dichloroethane	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
1,2-Dichloroethene (total)	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
1,2-Dichloropropane	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
2-Butanone	10	U	10	11	UJ	11	10	UJ	10	11	UJ	11
2-Hexanone	10	U	10	11	UJ	11	10	UJ	10	11	UJ	11
4-Methyl-2-Pentanone	10	U	10	11	UJ	11	10	UJ	10	11	UJ	11
Acetone	10	U	10	11	UJ	11	10	UJ	10	11	UJ	11
Benzene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Bromodichloromethane	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Bromoform	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Bromomethane	10	U	10	11	UJ	11	10	UJ	10	11	UJ	11
Carbon disulfide	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Carbon tetrachloride	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Chlorobenzene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Chloroethane	10	U	10	11	UJ	11	10	UJ	10	11	UJ	11
Chloroform	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Chloromethane	10	U	10	11	UJ	11	10	UJ	10	11	UJ	11
cis-1,2-Dichloroethylene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
cis-1,3-Dichloropropene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Dibromochloromethane	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Ethylbenzene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
m&p-Xylene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Methylene chloride	18	U	18	27	UJ	27	15	UJ	15	25	UJ	25
o-Xylene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Styrene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Tetrachloroethene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Toluene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
trans-1,2-Dichloroethylene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
trans-1,3-Dichloropropene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Trichloroethene	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6
Vinyl chloride	10	U	10	11	UJ	11	10	UJ	10	11	UJ	11
Xylenes (total)	5	U	5	6	UJ	6	5	UJ	5	6	UJ	6

Attachment	1	Sheet No.	8 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JP1 Location 4 Sample Date 3/9/06			J11JP2 Location 5 Sample Date 3/9/06			J11JP3 Location 6 Sample Date 3/9/06			J11JP4 Location 7 Sample Date 3/9/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls												
Aroclor-1016	15	U	15	14	U	14	14	U	14	14	U	14
Aroclor-1221	15	U	15	14	U	14	14	U	14	14	U	14
Aroclor-1232	15	U	15	14	U	14	14	U	14	14	U	14
Aroclor-1242	15	U	15	14	U	14	14	U	14	14	U	14
Aroclor-1248	15	U	15	14	U	14	14	U	14	14	U	14
Aroclor-1254	15	U	15	14	U	14	14	U	14	14	U	14
Aroclor-1260	15	U	15	3.5	J	14	14	U	14	14	U	14
Pesticides												
Aldrin	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
alpha-BHC	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
alpha-Chlordane	1.5	UD	1.5	0.63	JD	1.4	1.4	UD	1.4	1.4	UD	1.4
beta-BHC	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
delta-BHC	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Dichlorodiphenyldichloroethane	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Dichlorodiphenyldichloroethylene	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Dichlorodiphenyltrichloroethane	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Dieldrin	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Endosulfan I	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Endosulfan II	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Endosulfan sulfate	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Endrin	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Endrin aldehyde	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Endrin ketone	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
gamma-BHC (Lindane)	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
gamma-Chlordane	1.5	UD	1.5	2.6	D	1.4	1.4	UD	1.4	1.4	UD	1.4
Heptachlor	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Heptachlor epoxide	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Methoxychlor	1.5	UD	1.5	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4
Toxaphene	15	UDJ	15	14	UDJ	14	14	UDJ	14	14	UDJ	14
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	370	UJ	370	350	UJ	350	360	UJ	360	360	UJ	360
1,2-Dichlorobenzene	370	U	370	350	U	350	360	U	360	360	U	360
1,3-Dichlorobenzene	370	U	370	350	U	350	360	U	360	360	U	360
1,4-Dichlorobenzene	370	U	370	350	U	350	360	U	360	360	U	360
2,4,5-Trichlorophenol	920	U	920	880	U	880	900	U	900	900	U	900
2,4,6-Trichlorophenol	370	U	370	350	U	350	360	U	360	360	U	360
2,4-Dichlorophenol	370	U	370	350	U	350	360	U	360	360	U	360
2,4-Dimethylphenol	370	U	370	350	U	350	360	U	360	360	U	360
2,4-Dinitrophenol	920	UJ	920	880	UJ	880	900	UJ	900	900	UJ	900
2,4-Dinitrotoluene	370	U	370	350	U	350	360	U	360	360	U	360
2,6-Dinitrotoluene	370	U	370	350	U	350	360	U	360	360	U	360
2-Chloronaphthalene	370	U	370	350	U	350	360	U	360	360	U	360
2-Chlorophenol	370	U	370	350	U	350	360	U	360	360	U	360
2-Methylnaphthalene	370	U	370	350	U	350	360	U	360	360	U	360
2-Methylphenol (cresol, o-)	370	U	370	350	U	350	360	U	360	360	U	360
2-Nitroaniline	920	U	920	880	U	880	900	U	900	900	U	900
2-Nitrophenol	370	U	370	350	U	350	360	U	360	360	U	360

Attachment	1	Sheet No.	9 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JP1 Location 4 Sample Date 3/9/06			J11JP2 Location 5 Sample Date 3/9/06			J11JP3 Location 6 Sample Date 3/9/06			J11JP4 Location 7 Sample Date 3/9/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)												
3,3'-Dichlorobenzidine	370	U	370	350	U	350	360	U	360	360	U	360
3-Nitroaniline	920	U	920	880	U	880	900	U	900	900	U	900
4,6-Dinitro-2-methylphenol	920	U	920	880	U	880	900	U	900	900	U	900
4-Bromophenyl-phenylether	370	U	370	350	U	350	360	U	360	360	U	360
4-Chloro-3-methylphenol	370	U	370	350	U	350	360	U	360	360	U	360
4-Chloroaniline	370	U	370	350	U	350	360	U	360	360	U	360
4-Chlorophenyl-phenylether	370	U	370	350	U	350	360	U	360	360	U	360
4-Methylphenol (p-cresol)	370	U	370	350	U	350	360	U	360	360	U	360
4-Nitroaniline	920	U	920	880	U	880	900	U	900	900	U	900
4-Nitrophenol	920	U	920	880	U	880	900	U	900	900	U	900
Acenaphthene	370	U	370	350	U	350	360	U	360	360	U	360
Acenaphthylene	370	U	370	350	U	350	360	U	360	360	U	360
Anthracene	370	U	370	350	U	350	360	U	360	360	U	360
Benzo(a)anthracene	370	U	370	350	U	350	360	U	360	360	U	360
Benzo(a)pyrene	370	U	370	350	U	350	360	U	360	360	U	360
Benzo(b)fluoranthene	370	U	370	350	U	350	360	U	360	360	U	360
Benzo(g,h,i)perylene	370	U	370	350	U	350	360	U	360	360	U	360
Benzo(k)fluoranthene	370	U	370	350	U	350	360	U	360	360	U	360
bis(2-Chloro-1-methylethyl)ether	370	U	370	350	U	350	360	U	360	360	U	360
bis(2-Chloroethoxy)methane	370	U	370	350	U	350	360	U	360	360	U	360
bis(2-Chloroethyl)ether	370	U	370	350	U	350	360	U	360	360	U	360
bis(2-Ethylhexyl)phthalate	660	U	660	660	U	660	660	U	660	660	U	660
Butylbenzylphthalate	370	U	370	350	U	350	360	U	360	360	U	360
Carbazole	370	U	370	350	U	350	360	U	360	360	U	360
Chrysene	370	U	370	350	U	350	360	U	360	360	U	360
Di-n-butylphthalate	370	U	370	350	U	350	360	U	360	360	U	360
Di-n-octylphthalate	370	U	370	350	U	350	360	U	360	360	U	360
Dibenz(a,h)anthracene	370	U	370	350	U	350	360	U	360	360	U	360
Dibenzofuran	370	U	370	350	U	350	360	U	360	360	U	360
Diethylphthalate	370	U	370	350	U	350	360	U	360	360	U	360
Dimethylphthalate	370	U	370	350	U	350	360	U	360	360	U	360
Fluoranthene	370	U	370	350	U	350	360	U	360	360	U	360
Fluorene	370	U	370	350	U	350	360	U	360	360	U	360
Hexachlorobenzene	370	U	370	350	U	350	360	U	360	360	U	360
Hexachlorobutadiene	370	U	370	350	U	350	360	U	360	360	U	360
Hexachlorocyclopentadiene	370	U	370	350	U	350	360	U	360	360	U	360
Hexachloroethane	370	U	370	350	U	350	360	U	360	360	U	360
Indeno(1,2,3-cd)pyrene	370	U	370	350	U	350	360	U	360	360	U	360
Isophorone	370	UJ	370	350	UJ	350	360	UJ	360	360	UJ	360
N-Nitroso-di-n-dipropylamine	370	U	370	350	U	350	360	U	360	360	U	360
N-Nitrosodiphenylamine	370	U	370	350	U	350	360	U	360	360	U	360
Naphthalene	370	U	370	350	U	350	360	U	360	360	U	360
Nitrobenzene	370	U	370	350	U	350	360	U	360	360	U	360
Pentachlorophenol	920	U	920	880	U	880	900	U	900	900	U	900
Phenanthrene	370	U	370	350	U	350	360	U	360	360	U	360
Phenol	370	U	370	350	U	350	360	U	360	360	U	360
Pyrene	370	U	370	350	U	350	360	U	360	360	U	360

Attachment	1	Sheet No.	10 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JP1 Location 4 Sample Date 3/9/06			J11JP2 Location 5 Sample Date 3/9/06			J11JP3 Location 6 Sample Date 3/9/06			J11JP4 Location 7 Sample Date 3/9/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Volatile Organic Compounds												
1,1,1-Trichloroethane	6	U	6	5	U	5	5	UJ	5	5	U	5
1,1,2,2-Tetrachloroethane	6	U	6	5	U	5	5	UJ	5	5	U	5
1,1,2-Trichloroethane	6	U	6	5	U	5	5	UJ	5	5	U	5
1,1-Dichloroethane	6	U	6	5	U	5	5	UJ	5	5	U	5
1,1-Dichloroethene	6	U	6	5	U	5	5	UJ	5	5	U	5
1,2-Dichloroethane	6	U	6	5	U	5	5	UJ	5	5	U	5
1,2-Dichloroethene (total)	6	U	6	5	U	5	5	UJ	5	5	U	5
1,2-Dichloropropane	6	U	6	5	U	5	5	UJ	5	5	U	5
2-Butanone	11	U	11	10	U	10	10	UJ	10	10	U	10
2-Hexanone	11	U	11	10	U	10	10	UJ	10	10	U	10
4-Methyl-2-Pentanone	11	U	11	10	U	10	10	UJ	10	10	U	10
Acetone	11	U	11	10	U	10	10	UJ	10	10	U	10
Benzene	6	U	6	5	U	5	5	UJ	5	5	U	5
Bromodichloromethane	6	U	6	5	U	5	5	UJ	5	5	U	5
Bromoform	6	U	6	5	U	5	5	UJ	5	5	U	5
Bromomethane	11	U	11	10	U	10	10	UJ	10	10	U	10
Carbon disulfide	6	U	6	5	U	5	5	UJ	5	5	U	5
Carbon tetrachloride	6	U	6	5	U	5	5	UJ	5	5	U	5
Chlorobenzene	6	U	6	5	U	5	5	UJ	5	5	U	5
Chloroethane	11	U	11	10	U	10	10	UJ	10	10	U	10
Chloroform	6	U	6	5	U	5	5	UJ	5	5	U	5
Chloromethane	11	U	11	10	U	10	10	UJ	10	10	U	10
cis-1,2-Dichloroethylene	6	U	6	5	U	5	5	UJ	5	5	U	5
cis-1,3-Dichloropropene	6	U	6	5	U	5	5	UJ	5	5	U	5
Dibromochloromethane	6	U	6	5	U	5	5	UJ	5	5	U	5
Ethylbenzene	6	U	6	5	U	5	5	UJ	5	5	U	5
m&p-Xylene	6	U	6	5	U	5	5	UJ	5	5	U	5
Methylene chloride	19	U	19	15	U	15	19	UJ	19	11	U	11
o-Xylene	6	U	6	5	U	5	5	UJ	5	5	U	5
Styrene	6	U	6	5	U	5	5	UJ	5	5	U	5
Tetrachloroethene	6	U	6	5	U	5	5	UJ	5	5	U	5
Toluene	6	U	6	5	U	5	5	UJ	5	5	U	5
trans-1,2-Dichloroethylene	6	U	6	5	U	5	5	UJ	5	5	U	5
trans-1,3-Dichloropropene	6	U	6	5	U	5	5	UJ	5	5	U	5
Trichloroethene	6	U	6	5	U	5	5	UJ	5	5	U	5
Vinyl chloride	11	U	11	10	U	10	10	UJ	10	10	U	10
Xylenes (total)	6	U	6	5	U	5	5	UJ	5	5	U	5

Attachment	1	Sheet No.	11 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JP5 Location 8 Sample Date 3/9/06			J11JP6 Location 9 Sample Date 3/9/06			J11JP7 Location 10 Sample Date 3/9/06			J11L17 Waste Staging Area Sample Date 3/20/06		
	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	15	U	15	14	U	14
Aroclor-1221	14	U	14	14	U	14	15	U	15	14	U	14
Aroclor-1232	14	U	14	14	U	14	15	U	15	14	U	14
Aroclor-1242	14	U	14	14	U	14	15	U	15	14	U	14
Aroclor-1248	14	U	14	14	U	14	15	U	15	14	U	14
Aroclor-1254	14	U	14	14	U	14	15	U	15	3.4	J	14
Aroclor-1260	14	U	14	14	U	14	15	U	15	14	U	14
Pesticides												
Aldrin	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
alpha-BHC	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
alpha-Chlordane	1.0	JD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
beta-BHC	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
delta-BHC	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Dichlorodiphenyldichloroethane	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Dichlorodiphenyldichloroethylene	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.49	J	0.35
Dichlorodiphenyltrichloroethane	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	J	0.35
Dieldrin	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Endosulfan I	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Endosulfan II	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Endosulfan sulfate	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Endrin	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Endrin aldehyde	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Endrin ketone	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
gamma-BHC (Lindane)	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
gamma-Chlordane	2.6	D	1.4	0.61	JD	1.4	1.5	UD	1.5	0.83	J	0.35
Heptachlor	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Heptachlor epoxide	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Methoxychlor	1.4	UD	1.4	1.4	UD	1.4	1.5	UD	1.5	0.35	U	0.35
Toxaphene	14	UDJ	14	14	UDJ	14	15	UDJ	15	3.5	UJ	3.5
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	360	UJ	360	360	UJ	360	370	UJ	370	350	U	350
1,2-Dichlorobenzene	360	U	360	360	U	360	370	U	370	350	U	350
1,3-Dichlorobenzene	360	U	360	360	U	360	370	U	370	350	U	350
1,4-Dichlorobenzene	360	U	360	360	U	360	370	U	370	350	U	350
2,4,5-Trichlorophenol	900	U	900	900	U	900	930	U	930	870	U	870
2,4,6-Trichlorophenol	360	U	360	360	U	360	370	U	370	350	U	350
2,4-Dichlorophenol	360	U	360	360	U	360	370	U	370	350	U	350
2,4-Dimethylphenol	360	U	360	360	U	360	370	U	370	350	U	350
2,4-Dinitrophenol	900	UJ	900	900	UJ	900	930	UJ	930	870	U	870
2,4-Dinitrotoluene	360	U	360	360	U	360	370	U	370	350	U	350
2,6-Dinitrotoluene	360	U	360	360	U	360	370	U	370	350	U	350
2-Chloronaphthalene	360	U	360	360	U	360	370	U	370	350	U	350
2-Chlorophenol	360	U	360	360	U	360	370	U	370	350	U	350
2-Methylnaphthalene	360	U	360	360	U	360	370	U	370	350	U	350
2-Methylphenol (cresol, o-)	360	U	360	360	U	360	370	U	370	350	U	350
2-Nitroaniline	900	U	900	900	U	900	930	U	930	870	U	870
2-Nitrophenol	360	U	360	360	U	360	370	U	370	350	U	350

Attachment	1	Sheet No.	12 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JP5 Location 8 Sample Date 3/9/06			J11JP6 Location 9 Sample Date 3/9/06			J11JP7 Location 10 Sample Date 3/9/06			J11L17 Waste Staging Area Sample Date 3/20/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)												
3,3'-Dichlorobenzidine	360	U	360	360	U	360	370	U	370	350	U	350
3-Nitroaniline	900	U	900	900	U	900	930	U	930	870	U	870
4,6-Dinitro-2-methylphenol	900	U	900	900	U	900	930	U	930	870	U	870
4-Bromophenyl-phenylether	360	U	360	360	U	360	370	U	370	350	U	350
4-Chloro-3-methylphenol	360	U	360	360	U	360	370	U	370	350	U	350
4-Chloroaniline	360	U	360	360	U	360	370	U	370	350	U	350
4-Chlorophenyl-phenylether	360	U	360	360	U	360	370	U	370	350	U	350
4-Methylphenol (p-cresol)	360	U	360	360	U	360	370	U	370	350	U	350
4-Nitroaniline	900	U	900	900	U	900	930	U	930	870	U	870
4-Nitrophenol	900	U	900	900	U	900	930	U	930	870	U	870
Acenaphthene	360	U	360	360	U	360	370	U	370	350	U	350
Acenaphthylene	360	U	360	360	U	360	370	U	370	350	U	350
Anthracene	360	U	360	360	U	360	370	U	370	350	U	350
Benzo(a)anthracene	360	U	360	360	U	360	370	U	370	350	U	350
Benzo(a)pyrene	360	U	360	360	U	360	370	U	370	350	U	350
Benzo(b)fluoranthene	360	U	360	360	U	360	370	U	370	350	U	350
Benzo(g,h,i)perylene	360	U	360	360	U	360	370	U	370	350	U	350
Benzo(k)fluoranthene	360	U	360	360	U	360	370	U	370	350	U	350
bis(2-Chloro-1-methylethyl)ether	360	U	360	360	U	360	370	U	370	350	U	350
bis(2-Chloroethoxy)methane	360	U	360	360	U	360	370	U	370	350	U	350
bis(2-Chloroethyl)ether	360	U	360	360	U	360	370	U	370	350	U	350
bis(2-Ethylhexyl)phthalate	660	U	660	660	U	660	660	U	660	660	U	660
Butylbenzylphthalate	360	U	360	360	U	360	370	U	370	350	U	350
Carbazole	360	U	360	360	U	360	370	U	370	350	U	350
Chrysene	360	U	360	360	U	360	370	U	370	350	U	350
Di-n-butylphthalate	360	U	360	360	U	360	370	U	370	120	J	350
Di-n-octylphthalate	360	U	360	360	U	360	370	U	370	350	U	350
Dibenz(a,h)anthracene	360	U	360	360	U	360	370	U	370	350	U	350
Dibenzofuran	360	U	360	360	U	360	370	U	370	350	U	350
Diethylphthalate	360	U	360	360	U	360	370	U	370	350	U	350
Dimethylphthalate	360	U	360	360	U	360	370	U	370	350	U	350
Fluoranthene	360	U	360	360	U	360	370	U	370	350	U	350
Fluorene	360	U	360	360	U	360	370	U	370	350	U	350
Hexachlorobenzene	360	U	360	360	U	360	370	U	370	350	U	350
Hexachlorobutadiene	360	U	360	360	U	360	370	U	370	350	U	350
Hexachlorocyclopentadiene	360	U	360	360	U	360	370	U	370	350	U	350
Hexachloroethane	360	U	360	360	U	360	370	U	370	350	U	350
Indeno(1,2,3-cd)pyrene	360	U	360	360	U	360	370	U	370	350	U	350
Isophorone	360	UJ	360	360	UJ	360	370	UJ	370	350	U	350
N-Nitroso-di-n-dipropylamine	360	U	360	360	U	360	370	U	370	350	U	350
N-Nitrosodiphenylamine	360	U	360	360	U	360	370	U	370	350	U	350
Naphthalene	360	U	360	360	U	360	370	U	370	350	U	350
Nitrobenzene	360	U	360	360	U	360	370	U	370	350	U	350
Pentachlorophenol	900	U	900	900	U	900	930	U	930	870	U	870
Phenanthrene	360	U	360	360	U	360	370	U	370	350	U	350
Phenol	360	U	360	360	U	360	370	U	370	350	U	350
Pyrene	360	U	360	360	U	360	370	U	370	350	U	350

Attachment	1	Sheet No.	13 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JP5 Location 8 Sample Date 3/9/06			J11JP6 Location 9 Sample Date 3/9/06			J11JP7 Location 10 Sample Date 3/9/06			J11L17 Waste Staging Area Sample Date 3/20/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Volatile Organic Compounds												
1,1,1-Trichloroethane	5	U	5	5	U	5	6	UJ	6	6	U	6
1,1,2,2-Tetrachloroethane	5	U	5	5	U	5	6	UJ	6	6	U	6
1,1,2-Trichloroethane	5	U	5	5	U	5	6	UJ	6	6	U	6
1,1-Dichloroethane	5	U	5	5	U	5	6	UJ	6	6	U	6
1,1-Dichloroethene	5	U	5	5	U	5	6	UJ	6	6	U	6
1,2-Dichloroethane	5	U	5	5	U	5	6	UJ	6	6	U	6
1,2-Dichloroethene (total)	5	U	5	5	U	5	6	UJ	6	6	U	6
1,2-Dichloropropane	5	U	5	5	U	5	6	UJ	6	6	U	6
2-Butanone	10	U	10	10	U	10	11	UJ	11	12	U	12
2-Hexanone	10	U	10	10	U	10	11	UJ	11	12	U	12
4-Methyl-2-Pentanone	10	U	10	10	U	10	11	UJ	11	12	U	12
Acetone	10	U	10	10	U	10	11	UJ	11	5	J	12
Benzene	5	U	5	5	U	5	6	UJ	6	6	U	6
Bromodichloromethane	5	U	5	5	U	5	6	UJ	6	6	U	6
Bromoform	5	U	5	5	U	5	6	UJ	6	6	U	6
Bromomethane	10	U	10	10	U	10	11	UJ	11	12	U	12
Carbon disulfide	5	U	5	5	U	5	6	UJ	6	6	U	6
Carbon tetrachloride	5	U	5	5	U	5	6	UJ	6	6	U	6
Chlorobenzene	5	U	5	5	U	5	6	UJ	6	6	U	6
Chloroethane	10	U	10	10	U	10	11	UJ	11	12	U	12
Chloroform	5	U	5	5	U	5	6	UJ	6	1	J	6
Chloromethane	10	U	10	10	U	10	11	UJ	11	12	U	12
cis-1,2-Dichloroethylene	5	U	5	5	U	5	6	UJ	6	6	U	6
cis-1,3-Dichloropropene	5	U	5	5	U	5	6	UJ	6	6	U	6
Dibromochloromethane	5	U	5	5	U	5	6	UJ	6	6	U	6
Ethylbenzene	1	J	5	5	U	5	2	J	6	6	U	6
m&p-Xylene	2	J	5	5	U	5	4	J	6			
Methylene chloride	18	U	18	21	U	21	43	JB	6	10	U	10
o-Xylene	1	J	5	5	U	5	2	J	6			
Styrene	5	U	5	5	U	5	6	UJ	6	6	U	6
Tetrachloroethene	5	U	5	5	U	5	2	J	6	6	U	6
Toluene	5	U	5	5	U	5	1	J	6	6	U	6
trans-1,2-Dichloroethylene	5	U	5	5	U	5	6	UJ	6	6	U	6
trans-1,3-Dichloropropene	5	U	5	5	U	5	6	UJ	6	6	U	6
Trichloroethene	5	U	5	5	U	5	6	UJ	6	6	U	6
Vinyl chloride	10	U	10	10	U	10	11	UJ	11	12	U	12
Xylenes (total)	4	J	5	5	U	5	6	J	6	6	U	6

Attachment	1	Sheet No.	14 of 16
Originator	J. M. Capron	Date	07/10/06
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0263	Rev. No.	0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JN7 Equipment Blank Sample Date 3/9/06		
	µg/kg	Q	PQL
Semivolatile Organic Compounds			
1,2,4-Trichlorobenzene	330	UJ	330
1,2-Dichlorobenzene	330	U	330
1,3-Dichlorobenzene	330	U	330
1,4-Dichlorobenzene	330	U	330
2,4,5-Trichlorophenol	840	U	840
2,4,6-Trichlorophenol	330	U	330
2,4-Dichlorophenol	330	U	330
2,4-Dimethylphenol	330	U	330
2,4-Dinitrophenol	840	UJ	840
2,4-Dinitrotoluene	330	U	330
2,6-Dinitrotoluene	330	U	330
2-Chloronaphthalene	330	U	330
2-Chlorophenol	330	U	330
2-Methylnaphthalene	330	U	330
2-Methylphenol (cresol, o-)	330	U	330
2-Nitroaniline	840	U	840
2-Nitrophenol	330	U	330
3,3'-Dichlorobenzidine	330	U	330
3-Nitroaniline	330	U	330
4,6-Dinitro-2-methylphenol	840	U	840
4-Bromophenyl-phenylether	840	U	840
4-Chloro-3-methylphenol	330	U	330
4-Chloroaniline	330	U	330
4-Chlorophenyl-phenylether	330	U	330
4-Methylphenol (p-cresol)	330	U	330
4-Nitroaniline	840	U	840
4-Nitrophenol	840	U	840
Acenaphthene	330	U	330
Acenaphthylene	330	U	330
Anthracene	330	U	330
Benzo(a)anthracene	330	U	330
Benzo(a)pyrene	330	U	330
Benzo(b)fluoranthene	330	U	330
Benzo(g,h,i)perylene	330	U	330
Benzo(k)fluoranthene	330	U	330
bis(2-Chloro-1-methylethyl)ether	330	U	330
bis(2-Chloroethoxy)methane	330	U	330
bis(2-Chloroethyl)ether	330	U	330
bis(2-Ethylhexyl)phthalate	660	U	660
Butylbenzylphthalate	330	U	330
Carbazole	330	U	330
Chrysene	330	U	330
Di-n-butylphthalate	97	J	330
Di-n-octylphthalate	330	U	330
Dibenz(a,h)anthracene	330	U	330
Dibenzofuran	330	U	330
Diethylphthalate	330	U	330

Attachment 1 Sheet No. 15 of 16
Originator J. M. Capron Date 07/10/06
Checked T. M. Blakley Date
Calc. No. 0100F-CA-V0263 Rev. No. 0

Attachment 1. 1607-F3 Verification Sampling Results.

Constituents	J11JN7 Equipment Blank Sample Date 3/9/06		
	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)			
Dimethylphthalate	330	U	330
Fluoranthene	330	U	330
Fluorene	330	U	330
Hexachlorobenzene	330	U	330
Hexachlorobutadiene	330	U	330
Hexachlorocyclopentadiene	330	U	330
Hexachloroethane	330	U	330
Indeno(1,2,3-cd)pyrene	330	U	330
Isophorone	330	UJ	330
N-Nitroso-di-n-dipropylamine	330	U	330
N-Nitrosodiphenylamine	330	U	330
Naphthalene	330	U	330
Nitrobenzene	330	U	330
Pentachlorophenol	840	U	840
Phenanthrene	330	U	330
Phenol	330	U	330
Pyrene	330	U	330

Attachment 1 Sheet No. 16 of 16
Originator J. M. Capron Date 07/10/06
Checked T. M. Blakley Date
Calc. No. 0100F-CA-V0263 Rev. No. 0

CALCULATION COVER SHEET

Project Title:	Field Remediation	**Job No.**	14655
Area	100-F		
Discipline	Environmental	***Calc. No.**	0100F-CA-V0275
Subject	1607-F3 Phase II 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 ☒ **Preliminary** ☐ **Superseded** ☐ **Voided** ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 5 Attm. 1 = 1 Total = 7	K. A. Anselm 2/21/07	J. M. Capron 2/22/07	T. M. Blakely 2/22/07	J. D. Fancher ~~S. W. Callison~~	2/28/07

SUMMARY OF REVISIONS

WCH-DE-018 (09/01/2006) * Obtain Calc No. from Document Control and Form from Intranet

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm KAA **Date** 02/21/07 **Calc. No.** 0100F-CA-V0275 **Rev. No.** 0
Project Field Remediation **Job No.** 14655 **Checked** J. M. Capron JMC **Date** 2/22/07
Subject 1607-F3 Phase II Cleanup Verification 95% UCL Calculations **Sheet No.** 1 of 5

Summary

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

The verification data results from the 1607-F3 Phase I sampling (WCH 2006) indicated that this site required further remdiation for residual arsenic and lead contaminations. This 95% UCL evaluates the data from the 1607-F3 Phase II statistical verification sampling event, which was conducted after subsequent remediation for residual arsenic and lead contamination was performed at the site. Arsenic and lead were the only constituents analzyed in the Phase II sampling. The results from both sampling events (Phase I and Phase II) are presented and discussed in detail in the remaining sites verification package (RSVP) for the 1607-F3 waste site.

Table of Contents:

Given/References:

1) Sample Results (Attachment 1).
2) Remedial action goals (RAGs) are from DOE-RL (2005b) and Ecology (2005).
3) 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.
4) 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.
5) Ecology, 1992, *Statistical Guidance for Ecology Site Managers,* Publication #92-54, Washington Department of Ecology, Olympia, Washington.
6) 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.
7) Ecology, 2005, *Cleanup Levels and Risk Calculations (CLARC) Database* , Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
8) 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.
9) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code.*
10) WCH, 2006, *1607-F3 Waste Site Cleanup Verification 95% UCL Calculations* , Calculation No. 0100F-CA-V0263, Washington Closure Hanford, Richland, Washington.

Solution:

Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2005b). Use data from the attached worksheets to perform the 95% UCL calculation for each contaminant of concern/contaminant of potential concern (COC/COPC), 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 and are included as an appendix to the RSVP.

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm KAA Date 02/21/07 Calc. No. 0100F-CA-V0275 Rev. No. 0
Project Field Remediation Job No. 14655 Checked J. M. Capron JMC Date 2/22/07
Subject 1607-F3 Phase II Cleanup Verification 95% UCL Calculations Sheet No. 2 of 5

Summary (continued)

Calculation Description:
The subject calculations were performed on data from soil verification samples 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. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:
For nonradioactive analytes with ≤50% of the data below detection limits and all radionuclide analytes, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. The 95% UCL was not calculated for nonradionuclide data sets with no reported detections. For nonradioactive analytes with >50% of the data below detection limits, the maximum detected value for the data set is used instead of the 95% UCL. The evaluation of the portion of the data set below detection limits was performed by direct inspection of the attached sample results. The evaluation of the portion of each analyte's data set below detection limits was determined by direct inspection of the attached sample results, and no further calculations were performed for those data sets where >50% of the data was below detection limits.

All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics (Ecology 1993). 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), the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, as for this 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 WAC 173-340-740(7)(e) 3-part test is not performed for data sets where the statistical value defaults to the maximum value. Instead, direct comparison of the maximum value against site RAGs (within the RSVP) is used as the compliance basis.

The RPD is calculated when both the primary value and the duplicate 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, 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.

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm KAA **Date** 02/21/07 **Calc. No.** 0100F-CA-V0275 **Rev. No.** 0
Project Field Remediation **Job No.** 14655 **Checked** J. M. Capron JMC **Date** 2/22/07
Subject 1607-F3 Phase II Cleanup Verification 95% UCL Calculations **Sheet No.** 3 of 5

Summary (continued)

Methodology (continued):
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 at this site. Additional discussion is provided in the data quality assessment section of the RSVP, as necessary.

Results:
The results presented in the summary tables that follow include the 95% UCL calculations, the WAC 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the RSVP for this site.

Results Summary - Remediation Footprint		
Analyte	**95% UCL**	**Units**
Arsenic	8.2	mg/kg
Lead	29	mg/kg

WAC 173-340-740(7)(e) Evaluation		
WAC 173-340 3-Part Test:		Because of the "yes" answers to the 3-part test for lead, additional site-specific evaluations will be performed. The data set meets the 3-part test criteria when compared to direct exposure cleanup level.
95% UCL > Cleanup Limit?	YES	
> 10% above Cleanup Limit?	YES	
Any sample > 2x Cleanup Limit?	YES	

Relative Percent Difference Results* - QA/QC Analysis	
Analyte	**Duplicate Analysis**
Arsenic	
Lead	

* RPD listed where result produced, based on criteria. If RPD not required, no value is listed.

Abbreviations/Acronyms
COC = contaminant of concern
COPC = contaminant of potential concern
GW = groundwater
HEIS = Hanford Environmental Information System
MTCA = *Model Toxic Control Act*
PQL = practical quantitation limit
Q = qualifier
QA = quality assurance
QC = quality control
RAG = remedial action goal
RPD = relative percent difference
RSVP = remaining sites verification package
SAP = sampling and analysis plan
TDL = target detection limit
UCL = upper confidence limit
WAC = *Washington Administrative Code*

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm **Date** 02/21/07 **Calc. No.** 0100F-CA-V0275 **Rev. No.** 0
Project Field Remediation **Job No.** 14655 **Checked** J. M. Capron **Date** 2/23/05
Subject 1607-F3 Phase II Cleanup Verification 95% UCL Calculations **Sheet No.** 4 of 5

Remediation Footprint Verification Data

Sample Location	HEIS Number	Sample Date	Arsenic mg/kg	Arsenic Q	Arsenic PQL	Lead mg/kg	Lead Q	Lead PQL
6	J13W48	12/18/06	2.1		0.89	4.7		0.46
Duplicate of J13W48	J13W49	12/18/06	4.1		0.89	16.0		0.46
1	J13W53	12/18/06	4.3		0.88	11.3		0.45
2	J13W51	12/18/06	6.9		0.89	24.5		0.46
3	J13W52	12/18/06	1.7		0.89	4.2		0.46
4	J13W54	12/18/06	5.2		0.89	9.9		0.46
5	J13W55	12/18/06	1.9		0.90	3.0		0.47
7	J13W50	12/18/06	3.7		0.90	10.0		0.46
8	J13W56	12/18/06	15.2		0.96	47.3		0.49
9	J13W46	12/18/06	1.9		0.89	4.4		0.46
10	J13W47	12/18/06	3.6		0.90	10.3		0.46

Statistical Computation Input Data

Sample Location	HEIS Number	Sample Date	Arsenic mg/kg			Lead mg/kg		
6	J13W48/J13W49	12/18/06	3.1			10.4		
1	J13W53	12/18/06	4.3			11.3		
2	J13W51	12/18/06	6.9			24.5		
3	J13W52	12/18/06	1.7			4.2		
4	J13W54	12/18/06	5.2			9.9		
5	J13W55	12/18/06	1.9			3.0		
7	J13W50	12/18/06	3.7			10.0		
8	J13W56	12/18/06	15.2			47.3		
9	J13W46	12/18/06	1.9			4.4		
10	J13W47	12/18/06	3.6			10.3		

Statistical Computations

	Arsenic			Lead		
95% UCL value based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.			Large data set (n ≥ 10), use MTCAStat lognormal distribution.		
N	10			10		
% < Detection limit	0%			0%		
Mean	4.8			13.5		
Standard deviation	4.0			13.3		
95% UCL on mean	8.2			29.1		
Maximum detected value	15.2			47.3		
Statistical value	8.2			29.1		
Most Stringent Cleanup Limit for Nonradionuclide and RAG Type	20	Direct Exposure/ GW/River Protection		10.2	GW & River Protection	
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	NO			YES		
> 10% above Cleanup Limit?	NO			YES		
Any sample > 2X Cleanup Limit?	NO			YES		
WAC 173-340 Compliance? **Further evaluation required**	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.			Because of the "yes" answers to the 3-part test, additional site-specific evaluations will be performed. The data set meets the 3-part test criteria when compared to direct exposure cleanup level.		

'ashington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm ICaa **Date** 02/21/07 **Calc. No.** 0100F-CA-V0275 **Rev. No.** 0
Project Field Remediation **Job No.** 14655 **Checked** J. M. Capron JMC **Date** 2/22/07
Subject 1607-F3 Phase II Cleanup Verification 95% UCL Calculations **Sheet No.** 5 of 5

Ecology Software (MTCAStat) Results

DATA	ID	Arsenic 95% UCL Calculation				DATA	ID	Lead 95% UCL Calculation			
3.1	J13W48/J13W49					10.35	J13W48/J13W49				
4.3	J13W53					11.3	J13W53				
6.9	J13W51	Number of samples		Uncensored values		24.5	J13W51	er of samples		Uncensored values	
1.7	J13W52	Uncensored	10	Mean	4.8	4.2	J13W52	Uncensored	10	Mean	13.5
5.2	J13W54	Censored		Lognormal mean	4.7	9.9	J13W54	Censored		Lognormal mean	13.7
1.9	J13W55	Detection limit or PQL		Std. devn.	4.0	3.0	J13W55	limit or PQL		Std. devn.	13.3
3.7	J13W50	Method detection limit		Median	3.7	10.0	J13W50	etection limit		Median	10.2
15.2	J13W56	TOTAL	10	Min.	1.7	47.3	J13W56	TOTAL	10	Min.	3.0
1.9	J13W46			Max.	15.2	4.4	J13W46			Max.	47.3
3.6	J13W47					10.3	J13W47				
		Lognormal distribution?		Normal distribution?				Lognormal distribut		Normal distribution?	
		r-squared is:	0.928	r-squared is:	0.705			r-s	0.916	r-squared is:	0.690
		Recommendations:						Recommendations:			
		Use lognormal distribution.						Use lognormal distribution.			
		UCL (Land's method) is		8.2				UCL (Land's metho		29.1	

Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Arsenic			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL
6	J13W48	12/18/06	2.1		0.89	4.7		0.46
Duplicate of J13W48	J13W49	12/18/06	4.1		0.89	16.0		0.46

TDL		10	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)
	RPD		
	Difference >2xTDL?	No - acceptable	Yes - assess further

ATTACHMENT 1

Washington Closure Hanford

Originator K. A. Anselm KAA **Date** 02/21/07 **Calc. No.** 0100F-CA-V0275 **Rev. No.** 0
Project Field Remediation **Job No.** 14655 **Checked** J. M. Capron JMC **Date** 2/22/07
Subject 1607-F3 Phase II Cleanup Verification 95% UCL Calculations **Sheet No.** 1 of 1

1607-F3 Verification Sampling Results (Phase II Arsenic and Lead Data)

Sampling Area	HEIS Number	Sample Date	Arsenic			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL
6	J13W48	12/18/06	2.1		0.89	4.7		0.46
Duplicate of J13W48	J13W49	12/18/06	4.1		0.89	16.0		0.46
1	J13W53	12/18/06	4.3		0.88	11.3		0.45
2	J13W51	12/18/06	6.9		0.89	24.5		0.46
3	J13W52	12/18/06	1.7		0.89	4.2		0.46
4	J13W54	12/18/06	5.2		0.89	9.9		0.46
5	J13W55	12/18/06	1.9		0.90	3.0		0.47
7	J13W50	12/18/06	3.7		0.90	10.0		0.46
8	J13W56	12/18/06	15.2		0.96	47.3		0.49
9	J13W46	12/18/06	1.9		0.89	4.4		0.46
10	J13W47	12/18/06	3.6		0.90	10.3		0.46

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 files 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-F3 Waste Site Hazard Quotient and Carcinogenic Risk Calculations, 0100F-CA-V0264, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

CALCULATION COVER SHEET

Project Title Field Remediation **Job No.** 14655
Area 100-F
Discipline Environmental *__Calc. No.__ 0100F-CA-V0264
Subject 1607-F3 Waste Site Hazard Quotient and Carcinogenic Risk Calculations
Computer Program Excel **Program No.** Excel 2003

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

Committed Calculation ☒ **Preliminary** ☐ **Superseded** ☐ **Voided** ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 3 Total = 4	K. A. Anselm 2/21/07	J. M. Capron 2/22/07	T. M. Blakley 2/22/07	J. D. Fancher ~~S. W. Callison~~	2/28/07

SUMMARY OF REVISION

WCH-DE-018 (09/01/2006) * Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford CALCULATION SHEET

Originator:	K. A. Anselm KAA	Date:	02/21/07	Calc. No.:	0100F-CA-V0264	Rev.:	0
Project:	Field Remediation	Job No:	14655	Checked:	J. M. Capron JMC	Date:	2/22/07
Subject:	1607-F3 Waste Site Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk values for the 1607-F3 remediation verification sampling results. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2005), the following criteria must be met:

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

GIVEN/REFERENCES:

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

2) EPA, 1994, *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children*, EPA/540/R-93/081, Publication No. 9285.7-15-1, U.S. Environmental Protection Agency, Washington, D.C.

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

4) WCH, 2006, *1607-F3 Waste Site Cleanup Verification 95% UCL Calculations*, Calculation No. 0100F-CA-V0263, Rev. 0, Washington Closure Hanford, Richland, Washington.

5) WCH, 2007, *1607-F3 Phase II Cleanup Verification 95% UCL Calculations*, Calculation No. 0100F-CA-V0275, Rev. 0, Washington Closure Hanford, Richland, Washington.

SOLUTION:

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

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

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

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

Washington Closure Hanford CALCULATION SHEET

Originator:	K. A. Anselm KAA	Date:	02/21/07	Calc. No.:	0100F-CA-V0264	Rev.:	0
Project:	Field Remediation	Job No:	14655	Checked:	J. M. Capron JMC	Date:	2/22/07
Subject:	1607-F3 Waste Site Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	2 of 3

METHODOLOGY:

Hazard quotient and carcinogenic risk calculations for the 1607-F3 waste site were conservatively performed using the highest of the statistical/maximum values from all decision units for each analyte detected above background, as calculated in WCH (2006, 2007), and for each detected analyte where no background value is available. Of the contaminants of concern (COCs) and contaminants of potential concern (COPCs) for this site, those listed in Table 1 meet these criteria, except for arsenic. Arsenic was detected above the Hanford Site background value but below the *Washington Administrative Code* (WAC) 173-340 Method A cleanup level. Due to the intent of Method A cleanup values and the allowance to use such values for arsenic (DOE-RL 2005), arsenic has been excluded from the Method B individual analyte and cumulative risk requirements.

Of the metals listed in Table 1, boron requires the HQ calculations because it was detected and a Washington State or Hanford Site background value is not available, and lead and selenium are included because they were quantified above the Hanford Site or Washington State background values. The remainder of the COCs and COPCs listed in Table 1 are included because they were detected in one or more decision units by laboratory analysis and cannot be attributed to natural occurrence. All other nonradionuclide COCs and COPCs for this site were not detected or were detected below background levels and are not included. An example of the HQ and risk calculations in Table 1 is presented below:

1) For example, the maximum value for boron is 1.7 mg/kg, divided by the noncarcinogenic RAG value of 16,000 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 1.1×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculations are completed for the appropriate analytes, the cumulative HQ is obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The sum of the HQ values is 9.5×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess carcinogenic risk, the highest determined value for each carcinogenic analyte is divided by the carcinogenic RAG value, then multiplied by 1×10^{-6}. For example, the maximum value for chrysene is 0.022 mg/kg, divided by 137 mg/kg, and multiplied as indicated is 1.6×10^{-10}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess carcinogenic risk is obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual values prior to rounding are used for this calculation.) The sum of the excess carcinogenic risk values is 2.8×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

CONCLUSION:

This calculation demonstrates that the 1607-F3 waste site meets the requirements for hazard quotient and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2005).

Washington Closure Hanford CALCULATION SHEET

Originator:	K. A. Anselm Kaa	Date:	02/21/07	Calc. No.:	0100F-CA-V0264	Rev.:	0
Project:	Field Remediation	Job No:	14655	Checked:	J. M. Capron JMC	Date:	2/22/07
Subject:	1607-F3 Waste Site Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 3

RESULTS:

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

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 1607-F3 Waste Site.

COC/COPC	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.7	16,000	1.1E-04	--	--
Lead[c]	29	353	8.2E-02	--	--
Selenium	4.2	400	1.1E-02	--	--
Semivolatiles					
Benzo(a)pyrene	0.033	--	--	0.33[d]	1.0E-07
Benzo(k)fluoranthene	0.029	--	--	13.7	2.1E-09
Benzo(g,h,i)perylene[e]	0.023	2,400	9.6E-06	--	--
Chrysene	0.022	--	--	137	1.6E-10
Di-n-butylphthalate	0.12	8,000	1.5E-05	--	--
Indeno(1,2,3-cd) pyrene	0.022	--	--	1.37	1.6E-08
Pesticides					
Chlordane (alpha and gamma)	0.0036	40	9.0E-05	2.86	1.3E-09
DDE, 4,4'-	0.00049	--	--	2.94	1.7E-10
DDT, 4,4'-	0.00035	40	8.8E-06	2.94	1.2E-10
Polychlorinated Biphenyls					
Aroclor-1254	0.0034	1.6	2.1E-03	0.5	6.8E-09
Aroclor-1260	0.0035	--	--	0.5	7.0E-09
Volatiles					
Acetone	0.005	72,000	6.9E-08	--	--
Chloroform	0.001	800	1.3E-06	164	6.1E-12
Ethylbenzene	0.002	8,000	2.5E-07	--	--
Methylene chloride	0.043	4,800	9.0E-06	133	3.2E-10
Tetrachloroethene	0.002	800	2.5E-06	1.85	1.1E-09
Toluene	0.001	6,400	1.6E-07	--	--
Xylenes (total)	0.006	16,000	3.8E-07	--	--
Totals					
Cumulative Hazard Quotient:			**9.5E-02**		
Cumulative Excess Cancer Risk:					**2.8E-07**

[a] = From WCH 2006 or WCH 2007.

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

[c] = Value for the noncarcinogen RAG obtained from EPA (1994).

[d] = Cumulative carcinogenic risk calculated using the cleanup level of 0.137 mg/kg instead of the required detection limit, per WAC 173-340-740(3), Method B, 1996. Individual carcinogenic risk calculated using the required detection limit.

[e] = Toxicity data for this chemical are not available. RAGs for benzo(g,h,i)perylene are based on the surrogate chemical pyrene.

-- = not applicable

COC = contaminant of concern

COPC = contaminant of potential concern

RAG = remedial action goal