Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

11-AMRC-0092

FEB 22 2011

Mr. D. A. Faulk, Program Manager
Office of Environmental Cleanup
Hanford Project Office
U.S. Environmental Protection Agency
309 Bradley Boulevard, Suite 115
Richland, Washington 99352

Dear Mr. Faulk:

TRANSMITTAL OF THE APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 600-109, HANFORD TRAILER CAMP LANDFILL, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2010-075 and supporting "Remaining Sites Verification Package for the 600-109, Hanford Trailer Camp Landfill," Revision 0. If you have questions, please contact me or your staff may contact Jamie Zeisloft, of my staff, at (509) 372-0188.

Sincerely,

Mark S. French, Federal Project Director
for the River Corridor Closure Project

AMRC:JHZ

Attachment

cc w/attach:
C. J. Guzzetti, EPA
Administrative Record, H6-08

cc w/o attach:
S. L. Feaster, WCH
T. A. Foster, WCH
M. L. Proctor, WCH

Date Submitted: 11/08/2010 Originator: M. L. Proctor Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-IU-6 Waste Site Code: 600-109 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2010-075

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 600-109, Hanford Trailer Camp Landfill waste site was originally described as an area of surface debris within a gravel pit area. Debris that was observed on the surface included metal, glass, fabric, concrete, and rubber. Aerial photographs indicate that the 600-109 waste site was used as a solid waste landfill in support of the Hanford Construction Camp Trailer Park. From 1943 to 1945, domestic wastes were disposed of at this site. Historical documentation indicates that the landfill did not accept radiological or toxic dumping. The 600-109 waste site is identified as a remaining site for remediation in 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. Following an archaeological investigation, the 600-109 waste site was remediated from January to March 2010. The excavation was approximately 4.6 m (15 ft) deep in most areas with several places that were slightly deeper. The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility at the 200 Area of the Hanford 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 the 600-109 waste site to Interim Closed Out. The current site conditions achieve the remedial action goals (RAGs) established by the Remaining Sites ROD. The results of verification sampling 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 analytical results and rational presented also demonstrate that levels of residual contamination are protective of groundwater and the Columbia River. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 600-109 Hanford Trailer Camp Landfill* (attached). Residual waste site contamination originating from Hanford Site or Manhattan Project activities does not extend into the deep zone (below 4.6 m [15 ft] deep); therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep-zone soil are not required. Previous to the Manhattan Project, several orchards existed on the Hanford Site in the 100 Area. The 600-109 waste site is located within one of these known orchard areas. Lead and arsenic levels exceeding cleanup criteria exist only in the top 1 m (3 ft) of the waste site and this contamination has resulted from pesticide use in the orchards; therefore, lead and arsenic have been excluded as a site contaminants of potential concern, per the Tri-Party Agreement Change Notice TPA-CN-401 (dated December 6, 2010).

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.

M. S. French DOE Federal Project Director (printed)	Signature	1/31/11 Date
N/A Ecology Project Manager (printed)	Signature	Date
C. Guzzetti EPA Project Manager (printed)	Signature	2/1/11 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-109, HANFORD TRAILER CAMP LANDFILL

Attachment to Waste Site Reclassification Form 2010-075

November 2010

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-109, HANFORD TRAILER CAMP LANDFILL

EXECUTIVE SUMMARY

The 600-109, Hanford Trailer Camp Landfill waste site, located in the 100-IU-6 Operable Unit, was originally described as an area of surface debris within a gravel pit area. A large pile of river rock was located in the center of the pit area and the remainder of the site appeared to have been bulldozed and covered with clean soil. Debris that was observed on the surface included metal, glass, fabric, concrete, and rubber. The landfill was located within a former gravel pit and was approximately 3 to 6 m (10 to 20 ft) deep (BHI 1995).

Aerial photographs indicate that the 600-109 waste site was used as a solid waste landfill in support of the Hanford Construction Camp Trailer Park. From 1943 to 1945, domestic wastes were disposed of at this site. Historical documentation indicates that the landfill did not accept radiological or toxic dumping (Stenner et al. 1988). An archaeological investigation was performed at five zones of possible buried debris indicated by the geophysical survey performed at the 600-109 waste site in 2004. Test pits and trenches were excavated to establish profiles of the zones and characterize any buried debris.

Following an archaeological investigation and waste characterization sampling in September 2009, the 600-109 waste site was remediated from January to March 2010. The excavation was approximately 4.6 m (15 ft) deep in most areas with several places that were slightly deeper. Overburden material removed from the top of the waste site was placed into two stockpiles to be used as backfill material. Waste material and debris was placed in a staging pile area, which was then loaded out to the Environmental Restoration Disposal Facility (ERDF). Approximately 9,108 bank cubic meters (BCM) (11,913 bank cubic yards [BCY]) of material was removed from the excavation. Potential asbestos-containing material was secluded from the rest of the excavation, and was directly loaded into ERDF cans.

During excavation of the 600-109 waste site, large boulders were encountered and staged adjacent to the waste site near the staging pile area and on the floor of the excavation. It is envisioned that the boulders will be used to create a snake habitat in the northwest corner of the 600-109 excavation area.

Following remediation, verification sampling was conducted in June and July 2010. Verification sampling found elevated levels of lead and arsenic in the shallow soils of the waste site that are attributable to pre-Hanford orchard activities, and are not identified as Hanford Site contamination. In consideration of this, the verification sampling results indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs) established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). These results show that residual soil

concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow-zone soil (i.e., surface to 4.6 m [15 ft]), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River. 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 600-109 waste site in accordance with the TPA-MP-14 procedure (DOE-RL 2007). In accordance with this evaluation, the verification sampling results support a reclassification of this site to Interim Closed Out.

Residual waste site contamination originating from Hanford Site or Manhattan Project activities does not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required. Previous to the Manhattan Project, several orchards existed on the Hanford Site in the 100 Area. The 600-109 waste site is located within one of these known orchard areas. Lead and arsenic levels exceeding cleanup criteria exist only in the top 1 m (3 ft) of the waste site and this contamination has resulted from pesticide use in the orchards; therefore, lead and arsenic have been excluded as contaminants of potential concern, per the Tri-Party Agreement Change Notice TPA-CN-401 (dated December 6, 2010)

Table ES-1. Summary of Remedial Action Goals for the 600-109 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain 15-mrem/yr dose rate above background over 1,000 years.	Radionuclides were not COPCs for the 600-109 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria. Arsenic was detected above direct exposure criteria in the staging pile area footprint, but is attributable to historical orchards in the area. Therefore, arsenic has been excluded as a COPC (DOE-RL 2009b).	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for all sampling areas (1.5×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for hexavalent chromium, the only carcinogenic COPC detected above background levels, is 7.3×10^{-8}, which is $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The excess cancer risk for hexavalent chromium (7.3×10^{-8}), the only carcinogenic COPC detected above background levels, is $<1 \times 10^{-5}$.	

Table ES-1. Summary of Remedial Action Goals for the 600-109 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 600-109 waste site.	NA
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [a].		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 21.2 pCi/L [c].		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	All individual COPC concentrations are below the groundwater/river protection criteria, with the exception of lead and arsenic that are present only in the top 1 m (3 ft) of the waste site. This contamination originated from widespread applications of lead-arsenate pesticides in orchards, and both lead and arsenic are excluded as COPCs in the top 1 m (3 ft) of the waste site per Tri-Party Agreement Change Notice TPA-CN-401 (dated December 6, 2010). Residual lead concentrations in the base of the excavation, not attributable to pesticide application, are predicated to be protective of groundwater and the Columbia River.	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 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).
[d] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years (based on the distribution coefficient of lead of 30 mL/g). The vadose zone underlying the soil below the site is approximately 7.6 m (25 ft) thick. Therefore, residual concentrations of lead predicted to be protective of groundwater and the Columbia River.

COC = contaminant of concern
COPC = contaminant of potential concern
DOE = U.S. Department of Energy
MCL = maximum contaminant level
RAG = remedial action goal

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern, contaminants of potential concern, and other constituents. Those constituents exceeding the ecological screening level in the *Washington Administrative Code* Chapter 173-340, Table 749-3 were arsenic, boron, lead, and vanadium. U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, arsenic, lead,

manganese, vanadium, zinc. The results for antimony, manganese, vanadium, and zinc were below Hanford Site-wide background levels. No established background value is available for boron; a final cleanup level for boron, including consideration of background, will be established through the final remedial investigation/feasibility study process. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-109, HANFORD TRAILER CAMP LANDFILL

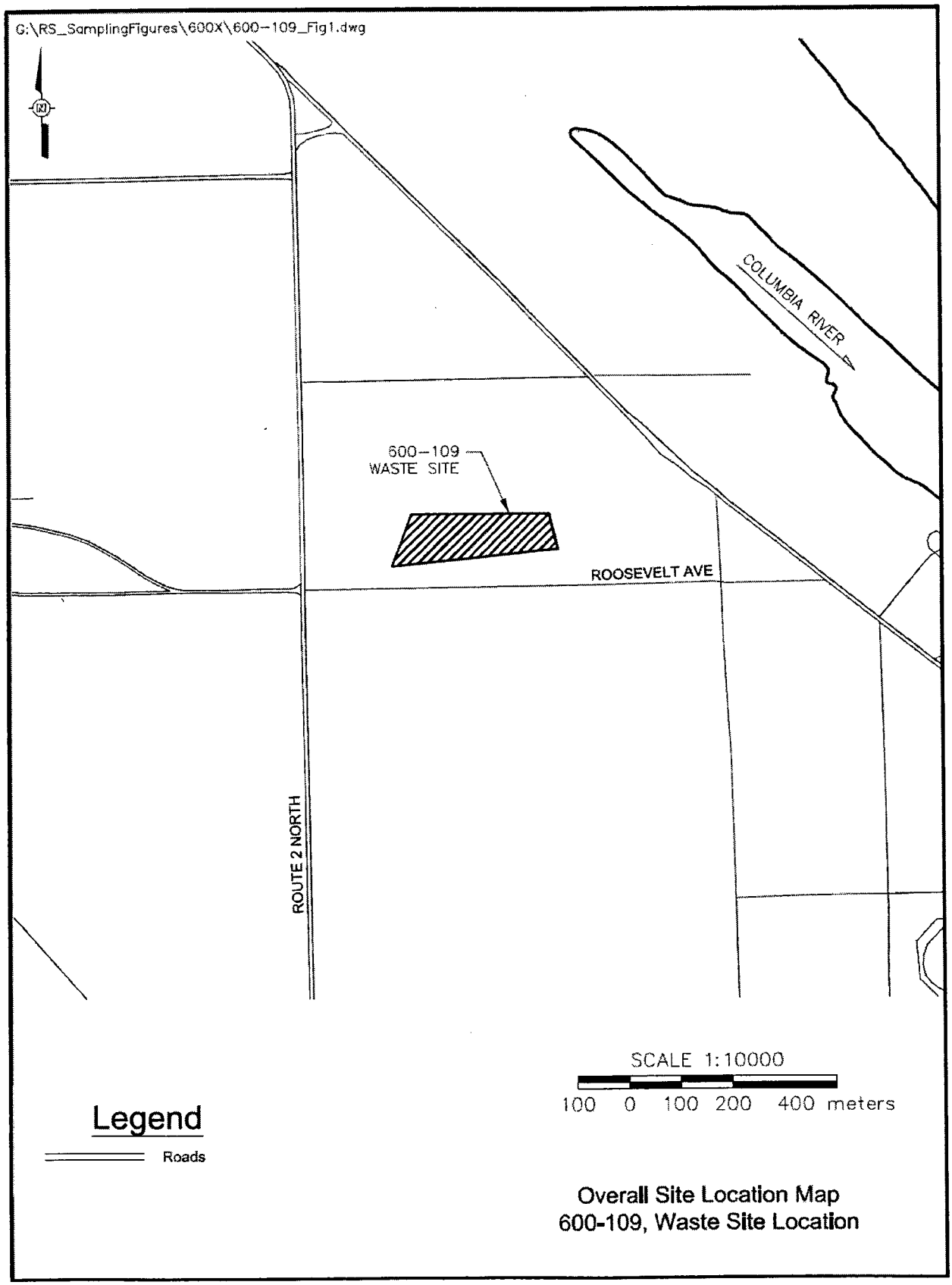
STATEMENT OF PROTECTIVENESS

The 600-109, Hanford Trailer Camp Landfill waste site verification sampling data, site evaluations, and supporting documentation demonstrate that this site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations originating from Hanford Site or Manhattan Project activities support unrestricted future use of shallow-zone soil (i.e., surface to 4.6 m [15 ft]) and that such contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Residual contamination from the 600-109 waste site did not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

GENERAL SITE INFORMATION AND BACKGROUND

The 600-109 waste site, located in the 100-IU-6 Operable Unit, east of Route 2 North and north of Roosevelt Avenue, was originally described as an area of surface debris within a gravel pit area (Figure 1). Aerial photographs indicate that the 600-109 waste site was used as a solid waste landfill in support of the Hanford Construction Camp Trailer Park. Domestic wastes were disposed of at this site from 1943 to 1945. A large pile of river rock was located in the center of the pit area and the remainder of the site appeared to have been bulldozed and covered with clean soil. Debris observed on the surface of the waste site included metal, glass, fabric, concrete, and rubber. Historical documentation indicates that the landfill did not accept radiological or toxic dumping (Stenner et al. 1988).

Figure 1. The 600-109 Waste Site Location Map.



Historic orchards were present in this area prior to the Hanford Construction Camp (BHI 1999). Historical orchard sites are not identified as waste sites in the Remaining Sites ROD. More specifically, the distribution of concentrations of lead and arsenic at the 600-109 waste site indicate that the surface soil in this area was contaminated with lead-arsenate pesticides, while deeper portions near the base of the excavation have lower concentrations of these constituents. In support of the location of the historic orchards near the 600-109 waste site, x-ray fluorescence (XRF) measurements were taken on soils surrounding the area, and are indicative of higher lead and arsenic concentrations in shallow soils outside of the boundary of the 600-109 waste site (Appendix A). Documentation and photographs supporting the location of these orchard lands are provided in Appendix B. The provided map of the Hanford Site orchard areas in 1943 indicates that the 600-109 waste site is located in the Hanford Platted Lands area.

Geophysical Survey

A geophysical survey was performed on the 600-109 waste site in 2004 (BHI 2004). Minimal surface debris was found; however, there were five large zones displaying high concentrations of possible buried debris (Figure 2). The majority of the debris appeared to be buried within a 120- by 200-m (394- by 656-ft)-area within the 600-109 waste site boundary.

Site Walkdown

A site walkdown was performed in April 2004, and indicated three specific locations with buried debris. These included the northwest side of the gravel pit, the north edge of the gravel pit, and the southeast corner of the gravel pit. A second site walkdown was performed in February 2004 in preparation for remedial action activities.

Archaeological Investigation

In September 2009, an archaeological investigation was performed at the five zones of possible buried debris indicated by the geophysical survey performed at the 600-109 waste site. Test pits and trenches were excavated to establish profiles of the zones and characterize any buried debris (Figure 3). Several trenches in the lettered areas were not delineated. On September 23, 2009, waste characterization samples were collected from the surface soil of the backfilled trenches after the archaeological investigation was complete. These sample results are provided in Appendix A. Due to potential non-friable asbestos fragments identified on the surface at trench B-1 and trench areas C and G, waste characterization samples were not collected at these areas.

REMEDIATION ACTION SUMMARY

Based on the site walkdown, geophysical survey, and observations during the archaeological investigation of the 600-109 waste site, confirmatory sampling was determined to be unnecessary, and the waste site was recommended for Remove, Treat, and Dispose (RTD). Remediation occurred from January to March, 2010.

Figure 2. The 600-109 Geophysical Interpretation Map.

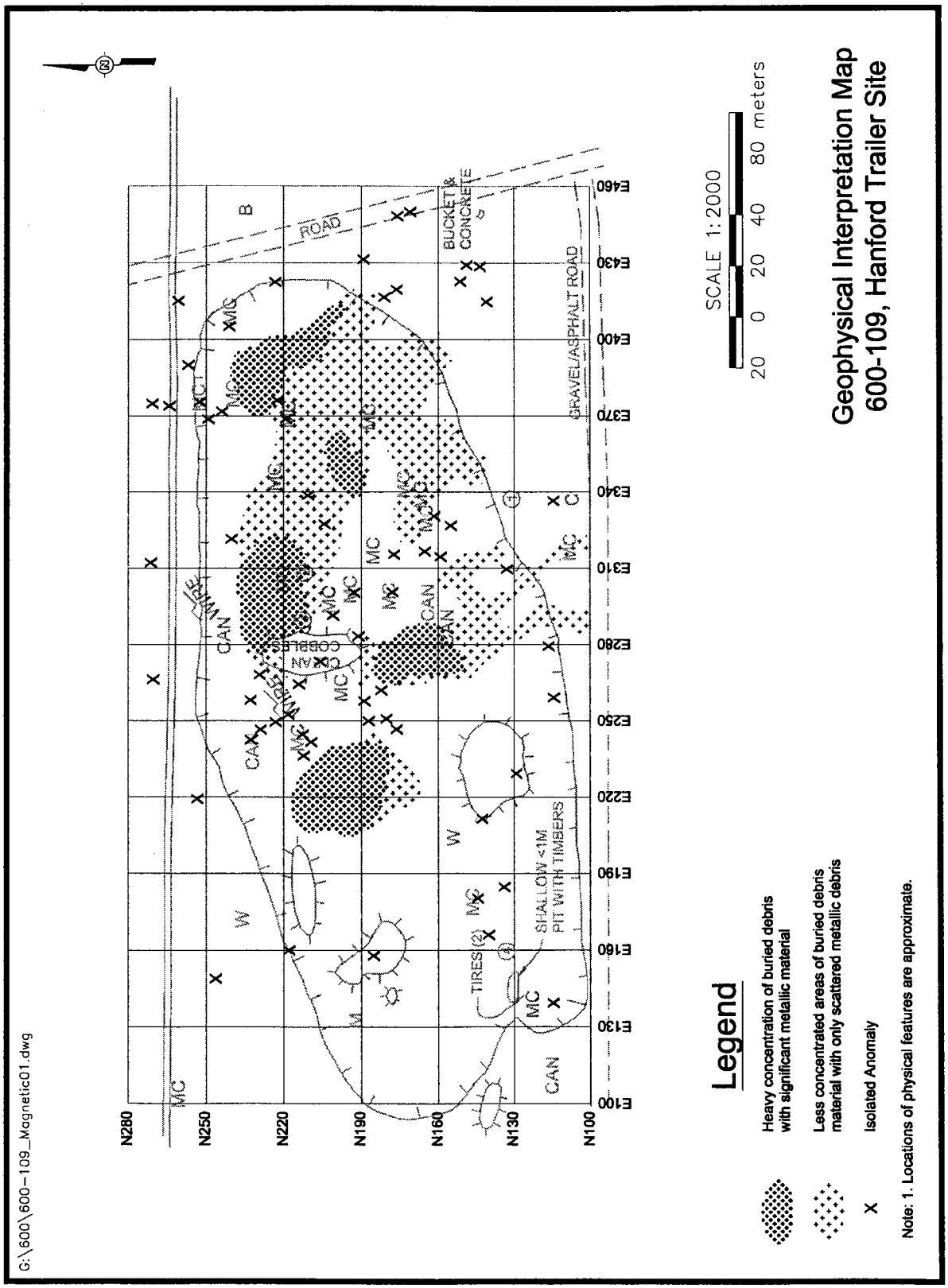


Figure B-5. Graphite Found at the 600-109 Waste Site.

Figure B-6. Yellow Powder Found at the 600-109 Waste Site.

Figure B-7. The 600-109 Waste Site Loadout.

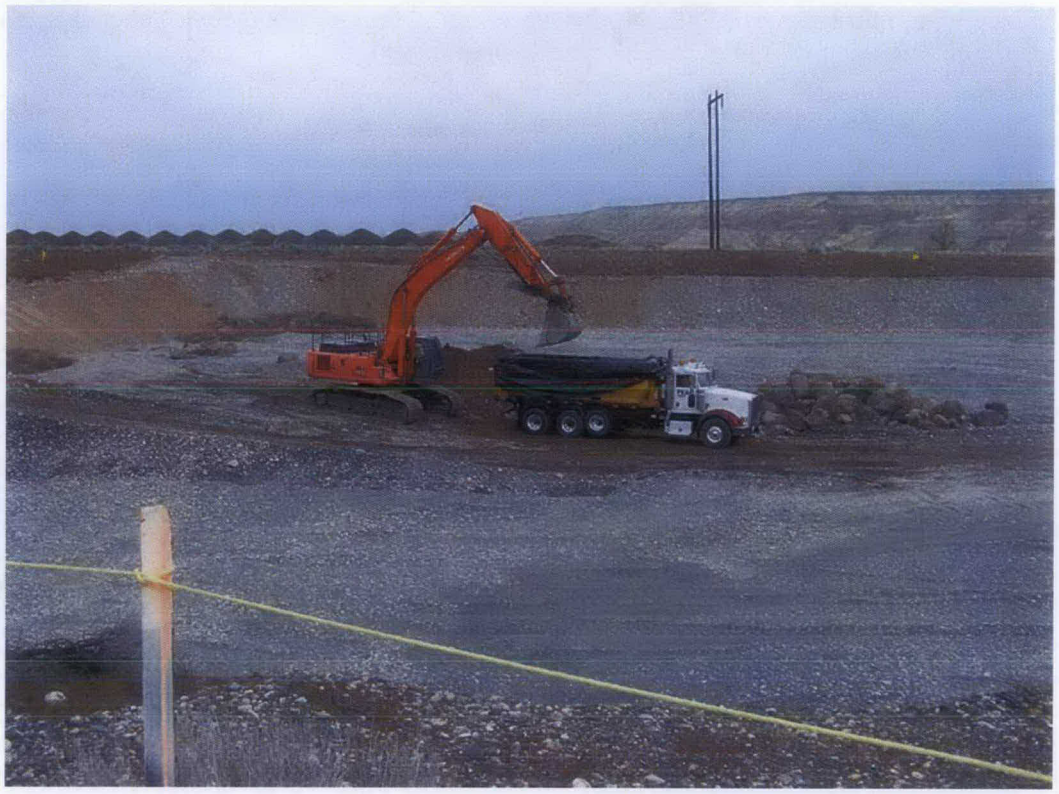


Figure B-8. Boulders at the 600-109 Waste Site.

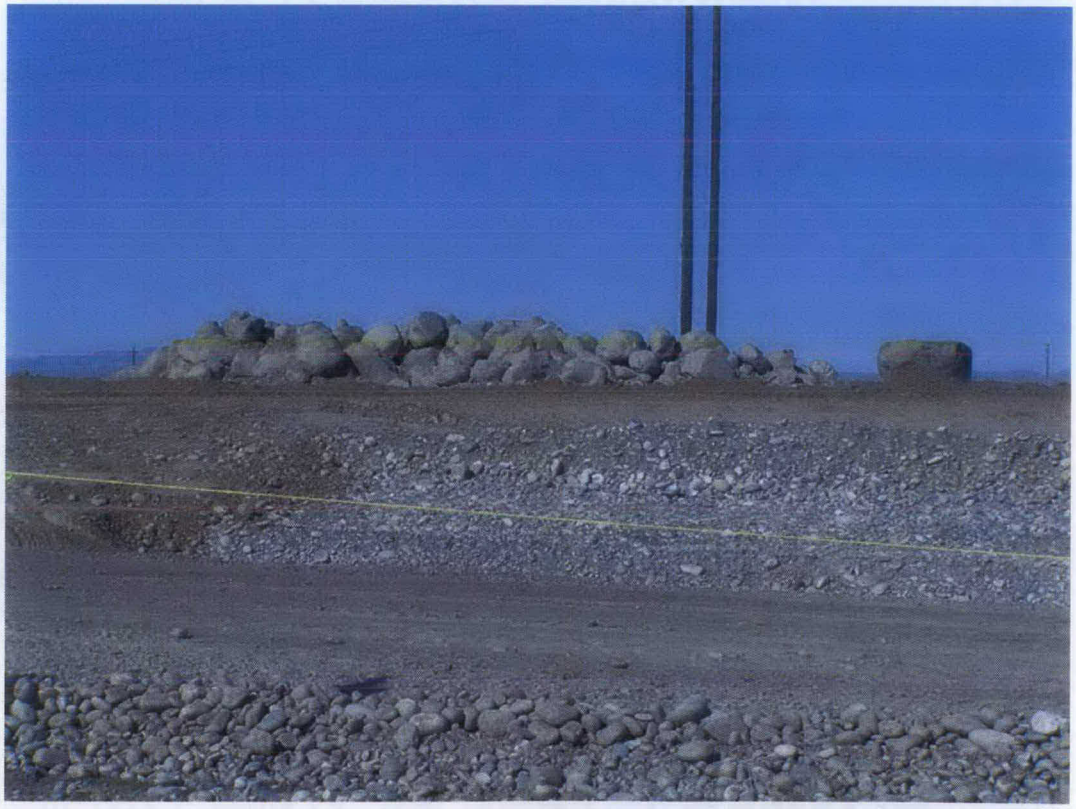


Figure 4. The 600-109 Excavation In-Process Sample Locations.

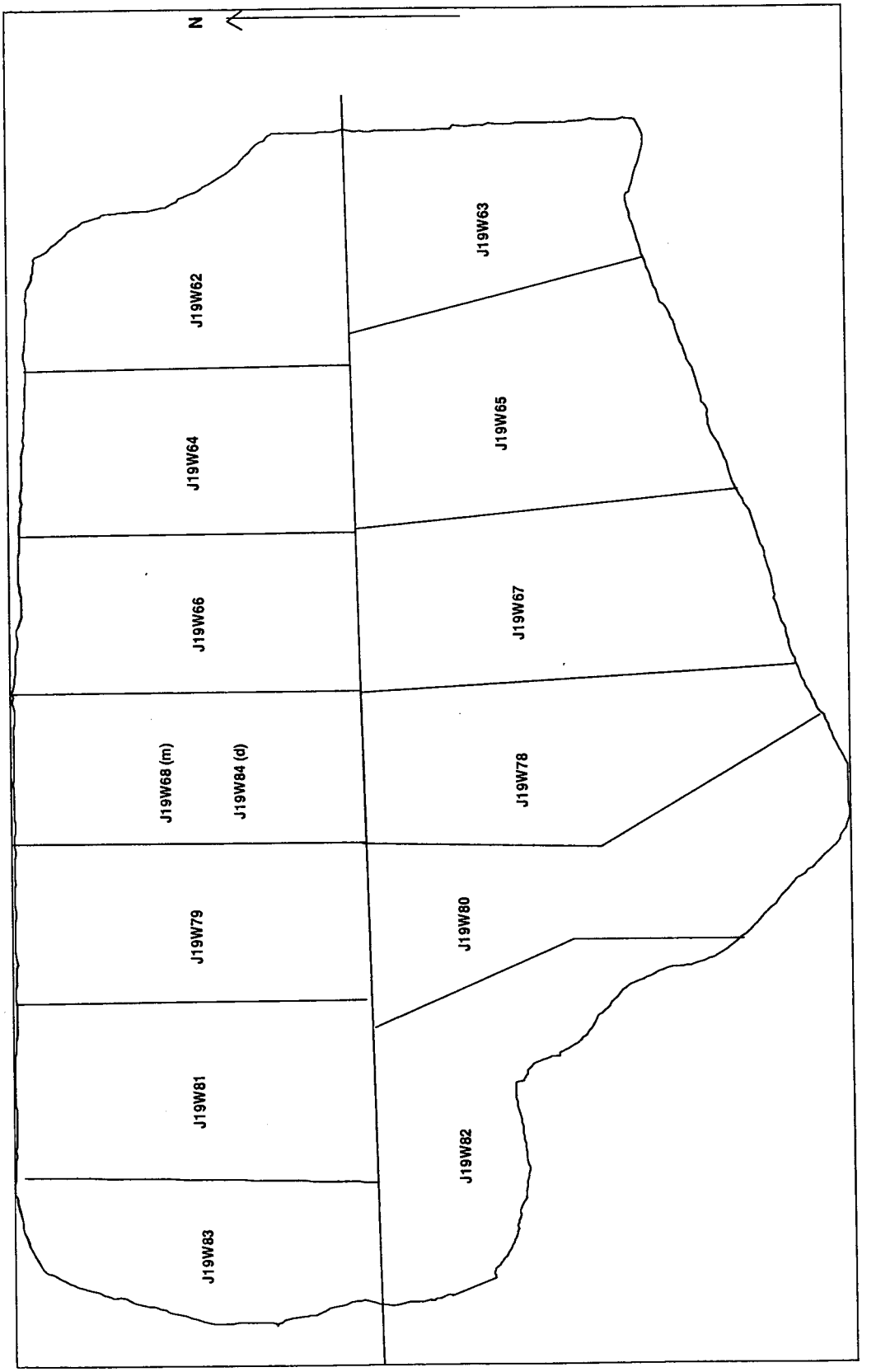


Table 1. 600-109 Waste Characterization and In-Process Sample Summary.

Waste Characterization Samples			
HEIS Number	**Sample Date**	**Location**	**Sample Type**
J19758	9/23/2009	Trenches A-1 and A-2	Soil aliquots
J19763	9/23/2009	Trenches A-1 and A-2	Duplicate of J19758
J19760	9/23/2009	Trenches B-2 and B-3	Soil aliquots
J19759	9/23/2009	Trenches D-1 and D-2	Soil aliquots
J19761	9/23/2009	Trenches E-1 through E-4	Soil aliquots
In-Process Samples			
HEIS Number	**Sample Date**	**Location**	**Sample Type**
J19W62	4/16/2010	Excavation	Soil aliquots
J19W63	4/16/2010	Excavation	Soil aliquots
J19W64	4/16/2010	Excavation	Soil aliquots
J19W65	4/16/2010	Excavation	Soil aliquots
J19W66	4/16/2010	Excavation	Soil aliquots
J19W67	4/16/2010	Excavation	Soil aliquots
J19W68	4/16/2010	Excavation	Soil aliquots
J19W84	4/16/2010	Excavation	Duplicate of J19W68
J19W78	4/16/2010	Excavation	Soil aliquots
J19W79	4/16/2010	Excavation	Soil aliquots
J19W80	4/16/2010	Excavation	Soil aliquots
J19W81	4/16/2010	Excavation	Soil aliquots
J19W82	4/16/2010	Excavation	Soil aliquots
J19W83	4/16/2010	Excavation	Soil aliquots
J19W85	4/16/2010	Excavation	Soil aliquots

HEIS = Hanford Environmental Information System

Contaminants of Potential Concern

The contaminants of potential concern (COPCs) for the 600-109 waste site were preliminarily identified in the 100 Area RDR/RAWP, and subsequently revised based on field observations during remediation, the results of waste characterization, and the results of in-process sampling (Appendix A). The COPCs listed in the RDR/RAWP are polychlorinated biphenyls (PCBs), pesticides, semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), asbestos, silver, cadmium, barium, total chromium, hexavalent chromium, mercury, and selenium. Although identified as a COPC in the verification work instruction, lead has been excluded as a COPC in the top 1 m (3 ft) of this waste site due to pre-Manhattan Project era orchards in this location per Tri-Party Agreement Change Notice TPA-CN-401 (dated December 6, 2010). Arsenic also has been excluded as a COPC in the top 1 m (3 ft) due to the presence of pre-Manhattan Project era orchards.

Mercury, PCBs, herbicides, VOCs, and SVOCs were all undetected during waste characterization sampling; therefore, all were eliminated as COPCs. Chlorinated organic pesticides were detected below the RAGs during waste characterization sampling and were undetected during in-process sampling; therefore, pesticides were eliminated as COPCs.

Hexavalent chromium was undetected during in-process sampling and was eliminated as a COPC.

Because TPH was not analyzed for during either sampling phase, it was retained as a COPC. Lead and polycyclic aromatic hydrocarbons were detected during waste characterization and in-process sampling, and were included as COPCs. Because potential ACM was found during remediation and samples were not collected for asbestos analysis, asbestos was retained as a COPC for verification sampling. However, because asbestos was separated from the remainder of the excavation and was not included in the staged waste, it was a COPC only at the focused sample locations where asbestos was found.

Barium, cadmium, total chromium, selenium, and silver were undetected or detected at less than the RAGs during waste characterization and in-process sampling; therefore, they were not considered COPCs. However, analysis for the constituents of the inductively coupled plasma (ICP) metals list included antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc. The COPCs for verification sampling and the laboratory analytical methods are identified in Table 2.

Table 2. 600-109 Laboratory Analytical Methods.

Analytical Method	Contaminant of Potential Concern
ICP metals [a] – EPA Method 6010	Lead[b]
PAH – EPA Method 8310	PAHs
TPH – EPA Method NWTPH-Dx	Total petroleum hydrocarbons
Bulk asbestos – NIOSH Method 7400	Asbestos

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

[b] Although identified in the verification work instruction as a COPC, lead has been excluded from evaluation in the top 1 m (3 ft) of this waste site, due to the presence of historic orchards in this location per Tri-Party Agreement Change Notice TPA-CN-401 (dated December 6, 2010).

EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma
NIOSH = National Institute of Occupational Safety and Health
NWTPH-Dx = Northwest total petroleum hydrocarbons – diesel range organics
PAH = polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons

Verification Sample Design

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples that were collected. All sampling was performed in accordance with the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). Professional judgment and the laboratory results of waste characterization and in-process sampling were used to develop the verification sampling design for the 600-109 waste site. A statistical sampling design was used to collect 12 statistical verification soil samples from each of the 3 decision units as shown in Table 3. Additionally, three focused samples were collected at the locations where asbestos was observed in the excavation. The footprint of the excavated area, staging pile areas, overburden piles, boulder staging area, and associated verification sampling locations are shown in Figure 5.

The excavation floor of the areas is at a depth of 4.6 m (15 ft) bgs, and the vadose beneath the excavation is approximately 7.6 m (25 ft) thick.

Table 3. 600-109 Verification Sampling Summary Table.

Sample Location	HEIS Number	Washington State Plane Coordinates		Sample Analysis
		Northing (m)	Easting (m)	
EX-1	J1B969	140092.2	584712.2	ICP metals [a], PAH, TPH
EX-2	J1B970	140110.9	584756.4	
EX-3	J1B971	140129.5	584800.7	
EX-4	J1B972	140121.2	584673.9	
EX-5	J1B973	140139.9	584718.2	
EX-6	J1B974	140158.5	584762.4	
EX-7	J1B975	140177.1	584806.7	
EX-8	J1B976	140150.2	584635.7	
EX-9	J1B977	140168.9	584679.9	
EX-10	J1B978	140187.5	584724.2	
EX-11	J1B979	140206.1	584768.4	
EX-12	J1B980	140197.9	584641.7	
Duplicate of EX-12	J1B981	140197.9	584641.7	
SPA-1	J1B989	140089.2	584473.4	
SPA-2	J1B990	140113.8	584499.9	
SPA-3	J1B991	140138.5	584526.4	
SPA-4	J1B992	140075.3	584412.4	
SPA-5	J1B993	140099.9	584438.9	
SPA-6	J1B994	140124.5	584465.4	
SPA-7	J1B995	140149.1	584491.9	
SPA-8	J1B996	140135.1	584430.8	
SPA-9	J1B997	140159.8	584457.3	
SPA-10	J1B998	140170.4	584422.7	
SPA-11	J1B999	140195.0	584449.2	
SPA-12	J1B9B0	140181.1	584388.2	
Duplicate of SPA-11	J1B9B1	140195.0	584449.2	
OB-1	J1B982	NA	NA	
OB-2	J1B983	NA	NA	
OB-3	J1B984	NA	NA	
OB-4	J1B986	NA	NA	ICP metals [a], PAH, TPH
Duplicate of OB-3	J1B987	NA	NA	
FS-1	J1B9B2	140178.5	584642.7	Asbestos
FS-2	J1B9B3	140176.7	584709.6	
FS-3	J1B9B4	140185.3	584745.2	
Boulder Soil Sample	J1B988	NA	NA	ICP metals [a], PAH, TPH
Equipment blank	J1B985	NA	NA	ICP metals [a]

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

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons

Figure B-9. Historic Orchard Locations (1943).

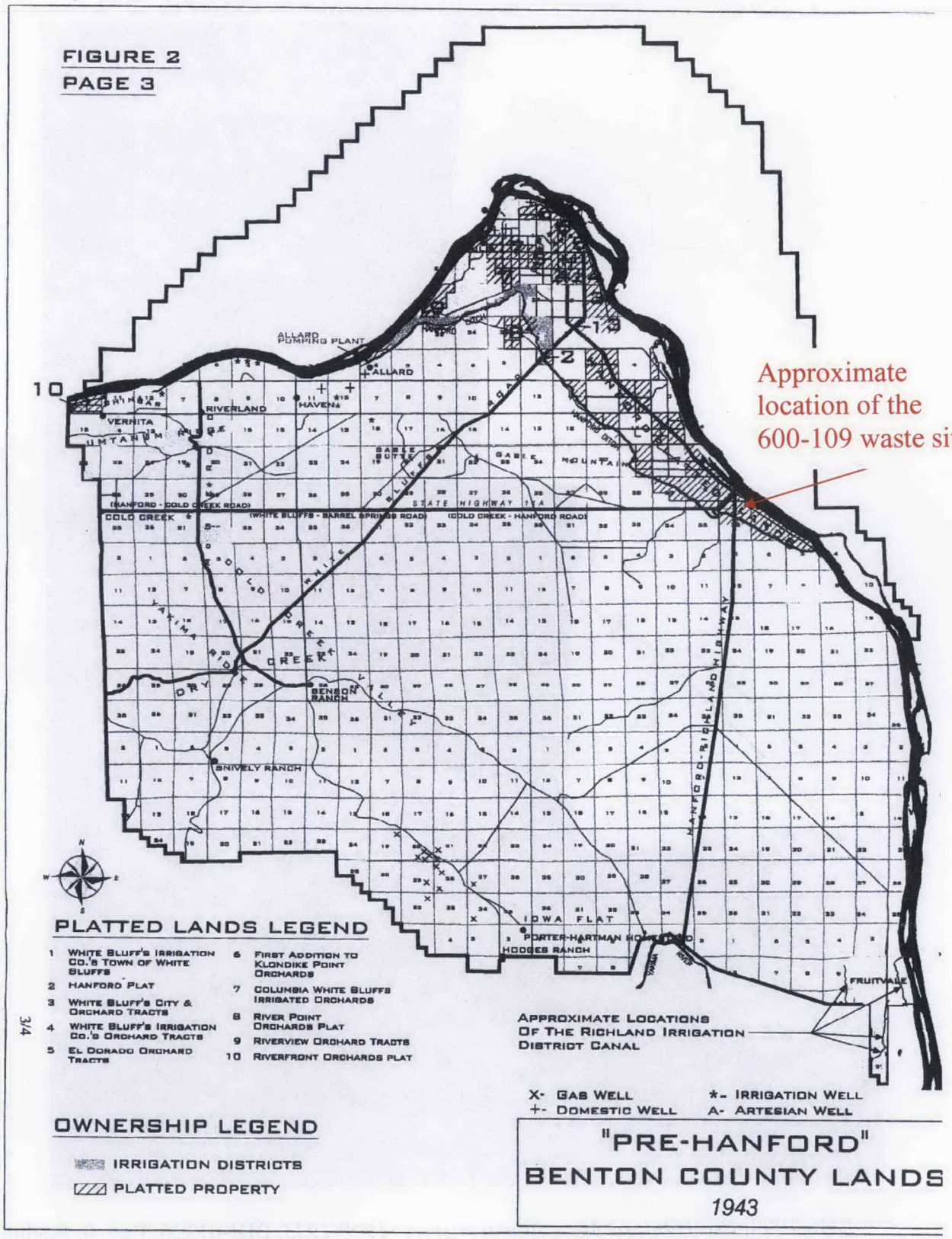


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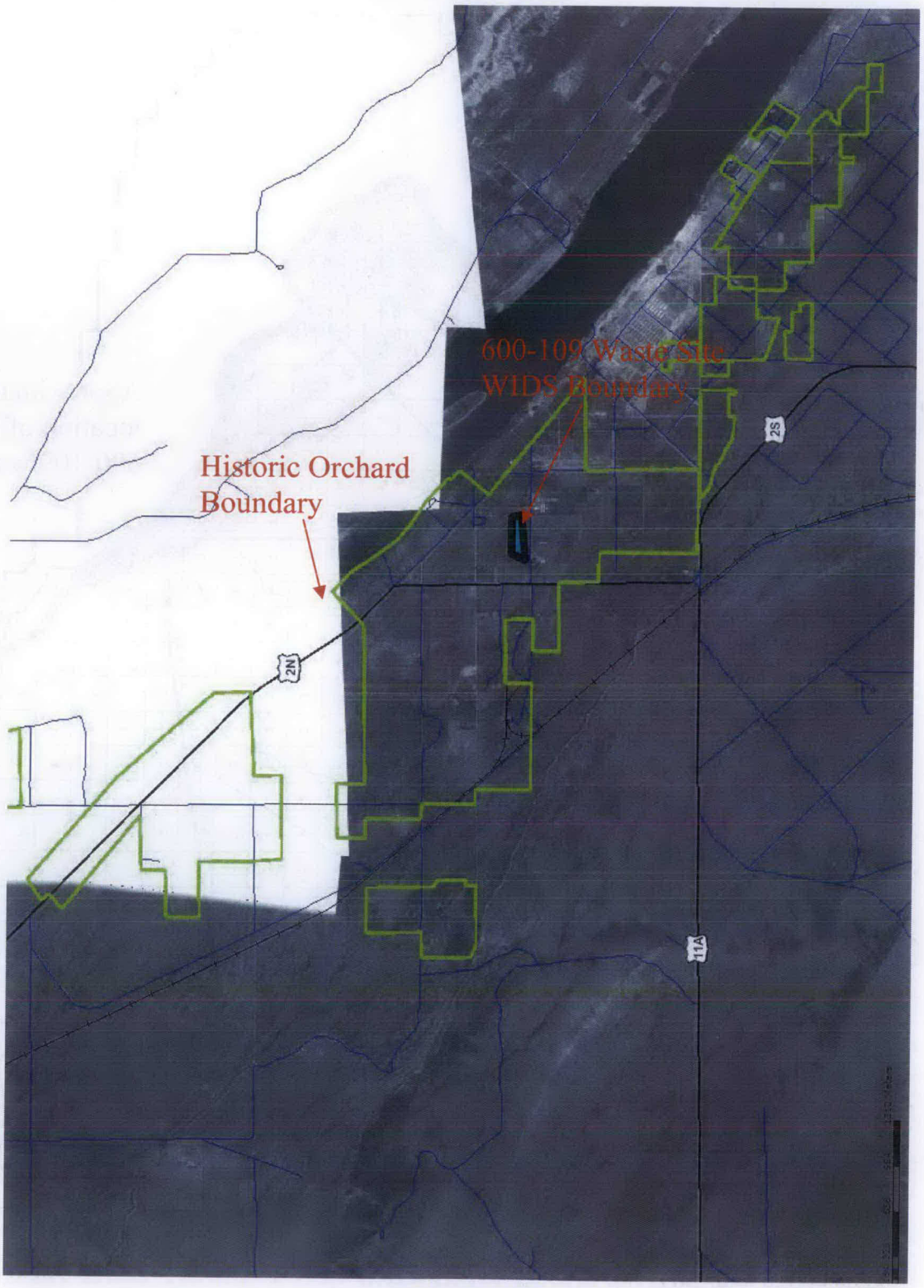
Figure B-10. Historic Orchard Locations and 600-109 Waste Site[a].



[a] BHI, 1999, *Pre-Hanford Agricultural History: 1900-1943*, BHI-01326, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Table 4. Comparison of Statistical Contaminant Concentrations to Remedial Action Goals for the 600-109 Excavation Footprint Verification Sampling Data. (2 Pages)

COPC	Statistical Result [b] (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Zinc	52.7 (<BG)	24,000	480	67.8 [c]	No	--
TPH – motor oil	17.1	200	200	200	No	--
Anthracene	0.00144	24,000	240	1,920	No	--
Benzo(a)anthracene	0.00616	1.37	0.015 [i]	0.015 [i]	No	--
Benzo(a)pyrene	0.00564	0.137	0.015 [i]	0.015 [i]	No	--
Benzo(b)fluoranthene	0.0102	1.37	0.015 [i]	0.015 [i]	No	--
Benzo(ghi)perylene [j]	0.00444	2,400	48	192	No	--
Benzo(k)fluoranthene	0.00379	1.37	0.015 [i]	0.015 [i]	No	--
Chrysene	0.00639	13.7	0.12	0.1 [i]	No	--
Fluoranthene	0.00916	3,200	64	18.0	No	--
Fluorene	0.00159	3,200	64	260	No	--
Indeno(1,2,3-cd)pyrene	0.0151	1.37	0.33 [i]	0.33 [i]	No	--
Phenanthrene [j]	0.00243	24,000	240	1,920	No	--
Pyrene	0.00300	2,400	48	192	No	--

[a] RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix B.
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700[4][d](1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[d] 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/m3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2009) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[g] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[h] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years (based on the distribution coefficient of lead of 30 mL/g). The vadose zone underlying the soil below the site is approximately 7.6 m (25 ft) thick. Therefore, residual concentrations of lead predicted to be protective of groundwater and the Columbia River.
[i] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2)(Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid turnaround analyses. Prior notification and concurrence with the laboratory may be necessary to analyze to meet this RDL. Actual detection limits may differ from any RDL.
[j] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: Contaminant: benzo(ghi)perylene, surrogate: pyrene; phenanthrene, surrogate: anthracene.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Table 5. Comparison of Statistical Contaminant Concentrations to Remedial Action Goals for the 600-109 Staging Pile Area Footprint Verification Sampling Data. (2 Pages)

COPC	Statistical Result[b] (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.772 (<BG)	32	5[c]	5[c]	No	--
Arsenic	27.2	20[c]	20[c]	20[c]	Yes	Yes[d]
Barium	95.2 (<BG)	5,600	200	400	No	--
Beryllium	0.282 (<BG)	10.4[e]	1.51[c]	1.51[c]	No	--
Boron[f]	2.16	7,200	320	--[g]	No	--
Cadmium[h]	0.177 (<BG)	13.9[e]	0.81[c]	0.81[c]	No	--
Chromium (total)	11.2 (<BG)	80,000	18.5[c]	18.5[c]	No	--
Cobalt	7.76 (<BG)	24	15.7[c]	--[g]	No	--
Copper	14.4 (<BG)	2,960	59.2	22.0[c]	No	--
Lead	141	353	10.2[c]	10.2[c]	Yes	Yes[d]
Manganese	360 (<BG)	3,760	512[c]	512[c]	No	--
Molybdenum[f]	0.459	400	8	--[g]	No	--
Nickel	10.4 (<BG)	1,600	19.1[c]	27.4	No	--
Vanadium	53.4 (<BG)	560	85.1[c]	--[g]	No	--
Zinc	67.2 (<BG)	24,000	480	67.8[c]	No	--
TPH – motor oil	39.7	200	200	200	No	--
TPH – diesel range	19.2	200	200	200	No	--
Acenaphthene	0.0300	4,800	96	129	No	--
Anthracene	0.00212	24,000	240	1,920	No	--
Benzo(a)anthracene	0.00265	1.37	0.015[j]	0.015[j]	No	--
Benzo(a)pyrene	0.00331	0.137	0.015[j]	0.015[j]	No	--
Benzo(b)fluoranthene	0.00501	1.37	0.015[j]	0.015[j]	No	--
Benzo(ghi)perylene[i]	0.0110	2,400	48	192	No	--
Benzo(k)fluoranthene	0.00195	1.37	0.015[j]	0.015[j]	No	--
Dibenz[a,h]anthracene	0.00151	1.37	0.03[j]	0.03[j]		
Fluoranthene	0.0112	3,200	64	18.0	No	--
Indeno(1,2,3-cd)pyrene	0.0216	1.37	0.33[j]	0.33[j]	No	--
Phenanthrene[i]	0.00429	24,000	240	1,920	No	--

Table 5. Comparison of Statistical Contaminant Concentrations to Remedial Action Goals for the 600-109 Staging Pile Area Footprint Verification Sampling Data. (2 Pages)

COPC	Statistical Result[b] (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Pyrene	0.00261	2,400	48	192	No	--

[a] RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] 95% upper confidence limit or maximum value, depending on data censorship, as described in Appendix B.
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700[4][d](1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[d] Due to historical orchards present in this area and residual concentrations of arsenic and lead exceeding RAGs not extending below 1 m (3 ft) bgs, arsenic is excluded as a COPC for the 600-109 waste site staging pile area footprint per Tri-Party Agreement Change Notice TPA-CN-401 (dated December 6, 2010).
[e] 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 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[f] No Hanford Site-specific or Washington State background value available.
[g] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2009) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[h] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[i] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: Contaminant: benzo(ghi)perylene, surrogate: pyrene; phenanthrene, surrogate: anthracene.
[j] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2)(Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid turnaround analyses. Prior notification and concurrence with the laboratory may be necessary to analyze to meet this RDL. Actual detection limits may differ from any RDL.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Table 6. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-109 Overburden Verification Sampling Data.

COPC	Maximum Result (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	15.3	20[b]	20[b]	20[b]	No	--
Barium	99.0 (<BG)	5,600	200	400	No	--
Beryllium	0.312 (<BG)	10.4[c]	1.51[b]	1.51[b]	No	--
Boron[d]	2.53	7,200	320	--[e]	No	--
Cadmium[f]	0.191 (<BG)	13.9[c]	0.81[b]	0.81[b]	No	--
Chromium (total)	13.3 (<BG)	80,000	18.5[b]	18.5[b]	No	--
Cobalt	7.52 (<BG)	24	15.7[b]	--[e]	No	--
Copper	12.0 (<BG)	2,960	59.2	22.0[b]	No	--
Lead	71.9	353	10.2[b]	10.2[b]	Yes	Yes[g]
Manganese	354 (<BG)	3,760	512[b]	512[b]	No	--
Molybdenum[d]	0.233	400	8	--[e]	No	--
Nickel	10.8 (<BG)	1,600	19.1[b]	27.4	No	--
Vanadium	54.5 (<BG)	560	85.1[b]	--[e]	No	--
Zinc	52.8 (<BG)	24,000	480	67.8[b]	No	--
TPH – motor oil	26.6	200	200	200	No	--
Acenaphthene	0.00600	4,800	96	129	No	--
Benzo(a)anthracene	0.00180	1.37	0.015[h]	0.015[h]	No	--
Benzo(a)pyrene	0.00204	0.137	0.015[h]	0.015[h]	No	--
Benzo(b)fluoranthene	0.00245	1.37	0.015[h]	0.015[h]	No	--
Benzo(ghi)perylene[i]	0.00359	2,400	48	192	No	--
Benzo(k)fluoranthene	0.00132	1.37	0.015[h]	0.015[h]	No	--
Chrysene	0.00231	13.7	0.12	0.1[h]	No	--
Fluoranthene	0.0140	3,200	64	18.0	No	--
Phenanthrene[i]	0.00266	24,000	240	1,920	No	--
Pyrene	0.00357	2,400	48	192	No	--

[a] RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700[4][d](1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[c] 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/m3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[d] No Hanford Site-specific or Washington State background value available.
[e] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2009) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[f] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[g] Due to historical orchards present in this area (Appendix A), lead is excluded from the statistical evaluation for the 600-109 waste site per Tri-Party Agreement Change Notice TPA-CN-401 (dated December 6, 2010).
[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2)(Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid turnaround analyses. Prior notification and concurrence with the laboratory may be necessary to analyze to meet this RDL. Actual detection limits may differ from any RDL.
[i] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: Contaminant: benzo(ghi)perylene, surrogate: pyrene; phenanthrene; surrogate: anthracene.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Table 7. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-109 Boulder Soil Verification Sampling Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	6.07 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	84.5 (<BG)	5,600	200	400	No	--
Beryllium	0.269 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Boron [d]	1.70	7,200	320	-- [e]	No	--
Cadmium [f]	0.113 (<BG)	13.9 [c]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	10.9 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	7.34 (<BG)	24	15.7 [b]	-- [e]	No	--
Copper	16.4 (<BG)	2,960	59.2	22.0 [b]	No	--
Lead	24.7	353	10.2 [b]	10.2 [b]	Yes	Yes [g]
Manganese	307 (<BG)	3,760	512 [b]	512 [b]	No	--
Molybdenum [d]	0.190	400	8	-- [e]	No	--
Nickel	10.6 (<BG)	1,600	19.1 [b]	27.4	No	--
Vanadium	52.5 (<BG)	560	85.1 [b]	-- [e]	No	--
Zinc	45.6 (<BG)	24,000	480	67.8 [b]	No	--
TPH – motor oil	6.95	200	200	200	No	--
Anthracene	0.000882	24,000	240	1,920	No	--
Chrysene	0.00295	13.7	0.12	0.1 [h]	No	--
Fluoranthene	0.00746	3,200	64	18.0	No	--
Phenanthrene [i]	0.00611	24,000	240	1,920	No	--
Benzo(a)anthracene	0.00476	1.37	0.015 [h]	0.015 [h]	No	--
Benzo(a)pyrene	0.00305	0.137	0.015 [h]	0.015 [h]	No	--
Benzo(b)fluoranthene	0.00238	1.37	0.015 [h]	0.015 [h]	No	--
Benzo(ghi)perylene [i]	0.00306	2,400	48	192	No	--
Benzo(k)fluoranthene	0.00112	1.37	0.015 [h]	0.015 [h]	No	--

Table 7. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-109 Boulder Soil Verification Sampling Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Pyrene	0.00837	2,400	48	192	No	--

[a] Lookup values and RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700[4][d](1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[c] 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/m3 (WDOH 1997).
[d] No Hanford Site-specific or Washington State background value available.
[e] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2009) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[f] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[g] Due to historical orchards present in this area (Appendix A), lead is excluded from the statistical evaluation for the 600-109 waste site per Tri-Party Agreement Change Notice TPA-CN-401 (dated December 6, 2010).
[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2)(Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid turnaround analyses. Prior notification and concurrence with the laboratory may be necessary to analyze to meet this RDL. Actual detection limits may differ from any RDL.
[i] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: Contaminant: benzo(ghi)perylene, surrogate: pyrene; phenanthrene, surrogate: anthracene.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
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DATA EVALUATION

Nonradionuclides

Tables 4 through 7 compare the cleanup verification sample values to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. All cleanup verification data values pass in direct comparison to the applicable RAGs. Arsenic is not considered a COPC for the 600-109 waste site, because the residual concentrations of this analyte did not exceed the RAGs below 1 m (3 ft) bgs. Additionally, residual concentrations of lead were not used in the evaluation of this waste site in the top 1 m (3 ft) of the waste site. Lead concentrations exceeded groundwater and river protection RAGs in the base of the excavation. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years (based on the distribution coefficient of lead of 30 mL/g). The vadose zone underlying the soil below the site is approximately 7.6 m (25 ft) thick. Therefore, residual concentrations of lead predicted to be protective of groundwater and the Columbia River.

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the *Washington Administrative Code* (WAC) 173-340-740(7)(e) three-part test. The WAC 173-340 three-part test consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection can exceed two times the cleanup criteria, and (3) the percentage of samples exceeding the cleanup criteria must be less than 10% of the data set.

The application of the WAC 173-340 three-part test for the 600-109 waste site statistical data is included in the 95% UCL calculation (Appendix C). The results of this evaluation indicate that all residual COC/COPC concentrations pass the three-part test in comparison to applicable RAGs.

Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. For the 600-109 waste site, these risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background levels. All individual hazard quotients for noncarcinogenic constituents were less than 1.0. The cumulative hazard quotient for those noncarcinogenic constituents above background or detected levels is 1.5×10^{-3}. The carcinogenic risk value for hexavalent chromium, the only carcinogenic constituent detected above background was 7.3×10^{-8}, which is less than the criteria of 1×10^{-6}. Based on the nonradionuclide groundwater and river protection RAGs shown in Tables 4 through 7, the residual concentrations of the nonradionuclide contaminants are protective of groundwater and the Columbia River.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach (WCH 2010b), the field logbook (WCH 2010a), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 600-109 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in the ENRE project-specific database for data evaluation prior to archival in the HEIS and are provided as an attachment to the 95% UCL calculation in Appendix C. The detailed DQA is presented in Appendix D.

SUMMARY FOR INTERIM CLOSURE

The 600-109 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2009b). Verification sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at this site meet the RAOs for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-109 waste site to Interim Closed Out. Residual waste site contamination originating from Hanford Site or

Manhattan Project activities does not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

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APPENDIX A

WASTE CHARACTERIZATION SAMPLE RESULTS, IN-PROCESS SAMPLE RESULTS, AND X-RAY FLUORESCENCE READINGS

Table A-1. 600-109 Waste Characterization Sampling Results. (6 Pages)

Constituent	J19758 Soil (A-1 & A-2) 09/23/2009			J19759 Soil (D-1 & D-2) 09/23/2009			J19760 Soil (B-2 & B-3) 09/23/2009			J19761 Soil (E-1 through E-4) 09/23/2009		
	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Metals												
Aluminum	7210		3.84	5230		3.63	8210		4.74	5610		5.1
Antimony	0.461	U	0.461	0.436	U	0.436	0.577		0.568	0.611	U	0.611
Arsenic	17.0		0.769	3.83		0.727	7.02		0.947	5.42		1.02
Barium	83.3		0.384	73.2		0.363	77.8		0.474	71.1		0.51
Beryllium	0.278		0.154	0.237		0.145	0.226		0.189	0.250		0.204
Boron	2.61		1.54	3.7		1.45	3.23		1.89	1.32	B	2.04
Cadmium	0.166		0.154	0.163		0.145	0.551		0.189	0.148	B	0.204
Calcium	6070		76.9	4510		72.7	15800		94.7	4300		102
Chromium	9.62		0.154	5.89		0.145	12.4		0.189	10.8		0.204
Cobalt	6.92		1.54	7.58		1.45	6.79		1.89	7.07		2.04
Copper	15.3		0.769	15.9		0.727	33		0.947	22.3		1.02
Lead	93.3		0.384	25.3		0.363	45		0.474	27.8		0.51
Magnesium	4330		57.7	3820		54.5	4900		71.0	4030		76.4
Manganese	335		3.84	295		3.63	279		4.74	291		5.1
Molybdenum	0.430	B	1.54	0.413	B	1.45	0.5	B	1.89	0.546	B	2.04
Nickel	10.2		3.07	8.19		2.91	18.8		3.79	11.1		4.08
Selenium	0.769	U	0.769	0.727	U	0.727	0.947	U	0.947	1.02	U	1.02
Silicon	433		1.54	304		1.45	420		1.89	419		2.04
Silver	0.154	U	0.154	0.145	U	0.145	0.200		0.189	0.204	U	0.204
Sodium	170		38.4	204		36.3	302		47.4	175		51
Vanadium	54.8		1.92	61.7		1.82	57.7		2.37	50.8		2.55
Zinc	123		7.69	111		7.27	150		9.47	67.6		10.2
Mercury	0.0289	U	0.0289	0.0241	U	0.0241	0.0186	B	0.0304	0.0295	U	0.0295

Table A-1. 600-109 Waste Characterization Sampling Results. (6 Pages)

Constituent	J19758 Soil (A-1 & A-2) 09/23/2009			J19759 Soil (D-1 & D-2) 09/23/2009			J19760 Soil (B-2 & B-3) 09/23/2009			J19761 Soil (E-1 through E-4) 09/23/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls (PCBs)												
Aroclor-1016	14.1	U	14.1	13.9	U	13.9	14.4	U	14.4	14.4	U	14.4
Aroclor-1221	14.1	U	14.1	13.9	U	13.9	14.4	U	14.4	14.4	U	14.4
Aroclor-1232	14.1	U	14.1	13.9	U	13.9	14.4	U	14.4	14.4	U	14.4
Aroclor-1242	14.1	U	14.1	13.9	U	13.9	14.4	U	14.4	14.4	U	14.4
Aroclor-1248	14.1	U	14.1	13.9	U	13.9	14.4	U	14.4	14.4	U	14.4
Aroclor-1254	14.1	U	14.1	13.9	U	13.9	14.4	U	14.4	4.57	J	14.4
Aroclor-1260	14.1	U	14.1	13.9	U	13.9	14.4	U	14.4	14.4	U	14.4
Polycyclic Aromatic Hydrocarbons (PAH)												
Naphthalene	35.4	U	35.4	19.2	J	34.9	36.1	U	36.1	36.1	U	36.1
Acenapthylene	35.4	U	35.4	34.9	U	34.9	36.1	U	36.1	36.1	U	36.1
Acenaphthene	35.4	U	35.4	185		34.9	36.1	U	36.1	36.1	U	36.1
Fluorene	3.01	J	3.54	28.1		3.49	18.0		3.61	3.61	U	3.61
Phenanthrene	7.60		3.54	9.07		3.49	7.38		3.61	3.96		3.61
Anthracene	3.54	U	3.54	1.05	J	3.49	3.61	U	3.61	3.61	U	3.61
Fluoranthene	50.4		3.54	36.3		3.49	3.61	U	3.61	12.1		3.61
Indeno[1,2,3-cd]pyrene	45.8		3.54	409		3.49	3.61	U	3.61	3.61	U	3.61
Pyrene	31.5		3.54	3.49	U	3.49	3.61	U	3.61	3.61	U	3.61
Benz[a]anthracene	21.7		3.54	12.4		3.49	23.7		3.61	12.6		3.61
Chrysene	21.4		3.54	8.72		3.49	88.0		3.61	8.1		3.61
Benzo[b]fluoranthene	15.0		3.54	27.9		3.49	64.2		3.61	11.7		3.61
Benzo[k]fluoranthene	6.37		3.54	6.28		3.49	3.61	U	3.61	1.8	J	3.61
Benzo[a]pyrene	11.3		3.54	13.6		3.49	30.4		3.61	4.68		3.61
Dibenz[a,h]anthracene	3.54	U	3.54	12.0		3.49	3.61	U	3.61	3.61	U	3.61
Benzo[g,h,i]perylene	16.6		3.54	3.49	U	3.49	36.7		3.61	1.26	J	3.61
Herbicides												
Dalapon	35.3	U	35.3	34.8	U	34.8	36.0	U	36.0	36.0	U	36.0
Dicamba	35.3	U	35.3	34.8	U	34.8	36.0	U	36.0	36.0	U	36.0
Dichloroprop	35.3	U	35.3	34.8	U	34.8	36.0	U	36.0	36.0	U	36.0
2,4-Dichlorophenoxyacetic acid	35.3	U	35.3	34.8	U	34.8	36.0	U	36.0	36.0	U	36.0
2,4,5-IP (Silvex)	17.7	U	17.7	17.5	U	17.5	18.0	U	18.0	18.0	U	18.0
2,4,5-Trichlorophenoxyacetic acid	17.7	U	17.7	17.5	U	17.5	18.0	U	18.0	18.0	U	18.0
Dinoseb	17.7	U	17.7	17.5	U	17.5	18.0	U	18.0	18.0	U	18.0
4-(2,4-dichlorophenoxy)butanoic acid	17.7	U	17.7	17.5	U	17.5	18.0	U	18.0	18.0	U	18.0

Table A-1. 600-109 Waste Characterization Sampling Results. (6 Pages)

Constituent	J19758 Soil (A-1 & A-2) 09/23/2009			J19759 Soil (D-1 & D-2) 09/23/2009			J19760 Soil (B-2 & B-3) 09/23/2009			J19761 Soil (E-1 through E-4) 09/23/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Pesticides												
alpha-BHC	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
gamma-BHC	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
beta-BHC	1.41	U	1.41	1.74	JD	1.39	1.44	U	1.44	1.44	U	1.44
delta-BHC	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Heptachlor	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Aldrin	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Heptachlor epoxide	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
gamma-Chlordane	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
alpha-Chlordane	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Endosulfan I	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
4,4'-DDE	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Dieldrin	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Endrin	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
4,4'-DDD	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Endosulfan II	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
4,4'-DDT	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Endrin aldehyde	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Endosulfan sulfate	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Methoxychlor	1.41	U	1.41	1.39	U	1.39	1.44	U	1.44	1.44	U	1.44
Endrin ketone	1.41	U	1.41	2.09	JD	1.39	1.44	U	1.44	1.44	U	1.44
Toxaphene	21.2	U	21.2	20.9	U	20.9	21.6	U	21.6	21.6	U	21.6

Table A-1. 600-109 Waste Characterization Sampling Results. (6 Pages)

Constituent	J19758 Soil (A-1 & A-2) 09/23/2009			J19759 Soil (D-1 & D-2) 09/23/2009			J19760 Soil (B-2 & B-3) 09/23/2009			J19761 Soil (E-1 through E-4) 09/23/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Volatile Organic Compounds (VOCs)												
1,1,1-Trichloroethane	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
1,1,2,2-Tetrachloroethane	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
1,1,2-Trichloroethane	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
1,1-Dichloroethane	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
1,1-Dichloroethene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
1,2-Dichloroethane	5.13	U	5.13	5.60	U	5.60	5.89	U	5.89	6.11	U	6.11
1,2-Dichloropropane	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
2-Butanone	10.3	U	10.3	11.2	U	11.2	11.8	U	11.8	12.2	U	12.2
2-Hexanone	10.3	U	10.3	11.2	U	11.2	11.8	U	11.8	12.2	U	12.2
4-Methyl-2-pentanone	10.3	U	10.3	11.2	U	11.2	11.8	U	11.8	12.2	U	12.2
Acetone	10.3	U	10.3	11.2	U	11.2	11.8	U	11.8	12.2	U	12.2
Benzene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Bromodichloromethane	5.13	U	5.13	5.60	U	5.60	5.89	U	5.89	6.11	U	6.11
Bromoform	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Bromomethane	8.56	U	8.56	9.34	U	9.34	9.82	U	9.82	10.2	U	10.2
Carbon Disulfide	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Carbon Tetrachloride	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Chlorobenzene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Chloroethane	8.56	U	8.56	9.34	U	9.34	9.82	U	9.82	10.2	U	10.2
Chloroform	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Chloromethane	8.56	U	8.56	9.34	U	9.34	9.82	U	9.82	10.2	U	10.2
cis-1,2-Dichloroethene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
cis-1,3-Dichlropropene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Dibromochloromethane	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Ethylbenzene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Methylene Chloride	5.13	U	5.13	5.60	U	5.60	5.89	U	5.89	6.11	U	6.11
Styrene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Tetrachloroethene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
trans-1,2-Dichloroethene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Toluene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
trans-1,3-Dichloropropene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Trichloroethene	4.28	U	4.28	4.67	U	4.67	4.91	U	4.91	5.10	U	5.10
Vinyl chloride	8.56	U	8.56	9.34	U	9.34	9.82	U	9.82	10.2	U	10.2
Xylenes, total	5.13	U	5.13	5.60	U	5.60	5.89	U	5.89	6.11	U	6.11

Table A-1. 600-109 Waste Characterization Sampling Results. (6 Pages)

Constituent	J19758 Soil (A-1 & A-2) 09/23/2009			J19759 Soil (D-1 & D-2) 09/23/2009			J19760 Soil (B-2 & B-3) 09/23/2009			J19761 Soil (E-1 through E-4) 09/23/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (SVOCs)												
1,2,4-Trichlorobenzene	350	U	350	345	U	345	356	U	356	356	U	356
1,2-Dichlorobenzene	350	U	350	345	U	345	356	U	356	356	U	356
1,3-Dichlorobenzene	350	U	350	345	U	345	356	U	356	356	U	356
1,3-Dichlorobenzene	350	U	350	345	U	345	356	U	356	356	U	356
2,4,5-Trichlorophenol	350	U	350	345	U	345	356	U	356	356	U	356
2,4,6-Trichlorophenol	350	U	350	345	U	345	356	U	356	356	U	356
2,4-Dichlorophenol	350	U	350	345	U	345	356	U	356	356	U	356
2,4-Dimethylphenol	350	U	350	345	U	345	356	U	356	356	U	356
2,4-Dinitrophenol	1750	U	1750	1730	U	1730	1780	U	1780	1780	U	1780
2,4-Dinitrotoluene	350	U	350	345	U	345	356	U	356	356	U	356
2,6-Dinitrotoluene	350	U	350	345	U	345	356	U	356	356	U	356
2-Chloronapthalene	350	U	350	345	U	345	356	U	356	356	U	356
2-Chlorophenol	350	U	350	345	U	345	356	U	356	356	U	356
2-Methylnapthalene	350	U	350	345	U	345	356	U	356	356	U	356
2-Methylphenol	350	U	350	345	U	345	356	U	356	356	U	356
2-Nitroaniline	1750	U	1750	1730	U	1730	1780	U	1780	1780	U	1780
2-Nitrophenol	350	U	350	345	U	345	356	U	356	356	U	356
3,3'-Dichlorobenzidine	700	U	700	690	U	690	713	U	713	713	U	713
3-Nitroaniline	1750	U	1750	1730	U	1730	1780	U	1780	1780	U	1780
4,6-Dinitro-2-methylphenol	350	U	350	345	U	345	356	U	356	356	U	356
4-Bromophenyl Phenyl Ether	350	U	350	345	U	345	356	U	356	356	U	356
4-Chloro-3-methylphenol	350	U	350	345	U	345	356	U	356	356	U	356
4-Chloroaniline	350	U	350	345	U	345	356	U	356	356	U	356
4-Chlorophenyl Phenyl Ether	350	U	350	345	U	345	356	U	356	356	U	356
3-and/or 4-Methylphenol	350	U	350	345	U	345	356	U	356	356	U	356
4-Nitroaniline	1750	U	1750	1730	U	1730	1780	U	1780	1780	U	1780
4-Nitrophenol	1750	U	1750	1730	U	1730	1780	U	1780	1780	U	1780
Acenaphthene	350	U	350	345	U	345	356	U	356	356	U	356
Acenapthylene	350	U	350	345	U	345	356	U	356	356	U	356
Anthracene	350	U	350	345	U	345	356	U	356	356	U	356
Benz[a]anthracene	350	U	350	345	U	345	356	U	356	356	U	356
Benzo[a]pyrene	350	U	350	345	U	345	356	U	356	356	U	356
Benzo[b]fluoranthene	350	U	350	345	U	345	356	U	356	356	U	356
Benzo[g,h,i]perylene	350	U	350	345	U	345	356	U	356	356	U	356
Benzo[k]fluoranthene	350	U	350	345	U	345	356	U	356	356	U	356
Bis(2-chloroethoxy) methane	350	U	350	345	U	345	356	U	356	356	U	356
Bis(2-chloroethyl) ether	350	U	350	345	U	345	356	U	356	356	U	356
Bis(2-chloroisopropyl) ether	350	U	350	345	U	345	356	U	356	356	U	356
Bis(2-ethylhexyl) phthalate	350	U	350	345	U	345	356	U	356	356	U	356
Butyl Benzyl Phthalate	350	U	350	345	U	345	356	U	356	356	U	356

Table A-1. 600-109 Waste Characterization Sampling Results. (6 Pages)

Constituent	J19758 Soil (A-1 & A-2) 09/23/2009			J19759 Soil (D-1 & D-2) 09/23/2009			J19760 Soil (B-2 & B-3) 09/23/2009			J19761 Soil (E-1 through E-4) 09/23/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (SVOCs)												
Carbazole	350	U	350	345	U	345	356	U	356	356	U	356
Chrysene	350	U	350	345	U	345	356	U	356	356	U	356
Dibenz[a,h]anthracene	350	U	350	345	U	345	356	U	356	356	U	356
Dibenzofuran	350	U	350	345	U	345	356	U	356	356	U	356
Diethyl Phthalate	350	U	350	345	U	345	356	U	356	356	U	356
Dimethyl Phthalate	350	U	350	345	U	345	356	U	356	356	U	356
Di-n-butyl Phthalate	350	U	350	345	U	345	356	U	356	356	U	356
Di-n-octyl Phthalate	350	U	350	345	U	345	356	U	356	356	U	356
Fluoranthene	350	U	350	345	U	345	356	U	356	356	U	356
Fluorene	350	U	350	345	U	345	356	U	356	356	U	356
Hexachlorobenzene	350	U	350	345	U	345	356	U	356	356	U	356
Hexachlorobutadiene	350	U	350	345	U	345	356	U	356	356	U	356
Hexachlorocyclopentadiene	350	U	350	345	U	345	356	U	356	356	U	356
Hexachloroethane	350	U	350	345	U	345	356	U	356	356	U	356
Indeno[1,2,3]pyrene	350	U	350	345	U	345	356	U	356	356	U	356
Isophorone	350	U	350	345	U	345	356	U	356	356	U	356
Napthalene	350	U	350	345	U	345	356	U	356	356	U	356
Bitrobenzene	350	U	350	345	U	345	356	U	356	356	U	356
N-Nitrosodi-n-propylamine	350	U	350	345	U	345	356	U	356	356	U	356
N-Nitrosodiphenylamine	350	U	350	345	U	345	356	U	356	356	U	356
Pentachlorophenol	1750	U	1750	1730	U	1730	1780	U	1780	1780	U	1780
Phenanthrene	350	U	350	345	U	345	356	U	356	356	U	356
Phenol	350	U	350	345	U	345	356	U	356	356	U	356
Pyrene	350	U	350	345	U	345	356	U	356	356	U	356

B = blank contamination (organic constituents); estimated result (inorganic constituents)
D = dilution
J = estimated result
PQL = practical quantitation limit
Q = qualifier
U = undetected

Table A-2. 600-109 In-Process Sampling Results. (6 Pages)

Constituent	J19W62 Soil Sample 04/06/2010			J19W63 Soil Sample 04/06/2010			J19W64 Soil Sample 04/06/2010			J19W65 Soil Sample 04/06/2010			J19W66 Soil Sample 04/06/2010			J19W67 Soil Sample 04/06/2010			J19W68 Soil Sample 04/06/2010			J19W78 Soil Sample 04/06/2010		
	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Metals																								
Aluminum	4,780		4.38	5,280		5.09	5,970		5.15	6,020		4.04	6,930		4.16	6,680		3.92	6,350		4.43	4,740		4.01
Antimony	0.525	U	0.53	0.611	U	0.61	0.618	U	0.62	0.485	U	0.49	0.499	U	0.5	0.47	U	0.47	0.532	U	0.53	0.481	U	0.48
Arsenic	2.5		0.88	1.98		1.02	2.09		1.03	2.59		0.81	5.71		0.83	5.49		0.78	5.91		0.89	2.02		0.8
Barium	68.4		0.44	64		0.51	71.3		0.52	66.8		0.4	62.2		0.42	69.6		0.39	72.2		0.44	52.7		0.4
Beryllium	0.154	B	0.18	0.167	B	0.2	0.206		0.21	0.203		0.16	0.26		0.17	0.248		0.16	0.216		0.18	0.177		0.16
Boron	0.665	B	1.75	0.599	B	2.04	0.861	B	2.06	1.71		1.62	0.788	B	1.66	0.822	B	1.57	1.13	B	1.77	0.439	B	1.6
Cadmium	0.168	B	0.18	0.171	B	0.2	0.179	B	0.21	0.168		0.16	0.15	B	0.17	0.166		0.16	0.212		0.18	0.143	B	0.16
Calcium	5,090		87.6	5160		102	5,020		103	5080		80.9	4860		83.2	5690		78.3	5,470		88.6	4,710		80.1
Chromium	5.72		0.18	5.19		0.2	6.24		0.21	7.24		0.16	7.33		0.17	7.35		0.16	7.89		0.18	4.53		0.16
Cobalt	7.87		1.75	7.96		2.04	8.59		2.06	7.59		1.62	7.89		1.66	7.78		1.57	7.5		1.77	7.4		1.6
Copper	12.7		0.88	12.4		1.02	13.2		1.03	13.3		0.81	13.8		0.83	14.5		0.78	13.4		0.89	12.9		0.8
Hexavalent chromium	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.18	B	0.21	0.21	U	0.21	0.21	U	0.21
Iron	24,100		17.5	24,300		20.4	25,400		20.6	24400		16.2	23,300		16.6	24,600		15.7	23,100		17.7	21,300		16
Lead	5.59		0.44	3.89		0.51	4.32		0.52	5.33		0.4	14.3		0.42	16		0.39	25.5		0.44	3.15		0.4
Magnesium	4,150		65.7	4,220		76.4	4,380		77.3	4340		60.7	4,410		62.4	4,590		58.7	4,550		66.5	3,630		60.1
Manganese	304		4.38	301		5.09	320		5.15	324		4.04	310		4.16	320		3.92	321		4.43	272		4.01
Mercury	0.025	U	0.02	0.024	U	0.02	0.024	U	0.02	0.025	U	0.02	0.025	U	0.02	0.029	U	0.03	0.028	U	0.03	0.025	U	0.03
Molybdenum	0.299	B	1.75	0.31	B	2.04	0.294	B	2.06	0.299	B	1.62	0.313	B	1.66	0.266	B	1.57	0.308	B	1.77	0.264	B	1.6
Nickel	8.62		3.5	7.68		4.07	8.17		4.12	9.25		3.24	10.7		3.33	8.73		3.13	10.8		3.55	6.83		3.21
Potassium	753		350	792		407	842		412	981		324	933		333	1080		313	1250		355	721		321
Selenium	0.263	U	0.26	0.305	U	0.31	0.309	U	0.31	0.243	U	0.24	0.25	U	0.25	0.235	U	0.24	0.266	U	0.27	0.24	U	0.24
Silicon	165		1.75	209		2.04	247		2.06	270		1.62	269		1.66	259		1.57	333		1.77	182		1.6
Silver	0.175	U	0.18	0.204	U	0.2	0.206	U	0.21	0.162	U	0.16	0.166	U	0.17	0.157	U	0.16	0.177	U	0.18	0.16	U	0.16
Sodium	225		43.8	214		50.9	222		51.5	223		40.4	236		41.6	274		39.2	190		44.3	216		40.1
Vanadium	69.5		2.19	69.8		2.55	74.8		2.58	67.8		2.02	60.1		2.08	62.9		1.96	61		2.22	61.3		2
Zinc	42.6		8.76	44.6		10.2	47.7		10.3	44.9		8.09	43.8		8.32	47.3		7.83	55.3		8.86	40.6		8.01

Table A-2. 600-109 In-Process Sampling Results. (6 Pages)

Constituent	J19W79 Soil Sample 04/06/2010			J19W80 Soil Sample 04/06/2010			J19W81 Soil Sample 04/06/2010			J19W82 Soil Sample 04/06/2010			J19W83 Soil Sample 04/06/2010			J19W84 Soil Sample 04/06/2010			J19W85 Soil Sample 04/06/2010		
	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
Metals																					
Aluminum	4,740		3.56	4,040		3.55	4,570		3.51	3,860		3.46	3,930		4.06	5,910		3.9	69.4		3.63
Antimony	0.427	U	0.43	0.426	U	0.43	0.422	U	0.42	0.416	U	0.42	0.487	U	0.49	0.468	U	0.47	0.435	U	0.44
Arsenic	3.19		0.71	1.49		0.71	1.44		0.7	1.53		0.69	1.77		0.81	6.22		0.78	0.725	U	0.73
Barium	56.1		0.36	56.6		0.36	63.7		0.35	53.9		0.35	58.9		0.41	70.1		0.39	0.97		0.36
Beryllium	0.171		0.14	0.137	B	0.14	0.146		0.14	0.136	B	0.14	0.135	B	0.16	0.213		0.16	0.145	U	0.15
Boron	0.581	B	1.42	0.42	B	1.42	0.428	B	1.41	1.39	U	1.39	1.62	U	1.62	1.11	B	1.56	1.45	U	1.45
Cadmium	0.162		0.14	0.151		0.14	0.157		0.14	0.155		0.14	0.147	B	0.16	0.201		0.16	0.145	U	0.15
Calcium	4,440		71.2	5,350		70.9	4,950		70.3	5,350		69.3	5,420		81.2	5,230		77.9	13	B	72.5
Chromium	4.67		0.14	3.79		0.14	4.15		0.14	3.83		0.14	5.13		0.16	8.75		0.16	0.145	U	0.15
Cobalt	7.47		1.42	7.94		1.42	8.57		1.41	7.27		1.39	7.4		1.62	7.1		1.56	1.45	U	1.45
Copper	12		0.71	12.4		0.71	11.9		0.7	10.9		0.69	11		0.81	12.5		0.78	0.725	U	0.73
Hexavalent chromium	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.2	U	0.2	0.21	U	0.21			
Iron	22,500		14.2	23,200		14.2	21,100		14.1	21,000		13.9	21,000		16.2	20,300		15.6	113		14.5
Lead	11.5		0.36	2.36		0.36	3.4		0.35	2.56		0.35	3.37		0.41	26.3		0.39	0.279	B	0.36
Magnesium	3,980		53.4	3,860		53.2	3,840		52.7	3,760		52	4,210		60.9	4,380		58.5	7.28	B	54.4
Manganese	277		3.56	275		3.55	333		3.51	260		3.46	293		4.06	281		3.9	3.19	B	3.63
Mercury	0.029	U	0.03	0.028	U	0.03	0.029	U	0.03	0.024	U	0.02	0.026	U	0.03	0.032	U	0.03	0.027	U	0.03
Molybdenum	0.259	B	1.42	0.309	B	1.42	0.259	B	1.41	0.246	B	1.39	0.287	B	1.62	0.241	B	1.56	1.45	U	1.45
Nickel	9.78		2.85	6.13		2.84	7.88		2.81	5.69		2.77	8.89		3.25	9.35		3.12	2.9	U	2.9
Potassium	764		285	604		284	724		281	638		277	651		325	1,370		312	21.3	B	290
Selenium	0.214	U	0.21	0.213	U	0.21	0.211	U	0.21	0.208	U	0.21	0.244	U	0.24	0.234	U	0.23	0.218	U	0.22
Silicon	157		1.42	128		1.42	156		1.41	132		1.39	152		1.62	347		1.56	69.7		1.45
Silver	0.142	U	0.14	0.142	U	0.14	0.141	U	0.14	0.139	U	0.14	0.162	U	0.16	0.156	U	0.16	0.145	U	0.15
Sodium	201		35.6	231		35.5	230		35.1	222		34.6	200		40.6	181		39	36.3	U	36.3
Vanadium	62.4		1.78	71.3		1.77	61.1		1.76	61.3		1.73	64.9		2.03	54		1.95	1.81	U	1.81
Zinc	42.7		7.12	44.4		7.09	41.4		7.03	42.4		6.93	42.8		8.12	50.1		7.79	7.25	U	7.25

Table A-2. 600-109 In-Process Sampling Results. (6 Pages)

Constituent	J19W62 Soil Sample 04/06/2010			J19W63 Soil Sample 04/06/2010			J19W64 Soil Sample 04/06/2010			J19W65 Soil Sample 04/06/2010			J19W66 Soil Sample 04/06/2010			J19W67 Soil Sample 04/06/2010			J19W68 Soil Sample 04/06/2010		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polycyclic Aromatic Hydrocarbons (PAH)																					
Acenaphthene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	3.49	U	3.49	3.54	U	3.54
Acenaphthylene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	3.49	U	3.49	3.54	U	3.54
Anthracene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	3.49	U	3.49	3.54	U	3.54
Benzo(a)anthracene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	2.94	J	3.49	3.54	U	3.54
Benzo(a)pyrene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	2.85	J	3.49	0.94	J	3.54
Benzo(b)fluoranthene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	0.946	J	3.5	3.49	U	3.49	2.89	J	3.49	2.23	J	3.54
Benzo(ghi)perylene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	1.59	J	3.49	3.54	U	3.54
Benzo(k)fluoranthene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	1.33	J	3.49	0.94	J	3.54
Chrysene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	3.49	U	3.49	3.54	U	3.54
Dibenz[a,h]anthracene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	3.49	U	3.49	3.54	U	3.54
Fluoranthene	3.55		3.44	1.45	J	3.46	0.998	J	3.5	3.5	U	3.5	3.49	U	3.49	11.4		3.49	3.54	U	3.54
Fluorene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	3.49	U	3.49	3.54	U	3.54
Indeno(1,2,3-cd)pyrene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	2.15	J	3.49	3.54	U	3.54
Naphthalene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	3.49	U	3.49	3.54	U	3.54
Phenanthrene	2.17	J	3.44	0.9	J	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	6.8		3.49	2.36	J	3.54
Pyrene	3.44	U	3.44	3.46	U	3.46	3.5	U	3.5	3.5	U	3.5	3.49	U	3.49	7.38		3.49	3.54	U	3.54

Table A-2. 600-109 In-Process Sampling Results. (6 Pages)

Constituent	J19W78 Soil Sample 04/06/2010			J19W79 Soil Sample 04/06/2010			J19W80 Soil Sample 04/06/2010			J19W81 Soil Sample 04/06/2010			J19W82 Soil Sample 04/06/2010			J19W83 Soil Sample 04/06/2010			J19W84 Soil Sample 04/06/2010		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polycyclic Aromatic Hydrocarbons (PAH)																					
Acenaphthene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.53
Acenaphthylene	143		3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.53
Anthracene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.53
Benzo(a)anthracene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.06	J	3.06
Benzo(a)pyrene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.06
Benzo(b)fluoranthene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.06
Benzo(ghi)perylene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	0.936	J	3.06
Benzo(k)fluoranthene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.06
Chrysene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.78		3.06
Dibenz[a,h]anthracene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.06
Fluoranthene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.06
Fluorene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.06
Indeno(1,2,3-cd)pyrene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.06
Naphthalene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	3.53	U	3.06
Phenanthrene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	1.59	J	3.06
Pyrene	3.47	U	3.47	3.46	U	3.46	3.45	U	3.45	3.42	U	3.42	3.42	U	3.42	3.41	U	3.41	0.989	J	3.06

Table A-2. 600-109 In-Process Sampling Results. (6 Pages)

Constituent	J19W62 Soil Sample 04/06/2010			J19W63 Soil Sample 04/06/2010			J19W64 Soil Sample 04/06/2010			J19W65 Soil Sample 04/06/2010			J19W66 Soil Sample 04/06/2010			J19W67 Soil Sample 04/06/2010			J19W68 Soil Sample 04/06/2010		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Pesticides																					
Aldrin	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Alpha-BHC	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
alpha-Chlordane	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
beta-1,2,3,4,5,6-Hexachloro cyclohexane	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Delta-BHC	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Dichlorodiphenyl dichloroethane	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Dichlorodiphenyl dichloroethylene	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Dichlorodiphenyl trichloroethane	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Dieldrin	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Endosulfan I	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Endosulfan II	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Endosulfan sulfate	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Endrin	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Endrin aldehyde	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Endrin ketone	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Gamma-BHC (lindane)	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
gamma-Chlordane	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Heptachlor	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Heptachlor epoxide	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Methoxychlor	1.38	UD	1.38	1.38	UD	1.38	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.4	UD	1.4	1.42	UD	1.42
Toxaphene	20.7	UD	20.7	20.8	UD	20.8	21	UD	21	21	UD	21	21	UD	21	21	UD	21	21.3	UD	21.3

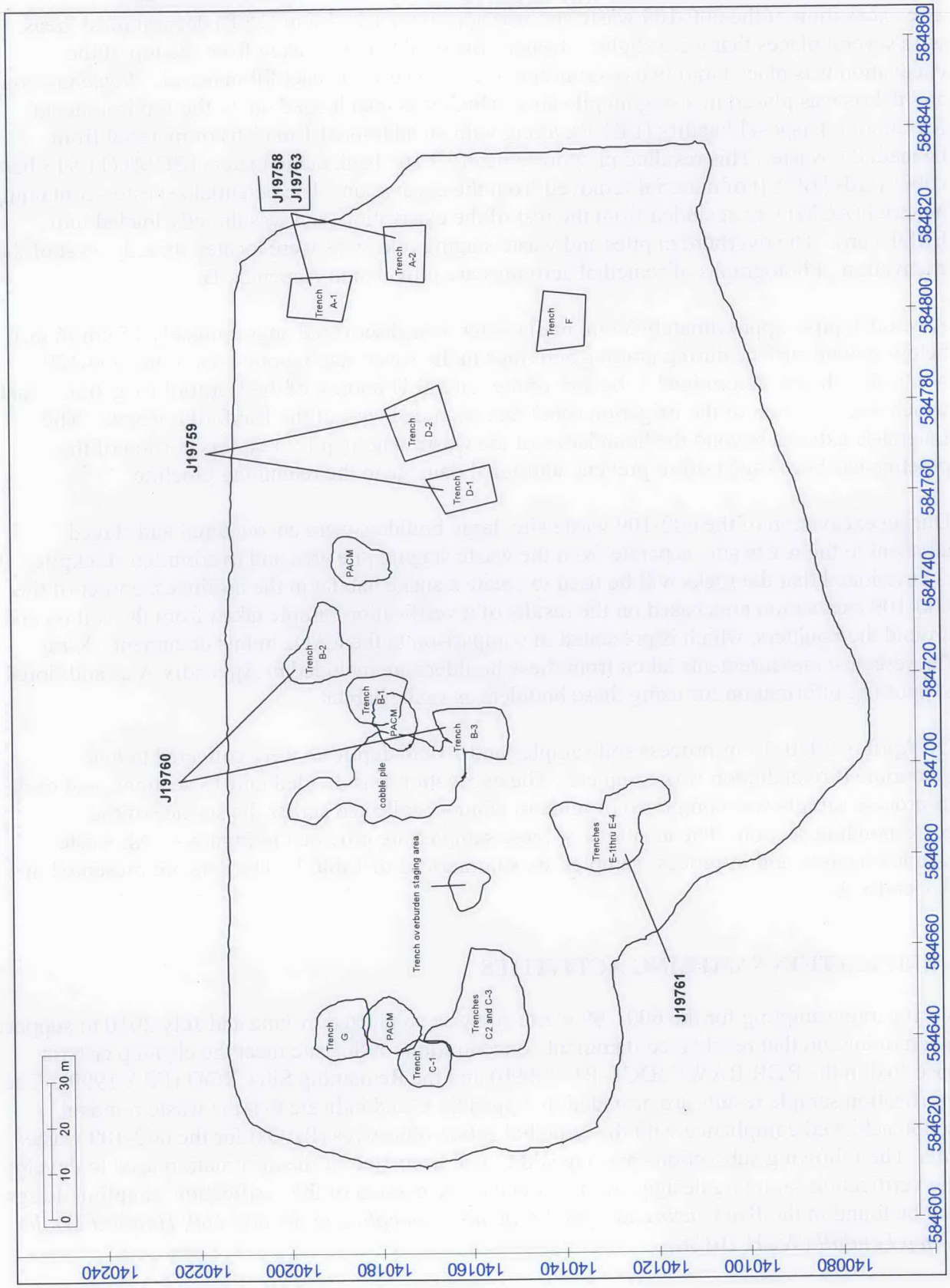
Table A-2. 600-109 In-Process Sampling Results. (6 Pages)

Constituent	J19W78 Soil Sample 04/06/2010			J19W79 Soil Sample 04/06/2010			J19W80 Soil Sample 04/06/2010			J19W81 Soil Sample 04/06/2010			J19W82 Soil Sample 04/06/2010			J19W83 Soil Sample 04/06/2010			J19W84 Soil Sample 04/06/2010		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Pesticides																					
Aldrin	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Alpha-BHC	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
alpha-Chlordane	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
beta-1,2,3,4,5,6-Hexachloro cyclohexane	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Delta-BHC	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Dichlorodiphenyl dichloroethane	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Dichlorodiphenyl dichloroethylene	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Dichlorodiphenyl trichloroethane	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Dieldrin	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Endosulfan I	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Endosulfan II	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Endosulfan sulfate	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Endrin	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Endrin aldehyde	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Endrin ketone	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Gamma-BHC (Lindane)	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
gamma-Chlordane	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Heptachlor	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Heptachlor epoxide	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Methoxychlor	1.39	UD	1.39	1.39	UD	1.39	1.38	UD	1.38	1.37	UD	1.37	1.37	UD	1.37	1.36	UD	1.36	1.41	UD	1.41
Toxaphene	20.8	UD	20.8	20.8	UD	20.8	20.7	UD	20.7	20.5	UD	20.5	20.5	UD	20.5	20.5	UD	20.5	21.2	UD	21.2

Note: Gray cells indicate not applicable.

B = blank contamination (organic constituents); estimated result (inorganic constituents)
D = dilution
J = estimated result
PQL = practical quantitation limit
Q = qualifier
U = undetected

Figure 3. The 600-109 Archaeological Investigation Location Map.



Remedial Action

The excavation of the 600-109 waste site was approximately 4.6 m (15 ft) deep in most areas, with several places that were slightly deeper. Material that was taken from the top of the excavation was placed into two overburden piles to be used as backfill material. Waste material and debris was placed in a staging pile area, which was then loaded out to the Environmental Restoration Disposal Facility (ERDF), along with an additional 1 m (3 ft) of material from beneath the waste. This resulted in approximately 9,108 bank cubic meters (BCM) (11,913 bank cubic yards [BCY]) of material removed from the excavation. The potential asbestos-containing material (ACM) was secluded from the rest of the excavation, and was directly loaded into ERDF cans. The overburden piles and waste staging pile areas were located directly west of the excavation. Photographs of remedial activities are provided in Appendix B.

A wooden pipe, approximately 34 in. in diameter, was discovered approximately 15 cm (6 in.) below ground surface during grading activities in the waste staging pile area of the 600-109 waste site. It was determined to be part of the Lateral-H portion of the Hanford Irrigation Canal, which was a section of the irrigation canal that extended west of the Hanford townsite. The Lateral-H extends beyond the boundaries of the waste staging pile area; this portion of the pipeline has been roped off to prevent additional damage to the remaining pipeline.

During excavation of the 600-109 waste site, large boulders were encountered and staged adjacent to the waste site, separate from the waste staging pile area and overburden stockpiles. It is envisioned that the rocks will be used to create a snake habitat in the northwest corner of the 600-109 excavation area based on the results of a verification sample taken from the soil on and around the boulders, which is presented in comparison to the RAGs in this document. X-ray fluorescence measurements taken from these boulders are included in Appendix A as additional supporting information for using these boulders as snake habitat.

On April 6, 2010, 13 in-process soil samples and 1 field duplicate were collected to help determine if remediation was complete. The excavation was divided into 13 sections, and each in-process sample was comprised of random aliquots collected across the surface of the corresponding section. The locations of these samples are provided in Figure 4. All waste characterization and in-process samples are summarized in Table 1. The data are presented in Appendix A.

VERIFICATION SAMPLING ACTIVITIES

Verification sampling for the 600-109 waste site was conducted in June and July 2010 to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The verification sample results are provided in Appendix C and indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) for the 600-109 waste site. The following subsections provide additional discussion of the information used to develop the verification sampling design. A more detailed discussion of the verification sampling design can be found in the *Work Instruction for Verification Sampling of the 600-109, Hanford Trailer Camp Landfill* (WCH 2010b).

Table A-3. 600-109 Boulder Pile X-Ray Fluorescence Results. (5 Pages)

Reading	Date	Mode	V	V +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-	Ni	Ni +/-	Cu	Cu +/-
1	7/12/2010	Standardization														
2	7/12/2010	Soil	NA		<LOD	162	2735	114	87303	1294	446	144	<LOD	73	<LOD	38
3	7/12/2010	Soil	NA		<LOD	144	1377	83	94876	1285	803	140	<LOD	71	<LOD	34
4	7/12/2010	Soil	NA		<LOD	167	1622	92	89339	1283	584	143	<LOD	72	<LOD	36
5	7/12/2010	Soil	NA		<LOD	152	1277	80	92120	1231	835	137	<LOD	68	<LOD	34
6	7/12/2010	Soil	NA		<LOD	295	4076	191	400305	6379	<LOD	1008	<LOD	145	<LOD	48
7	7/12/2010	Soil	NA		<LOD	75	156	26	10009	148	<LOD	108	<LOD	32	<LOD	26
8	7/12/2010	Soil	NA		<LOD	148	984	74	83413	1134	780	132	<LOD	69	<LOD	35
9	7/12/2010	Soil	NA		<LOD	145	807	70	68381	991	<LOD	370	<LOD	67	<LOD	36
10	7/12/2010	Soil	NA		<LOD	146	2120	100	90022	1291	907	145	<LOD	73	<LOD	35
11	7/12/2010	Soil	NA		<LOD	165	2351	103	102264	1414	763	149	<LOD	75	<LOD	36
12	7/12/2010	Soil	NA		<LOD	145	1299	84	82321	1195	838	139	<LOD	71	<LOD	36
13	7/12/2010	Soil	NA		<LOD	149	1282	81	87219	1200	804	137	<LOD	71	42	12
14	7/12/2010	Soil	NA		<LOD	129	901	68	61835	865	495	114	<LOD	62	65	12
15	7/12/2010	Soil	NA		<LOD	137	1725	85	70541	967	588	120	<LOD	68	<LOD	34
16	7/12/2010	Soil	NA		<LOD	159	1070	80	96213	1329	720	144	<LOD	74	<LOD	34
17	7/12/2010	Soil	NA		<LOD	211	11114	280	108355	1817	<LOD	535	<LOD	91	<LOD	45
18	7/12/2010	Soil	NA		<LOD	150	1999	98	74461	1109	613	134	<LOD	71	<LOD	37
19	7/12/2010	Soil	NA		<LOD	156	2375	99	87476	1180	880	135	<LOD	67	<LOD	33
20	7/12/2010	Soil	NA		<LOD	149	1309	81	76659	1069	742	129	<LOD	67	<LOD	34
21	7/12/2010	Standardization														
22	7/12/2010	Soil	NA		<LOD	133	1098	73	82181	1075	779	126	<LOD	67	<LOD	31
23	7/12/2010	Soil	NA		<LOD	80	242	32	17884	238	185	51	<LOD	37	<LOD	25
24	7/12/2010	Soil	NA		<LOD	142	1469	83	78554	1087	407	127	<LOD	68	<LOD	35
25	7/12/2010	Soil	NA		<LOD	131	738	68	73232	1024	631	126	<LOD	69	<LOD	36
26	7/12/2010	Soil	NA		<LOD	98	402	44	30669	415	721	77	<LOD	47	<LOD	30
27	7/12/2010	Soil	NA		<LOD	91	391	41	28855	373	202	67	<LOD	45	<LOD	28

Table A-3. 600-109 Boulder Pile X-Ray Fluorescence Results. (5 Pages)

Reading	Date	Mode	Zn	Zn +/-	As	As +/-	Se	Se +/-	Rb	Rb +/-	Sr	Sr +/-	Zr	Zr +/-	Nb	Nb +/-
1	7/12/2010	Standardization														
2	7/12/2010	Soil	58	8	<LOD	13	<LOD	5	20	2	303	7	140	5	NA	
3	7/12/2010	Soil	82	8	<LOD	11	<LOD	5	31	2	361	7	155	5	NA	
4	7/12/2010	Soil	80	8	13	4	<LOD	5	34	2	245	6	221	6	NA	
5	7/12/2010	Soil	73	8	<LOD	10	<LOD	5	26	2	305	7	147	5	NA	
6	7/12/2010	Soil	<LOD	25	<LOD	21	<LOD	6	32	3	196	6	135	5	NA	
7	7/12/2010	Soil	21	4	10	3	<LOD	3	11	1	862	11	69	3	NA	
8	7/12/2010	Soil	84	8	19	4	<LOD	4	20	2	294	6	142	5	NA	
9	7/12/2010	Soil	85	8	<LOD	10	<LOD	5	19	2	316	7	124	5	NA	
10	7/12/2010	Soil	93	9	<LOD	12	<LOD	5	36	2	290	7	160	5	NA	
11	7/12/2010	Soil	82	8	18	4	<LOD	5	28	2	272	6	234	6	NA	
12	7/12/2010	Soil	68	8	<LOD	13	<LOD	5	28	2	300	7	147	5	NA	
13	7/12/2010	Soil	80	8	34	5	<LOD	5	24	2	343	7	169	5	NA	
14	7/12/2010	Soil	73	8	11	3	<LOD	4	36	2	237	6	193	5	NA	
15	7/12/2010	Soil	79	8	17	4	<LOD	4	14	2	199	5	121	4	NA	
16	7/12/2010	Soil	75	8	<LOD	11	<LOD	5	25	2	242	6	225	6	NA	
17	7/12/2010	Soil	83	10	<LOD	14	<LOD	5	30	3	176	6	318	8	NA	
18	7/12/2010	Soil	66	8	14	5	<LOD	5	10	2	191	5	126	5	NA	
19	7/12/2010	Soil	88	8	<LOD	13	6	2	26	2	274	6	223	5	NA	
20	7/12/2010	Soil	75	8	<LOD	11	<LOD	5	41	2	270	6	381	8	NA	
21	7/12/2010	Standardization														
22	7/12/2010	Soil	100	8	<LOD	14	<LOD	4	24	2	268	6	191	5	NA	
23	7/12/2010	Soil	47	5	<LOD	9	<LOD	3	40	2	185	4	158	4	NA	
24	7/12/2010	Soil	84	8	<LOD	11	<LOD	5	30	2	276	6	232	6	NA	
25	7/12/2010	Soil	113	9	49	8	<LOD	5	32	2	249	6	221	6	NA	
26	7/12/2010	Soil	75	7	20	6	<LOD	4	37	2	217	5	196	5	NA	
27	7/12/2010	Soil	55	6	12	4	<LOD	4	77	3	176	4	149	4	NA	

Table A-3. 600-109 Boulder Pile X-Ray Fluorescence Results. (5 Pages)

Reading	Date	Mode	Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sn	Sn +/-	Sb	Sb +/-	I	I +/-	Ba	Ba +/-
1	7/12/2010	Standardization														
2	7/12/2010	Soil	<LOD	12	<LOD	44	<LOD	56	<LOD	96	<LOD	103	NA		1060	294
3	7/12/2010	Soil	<LOD	11	<LOD	40	<LOD	51	<LOD	89	<LOD	96	NA		1430	289
4	7/12/2010	Soil	<LOD	11	<LOD	43	<LOD	54	<LOD	94	<LOD	102	NA		1410	321
5	7/12/2010	Soil	<LOD	10	<LOD	40	<LOD	51	<LOD	88	<LOD	94	NA		1111	267
6	7/12/2010	Soil	<LOD	13	<LOD	50	<LOD	64	<LOD	111	<LOD	120	NA		<LOD	1204
7	7/12/2010	Soil	<LOD	8	<LOD	32	<LOD	42	<LOD	72	<LOD	77	NA		<LOD	318
8	7/12/2010	Soil	<LOD	10	<LOD	40	<LOD	52	<LOD	89	<LOD	96	NA		<LOD	811
9	7/12/2010	Soil	<LOD	11	<LOD	42	<LOD	55	<LOD	93	<LOD	101	NA		<LOD	677
10	7/12/2010	Soil	<LOD	11	<LOD	43	<LOD	55	<LOD	95	<LOD	102	NA		<LOD	826
11	7/12/2010	Soil	<LOD	11	<LOD	42	<LOD	53	<LOD	92	<LOD	98	NA		<LOD	901
12	7/12/2010	Soil	<LOD	11	<LOD	43	<LOD	55	<LOD	95	<LOD	103	NA		913	279
13	7/12/2010	Soil	<LOD	11	<LOD	41	<LOD	52	<LOD	89	<LOD	96	NA		2255	302
14	7/12/2010	Soil	<LOD	11	<LOD	40	<LOD	51	<LOD	88	<LOD	95	NA		816	211
15	7/12/2010	Soil	<LOD	10	<LOD	40	<LOD	52	<LOD	90	<LOD	96	NA		682	222
16	7/12/2010	Soil	<LOD	11	<LOD	41	<LOD	52	<LOD	90	<LOD	97	NA		<LOD	879
17	7/12/2010	Soil	17	5	<LOD	50	<LOD	64	<LOD	109	<LOD	116	NA		1804	325
18	7/12/2010	Soil	<LOD	11	<LOD	44	<LOD	57	<LOD	98	<LOD	106	NA		1140	254
19	7/12/2010	Soil	<LOD	11	<LOD	40	<LOD	51	<LOD	89	<LOD	96	NA		<LOD	872
20	7/12/2010	Soil	<LOD	11	<LOD	41	<LOD	52	<LOD	89	<LOD	97	NA		2168	283
21	7/12/2010	Standardization														
22	7/12/2010	Soil	<LOD	10	<LOD	39	<LOD	50	<LOD	85	<LOD	92	NA		827	256
23	7/12/2010	Soil	17	3	<LOD	33	<LOD	41	<LOD	70	<LOD	75	NA		<LOD	345
24	7/12/2010	Soil	<LOD	11	<LOD	40	<LOD	51	<LOD	87	<LOD	94	NA		826	253
25	7/12/2010	Soil	13	4	<LOD	41	<LOD	53	<LOD	90	<LOD	97	NA		1044	253
26	7/12/2010	Soil	18	3	<LOD	36	<LOD	46	<LOD	78	<LOD	84	NA		<LOD	426
27	7/12/2010	Soil	15	3	<LOD	34	<LOD	43	<LOD	73	<LOD	78	NA		<LOD	388

Table A-3. 600-109 Boulder Pile X-Ray Fluorescence Results. (5 Pages)

Reading	Date	Mode	Hf	Hf +/-	Ta	Ta +/-	W	W +/-	Re	Re +/-	Hg	Hg +/-	Pb	Pb +/-	Bi
1	7/12/2010	Standardization													
2	7/12/2010	Soil	NA		NA		NA		NA		<LOD	15	22	5	NA
3	7/12/2010	Soil	NA		NA		NA		NA		<LOD	16	<LOD	12	NA
4	7/12/2010	Soil	NA		NA		NA		NA		<LOD	13	<LOD	13	NA
5	7/12/2010	Soil	NA		NA		NA		NA		<LOD	15	14	4	NA
6	7/12/2010	Soil	NA		NA		NA		NA		<LOD	20	64	8	NA
7	7/12/2010	Soil	NA		NA		NA		NA		<LOD	10	21	3	NA
8	7/12/2010	Soil	NA		NA		NA		NA		<LOD	13	<LOD	12	NA
9	7/12/2010	Soil	NA		NA		NA		NA		<LOD	14	<LOD	12	NA
10	7/12/2010	Soil	NA		NA		NA		NA		<LOD	14	<LOD	13	NA
11	7/12/2010	Soil	NA		NA		NA		NA		<LOD	15	15	5	NA
12	7/12/2010	Soil	NA		NA		NA		NA		<LOD	14	20	5	NA
13	7/12/2010	Soil	NA		NA		NA		NA		<LOD	14	22	5	NA
14	7/12/2010	Soil	NA		NA		NA		NA		<LOD	13	<LOD	11	NA
15	7/12/2010	Soil	NA		NA		NA		NA		<LOD	12	<LOD	11	NA
16	7/12/2010	Soil	NA		NA		NA		NA		<LOD	13	13	4	NA
17	7/12/2010	Soil	NA		NA		NA		NA		<LOD	18	<LOD	16	NA
18	7/12/2010	Soil	NA		NA		NA		NA		<LOD	15	21	5	NA
19	7/12/2010	Soil	NA		NA		NA		NA		<LOD	14	28	5	NA
20	7/12/2010	Soil	NA		NA		NA		NA		<LOD	16	<LOD	12	NA
21	7/12/2010	Standardization													
22	7/12/2010	Soil	NA		NA		NA		NA		<LOD	14	46	5	NA
23	7/12/2010	Soil	NA		NA		NA		NA		<LOD	11	16	3	NA
24	7/12/2010	Soil	NA		NA		NA		NA		<LOD	15	15	4	NA
25	7/12/2010	Soil	NA		NA		NA		NA		<LOD	14	162	8	NA
26	7/12/2010	Soil	NA		NA		NA		NA		<LOD	12	128	7	NA
27	7/12/2010	Soil	NA		NA		NA		NA		<LOD	11	29	4	NA

Figure A-2. Locations of X-Ray Fluorescence Readings Surrounding the 600-109 Staging Pile Area in Support of Historic Orchard Contamination.

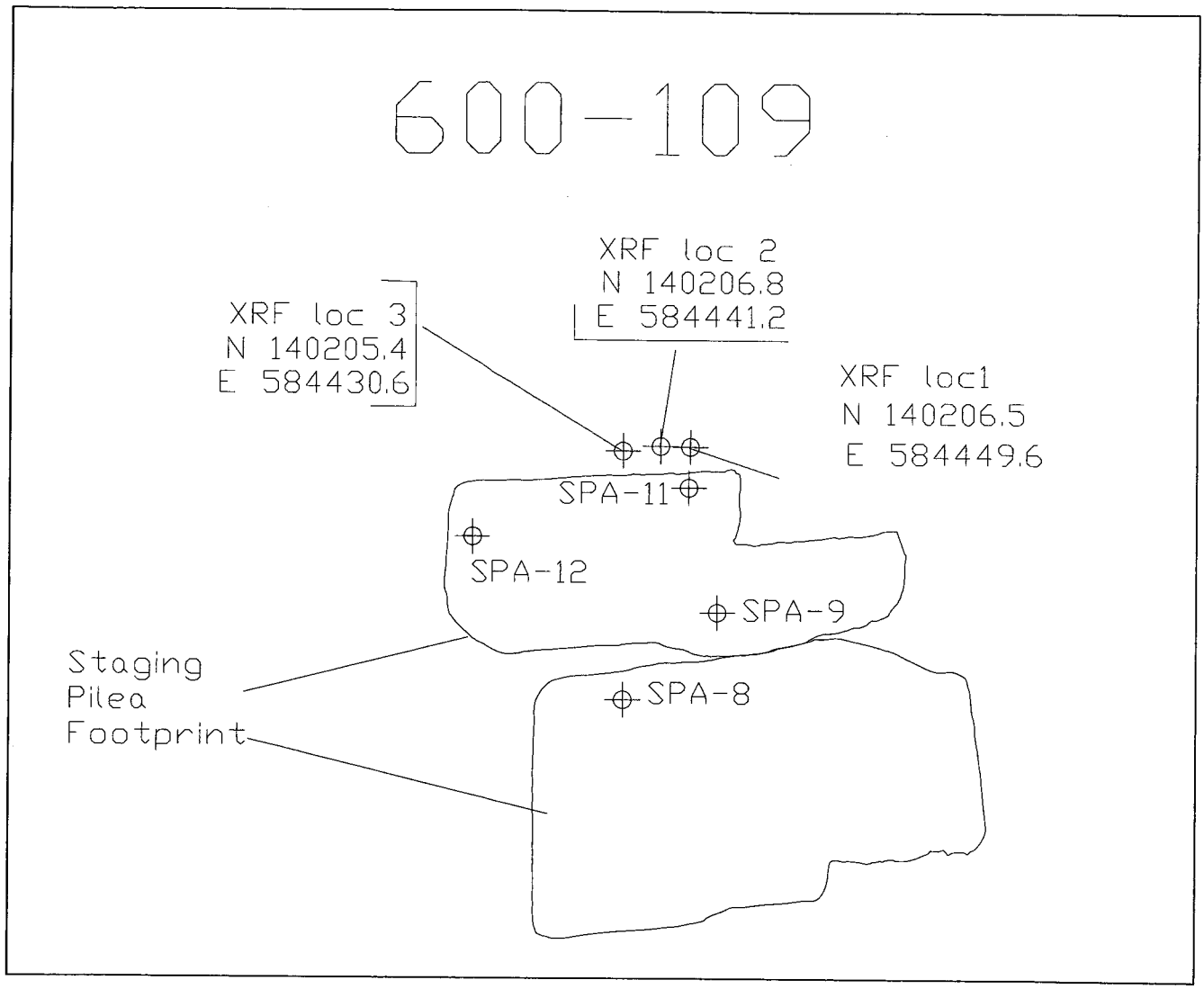


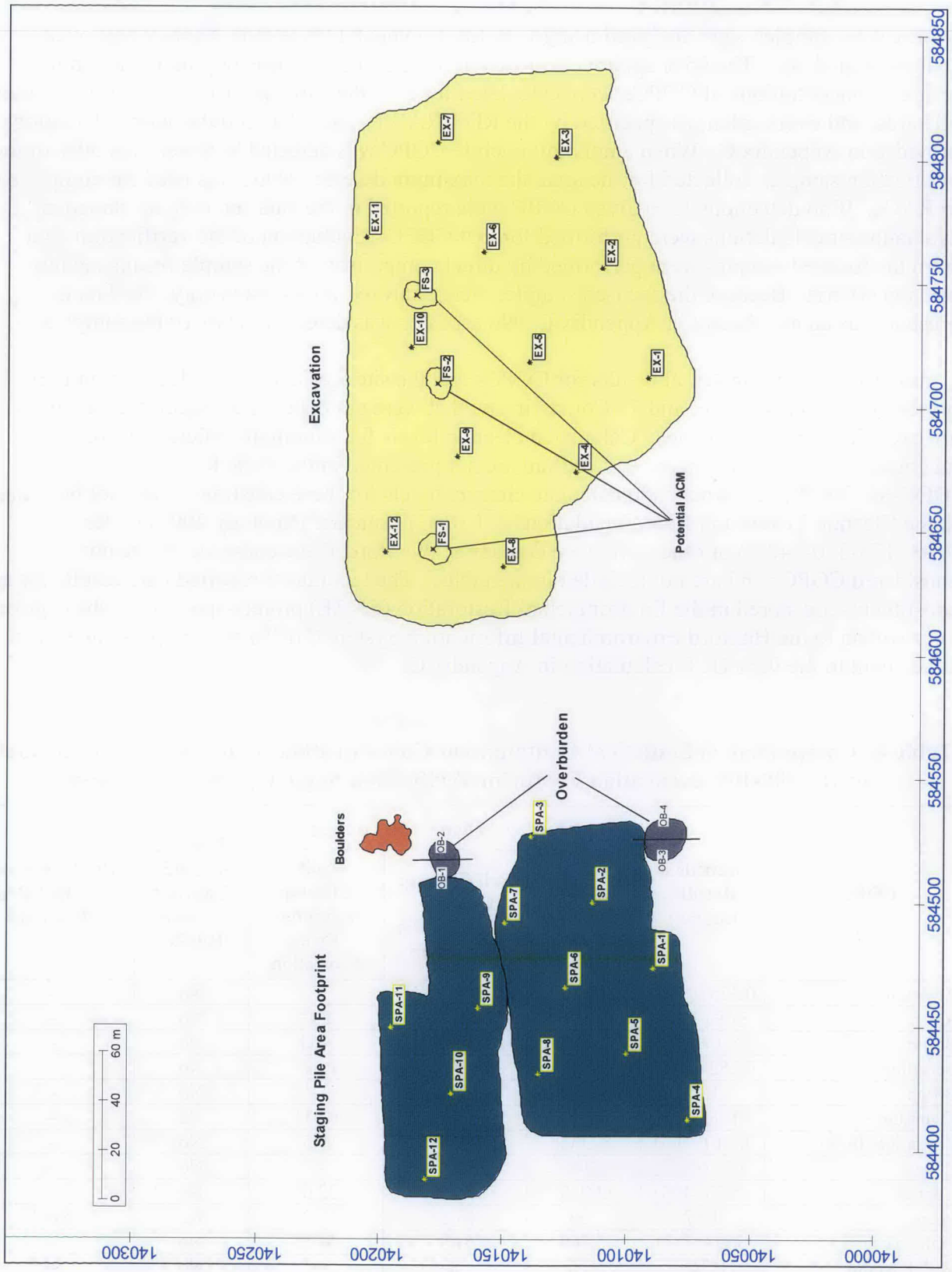
Table A-4. X-Ray Fluorescence Readings Surrounding the 600-109 Staging Pile Area in Support of Historic Orchard Contamination.

Reading	Date	Mode	As	As +/-	Pb	Pb +/-	Location	Northing	Easting
1	8/23/2010	Standardization							
2	8/23/2010	Soil	37	8	327	10	1	140206.5	E584449.6
3	8/23/2010	Soil	38	9	386	11			
4	8/23/2010	Soil	<LOD	25	303	10			
5	8/23/2010	Soil	49	9	347	10			
6	8/23/2010	Soil	42	10	460	12			
	Average Values (ppm)		33.2		364.6				
Reading	**Date**	**Mode**	**As**	**As +/-**	**Pb**	**Pb +/-**	**Location**	**Northing**	**Easting**
1	8/23/2010	Standardization							
7	8/23/2010	Soil	34	9	371	11	2	140206.8	E584441.2
8	8/23/2010	Soil	38	7	254	8			
9	8/23/2010	Soil	36	9	338	11			
10	8/23/2010	Soil	38	10	459	12			
11	8/23/2010	Soil	<LOD	27	394	11			
12	8/23/2010	Soil	57	10	435	12			
	Average Values (ppm)		33.8		375.2				
Reading	**Date**	**Mode**	**As**	**As +/-**	**Pb**	**Pb +/-**	**Location**	**Northing**	**Easting**
1	8/23/2010	Standardization							
13	8/23/2010	Soil	45	11	490	12	3	140205.4	584430.6
14	8/23/2010	Soil	39	9	298	11			
15	8/23/2010	Soil	57	10	458	12			
16	8/23/2010	Soil	56	11	444	13			
17	8/23/2010	Soil	57	8	274	9			
	Average Values (ppm)		50.8		392.8				

APPENDIX B

PHOTOGRAPHS

Figure 5. Verification Sampling Locations for the 600-109 Waste Site.



Verification Sample Results

Verification samples were analyzed using U.S. Environmental Protection Agency-approved analytical methods. The 95% upper confidence limit (UCL) on the true population mean for residual concentrations of COPCs were calculated for each decision unit (the excavation, staging pile area, and overburden) as specified by the RDR/RAWP (DOE-RL 2009b), with calculations provided in Appendix C. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for the area, the maximum detected value was used for comparison to RAGs. If no detections for a given COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COPC. Evaluation of the verification data from the focused samples were performed by direct comparison of the sample results against cleanup criteria. Because the focused samples were analyzed for asbestos only, the data is presented as an attachment in Appendix C. No asbestos was detected in any of the samples.

Comparisons of the statistical results for COPCs and the site RAGs for each decision unit are presented in Tables 4, 5, 6, and 7. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not presented in the RDR/RAWP (DOE-RL 2009b). Parameters to calculate cleanup levels for these constituents are not presented in the Cleanup Levels and Risk Calculations (CLARC) Database (Ecology 2009) under WAC 173-340-740(3) or other reference databases; therefore, these constituents are not considered COPCs and are not included in the tables. The laboratory-reported data results for all constituents are stored in the Environmental Restoration (ENRE) project-specific database prior to provision to the Hanford Environmental Information System (HEIS) and are presented as an attachment to the 95% UCL calculation in Appendix C.

Table 4. Comparison of Statistical Contaminant Concentrations to Remedial Action Goals for the 600-109 Excavation Footprint Verification Sampling Data. (2 Pages)

COPC	Statistical Result [b] (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.375 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	5.09 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	88.1 (<BG)	5,600	200	400	No	--
Beryllium	0.252 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.02	7,200	320	-- [f]	No	--
Cadmium [g]	0.116 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	8.61 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	9.86 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	15.7 (<BG)	2,960	59.2	22.0 [c]	No	--
Lead	19.7	353	10.2 [c]	10.2 [c]	Yes	Yes [h]
Manganese	369 (<BG)	3,760	512 [c]	512 [c]	No	--
Molybdenum [e]	0.368	400	8	-- [f]	No	--
Nickel	11.3 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	80.6 (<BG)	560	85.1 [c]	-- [f]	No	--

Figure A-1. Map of the 600-109 Boulder Pile X-Ray Fluorescence Locations.

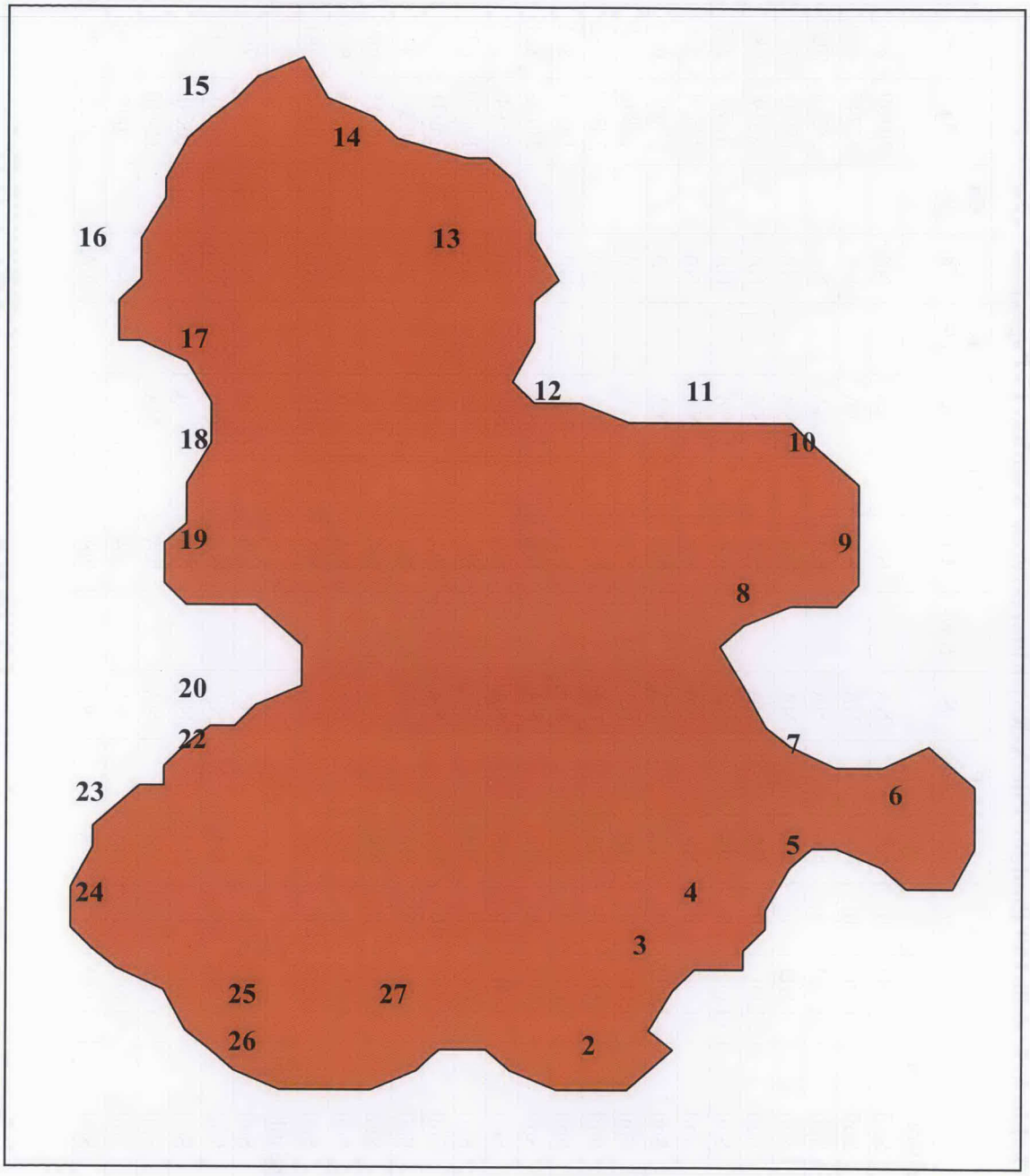


Table A-3. 600-109 Boulder Pile X-Ray Fluorescence Results. (5 Pages)

Reading	Date	Mode	LE	LE +/-	P	P +/-	S	S +/-	Cl	Cl +/-	K	K +/-	Ca	Ca +/-	Ti	Ti +/-
1	7/12/2010	Standardization														
2	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		20199	895
3	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		22745	882
4	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		28553	1027
5	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		18993	797
6	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		8819	981
7	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		1276	247
8	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		24554	879
9	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		10672	644
10	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		18898	838
11	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		28327	982
12	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		19354	851
13	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		21123	881
14	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		7594	563
15	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		10870	627
16	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		26081	941
17	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		9839	833
18	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		10315	689
19	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		29585	966
20	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		16024	791
21	7/12/2010	Standardization														
22	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		21214	799
23	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		2850	297
24	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		16643	757
25	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		15410	743
26	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		3095	358
27	7/12/2010	Soil	<LOD	0	NA		NA		NA		NA		NA		3132	332

Figure A-2. Locations of X-Ray Fluorescence Readings Surrounding the 600-109 Staging Pile Area in Support of Historic Orchard Contamination.

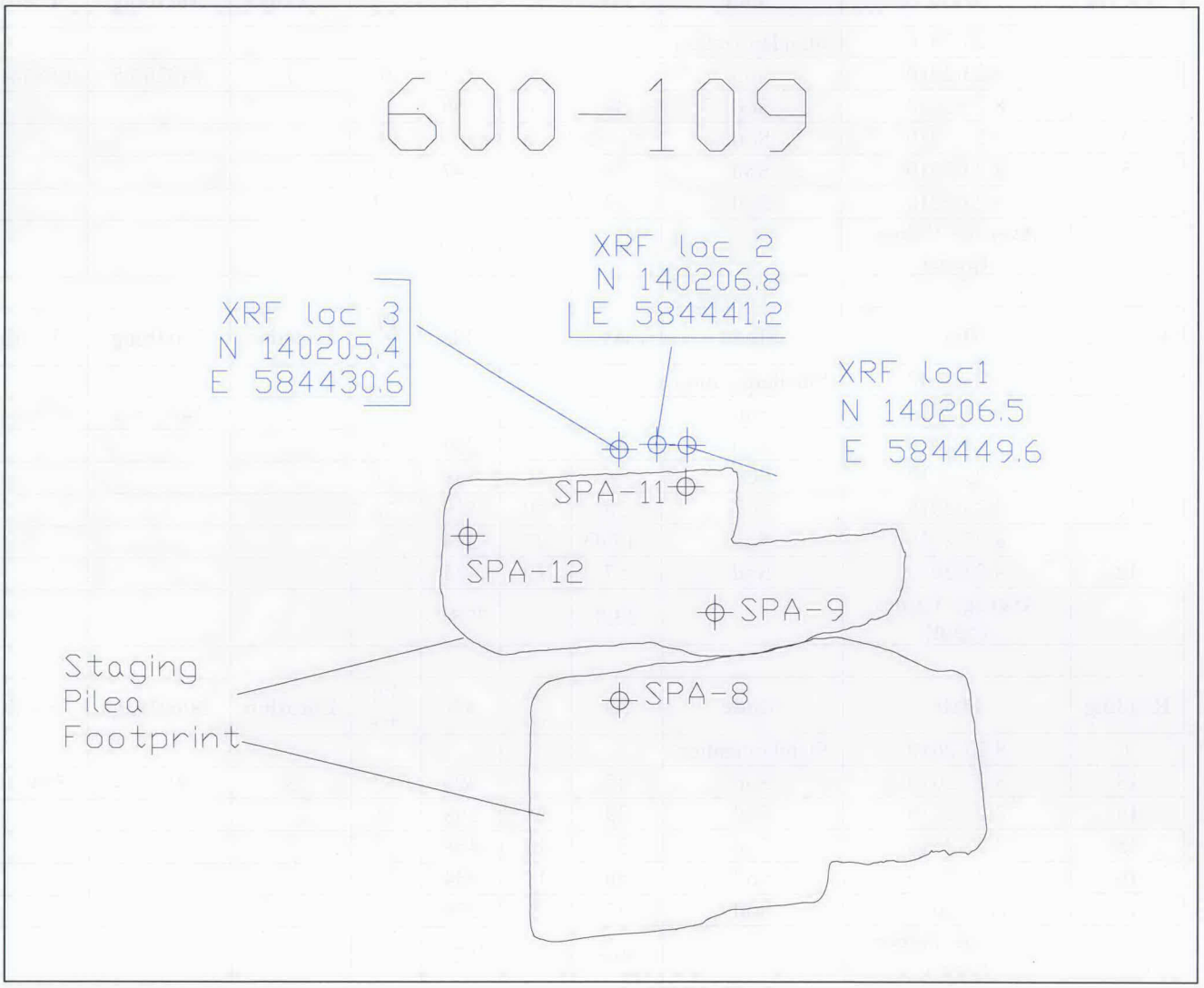


Table A-4. X-Ray Fluorescence Readings Surrounding the 600-109 Staging Pile Area in Support of Historic Orchard Contamination.

Reading	Date	Mode	As	As +/-	Pb	Pb +/-	Location	Northing	Easting
1	8/23/2010	Standardization							
2	8/23/2010	Soil	37	8	327	10	1	140206.5	E584449.6
3	8/23/2010	Soil	38	9	386	11			
4	8/23/2010	Soil	<LOD	25	303	10			
5	8/23/2010	Soil	49	9	347	10			
6	8/23/2010	Soil	42	10	460	12			
	Average Values (ppm)		33.2		364.6				
Reading	**Date**	**Mode**	**As**	**As +/-**	**Pb**	**Pb +/-**	**Location**	**Northing**	**Easting**
1	8/23/2010	Standardization							
7	8/23/2010	Soil	34	9	371	11	2	140206.8	E584441.2
8	8/23/2010	Soil	38	7	254	8			
9	8/23/2010	Soil	36	9	338	11			
10	8/23/2010	Soil	38	10	459	12			
11	8/23/2010	Soil	<LOD	27	394	11			
12	8/23/2010	Soil	57	10	435	12			
	Average Values (ppm)		33.8		375.2				
Reading	**Date**	**Mode**	**As**	**As +/-**	**Pb**	**Pb +/-**	**Location**	**Northing**	**Easting**
1	8/23/2010	Standardization							
13	8/23/2010	Soil	45	11	490	12	3	140205.4	584430.6
14	8/23/2010	Soil	39	9	298	11			
15	8/23/2010	Soil	57	10	458	12			
16	8/23/2010	Soil	56	11	444	13			
17	8/23/2010	Soil	57	8	274	9			
	Average Values (ppm)		50.8		392.8				

APPENDIX C

95% UPPER CONFIDENCE LIMIT (UCL) CALCULATION AND DIRECT CONTACT HAZARD QUOTIENT CALCULATION

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-IU-6 Field Remediation **Job No. 14655**

Area: 100-IU-6

Discipline: Environmental *Calculation No: 0600X-CA-V0085

Subject: 600-109 Waste Site Cleanup Verification 95% UCL Calculation

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 17 Attm. 1 = 7 Total = 25	T. E. Queen	J. D. Skoglie	D. I. Rollosson	D. F. Obenauer	signed 10/4/10
1	Cover = 1 Sheets = 17 Attm. 1 = 7 Total = 25	T. E. Queen TEQueen	J. D. Skoglie	NA	D. F. Obenauer D.F.Obenauer	10/25/10

SUMMARY OF REVISION

1	Sheet 6: lines 43-46, Changed 3-Part Test to "NA" for zinc because all values were below background.
WCH-DE-018 (05/08/2007)	*Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford **CALCULATION SHEET**

Originator T. E. Queen	**Date** 09/28/10	**Calc. No.** 0600X-CA-V0085	**Rev. No.** 0
Project 100-IU-6 Field Remediation	**Job No.** 14655	**Checked** J. D. Skoglie	**Date** 09/28/10
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 1 of 17

Summary

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

Table of Contents:
Sheets 1 to 4 - Calculation Sheet Summary
Sheets 5 to 9 - Calculation Sheet Verification Data - Excavation and Staging Pile Area
Sheets 10 to 14 - Ecology Software (MTCAStat) Results - Excavation and Staging Pile Area
Sheet 15 to 17 - Calculation Sheet Duplicate Analysis - Excavation, Staging Pile Area, and Overburden
Attachment 1 - 600-109, Verification Sampling Results (7 sheets)

Given/References:
1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2009b), DOE-RL (2001), and Ecology (1996).
3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
6) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
7) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets),* Publication #92-54, Washington Department of Ecology, Olympia, Washington.
8) Ecology, 1996, *Model Toxic Control Act Cleanup Levels and Risk Calculations (CLARC II),* Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
9) Ecology, 2005, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
10) 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 2009b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).

Calculation Description:
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 600-109 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 2009b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:
The 600-109 waste site underwent statistical and focused sampling and had four decision units for verification sampling, consisting of the excavation, the waste staging pile area, the overburden stockpile, and the boulder staging area. In addition to statistical sampling, three focused samples were collected from within the excavation and analyzed for asbestos only. Analytical results for all sampling locations are summarized in the tables provided on sheets 3 and 4. The results of asbestos sampling are included in Attachment 1. Further information of the sample data quality is presented in the data quality assessment section of the associated RSVP.

Washington Closure Hanford CALCULATION SHEET

Originator T. E. Queen Date 09/28/10 Calc. No. 0600X-CA-V0085 Rev. No. 0
Project 100-IU-6 Field Remediation Job No. 14655 Checked J. D. Skoglie Date 09/28/10
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 2 of 17

Summary (continued)

Methodology, continued:

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

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 radionuclide data, calculation of the statistics is done using the reported value. In cases where the laboratory does not report a value below the minimum 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 ($n < 10$), the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2009b) 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 where the statistical value defaults to the maximum value in the data set. Instead, direct comparison of the maximum value against site remedial action goals (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 and is listed in Table 2-1 of the SAP (DOE-RL 2009a) for certain constituents with cleanup levels. All other constituents will have their own pre-determined TDL's based on the laboratory and method used. 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) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. If the RPD is greater than 30%, further investigation regarding the usability of the data is performed. To assist in the identification of anomalous sample pairs, 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 result exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable RSVP.

Washington Closure Hanford

CALCULATION SHEET

Originator T. E. Queen **Date** 09/28/10 **Calc. No.** 0600X-CA-V0085 **Rev. No.** 0
Project 100-IU-6 Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 09/28/10
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 3 of 17

Summary (continued)

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

Results Summary - Excavation [a]

Analyte	95% UCL Result	Maximum Result	Units
Arsenic	5.09	--	mg/kg
Barium	88.1	--	mg/kg
Beryllium	0.252	--	mg/kg
Boron	1.02	--	mg/kg
Cadmium	0.116	--	mg/kg
Chromium	8.61	--	mg/kg
Cobalt	9.86	--	mg/kg
Copper	15.7	--	mg/kg
Lead	19.7	--	mg/kg
Manganese	369	--	mg/kg
Molybdenum	0.368	--	mg/kg
Nickel	11.3	--	mg/kg
Vanadium	80.6	--	mg/kg
Zinc	52.7	--	mg/kg
Antimony	--	0.375	mg/kg
TPH - motor oil	--	17.1	mg/kg
Anthracene	--	0.00144	mg/kg
Benzo(a)anthracene	--	0.00616	mg/kg
Benzo(a)pyrene	--	0.00564	mg/kg
Benzo(b)fluoranthene	--	0.0102	mg/kg
Benzo(ghi)perylene	--	0.00444	mg/kg
Benzo(k)fluoranthene	--	0.00379	mg/kg
Chrysene	--	0.00639	mg/kg
Fluoranthene	--	0.00916	mg/kg
Fluorene	--	0.00159	mg/kg
Indeno(1,2,3-cd)pyrene	--	0.0151	mg/kg
Phenanthrene	--	0.00243	mg/kg
Pyrene	--	0.00300	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

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

Results Summary - Staging Pile Area [a]

Analyte	95% UCL Result	Maximum Result	Units
Antimony	0.772	--	mg/kg
Arsenic	27.2	--	mg/kg
Barium	95.2	--	mg/kg
Beryllium	0.282	--	mg/kg
Boron	2.16	--	mg/kg
Cadmium	0.177	--	mg/kg
Chromium	11.2	--	mg/kg
Cobalt	7.76	--	mg/kg
Copper	14.4	--	mg/kg
Lead	141	--	mg/kg
Manganese	360	--	mg/kg
Molybdenum	0.459	--	mg/kg
Nickel	10.4	--	mg/kg
Vanadium	53.4	--	mg/kg
Zinc	67.2	--	mg/kg
TPH - motor oil	39.7	--	mg/kg
Benzo(a)anthracene	0.00265	--	mg/kg
Benzo(a)pyrene	0.00331	--	mg/kg
Benzo(b)fluoranthene	0.00501	--	mg/kg
Benzo(ghi)perylene	0.0110	--	mg/kg
Benzo(k)fluoranthene	0.00195	--	mg/kg
Fluoranthene	0.0112	--	mg/kg
Indeno(1,2,3-cd)pyrene	0.0216	--	mg/kg
Phenanthrene	0.00429	--	mg/kg
Pyrene	0.00261	--	mg/kg
TPH - diesel range	--	19.2	mg/kg
Acenaphthene	--	0.0300	mg/kg
Anthracene	--	0.00212	mg/kg
Dibenz[a,h]anthracene	--	0.00151	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

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

-- = not applicable
B = blank contamination (inorganic constituents)
C = Sample was </= 5X the blank concentration
DE = direct exposure
GW = groundwater
J = estimate
L = dilution indicating physical and chemical interference are present
M = sample duplicate precision not met
MTCA = *Model Toxics Control Act*
PQL = practical quantitation limit
Q = qualifier

QA/QC = quality assurance/quality control
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
RSVP = remaining sites verification package
SAP = sampling and analysis plan
TDL = target detection limit
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

Washington Closure Hanford

CALCULATION SHEET

Originator T. E. Queen **Date** 09/28/10 **Calc. No.** 0600X-CA-V0085 **Rev. No.** 0
Project 100-IU-6 Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 09/28/10
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 4 of 17

Summary (continued)

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

Results Summary

Analyte	Overburden	Boulder Soil Sample	Units
	Maximum Result	Maximum Result	
Arsenic	15.3	6.07	mg/kg
Barium	99.0	84.5	mg/kg
Beryllium	0.312	0.269	mg/kg
Boron	2.53	1.70	mg/kg
Cadmium	0.191	0.113	mg/kg
Chromium	13.3	10.9	mg/kg
Cobalt	7.52	7.34	mg/kg
Copper	12.0	16.4	mg/kg
Lead	71.9	24.7	mg/kg
Manganese	354	307	mg/kg
Molybdenum	0.233	0.190	mg/kg
Nickel	10.8	10.6	mg/kg
Vanadium	54.5	52.5	mg/kg
Zinc	52.8	45.6	mg/kg
TPH - motor oil	26.6	6.95	mg/kg
Acenaphthene	0.00600	--	mg/kg
Anthracene	--	0.000882	mg/kg
Benzo(a)anthracene	0.00180	0.00476	mg/kg
Benzo(a)pyrene	0.00204	0.00305	mg/kg
Benzo(b)fluoranthene	0.00245	0.00238	mg/kg
Benzo(ghi)perylene	0.00359	0.00306	mg/kg
Benzo(k)fluoranthene	0.00132	0.00112	mg/kg
Chrysene	0.00231	0.00295	mg/kg
Fluoranthene	0.0140	0.00746	mg/kg
Phenanthrene	0.00266	0.00611	mg/kg
Pyrene	0.00357	0.00837	mg/kg

Relative Percent Difference Results and QA/QC Analysis[a]

Analyte	Duplicate Analysis		
	Excavation	Staging Pile Area	Overburden
Aluminum	5.0%	1.4%	2.0%
Barium	10.7%	1.0%	1.7%
Calcium	4.7%	3.5%	6.4%
Chromium	16.1%	4.5%	3.5%
Copper	0.7%	0.9%	6.3%
Iron	5.7%	0.9%	2.0%
Lead	--	0.9%	4.7%
Magnesium	8.8%	3.6%	1.8%
Manganese	5.5%	0.8%	4.7%
Silicon	31.2%	7.3%	9.1%
Sodium	13.8%	--	--
Vanadium	7.6%	2.9%	3.7%
Zinc	3.4%	0.6%	1.1%
TPH - diesel range	--	16.1%	--
TPH - motor oil	--	29.3%	2.6%

[a]RPD listed where result produced, based on criteria. If RPD not required, no value is listed. The significance of the reported RPD values, including values greater than 30%, is addressed in the data quality assessment section of the RSVP.

CALCULATION SHEET

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/28/10
Job No. 14655

Calc. No. 0600X-CA-V0085
Checked J. D. Skoglie

Rev. No. 0
Date 09/28/10
Sheet No. 5 of 17

1 **600-109 Statistical Calculations**

2 **Verification Data - Excavation**

3	Sample	Sample	Sample	Arsenic			Barium			Beryllium			Boron			Cadmium			Chromium			Cobalt			Copper			Lead			Manganese		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	EX-12	J1B980	6/29/2010	1.13		0.800	55		0.400	0.156		0.160	0.55		1.60	0.101		0.160	5.90		0.160	9.89		1.60	13.8		0.800	1.07		0.400	352		4.00
6	Duplicate of EX-12	J1B981	6/29/2010	1.61		0.800	61.2		0.401	0.169		0.160	1.60	U	1.60	0.0975		0.160	5.02		0.160	9.54		1.60	13.7		0.800	1.28		0.401	333		4.01
7	EX-1	J1B969	6/29/2010	1.78		1.02	69.2		0.512	0.240		0.205	0.727		2.05	0.107		0.205	7.08		0.205	10.1		2.05	15.4		1.02	3.41		0.512	377		5.12
8	EX-2	J1B970	6/29/2010	13.6		0.852	105		0.426	0.349		0.170	1.89		1.70	0.145		0.170	13.7		0.170	9.26		1.70	17.2		0.852	47.7		0.426	396		4.26
9	EX-3	J1B971	6/29/2010	2.84		0.751	122		0.376	0.248		0.150	0.545		1.50	0.0964		0.150	6.05		0.150	8.78		1.50	14.5		0.751	4.39		0.376	344		3.76
10	EX-4	J1B972	6/29/2010	2.48		0.911	83.9		0.456	0.263		0.182	0.766		1.82	0.115		0.182	7.89		0.182	11.2		1.82	17.6		0.911	2.72		0.456	403		4.56
11	EX-5	J1B973	6/29/2010	2.06		0.890	58.7		0.445	0.198		0.178	0.640		1.78	0.103		0.178	6.51		0.178	9.77		1.78	13.6		0.890	2.31		0.445	362		4.45
12	EX-6	J1B974	6/29/2010	1.85		0.817	60.5		0.409	0.206		0.163	0.531		1.63	0.0942		0.163	4.88		0.163	9.26		1.63	15.2		0.817	3.07		0.409	326		4.09
13	EX-7	J1B975	6/29/2010	2.92		0.776	72.9		0.388	0.173		0.155	1.35		1.55	0.118		0.155	6.65		0.155	8.90		1.55	13.2		0.776	7.81		0.388	345		3.88
14	EX-8	J1B976	6/29/2010	1.97		0.829	78.1		0.414	0.186		0.166	0.592		1.66	0.108		0.166	6.49		0.166	9.33		1.66	12.7		0.829	2.31		0.414	357		4.14
15	EX-9	J1B977	6/29/2010	2.75		0.673	69.0		0.337	0.186		0.135	0.555		1.35	0.107		0.135	6.76		0.135	8.54		1.35	12.7		0.673	8.12		0.337	323		3.37
16	EX-10	J1B978	6/29/2010	2.29		0.761	78.4		0.380	0.190		0.152	0.958		1.52	0.113		0.152	7.27		0.152	9.71		1.52	15.8		0.761	6.07		0.380	336		3.80
17	EX-11	J1B979	6/29/2010	5.87		0.796	75.4		0.398	0.264		0.159	0.751		1.59	0.107		0.159	10.7		0.159	9.30		1.59	16.0		0.796	16.1		0.398	349		3.98

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
21	EX-12	J1B980/ J1B981	6/29/2010	1.37	58.1	0.163	0.675	0.0993	5.46	9.72	13.8	1.18	343
22	EX-1	J1B969	6/29/2010	1.78	69.2	0.240	0.727	0.107	7.08	10.1	15.4	3.41	377
23	EX-2	J1B970	6/29/2010	13.6	105	0.349	1.89	0.145	13.7	9.26	17.2	47.7	396
24	EX-3	J1B971	6/29/2010	2.84	122	0.248	0.545	0.0964	6.05	8.78	14.5	4.39	344
25	EX-4	J1B972	6/29/2010	2.48	83.9	0.263	0.766	0.115	7.89	11.2	17.6	2.72	403
26	EX-5	J1B973	6/29/2010	2.06	58.7	0.198	0.640	0.103	6.51	9.77	13.6	2.31	362
27	EX-6	J1B974	6/29/2010	1.85	60.5	0.206	0.531	0.0942	4.88	9.26	15.2	3.07	326
28	EX-7	J1B975	6/29/2010	2.92	72.9	0.173	1.35	0.118	6.65	8.90	13.2	7.81	345
29	EX-8	J1B976	6/29/2010	1.97	78.1	0.186	0.592	0.108	6.49	9.33	12.7	2.31	357
30	EX-9	J1B977	6/29/2010	2.75	69.0	0.186	0.555	0.107	6.76	8.54	12.7	8.12	323
31	EX-10	J1B978	6/29/2010	2.29	78.4	0.190	0.958	0.113	7.27	9.71	15.8	6.07	336
32	EX-11	J1B979	6/29/2010	5.87	75.4	0.264	0.751	0.107	10.7	9.30	16.0	16.1	349

33 **Statistical Computations**

34		Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
35	95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), 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), lognormal and normal distribution rejected, use 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), use MTCAStat lognormal distribution.
36	N	12	12	12	12	12	12	12	12	12	12
37	% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
38	Mean	3.48	77.6	0.222	0.832	0.109	7.45	9.49	14.8	8.77	355
39	Standard deviation	3.39	19.0	0.0531	0.404	0.0133	2.44	0.700	1.67	12.9	25.5
40	95% UCL on mean	5.09	88.1	0.252	1.02	0.116	8.61	9.86	15.7	19.7	369
41	Maximum value	13.6	122	0.349	1.89	0.145	13.7	11.2	17.6	47.7	403
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection	10.2 GW & River Protection	512 GW & River Protection
43	**WAC 173-340 3-PART TEST**										
44	95% UCL > Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NA	YES	NA
45	> 10% above Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NA	YES	NA
46	Any sample > 2X Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NA	YES	NA
47	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	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 RAG.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	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.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

Date 10/25/10
Job No. 14655

Calc. No. 0600X-CA-V0085
Checked J. D. Skoglie

Rev. No. 1
Date 10/25/10
Sheet No. 6 of 17

1 **600-109 Statistical Calculations**
2 **Verification Data - Excavation**

3	Sample	Sample	Sample	Molybdenum			Nickel			Vanadium			Zinc		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	EX-12	J1B980	6/29/2010	0.168		1.60	8.47		3.20	82.1		2.00	51.0		8.01
6	Duplicate of EX-12	J1B981	6/29/2010	0.209		1.60	7.46		3.21	76.1		2.00	49.3		8.01
7	EX-1	J1B969	6/29/2010	0.581		2.05	10.8		4.10	78.4		2.56	49.8		10.2
8	EX-2	J1B970	6/29/2010	0.520		1.70	13.4		3.41	67.2		2.13	52.4		8.52
9	EX-3	J1B971	6/29/2010	0.520		1.50	8.21		3.01	69.6		1.88	45.8		7.51
10	EX-4	J1B972	6/29/2010	0.307		1.82	13.7		3.64	90.1		2.28	57.7		9.11
11	EX-5	J1B973	6/29/2010	0.233		1.78	9.17		3.56	86.7		2.22	50.5		8.90
12	EX-6	J1B974	6/29/2010	0.197		1.63	7.54		3.27	69.1		2.04	54.2		8.17
13	EX-7	J1B975	6/29/2010	0.194		1.55	9.28		3.10	76.8		1.94	51.3		7.76
14	EX-8	J1B976	6/29/2010	0.182		1.66	11.1		3.31	79.5		2.07	48.2		8.29
15	EX-9	J1B977	6/29/2010	0.228		1.35	9.33		2.69	73.1		1.68	45.8		6.73
16	EX-10	J1B978	6/29/2010	0.214		1.52	10.2		3.04	80.3		1.90	52.0		7.61
17	EX-11	J1B979	6/29/2010	0.187		1.59	11.5		3.18	70.7		1.99	52.6		7.96

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Molybdenum			Nickel			Vanadium			Zinc		
20	Area	Number	Date	mg/kg			mg/kg			mg/kg			mg/kg		
21	EX-12	J1B980/ J1B981	6/29/2010	0.189			7.97			79.1			50.2		
22	EX-1	J1B969	6/29/2010	0.581			10.8			78.4			49.8		
23	EX-2	J1B970	6/29/2010	0.520			13.4			67.2			52.4		
24	EX-3	J1B971	6/29/2010	0.520			8.21			69.6			45.8		
25	EX-4	J1B972	6/29/2010	0.307			13.7			90.1			57.7		
26	EX-5	J1B973	6/29/2010	0.233			9.17			86.7			50.5		
27	EX-6	J1B974	6/29/2010	0.197			7.54			69.1			54.2		
28	EX-7	J1B975	6/29/2010	0.194			9.28			76.8			51.3		
29	EX-8	J1B976	6/29/2010	0.182			11.1			79.5			48.2		
30	EX-9	J1B977	6/29/2010	0.228			9.33			73.1			45.8		
31	EX-10	J1B978	6/29/2010	0.214			10.2			80.3			52.0		
32	EX-11	J1B979	6/29/2010	0.187			11.5			70.7			52.6		

33 **Statistical Computations**

34		Molybdenum	Nickel	Vanadium	Zinc
35	95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
36	N	12	12	12	12
37	% < Detection limit	0%	0%	0%	0%
38	Mean	0.296	10.2	76.7	50.9
39	Standard deviation	0.152	2.00	7.11	3.37
40	95% UCL on mean	0.368	11.3	80.6	52.7
41	Maximum value	0.581	13.7	90.1	57.7
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	8 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection
43	**WAC 173-340 3-PART TEST**				
44	95% UCL > Cleanup Limit?	NO	NA	NO	NA
45	> 10% above Cleanup Limit?	NO	NA	YES	NA
46	Any sample > 2X Cleanup Limit?	NO	NA	NO	NA
47	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.

Attachment to Waste Site Reclassification Form 2010-075

CALCULATION SHEET

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/28/10
Job No. 14655

Calc. No. 0600X-CA-V0085
Checked J. D. Skoglie

Rev. No. 0
Date 09/28/10
Sheet No. 7 of 17

1 **600-109 Statistical Calculations**

2 **Verification Data - Staging Pile Area**

	Sample Area	Sample Number	Sample Date	Antimony mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Lead mg/kg	Q	PQL
3	SPA-11	J1B999	7/13/2010	0.742	J	0.457	41.0		0.762	86.1		0.381	0.265		0.152	1.58		1.52	0.248		0.152	10.2		0.152	8.17		1.52	11.7		0.762	340		0.381
4	Duplicate of SPA-11	J1B9B1	7/13/2010	0.954	J	0.477	41.1		0.795	87.0		0.397	0.273		0.159	1.63		1.59	0.254		0.159	9.75		0.159	7.87		1.59	11.8		0.795	337		0.397
5	SPA-1	J1B989	7/13/2010	0.657	J	0.514	13.5		0.857	96.4		0.428	0.311		0.171	2.86		1.71	0.110	B	0.171	11.7		0.171	7.90		1.71	12.5		0.857	25.1		0.428
6	SPA-2	J1B990	7/13/2010	0.677	J	0.408	16.3		0.679	84.4		0.340	0.271		0.136	1.65		1.36	0.107	B	0.136	10.7		0.136	7.08		1.36	11.4		0.679	51.8		0.340
7	SPA-3	J1B991	7/13/2010	0.579	J	0.477	5.48		0.795	90.6		0.398	0.197		0.159	0.821	B	1.59	0.00668	B	0.159	7.90		0.159	5.77		1.59	9.34		0.795	14.2		0.398
8	SPA-4	J1B992	7/13/2010	0.554	J	0.450	14.7		0.750	67.0		0.375	0.214		0.150	1.48	B	1.50	0.0982	B	0.150	10.3		0.150	6.15		1.50	10.7		0.750	82.9		0.375
9	SPA-5	J1B993	7/13/2010	0.668	J	0.457	13.2		0.761	69.3		0.381	0.198		0.152	1.42	B	1.52	0.0831	B	0.152	8.62		0.152	5.42		1.52	9.97		0.761	75.9		0.381
10	SPA-6	J1B994	7/13/2010	0.755	J	0.497	17.4		0.828	90.1		0.414	0.275		0.166	2.67		1.66	0.103	B	0.166	10.8		0.166	7.10		1.66	12.5		0.828	64.1		0.414
11	SPA-7	J1B995	7/13/2010	0.800	J	0.543	11.2		0.906	99.1		0.453	0.314		0.181	2.11		1.81	0.164	B	0.181	12.4		0.181	8.30		1.81	14.5		0.906	33.4		0.453
12	SPA-8	J1B996	7/13/2010	0.663	J	0.425	22.7		0.708	87.7		0.354	0.276		0.142	2.07		1.42	0.124	B	0.142	10.9		0.142	7.11		1.42	12.5		0.708	117		0.354
13	SPA-9	J1B997	7/13/2010	0.564	J	0.489	25.2		0.815	111		0.407	0.268		0.163	1.47	B	1.63	0.142	B	0.163	10.4		0.163	7.03		1.63	13.7		0.815	41.9		0.407
14	SPA-10	J1B998	7/13/2010	0.842	J	0.517	12.8		0.861	93.3		0.430	0.264		0.172	1.44	B	1.72	0.346		0.172	11.0		0.172	7.92		1.72	22.2		0.861	35.1		0.430
15	SPA-12	J1B9B0	7/13/2010	0.865	J	0.529	32.5		0.176	92.4		0.441	0.300		0.176	1.66	B	1.76	0.0965	B	0.176	11.8		0.176	8.28		1.76	12.8		0.176	42.1		0.441

16 **Statistical Computation Input Data**

	Sample Area	Sample Number	Sample Date	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Lead mg/kg
17	SPA-11	J1B999/ J1B9B1	7/13/2010	0.848	41.1	86.6	0.269	1.61	0.251	9.98	8.02	11.8	339
18	SPA-1	J1B989	7/13/2010	0.657	13.5	96.4	0.311	2.86	0.110	11.7	7.90	12.5	25.1
19	SPA-2	J1B990	7/13/2010	0.677	16.3	84.4	0.271	1.65	0.107	10.7	7.08	11.4	51.8
20	SPA-3	J1B991	7/13/2010	0.579	5.48	90.6	0.197	0.821	0.00668	7.90	5.77	9.34	14.2
21	SPA-4	J1B992	7/13/2010	0.554	14.7	67.0	0.214	1.48	0.0982	10.3	6.15	10.7	82.9
22	SPA-5	J1B993	7/13/2010	0.668	13.2	69.3	0.198	1.42	0.0831	8.62	5.42	10.0	75.9
23	SPA-6	J1B994	7/13/2010	0.755	17.4	90.1	0.275	2.67	0.103	10.8	7.10	12.5	64.1
24	SPA-7	J1B995	7/13/2010	0.800	11.2	99.1	0.314	2.11	0.164	12.4	8.30	14.5	33.4
25	SPA-8	J1B996	7/13/2010	0.663	22.7	87.7	0.276	2.07	0.124	10.9	7.11	12.5	117
26	SPA-9	J1B997	7/13/2010	0.564	25.2	111	0.268	1.47	0.142	10.4	7.03	13.7	41.9
27	SPA-10	J1B998	7/13/2010	0.842	12.8	93.3	0.264	1.44	0.346	11.0	7.92	22.2	35.1
28	SPA-12	J1B9B0	7/13/2010	0.865	32.5	92.4	0.300	1.66	0.0965	11.8	8.28	12.8	42.1

29 **Statistical Computations**

	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead
30 95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.
31 N	12	12	12	12	12	12	12	12	12	12
32 % < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33 Mean	0.706	18.8	89.0	0.263	1.77	0.136	10.5	7.17	12.8	76.8
34 Standard deviation	0.113	10.0	12.0	0.0401	0.569	0.0871	1.27	0.974	3.30	87.2
35 95% UCL on mean	0.772	27.2	95.2	0.282	2.16	0.177	11.2	7.76	14.4	141
36 Maximum value	0.954	41.1	111	0.314	2.86	0.346	12.4	8.30	22.2	340
37 **Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	5 GW & River Protection	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection	10.2 GW & River Protection
38 **WAC 173-340 3-PART TEST**										
39 95% UCL > Cleanup Limit?	NA	YES	NA	NA	NO	NA	NA	NA	NO	YES
40 > 10% above Cleanup Limit?	NA	YES	NA	NA	NO	NA	NA	NA	NO	YES
41 Any sample > 2X Cleanup Limit?	NA	YES	NA	NA	NO	NA	NA	NA	NO	YES
42 **WAC 173-340 Compliance?**	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set DOES NOT MEET the 3-part test criteria when compared to the direct exposure RAG.	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 RAG.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

CALCULATION SHEET

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Job No. 14655

Calc. No. 0600X-CA-V0085
Checked J. D. Skoglie

Rev. No. 0
Date 09/28/10
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1 **600-109 Statistical Calculations**

2 **Verification Data - Staging Pile Area**

3 Sample Area	Sample Number	Sample Date	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL	TPH - motor oil mg/kg	Q	PQL	Benzo(a)anthracene ug/kg	Q	PQL	Benzo(a)pyrene ug/kg	Q	PQL	Benzo(b)fluoranthene ug/kg	Q	PQL	Benzo(ghi)perylene ug/kg	Q	PQL
4 SPA-11	J1B999	7/13/2010	363		3.81	0.427	B	1.52	9.66		3.05	56.9		1.90	62.0		7.62	38.0	J	10.1	2.60	J	3.24	2.43	J	3.24	4.71		3.24	10.9		3.24
5 Duplicate of SPA-11	J1B9B1	7/13/2010	360		3.97	0.423	B	1.59	9.17		3.18	55.3		1.99	61.6		7.95	28.3	J	10.0	1.95	J	3.25	2.44	J	3.25	3.91		3.25	6.02		3.25
6 SPA-1	J1B989	7/13/2010	397		4.28	0.454	B	1.71	10.1		3.43	54.6		2.14	49.1		8.57	12.4	J	9.84	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	1.34	J	3.35
7 SPA-2	J1B990	7/13/2010	354		3.40	0.427	B	1.36	9.50		2.72	48.9		1.70	46.5		6.79	9.98	J	10.0	3.35	U	3.35	1.68	J	3.35	3.35	U	3.35	6.21		3.35
8 SPA-3	J1B991	7/13/2010	265		3.98	0.326	B	1.59	9.03		3.18	40.5		1.99	35.2		7.95	9.90	UJ	9.90	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	2.30	J	3.28
9 SPA-4	J1B992	7/13/2010	294		3.75	0.357	B	1.50	9.08		3.00	42.4		1.88	42.6		7.50	28.9	J	9.87	2.01	J	3.34	2.18	J	3.34	3.68		3.34	1.84	J	3.34
10 SPA-5	J1B993	7/13/2010	275		3.81	0.380	B	1.52	8.24		3.05	39.6		1.90	39.2		7.61	14.3	J	9.83	2.14	J	3.29	1.32	J	3.29	3.13	J	3.29	1.48	J	3.29
11 SPA-6	J1B994	7/13/2010	347		4.14	0.489	B	1.66	10.7		3.31	51.4		2.07	49.5		8.28	20.1	J	10.2	2.00	J	3.33	2.50	J	3.33	1.33	J	3.33	15.8		3.33
12 SPA-7	J1B995	7/13/2010	398		4.53	0.495	B	1.81	11.4		3.62	56.8		2.26	56.6		9.06	34.2	J	10.2	1.88	J	3.41	3.24	J	3.41	4.27		3.41	6.65		3.41
13 SPA-8	J1B996	7/13/2010	330		3.54	0.428	B	1.42	9.68		2.83	49.9		1.77	51.4		7.08	21.2	J	9.99	2.51	J	3.34	2.34	J	3.34	3.85		3.34	8.53		3.34
14 SPA-9	J1B997	7/13/2010	322		4.07	0.424	B	1.63	9.72		3.26	45.3		2.04	124		8.15	35.7	J	10.2	2.37	J	3.38	2.03	J	3.38	3.72		3.38	2.37	J	3.38
15 SPA-10	J1B998	7/13/2010	323		4.30	0.515	B	1.72	11.2		3.44	53.6		2.15	68.9		8.61	47.7	J	10.0	4.85		3.34	7.53		3.34	12.0		3.34	7.86		3.34
16 SPA-12	J1B9B0	7/13/2010	354		4.41	0.398	B	1.76	10.7		3.53	56.5		2.20	48.6		8.82	7.12	J	9.91	1.84	J	3.34	1.67	J	3.34	2.67	J	3.34	2.01	J	3.34

17 **Statistical Computation Input Data**

18 Sample Area	Sample Number	Sample Date	Manganese mg/kg	Molybdenum mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	TPH - motor oil mg/kg	Benzo(a)anthracene ug/kg	Benzo(a)pyrene ug/kg	Benzo(b)fluoranthene ug/kg	Benzo(ghi)perylene ug/kg
19 SPA-11	J1B999/ J1B9B1	7/13/2010	362	0.425	9.42	56.1	61.8	33.2	2.28	2.44	4.31	8.46
20 SPA-1	J1B989	7/13/2010	397	0.454	10.1	54.6	49.1	12.4	1.68	1.68	1.68	1.34
21 SPA-2	J1B990	7/13/2010	354	0.427	9.50	48.9	46.5	10.0	1.68	1.68	1.68	6.21
22 SPA-3	J1B991	7/13/2010	265	0.326	9.03	40.5	35.2	4.95	1.64	1.64	1.64	2.30
23 SPA-4	J1B992	7/13/2010	294	0.357	9.08	42.4	42.6	28.9	2.01	2.18	3.68	1.84
24 SPA-5	J1B993	7/13/2010	275	0.380	8.24	39.6	39.2	14.3	2.14	1.32	3.13	1.48
25 SPA-6	J1B994	7/13/2010	347	0.489	10.7	51.4	49.5	20.1	2.00	2.50	1.33	15.8
26 SPA-7	J1B995	7/13/2010	398	0.495	11.4	56.8	56.6	34.2	1.88	3.24	4.27	6.65
27 SPA-8	J1B996	7/13/2010	330	0.428	9.68	49.9	51.4	21.2	2.51	2.34	3.85	8.53
28 SPA-9	J1B997	7/13/2010	322	0.424	9.72	45.3	124	35.7	2.37	2.03	3.72	2.37
29 SPA-10	J1B998	7/13/2010	323	0.515	11.2	53.6	68.9	47.7	4.85	7.53	12.0	7.86
30 SPA-12	J1B9B0	7/13/2010	354	0.398	10.7	56.5	48.6	7.12	1.84	1.67	2.67	2.01

31 **Statistical Computations**

32	Manganese	Molybdenum	Nickel	Vanadium	Zinc	TPH - motor oil	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene
33 95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), 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.
34 N	12	12	12	12	12	12	12	12	12	12
35 % < Detection limit	0%	0%	0%	0%	0%	8%	25%	17%	25%	0%
36 Mean	335	0.427	9.90	49.6	56.1	22.5	2.24	2.52	3.66	5.40
37 Standard deviation	42.5	0.0565	0.950	6.32	23.3	13.4	0.869	1.66	2.85	4.37
38 95% UCL on mean	360	0.459	10.4	53.4	67.2	39.7	2.65	3.31	5.01	11.0
39 Maximum value	398	0.515	11.4	56.9	124	47.7	4.85	7.53	12.0	15.8
40 **Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	512 GW & River Protection	8 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200 DE, GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	48000 ug/kg GW Protection
41 **WAC 173-340 3-PART TEST**										
42 95% UCL > Cleanup Limit?	NA	NO	NA	NA	NO	NO	NO	NO	NO	NO
43 > 10% above Cleanup Limit?	NA	NO	NA	NA	YES	NO	NO	NO	NO	NO
44 Any sample > 2X Cleanup Limit?	NA	NO	NA	NA	NO	NO	NO	NO	NO	NO
45 **WAC 173-340 Compliance?**	Because all values are below background (512 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 RAG.	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.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

CALCULATION SHEET

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/28/10
Job No. 14655

Calc. No. 0600X-CA-V0085
Checked J. D. Skoglie

Rev. No. 0
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Sheet No. 9 of 17

1 **600-109 Statistical Calculations**

2 **Verification Data - Staging Pile Area**

3	Sample	Sample	Sample	Benzo(k)fluoranthene			Fluoranthene			Indeno(1,2,3-cd)pyrene			Phenanthrene			Pyrene		
4	Area	Number	Date	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	SPA-11	J1B999	7/13/2010	1.46	J	3.24	3.24	U	3.24	4.71		3.24	2.92	J	3.24	2.11	J	3.24
6	Duplicate of SPA-11	J1B9B1	7/13/2010	1.63	J	3.25	3.25	U	3.25	4.56		3.25	3.26		3.25	2.93	J	3.25
7	SPA-1	J1B989	7/13/2010	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35
8	SPA-2	J1B990	7/13/2010	3.35	U	3.35	3.35	U	3.35	23.5		3.35	1.68	J	3.35	3.35	U	3.35
9	SPA-3	J1B991	7/13/2010	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28
10	SPA-4	J1B992	7/13/2010	1.17	J	3.34	15.6		3.34	6.19		3.34	2.68	J	3.34	2.34	J	3.34
11	SPA-5	J1B993	7/13/2010	0.987	J	3.29	6.74		3.29	3.78		3.29	3.13	J	3.29	2.14	J	3.29
12	SPA-6	J1B994	7/13/2010	1.33	J	3.33	20.2		3.33	11.5		3.33	6.33		3.33	3.33	U	3.33
13	SPA-7	J1B995	7/13/2010	2.05	J	3.41	12.3		3.41	10.4		3.41	3.92		3.41	2.90	J	3.41
14	SPA-8	J1B996	7/13/2010	1.34	J	3.34	13.5		3.34	4.51		3.34	3.68		3.34	2.84	J	3.34
15	SPA-9	J1B997	7/13/2010	1.01	J	3.38	3.38	U	3.38	7.44		3.38	2.37	J	3.38	1.52	J	3.38
16	SPA-10	J1B998	7/13/2010	3.51		3.34	14.1		3.34	35.3		3.34	5.19		3.34	3.34	U	3.34
17	SPA-12	J1B9B0	7/13/2010	3.34	U	3.34	5.02		3.34	3.18	J	3.34	3.51		3.34	4.18		3.34

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Benzo(k)fluoranthene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Phenanthrene	Pyrene
20	Area	Number	Date	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
21	SPA-11	J1B999/ J1B9B1	7/13/2010	1.55	1.62	4.64	3.09	2.52
22	SPA-1	J1B989	7/13/2010	1.68	1.68	1.68	1.68	1.68
23	SPA-2	J1B990	7/13/2010	1.68	1.68	23.5	1.68	1.68
24	SPA-3	J1B991	7/13/2010	1.64	1.64	1.64	1.64	1.64
25	SPA-4	J1B992	7/13/2010	1.17	15.6	6.19	2.68	2.34
26	SPA-5	J1B993	7/13/2010	0.987	6.74	3.78	3.13	2.14
27	SPA-6	J1B994	7/13/2010	1.33	20.2	11.5	6.33	1.67
28	SPA-7	J1B995	7/13/2010	2.05	12.3	10.4	3.92	2.90
29	SPA-8	J1B996	7/13/2010	1.34	13.5	4.51	3.68	2.84
30	SPA-9	J1B997	7/13/2010	1.01	1.69	7.44	2.37	1.52
31	SPA-10	J1B998	7/13/2010	3.51	14.1	35.3	5.19	1.67
32	SPA-12	J1B9B0	7/13/2010	1.67	5.02	3.18	3.51	4.18

33 **Statistical Computations**

34		Benzo(k)fluoranthene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Phenanthrene	Pyrene
35	95% UCL based on	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.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
36	N	12	12	12	12	12
37	% < Detection limit	33%	42%	17%	17%	42%
38	Mean	1.63	7.98	9.48	3.24	2.23
39	Standard deviation	0.668	6.77	10.1	1.43	0.788
40	95% UCL on mean	1.95	11.2	21.6	4.29	2.61
41	Maximum value	3.51	20.2	35.3	6.33	4.18
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	15 ug/kg GW & River Protection	18000 ug/kg River Protection	330 ug/kg GW & River Protection	240000 ug/kg GW Protection	48000 ug/kg GW Protection
43	**WAC 173-340 3-PART TEST**					
44	95% UCL > Cleanup Limit?	NO	NO	NO	NO	NO
45	> 10% above Cleanup Limit?	NO	NO	NO	NO	NO
46	Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO
47	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

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CALCULATION SHEET

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/28/10
Job No. 14655

Calc. No. 0600X-CA-V0085
Checked J. D. Skoglie

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Ecology Software (MTCAStat) Results, 600-109 Excavation

Arsenic 95% UCL Calculation

DATA	ID
1.37	J1B980/ J1B981
1.78	J1B969
13.6	J1B970
2.84	J1B971
2.48	J1B972
2.06	J1B973
1.85	J1B974
2.92	J1B975
1.97	J1B976
2.75	J1B977
2.29	J1B978
5.87	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	3.48
Censored		Lognormal mean	3.33
Detection limit or PQL		Std. devn.	3.39
Method detection limit		Median	2.39
TOTAL	12	Min.	1.37
		Max.	13.6

Lognormal distribution? r-squared is: 0.793
Normal distribution? r-squared is: 0.547
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 5.09

Barium 95% UCL Calculation

DATA	ID
58.1	J1B980/ J1B981
69.2	J1B969
105	J1B970
122	J1B971
83.9	J1B972
58.7	J1B973
60.5	J1B974
72.9	J1B975
78.1	J1B976
69.0	J1B977
78.4	J1B978
75.4	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	77.6
Censored		Lognormal mean	77.7
Detection limit or PQL		Std. devn.	19.0
Method detection limit		Median	74.2
TOTAL	12	Min.	58.1
		Max.	122

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

UCL (Land's method) is 88.1

Beryllium 95% UCL Calculation

DATA	ID
0.163	J1B980/ J1B981
0.240	J1B969
0.349	J1B970
0.248	J1B971
0.263	J1B972
0.198	J1B973
0.206	J1B974
0.173	J1B975
0.186	J1B976
0.186	J1B977
0.190	J1B978
0.264	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	0.222
Censored		Lognormal mean	0.222
Detection limit or PQL		Std. devn.	0.0531
Method detection limit		Median	0.202
TOTAL	12	Min.	0.163
		Max.	0.349

Lognormal distribution? r-squared is: 0.929
Normal distribution? r-squared is: 0.874
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.252

Boron 95% UCL Calculation

DATA	ID
0.675	J1B980/ J1B981
0.727	J1B969
1.89	J1B970
0.545	J1B971
0.766	J1B972
0.640	J1B973
0.531	J1B974
1.35	J1B975
0.592	J1B976
0.555	J1B977
0.958	J1B978
0.751	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	0.832
Censored		Lognormal mean	0.828
Detection limit or PQL		Std. devn.	0.404
Method detection limit		Median	0.701
TOTAL	12	Min.	0.531
		Max.	1.89

Lognormal distribution? r-squared is: 0.842
Normal distribution? r-squared is: 0.720
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 1.02

Cadmium 95% UCL Calculation

DATA	ID
0.0993	J1B980/ J1B981
0.107	J1B969
0.145	J1B970
0.0964	J1B971
0.115	J1B972
0.103	J1B973
0.0942	J1B974
0.118	J1B975
0.108	J1B976
0.107	J1B977
0.113	J1B978
0.107	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	0.109
Censored		Lognormal mean	0.109
Detection limit or PQL		Std. devn.	0.0133
Method detection limit		Median	0.107
TOTAL	12	Min.	0.0942
		Max.	0.145

Lognormal distribution? r-squared is: 0.867
Normal distribution? r-squared is: 0.816
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.116

Chromium 95% UCL Calculation

DATA	ID
5.46	J1B980/ J1B981
7.08	J1B969
13.7	J1B970
6.05	J1B971
7.89	J1B972
6.51	J1B973
4.88	J1B974
6.65	J1B975
6.49	J1B976
6.76	J1B977
7.27	J1B978
10.7	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	7.45
Censored		Lognormal mean	7.45
Detection limit or PQL		Std. devn.	2.44
Method detection limit		Median	6.71
TOTAL	12	Min.	4.88
		Max.	13.7

Lognormal distribution? r-squared is: 0.873
Normal distribution? r-squared is: 0.771
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 8.61

Cobalt 95% UCL Calculation

DATA	ID
9.72	J1B980/ J1B981
10.1	J1B969
9.26	J1B970
8.78	J1B971
11.2	J1B972
9.77	J1B973
9.26	J1B974
8.90	J1B975
9.33	J1B976
8.54	J1B977
9.71	J1B978
9.30	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	9.49
Censored		Lognormal mean	9.49
Detection limit or PQL		Std. devn.	0.700
Method detection limit		Median	9.32
TOTAL	12	Min.	8.54
		Max.	11.2

Lognormal distribution? r-squared is: 0.916
Normal distribution? r-squared is: 0.893
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 9.86

Copper 95% UCL Calculation

DATA	ID
13.8	J1B980/ J1B981
15.4	J1B969
17.2	J1B970
14.5	J1B971
17.6	J1B972
13.6	J1B973
15.2	J1B974
13.2	J1B975
12.7	J1B976
12.7	J1B977
15.8	J1B978
16.0	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	14.8
Censored		Lognormal mean	14.8
Detection limit or PQL		Std. devn.	1.67
Method detection limit		Median	14.9
TOTAL	12	Min.	12.7
		Max.	17.6

Lognormal distribution? r-squared is: 0.962
Normal distribution? r-squared is: 0.958
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 15.7

Lead 95% UCL Calculation

DATA	ID
1.18	J1B980/ J1B981
3.41	J1B969
47.7	J1B970
4.39	J1B971
2.72	J1B972
2.31	J1B973
3.07	J1B974
7.81	J1B975
2.31	J1B976
8.12	J1B977
6.07	J1B978
16.1	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	8.77
Censored		Lognormal mean	8.20
Detection limit or PQL		Std. devn.	12.9
Method detection limit		Median	3.90
TOTAL	12	Min.	1.18
		Max.	47.7

Lognormal distribution? r-squared is: 0.925
Normal distribution? r-squared is: 0.549
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 19.7

CALCULATION SHEET

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

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Job No. 14655

Calc. No. 0600X-CA-V0085
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Ecology Software (MTCAStat) Results, 600-109 Excavation

Manganese 95% UCL Calculation

DATA	ID
343	J1B980/ J1B981
377	J1B969
396	J1B970
344	J1B971
403	J1B972
362	J1B973
326	J1B974
345	J1B975
357	J1B976
323	J1B977
336	J1B978
349	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	355
Censored		Lognormal mean	355
Detection limit or PQL		Std. devn.	25.5
Method detection limit		Median	347
TOTAL	12	Min.	323
		Max.	403

Lognormal distribution? r-squared is: 0.941
Normal distribution? r-squared is: 0.928
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 369

Molybdenum 95% UCL Calculation

DATA	ID
0.189	J1B980/ J1B981
0.581	J1B969
0.520	J1B970
0.520	J1B971
0.307	J1B972
0.233	J1B973
0.197	J1B974
0.194	J1B975
0.182	J1B976
0.228	J1B977
0.214	J1B978
0.187	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	0.296
Censored		Lognormal mean	0.296
Detection limit or PQL		Std. devn.	0.152
Method detection limit		Median	0.221
TOTAL	12	Min.	0.182
		Max.	0.581

Lognormal distribution? r-squared is: 0.793
Normal distribution? r-squared is: 0.738
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.368

Nickel 95% UCL Calculation

DATA	ID
7.97	J1B980/ J1B981
10.8	J1B969
13.4	J1B970
8.21	J1B971
13.7	J1B972
9.17	J1B973
7.54	J1B974
9.28	J1B975
11.1	J1B976
9.33	J1B977
10.2	J1B978
11.5	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	10.2
Censored		Lognormal mean	10.2
Detection limit or PQL		Std. devn.	2.00
Method detection limit		Median	9.77
TOTAL	12	Min.	7.54
		Max.	13.7

Lognormal distribution? r-squared is: 0.971
Normal distribution? r-squared is: 0.950
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.3

Vanadium 95% UCL Calculation

DATA	ID
79.1	J1B980/ J1B981
78.4	J1B969
67.2	J1B970
69.6	J1B971
90.1	J1B972
86.7	J1B973
69.1	J1B974
76.8	J1B975
79.5	J1B976
73.1	J1B977
80.3	J1B978
70.7	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	76.7
Censored		Lognormal mean	76.7
Detection limit or PQL		Std. devn.	7.11
Method detection limit		Median	77.6
TOTAL	12	Min.	67.2
		Max.	90.1

Lognormal distribution? r-squared is: 0.959
Normal distribution? r-squared is: 0.951
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 80.6

Zinc 95% UCL Calculation

DATA	ID
50.2	J1B980/ J1B981
49.8	J1B969
52.4	J1B970
45.8	J1B971
57.7	J1B972
50.5	J1B973
54.2	J1B974
51.3	J1B975
48.2	J1B976
45.8	J1B977
52.0	J1B978
52.6	J1B979

Number of samples		Uncensored values	
Uncensored	12	Mean	50.9
Censored		Lognormal mean	50.9
Detection limit or PQL		Std. devn.	3.37
Method detection limit		Median	50.9
TOTAL	12	Min.	45.8
		Max.	57.7

Lognormal distribution? r-squared is: 0.959
Normal distribution? r-squared is: 0.957
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 52.7

CALCULATION SHEET

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

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Job No. 14655

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Ecology Software (MTCAStat) Results, 600-109 Staging Pile Area

Antimony 95% UCL Calculation

DATA	ID
	J1B999/
0.848	J1B9B1
0.657	J1B989
0.677	J1B990
0.579	J1B991
0.554	J1B992
0.668	J1B993
0.755	J1B994
0.800	J1B995
0.663	J1B996
0.564	J1B997
0.842	J1B998
0.865	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.706
Censored		Lognormal mean	0.707
Detection limit or PQL		Std. devn.	0.113
Method detection limit		Median	0.673
TOTAL	12	Min.	0.554
		Max.	0.865

Lognormal distribution? r-squared is: 0.935
Normal distribution? r-squared is: 0.932
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.772

Arsenic 95% UCL Calculation

DATA	ID
	J1B999/
41.1	J1B9B1
13.5	J1B989
16.3	J1B990
5.48	J1B991
14.7	J1B992
13.2	J1B993
17.4	J1B994
11.2	J1B995
22.7	J1B996
25.2	J1B997
12.8	J1B998
32.5	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	18.8
Censored		Lognormal mean	19.1
Detection limit or PQL		Std. devn.	9.98
Method detection limit		Median	15.5
TOTAL	12	Min.	5.48
		Max.	41.1

Lognormal distribution? r-squared is: 0.949
Normal distribution? r-squared is: 0.892
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 27.2

Barium 95% UCL Calculation

DATA	ID
	J1B999/
86.6	J1B9B1
96.4	J1B989
84.4	J1B990
90.6	J1B991
67.0	J1B992
69.3	J1B993
90.1	J1B994
99.1	J1B995
87.7	J1B996
111	J1B997
93.3	J1B998
92.4	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	89.0
Censored		Lognormal mean	89.1
Detection limit or PQL		Std. devn.	12.0
Method detection limit		Median	90.4
TOTAL	12	Min.	67.0
		Max.	111

Lognormal distribution? r-squared is: 0.897
Normal distribution? r-squared is: 0.922
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 95.2

Beryllium 95% UCL Calculation

DATA	ID
	J1B999/
0.269	J1B9B1
0.311	J1B989
0.271	J1B990
0.197	J1B991
0.214	J1B992
0.198	J1B993
0.275	J1B994
0.314	J1B995
0.276	J1B996
0.268	J1B997
0.264	J1B998
0.300	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.263
Censored		Lognormal mean	0.263
Detection limit or PQL		Std. devn.	0.0401
Method detection limit		Median	0.270
TOTAL	12	Min.	0.197
		Max.	0.314

Lognormal distribution? r-squared is: 0.862
Normal distribution? r-squared is: 0.889
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.282

Boron 95% UCL Calculation

DATA	ID
	J1B999/
1.61	J1B9B1
2.86	J1B989
1.65	J1B990
0.821	J1B991
1.48	J1B992
1.42	J1B993
2.67	J1B994
2.11	J1B995
2.07	J1B996
1.47	J1B997
1.44	J1B998
1.66	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	1.77
Censored		Lognormal mean	1.78
Detection limit or PQL		Std. devn.	0.569
Method detection limit		Median	1.63
TOTAL	12	Min.	0.821
		Max.	2.86

Lognormal distribution? r-squared is: 0.906
Normal distribution? r-squared is: 0.904
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.16

Cadmium 95% UCL Calculation

DATA	ID
	J1B999/
0.251	J1B9B1
0.110	J1B989
0.107	J1B990
0.00668	J1B991
0.0982	J1B992
0.0831	J1B993
0.103	J1B994
0.164	J1B995
0.124	J1B996
0.142	J1B997
0.346	J1B998
0.0965	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.136
Censored		Lognormal mean	0.165
Detection limit or PQL		Std. devn.	0.0871
Method detection limit		Median	0.109
TOTAL	12	Min.	0.00668
		Max.	0.346

Lognormal distribution? r-squared is: 0.698
Normal distribution? r-squared is: 0.828
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.177

Chromium 95% UCL Calculation

DATA	ID
	J1B999/
9.98	J1B9B1
11.7	J1B989
10.7	J1B990
7.90	J1B991
10.3	J1B992
8.62	J1B993
10.8	J1B994
12.4	J1B995
10.9	J1B996
10.4	J1B997
11.0	J1B998
11.8	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	10.5
Censored		Lognormal mean	10.6
Detection limit or PQL		Std. devn.	1.27
Method detection limit		Median	10.8
TOTAL	12	Min.	7.90
		Max.	12.4

Lognormal distribution? r-squared is: 0.896
Normal distribution? r-squared is: 0.929
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 11.2

Cobalt 95% UCL Calculation

DATA	ID
	J1B999/
8.02	J1B9B1
7.90	J1B989
7.08	J1B990
5.77	J1B991
6.15	J1B992
5.42	J1B993
7.10	J1B994
8.30	J1B995
7.11	J1B996
7.03	J1B997
7.92	J1B998
8.28	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	7.17
Censored		Lognormal mean	7.18
Detection limit or PQL		Std. devn.	0.974
Method detection limit		Median	7.11
TOTAL	12	Min.	5.42
		Max.	8.30

Lognormal distribution? r-squared is: 0.900
Normal distribution? r-squared is: 0.918
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 7.76

Copper 95% UCL Calculation

DATA	ID
	J1B999/
11.8	J1B9B1
12.5	J1B989
11.4	J1B990
9.34	J1B991
10.7	J1B992
9.97	J1B993
12.5	J1B994
14.5	J1B995
12.5	J1B996
13.7	J1B997
22.2	J1B998
12.8	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	12.8
Censored		Lognormal mean	12.8
Detection limit or PQL		Std. devn.	3.30
Method detection limit		Median	12.5
TOTAL	12	Min.	9.34
		Max.	22.2

Lognormal distribution? r-squared is: 0.845
Normal distribution? r-squared is: 0.733
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 14.4

CALCULATION SHEET

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/28/10
Job No. 14655

Calc. No. 0600X-CA-V0085
Checked J. D. Skoglie

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Ecology Software (MTCAStat) Results, 600-109 Staging Pile Area

Lead 95% UCL Calculation

DATA	ID
339	J1B999/J1B9B1
25.1	J1B989
51.8	J1B990
14.2	J1B991
82.9	J1B992
75.9	J1B993
64.1	J1B994
33.4	J1B995
117	J1B996
41.9	J1B997
35.1	J1B998
42.1	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	76.8
Censored		Lognormal mean	74.9
Detection limit or PQL		Std. devn.	87.2
Method detection limit		Median	47.0
TOTAL	12	Min.	14.2
		Max.	339

Lognormal distribution? r-squared is: 0.941
Normal distribution? r-squared is: 0.597
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 141

Manganese 95% UCL Calculation

DATA	ID
362	J1B999/J1B9B1
397	J1B989
354	J1B990
265	J1B991
294	J1B992
275	J1B993
347	J1B994
398	J1B995
330	J1B996
322	J1B997
323	J1B998
354	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	335
Censored		Lognormal mean	335
Detection limit or PQL		Std. devn.	42.5
Method detection limit		Median	339
TOTAL	12	Min.	265
		Max.	398

Lognormal distribution? r-squared is: 0.957
Normal distribution? r-squared is: 0.965
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 360

Molybdenum 95% UCL Calculation

DATA	ID
0.425	J1B999/J1B9B1
0.454	J1B989
0.427	J1B990
0.326	J1B991
0.357	J1B992
0.380	J1B993
0.489	J1B994
0.495	J1B995
0.428	J1B996
0.424	J1B997
0.515	J1B998
0.398	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.427
Censored		Lognormal mean	0.427
Detection limit or PQL		Std. devn.	0.0565
Method detection limit		Median	0.426
TOTAL	12	Min.	0.326
		Max.	0.515

Lognormal distribution? r-squared is: 0.965
Normal distribution? r-squared is: 0.972
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.459

Nickel 95% UCL Calculation

DATA	ID
9.42	J1B999/J1B9B1
10.1	J1B989
9.50	J1B990
9.03	J1B991
9.08	J1B992
8.24	J1B993
10.7	J1B994
11.4	J1B995
9.68	J1B996
9.72	J1B997
11.2	J1B998
10.7	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	9.90
Censored		Lognormal mean	9.90
Detection limit or PQL		Std. devn.	0.950
Method detection limit		Median	9.70
TOTAL	12	Min.	8.24
		Max.	11.4

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

UCL (Land's method) is 10.4

Vanadium 95% UCL Calculation

DATA	ID
56.1	J1B999/J1B9B1
54.6	J1B989
48.9	J1B990
40.5	J1B991
42.4	J1B992
39.6	J1B993
51.4	J1B994
56.8	J1B995
49.9	J1B996
45.3	J1B997
53.6	J1B998
56.5	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	49.6
Censored		Lognormal mean	49.7
Detection limit or PQL		Std. devn.	6.32
Method detection limit		Median	50.7
TOTAL	12	Min.	39.6
		Max.	56.8

Lognormal distribution? r-squared is: 0.915
Normal distribution? r-squared is: 0.926
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 53.4

Zinc 95% UCL Calculation

DATA	ID
61.8	J1B999/J1B9B1
49.1	J1B989
46.5	J1B990
35.2	J1B991
42.6	J1B992
39.2	J1B993
49.5	J1B994
56.6	J1B995
51.4	J1B996
124	J1B997
68.9	J1B998
48.6	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	56.1
Censored		Lognormal mean	55.9
Detection limit or PQL		Std. devn.	23.3
Method detection limit		Median	49.3
TOTAL	12	Min.	35.2
		Max.	124

Lognormal distribution? r-squared is: 0.841
Normal distribution? r-squared is: 0.677
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 67.2

TPH - motor oil 95% UCL Calculation

DATA	ID
33.2	J1B999/J1B9B1
12.4	J1B989
9.98	J1B990
4.95	J1B991
28.9	J1B992
14.3	J1B993
20.1	J1B994
34.2	J1B995
21.2	J1B996
35.7	J1B997
47.7	J1B998
7.12	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	22.5
Censored		Lognormal mean	23.6
Detection limit or PQL		Std. devn.	13.4
Method detection limit		Median	20.7
TOTAL	12	Min.	4.95
		Max.	47.7

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

UCL (Land's method) is 39.7

Benzo(a)anthracene 95% UCL Calculation

DATA	ID
2.28	J1B999/J1B9B1
1.68	J1B989
1.68	J1B990
1.64	J1B991
2.01	J1B992
2.14	J1B993
2.00	J1B994
1.88	J1B995
2.51	J1B996
2.37	J1B997
4.85	J1B998
1.84	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	2.24
Censored		Lognormal mean	2.23
Detection limit or PQL		Std. devn.	0.869
Method detection limit		Median	2.01
TOTAL	12	Min.	1.64
		Max.	4.85

Lognormal distribution? r-squared is: 0.752
Normal distribution? r-squared is: 0.605
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2.65

Benzo(a)pyrene 95% UCL Calculation

DATA	ID
2.44	J1B999/J1B9B1
1.68	J1B989
1.68	J1B990
1.64	J1B991
2.18	J1B992
1.32	J1B993
2.50	J1B994
3.24	J1B995
2.34	J1B996
2.03	J1B997
7.53	J1B998
1.67	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	2.52
Censored		Lognormal mean	2.48
Detection limit or PQL		Std. devn.	1.66
Method detection limit		Median	2.11
TOTAL	12	Min.	1.32
		Max.	7.53

Lognormal distribution? r-squared is: 0.801
Normal distribution? r-squared is: 0.583
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 3.31

Washington Closure Hanford

CALCULATION SHEET

Originator T. E. Queen
Project 100-IU-6 Field Remediation
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Ecology Software (MTCAStat) Results, 600-109 Staging Pile Area

Benzo(b)fluoranthene 95% UCL Calculation

DATA	ID
	J1B999/
4.31	J1B9B1
1.68	J1B989
1.68	J1B990
1.64	J1B991
3.68	J1B992
3.13	J1B993
1.33	J1B994
4.27	J1B995
3.85	J1B996
3.72	J1B997
12.0	J1B998
2.67	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	3.66
Censored		Lognormal mean	3.64
Detection limit or PQL		Std. devn.	2.85
Method detection limit		Median	3.41
TOTAL	12	Min.	1.33
		Max.	12.0

Lognormal distribution? r-squared is: 0.895
Normal distribution? r-squared is: 0.657
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 5.01

Benzo(ghi)perylene 95% UCL Calculation

DATA	ID
	J1B999/
8.46	J1B9B1
1.34	J1B989
6.21	J1B990
2.30	J1B991
1.84	J1B992
1.48	J1B993
15.8	J1B994
6.65	J1B995
8.53	J1B996
2.37	J1B997
7.86	J1B998
2.01	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	5.40
Censored		Lognormal mean	5.64
Detection limit or PQL		Std. devn.	4.37
Method detection limit		Median	4.29
TOTAL	12	Min.	1.34
		Max.	15.8

Lognormal distribution? r-squared is: 0.910
Normal distribution? r-squared is: 0.834
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.0

Benzo(k)fluoranthene 95% UCL Calculation

DATA	ID
	J1B999/
1.55	J1B9B1
1.68	J1B989
1.68	J1B990
1.64	J1B991
1.17	J1B992
0.987	J1B993
1.33	J1B994
2.05	J1B995
1.34	J1B996
1.01	J1B997
3.51	J1B998
1.67	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	1.63
Censored		Lognormal mean	1.63
Detection limit or PQL		Std. devn.	0.668
Method detection limit		Median	1.59
TOTAL	12	Min.	0.987
		Max.	3.51

Lognormal distribution? r-squared is: 0.887
Normal distribution? r-squared is: 0.738
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 1.95

Fluoranthene 95% UCL Calculation

DATA	ID
	J1B999/
1.62	J1B9B1
1.68	J1B989
1.68	J1B990
1.64	J1B991
15.6	J1B992
6.74	J1B993
20.2	J1B994
12.3	J1B995
13.5	J1B996
1.69	J1B997
14.1	J1B998
5.02	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	7.98
Censored		Lognormal mean	8.92
Detection limit or PQL		Std. devn.	6.77
Method detection limit		Median	5.88
TOTAL	12	Min.	1.62
		Max.	20.2

Lognormal distribution? r-squared is: 0.839
Normal distribution? r-squared is: 0.865
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 11.2

Indeno(1,2,3-cd)pyrene 95% UCL Calculation

DATA	ID
	J1B999/
4.64	J1B9B1
1.68	J1B989
23.5	J1B990
1.64	J1B991
6.19	J1B992
3.78	J1B993
11.5	J1B994
10.4	J1B995
4.51	J1B996
7.44	J1B997
35.3	J1B998
3.18	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	9.48
Censored		Lognormal mean	9.68
Detection limit or PQL		Std. devn.	10.1
Method detection limit		Median	5.41
TOTAL	12	Min.	1.64
		Max.	35.3

Lognormal distribution? r-squared is: 0.970
Normal distribution? r-squared is: 0.738
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 21.6

Phenanthrene 95% UCL Calculation

DATA	ID
	J1B999/
3.09	J1B9B1
1.68	J1B989
1.68	J1B990
1.64	J1B991
2.68	J1B992
3.13	J1B993
6.33	J1B994
3.92	J1B995
3.68	J1B996
2.37	J1B997
5.19	J1B998
3.51	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	3.24
Censored		Lognormal mean	3.27
Detection limit or PQL		Std. devn.	1.43
Method detection limit		Median	3.11
TOTAL	12	Min.	1.64
		Max.	6.33

Lognormal distribution? r-squared is: 0.957
Normal distribution? r-squared is: 0.918
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 4.29

Pyrene 95% UCL Calculation

DATA	ID
	J1B999/
2.52	J1B9B1
1.68	J1B989
1.68	J1B990
1.64	J1B991
2.34	J1B992
2.14	J1B993
1.67	J1B994
2.90	J1B995
2.84	J1B996
1.52	J1B997
1.67	J1B998
4.18	J1B9B0

Number of samples		Uncensored values	
Uncensored	12	Mean	2.23
Censored		Lognormal mean	2.23
Detection limit or PQL		Std. devn.	0.788
Method detection limit		Median	1.91
TOTAL	12	Min.	1.52
		Max.	4.18

Lognormal distribution? r-squared is: 0.873
Normal distribution? r-squared is: 0.811
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2.61

CALCULATION SHEET

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
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Duplicate Analysis - 600-109 Excavation

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Cadmium			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	mg/kg	Q	PQL
EX-12	J1B980	6/29/2010	5140		4.00	1.13		0.800	55.0		0.400	0.156		0.160	0.101		0.160	5650		80.1	5.90		0.160	9.89		1.60
Duplicate of EX-12	J1B981	6/29/2010	4890		4.01	1.61		0.800	61.2		0.401	0.169		0.160	0.0975		0.160	5390		80.1	5.02		0.160	9.54		1.60

Analysis:

	TDL	5	10	2	0.2	0.2	100	1	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)			Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	5.0%		10.7%			4.7%	16.1%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Duplicate Analysis - 600-109 Excavation

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EX-12	J1B980	6/29/2010	13.8		0.800	27100		16.0	1.07		0.400	4990		60.1	352		4.00	0.168		1.60	8.47		3.20	601		320
Duplicate of EX-12	J1B981	6/29/2010	13.7		0.800	25600		16.0	1.28		0.401	4570		60.1	333		4.01	0.209		1.60	7.46		3.21	652		321

Analysis:

	TDL	1	5	5	75	5	2	4	400
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)	No-Stop (acceptable)
	RPD	0.7%	5.7%		8.8%	5.5%			
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Duplicate Analysis - 600-109 Excavation

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
EX-12	J1B980	6/29/2010	597		1.60	403		40.0	82.1		2.00	51.0		8.01
Duplicate of EX-12	J1B981	6/29/2010	436		1.60	351		40.1	76.1		2.00	49.3		8.01

Analysis:

	TDL	2	50	2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	31.2%	13.8%	7.6%	3.4%
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable

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Duplicate Analysis - 600-109 Staging Pile Area

Sampling Area	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-11	J1B999	7/13/2010	7580		3.81	0.742	J	0.457	41.0		0.762	86.1		0.381	0.265		0.152	1.58		1.52	0.248		0.152	3510		76.2	10.2		0.152
Duplicate of SPA-11	J1B9B1	7/13/2010	7690		3.97	0.954	J	0.477	41.1		0.795	87.0		0.397	0.273		0.159	1.63		1.59	0.254		0.159	3390		79.5	9.75		0.159

Analysis:

	TDL	5	0.6	10	2	0.2	2	0.2	100	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD	1.4%			1.0%				3.5%	4.5%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable

Duplicate Analysis - 600-109 Staging Pile Area

Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead			Magnesium			Manganese			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-11	J1B999	7/13/2010	8.17		1.52	11.7		0.762	21400		15.2	340		0.381	4550		57.1	363		3.81	0.427	B	1.52	9.66		3.05	1630		305
Duplicate of SPA-11	J1B9B1	7/13/2010	7.87		1.59	11.8		0.795	21200		15.9	337		0.397	4390		59.6	360		3.97	0.423	B	1.59	9.17		3.18	1640		318

Analysis:

	TDL	2	1	5	5	75	5	2	4	400
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)	No-Stop (acceptable)
	RPD		0.9%	0.9%	0.9%	3.6%	0.8%			
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Duplicate Analysis - 600-109 Staging Pile Area

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc			TPH - diesel range			TPH - motor oil			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
SPA-11	J1B999	7/13/2010	545	J	1.52	153		38.1	56.9		1.90	62.0		7.62	15400		3370	38000	J	10100	1.78	J	3.24	2.60	J	3.24	2.43	J	3.24
Duplicate of SPA-11	J1B9B1	7/13/2010	586	J	1.59	152		39.7	55.3		1.99	61.6		7.95	13100		3340	28300	J	10000	2.12	J	3.25	1.95	J	3.25	2.44	J	3.25

Analysis:

	TDL	2	50	2.5	1	5	5	15	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)			
	RPD	7.3%		2.9%	0.6%	16.1%	29.3%			
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Duplicate Analysis - 600-109 Staging Pile Area

Sampling Area	HEIS Number	Sample Date	Benzo(b)fluoranthene			Benzo(ghi)perylene			Benzo(k)fluoranthene			Indeno(1,2,3-cd)pyrene			Phenanthrene			Pyrene		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
SPA-11	J1B999	7/13/2010	4.71		3.24	10.9		3.24	1.46	J	3.24	4.71		3.24	2.92	J	3.24	2.11	J	3.24
Duplicate of SPA-11	J1B9B1	7/13/2010	3.91		3.25	6.02		3.25	1.63	J	3.25	4.56		3.25	3.26		3.25	2.93	J	3.25

Analysis:

	TDL	15	15	15	15	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)		No-Stop (acceptable)		
	RPD						
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford

Originator T. E. Queen
Project 100-IU-6 Field Remediation
Subject 600-109 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/28/10
Job No. 14655

Calc. No. 0600X-CA-V0085
Checked J. D. Skoglie

Rev. No. 0
Date 09/28/10
Sheet No. 17 of 17

Duplicate Analysis - 600-109 Overburden

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
OB-3	J1B984	7/6/2010	8390		3.54	15.0		0.708	83.7		0.354	0.275		0.142	1.77		1.42	0.133	B	0.142	3770		70.8	11.2		0.142
Duplicate of OB-3	J1B987	7/6/2010	8560		3.99	15.3		0.797	85.1		0.399	0.280		0.159	1.86		1.59	0.140	B	0.159	4020		79.7	11.6		0.159

Analysis:

	TDL	5	10	2	0.2	2	0.2	100	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)		Yes (calc RPD)	Yes (calc RPD)
	RPD	2.0%		1.7%				6.4%	3.5%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable

Duplicate Analysis - 600-109 Overburden

Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead			Magnesium			Manganese			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	mg/kg	Q	PQL	mg/kg	Q	PQL
OB-3	J1B984	7/6/2010	6.66		1.42	10.7		0.708	20000		14.2	51.6		0.354	4380		53.1	313		3.54	0.175	B	1.42	9.27		2.83
Duplicate of OB-3	J1B987	7/6/2010	6.94		1.59	11.4		0.797	20400		15.9	54.1		0.399	4460		59.8	328		3.99	0.215	B	1.59	10.6		3.19

Analysis:

	TDL	2	1	5	5	75	5	2	4
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)
	RPD		6.3%	2.0%	4.7%	1.8%	4.7%		
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable

Duplicate Analysis - 600-109 Overburden

Sampling Area	HEIS Number	Sample Date	Potassium			Silicon			Sodium			Vanadium			Zinc			TPH - motor oil			Benzo(a)anthracene			Benzo(a)pyrene		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
OB-3	J1B984	7/6/2010	1850		283	347		1.42	190		35.4	50.2		1.77	45.8		7.08	19700		9480	1.39	J	3.34	0.837	J	3.34
Duplicate of OB-3	J1B987	7/6/2010	1910		319	380		1.59	196		39.9	52.1		1.99	46.3		7.97	19200		9670	1.31	J	3.16	1.11	J	3.16

Analysis:

	TDL	400	2	50	2.5	1	5	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)		
	RPD		9.1%		3.7%	1.1%	2.6%		
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable

Duplicate Analysis - 600-109 Overburden

Sampling Area	HEIS Number	Sample Date	Benzo(b)fluoranthene			Benzo(ghi)perylene			Chrysene			Fluoranthene			Phenanthrene		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
OB-3	J1B984	7/6/2010	1.86	J	3.34	1.14	J	3.34	2.13	J	3.34	5.56		3.34	2.26	J	3.34
Duplicate of OB-3	J1B987	7/6/2010	2.25	J	3.16	1.52	J	3.16	1.14	J	3.16	3.89		3.16	2.66	J	3.16

Analysis:

	TDL	15	15	15	15	15
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?				No-Stop (acceptable)	
	RPD					
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

Attachment 1. 600-109 Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EX-12	J1B980	6/29/2010	5140		4.00	0.481	U	0.481	1.13		0.800	55.0		0.400	0.156		0.160	0.550		1.60	0.101		0.160
Duplicate of EX-12	J1B981	6/29/2010	4890		4.01	0.481	U	0.481	1.61		0.800	61.2		0.401	0.169		0.160	1.60	U	1.60	0.0975		0.160
EX-1	J1B969	6/29/2010	6690		5.12	0.375		0.615	1.78		1.02	69.2		0.512	0.240		0.205	0.727		2.05	0.107		0.205
EX-2	J1B970	6/29/2010	10000		4.26	0.359		0.511	13.6		0.852	105		0.426	0.349		0.170	1.89		1.70	0.145		0.170
EX-3	J1B971	6/29/2010	6260		3.76	0.356		0.451	2.84		0.751	122		0.376	0.248		0.150	0.545		1.50	0.0964		0.150
EX-4	J1B972	6/29/2010	8210		4.56	0.547	U	0.547	2.48		0.911	83.9		0.456	0.263		0.182	0.766		1.82	0.115		0.182
EX-5	J1B973	6/29/2010	6450		4.45	0.534	U	0.534	2.06		0.890	58.7		0.445	0.198		0.178	0.640		1.78	0.103		0.178
EX-6	J1B974	6/29/2010	6240		4.09	0.490	U	0.490	1.85		0.817	60.5		0.409	0.206		0.163	0.531		1.63	0.0942		0.163
EX-7	J1B975	6/29/2010	5800		3.88	0.466	U	0.466	2.92		0.776	72.9		0.388	0.173		0.155	1.35		1.55	0.118		0.155
EX-8	J1B976	6/29/2010	6180		4.14	0.497	U	0.497	1.97		0.829	78.1		0.414	0.186		0.166	0.592		1.66	0.108		0.166
EX-9	J1B977	6/29/2010	6000		3.37	0.404	U	0.404	2.75		0.673	69.0		0.337	0.186		0.135	0.555		1.35	0.107		0.135
EX-10	J1B978	6/29/2010	6190		3.80	0.456	U	0.456	2.29		0.761	78.4		0.380	0.190		0.152	0.958		1.52	0.113		0.152
EX-11	J1B979	6/29/2010	7900		3.98	0.478	U	0.478	5.87		0.796	75.4		0.398	0.264		0.159	0.751		1.59	0.107		0.159
SPA-11	J1B999	7/13/2010	7580		3.81	0.742	J	0.457	41.0		0.762	86.1		0.381	0.265		0.152	1.58		1.52	0.248		0.152
Duplicate of SPA-11	J1B9B1	7/13/2010	7690		3.97	0.954	J	0.477	41.1		0.795	87.0		0.397	0.273		0.159	1.63		1.59	0.254		0.159
SPA-1	J1B989	7/13/2010	9610		4.28	0.657	J	0.514	13.5		0.857	96.4		0.428	0.311		0.171	2.86		1.71	0.110	B	0.171
SPA-2	J1B990	7/13/2010	7990		3.40	0.677	J	0.408	16.3		0.679	84.4		0.340	0.271		0.136	1.65		1.36	0.107	B	0.136
SPA-3	J1B991	7/13/2010	6230		3.98	0.579	J	0.477	5.48		0.795	90.6		0.398	0.197		0.159	0.821	B	1.59	0.00668	B	0.159
SPA-4	J1B992	7/13/2010	6660		3.75	0.554	J	0.450	14.7		0.750	67.0		0.375	0.214		0.150	1.48	B	1.50	0.0982	B	0.150
SPA-5	J1B993	7/13/2010	6020		3.81	0.668	J	0.457	13.2		0.761	69.3		0.381	0.198		0.152	1.42	B	1.52	0.0831	B	0.152
SPA-6	J1B994	7/13/2010	8010		4.14	0.755	J	0.497	17.4		0.828	90.1		0.414	0.275		0.166	2.67		1.66	0.103	B	0.166
SPA-7	J1B995	7/13/2010	9280		4.53	0.800	J	0.543	11.2		0.906	99.1		0.453	0.314		0.181	2.11		1.81	0.164	B	0.181
SPA-8	J1B996	7/13/2010	8050		3.54	0.663	J	0.425	22.7		0.708	87.7		0.354	0.276		0.142	2.07		1.42	0.124	B	0.142
SPA-9	J1B997	7/13/2010	7710		4.07	0.564	J	0.489	25.2		0.815	111		0.407	0.268		0.163	1.47	B	1.63	0.142	B	0.163
SPA-10	J1B998	7/13/2010	7500		4.30	0.842	J	0.517	12.8		0.861	93.3		0.430	0.264		0.172	1.44	B	1.72	0.346		0.172
SPA-12	J1B9B0	7/13/2010	8630		4.41	0.865	J	0.529	32.5		0.176	92.4		0.441	0.300		0.176	1.66	B	1.76	0.0965	B	0.176
OB-3	J1B984	7/6/2010	8390		3.54	0.425	U	0.425	15.0		0.708	83.7		0.354	0.275		0.142	1.77		1.42	0.133	B	0.142
Duplicate of OB-3	J1B987	7/6/2010	8560		3.99	0.478	U	0.478	15.3		0.797	85.1		0.399	0.280		0.159	1.86		1.59	0.140	B	0.159
OB-1	J1B982	7/6/2010	8360		4.22	0.506	U	0.506	12.6		0.843	86.4		0.422	0.267		0.169	2.53		1.69	0.185		0.169
OB-2	J1B983	7/6/2010	9580		4.51	0.541	U	0.541	14.3		0.902	99.0		0.451	0.312		0.180	2.11		1.80	0.191		0.180
OB-4	J1B986	7/6/2010	7500		3.64	0.437	U	0.437	9.71		0.728	80.6		0.364	0.242		0.146	1.63		1.46	0.132	B	0.146
Boulder Soil Sample	J1B988	7/6/2010	8150		3.81	0.457	U	0.457	6.07		0.761	84.5		0.381	0.269		0.152	1.70		1.52	0.113	B	0.152
Equipment blank	J1B985	6/29/2010	215		4.47	0.537	U	0.537	0.895	U	0.895	2.21		0.450	0.049		0.179	1.79	U	1.79	0.179	U	0.179

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

Gray cells indicate not applicable.

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

B = blank contamination (organic constituents) = Estimated (inorganic)

HEIS = Hanford Environmental Information System

C = Blank contamination where sample concentration is </= 5x the blank concentration (inorganic)

J = estimate (organic) = blank contamination (inorganic)

L = dilution indicating physical and chemical interference are present

M = Sample duplicate precision not met

N = recovery is outside control limits

ND = not detected

P = greater than 25% difference between column analyses

PQL = practical quantitation limit

Q = qualifier

R = rejected

T = spike and/or spike duplicate recovery is outside control limits

U = undetected

X = > 40% difference between the primary and confirmation detector

Attachment	1	Sheet No.	1 of 7
Originator	T. E. Queen	Date	9/28/10
Checked	J. D. Skoglie	Date	9/28/10
Calc. No.	0600X-CA-V0085	Rev. No.	0

Attachment 1. 600-109 Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper			Iron			Lead			Magnesium		
			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
EX-12	J1B980	6/29/2010	5650		80.1	5.90		0.160	9.89		1.60	13.8		0.800	27100		16.0	1.07		0.400	4990		60.1
Duplicate of EX-12	J1B981	6/29/2010	5390		80.1	5.02		0.160	9.54		1.60	13.7		0.800	25600		16.0	1.28		0.401	4570		60.1
EX-1	J1B969	6/29/2010	6260		102	7.08		0.205	10.1		2.05	15.4		1.02	29000		20.5	3.41		0.512	5440		76.8
EX-2	J1B970	6/29/2010	5350		85.2	13.7		0.170	9.26		1.70	17.2		0.852	26300		17.0	47.7		0.426	5530		63.9
EX-3	J1B971	6/29/2010	4920		75.1	6.05		0.150	8.78		1.50	14.5		0.751	26000		15.0	4.39		0.376	4520		56.4
EX-4	J1B972	6/29/2010	6610		91.1	7.89		0.182	11.2		1.82	17.6		0.911	30700		18.2	2.72		0.456	6170		68.3
EX-5	J1B973	6/29/2010	5750		89.0	6.51		0.178	9.77		1.78	13.6		0.890	28500		17.8	2.31		0.445	5190		66.7
EX-6	J1B974	6/29/2010	5210		81.7	4.88		0.163	9.26		1.63	15.2		0.817	26000		16.3	3.07		0.409	4700		61.3
EX-7	J1B975	6/29/2010	6410		77.6	6.65		0.155	8.90		1.55	13.2		0.776	25700		15.5	7.81		0.388	4960		58.2
EX-8	J1B976	6/29/2010	6690		82.9	6.49		0.166	9.33		1.66	12.7		0.829	26200		16.6	2.31		0.414	5290		62.2
EX-9	J1B977	6/29/2010	6060		67.3	6.76		0.135	8.54		1.35	12.7		0.673	24300		13.5	8.12		0.337	4640		50.5
EX-10	J1B978	6/29/2010	6450		76.1	7.27		0.152	9.71		1.52	15.8		0.761	26700		15.2	6.07		0.380	5050		57.1
EX-11	J1B979	6/29/2010	5440		79.6	10.7		0.159	9.30		1.59	16.0		0.796	25300		15.9	16.1		0.398	5420		59.7
SPA-11	J1B999	7/13/2010	3510		76.2	10.2		0.152	8.17		1.52	11.7		0.762	21400		15.2	340		0.381	4550		57.1
Duplicate of SPA-11	J1B9B1	7/13/2010	3390		79.5	9.75		0.159	7.87		1.59	11.8		0.795	21200		15.9	337		0.397	4390		59.6
SPA-1	J1B989	7/13/2010	4310		85.7	11.7		0.171	7.90		1.71	12.5		0.857	23700		17.1	25.1		0.428	4640		64.3
SPA-2	J1B990	7/13/2010	3520		67.9	10.7		0.136	7.08		1.36	11.4		0.679	20600		13.6	51.8		0.340	4230		50.9
SPA-3	J1B991	7/13/2010	6400		79.5	7.90		0.159	5.77		1.59	9.34		0.795	18000		15.9	14.2		0.398	4260		59.6
SPA-4	J1B992	7/13/2010	5170		75.0	10.3		0.150	6.15		1.50	10.7		0.750	17600		15.0	82.9		0.375	4230		56.3
SPA-5	J1B993	7/13/2010	4590		76.1	8.62		0.152	5.42		1.52	9.97		0.761	16300		15.2	75.9		0.381	3930		57.1
SPA-6	J1B994	7/13/2010	4410		82.8	10.8		0.166	7.10		1.66	12.5		0.828	21200		16.6	64.1		0.414	4650		62.1
SPA-7	J1B995	7/13/2010	4900		90.6	12.4		0.181	8.30		1.81	14.5		0.906	23900		18.1	33.4		0.453	5040		67.9
SPA-8	J1B996	7/13/2010	4370		70.8	10.9		0.142	7.11		1.42	12.5		0.708	20300		14.2	117		0.354	4540		53.1
SPA-9	J1B997	7/13/2010	3950		81.5	10.4		0.163	7.03		1.63	13.7		0.815	19700		16.3	41.9		0.407	4310		61.1
SPA-10	J1B998	7/13/2010	6270		86.1	11.0		0.172	7.92		1.72	22.2		0.861	21000		17.2	35.1		0.430	4840		64.6
SPA-12	J1B9B0	7/13/2010	3630		88.2	11.8		0.176	8.28		1.76	12.8		0.176	22100		17.6	42.1		0.441	4920		66.1
OB-3	J1B984	7/6/2010	3770		70.8	11.2		0.142	6.66		1.42	10.7		0.708	20000		14.2	51.6		0.354	4380		53.1
Duplicate of OB-3	J1B987	7/6/2010	4020		79.7	11.6		0.159	6.94		1.59	11.4		0.797	20400		15.9	54.1		0.399	4460		59.8
OB-1	J1B982	7/6/2010	3280		84.3	11.1		0.169	6.38		1.69	10.4		0.843	18900		16.9	71.9		0.422	4060		63.2
OB-2	J1B983	7/6/2010	3820		90.2	13.3		0.180	7.52		1.80	12.0		0.902	21900		18.0	70.3		0.451	4620		67.6
OB-4	J1B986	7/6/2010	4950		72.8	10.3		0.146	6.00		1.46	10.0		0.728	17700		14.6	44.4		0.364	4400		54.6
Boulder Soil Sample	J1B988	7/6/2010	4050		76.1	10.9		0.152	7.34		1.52	16.4		0.761	20300		15.2	24.7		0.381	4520		57.1
Equipment blank	J1B985	6/29/2010	50.3		89.5	0.204		0.179	1.79	U	1.79	0.895	U	0.895	258		17.9	0.419		0.450	33.5		67.1

Attachment	1	Sheet No.	2 of 7
Originator	T. E. Queen	Date	9/28/10
Checked	J. D. Skoglie	Date	9/28/10
Calc. No.	0600X-CA-V0085	Rev. No.	0

Attachment 1. 600-109 Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Manganese			Molybdenum			Nickel			Potassium			Selenium			Silicon			Silver		
			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
EX-12	J1B980	6/29/2010	352		4.00	0.168		1.60	8.47		3.20	601		320	0.240	U	0.240	597		1.60	0.160	U	0.160
Duplicate of EX-12	J1B981	6/29/2010	333		4.01	0.209		1.60	7.46		3.21	652		321	0.240	U	0.240	436		1.60	0.160	U	0.160
EX-1	J1B969	6/29/2010	377		5.12	0.581		2.05	10.8		4.10	966		410	0.307	U	0.307	713		2.05	0.205	U	0.205
EX-2	J1B970	6/29/2010	396		4.26	0.520		1.70	13.4		3.41	1770		341	0.256	U	0.256	605		1.70	0.170	U	0.170
EX-3	J1B971	6/29/2010	344		3.76	0.520		1.50	8.21		3.01	1020		301	0.225	U	0.225	309		1.50	0.150	U	0.150
EX-4	J1B972	6/29/2010	403		4.56	0.307		1.82	13.7		3.64	1220		364	0.273	U	0.273	1020		1.82	0.182	U	0.182
EX-5	J1B973	6/29/2010	362		4.45	0.233		1.78	9.17		3.56	871		356	0.267	U	0.267	967		1.78	0.178	U	0.178
EX-6	J1B974	6/29/2010	326		4.09	0.197		1.63	7.54		3.27	839		327	0.245	U	0.245	814		1.63	0.163	U	0.163
EX-7	J1B975	6/29/2010	345		3.88	0.194		1.55	9.28		3.10	811		310	0.233	U	0.233	535		1.55	0.155	U	0.155
EX-8	J1B976	6/29/2010	357		4.14	0.182		1.66	11.1		3.31	780		331	0.249	U	0.249	783		1.66	0.166	U	0.166
EX-9	J1B977	6/29/2010	323		3.37	0.228		1.35	9.33		2.69	857		269	0.202	U	0.202	515		1.35	0.135	U	0.135
EX-10	J1B978	6/29/2010	336		3.80	0.214		1.52	10.2		3.04	889		304	0.228	U	0.228	504		1.52	0.152	U	0.152
EX-11	J1B979	6/29/2010	349		3.98	0.187		1.59	11.5		3.18	1170		318	0.239	U	0.239	626		1.59	0.159	U	0.159
SPA-11	J1B999	7/13/2010	363		3.81	0.427	B	1.52	9.66		3.05	1630		305	0.228	U	0.228	545	J	1.52	0.152	U	0.152
Duplicate of SPA-11	J1B9B1	7/13/2010	360		3.97	0.423	B	1.59	9.17		3.18	1640		318	0.238	U	0.238	586	J	1.59	0.159	U	0.159
SPA-1	J1B989	7/13/2010	397		4.28	0.454	B	1.71	10.1		3.43	1990		343	0.257	U	0.257	947	J	1.71	0.171	U	0.171
SPA-2	J1B990	7/13/2010	354		3.40	0.427	B	1.36	9.50		2.72	1820		272	0.204	U	0.204	503	J	1.36	0.136	U	0.136
SPA-3	J1B991	7/13/2010	265		3.98	0.326	B	1.59	9.03		3.18	1150		318	0.239	U	0.239	455	J	1.59	0.159	U	0.159
SPA-4	J1B992	7/13/2010	294		3.75	0.357	B	1.50	9.08		3.00	1480		300	0.225	U	0.225	465	J	1.50	0.150	U	0.150
SPA-5	J1B993	7/13/2010	275		3.81	0.380	B	1.52	8.24		3.05	1260		305	0.228	U	0.228	431	J	1.52	0.152	U	0.152
SPA-6	J1B994	7/13/2010	347		4.14	0.489	B	1.66	10.7		3.31	1770		331	0.249	U	0.249	506	J	1.66	0.166	U	0.166
SPA-7	J1B995	7/13/2010	398		4.53	0.495	B	1.81	11.4		3.62	2040		362	0.272	U	0.272	607	J	1.81	0.181	U	0.181
SPA-8	J1B996	7/13/2010	330		3.54	0.428	B	1.42	9.68		2.83	1820		283	0.212	U	0.212	511	J	1.42	0.142	U	0.142
SPA-9	J1B997	7/13/2010	322		4.07	0.424	B	1.63	9.72		3.26	1720		326	0.244	U	0.244	470	J	1.63	0.163	U	0.163
SPA-10	J1B998	7/13/2010	323		4.30	0.515	B	1.72	11.2		3.44	1270		344	0.258	U	0.258	506	J	1.72	0.172	U	0.172
SPA-12	J1B9B0	7/13/2010	354		4.41	0.398	B	1.76	10.7		3.53	1880		353	0.265	U	0.265	651	J	1.76	0.176	U	0.176
OB-3	J1B984	7/6/2010	313		3.54	0.175	B	1.42	9.27		2.83	1850		283	0.213	U	0.213	347		1.42	0.142	U	0.142
Duplicate of OB-3	J1B987	7/6/2010	328		3.99	0.215	B	1.59	10.6		3.19	1910		319	0.239	U	0.239	380		1.59	0.159	U	0.159
OB-1	J1B982	7/6/2010	314		4.22	1.69	U	1.69	9.04		3.37	1900		337	0.253	U	0.253	362		1.69	0.169	U	0.169
OB-2	J1B983	7/6/2010	354		4.51	0.233	B	1.80	10.8		3.61	2190		361	0.271	U	0.271	431		1.80	0.180	U	0.180
OB-4	J1B986	7/6/2010	296		3.64	0.147	B	1.46	8.43		2.91	1720		291	0.218	U	0.218	351		1.46	0.146	U	0.146
Boulder Soil Sample	J1B988	7/6/2010	307		3.81	0.190	B	1.52	10.6		3.05	1640		305	0.228	U	0.228	287		1.52	0.152	U	0.152
Equipment blank	J1B985	6/29/2010	4.35		4.47	1.79	U	1.79	3.58	U	3.58	46.9		358	0.268	U	0.268	267		1.79	0.179	U	0.179

Attachment	1	Sheet No.	3 of 7
Originator	T. E. Queen	Date	9/28/10
Checked	J. D. Skoglie	Date	9/28/10
Calc. No.	0600X-CA-V0085	Rev. No.	0

Attachment 1. 600-109 Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Sodium			Vanadium			Zinc			TPH - diesel range			TPH - motor oil		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EX-12	J1B980	6/29/2010	403		40.0	82.1		2.00	51.0		8.01	3350	U	3350	10100	U	10100
Duplicate of EX-12	J1B981	6/29/2010	351		40.1	76.1		2.00	49.3		8.01	3300	U	3300	9910	U	9910
EX-1	J1B969	6/29/2010	328		51.2	78.4		2.56	49.8		10.2	3380	U	3380	10100	U	10100
EX-2	J1B970	6/29/2010	269		42.6	67.2		2.13	52.4		8.52	3340	U	3340	14900		10000
EX-3	J1B971	6/29/2010	254		37.6	69.6		1.88	45.8		7.51	3260	U	3260	4120	J	9780
EX-4	J1B972	6/29/2010	418		45.6	90.1		2.28	57.7		9.11	3240	U	3240	9710	U	9710
EX-5	J1B973	6/29/2010	367		44.5	86.7		2.22	50.5		8.90	3360	U	3360	10100	U	10100
EX-6	J1B974	6/29/2010	389		40.9	69.1		2.04	54.2		8.17	3520	U	3520	10600	U	10600
EX-7	J1B975	6/29/2010	355		38.8	76.8		1.94	51.3		7.76	3290	U	3290	9860	U	9860
EX-8	J1B976	6/29/2010	342		41.4	79.5		2.07	48.2		8.29	3360	U	3360	10100	U	10100
EX-9	J1B977	6/29/2010	318		33.7	73.1		1.68	45.8		6.73	3290	U	3290	9880	U	9880
EX-10	J1B978	6/29/2010	383		38.0	80.3		1.90	52		7.61	3340	U	3340	17100		10000
EX-11	J1B979	6/29/2010	337		39.8	70.7		1.99	52.6		7.96	3330	U	3330	10000	U	10000
SPA-11	J1B999	7/13/2010	153		38.1	56.9		1.90	62.0		7.62	15400		3370	38000	J	10100
Duplicate of SPA-11	J1B9B1	7/13/2010	152		39.7	55.3		1.99	61.6		7.95	13100		3340	28300	J	10000
SPA-1	J1B989	7/13/2010	204		42.8	54.6		2.14	49.1		8.57	3280	U	3280	12400	J	9840
SPA-2	J1B990	7/13/2010	147		34.0	48.9		1.70	46.5		6.79	3330	U	3330	9980	J	10000
SPA-3	J1B991	7/13/2010	132		39.8	40.5		1.99	35.2		7.95	3300	U	3300	9900	UJ	9900
SPA-4	J1B992	7/13/2010	213		37.5	42.4		1.88	42.6		7.50	3290	U	3290	28900	J	9870
SPA-5	J1B993	7/13/2010	203		38.1	39.6		1.90	39.2		7.61	3280	U	3280	14300	J	9830
SPA-6	J1B994	7/13/2010	233		41.4	51.4		2.07	49.5		8.28	3410	U	3410	20100	J	10200
SPA-7	J1B995	7/13/2010	206		45.3	56.8		2.26	56.6		9.06	3400	U	3400	34200	J	10200
SPA-8	J1B996	7/13/2010	271		35.4	49.9		1.77	51.4		7.08	3330	U	3330	21200	J	9990
SPA-9	J1B997	7/13/2010	171		40.7	45.3		2.04	124		8.15	19200		3410	35700	J	10200
SPA-10	J1B998	7/13/2010	217		43.0	53.6		2.15	68.9		8.61	3340	U	3340	47700	J	10000
SPA-12	J1B9B0	7/13/2010	215		44.1	56.5		2.20	48.6		8.82	3300	U	3300	7120	J	9910
OB-3	J1B984	7/6/2010	190		35.4	50.2		1.77	45.8		7.08	3160	U	3160	19700		9480
Duplicate of OB-3	J1B987	7/6/2010	196		39.9	52.1		1.99	46.3		7.97	3220	U	3220	19200		9670
OB-1	J1B982	7/6/2010	175		42.2	46.3		2.11	47.8		8.43	3320	U	3320	25000		9960
OB-2	J1B983	7/6/2010	199		45.1	54.5		2.25	52.8		9.02	3180	U	3180	24600		9530
OB-4	J1B986	7/6/2010	183		36.4	44.2		1.82	41.3		7.28	3260	U	3260	26600		9780
Boulder Soil Sample	J1B988	7/6/2010	236		38.1	52.5		1.90	45.6		7.61	3210	U	3210	6950	J	9630
Equipment blank	J1B985	6/29/2010	44.7	U	44.7	0.455		2.24	8.95	U	8.95						

Attachment	1	Sheet No.	4 of 7
Originator	T. E. Queen	Date	9/28/10
Checked	J. D. Skoglie	Date	9/28/10
Calc. No.	0600X-CA-V0085	Rev. No.	0

Attachment 1. 600-109 Verification Sampling Results (Polycyclic aromatic hydrocarbons)

Sample Location	HEIS Number	Sample Date	Acenaphthene			Acenaphthylene			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b) fluoranthene			Benzo(ghi)perylene			Benzo(k) fluoranthene		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EX-12	J1B980	6/29/2010	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36
Duplicate of EX-12	J1B981	6/29/2010	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35
EX-1	J1B969	6/29/2010	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41
EX-2	J1B970	6/29/2010	3.15	U	3.15	3.15	U	3.15	1.44	J	3.15	6.16		3.15	5.64		3.15	10.2		3.15	3.16		3.15	3.79		3.15
EX-3	J1B971	6/29/2010	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34
EX-4	J1B972	6/29/2010	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39
EX-5	J1B973	6/29/2010	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36
EX-6	J1B974	6/29/2010	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52
EX-7	J1B975	6/29/2010	3.19	U	3.19	3.19	U	3.19	3.19	U	3.19	3.19	U	3.19	1.32	J	3.19	1.24	J	3.19	2.01	J	3.19	3.19	U	3.19
EX-8	J1B976	6/29/2010	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28
EX-9	J1B977	6/29/2010	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29
EX-10	J1B978	6/29/2010	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	2.58	J	3.39	2.93	J	3.39	4.44		3.39	1.08	J	3.39
EX-11	J1B979	6/29/2010	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39
SPA-11	J1B999	7/13/2010	3.24	U	3.24	3.24	U	3.24	1.78	J	3.24	2.60	J	3.24	2.43	J	3.24	4.71		3.24	10.9		3.24	1.46	J	3.24
Duplicate of SPA-11	J1B9B1	7/13/2010	3.25	U	3.25	3.25	U	3.25	2.12	J	3.25	1.95	J	3.25	2.44	J	3.25	3.91		3.25	6.02		3.25	1.63	J	3.25
SPA-1	J1B989	7/13/2010	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	1.34	J	3.35	3.35	U	3.35
SPA-2	J1B990	7/13/2010	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	1.68	J	3.35	3.35	U	3.35	6.21		3.35	3.35	U	3.35
SPA-3	J1B991	7/13/2010	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	2.30	J	3.28	3.28	U	3.28
SPA-4	J1B992	7/13/2010	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	2.01	J	3.34	2.18	J	3.34	3.68		3.34	1.84	J	3.34	1.17	J	3.34
SPA-5	J1B993	7/13/2010	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	2.14	J	3.29	1.32	J	3.29	3.13	J	3.29	1.48	J	3.29	0.987	J	3.29
SPA-6	J1B994	7/13/2010	3.33	U	3.33	3.33	U	3.33	3.33	U	3.33	2.00	J	3.33	2.50	J	3.33	1.33	J	3.33	15.8		3.33	1.33	J	3.33
SPA-7	J1B995	7/13/2010	30.0		3.41	3.41	U	3.41	3.41	U	3.41	1.88	J	3.41	3.24	J	3.41	4.27		3.41	6.65		3.41	2.05	J	3.41
SPA-8	J1B996	7/13/2010	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	2.51	J	3.34	2.34	J	3.34	3.85		3.34	8.53		3.34	1.34	J	3.34
SPA-9	J1B997	7/13/2010	3.38	U	3.38	3.38	U	3.38	1.01	J	3.38	2.37	J	3.38	2.03	J	3.38	3.72		3.38	2.37	J	3.38	1.01	J	3.38
SPA-10	J1B998	7/13/2010	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	4.85		3.34	7.53		3.34	12.0		3.34	7.86		3.34	3.51		3.34
SPA-12	J1B9B0	7/13/2010	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	1.84	J	3.34	1.67	J	3.34	2.67	J	3.34	2.01	J	3.34	3.34	U	3.34
OB-3	J1B984	7/6/2010	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	1.39	J	3.34	0.837	J	3.34	1.86	J	3.34	1.14	J	3.34	3.34	U	3.34
Duplicate of OB-3	J1B987	7/6/2010	6.00		3.16	3.16	U	3.16	3.16	U	3.16	1.31	J	3.16	1.11	J	3.16	2.25	J	3.16	1.52	J	3.16	3.16	U	3.16
OB-1	J1B982	7/6/2010	3.21	U	3.21	3.21	U	3.21	3.21	U	3.21	1.41	J	3.21	2.04	J	3.21	2.41	J	3.21	3.14	J	3.21	1.32	J	3.21
OB-2	J1B983	7/6/2010	3.32	U	3.32	3.32	U	3.32	3.32	U	3.32	1.80	J	3.32	1.53	J	3.32	2.45	J	3.32	3.59		3.32	1.11	J	3.32
OB-4	J1B986	7/6/2010	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	0.822	J	3.28	1.13	J	3.28	1.68	J	3.28	3.28	U	3.28	3.28	U	3.28
Boulder Soil Sample	J1B988	7/6/2010	3.33	U	3.33	3.33	U	3.33	0.882	J	3.33	4.76		3.33	3.05	J	3.33	2.38	J	3.33	3.06	J	3.33	1.12	J	3.33

Attachment	1	Sheet No.	5 of 7
Originator	T. E. Queen	Date	9/28/10
Checked	J. D. Skoglie	Date	9/28/10
Calc. No.	0600X-CA-V0085	Rev. No.	0

Attachment 1. 600-109 Verification Sampling Results (Polycyclic aromatic hydrocarbons)

Sample Location	HEIS Number	Sample Date	Chrysene			Dibenz[a,h] anthracene			Fluoranthene			Fluorene			Indeno(1,2,3-cd) pyrene			Naphthalene			Phenanthrene			Pyrene		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EX-12	J1B980	6/29/2010	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36
Duplicate of EX-12	J1B981	6/29/2010	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35
EX-1	J1B969	6/29/2010	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41
EX-2	J1B970	6/29/2010	6.39		3.15	3.15	U	3.15	9.16		3.15	1.59	J	3.15	8.53		3.15	3.15	U	3.15	2.43	J	3.15	3.00	J	3.15
EX-3	J1B971	6/29/2010	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34
EX-4	J1B972	6/29/2010	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39
EX-5	J1B973	6/29/2010	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36
EX-6	J1B974	6/29/2010	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52	3.52	U	3.52	1.37	J	3.52	3.52	U	3.52
EX-7	J1B975	6/29/2010	3.19	U	3.19	3.19	U	3.19	6.11		3.19	3.19	U	3.19	1.80	J	3.19	3.19	U	3.19	1.66	J	3.19	3.19	U	3.19
EX-8	J1B976	6/29/2010	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28
EX-9	J1B977	6/29/2010	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29	3.29	U	3.29
EX-10	J1B978	6/29/2010	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	15.1		3.39	3.39	U	3.39	1.44	J	3.39	3.39	U	3.39
EX-11	J1B979	6/29/2010	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39	3.39	U	3.39
SPA-11	J1B999	7/13/2010	3.24	U	3.24	0.973	J	3.24	3.24	U	3.24	3.24	U	3.24	4.71		3.24	3.24	U	3.24	2.92	J	3.24	2.11	J	3.24
Duplicate of SPA-11	J1B9B1	7/13/2010	3.25	U	3.25	3.25	U	3.25	3.25	U	3.25	3.25	U	3.25	4.56		3.25	3.25	U	3.25	3.26		3.25	2.93	J	3.25
SPA-1	J1B989	7/13/2010	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35
SPA-2	J1B990	7/13/2010	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	3.35	U	3.35	23.5		3.35	3.35	U	3.35	1.68	J	3.35	3.35	U	3.35
SPA-3	J1B991	7/13/2010	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28
SPA-4	J1B992	7/13/2010	3.34	U	3.34	3.34	U	3.34	15.6		3.34	3.34	U	3.34	6.19		3.34	3.34	U	3.34	2.68	J	3.34	2.34	J	3.34
SPA-5	J1B993	7/13/2010	3.29	U	3.29	3.29	U	3.29	6.74		3.29	3.29	U	3.29	3.78		3.29	3.29	U	3.29	3.13	J	3.29	2.14	J	3.29
SPA-6	J1B994	7/13/2010	3.33	U	3.33	0.999	J	3.33	20.2		3.33	3.33	U	3.33	11.5		3.33	3.33	U	3.33	6.33		3.33	3.33	U	3.33
SPA-7	J1B995	7/13/2010	3.41	U	3.41	1.02	J	3.41	12.3		3.41	3.41	U	3.41	10.4		3.41	3.41	U	3.41	3.92		3.41	2.90	J	3.41
SPA-8	J1B996	7/13/2010	3.34	U	3.34	3.34	U	3.34	13.5		3.34	3.34	U	3.34	4.51		3.34	3.34	U	3.34	3.68		3.34	2.84	J	3.34
SPA-9	J1B997	7/13/2010	3.38	U	3.38	3.38	U	3.38	3.38	U	3.38	3.38	U	3.38	7.44		3.38	3.38	U	3.38	2.37	J	3.38	1.52	J	3.38
SPA-10	J1B998	7/13/2010	3.34	U	3.34	1.51	J	3.34	14.1		3.34	3.34	U	3.34	35.3		3.34	3.34	U	3.34	5.19		3.34	3.34	U	3.34
SPA-12	J1B9B0	7/13/2010	3.34	U	3.34	3.34	U	3.34	5.02		3.34	3.34	U	3.34	3.18	J	3.34	3.34	U	3.34	3.51		3.34	4.18		3.34
OB-3	J1B984	7/6/2010	2.13	J	3.34	3.34	U	3.34	5.56		3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	2.26	J	3.34	3.34	U	3.34
Duplicate of OB-3	J1B987	7/6/2010	1.14	J	3.16	3.16	U	3.16	3.89		3.16	3.16	U	3.16	3.16	U	3.16	3.16	U	3.16	2.66	J	3.16	3.57		3.16
OB-1	J1B982	7/6/2010	2.31	J	3.21	3.21	U	3.21	11.1		3.21	3.21	U	3.21	3.21	U	3.21	3.21	U	3.21	2.17	J	3.21	1.38	J	3.21
OB-2	J1B983	7/6/2010	3.32	U	3.32	3.32	U	3.32	14.0		3.32	3.32	U	3.32	3.32	U	3.32	3.32	U	3.32	2.33	J	3.32	2.51	J	3.32
OB-4	J1B986	7/6/2010	1.53	J	3.28	3.28	U	3.28	1.50	J	3.28	3.28	U	3.28	3.28	U	3.28	3.28	U	3.28	1.04	J	3.28	3.28	U	3.28
Boulder Soil Sample	J1B988	7/6/2010	2.95	J	3.33	3.33	U	3.33	7.46		3.33	3.33	U	3.33	3.33	U	3.33	3.33	U	3.33	6.11		3.33	8.37		3.33

Attachment	1	Sheet No.	6 of 7
Originator	T. E. Queen	Date	9/28/10
Checked	J. D. Skoglie	Date	9/28/10
Calc. No.	0600X-CA-V0085	Rev. No.	0

Attachment 1. 600-109 Verification Sampling Results (Asbestos)

Sample Location	HEIS Number	Sample Date	% Total Asbestos
FS-1	J1B9B2	6/29/2010	ND
FS-2	J1B9B3	6/29/2010	ND
FS-3	J1B9B4	6/29/2010	ND

Attachment	1	Sheet No.	7 of 7
Originator	T. E. Queen	Date	9/28/10
Checked	J. D. Skoglie	Date	9/28/10
Calc. No.	0600X-CA-V0085	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-IU-6 Field Remediation **Job No. 14655**

Area: 100-IU-6

Discipline: Environmental Calculation No: 0600X-CA-V0086

Subject: 600-109 Waste Site Direct Contact 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 = 4 Total = 5	T. E. Queen	J. D. Skoglie	B. L. Vedder	D. F. Obenauer	10/4/10

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	9/28/2010	Calc. No.:	0600X-CA-V0086	Rev.:	0
Project:	100-IU-6 Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	9/28/2010
Subject:	600-109 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 4	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 600-109 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009a), the following criteria must be met:

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

GIVEN/REFERENCES:

1) DOE-RL, 2009a, *Remedial Design Report/Remedial Action Work Plan for the 100 Area,* DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2009b, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

4) WCH, 2010, *Remaining Sites Verification Package for the 600-109 Hanford Trailer Camp Landfill,* Attachment to Waste Site Reclassification Form 2010-0075, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate an HQ for each noncarcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the individual HQ of <1.0 (DOE-RL 2009a).

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

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the excess cancer risk of $<1 \times 10^{-6}$ (DOE-RL 2009a).

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	9/28/2010	Calc. No.:	0600X-CA-V0086	Rev.:	0
Project:	100-IU-6 Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	9/28/2010
Subject:	600-109 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	2 of 4

METHODOLOGY:

The 600-109 waste site is comprised of four decision units for verification sampling, consisting of the excavation, the waste staging pile area, the overburden stockpile, and the boulder staging area. The direct contact hazard quotient and carcinogenic risk calculations for the 600-109 waste site were conservatively calculated for the entire waste site using the greater of the statistical and focused verification soil sample results (WCH 2010). Of the contaminants of potential concern (COPCs) for this site, boron, molybdenum, and the detected polycyclic aromatic hydrocarbons require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead was detected above background; however, lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake. Additionally, arsenic was detected above background; however, the arsenic standard is not toxicity based. Although total petroleum hydrocarbons (diesel range and motor oil) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to cumulative toxicity. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron is 2.53 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 3.5×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 1.5×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for benzo(a)anthracene is 0.00616 mg/kg, divided by 1.37 mg/kg, and multiplied as indicated, is 4.5×10^{-9}. 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 cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 7.3×10^{-8}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

Table 1 shows the results of the hazard quotient and excess cancer risk calculations.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	9/28/2010	Calc. No.:	0600X-CA-V0086	Rev.:	0
Project:	100-IU-6 Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	9/28/2010
Subject:	600-109 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 4

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 600-109 Waste Site.

Contaminants of Potential Concern	Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Arsenic[c]	27.2	20	--	0.667	--
Boron	2.53	7,200	3.5E-04	--	--
Lead[d]	141	353	--	--	--
Molybdenum	0.459	400	1.1E-03	--	--
Polyaromatic Hydrocarbons					
Acenaphthene	0.0300	4,800	6.3E-06	--	--
Anthracene	0.00212	24,000	8.8E-08	--	--
Benzo(a)anthracene	0.00616	--	--	1.37	4.5E-09
Benzo(a)pyrene	0.00564	--	--	0.137	4.1E-08
Benzo(b)fluoranthene	0.0102	--	--	1.37	7.4E-09
Benzo(ghi)perylene[e]	0.0110	2,400	4.6E-06	--	--
Benzo(k)fluoranthene	0.00379	--	--	1.37	2.8E-09
Chrysene	0.00639	--	--	13.7	4.7E-10
Dibenz(a,h)anthracene	0.00151	--	--	1.37	1.1E-09
Fluoranthene	0.0140	3,200	4.4E-06	--	--
Fluorene	0.00159	3,200	5.0E-07	--	--
Indeno(1,2,3-cd)pyrene	0.0216	--	--	1.37	1.6E-08
Phenanthrene[e]	0.00611	24,000	2.5E-07	--	--
Pyrene	0.00837	2,400	3.5E-06	--	--
Total Petroleum Hydrocarbons					
Diesel range and motor oil[f]	58.9	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**1.5E-03**		
Cumulative Excess Cancer Risk:					**7.3E-08**

[a] = From WCH (2010).

[b] = Value obtained from the RDR/RAWP (DOE-RL 2009a) or *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

[c] = The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009a). The arsenic standard is not toxicity based, therefore, the hazard quotient will not be calculated.

[d] = Value for the noncarcinogenic RAG calculated using Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, EPA/540/R 93/081, Publication No. 9285.7, U.S. Environmental Protection Agency, Washington, D.C.

[e] = Toxicity data for benzo(ghi)perylene and phenanthrene are not available. The cleanup level is based on use of surrogate chemicals.

[f] = The risk associated with total petroleum hydrocarbons do not contribute to cumulative toxicity

benzo(ghi)perylene surrogate: pyrene; phenanthrene surrogate: anthracene

-- = not applicable RAG = remedial action goal

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	9/28/2010	Calc. No.:	0600X-CA-V0086	Rev.:	0
Project:	100-IU-6 Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	9/28/2010
Subject:	600-109 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 4	

CONCLUSION:

The calculations in Table 1 demonstrates that the 600-109 waste site meets the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk, respectively, as identified in the RDR/RAWP (DOE-RL 2009a) and SAP (DOE-RL 2009b). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

APPENDIX D

DATA QUALITY ASSESSMENT

APPENDIX D

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WHC 2010a). This DQA was performed in accordance with site-specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009).

A review of the sample design (WCH 2010b), the field logbook (WCH 2010a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the SAP data assurance requirements (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 600-109 waste site were provided by the laboratories in four sample delivery groups (SDGs): SDG K2117, K2127, K2136, and MA00914. SDG K2136 was submitted for third-party validation.

Samples in the 600-109 data set were analyzed using U.S. Environmental Protection Agency (EPA) method 6010 (inductively coupled plasma [ICP] metals), EPA method 8310 (polycyclic aromatic hydrocarbons [PAH]), SW-846 Method 8015 (total petroleum hydrocarbons [TPH]), and National Institute for Occupational Safety and Health (NIOSH) Method 7400 (bulk asbestos). The ICP metals include: antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

No major deficiencies were found in any of the SDGs. Minor deficiencies are discussed by SDG as follows below. If no comments are made about a specific analysis it should be assumed that no deficiencies in the quality of the data were found. Unless otherwise noted, deficiencies listed below are specific to the individual SDG, but apply to all samples within that SDG.

SDG K2117

This SDG comprises 14 statistical soil samples (J1B969-81 and J1B985) from the 600-109 waste site excavation area. Sample J1B981 is a duplicate of J1B980. Sample J1B985 is the equipment blank (EB). Minor deficiencies are as follows:

In the ICP metals analysis, the matrix spike (MS) recoveries for antimony (44%), calcium (47%), chromium (68%), magnesium (31%), nickel (66%), silver (65%), vanadium (51%), and zinc

(63%) were below the acceptance criteria (70-130%). All results for these analytes in SDG K2117 may be considered estimated. Estimated data are useable for decision-making purposes.

In the TPH analysis, the laboratory did not perform a laboratory control standard (LCS), MS, or matrix spike duplicate (MSD) on the motor oil sample. All motor oil results in SDG K2117 may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K2127

This SDG comprises six composite soil samples from two decision units. Samples J1B982-4 and J1B986-7 from the overburden stockpile area and J1B988 from the boulder staging area. Sample J1B987 is a duplicate of J1B984. Minor deficiencies are as follows:

In the ICP metals analysis, the MS recovery for antimony (35%) was below the acceptance criteria (70-130%). All antimony results in SDG K2127 may be considered estimated. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the LCS result for silicon was below quality control (QC) limits (70-130%) at 63%. All silicon results in SDG K2127 may be considered estimated. Estimated data are useable for decision making purposes

In the TPH analysis, the laboratory did not perform an LCS, MS, or MSD on the motor oil sample. All motor oil results in SDG K2127 may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K2136

This SDG comprises 13 statistical soil samples (J1B989-99 and J1B9B0-1) from the waste staging pile area. Sample J1B9B1 is a duplicate of J1B9B0. SDG K2136 was submitted for third party validation. Minor deficiencies are as follows:

In the ICP metals analysis, the relative percent difference (RPD) calculated for silicon (67%) was above the acceptance criteria (less than 30%). Elevated RPDs in environmental samples are generally attributed to natural heterogeneity in the sample matrix. Third-party validation has qualified all silicon results in SDG K2136 with "J" flags as estimated. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the MS recovery for antimony (45%) was below the acceptance criteria (70-130%). Third-party validation has qualified all antimony results in SDG K2136 with "J" flags as estimated. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon (59%) was below the acceptance criteria (70-130%). Third-party validation has qualified all silicon results in SDG K2136 with "J" flags as estimated. Estimated data are useable for decision-making purposes.

In the TPH analysis, the laboratory did not perform an LCS, MS, or MSD on the motor oil sample. Third-party validation has qualified all motor oil results in SDG K2136 with "J" flags as estimated. Estimated data are useable for decision-making purposes.

SDG MA00914

This SDG comprises three focused soil samples (J1B9B2-4) taken from within the 600-109 waste site excavation area where potential asbestos-containing material was encountered. These samples were analyzed for bulk asbestos. No minor deficiencies were found in SDG MA00914. The data are useable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance/quality control (QA/QC) measures are used to assess potential sources of error and cross contamination of samples that could bias results. Three sets of field QA/QC samples (main sample and duplicate) were collected, as documented in the field logbook (WCH 2010a). The first QA/QC set comprises samples J1B980 (main) and J1B981 (duplicate) from the excavation area. The second QA/QC set comprises samples J1B9B0 (main) and J1B9B1 (duplicate) from the waste staging pile area. The third QA/QC set comprises samples J1B984 (main) and J1B987 (duplicate) from the overburden stockpile area.

The entire sample data set including the duplicate sample data are presented in the 95% upper confidence limit (UCL) calculation in Appendix C. The RPDs for the field duplicate samples have been calculated and are also presented in the 95% UCL calculation. Please refer to the 95% UCL calculation for details.

Field duplicate samples provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the relative percent difference RPD of the sample/duplicate pair(s), for each contaminant of concern. No major deficiencies in the RPD calculations were found for the duplicate samples in any of the three decision units. In addition, no minor deficiencies in the RPD calculations were found for the duplicate samples in either the waste staging pile area or the overburden stockpile area. Minor deficiencies for the excavation area are discussed below.

600-109 Excavation Area

In the duplicate evaluation, the RPD calculated for silicon (31.2%) was above the field duplicate acceptance criteria (less than 30%). Elevated RPDs in environmental samples are generally attributed to natural heterogeneity in the sample matrix. The data are useable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than 5 times the target detection limit (TDL), including undetected analytes. In these cases, a control limit of $\pm$ 2 times the TDL is used (Appendix C) to indicate that a visual check of the data is required by the review. No sample results in the 600-109 waste site required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are useable for decision-making purposes.

SUMMARY

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 600-109 verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling.

The DQA review for the 600-109 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of QA and QC deficiencies. The analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in the Environmental Restoration (ENRE) project-specific prior to being submitted for inclusion in the Hanford Environmental Information System (HEIS) database. The verification sample analytical data are also summarized in Appendix C.

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