WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2013-011

Waste Site Code(s)/Subsite Code(s): 100-D-50:6

Reclassification Category: Interim ☒ Final ☐

Reclassification Status: Closed Out ☒ No Action ☐ Rejected ☐
RCRA Postclosure ☐ Consolidated ☐ None ☐

Approvals Needed: DOE ☒ Ecology ☒ EPA ☐

Description of current waste site condition:

The 100-D-50:6, 183-DR Clearwell Pipelines is a subsite of the 100-D-50 underground pipelines associated with pre-reactor process cooling water, process wastewater, and sanitary wastewater. The 100-D-50 waste site was identified as a candidate site for confirmatory sampling in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2004), and added to 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 (EPA 1999). Confirmatory sampling results for portions of the 100-D-50 pipelines failed to meet remedial action goals (RAGs) for multiple metals. Based upon these results, the functionally analogous 100-D-50:6 pipelines were recommended for remedial action.

Remedial action at the 100-D-50:6 pipeline subsite was performed between March 11, 2011, and May 28, 2012. The subsite was excavated to a depth of approximately 9 m (30 ft) below grade, resulting in approximately 49,975 bank cubic meters (BCM) (65,365 bank cubic yards [BCY]) of material removed for disposal at the Environmental Restoration Disposal Facility (ERDF), including approximately 535 m (1,755 ft) of pipe. Approximately 31,400 BCM (41,070 BCY) of overburden soil was removed and stockpiled for evaluation for use as clean backfill. Following verification sample results, it was determined that more remediation was required because sample results had detectable levels of asbestos and exceeded cleanup criteria for polycyclic aromatic hydrocarbons (PAH) within the excavation and staging pile areas, respectively. Additional remediation was conducted within one location of the excavation on January 21 and 22, 2013. Approximately 180 BCM (235 BCY) of contaminated soil was direct loaded for disposal at ERDF, for a total disposal volume of 50,155 BCM (65,600 BCY). One location within the staging pile area was also further remediated on January 24, 2013. Approximately 100 BCM (131 BCY) of contaminated soil from the staging pile area was placed within the deep zone of the excavation with regulatory concurrence. Overburden material that exceeds direct exposure for PAH will also be placed in the deep zone during backfill of the excavated waste site.

Basis for reclassification:

Verification soil samples were collected on September 4 through 6, 2012. The sample results were compared directly to the RAGs. After additional remediation, soil samples were collected for verification purposes on January 23 and 24, 2013. The results demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River based on RESidual RADioactivity (RESRAD) modeling.

In accordance with this evaluation, the verification sampling results support a reclassification of the 100-D-50:6 pipeline subsite to Interim Closed Out. The current site conditions achieve the RAGs and remedial action objectives established by the *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland, Washington, and the Remaining Sites ROD (EPA 1999). All PAH direct exposure exceedances were within the deep zone of the 100-D-50:6 waste subsite, and therefore not evaluated against direct exposure cleanup criteria. The high concentrations of these PAHs were the result of asphaltic particulates that fell from the pipelines during remediation and are not systemic throughout the 100-D-50:6 waste subsite. 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 rationale presented in the attached remaining sites verification package also demonstrate that the 100-D-50:6 pipeline subsite is protective of groundwater and the Columbia River. However, contamination above direct exposure was measured in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-D-50:6, 183-DR Clearwell Pipelines* (attached).

attached to: 1220922
100-DR-1

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2013-011

Waste Site Code(s)/Subsite Code(s): 100-D-50:6

Regulator comments:

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:

Institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are required because contamination above direct exposure cleanup levels was observed in deep zone soils. This requirement is per the remedial action objectives cited on page 26 of the *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*, September 1995, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

J. P. Neath	J P Neath	6/6/13
DOE Federal Project Director (printed)	Signature	Date
N. Menard	Nina M. Menard	6/11/13
Ecology Project Manager (printed)	Signature	Date
N/A		
EPA Project Manager (printed)	Signature	Date

RECEIVED
JUL 03 2013
EDMC

A-6006-136 (REV 0)

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-50:6, 183-DR CLEARWELL PIPELINES

Attachment to Waste Site Reclassification Form 2013-011

June 2013

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-50:6, 183-DR CLEARWELL PIPELINES

EXECUTIVE SUMMARY

The 100-D-50:6, 183-DR Clearwell Pipelines, part of the 100-DR-1 Operable Unit, consisted of process sewers and supply lines that formerly serviced the 183-DR Clearwell and the concrete clearwell pads. The pipelines of this subsite were divided into three functional groups for confirmatory sampling: (1) clearwell process sewers, (2) clearwell supply pipelines, and (3) 190-DR Pumphouse tunnel drain lines. The 100-D-50:6 pipelines are a subsite of the 100-D-50 waste site, which was identified as a candidate site for confirmatory sampling in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision* (EPA 2004) and added to 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 Unit* (Remaining Sites ROD) (EPA 1999).

Confirmatory sampling of the 100-D-50 waste site was conducted on November 8 and 9, 2005. Confirmatory samples were collected from pipeline contents and underlying soils at junction boxes and pipeline locations. Confirmatory sampling results for portions of the 100-D-50 pipelines failed to meet remedial action goals (RAGs) for multiple metals. Based upon these results, the functionally analogous 100-D-50:6 pipelines were recommended for remedial action.

The sole catch basin for the 190-DR tunnel drain lines was discovered to have been demolished, and residual pipelines could not be breached to collect a sample of pipeline contents. Therefore, in consultation with the Washington State Department of Ecology, confirmatory samples were collected from soil underlying the demolished junction box and from beneath the pipelines at the influent to the junction box. The results for these samples achieved all RAGs; therefore, no further action was recommended for these pipelines. However, during the excavation design process, this section of pipeline was included for remediation along with the other sections of the 100-D-50:6 subsite. As a result, all pipeline sections were remediated.

Remediation of the 100-D-50:6 subsite was performed from March 11, 2011, through May 28, 2012. The excavation extended to a depth of approximately 9 m (30 ft) below ground surface (bgs). Approximately 49,975 bank cubic meters (BCM) (65,365 bank cubic yards [BCY]) of contaminated soil, concrete, and piping was excavated and direct loaded for disposal at the Environmental Restoration Disposal Facility (ERDF). Approximately 31,400 BCM (41,070BCY) of soil (overburden) was removed and stockpiled for evaluation for use as clean backfill.

Following remediation, verification sampling was conducted from September 4 through 6, 2012. The sample results indicated that three locations (one from the excavation, one from the staging pile area, and one from the overburden) exceeded direct exposure cleanup criteria. The contaminated soil from this overburden location was placed in the deep zone of the 100-D-50:6 excavation, and no further remediation was required. The excavation and staging pile

area exceedance locations were further remediated between January 21 through 24, 2013. Following the additional remediation, verification sampling was conducted on January 23 and 24, 2013.

A summary of the cleanup evaluation for the soil results compared to the applicable cleanup criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 100-D-50:6 subsite in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011). In accordance with this evaluation, the verification sampling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the remedial action objectives (RAOs) and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The verification sample results show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The results of verification sampling indicate that deep zone concentrations of residual waste site contamination exceed direct exposure cleanup levels. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are required.

In accordance with this evaluation, the verification sampling results and fate-and-transport modeling support a reclassification of this site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). All PAH direct exposure exceedances were within the deep zone of the 100-D-50:6 waste subsite, and therefore not evaluated against direct exposure cleanup criteria. These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The sampling and modeling 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. However, contamination above direct exposure was measured in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-50:6 subsite contaminants of potential concern and other constituents. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, manganese, vanadium, zinc, and high molecular weight polycyclic aromatic hydrocarbons (PAH). Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for boron and vanadium.

Table ES-1. Summary of Remedial Action Goals for the 100-D-50:6 Subsite. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15-mrem/yr dose rate above background over 1,000 years.	Radionuclides were not COPCs for the 100-D-50:6 subsite.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All shallow zone individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	All hazard quotients are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (8.4×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for carcinogens is $<1 \times 10^{-6}$ [a].	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	Total excess cancer risk of 2.3×10^{-5} was calculated due to PAH at one overburden sampling location (OB-8). Contaminated soil was removed to reduce total excess cancer risk to below 1×10^{-5} [a].	
Groundwater/River Protection – Radionuclides	Attain single-COPC groundwater and river protection RAGs.	Radionuclides were not COPCs for the 100-D-50:6 subsite.	NA
	Attain national primary drinking water standards [b]. 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.		
	Meet drinking water standards for alpha emitters: the most stringent of 15 pCi/L MCL or 1/25th of the derived concentration guides from DOE Order 5400.5 [c].		
	Meet total uranium standard of 30 μg/L (21.2 pCi/L) [d].		

Table ES-1. Summary of Remedial Action Goals for the 100-D-50:6 Subsite. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Residual concentrations of copper, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, aroclor-1254, and total PCBs exceeded the soil RAGs for the protection of groundwater and/or the Columbia River. However, based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), it is predicted that these constituents will not reach groundwater (and thus the Columbia River) within 1,000 years [e].	Yes

[a] The contaminated soil from one sample location (OB-8) within the overburden decision unit was placed in the deep zone of the 100-D-50:6 excavation due to direct exposure exceedances of benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. As a result, the total excess cancer risk will be reduced to less than 1×10^{-5}.

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

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

[d] Based on the isotopic distribution of uranium in the 100 Areas, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).

[e] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of copper, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, aroclor-1254, and total PCBs are not predicted to migrate more than 10 m (33 ft) vertically within 1,000 years (based on the lowest distribution coefficient of the contaminants exceeding RAGs, fluorene, with a distribution coefficient value of 7.71 mL/g). The distance to groundwater from the bottom of the excavation area is 15 m (50 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

COPC = contaminant of potential concern
MCL = maximum contaminant level
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
RAG = remedial action goal
RESRAD = RESidual RADioactivity
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*

Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, vanadium, and zinc are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-50:6, 183-DR CLEARWELL PIPELINES

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 100-D-50:6, 183-DR Clearwell Pipelines subsite meets the objectives to support a reclassification of this site to Interim Closed Out as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (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). The verification sample results show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The results of verification sampling indicate that deep zone concentrations of residual waste site contamination exceed direct exposure cleanup levels. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-50:6 subsite contaminants of potential concern (COPCs) and other constituents (Appendix A). The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, manganese, vanadium, zinc, and high molecular weight polycyclic aromatic hydrocarbons (PAH). Ecological screening levels from *Washington Administrative Code* (WAC) 173-340 were exceeded for boron and vanadium. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, vanadium, and zinc are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-D-50 site encompasses those underground pipelines associated with pre-reactor process cooling water, process wastewater, and sanitary wastewater. This site has been administratively divided into 10 subsites based on process knowledge, COPCs, and possible remedial actions.

The 10 subsites are as follows:

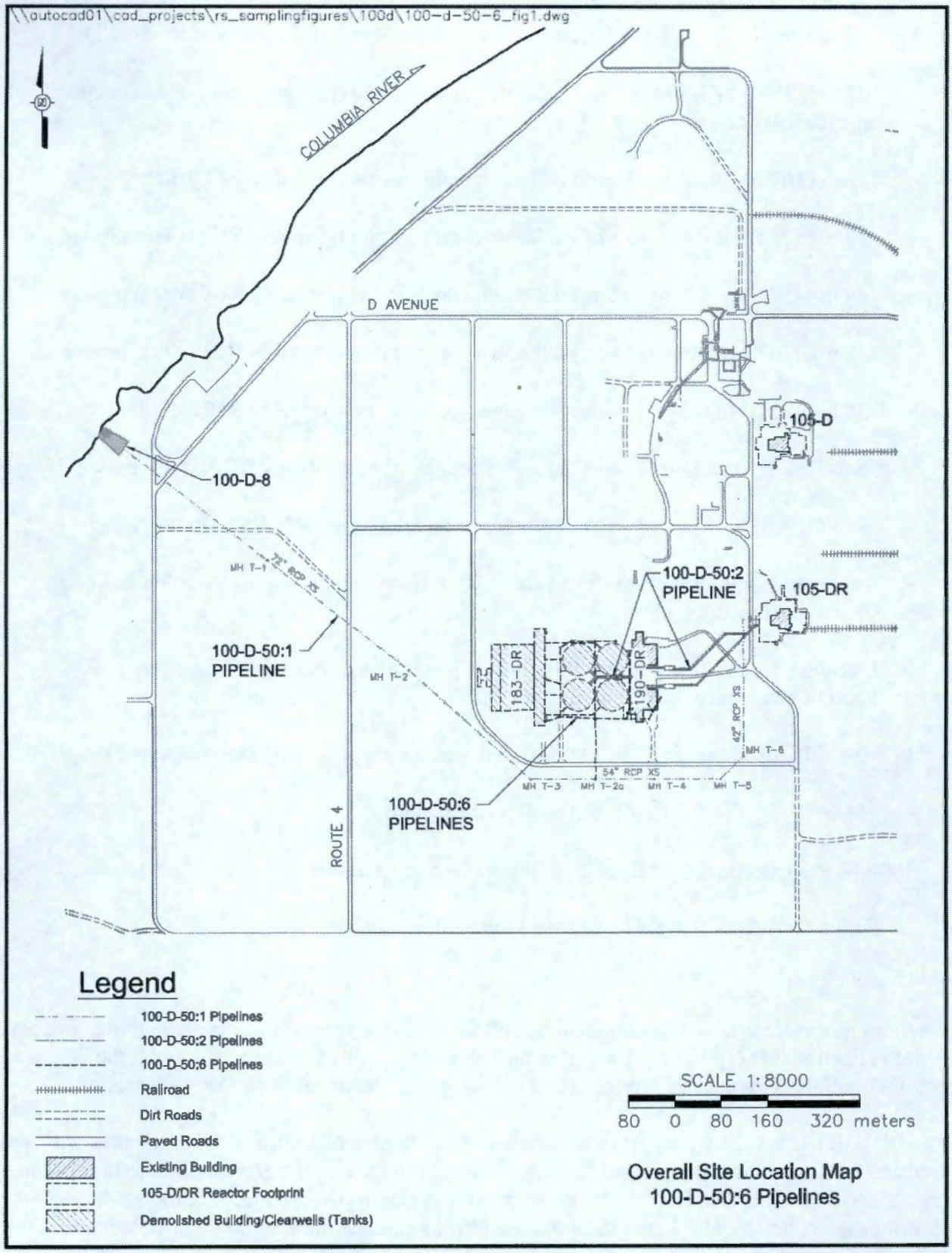
- 100-D-50:1 Emergency Discharge Pipeline
- 100-D-50:2 Reactor Cooling Water Pipelines
- 100-D-50:3 Reactor Cooling Water Pipelines
- 100-D-50:4 Gas Recirculation Pipelines
- 100-D-50:5 183-DR Sedimentation Basin Drain Pipelines
- 100-D-50:6 183-DR Clearwell Drain Pipelines
- 100-D-50:7 183-DR Head House Floor Drain and Catch Basins Pipelines
- 100-D-50:8 117-DR Condensate Drain Pipelines
- 100-D-50:9 1607-DR3 Sanitary Sewer Pipelines
- 100-D-50:10 Construction Camp Potable Water Supply Pipelines.

The 100-D-50 underground pipelines waste site includes those underground pipelines that transported nonradioactive treated and untreated wastewater from the 183-DR basins, 183-DR Clearwells, and 105-DR Reactor Buildings to discharge to the Columbia River via the outfall at the 100-D-8 waste site.

The 100-D-50:6, 183-DR Clearwell Drain Pipelines surrounded the former 183-DR Clearwells, draining south to the 100-D-50:1 emergency discharge pipeline at manhole T-2a (Figure 1). The cooling water process pipelines associated with this subsite ran from the 183-DR Filter Building to the 183-DR Clearwells.

The 100-D-50:6 subsite encompassed three functional pipeline groups: (1) process sewers that provided underflow and overflow drainage for the 183-DR Clearwells and drainage for proximate runoff catch basins, (2) process supply lines from the 183-DR Filter Building, and (3) drainage lines for the 190-DR Pumphouse tunnel floor drains. These three functional groups were used as the basis for delineation of confirmatory sampling service areas. The 100-D-50:6 subsite and remedial action recommendation was expanded to include the concrete clearwell pads.

Figure 1. 100-D-50:6, 183-D Clearwell Pipelines Location Map.



The 100-D-50:6 pipelines consisted of the following:

- Process sewers for the 183-DR Clearwells and proximate catch basins (service area 1):
  - 102 m (335 ft) of 1.5-m (60-in.) unknown composition (probably reinforced concrete pipe [RCP]) drain piping
  - 112 m (367 ft) of 1.2-m (48-in.) unknown composition (probably RCP) drain piping
  - 180 m (591 ft) of 0.9-m (36-in.) unknown composition (probably RCP) drain piping
  - 149 m (489 ft) of 0.8-m (30-in.) unknown composition (probably RCP) drain piping
  - 145 m (476 ft) of 0.6-m (24-in.) unknown composition (probably RCP) drain piping
  - 138 m (453 ft) of 0.5-m (18-in.) unknown composition (probably RCP) drain piping
  - 58 m (190 ft) of 0.3-m (12-in.) unknown composition (probably RCP) drain piping
  - 33 m (108 ft) of 0.1-m (4-in.) unknown composition (probably RCP) drain piping
  - Unknown length of 0.15-m (6-in.) and 0.10-m (4-in.) unknown composition (probably steel) overflow drain piping
  - Unknown length of residual 0.30-m (12-in.) unknown composition (probably RCP) 190-DR catch basin drain piping.
- 183-DR Filter Building to 183-DR Clearwell process supply piping (service area 2):
  - 266 m (873 ft) of 1.2-m (48-in.) steel process piping.
- 190-DR Pumphouse tunnel floor drain piping (service area 3):
  - 233 m (764 ft) of 0.3-m (12-in.) steel tunnel drain piping.
- Clearwell pads.

Pipelines in service area 3 discharged to the service area 1 sewers, which discharged to a process sewer collection line (100-D-50:1 subsite), and ultimately to the Columbia River via the 100-D-8 outfall. Pipelines in service area 2 discharged to the former 183-DR Clearwells.

The 183-DR Clearwells were part of the coolant water treatment facilities. The function of these facilities was to provide storage and chemical contact time for river water conditioned for use in reactor cooling. The chemicals added upstream of the clearwells included sulfuric acid, lime, chlorine, and commercial coagulants including ferrous sulfate, alum, or polymeric flocculants to coagulate suspended solids in the water before filtration. The water then passed through gravity

filters and was stored in underground clearwells (WHC 1993). Clarified water from the clearwells entered the 190-DR Pumphouse (via the western portion of the 100-D-50:2 pipelines), which provided the head to pump the cooling water through the 105-DR Reactor. Sodium dichromate was also used in cooling water conditioning as a corrosion inhibitor and was initially introduced to the treatment train at the 190-DR Pumphouse. However, the presence of a sodium dichromate transfer line (100-D-56 waste site) at the 183-DR headhouse suggests that sodium dichromate addition was subsequently relocated farther upstream in the treatment train.

CONFIRMATORY SAMPLING ACTIVITIES

Contaminants of Potential Concern

Contaminants of potential concern for confirmatory sampling were identified based on process knowledge of the 100-D-50:6 pipelines and the facilities serviced. The COPC list identified in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009a) for the 100-D-50 waste site includes cobalt-60, cesium-137, europium-152, europium-154, strontium-90, lead, hexavalent chromium, and metals. While process knowledge of the 100-D-50:6 subsite does not suggest the historic introduction of radionuclides to the subsite, cobalt-60, cesium-137, europium-152, europium-154, and strontium-90 were identified as COPCs for the 100-D-50 site in its entirety and retained for the 100-D-50:6 subsite.

While not considered COPCs, the potential presence of volatile organic compounds (VOCs) was evaluated by field screening with an organic vapor monitor during confirmatory sampling activities. No VOCs were detected at the 100-D-50:6 pipelines or underlying soil, and no further analysis was performed. The analytical methods used for confirmatory sampling are provided in Table 1.

Table 1. Laboratory Analytical Methods for Confirmatory Sampling.

Analytical Method	Contaminants of Potential Concern
ICP metals – EPA Method 6010	Arsenic, barium, cadmium, chromium (total), lead, selenium, and silver [a]
Mercury – EPA Method 7471	Mercury
Hexavalent chromium – EPA Method 7196	Hexavalent chromium
GEA – Gamma spectroscopy	Cobalt-60, cesium-137, europium-152, europium-154
Gross beta – Proportional counting	Strontium-90
Gross alpha – Proportional counting	Alpha-emitting radionuclides
Kinetic phosphorescence analysis	Total uranium
Bulk asbestos – NIOSH Method 7400	Asbestos

[a] The expanded list of ICP metals was performed to include antimony, beryllium, boron, cobalt, copper, manganese, molybdenum, nickel, vanadium, and zinc in the analytical results package.

EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
ICP = inductively coupled plasma
NIOSH = National Institute for Occupational Safety and Health

Confirmatory Sample Design

Historical design drawings and process knowledge were used to develop a site-specific sample design for the 100-D-50:6 subsite (WCH 2005c). The subsite was divided into three service areas based on the separation of functional pipeline groups and the direction of historic waste flows.

Per the sampling design, a test trench was excavated to access pipeline contents and underlying soils at service areas 1 and 2 and a separate test pit was excavated to access pipeline contents and underlying soils at service area 3. The central collection catch basin for the service area 1 pipelines was discovered to contain water up to the invert of the outlet pipeline. Samples were collected from sediment and scale within the outlet line and from the water within the catch basin. The depth of the outlet line invert was approximately 2.4 m (8 ft) below ground surface (bgs), with the invert of the catch basin estimated at several additional feet below ground surface. A mastic coating was also identified on the outlet line, and a sample was collected and submitted for asbestos analysis.

The 1.22-m (48-in.) steel pipeline within service area 2 was also located by the test trench, but could not be breached to collect a sample of pipeline contents. Additional excavation was performed further downgradient, near the foundation for the clearwell formerly supplied by the pipeline, but the riser line was discovered to have been previously backfilled. A sample was collected from underlying soil at the location of the initial excavation.

Excavation at service area 3 revealed that the junction box at the test pit location had been previously demolished/backfilled, but the 0.30-m (12-in.) steel inlet lines were discovered intact. The pipelines could not be breached to collect a sample of residual contents; therefore, in discussion with the Washington State Department of Ecology (Ecology), samples were collected from soil underlying the inlet pipelines and from soil underlying the former catch basin.

Because all planned samples could not be collected from service area 2, it was determined that confirmatory sample results from the downstream 100-D-50:2 main process pipelines could be used to make a decision regarding the disposition of the service area 2 pipelines. The 100-D-50:2 subsite contained the supply pipelines from the 183-DR Clearwells to the 190-DR Pumphouse and from the 190-DR Pumphouse to the 105-DR Reactor Building. No additional treatment steps were performed for process water in these pipelines, and the pumping process would not have had any significant impact on residual contamination within the pipelines. Confirmatory sampling of the 100-D-50:2 main process pipelines was performed by direct access to pipe scale within two previously cut 0.61-m (24-in.) lines in the southern supply tunnel between the 190-DR and 105-DR facilities.

A summary of the samples collected at the 100-D-50:6 subsite is shown in Figure 2 and presented in Table 2a. A summary of the samples collected at the 100-D-50:2 subsite is presented in Table 2b.

Figure 2. Service Areas and Confirmatory Sampling Locations at the 100-D-50:6 Subsite.

Table 2a. Confirmatory Sample Summary for the 100-D-50:6 Subsite.

Sample Location	Sample Media	Sample Number	WSP Coordinate Locations (Field Estimate)	Depth (Field Estimate, m bgs)	Lateral Dimensions of Area Sampled (Field Estimate)	Sample Analysis
Service area 1	Liquid (water) in catch basin J	J10LD7	N 151115 E 573445	2.4 m	NA	ICP metals, mercury, gross alpha, gross beta, GEA, and KPA
		J10LD8				Hexavalent chromium
	Sediment and scale in effluent pipe from catch basin J	J10L61		2.4 m	NA	ICP metals, mercury, gross alpha, gross beta, GEA, and KPA
		J10L65				Hexavalent chromium
	Soil underlying catch basin and pipeline	J10L69		2.7 m	1 m by 1 m (3 ft by 3 ft)	ICP metals, mercury, hexavalent chromium, gross alpha, gross beta, GEA, and KPA
	Mastic pipe coating	J10DF7		2.4 m	NA	Asbestos
Service area 2	Soil underlying pipeline	J10L70	N 151125 E 573435	4.0 m	1 m by 1 m (3 ft by 3 ft)	ICP metals, mercury, hexavalent chromium, gross alpha, gross beta, GEA, and KPA
Service area 3	Soil underlying inlet pipelines to catch basin N	J10L62	N 151126 E 573502	3.4 m	1 m by 1 m (3 ft by 3 ft)	ICP metals, mercury, hexavalent chromium, gross alpha, gross beta, GEA, and KPA
	Soil underlying inlet pipelines to catch basin N (duplicate)	J10L63				ICP metals, mercury, hexavalent chromium, gross alpha, gross beta, GEA, KPA, and total beta radiostrontium
	Soil underlying catch basin N	J10L71		4.0 m	1 m by 1 m (3 ft by 3 ft)	ICP metals, mercury, hexavalent chromium, gross alpha, gross beta, GEA, and KPA
Equipment blank	Silica sand	J10L72	NA	NA	NA	ICP metals and mercury

Sources: *Remaining Sites Field Sampling*, Logbooks EL-1578-7 and El-1578-9 (WCH 2005a, 2005b).

bgs = below ground surface
GEA = gamma energy analysis
ICP = inductively coupled plasma
KPA = kinetic phosphorescence analysis
NA = not applicable
WSP = Washington State Plane

Table 2b. Confirmatory Sample Summary for the 100-D-50:2 Main Process Lines.

Sample Location	Sample Media	Sample Number	WSP Coordinate Locations	Depth	Sample Analysis
Southern main process lines [a]	Pipe scale	J13H93	N 151175 E 573581 and N 151278 E 573729	Surface access to tunnels	ICP metals, mercury, anions, PCBs, GEA, gross alpha, gross beta, and KPA
		J13HC2			Hexavalent chromium
	Pipe scale (duplicate) [b]	J13HC3			Hexavalent chromium
Equipment blank	Silica sand	J13H94	NA	NA	ICP metals and mercury

Source: *100D-Remaining Sites*, Logbook EL-1601 (WCH 2006a).

[a] Sample collected by combining material collected from both ends of the two 0.61-m (24-in.) main process pipelines.
[b] Due to insufficient sample material, all planned analyses could not be performed for the duplicate sample.

GEA = gamma energy analysis
ICP = inductively coupled plasma
KPA = kinetic phosphorescence analysis
NA = not applicable
PCB = polychlorinated biphenyl
WSP = Washington State Plane

Confirmatory Sample Results

Confirmatory sampling of the 100-D-50:6 subsite was performed on November 8 and 9, 2005; confirmatory sampling of the 100-D-50:2 subsite was performed on September 21, 2006. Samples were analyzed using analytical methods approved by the EPA. The laboratory-reported results for all constituents are stored in the Environmental Restoration (ENRE) project-specific database prior to archiving in the Hanford Environmental Information System (HEIS) and are included in Appendix B.

Comparisons of the maximum concentrations of detected COPCs in each service area and the site RAGs are summarized in Tables 3a through 3c. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Model Toxics Control Act Cleanup Levels and Risk Calculations database under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the 100-D-50:6 subsite, but are not considered within Tables 3a through 3c because these isotopes are not related to the operational history of the site. The laboratory-reported data results for all constituents are provided in Appendix B.

Table 3a. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 100-D-50:6 Confirmatory Sampling Event (Service Area 1). (2 Pages)

COPC	Maximum Pipe Sediment/ Scale Result (pCi/g)	Maximum Underlying Soil Result (pCi/g)	Generic Site Lookup Values [a] (pCi/g)			Does the Maximum Pipe Sediment/ Scale Result Exceed Lookup Values?	Does the Maximum Underlying Soil Result Exceed Lookup Values?
			Shallow Zone Lookup Value [b]	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.170	U	6.2	1,465[c]	2,930[c]	No	--
COPC	**Maximum Pipe Sediment/ Scale Result (mg/kg)**	**Maximum Underlying Soil Result (mg/kg)**	**Remedial Action Goals [a] (mg/kg)**			**Does the Maximum Pipe Sediment/Scale Result Exceed RAGs?**	**Does the Maximum Underlying Soil Result Exceed RAGs?**
			Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Arsenic	31.7	2.4 (<BG)	20	20	20	Yes	No
Barium	79.7 (<BG)	53.0 (<BG)	5,600 [d]	200 [e]	400	No	No
Beryllium	0.09 (<BG)	0.17 (<BG)	10.4 [f]	1.51 [e]	1.51 [e]	No	No
Boron [g]	5.7	1.9	7,200	320	-- [h]	No	No
Cadmium [i]	5.2	U	13.9 [f]	0.81 [e]	0.81 [e]	Yes	--
Chromium (total)	438	9.0 (<BG)	80,000 [d]	18.5 [e]	18.5 [e]	Yes	No
Chromium (hexavalent) [g]	7.53	U	2.1	4.8	2	Yes	--
Cobalt	70.2	5.2 (<BG)	24	15.7 [e]	-- [h]	Yes	No
Copper	148	11.9 (<BG)	2,960	59.2	22 [e]	Yes	No
Lead	32.0	4.1 (<BG)	353 [j]	10.2 [e]	10.2 [e]	Yes	No
Manganese	1610	245 (<BG)	3,760	512 [e]	512 [e]	Yes	No

Table 3a. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 100-D-50:6 Confirmatory Sampling Event (Service Area 1). (2 Pages)

COPC	Maximum Pipe Sediment/ Scale Result (mg/kg)	Maximum Underlying Soil Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Pipe Sediment/Scale Result Exceed RAGs?	Does the Maximum Underlying Soil Result Exceed RAGs?
			Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Mercury	4.3	U	24	0.33 [e]	0.33 [e]	Yes	--
Molybdenum [g]	4.3	0.35	400	8	-- [h]	No	No
Nickel	218	10.2 (<BG)	1,600	19.1 [e]	27.4	Yes	No
Selenium [i]	U	1.0	400	5	1	--	No
Uranium	0.744(<BG)	1.42 (<BG)	240	3.21 [e]	3.21 [e]	No	No
Vanadium	23.8 (<BG)	27.2 (<BG)	560	85.1 [e]	-- [h]	No	No
Zinc	182	30.6 (<BG)	24,000	480	67.8 [e]	Yes	No

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b) or calculated per WAC 173-340-720, WAC 173-340-730, and WAC 173-340-740, Method B, 1996, unless otherwise noted.
[b] Activity corresponding to a single-radionuclide 15 mrem/yr exposure as calculated using a generic RESRAD model (DOE-RL 2009b).
[c] Lookup value calculated per *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004).
[d] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) as presented in DOE-RL (2009b). Updated oral reference dose values (as provided in IRIS) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and total chromium, respectively.
[e] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).
[f] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750[3], 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (WDOH 1997).
[g] No Hanford Site-specific or Washington State background value available.
[h] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[i] Hanford Site-specific background is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[j] Use EPA, 1994, *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.

-- = not applicable
BG = background
CFR = *Code of Federal Regulations*
COPC = contaminant of potential concern
Ecology Washington State Department of Ecology
IRIS = Integrated Risk Information System
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)
U = undetected
WAC = *Washington Administrative Code*

Table 3b. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 100-D-50:2 Main Process Pipelines and 100-D-50:6 (Service Area 2) Underlying Soil Confirmatory Sampling Events. (2 Pages)

COPC	Maximum Pipe Scale Result [a] (pCi/g)	Maximum Underlying Soil Result (pCi/g)	Generic Site Lookup Values [b] (pCi/g)			Does the Maximum Pipe Scale Result Exceed Lookup Values?	Does the Underlying Soil Result Exceed Lookup Values?
			Shallow Zone Lookup Value [c]	Groundwater Protection Lookup Value	River Protection Lookup Value		
Europium-152	0.356	U	3.3	-- [d]	-- [d]	No	--
COPC	**Maximum Pipe Scale Result [a] (mg/kg)**	**Underlying Soil Result (mg/kg)**	**Remedial Action Goals [b] (mg/kg)**			**Does the Maximum Pipe Scale Result Exceed RAGs?**	**Does the Underlying Soil Result Exceed RAGs?**
			Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [e]	20.8	U	32	5 [f]	5 [f]	Yes	--
Arsenic	60.1	3.6 (<BG)	20	20	20	Yes	No
Barium	41.9 (<BG)	63.8 (<BG)	5,600 [g]	200 [f]	400	No	No

Table 3b. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 100-D-50:2 Main Process Pipelines and 100-D-50:6 (Service Area 2) Underlying Soil Confirmatory Sampling Events. (2 Pages)

COPC	Maximum Pipe Scale Result [a] (mg/kg)	Underlying Soil Result (mg/kg)	Remedial Action Goals [b] (mg/kg)			Does the Maximum Pipe Scale Result Exceed RAGs?	Does the Underlying Soil Result Exceed RAGs?
			Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Beryllium	0.14 (<BG)	0.23 (<BG)	10.4 [h]	1.51 [f]	1.51 [f]	No	No
Boron [i]	5.7	1.6	7,200	320	-- [j]	No	No
Cadmium [e]	12.4	U	13.9 [h]	0.81 [f]	0.81 [f]	Yes	--
Chromium (total)	13,500	11.9 (<BG)	80,000 [g]	18 [f]	18.5 [f]	Yes	No
Chromium (hexavalent) [i]	87.0	0.29	2.1	4.8	2	Yes	No
Cobalt	13.1 (<BG)	5.8 (<BG)	24	15.7 [f]	-- [j]	No	No
Copper	101	14.1 (<BG)	2,960	59.2	22 [f]	Yes	No
Lead	85.3	4.3 (<BG)	353	10.2 [f]	10.2 [f]	Yes	No
Manganese	1,280	284 (<BG)	11,200	512 [f]	512 [f]	Yes	No
Molybdenum [i]	10.8	0.56	400	8	-- [j]	No	No
Nickel	26.3	12.1 (<BG)	1,600	19.1 [f]	27.4	Yes	No
Silver	11.3	U	400	8	0.73 [f]	Yes	--
Uranium	2.03 (<BG)	1.57 (<BG)	240	3.21 [f]	3.21 [f]	No	No
Vanadium	114	30.1 (<BG)	560	85.1 [f]	-- [j]	Yes	No
Zinc	585	34.9 (<BG)	24,000	480	67.8 [f]	Yes	No
Nitrate (as nitrogen)	14.0	--	128,000	1,000	2,000	No	--
Sulfate	29.8 (<BG)	--	-- [l]	25,000	-- [j]	No	--
Aroclor-1260	0.28	--	0.5	0.017 [m]	0.017 [m]	Yes	--

[a] Pipe scale results are taken from the confirmatory sampling results for the 100-D-50:2 main process pipelines.
[b] Lookup values and remedial action goals (RAGs) obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b) or calculated per WAC 173-340-720, WAC 173-340-730, and WAC 173-340-740, Method B, 1996, unless otherwise noted.
[c] Activity corresponding to a single-radionuclide 15 mrem/yr exposure as calculated using a generic RESRAD model (DOE-RL 2009b).
[d] No value—RESRAD modeling predicts the contaminant will not impact groundwater within 1,000 years.
[e] Hanford Site-specific background is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[f] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).
[g] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) as presented in DOE-RL (2009b). Updated oral reference dose values (as provided in IRIS) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and total chromium, respectively.
[h] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750[3], 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (WDOH 1997).
[i] No Hanford Site-specific or Washington State background value available.
[j] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[k] Use EPA, 1994, *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.
[l] No parameters (toxicity/carcinogenicity) values are available from the Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-740(3), 1996 [Method B for soils]).
[m] Where cleanup levels are less than the RDL, cleanup levels default to the RDL (WAC 173-340-707[2], 1996 and DOE-RL 2009b).

-- = not applicable
BG = background
CFR = *Code of Federal Regulations*
COPC = contaminant of potential concern
Ecology = Washington State Department of Ecology
IRIS = Integrated Risk Information System
RAG = remedial action goal
RDL = required detection limit
RESRAD = RESidual RADioactivity (dose assessment model)
U = undetected
WAC = *Washington Administrative Code*

Table 3c. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 100-D-50:6 Confirmatory Sampling Event (Service Area 3).

COPC	Maximum Underlying Soil Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Underlying Soil Result Exceed RAGs?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection	
Arsenic	3.9 (<BG)	20	20	20	No
Barium	65.3 (<BG)	5,600 [b]	200 [c]	400	No
Beryllium	0.24 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No
Boron [e]	1.1	7,200	320	-- [f]	No
Cadmium [g]	0.14 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No
Chromium (total)	13.3 (<BG)	80,000 [b]	18.5 [c]	18.5 [c]	No
Chromium (hexavalent) [e]	0.36	2.1	4.8	2	No
Cobalt	7.1 (<BG)	24	15.7 [c]	-- [f]	No
Copper	13.7 (<BG)	2,960	59.2	22 [c]	No
Lead	4.4 (<BG)	353 [h]	10.2 [c]	10.2 [c]	No
Manganese	279 (<BG)	11,200	512 [c]	512 [c]	No
Nickel	12.2 (<BG)	1,600	19.1 [c]	27.4	No
Uranium	1.66 (<BG)	240	3.21 [c]	3.21 [c]	No
Vanadium	48.6 (<BG)	560	85.1 [c]	-- [f]	No
Zinc	39.2 (<BG)	24,000 [c]	480	67.8 [c]	No

[a] Remedial action goals obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b) or calculated per WAC 173-340-720, WAC 173-340-730, and WAC 173-340-740, Method B, 1996, unless otherwise noted.

[b] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) as presented in DOE-RL (2009b). Updated oral reference dose values (as provided in IRIS) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and total chromium, respectively.

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

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

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

[f] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Ecology Cleanup Levels and Risk Calculations database 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 is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[h] A WAC 173-340-740(3) (1996) value for lead is not available. This value is based on the *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children* (EPA 1994).

-- = not applicable
BG = background
CFR = *Code of Federal Regulations*
COPC = contaminant of potential concern
Ecology = Washington State Department of Ecology
IRIS = Integrated Risk Information System
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)
WAC = *Washington Administrative Code*

Service Area 1

Arsenic, cobalt, and hexavalent chromium were detected above direct exposure RAGs and the soil RAGs for protection of groundwater and the Columbia River in the sediment/scale sample. Cadmium, chromium, copper, lead, manganese, mercury, nickel, and zinc were also quantified at concentrations exceeding soil RAGs for groundwater and/or river protection in this sample. No COPCs were detected above RAGs in the underlying soil sample. Because direct exposure RAGs were exceeded, this service area required remediation. Confirmatory sampling results for service area 1 are presented in Table 3a.

Service Area 2

Hexavalent chromium and arsenic were detected above direct exposure RAGs and the soil RAGs for protection of groundwater and the Columbia River in the 100-D-50:2 main process pipeline scale sample, as shown in Table 3b. Multiple additional metals and aroclor-1260 were also quantified at concentrations exceeding soil RAGs for groundwater and/or river protection in this sample. No COPCs were detected above RAGs in the underlying soil sample collected from service area 2; however, because direct exposure RAGs were exceeded in the analogous pipe scale sample, this service area required remediation.

Service Area 3

No COPCs were detected above RAGs in the soil samples collected from service area 3, as shown in Table 3c. No samples were collected from residual pipeline contents due to previous demolition activities, but soil samples were collected from the locations most likely to have received any leakage from this service area. No other junction boxes were known to exist, and the lines are steel and formerly operated only under gravity flow. Based on the data presented in Table 3c, the service area 3 pipelines were recommended to have no further action.

All service area 1 and service area 2 pipelines were recommended for remediation, and service area 3 was also included in the remediation design. The 126-DR-1, 190-DR Clearwell Tank Pit; 100-DR Clearwells waste site was used as a demolition waste site burial ground between 1975 and 1988. This waste site was remediated in 2008, however, the pads and surrounding soils (including sidewalls) were remediated with the 100-D-50:6 waste subsite. Following remediation of the 126-DR-1 waste site, the 183-DR Clearwell concrete pads were sampled and determined to be contaminated by hexavalent chromium above direct exposure soil RAGs. As a result, the 183-DR Clearwell pads were included in the 100-D-50:6 remedial action.

REMEDIAL ACTION ACTIVITIES

Remediation of the 100-D-50:6 subsite was performed from March 11, 2011, through May 28, 2012, to a depth of approximately 9 m (30 ft). Figure 3 shows that all the pipeline service areas were included in the excavation design and therefore removed with 100-D-50:6 remediation activities. Figures 4 and 5 show the site before and after remediation, respectively. Approximately 49,975 bank cubic meters (BCM) (65,365 bank cubic yards [BCY]) of contaminated soil, concrete, and piping was excavated for disposal at the Environmental Restoration Disposal Facility (ERDF). A majority of the waste was direct loaded for shipment to ERDF, but a portion of the waste was stockpiled separately, prior to shipment and disposal at ERDF. Approximately 31,400 BCM (41,070 BCY) of soil (overburden) was removed and stockpiled for evaluation for use as clean backfill. Additionally, approximately 58,674 L (15,500 gal) of water from within the pipelines was removed and disposed at the Effluent Treatment Facility. Appendix C provides photographs of the excavation.

Figure 3. Excavation Area Overlain on 100-D-50:6 Subsite Pipelines.

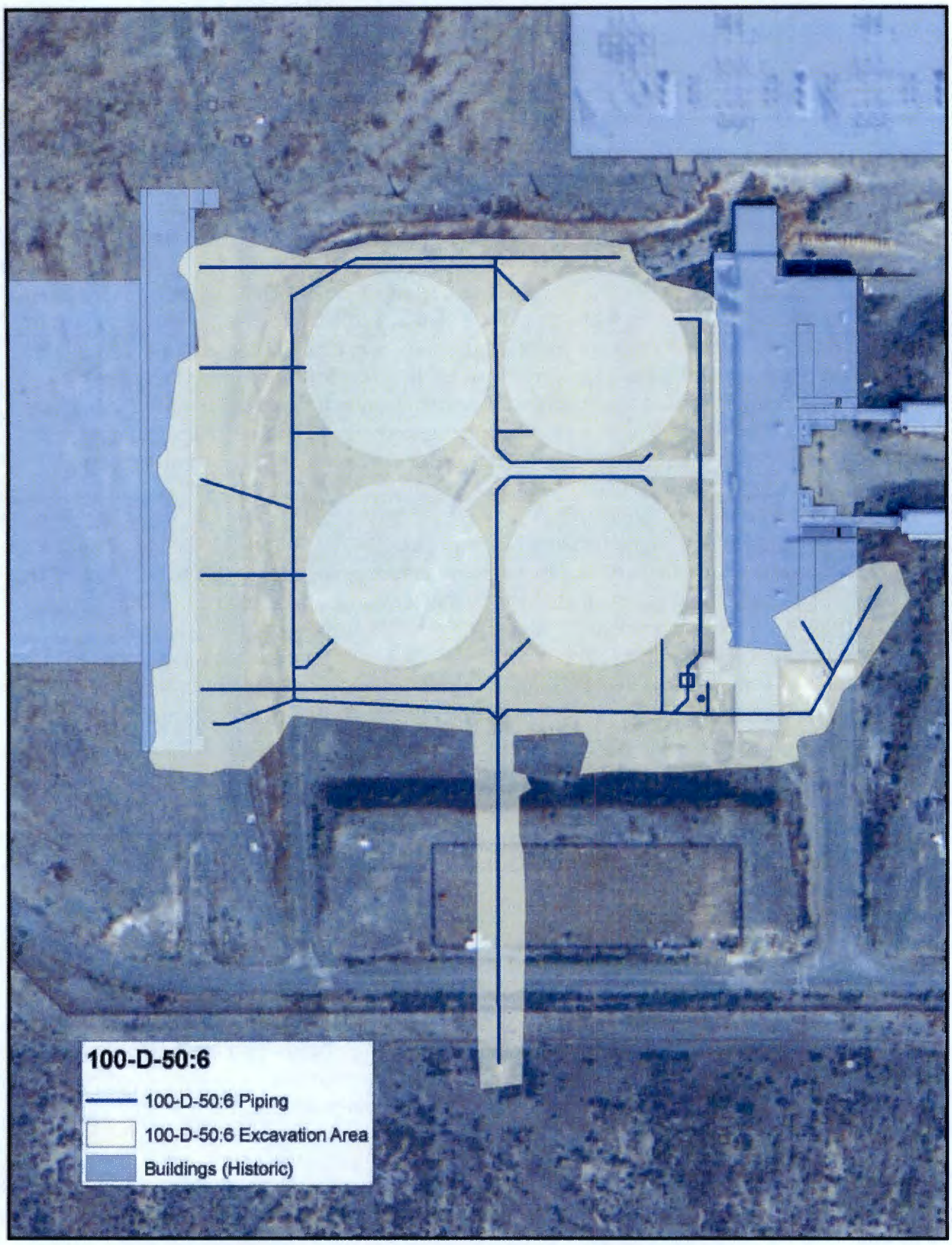


Figure 4. 100-D-50:6 Subsite Prior to Remediation (December 2010).

Figure 5. 100-D-50:6 Subsite Following Remediation (December 2012).

Included within the excavation were the 100-D-50:2 process water pipelines from the 183-DR Clearwells to the 190-DR Pumphouse. These pipelines were entirely removed from within the footprint of the 100-D-50:6 subsite remediation.

Various in-process and waste characterization samples were collected during the excavation of the 100-D-50:6 subsite (Table 4) (WCH 2011a, 2011b, 2011c, 2012b, 2013). These sample results are reported in Appendix B.

Table 4. Summary of 100-D-50:6 In-Process Samples.

HEIS Number	Sample Description	Sample Purpose	Date Collected	WSP Coordinate Locations (m)	
				Northing	Easting
JP0130	Concrete pads	Waste management	3/22/2011	Composite	
JP0139	Pipeline scale	Waste profile	3/24/2011	Composite	
JP0140	Liquid – catch basin J	Waste profile	3/24/2011	151115	573445
JP0207	Liquid – northwest and northeast pad pipeline	Waste management	6/22/2011	151219 151242	573389 573541
JP0211	Pipeline scale – north-central and northwest pad	In-process	6/23/2011	151233 151221	573445 573412
JP0214	Liquid, northeast pad pipeline (SVOA)	Waste management	6/27/2011	151242	573541
JP0226	Liquid, southwest pad pipeline	In-process	7/14/2011	151219	573388
JP0227	Wetted soils adjacent to leak	In-process	7/14/2011	151219	573388
JP0258	Southwest pad pipeline contents	In-process	8/4/2011	151201	573391
J1P178	Tar-like substance within drum	Anomaly characterization	4/26/2012	151182	573480
J1R936	SPA resample perimeter (south)	Verification sample support	1/14/13	150644.1	573068.7
J1R937	SPA resample perimeter (west)	Verification sample support	1/14/13	150647.5	573061.8
J1R938	SPA resample perimeter (north)	Verification sample support	1/14/13	150655.8	573066.1
J1R939	SPA resample perimeter (east)	Verification sample support	1/14/13	150652.6	573073.2
J1RC25	SPA resample perimeter (south)	Verification sample support	1/24/13	150644.1	573068.7
J1RC26	SPA resample perimeter (north)	Verification sample support	1/24/13	150655.8	573066.1
J1RC27	SPA resample perimeter (east)	Verification sample support	1/24/13	150652.6	573073.2

HEIS = Hanford Environmental Information System
SPA = staging pile area
SVOA = semivolatile organic analysis
WSP = Washington State Plane

On March 15, 2011, red-stained rock located on the western slope of the remediation area was excavated and disposed at ERDF (Figure 6). A focused sample (FS-1) was collected at this location for verification sampling and the sample results are located in Appendix D.

Figure 6. Red-Stained Rocks (March 23, 2011).

On June 29, 2011, reddish material located within the 100-D-50:6 pipeline and the pipeline were excavated and disposed at ERDF (Figure 7). Focused sample FS-2 was collected at this location for verification sampling and the sample results are located in Appendix D.

On July 14, 2011, a leaking pipe was discovered within the 100-D-50:6 pipeline excavation. It was suspected that the pipe was leaking dust-suppression water, and both the water within the pipeline and the soil underneath the pipeline were sampled. The sample results did not exceed direct exposure soil cleanup levels for any of the analyzed contaminants. Groundwater and river protection RAGs were exceeded for total chromium, lead, and some semivolatile organic compounds. Focused sample FS-3 was collected at this location for verification sampling and the sample results are located in Appendix D. The pipe section and soils underlying the leaking pipeline were removed and disposed at ERDF.

On November 14, 2011, a drum containing tar-like material was also discovered during remediation at Washington State Plane coordinates N 151182, E 573480 (Figure 8). This drum was placed on a plastic tarp and covered at the same location it was discovered within the excavation, prior to in-process sampling. Following in-process sampling (WCH 2012b), the drum and underlying soil were disposed at ERDF. Analytical results of the in-process sample have been included in Appendix B. Focused sample FS-4 was collected at the original location of the drum during verification sampling and the sample results are located in Appendix D.

Figure 7. Reddish Material Located within Pipeline Segment (June 22, 2011).

Figure 8. Black Tar Discovered in Drum.

RADIOLOGICAL SURVEYS

Global Positioning Environmental Radiological Surveyor (GPERS) gamma surveys within the excavation area were performed on June 8 and 12, 2012, within the 100-D-50:6 subsite following the site remedial action. The composite gamma survey did not show any elevated reading within the excavation (Figure 9).

Additional Remediation

Following sample analysis of the original excavation, it was determined that additional remediation was required because two sample locations, Pipe-4 and SPA-8, had detectable levels of asbestos and exceeded direct exposure cleanup criteria for PAH, respectively. This extra remediation, with agreement from Ecology (WCH 2012c), was conducted from January 21 through 24, 2013. Approximately 180 BCM (235 BCY) of additional soil was removed from the Pipe-4 location within the excavation area on January 21 and 22, 2013, and disposed at ERDF. Approximately 100 BCM (131 BCY) of contaminated soil was removed from the SPA-8 location on January 24, 2013, and placed into the deep zone of the 100-D-50:6 excavation with regulatory concurrence (WCH 2012c). The removal of extra material from these two locations did not change the original boundary for either decision unit and the original sample locations were utilized. A sample in the overburden decision unit (OB-8) also exceeded RAGs for PAH, but soil from this location was placed in the deep zone at least 4.6 m (15 ft) bgs within the 100-D-50:6 excavation during site backfill and therefore does not require additional remediation (WCH 2012c). The vadose zone underlying the excavation is approximately 15 m (50 ft). The residual concentrations of the contaminants in the overburden decision unit are not predicted to migrate more than 1 m (3.3 ft) vertically within 1,000 years (based on the contaminant [aroclor-1254] with the lowest distribution coefficient [75.6 mL/g] of the contaminants exceeding RAGs).

VERIFICATION SAMPLING ACTIVITIES

Statistical verification sampling was conducted at the 100-D-50:6 subsite on September 4 through 6, 2012 (WCH 2012a), to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999).

Resampling of the verification sampling locations that were further remediated was conducted at the 100-D-50:6 subsite on January 23 and 24, 2013, after additional remediation of the failed sample locations in the excavation (Pipe-4) and staging pile area (SPA-8) (WCH 2013).

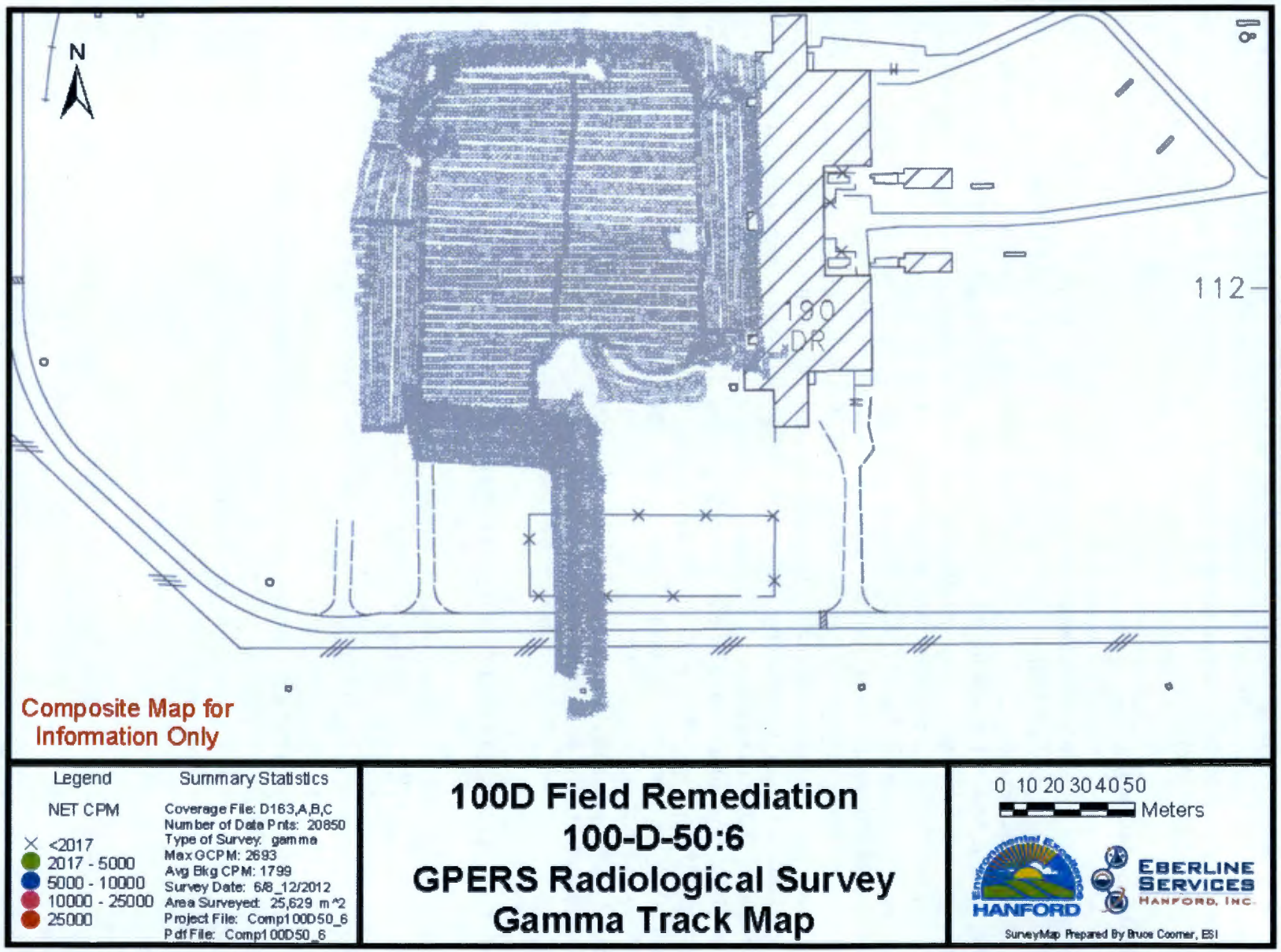


Figure 9. 100-D-50:6 Waste Site Composite Gamma GPERS Survey, June 8 and 12, 2012.

The verification sample results are provided in Appendix D and indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and RAGs for the 100-D-50:6 subsite. The following subsections provide additional discussion of the information used to develop the verification sampling design. The results of verification sampling are also summarized to support interim closure of the site. A more detailed discussion of the verification sampling can be found in the *Work Instruction for Verification Sampling of the 100-D-50:6, 183-DR Clearwell Drain Pipelines Waste Site* (WCH 2012d).

Contaminants of Potential Concern

The COPCs for the 100-D-50 100-DR Water Treatment Facilities site were identified in the 100 Area RDR/RAWP (DOE-RL 2009b) based on existing historical information for the site. This COPC list included cobalt-60, cesium-137, europium-152, europium-154, strontium-90, lead, mercury, and hexavalent chromium. However, process knowledge of the 100-D-50:6 183-DR Clearwell Pipelines subsite does not suggest the historic introduction of radionuclides to the subsite and, furthermore, the confirmatory samples did not detect radionuclides at levels exceeding RAGs. Therefore, radionuclides were eliminated from the 100-D-50:6 COPC list. While not considered COPCs, antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc concentrations were evaluated using the expanded inductively coupled plasma (ICP) metals analysis.

Since a portion of the 100-D-50:6 excavation design included the 183-DR Clearwell concrete pads beneath the 126-DR-1 debris site, the COPC list for 100-D-50:6 verification sampling also included polychlorinated biphenyls (PCBs) and asbestos. No evidence of radiological contamination was encountered during the remediation of the 126-DR-1 waste site.

Based on in-process analytical results from soil and water at the location of a pipeline that was leaking suspected dust-suppression water, PAH were also included as COPCs for the 100-D-50:6 subsite. Focused sample FS-3 was collected at this location.

The COPCs for the fourth focused sample (FS-4), collected at the location of a drum containing tar-like material, were also based on in-process results and included all the COPCs for the waste site. Additionally, for this focused sample location only, total petroleum hydrocarbons (TPH) was also included as a COPC.

The waste staging area included waste from the 100-D-50:6, 100-D-62, 100-D-77, and 100-D-104 waste sites; therefore, additional COPCs for the staging pile area included sulfate, nitrate, and TPH.

No VOCs were detected at the 100-D-50:6 pipelines or underlying soil during confirmatory sampling, and therefore VOCs were not included as COPCs for verification sampling.

The laboratory analyses for verification sampling are identified in Table 5.

Table 5. Laboratory Analytical Methods for Verification Sampling of the 100-D-50:6 Subsite.

Analytical Method	COPC
ICP metals [a] – EPA Method 6010	Chromium, lead
Mercury – EPA Method 7471	Mercury
Hexavalent chromium – EPA Method 7196	Hexavalent chromium
Bulk asbestos – NIOSH Method 7400	Asbestos
PAH – EPA Method 8310	Polycyclic aromatic hydrocarbons
PCB – EPA Method 8082	Polychlorinated biphenyls
IC anions [b] – EPA Method 300.0	Sulfate
NO_2/NO_3 [c] – EPA Method 353	Nitrogen in nitrate and nitrite
TPH – EPA Method NWTPH-Dx	Total petroleum hydrocarbons

[a] The expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc in the analytical results package.

[b] The expanded list of IC anions included bromide, chloride, fluoride, nitrate, nitrite, phosphate, and sulfate in the analytical results package.

[c] To preclude holding time issues associated with EPA Method 300.0 for nitrites and nitrates, EPA Method 353 was performed.

COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
IC = ion chromatography
ICP = inductively coupled plasma
NIOSH = National Institute for Occupational Safety and Health
NWTPH-Dx = Northwest total petroleum hydrocarbons-diesel range organics
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
TPH = total petroleum hydrocarbons

Verification Sample Design

The statistical sampling design for the 100-D-50:6 subsite was developed using Visual Sample Plan[1] (VSP). The 100-D-50:6 subsite consists of four decision units for verification sampling: (1) the pipeline excavation (deep zone), (2) the clearwell excavation (deep zone), (3) the overburden soil (shallow zone), and (4) the soil staging pile area. The decision units identified for the purpose of statistical verification sampling were delineated in VSP and used as the basis for a random-start systematic grid for verification soil sample collection at the site. Twelve statistical verification soil samples plus a duplicate sample were collected on the grid within each of the four decision units at the 100-D-50:6 subsite. Four focused samples were collected from within the excavation. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). All samples were grab samples collected at the predetermined coordinates. Additional information related to verification sampling can be found in the field sampling logbooks (WCH 2012a, 2013). The verification sample summary is provided in Table 6. Figures 10 through 13 show the footprints and the sampling locations for each decision unit.

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

Table 6. 100-D-50:6, 183-DR Clearwell Pipelines Verification Sample Summary. (3 Pages)

Sample Location	HEIS Sample Number	WSP Coordinates (m)		Sample Analysis [a]
		Northing	Easting	
Pipe-1	J1R116/ J1R161	151148.4	573556.7	ICP metals [b], mercury, PCBs, hexavalent chromium, PAH, and asbestos
Pipe-2	J1R117/ J1R162	151189.2	573506.9	
Pipe-3	J1R118/ J1R163	151183.5	573491.8	
Pipe-4	J1R119/ J1R164	151076.9	573446	ICP metals [b], mercury, PCBs, hexavalent chromium, PAH
Pipe-4 resample	J1RD53	151076.9	573446	Asbestos
Pipe-5	J1R120/ J1R165	151251.6	573474.8	ICP metals [b], mercury, PCBs, hexavalent chromium, PAH, and asbestos
Pipe-6	J1R121/ J1R166	151118.8	573438.8	
Pipe-7	J1R122/ J1R167	151166.5	573446.7	
Pipe-8	J1R123/ J1R168	151240.2	573444.7	
Pipe-9	J1R124/ J1R169	151123.4	573411.3	
Pipe-10	J1R125/ J1R170	151250.4	573432.2	
Pipe-11	J1R126/ J1R171	151143.8	573386.4	
Pipe-12	J1R127/ J1R172	151217.5	573384.4	
Pipe-duplicate of J1R118/J1R163 [c]	J1R128/ J1R173	151183.5	573491.8	
Clear-1	J1R1K9/ J1R1J6	151067.2	573442.1	ICP metals [b], mercury, PCBs, hexavalent chromium, PAH, and asbestos
Clear-2	J1R1L0/ J1R1J7	151109.4	573368.9	
Clear-3	J1R1L1/ J1R1J8	151109.4	573515.2	
Clear-4	J1R1L2/ J1R1J9	151151.7	573393.3	
Clear-5	J1R1L3/ J1R1K0	151151.7	573442.1	
Clear-6	J1R1L4/ J1R1K1	151151.7	573490.9	
Clear-7	J1R1L5/ J1R1K2	151193.9	573368.9	
Clear-8	J1R1L6/ J1R1K3	151193.9	573417.7	
Clear-9	J1R1L7/ J1R1K4	151193.9	573466.5	
Clear-10	J1R1L8/ J1R1K5	151236.2	573393.3	

Table 6. 100-D-50:6, 183-DR Clearwell Pipelines Verification Sample Summary. (3 Pages)

Sample Location	HEIS Sample Number	WSP Coordinates (m)		Sample Analysis [a]
		Northing	Easting	
Clear-11	J1R1L9/ J1R1K6	151236.2	573442.1	ICP metals [b], mercury, PCBs, hexavalent chromium, PAH, and asbestos
Clear-12	J1R1M0/ J1R1K7	151236.2	573490.9	
Clear-duplicate of J1R1L4/J1R1K1 [c]	J1R1M1/ J1R1K8	151151.7	573490.9	
OB-1	J1R129/ J1R174	151067.7	573414	ICP metals [b], mercury, PCBs, hexavalent chromium, PAH, and asbestos
OB-2	J1R130/ J1R175	151477.3	573095.4	
OB-3	J1R131/ J1R176	151477.3	573132	
OB-4	J1R132/ J1R177	151477.3	573168.5	
OB-5	J1R133/ J1R178	151295.7	572740.4	
OB-6	J1R134/ J1R179	151359	572740.4	
OB-7	J1R135/ J1R180	151359	572813.5	
OB-8	J1R136/ J1R181	151390.7	572758.6	
OB-9	J1R137/ J1R183	151390.7	572795.2	
OB-10	J1R138/ J1R183	151277.4	572774.9	
OB-11	J1R139/ J1R184	151277.4	572811.4	
OB-12	J1R140/ J1R185	151309	572793.1	
OB-duplicate of J1R137/J1R183 [c]	J1R141/ J1R186	151390.7	572795.2	
SPA-1	J1R142/ J1R187	150578.5	573066.9	ICP metals [b], mercury, PCBs, hexavalent chromium, IC anions [d], nitrate/nitrite [e], TPH, PAH, and asbestos
SPA-2	J1R143/ J1R188	150578.5	573108.6	
SPA-3	J1R144/ J1R189	150578.5	573150.3	
SPA-4	J1R145/ J1R190	150614.7	573046.1	
SPA-5	J1R146/ J1R191	150614.7	573087.8	
SPA-6	J1R147/ J1R192	150614.7	573129.5	
SPA-7	J1R148/ J1R193	150614.7	573171.2	
SPA-8	J1R149/ J1R194	150650.8	573066.9	ICP metals [b], mercury, PCBs, hexavalent chromium, IC anions [d], nitrate/nitrite [e], TPH, and asbestos

Table 6. 100-D-50:6, 183-DR Clearwell Pipelines Verification Sample Summary. (3 Pages)

Sample Location	HEIS Sample Number	WSP Coordinates (m)		Sample Analysis [a]
		Northing	Easting	
SPA-8 resample	J1RD54	150650.8	573066.9	PAH
SPA-9	J1R150/ J1R195	150686.9	573046.1	ICP metals [b], mercury, PCBs, hexavalent chromium, IC anions [d], nitrate/nitrite [e], TPH, PAH, and asbestos
SPA-10	J1R151/ J1R196	150686.9	573087.8	
SPA-11	J1R152/ J1R197	150723	573066.9	
SPA-12	J1R153/ J1R198	150723	573108.6	
SPA-Duplicate of J1R149/J1R194 [c]	J1R154/ J1R199	150650.8	573066.9	ICP metals [b], mercury, PCBs, hexavalent chromium, IC anions [d], nitrate/nitrite [e], TPH, and asbestos
FS-1 (red stain rock location)	J1R156/ J1R1C0	151216.0	573360.0	ICP metals [b], mercury, PCBs, hexavalent chromium, PAH, and asbestos
FS-2 (location of reddish material)	J1R157/ J1R1C1	151221.0	573412.0	
FS-3 (leaking pipe)	J1R158/ J1R1C2	151219	573388	
FS-4 (tar drum)	J1R159/ J1R1C3	151182	573480	ICP metals [b], mercury, PCBs, hexavalent chromium, PAH, asbestos, and TPH
Equipment blank	J1R155	NA	NA	ICP metals [a], mercury

[a] Grab samples were collected at each location, and sample analysis will be performed as defined in Table 4. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, consistent with the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a) requirements.

[b] 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.

[c] One duplicate soil sample was collected from a location selected at the project analytical lead's discretion.

[d] The expanded list of IC anions included bromide, chloride, fluoride, nitrate, nitrite, phosphate, and sulfate in the analytical results package.

[e] To preclude holding time issues associated with EPA Method 300.0 for nitrates and nitrites, EPA Method 353 was performed.

EPA = U.S. Environmental Protection Agency
HEIS = Hanford Environmental Information System
IC = ion chromatography
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons
WSP = Washington State Plane

Figure 10. Verification Sample Locations for the 100-D-50:6 Subsite Excavation.

Figure 11. 100-D-50:6 Overall Subsite Location Map with Verification Sample Locations.

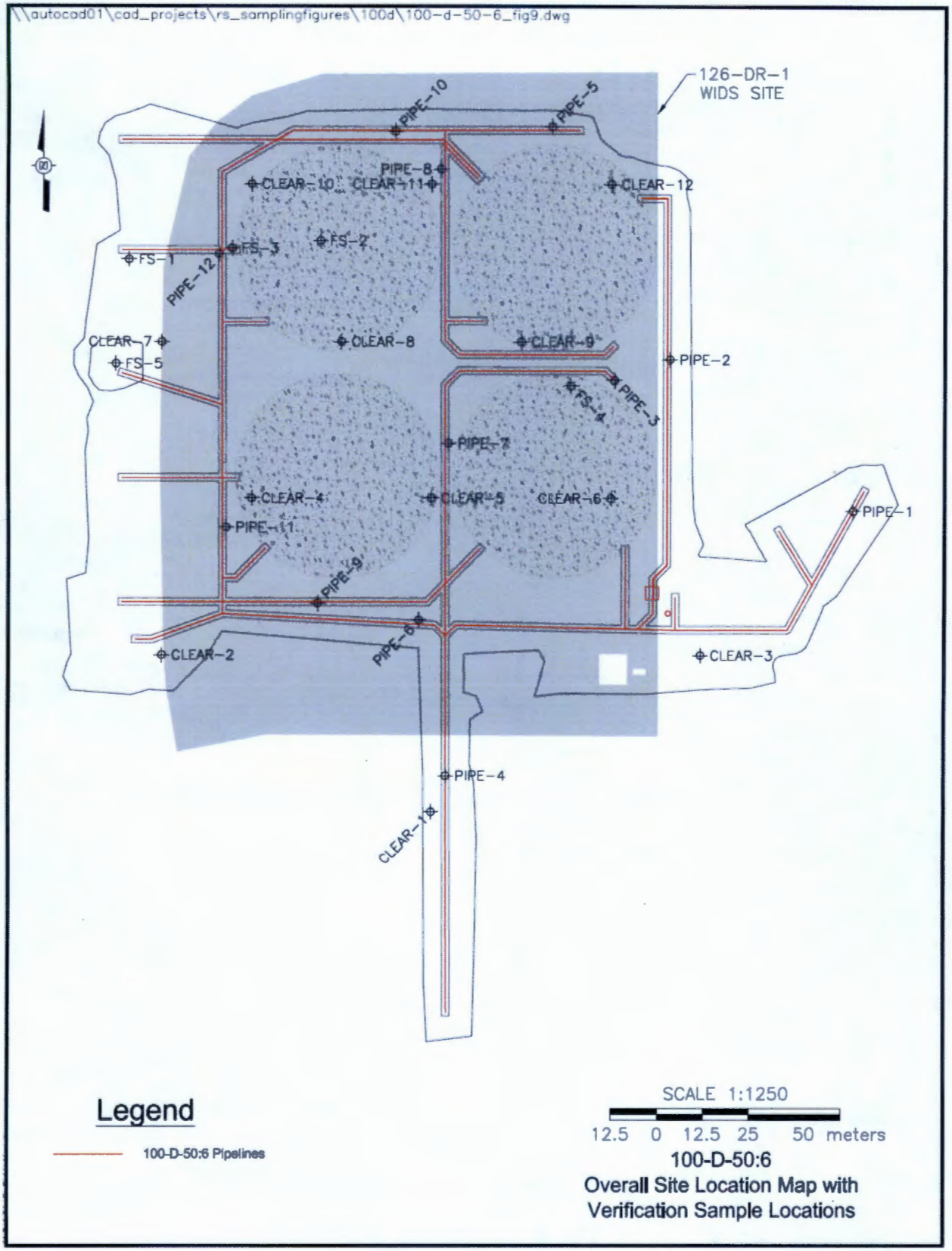


Figure 12. Verification Sample Locations for the 100-D-50:6 Subsite Overburden.

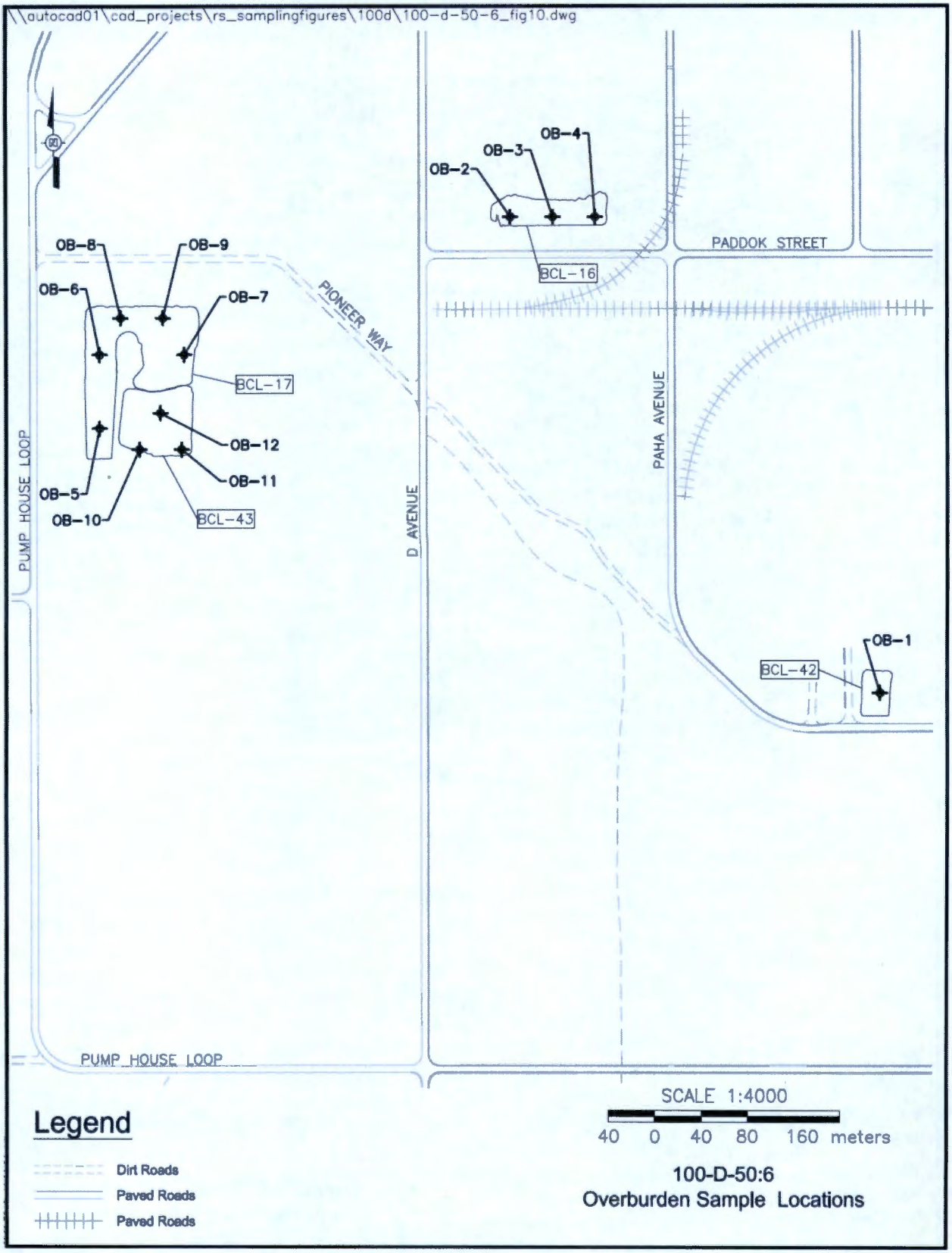
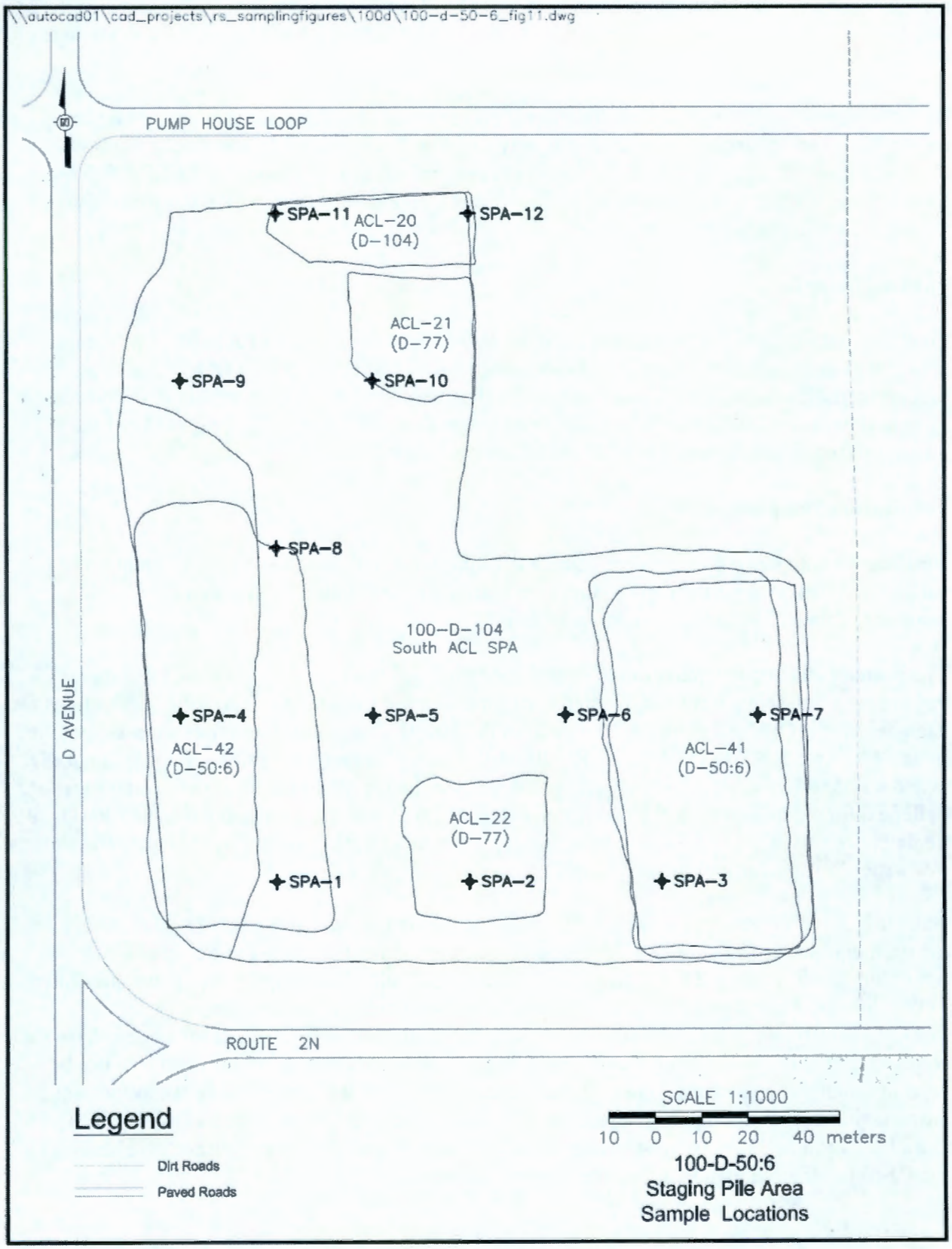


Figure 13. Verification Sample Locations for the 100-D-50:6 Subsite Staging Pile Area.



After the initial verification samples were analyzed, it was determined that one sample location from each the pipeline area and waste staging pile area decision units had detectable levels of asbestos and exceeded RAGs for PAH, respectively. Therefore, additional soil totaling 280 BCM (366 BCY) at each of the failed locations was removed and placed in the deep zone of the 100-D-50:6 subsite.

Both the Pipe-4 and SPA-8 sample locations that exceeded cleanup criteria were subsequently resampled. The resamples were analyzed only for asbestos and PAH, respectively, using the original sample design coordinates. During the original sampling campaign, the SPA-8 sample location was used as a duplicate sample. However, a duplicate was not collected from SPA-8 during the resampling campaign.

Focused Samples

Four focused samples were collected from the 100-D-50:6 excavation (Table 6). One sample (FS-1) was collected at the location of red-stained rocks associated with a french drain. A second focused sample (FS-2) was collected at the location of reddish material. A third focused sample (FS-3) was collected at the location of a pipe that was breached during excavation. A fourth sample (FS-4) was collected at the location of a tar drum.

Verification Sampling Results

Verification samples were analyzed using EPA-approved analytical methods. Evaluation of the verification data was performed by direct comparison of the statistical or maximum sample results for each COPC against cleanup criteria.

The primary statistical calculation to evaluate compliance with cleanup standards is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. The 95% UCL values for each detected COPC are computed for each of the 100-D-50:6 subsite decision units as specified by the 100 Area RDR/RAWP (DOE-RL 2009b). The calculations are provided in Appendix D. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for a decision unit, 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 calculation or evaluation was performed for that COPC.

Comparisons of the results for site COPCs with the RAGs for each of the 100-D-50:6 subsite decision units are listed in Tables 7 through 11. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2012) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. The complete laboratory results are stored in the ENRE project-specific database prior to submitting to the HEIS for archiving and are provided in Appendix D.

Table 7. 100-D-50:6 Pipeline Excavation Statistical Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]		Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [c]	0.90 (<BG)	5 [d]	5 [d]	No	--
Arsenic	5.2 (<BG)	20 [d]	20 [d]	No	--
Barium	67.0 (<BG)	200	400	No	--
Beryllium	0.18 (<BG)	1.51 [d]	1.51 [d]	No	--
Boron [e]	4.1	320	-- [f]	No	--
Cadmium [c]	0.057 (<BG)	0.81 [d]	0.81 [d]	No	--
Chromium	16.2 (<BG)	18.5 [d]	18.5 [d]	No	--
Cobalt	8.7 (<BG)	15.7 [d]	-- [f]	No	--
Copper	23.4	59.2	22.0 [d]	Yes	Yes [g]
Hexavalent chromium [e]	1.32	4.8	2	No	--
Lead	9.9 (<BG)	10.2 [d]	10.2 [d]	No	--
Manganese	323 (<BG)	512 [d]	512 [d]	No	--
Mercury	0.064 (<BG)	0.33 [d]	0.33 [d]	No	--
Molybdenum [e]	0.76	8	-- [f]	No	--
Nickel	13.4 (<BG)	19.1 [d]	27.4	No	--
Vanadium	59.6 (<BG)	85.1 [d]	-- [f]	No	--
Zinc	56.5 (<BG)	480	67.8 [d]	No	--
Acenaphthene	9.4	96	129	No	--
Acenaphthylene [h]	0.22	96	129	No	--
Anthracene	1,300,000	240	1,920	Yes	Yes [g]
Benzo(a)anthracene	11,000	0.015 [i]	0.015 [i]	Yes	Yes [g]
Benzo(a)pyrene	2,300	0.015 [i]	0.015 [i]	Yes	Yes [g]
Benzo(b)fluoranthene	3,500	0.015 [i]	0.015 [i]	Yes	Yes [g]
Benzo(ghi)perylene [h]	470	48	192	Yes	Yes [g]
Benzo(k)fluoranthene	1,500	0.015 [i]	0.015 [i]	Yes	Yes [g]
Chrysene	9,100	0.12	0.1 [i]	Yes	Yes [g]
Dibenz(a,h)anthracene	2.4	0.03 [i]	0.03 [i]	Yes	Yes [g]
Fluoranthene	26,000	64	18.0	Yes	Yes [g]
Fluorene	10,000	64	260	Yes	Yes [g]
Indeno(1,2,3-cd)pyrene	2,000	0.33 [i]	0.33 [i]	Yes	Yes [g]
Naphthalene	9.7	16.0	988	No	--
Phenanthrene [h]	61,000	240	1,920	Yes	Yes [g]

Table 7. 100-D-50:6 Pipeline Excavation Statistical Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]		Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Pyrene	24,000	48	192	Yes	Yes [g]

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).

[b] Maximum or 95% UCL, depending on data censorship, as described in the *100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations* (Appendix D).

[c] 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).

[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 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 100 Area RDR/RAWP (DOE-RL 2009b).

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

[f] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).

[g] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of copper, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene are not predicted to migrate more than 10 m (33 ft) vertically within 1,000 years (based on the lowest distribution coefficient of the contaminants exceeding RAGs, fluorene, with a distribution coefficient value of 7.71 mL/g). The distance to groundwater from the bottom of the excavation area is 15 m (50 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

[h] Toxicity data for this chemical are not available. Cleanup levels are based on the following surrogate chemicals:
contaminant:
acenaphthylene, surrogate: acenaphthene
benzo(g,h,i)perylene, surrogate: pyrene
phenanthrene, surrogate: anthracene.

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

-- = not applicable
BG = background
COPC = contaminant of potential concern
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)
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 8. 100-D-50:6 Clearwell Excavation Statistical Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]		Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [c]	0.59 (<BG)	5 [d]	5 [d]	No	--
Arsenic	3.0 (<BG)	20 [d]	20 [d]	No	--
Barium	66.3 (<BG)	200	400	No	--
Beryllium	0.12 (<BG)	1.51 [d]	1.51 [d]	No	--
Boron [e]	1.3	320	-- [f]	No	--
Cadmium [c]	0.055 (<BG)	0.81 [d]	0.81 [d]	No	--
Chromium	13.3 (<BG)	18.5 [d]	18.5 [d]	No	--
Cobalt	9.5 (<BG)	15.7 [d]	-- [f]	No	--
Copper	18.1 (<BG)	59.2	22.0 [d]	No	--
Lead	6.4 (<BG)	10.2 [d]	10.2 [d]	No	--
Manganese	320 (<BG)	512 [d]	512 [d]	No	--
Mercury	0.031 (<BG)	0.33 [d]	0.33 [d]	No	--
Molybdenum [e]	0.31	8	-- [f]	No	--
Nickel	12.3 (<BG)	19.1 [d]	27.4	No	--
Vanadium	66.4 (<BG)	85.1 [d]	-- [f]	No	--
Zinc	46.0 (<BG)	480	67.8 [d]	No	--
Acenaphthene	0.38	96	129	No	--
Acenaphthylene [g]	0.063	96	129	No	--
Anthracene	1,100	240	1,920	Yes	Yes [h]
Benzo(a)anthracene	720	0.015 [i]	0.015 [i]	Yes	Yes [h]
Benzo(a)pyrene	110	0.015 [i]	0.015 [i]	Yes	Yes [h]
Benzo(b)fluoranthene	210	0.015 [i]	0.015 [i]	Yes	Yes [h]
Benzo(ghi)perylene [g]	22	48	192	No	--
Benzo(k)fluoranthene	39	0.015 [i]	0.015 [i]	Yes	Yes [h]
Chrysene	230	0.12	0.1 [i]	Yes	Yes [h]
Dibenz(a,h)anthracene	0.18	0.03 [i]	0.03 [i]	Yes	Yes [h]
Fluoranthene	480	64	18.0	Yes	Yes [h]
Fluorene	42	64	260	No	--
Indeno(1,2,3-cd)pyrene	8.4	0.33 [i]	0.33 [i]	Yes	Yes [h]
Naphthalene	0.78	16.0	988	No	--
Phenanthrene [g]	600	240	1,920	Yes	Yes [h]
Pyrene	540	48	192	Yes	Yes [h]

Table 8. 100-D-50:6 Clearwell Excavation Statistical Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]		Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Aroclor-1254	0.020	0.017 [i]	0.017 [i]	Yes	Yes [h]

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).

[b] Maximum or 95% UCL, depending on data censorship, as described in the *100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations* (Appendix D).

[c] 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).

[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 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 100 Area RDR/RAWP (DOE-RL 2009b).

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

[f] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).

[g] Toxicity data for this chemical are not available. Cleanup levels are based on the following surrogate chemicals:
contaminant:
acenaphthylene, surrogate: acenaphthene
benzo(g,h,i)perylene, surrogate: pyrene
phenanthrene, surrogate: anthracene.

[h] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, and aroclor-1254 are not predicted to migrate more than 3.0 m (9.9 ft) vertically within 1,000 years (based on the lowest distribution coefficient of the contaminants exceeding RAGs, anthracene and phenanthrene, with a distribution coefficient value of 23.5 mL/g). The distance to groundwater from the bottom of the excavation area is 15 m (50 ft). Therefore, residual concentrations of these constituents are 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).

-- = not applicable
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
PCB = polychlorinated biphenyl
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)
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 9. 100-D-50:6 Overburden Statistical Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [c]	0.55 (<BG)	32	5 [d]	5 [d]	No	--
Arsenic	2.7 (<BG)	20 [d]	20 [d]	20 [d]	No	--
Barium	66.5 (<BG)	5,600	200	400	No	--
Beryllium	0.12 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Boron [f]	1.2	7,200	320	-- [g]	No	--
Cadmium [c]	0.075 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium	11.3 (<BG)	80,000	18.5 [d]	18.5 [d]	No	--
Cobalt	8.4 (<BG)	24	15.7 [d]	-- [g]	No	--
Copper	16.4 (<BG)	2,960	59.2	22.0 [d]	No	--
Lead	4.9 (<BG)	353 [h]	10.2 [d]	10.2 [d]	No	--
Manganese	340 (<BG)	3,760	512 [d]	512 [d]	No	--
Mercury	0.044 (<BG)	24	0.33 [d]	0.33 [d]	No	--
Molybdenum [f]	0.40	400	8	-- [g]	No	--
Nickel	12.0 (<BG)	1,600	19.1 [d]	27.4	No	--
Vanadium	58.6 (<BG)	560	85.1 [d]	-- [g]	No	--
Zinc	46.5 (<BG)	24,000	480	67.8 [d]	No	--
Acenaphthene	2.2	4,800	96	129	No	--
Anthracene	4.2	24,000	240	1,920	No	--
Benzo(a)anthracene	1.3	1.37	0.015 [i]	0.015 [i]	Yes	Yes [j]
Benzo(a)pyrene	2.6	0.137	0.015 [i]	0.015 [i]	Yes	Yes [j, k]
Benzo(b)fluoranthene	0.82	1.37	0.015 [i]	0.015 [i]	Yes	Yes [j]
Benzo(ghi)perylene [l]	1.6	2,400	48	192	No	--
Benzo(k)fluoranthene	1.1	1.37	0.015 [i]	0.015 [i]	Yes	Yes [j]
Chrysene	1.3	13.7	0.12	0.1 [i]	Yes	Yes [j]
Dibenz(a,h)anthracene	0.55	1.37	0.03 [i]	0.03 [i]	Yes	Yes [j]
Fluoranthene	2.7	3,200	64	18.0	No	--
Fluorene	2.4	3,200	64	260	No	--
Indeno(1,2,3-cd)pyrene	1.1	1.37	0.33 [i]	0.33 [i]	Yes	Yes [j]
Phenanthrene [l]	11	24,000	240	1,920	No	--

Table 9. 100-D-50:6 Overburden Statistical Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Pyrene	2.7	2,400	48	192	No	--
Aroclor-1254	0.020	0.5	0.017 [i]	0.017 [i]	Yes	Yes [j]

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).

[b] Maximum or 95% UCL, depending on data censorship, as described in the *100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations* (Appendix D).

[c] 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).

[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 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 100 Area RDR/RAWP (DOE-RL 2009b).

[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], Ecology 1996) using 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 ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).

[h] Use EPA, 1994, *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.

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

[j] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and aroclor-1254 are not predicted to migrate vertically within 1,000 years (based on the lowest distribution coefficient of the contaminants exceeding RAGs, chrysene, with a distribution coefficient value of 200 mL/g). The distance to groundwater from the bottom of the excavation area is 15 m (50 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

[k] The overburden stockpile decision unit will be placed in the deep zone of the excavation, and therefore only groundwater and river protection criteria are considered.

[l] Toxicity data for this chemical are not available. Cleanup levels are based on the following surrogate chemicals: contaminant: benzo(g,h,i)perylene, surrogate: pyrene
phenanthrene, surrogate: anthracene.

-- = not applicable
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
PCB = polychlorinated biphenyl
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)
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 10. 100-D-50:6 Staging Pile Area Statistical Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [c]	0.55 (<BG)	32	5 [d]	5 [d]	No	--
Arsenic	2.6 (<BG)	20 [d]	20 [d]	20 [d]	No	--
Barium	84.5 (<BG)	5,600	200	400	No	--
Beryllium	0.17 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Boron [f]	2.0	7,200	320	-- [g]	No	--
Cadmium [c]	0.12 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium	14.2 (<BG)	80,000	18.5 [d]	18.5 [d]	No	--
Cobalt	8.0 (<BG)	24	15.7 [d]	-- [g]	No	--
Copper	15.6 (<BG)	2,960	59.2	22.0 [d]	No	--
Lead	5.7 (<BG)	353 [h]	10.2 [d]	10.2 [d]	No	--
Manganese	339 (<BG)	3,760	512 [d]	512 [d]	No	--
Mercury	0.042 (<BG)	24	0.33 [d]	0.33 [d]	No	--
Molybdenum [f]	1.1	400	8	-- [g]	No	--
Nickel	11.7 (<BG)	1,600	19.1 [d]	27.4	No	--
Vanadium	49.0 (<BG)	560	85.1 [d]	-- [g]	No	--
Zinc	43.8 (<BG)	24,000	480	67.8 [d]	No	--
Chloride	255	--	25,000	-- [g]	No	--
Nitrogen in nitrate	49.4	128,000	1,000	2,000	No	--
Nitrogen in nitrite and nitrate	112	128,000	1,000	2,000	No	--
Sulfate	67.7 (<BG)	--	25,000	-- [g]	No	--
TPH – diesel	17	200	200	200	No	--
TPH – diesel EXT	43	200	200	200	No	--
Anthracene	0.020	24,000	240	1,920	No	--
Benzo(a)anthracene	0.024	1.37	0.015 [i]	0.015 [i]	Yes	Yes [j]
Benzo(a)pyrene	0.017	0.137	0.015 [i]	0.015 [i]	Yes	Yes [j]
Benzo(b)fluoranthene	0.019	1.37	0.015 [i]	0.015 [i]	Yes	Yes [j]
Benzo(ghi)perylene [k]	0.040	2,400	48	192	No	--
Benzo(k)fluoranthene	0.025	1.37	0.015 [i]	0.015 [i]	Yes	Yes [j]
Chrysene	0.017	13.7	0.12	0.1 [i]	No	--
Fluoranthene	0.046	3,200	64	18.0	No	--
Fluorene	0.013	3,200	64	260	No	--
Indeno(1,2,3-cd)pyrene	0.028	1.37	0.33 [i]	0.33 [i]	No	--
Phenanthrene [k]	0.057	24,000	240	1,920	No	--

Table 10. 100-D-50:6 Staging Pile Area Statistical Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Pyrene	0.041	2,400	48	192	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[b] Maximum or 95% UCL, depending on data censorship, as described in the *100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations* (Appendix D).
[c] 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).
[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 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 100 Area RDR/RAWP (DOE-RL 2009b).
[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], Ecology 1996) using 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 ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).
[h] Use EPA, 1994, *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.
[i] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).
[j] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not predicted to migrate vertically within 1,000 years (based on the lowest distribution coefficient of the contaminants exceeding RAGs, benzo(a)anthracene, with a distribution coefficient value of 360 mL/g). The distance to groundwater from the bottom of the excavation area is 15 m (50 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.
[k] Toxicity data for this chemical are not available. Cleanup levels are based on the following surrogate chemicals:
contaminant:
benzo(g,h,i)perylene, surrogate: pyrene
phenanthrene, surrogate: anthracene.

-- = not applicable
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
PCB = polychlorinated biphenyl
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
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 11. 100-D-50:6 Focused Deep Zone Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg) [a]		Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [b]	0.85 (<BG)	5 [c]	5 [c]	No	--
Arsenic	2.6 (<BG)	20 [c]	20 [c]	No	--
Barium	61.4 (<BG)	200	400	No	--
Beryllium	0.19 (<BG)	1.51 [c]	1.51 [c]	No	--
Boron [d]	0.97	320	-- [e]	No	--
Cadmium [b]	0.065 (<BG)	0.81 [c]	0.81 [c]	No	--
Chromium	14.2 (<BG)	18.5 [c]	18.5 [c]	No	--
Cobalt	9.8 (<BG)	15.7 [c]	-- [e]	No	--
Copper	18.9 (<BG)	59.2	22.0 [c]	No	--
Hexavalent chromium [d]	0.259	4.8	2	No	--
Lead	7.1 (<BG)	10.2 [c]	10.2 [c]	No	--
Manganese	309 (<BG)	512 [c]	512 [c]	No	--
Mercury	0.32 (<BG)	0.33 [c]	0.33 [c]	No	--
Molybdenum [d]	0.37	8	-- [e]	No	--
Nickel	10.7 (<BG)	19.1 [c]	27.4	No	--
Vanadium	69.9 (<BG)	85.1 [c]	-- [e]	No	--
Zinc	58.3 (<BG)	480	67.8 [c]	No	--
Acenaphthene	0.25	96	129	No	--
Anthracene	0.68	240	1,920	No	--
Benzo(a)anthracene	1.1	0.015 [f]	0.015 [f]	Yes	Yes [g]
Benzo(a)pyrene	1.1	0.015 [f]	0.015 [f]	Yes	Yes [g]
Benzo(b)fluoranthene	1.1	0.015 [f]	0.015 [f]	Yes	Yes [g]
Benzo(ghi)perylene [h]	0.65	48	192	No	--
Benzo(k)fluoranthene	0.49	0.015 [f]	0.015 [f]	Yes	Yes [g]
Chrysene	1.0	0.12	0.1 [f]	Yes	Yes [g]
Dibenz(a,h)anthracene	0.21	0.03 [f]	0.03 [f]	Yes	Yes [g]
Fluoranthene	2.4	64	18.0	No	--
Fluorene	0.38	64	260	No	--
Indeno(1,2,3-cd)pyrene	0.67	0.33 [f]	0.33 [f]	Yes	Yes [g]
Phenanthrene [h]	1.7	240	1,920	No	--
Pyrene	2.4	48	192	No	--
Aroclor-1254	0.013	0.017 [f]	0.017 [f]	No	--
Aroclor-1260	0.0048	0.017 [f]	0.017 [f]	No	--

Table 11. 100-D-50:6 Focused Deep Zone Verification Samples; Comparison of Contaminant Concentrations to Action Levels. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg)[a]		Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Total PCBs	0.0178	0.017[f]	0.017[f]	Yes	Yes[g]

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[b] 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).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 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 100 Area RDR/RAWP (DOE-RL 2009b).
[d] No Hanford Site-specific or Washington State background value available.
[e] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).
[f] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).
[g] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and total PCBs are not predicted to migrate more than 1.0 m (3.3 ft) vertically within 1,000 years (based on the lowest distribution coefficient of the contaminants exceeding RAGs, total PCBs, with a distribution coefficient value of 75.6 mL/g). The distance to groundwater from the bottom of the excavation area is 15 m (50 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.
[h] Toxicity data for this chemical are not available. Cleanup levels are based on the following surrogate chemicals:
contaminant:
benzo(g,h,i)perylene, surrogate: pyrene
phenanthrene, surrogate: anthracene.

-- = not applicable
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
PCB = polychlorinated biphenyl
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)
UCL = upper confidence limit
WAC = *Washington Administrative Code*

DATA EVALUATION

This section demonstrates that contaminant concentrations at the 100-D-50:6 subsite achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the Remaining Sites ROD (EPA 1999) and documented in the 100 Area RDR/RAWP (DOE-RL 2009b).

Attainment of Nonradionuclide RAGs

Evaluation of the results listed in Tables 7 through 11 from the verification sampling at the 100-D-50:6 subsite indicate that all COPCs were undetected and/or quantified below RAGs and lookup values, except for copper, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, aroclor-1254, and total PCBs. All PAH direct exposure exceedances were associated with deep

zone decision units, or, as in the case of the one sample location in the overburden decision unit, were placed within the deep zone of the 100-D-50:6 waste subsite. Therefore, these exceedances were not evaluated against direct exposure cleanup criteria. The residual concentrations of these contaminants are not predicted to migrate more than 10 m (33 ft) vertically within 1,000 years (based on the contaminant [fluorene] with the lowest distribution coefficient [7.71 mL/g] of the contaminants exceeding RAGs). The vadose zone underlying the excavation is approximately 15 m (50 ft) thick. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater (and thus the Columbia River). Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), constituents with a distribution coefficient of 4.9 mL/g or greater are not predicted to migrate through the vadose zone soil to reach groundwater within 1,000 years.

WAC Three-Part Test for Nonradionuclides

A RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test, which consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection shall 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 three-part test for the 100-D-50:6 subsite is included in the statistical calculations, where half or more of the data set was detected (Appendix D). The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs, with the exception of copper, lead, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene, which fail one or more parts of the three-part test. However, the residual concentrations of these constituents are not expected to migrate more than 10 m (33 ft) vertically within 1,000 years, based on the lowest soil-partitioning coefficient of the contaminants (fluorene) of 7.71 mL/g. With approximately 15 m (50 ft) of vadose zone beneath the 100-D-50:6 subsite, the residual concentrations of COPCs are predicted to be protective of groundwater and the Columbia River.

An additional application of the three-part test is included for the statistical data sets that default to the maximum because less than half of the data set was detected. The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs, except for benzo(a)pyrene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and aroclor-1254, which fail one or more parts of the three-part test. However, the residual concentrations of these constituents are predicted to migrate less than 1.0 m (3.3 ft) vertically in 1,000 years based on the lowest soil-partitioning coefficient of 75.6 mL/g for aroclor-1254. Therefore, residual concentrations of all COPCs are predicted to be protective of groundwater and the Columbia River.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Nonradionuclide risk requirements include a hazard quotient of less than 1.0 for all individual noncarcinogens, a cumulative hazard quotient of less than 1.0 for noncarcinogens, an excess

cancer risk of less than 1 x 10^{-6} for individual carcinogens, and a cumulative excess cancer risk of less than 1 x 10^{-5} for carcinogens. These risk values were calculated for the entire pipeline subsite using the highest values from each of the decision units. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values.

All individual hazard quotients for noncarcinogenic constituents detected above background are less than 1.0. The cumulative hazard quotient of 8.4 x 10^{-3}, is less than 1.0. The individual carcinogenic risk values for the carcinogenic constituents detected above background are less than 1 x 10^{-6}, except for the occurrence of benzo(a)pyrene at the OB-8 shallow zone sample location. Because of this, the cumulative carcinogenic risk value is calculated to be 2.3 x 10^{-5}. Because direct exposure exceedances at one location (OB-8) within the overburden decision unit caused exceedances of direct exposure criteria, the contaminated soil from the OB-8 location was placed within the deep zone of the 100-D-50:6 subsite during backfill of the excavation. As a result, it is not included in the calculation of the shallow zone excess cancer risk. Therefore, the 100-D-50:6 pipeline subsite meets the requirements for the direct contact hazard quotient and excess carcinogenic risk as identified in the 100 Area RDR/RAWP (DOE-RL 2009b).

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 100-D-50:6 pipeline subsite included calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides. The requirements include a hazard quotient of less than 1.0 for all individual noncarcinogens, a cumulative hazard quotient of less than 1.0 for noncarcinogens, an excess cancer risk of less than 1 x 10^{-6} for individual carcinogens, and a cumulative excess cancer risk of less than 1 x 10^{-5} for carcinogens. These risk values were conservatively calculated for the entire pipeline subsite using the highest value for each COPC from each of the decision units. Risk values were not calculated for constituents that were not detected, were detected at concentrations below Hanford Site or Washington State background values, or had a distribution coefficient greater than that required to show no migration to groundwater in 1,000 years using the RESRAD model discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b). Based on this model and a vadose zone of approximately 15 m (50 ft) in thickness at the excavation, a distribution coefficient of 4.9 or greater is required to show no predicted migration to groundwater within 1,000 years.

All individual hazard quotients for noncarcinogenic constituents detected above background are less than 1.0. The cumulative hazard quotient, 9.4 x 10^{-1}, is less than 1.0. No carcinogenic constituents from groundwater met the criteria for evaluation at the 100-D-50:6 subsite; therefore, no calculations of excess carcinogenic risks were performed. Therefore, nonradionuclide risk requirements related to groundwater are met.

Focused Sampling Results

Four focused samples (FS-1 through FS-4) were taken within the 100-D-50:6 excavation footprint with the maximum values located in Table 11. All focused samples were located in the deep zone excavation, and therefore, the direct exposure evaluation of results against soil RAGs

was not required FS-1 exceeds groundwater and river protection RAGs for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and total PCBs. FS-2 did not exceed groundwater and river protection RAGs for any contaminant. FS-3 exceeded groundwater and river protection RAGs for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. FS-4 exceeded groundwater and river protection RAGs for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene. The residual concentration of these contaminants are predicted to migrate less than 1.0 m (3.3 ft) vertically within 1,000 years (based on the total PCBs distribution coefficient [75.6 mL/g]). Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), constituents with a distribution coefficient of 4.9 mL/g or greater are not predicted to migrate through vadose zone soil to reach groundwater within 1,000 years. These focused sample analytical results are presented in Appendix D.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the confirmatory and verification sampling approaches (WCH 2005c, 2006b, 2012d), the field logbooks (WCH 2005a, 2005b, 2012a, 2013), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 100-D-50:6 subsite 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 its archival in the HEIS and are summarized in Appendix D. The detailed DQA are presented in Appendix E.

SUMMARY FOR INTERIM CLOSURE

The 100-D-50:6 subsite has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). The site was remediated by removing approximately 49,975 BCM (65,365 BCY) of material for disposal at ERDF. Statistical sampling results showed that the one location (OB-8) within the overburden was not suitable for use as shallow zone backfill and, subsequently, was placed in the deep zone of the 100-D-50:6 subsite during backfill of the excavation. Verification sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at this subsite meet the remedial action objectives and corresponding RAGs for direct exposure, groundwater protection, and river protection. The results indicate that the residual concentrations of COCs/COPCs at this site do not preclude any futures uses (as bounded by a rural-residential scenario) and allow for unrestricted use of the shallow zone soil (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations at the bottom of the excavation are protective of groundwater and the Columbia River. The results of verification sampling indicate that deep zone concentrations of residual waste site contamination exceed direct exposure cleanup levels. Therefore, institutional controls to prevent uncontrolled drilling or excavation

into the deep zone soil are required. In accordance with this evaluation, the verification sampling results support a reclassification of the 100-D-50:6 subsite to Interim Closed Out.

REFERENCES

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

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

BHI, 2004, 100 *Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision*, 0100X-CA-V0046, Rev. 0, Bechtel Hanford Inc., Richland, Washington.

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

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

DOE-RL, 2009b, *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.

DOE-RL, 2011, *Tri-Party Agreement Handbook Management Procedures,* RL-TPA-90-0001, Guideline Number TPA-MP-14, Rev. 2, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State,* Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington.

Ecology, 1996, "Model Toxics Control Act – Cleanup," *Washington Administrative Code* (WAC) 173-340, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2012, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc.CLARCHome.aspx>.

ENV-1, *Environmental Monitoring & Management*, Washington Closure Hanford, Richland, Washington.

EPA, 1989, *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1994, *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.

EPA, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2004, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington

WAC 173-340, 2001, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, Washington State Department of Ecology, Olympia, Washington.

WCH, 2005a, *Remaining Sites Field Sampling*, Logbook EL-1578-7, Washington Closure Hanford, Richland, Washington.

WCH, 2005b, *Remaining Sites Field Sampling*, Logbook EL-1578-9, Washington Closure Hanford, Richland, Washington.

WCH, 2005c, *Work Instruction for 100-D-50:6, 183-DR Clearwell Drain Pipelines*, 0100D-WI-G0014, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2006a, *100D-Remaining Sites*, Logbook EL-1601, Washington Closure Hanford, Richland, Washington.

WCH, 2006b, *Work Instruction for Confirmatory Sampling of the 100-D-50:2 Reactor Cooling Water Pipelines*, 0100D-WI-G0023, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2008, *100-D-77 Remaining Site for Remedial Action*, CCN 142031 to R. A. Carlson from M. L. Proctor, Washington Closure Hanford, Richland, Washington, November 18.

WCH, 2011a, *100-D Field Remediation Project Sampling and Field Notes*, EL-1607-09, pp. 88-90, Washington Closure Hanford, Richland, Washington.

WCH, 2011b, *100-D Field Remediation Project Sampling and Field Notes*, EL-1607-10, pp. 2-5, 10-11, 74-89, Washington Closure Hanford, Richland, Washington.

WCH, 2011c, *100-D Field Remediation Project Sampling and Field Notes*, EL-1607-11, pp. 5-6, 23-28, Washington Closure Hanford, Richland, Washington.

WCH, 2012a, *100-D Field Remediation & Sampling Project*, EL-1607-14, pp. 69-85, Washington Closure Hanford, Richland, Washington.

WCH, 2012b, *100-D Field Remediation Project - Sampling*, EL-1662-01, pp. 23-24 Washington Closure Hanford, Richland, Washington.

WCH, 2012c, *Regulatory Decision – 100-D-100 and 100-D-50:6 – December 5, 2012, Meeting*, external email 168964 to A. Kapell (Ecology), et. al., from S. W. Callison, Washington Closure Hanford, Richland, Washington.

WCH, 2012d, *Work Instruction for Verification Sampling of the 100-D-50:6, 183-DR Clearwell Drain Pipelines Waste Site*, 0100D-WI-G0109, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2013, *100-D Field Remediation & Sampling Project*, EL-1607-15, pp. 43-49, 79-80, Washington Closure Hanford, Richland, Washington.

WDOH, 1997, *State of Washington Department of Health Interim Regulatory Guidance: Hanford Guidance for Radiological Cleanup*, WDOH/320-015, Rev. 1, Washington Department of Health, Richland, Washington.

WHC, 1993, *100-D Area Technical Baseline Report*, WHC-SD-EN-TI-181, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Contaminants Exceeding Ecological Screening Levels for the 100-D-50:6 Subsite [a].

Hazardous Substance		2007 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Maximum or Statistical Result
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
Metals (mg/kg)									
	BG								
Antimony	5	5	--	--	--	78	--	0.27	0.55 (<BG)
Boron	--	0.5	--	--	--	--	--	--	2.0
Manganese	512	1,100 [d]	--	1,500	220	450	4,300	4,000	340 (<BG)
Vanadium	85.1	2	--	--	--	--	7.8	280	58.6 (<BG)
Zinc	67.8	86 [d]	200	360	160	120	46	79	46.5 (<BG)
High molecular weight PAH [e]	--	--	--	--	--	18	--	1.1	13.1 [f]

NOTE: Shaded cells are exceeded by the maximum or the statistical result.

[a] Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. All exceedances must be evaluated in the context of additional lines of evidence for ecological effects following a baseline risk assessment for the river corridor portion of the Hanford Site, which will include a more complete quantitative ecological risk assessment.

[b] Available on the Internet at www.epa.gov/ecotox/ecossl.

[c] Wildlife.

[d] Benchmark replaced by Washington State natural background concentration.

[e] High molecular weight polynuclear aromatic hydrocarbons (HMW-PAH), e.g., benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene, perylene, and pyrene.

[f] PAH contamination is attributed to cross-contamination from asphalt.

-- = not available
BG = background
EPA = U.S. Environmental Protection Agency
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
WAC = *Washington Administrative Code*

APPENDIX B

CONFIRMATORY AND WASTE CHARACTERIZATION SAMPLE RESULTS

Table B-1. 100-D-50:6 Confirmatory Data Results. (2 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Service area 1 pipe scale/sediment	J10L61	11/8/05	0.29	U	0.29	0.170		0.07	0.080	U	0.080	0.23	U	0.23	0.26	U	0.26	0.15	U	0.15
Service area 1 underlying soil	J10L69	11/8/05	0.17	U	0.17	0.034	U	0.034	0.033	U	0.033	0.11	U	0.11	0.12	U	0.12	0.12	U	0.12
Service area 2 underlying soil	J10L70	11/8/05	0.35	U	0.35	0.042	U	0.042	0.050	U	0.050	0.10	U	0.10	0.15	U	0.15	0.15	U	0.15
Service area 3 underlying soil	J10L62	11/9/05	0.059	U	0.059	0.041	U	0.041	0.050	U	0.050	0.12	U	0.12	0.15	U	0.15	0.089	U	0.089
Duplicate of J10L62	J10L63	11/9/05	0.18	U	0.18	0.035	U	0.035	0.039	U	0.039	0.12	U	0.12	0.13	U	0.13	0.13	U	0.13
Service area 3 underlying soil	J10L71	11/9/05	0.044	U	0.044	0.034	U	0.034	0.040	U	0.040	0.096	U	0.096	0.13	U	0.13	0.069	U	0.069

Sample Location	HEIS Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Thorium-228		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Service area 1 pipe scale/sediment	J10L61	11/8/05	4.46		3.9	9.66		5.6	2.44		0.83	0.147		0.14	0.35	U	0.35	0.127	U	0.13
Service area 1 underlying soil	J10L69	11/8/05	3.67	U	3.9	15.9		5.5	10.7		0.34	0.533		0.070	0.787		0.15	0.913		0.057
Service area 2 underlying soil	J10L70	11/8/05	9.35		3.8	19.5		5.9	16.5		0.43	0.688		0.078	0.995		0.17	1.07		0.078
Service area 3 underlying soil	J10L62	11/9/05	7.98		3.8	22.4		5.5	14.2		0.28	0.503		0.080	0.535		0.19	0.868		0.063
Duplicate of J10L62	J10L63	11/9/05	10.9		3.7	33.7		7.8	10.4		0.34	0.484		0.066	0.781		0.14	0.091	U	0.091
Service area 3 underlying soil	J10L71	11/9/05	8.68		4.0	22.3		5.8	9.16		0.26	0.381		0.057	0.509		0.14	0.616		0.047

Sample Location	HEIS Number	Sample Date	Thorium-232			Total beta radiostrontium			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Service area 1 pipe scale/sediment	J10L61	11/8/05	0.35	U	0.35				0.27	U	0.27	9.6	U	9.6
Service area 1 underlying soil	J10L69	11/8/05	0.787		0.15				0.16	U	0.16	4.1	U	4.1
Service area 2 underlying soil	J10L70	11/8/05	0.995		0.17				0.19	U	0.19	5.2	U	5.2
Service area 3 underlying soil	J10L62	11/9/05	0.535		0.19				0.14	U	0.14	5.4	U	5.4
Duplicate of J10L62	J10L63	11/9/05	0.781		0.14	-0.008	U	0.31	0.19	U	0.19	4.2	U	4.2
Service area 3 underlying soil	J10L71	11/9/05	0.509		0.14				0.11	U	0.11	4.3	U	4.3

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

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

C = blank contamination

HEIS = Hanford Environmental Information System

J = estimated

MDA = minimum detectable activity

PQL = practical quantitation limit

Q = qualifier

R = rejected

U = undetected

Table B-1. 100-D-50:6 Confirmatory Data Results. (2 Pages)

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
Service area 1 pipe scale/sediment	J10L61	11/8/05	2140	C	10.8	2.4	U	2.4	31.7		2.0	79.7	C	0.12	0.09		0.06	5.7	C	1.6	5.2		0.41
Service area 1 underlying soil	J10L69	11/8/05	4800	C	3.6	0.80	U	0.80	2.4		0.68	53.0	C	0.04	0.17		0.02	1.9	C	0.54	0.14	U	0.14
Service area 2 underlying soil	J10L70	11/8/05	5780	C	4.0	0.87	U	0.87	3.6		0.74	63.8	C	0.04	0.23		0.02	1.6	C	0.59	0.15	U	0.15
Service area 3 underlying soil	J10L62	11/9/05	6040		1.8	0.39	UJ	0.39	3.9		0.33	60.1	C	0.02	0.24		0.01	1.1		0.26	0.12		0.07
Duplicate of J10L62	J10L63	11/9/05	5390		1.8	0.40	UJ	0.40	3.7		0.34	56.7	C	0.02	0.21		0.01	1.1		0.27	0.14		0.07
Service area 3 underlying soil	J10L71	11/9/05	4830		1.8	0.40	UJ	0.40	2.5		0.34	65.3	C	0.02	0.23		0.01	1.1		0.27	0.07		0.07
Equipment blank	J10L72	11/9/05	35.3		1.8	0.38	UJ	0.38	0.33	U	0.33	0.97	C	0.02	0.01	U	0.01	0.26	U	0.26	0.07	U	0.07

Sample Location	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Service area 1 pipe scale/sediment	J10L61	11/8/05	12300	C	7.0	438		0.95	70.2		0.71	148		0.71				343000		11.7	32.0		1.8
Service area 1 pipe scale/sediment	J10L65*	11/8/05													7.53		0.350						
Service area 1 underlying soil	J10L69	11/8/05	7850	C	2.4	9.0		0.32	5.2		0.24	11.9		0.24	0.21	U	0.21	13400		6.4	4.1		0.62
Service area 2 underlying soil	J10L70	11/8/05	9510	C	2.6	11.9		0.35	5.8		0.26	14.1		0.26	0.29		0.23	14500		7.0	4.3		0.68
Service area 3 underlying soil	J10L62	11/9/05	9290	JC	1.2	13.3	J	0.16	5.7		0.12	13.7		0.12	0.23		0.20	15900		3.1	3.8		0.30
Duplicate of J10L62	J10L63	11/9/05	8510	JC	1.2	10.7	J	0.16	5.6		0.12	12.3		0.12	0.36		0.20	14700		3.2	3.8		0.31
Service area 3 underlying soil	J10L71	11/9/05	7530	JC	1.2	7.1	J	0.16	7.1		0.12	13.7		0.12	0.24		0.21	19800		3.2	4.4		0.31
Equipment blank	J10L72	11/9/05	20.2	UJ	1.1	0.18	J	0.15	0.12	U	0.12	0.12	U	0.12				200		3.1	0.30	U	0.30

*Only analyte was hexavalent chromium.

Sample Location	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Service area 1 pipe scale/sediment	J10L61	11/8/05	1690		8.0	1610		0.12	4.3		0.08	4.3	C	0.77	218		0.77	2230		32.8	2.1	U	2.1
Service area 1 underlying soil	J10L69	11/8/05	4040		2.7	245		0.04	0.02	U	0.02	0.35	C	0.26	10.2		0.26	956		11.0	1.0		0.72
Service area 2 underlying soil	J10L70	11/8/05	4590		3.0	284		0.04	0.02	U	0.02	0.56	C	0.28	12.1		0.28	1200		12.1	0.79	U	0.79
Service area 3 underlying soil	J10L62	11/9/05	4840		1.3	279	C	0.02	0.01	U	0.01	0.42	UJ	0.13	12.2		0.13	1140		5.4	0.35	U	0.35
Duplicate of J10L62	J10L63	11/9/05	4400		1.3	262	C	0.02	0.02	U	0.02	0.47	UJ	0.13	11.0		0.13	1020		5.5	0.36	U	0.36
Service area 3 underlying soil	J10L71	11/9/05	4010		1.4	270	C	0.02	0.01	U	0.01	0.46	UJ	0.13	8.7		0.13	846		5.6	0.36	U	0.36
Equipment blank	J10L72	11/9/05	6.2		1.3	3.7	C	0.02	0.02	U	0.02	0.16	UJ	0.13	0.13	U	0.13	16.5		5.3	0.35	U	0.35

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Uranium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Service area 1 pipe scale/sediment	J10L61	11/8/05	835	C	4.9	0.83	U	0.83	4430	C	1.0	0.744		0.019	23.8		0.53	182	C	0.30
Service area 1 underlying soil	J10L69	11/8/05	988	C	1.6	0.28	U	0.28	114	C	0.34	1.42		0.019	27.2		0.18	30.6	C	0.1
Service area 2 underlying soil	J10L70	11/8/05	1020	C	1.8	0.31	U	0.31	158	C	0.37	1.57		0.019	30.1		0.20	34.9	C	0.11
Service area 3 underlying soil	J10L62	11/9/05	414	J	0.80	0.14	U	0.14	197	C	0.17	1.27		0.019	32.6		0.09	35.1	C	0.05
Duplicate of J10L62	J10L63	11/9/05	586	J	0.81	0.14	U	0.14	183	C	0.17	1.66		0.019	28.8		0.09	32.7	C	0.05
Service area 3 underlying soil	J10L71	11/9/05	376	J	0.82	0.14	U	0.14	196	C	0.17	1.49		0.019	48.6		0.09	39.2	C	0.05
Equipment blank	J10L72	11/9/05	43.1	J	0.79	0.13	U	0.13	6.0	C	0.16				0.09	U	0.09	0.96	UJ	0.05

Asbestos Data Results.

Sample Area	HEIS Number	Sample Date	Asbestos Result
Service area 1 pipe mastic coating	J10DF7	11/8/05	None detected

Table B-2. 100-D-50:6 Waste Characterization Data Results.

Sample Location	HEIS Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
Service area 1 liquid (water)	J10LD7	11/9/05	93	U	93	30	U	30	31	U	31	79	U	79	95	U	95	72	U	72

Sample Location	HEIS Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Thorium-228		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
Service area 1 liquid (water)	J10LD7	11/9/05	1.64	U	2.4	17.9		3.0	490	U	490	50	U	50	130	U	130	41	U	41

Sample Location	HEIS Number	Sample Date	Thorium-232			Uranium-235			Uranium-238		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
Service area 1 liquid (water)	J10LD7	11/9/05	130	U	130	99	U	99	3400	U	3400

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL
Service area 1 liquid (water)	J10LD7	11/9/05	1650		305	40.0	U	40.0	34.0	U	34.0	56.3	C	2.0	1.9	C	1.0	35.1		27.0

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL
Service area 1 liquid (water)	J10LD7	11/9/05	7.0	U	7.0	41400		119	16.0	U	16.0	17.2	C	12.0	34.8	C	12.0			
Service area 1 liquid (water)	J10LD8*	11/9/05																0.0900		0.00200

*Only analyte was hexavalent chromium.

Sample Location	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL
Service area 1 liquid (water)	J10LD7	11/9/05	3580		321	36.7	C	31.0	5180		135	74.5		2.0	0.30	U	0.30	13.0	U	13.0

Sample Location	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL
Service area 1 liquid (water)	J10LD7	11/9/05	30.7	C	13.0	13100		554	36.0	U	36.0	12400		82.0	14.0	U	14.0	36200	C	17.0

Sample Location	HEIS Number	Sample Date	Uranium			Vanadium			Zinc		
			µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL
Service area 1 liquid (water)	J10LD7	11/9/05	0.348		0.049	14.8	C	9.0	189		5.0

Table B-3. 100-D-50:2 Main Process Pipelines Confirmatory Sampling Results. (2 Pages)

Sample Location	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Main pipe scale	J13H93	9/21/06	0.089	U	0.089	0.031	U	0.031	0.032	U	0.032	0.356		0.066	0.083	U	0.083	0.074	U	0.074

Sample Location	Sample Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Thorium-228		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Main pipe scale	J13H93	9/21/06	4.10	U	4.5	6.38		3.1	0.80	U	0.80	0.120		0.056	0.13	U	0.13	0.039	U	0.039

Sample Location	Sample Number	Sample Date	Thorium-232			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Main pipe scale	J13H93	9/21/06	0.13	U	0.13	0.11	U	0.11	3.5	U	3.5

Sample Location	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main pipe scale	J13H93	9/21/06	21300		26.8	20.8		4.2	60.1		4.4	41.9	C	0.24	0.14		0.12	5.7		4.4
Equipment blank	J13H94	9/21/06	36.2		2.1	0.34	U	0.34	0.35		0.35	1.1	C	0.02	0.01		0.009	0.35	U	0.35

Sample Location	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main pipe scale	J13H93	9/21/06	12.4		0.35	626	C	10.1	13500		0.82	13.1		0.29	101		0.94			
Equipment blank	J13H94	9/21/06	0.03	U	0.03	21.4	C	0.80	0.57		0.07	0.07		0.05	0.07	U	0.07			
Main pipe scale	J13HC2*	9/21/06																77.3		0.350
Duplicate of J13HC2	J13HC3*	9/21/06																87.0		0.350

*Only analyte was hexavalent chromium.

Sample Location	Sample Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main pipe scale	J13H93	9/21/06	480000		28.6	85.3		1.4	117		8.5	1280		0.24	16.2		0.31	10.8		1.2
Equipment blank	J13H94	9/21/06	105		2.3	0.29		0.11	6.5		0.67	2.8		0.02	0.02	U	0.02	0.09	U	0.09

Sample Location	Sample Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main pipe scale	J13H93	9/21/06	26.3		1.5	28.4		25.0	3.1	UJ	3.1	5220	J	4.7	11.3		1.3	17.2	C	2.5
Equipment blank	J13H94	9/21/06	0.12	U	0.12	14.8		2.0	0.24	UJ	0.24	28.6	J	0.37	0.10	U	0.10	7.5	C	0.20

Sample Location	Sample Number	Sample Date	Uranium			Vanadium			Zinc			Bromide			Chloride			Fluoride		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main pipe scale	J13H93	9/21/06	2.03		0.010	114		0.59	585		0.35	6.2	U	6.2	21.6		6.2	6.2	U	6.2
Equipment blank	J13H94	9/21/06				0.06		0.05	0.42		0.03									

Sample Location	Sample Number	Sample Date	Nitrite			Nitrate			Phosphate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main pipe scale	J13H93	9/21/06	6.21	UR	6.21	61.8	J	6.21	6.2	UR	6.2	29.8		6.2

Table B-3. 100-D-50:2 Main Process Pipelines Confirmatory Sampling Results. (2 Pages)

Constituents	J13H93 Main Pipe Scale Sample Date 9/21/06		
	µg/kg	Q	PQL
Polychlorinated Biphenyls			
Aroclor-1016	42	U	42
Aroclor-1221	42	U	42
Aroclor-1232	42	U	42
Aroclor-1242	42	U	42
Aroclor-1248	42	U	42
Aroclor-1254	42	U	42
Aroclor-1260	280		42

Table B-4. 100-D-50:6 In-Process Sampling Results (Radionuclides) (2 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241			Antimony-125			Cerium-144			Cesium-134			Cesium-137			Cobalt-60			Europium-152		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
100-D-50:6 NW pad pipeline	J1FL20	6/22/11 8:25	-114	U	255	-22.5	U	83.8	27.8	U	170	-3.36	U	36.9	12.5	U	37	8.61	U	36.1	8.37	U	95.5
100-D-50:6 NE pad pipeline	J1FL21	6/22/11 9:40	50.5	U	114	34.5	U	119	54.8	U	179	26.6	U	55.8	-5.76	U	47.3	23.4	U	56.2	-5.18	U	114
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11 13:45																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11 14:30	-39	U	88.1	-28.7	U	78.6	30.4	U	144	2.05	U	36.4	-1.75	U	31.6	2.87	U	30.9	5.75	U	79.5
100-D-50:6 Catch basin J	J1FL24	3/24/11 9:15	2.4	U	9.31	-8.42	U	14.4	4.47	U	29	1.42	U	7.4	-1.16	U	6.48	-2.81	U	5.99	0.678	U	17.2
Sample Location	**HEIS Number**	**Sample Date**	**Americium-241**			**Antimony-125**			**Cerium-144**			**Cesium-134**			**Cesium-137**			**Cobalt-60**			**Europium-152**		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
100-D-50:6 Pipeline scale	J1FJ98	3/24/11 10:05	0.0102	U	0.0737										0.0663		0.013	0.0001	U	0.0151	0.0051	U	0.0337
100-D-50:6 Concrete pads	J1FL25	3/22/11 8:45	-0.0293	U	0.143										-0.004	U	0.023	-0.0035	U	0.0242	-0.0235	U	0.0537
100-D-50:6 N central pad	J1JWF2	6/23/11 7:55																					
100-D-50:6 NW pad	J1JWF3	6/23/11 8:00																					
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11 14:00	0.0473	U	0.151										0.0313	U	0.0287	-0.001	U	0.0214	-0.0229	U	0.0548
100-D-50:6 SW pad pipeline	J1KN99	8/4/11 9:45																					
100-D-50:6 Tar drum	J1P178	4/26/12 9:25																					

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

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

B (organic constituents) = blank contamination

B (inorganic constituents) = esimated result

C = Blank contamination

D = reported value is from a dilution.

HEIS = Hanford Environmental Information System

J (organic constituents) = estimate

M = Sample duplicate precision not met

N = MS/MSD or LCS recovery is outside control limits.

PQL = practical quantitation limit

Q = qualifier

U = undetected

X (organic constituents) = more than 40% difference between columns, lower result reported.

X (inorganic constituents) = serial dilution in the analytical batch indicates that physical and chemical interferences are present.

Sample Location	HEIS Number	Sample Date	Europium-154			Europium-155			Iodine-129			Neptunium-237			Niobium-94			Radium-226			Ruthenium-106		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
100-D-50:6 NW pad pipeline	J1FL20	6/22/11 8:25	-107	U	97.7	-21.1	U	93.7	-0.0123	U	1.43	-0.102	U	64.3	-4.95	U	32.9	39.8	U	96.5	-146	U	306
100-D-50:6 NE pad pipeline	J1FL21	6/22/11 9:40	-22.4	U	138	-7.08	U	84	-0.159	U	0.805	-6.74	U	80.5	4.64	U	44	-127	U	106	-121	U	343
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11 13:45																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11 14:30	6.6	U	93.8	-19	U	73.5	0.381	U	1.66										8.45	U	284
100-D-50:6 Catch basin J	J1FL24	3/24/11 9:15	-0.203	U	20.5	-7.1	U	13.1	0.0586	U	0.418	-4.99	U	11.7	2.4	U	6.62	-7.61	U	17.8	-21.1	U	54.3
Sample Location	**HEIS Number**	**Sample Date**	**ropium-154**			**Europium-155**			**Iodine-129**			**Neptunium-237**			**Niobium-94**			**Radium-226**			**Ruthenium-106**		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
100-D-50:6 Pipeline scale	J1FJ98	3/24/11 10:05	-0.0101	U	0.0375	0.0091	U	0.0297															
100-D-50:6 Concrete pads	J1FL25	3/22/11 8:45	-0.0319	U	0.0779	0.0406	U	0.065															
100-D-50:6 N central pad	J1JWF2	6/23/11 7:55																					
100-D-50:6 NW pad	J1JWF3	6/23/11 8:00																					
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11 14:00	0.0355	U	0.0819	0.0071	U	0.0667															
100-D-50:6 SW pad pipeline	J1KN99	8/4/11 9:45																					
100-D-50:6 Tar drum	J1P178	4/26/12 9:25																					

Table B-4. 100-D-50:6 In-Process Sampling Results (Radionuclides) (2 Pages)

Sample Location	HEIS Number	Sample Date	Silver-108m			Zinc-65			Gross alpha			Gross beta			Total beta radiostrontium			Carbon-14			Nickel-63		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
100-D-50:6 NW pad pipeline	J1FL20	6/22/11 8:25				-26.5	U	85.8	1.05	U	2.47	29.7		5.9	1.76		1.33	3.33	U	7.61			
100-D-50:6 NE pad pipeline	J1FL21	6/22/11 9:40				-15.1	U	94.7	2.91		1.21	57		6.64	0.379	U	1.24	6.48	U	7.59			
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11 13:45																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11 14:30				14.8	U	68.9	0.15	U	1.96	15.4		4.14	1.2	U	1.98	-2.91	U	11.7			
100-D-50:6 Catch basin J	J1FL24	3/24/11 9:15				-7.68	U	13.7	4.55		2.54	38.5		4.74	0.864	U	1.9	2.65	U	11.1			
Sample Location	**HEIS Number**	**Sample Date**	**Silver-108m**			**Zinc-65**			**Gross alpha**			**Gross beta**			**Total beta radiostrontium**			**Carbon-14**			**Nickel-63**		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
100-D-50:6 Pipeline scale	J1FJ98	3/24/11 10:05							2.99	U	6.15	4.67	U	4.86	-0.0663	U	0.326				-2.19	U	15.5
100-D-50:6 Concrete pads	J1FL25	3/22/11 8:45							4.53		4.4	15.8		4.53	0.0417	U	0.14				15.8		15.8
100-D-50:6 N central pad	J1JWF2	6/23/11 7:55																					
100-D-50:6 NW pad	J1JWF3	6/23/11 8:00																					
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11 14:00	0.0021	U	0.0174																		
100-D-50:6 SW pad pipeline	J1KN99	8/4/11 9:45																					
100-D-50:6 Tar drum	J1P178	4/26/12 9:25																					

Sample Location	HEIS Number	Sample Date	Technetium-99			Tritium		
			pCi/L	Q	MDA	pCi/L	Q	MDA
100-D-50:6 NW pad pipeline	J1FL20	6/22/11 8:25	6.05	U	10.1	116	U	348
100-D-50:6 NE pad pipeline	J1FL21	6/22/11 9:40	20.4		10.1	124	U	365
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11 13:45						
100-D-50:6 SW pad pipeline	J1FL22	7/14/11 14:30	3.45	U	9.79	339		323
100-D-50:6 Catch basin J	J1FL24	3/24/11 9:15	5.9	U	10.1	277	U	340
Sample Location	**HEIS Number**	**Sample Date**	**Technetium-99**			**Tritium**		
			pCi/g	Q	MDA	pCi/g	Q	MDA
100-D-50:6 Pipeline scale	J1FJ98	3/24/11 10:05						
100-D-50:6 Concrete pads	J1FL25	3/22/11 8:45						
100-D-50:6 N central pad	J1JWF2	6/23/11 7:55						
100-D-50:6 NW pad	J1JWF3	6/23/11 8:00						
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11 14:00						
100-D-50:6 SW pad pipeline	J1KN99	8/4/11 9:45						
100-D-50:6 Tar drum	J1P178	4/26/12 9:25						

Table B-5. 100-D-50:6 In-Process Sampling Results (Inorganic and TPH) (2 Pages)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Arsenic TCLP			Barium			Barium TCLP			Beryllium		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
100-D-50:6 NW pad pipeline	J1FL20	6/22/11	0.069		0.018	0.0031	U	0.0031	0.0044	U	0.0044				0.023		0.0006				0.0005	U	0.0005
100-D-50:6 NE pad pipeline	J1FL21	6/22/11	5.6	MN	0.018	0.0031	U	0.0031	0.0099	B	0.0044				0.065		0.0006				0.0005	U	0.0005
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11	0.38		0.018	0.0031	U	0.0031	0.0044	U	0.0044				0.019		0.0006				0.0005	U	0.0005
100-D-50:6 Catch basin J	J1FL24	3/24/11	8.2		0.018	0.0031	U	0.0031	0.011		0.0044				0.081		0.0006				0.0005	U	0.0005
Sample Location	**HEIS Number**	**Sample Date**	**Aluminum**			**Antimony**			**Arsenic**			**Arsenic TCLP**			**Barium**			**Barium TCLP**			**Beryllium**		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/L	Q	PQL	mg/kg	Q	PQL	mg/L	Q	PQL	mg/kg	Q	PQL
100-D-50:6 Pipeline scale	J1FJ98	3/24/11	501	XN	7.6	5		1.9	42.1	M	0.64	0.022	U	0.022	19.5	M	0.074	0.27	B	0.002	0.032	U	0.032
100-D-50:6 Concrete pads	J1FL25	3/22/11	8270		1.4	0.53	B	0.35	5.3	M	0.62	0.022	U	0.022	108		0.071	0.99	B	0.002	0.031	U	0.031
100-D-50:6 N central pad	J1JWF2	6/23/11	3160	M	1.9	31.2		0.46	4.6		0.79	0.022	U	0.022	79.8	M	0.091	0.44	B	0.002	0.047	B	0.04
100-D-50:6 NW pad	J1JWF3	6/23/11	5310		1.4	4		0.33	17.6		0.58	0.022	U	0.022	66.2		0.067	0.44	B	0.002	0.029	U	0.029
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11	6450		1.6	0.4	U	0.4	2.7		0.69				63.3		0.079				0.12	B	0.034
100-D-50:6 SW pad pipeline	J1KN99	8/4/11	2030		7.3	0.36	U	0.36	0.74	B	0.62	0.022	U	0.022	1.6	B	0.36	0.019	BC	0.002	0.16	U	0.16
100-D-50:6 Tar drum	J1P178	4/26/12	40.1		1.3	0.32	U	0.32	0.56	U	0.56	0.022	U	0.022	1.1		0.064	0.042	BC	0.002	0.028	U	0.028

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Cadmium TCLP			Calcium			Chromium			Chromium TCLP			Cobalt		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
100-D-50:6 NW pad pipeline	J1FL20	6/22/11				0.0005	U	0.0005				124		0.035	0.0009	B	0.0007						
100-D-50:6 NE pad pipeline	J1FL21	6/22/11				0.0005	B	0.0005				11.3		0.035	0.014		0.0007						
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11				0.0005	U	0.0005				24.7		0.035	0.0021		0.0007						
100-D-50:6 Catch basin J	J1FL24	3/24/11				0.0005	B	0.0005				12.1		0.034	0.044		0.0007						
Sample Location	**HEIS Number**	**Sample Date**	**Boron**			**Cadmium**			**Cadmium TCLP**			**Calcium**			**Chromium**			**Chromium TCLP**			**Cobalt**		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/L	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/L	Q	PQL	mg/kg	Q	PQL
100-D-50:6 Pipeline scale	J1FJ98	3/24/11	0.96	U	0.96	0.04	U	0.04	0.002	U	0.002	3260	M	13.8	255		0.057	0.0032	BM	0.003	22.7	M	0.098
100-D-50:6 Concrete pads	J1FL25	3/22/11	4.8	M	0.91	0.038	U	0.038	0.002	U	0.002	75100	X	13.1	10.8		0.054	0.003	U	0.003	4.6		0.093
100-D-50:6 N central pad	J1JWF2	6/23/11	1.2	U	1.2	3.5		0.049	0.002	U	0.002	11200	MN	16.9	8300		0.69	0.093	B	0.003	29.9		0.12
100-D-50:6 NW pad	J1JWF3	6/23/11	1.8		0.86	0.6		0.036	0.002	U	0.002	14300		12.4	977		0.051	0.041	B	0.003	26.8		0.088
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11	1.5	B	1	0.12	B	0.043				12000		14.7	32.1	M	0.061				7.7	X	0.1
100-D-50:6 SW pad pipeline	J1KN99	8/4/11	0.93	UN	0.93	2		0.039	0.066	B	0.002	521		66.6	3.4		0.055	0.0056	BM	0.003	0.58	B	0.095
100-D-50:6 Tar drum	J1P178	4/26/12	0.83	U	0.83	0.035	U	0.035	0.002	U	0.002	103		11.9	0.21	C	0.049	0.003	U	0.003	0.12	B	0.085

Sample Location	HEIS Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Lead TCLP			Magnesium			Manganese		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
100-D-50:6 NW pad pipeline	J1FL20	6/22/11	0.0014	U	0.0014	0.0037	U	0.0037	2.4		0.022	0.0026	U	0.0026				9.1		0.011	0.24		0.0003
100-D-50:6 NE pad pipeline	J1FL21	6/22/11	0.019		0.0014	0.024		0.0037	8.7		0.022	0.014		0.0026				3.6		0.011	0.2		0.0003
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11	0.0022	B	0.0014	0.0037	U	0.0037	0.56		0.022	0.0026	U	0.0026				2.5		0.011	0.038		0.0003
100-D-50:6 Catch basin J	J1FL24	3/24/11	0.025		0.0014	0.002	U	0.002	12.4		0.022	0.02		0.0026				4.8		0.011	0.28		0.0003
Sample Location	**HEIS Number**	**Sample Date**	**Copper**			**Hexavalent Chromium**			**Iron**			**Lead**			**Lead TCLP**			**Magnesium**			**Manganese**		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/L	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
100-D-50:6 Pipeline scale	J1FJ98	3/24/11	284	M	0.21	0.298		0.154	397000		18.5	8.8		1.3	0.013	U	0.013	571	X	3.6	1790		0.098
100-D-50:6 Concrete pads	J1FL25	3/22/11	15.4		0.2	0.784		0.153	15200	X	3.5	7.2		0.25	0.013	U	0.013	4250	X	3.4	215		0.093
100-D-50:6 N central pad	J1JWF2	6/23/11	76.4	N	0.26	28		0.153	498000		45.5	97.6	MN	0.32	0.013	U	0.013	583	X	4.4	833		0.12
100-D-50:6 NW pad	J1JWF3	6/23/11	80.3		0.19	4.9		0.154	126000		33.3	28.2		0.24	0.037	B	0.013	2980	X	3.2	569		0.088
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11	15.7		0.23	0.155	U	0.155	23200		4	15.9		0.28				3850		3.9	268		0.1
100-D-50:6 SW pad pipeline	J1KN99	8/4/11	3.2		0.21	0.155	U	0.155	7370		18	32.9		1.3	0.49	B	0.013	334	X	3.5	231		0.095
100-D-50:6 Tar drum	J1P178	4/26/12	0.41	BC	0.18				145		3.2	0.36	B	0.23	0.013	U	0.013	25.8		3.1	2		0.085

Table B-5. 100-D-50:6 In-Process Sampling Results (Inorganic and TPH) (2 Pages)

Sample Location	HEIS Number	Sample Date	Mercury			Mercury TCLP			Molybdenum			Nickel			Potassium			Selenium			Selenium TCLP		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
100-D-50:6 NW pad pipeline	J1FL20	6/22/11	3E-05	U	3E-05							0.0028	B	0.0013	25.5		0.24	0.0074	B	0.0049			
100-D-50:6 NE pad pipeline	J1FL21	6/22/11	0.0012		3E-05							0.0088	B	0.0013	52.6		0.24	0.0049	U	0.0049			
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11	3E-05	U	3E-05							0.0014	B	0.0013	14.6		0.24	0.0049	U	0.0049			
100-D-50:6 Catch basin J	J1FL24	3/24/11	0.0001	B	3E-05							0.012	B	0.0013	33.6		0.24	0.0049	U	0.0049			
Sample Location	**HEIS Number**	**Sample Date**	**Mercury**			**Mercury TCLP**			**Molybdenum**			**Nickel**			**Potassium**			**Selenium**			**Selenium TCLP**		
			mg/kg	Q	PQL	mg/L	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/L	Q	PQL
100-D-50:6 Pipeline scale	J1FJ98	3/24/11	0.73	MN	0.027	3E-05	U	3E-05	43.6		0.25	117	XN	0.12	77.6	BM	40	4.2	U	4.2	0.038	B	0.024
100-D-50:6 Concrete pads	J1FL25	3/22/11	0.058	MN	0.0058	3E-05	U	3E-05	0.79	BM	0.24	7.4	X	0.11	1010		38.2	0.96		0.8	0.028	B	0.024
100-D-50:6 N central pad	J1JWF2	6/23/11	11.4		0.14	3E-05	U	3E-05	7.1		0.31	79.5		0.15	66.6	B	49.1	1	U	1	0.024	U	0.024
100-D-50:6 NW pad	J1JWF3	6/23/11	1.9		0.05	3E-05	UN	3E-05	3.1		0.23	82		0.11	946		36	0.75	U	0.75	0.024	U	0.024
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11	0.031	M	0.006				0.44	B	0.27	11.3		0.13	1020		42.9	0.9	U	0.9			
100-D-50:6 SW pad pipeline	J1KN99	8/4/11	1.2		0.028	3E-05	U	3E-05	0.25	U	0.25	2.7	B	0.12	194	U	194	0.81	U	0.81	0.024	U	0.024
100-D-50:6 Tar drum	J1P178	4/26/12	0.0066	U	0.0066	6E-05	BC	3E-05	0.22	U	0.22	5.6		0.1	34.7	U	34.7	0.75	B	0.73	0.024	U	0.024

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Silver TCLP			Sodium			Uranium			Uranium			Vanadium		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
100-D-50:6 NW pad pipeline	J1FL20	6/22/11	1.3		0.035	0.0009	U	0.0009				101		0.092	5E-05	BM	2E-05				0.0011	U	0.0011
100-D-50:6 NE pad pipeline	J1FL21	6/22/11	21.8	N	0.035	0.0009	U	0.0009				403		0.092	0.0031		2E-05				0.021		0.0011
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11	3.6		0.035	0.0011	BC	0.0009				184		0.092	7E-05	BC	2E-05				0.0014	B	0.0011
100-D-50:6 Catch basin J	J1FL24	3/24/11	27.6		0.035	0.0009	U	0.0009				101		0.092	0.0009	B	2E-05				0.025		0.0011
Sample Location	**HEIS Number**	**Sample Date**	**Silicon**			**Silver**			**Silver TCLP**			**Sodium**			**Uranium**			**Uranium**			**Vanadium**		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/L	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
100-D-50:6 Pipeline scale	J1FJ98	3/24/11	273		5.5	1.2	M	0.16	0.004	U	0.004	264	N	57.6				0.0127	U	0.342	14.4	M	0.092
100-D-50:6 Concrete pads	J1FL25	3/22/11	163		5.3	0.15	U	0.15	0.004	U	0.004	580	M	55				0.167	U	0.341	40.1		0.088
100-D-50:6 N central pad	J1JWF2	6/23/11	804	N	6.8	1.6		0.19	0.0051	B	0.004	287	N	70.7							31.9	M	0.11
100-D-50:6 NW pad	J1JWF3	6/23/11	272		5	0.74		0.14	0.0051	B	0.004	544		51.7							52.4		0.082
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11	357	N	5.9	0.17	U	0.17				376		61.7							46.6		0.098
100-D-50:6 SW pad pipeline	J1KN99	8/4/11	120	N	26.7	0.15	U	0.15	0.004	U	0.004	279	U	279							0.7	B	0.089
100-D-50:6 Tar drum	J1P178	4/26/12	32.3		4.8	0.14	U	0.14	0.004	U	0.004	50	U	50							9.8		0.08

Sample Location	HEIS Number	Sample Date	Zinc			Total organic carbon			TPH - Diesel			TPH - Diesel EXT		
			mg/L	Q	PQL	mg/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
100-D-50:6 NW pad pipeline	J1FL20	6/22/11	0.0045	U	0.0045	1.2		0.16						
100-D-50:6 NE pad pipeline	J1FL21	6/22/11	0.035		0.0045	10.1		0.16						
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11												
100-D-50:6 SW pad pipeline	J1FL22	7/14/11	0.0045	U	0.0045	4.3		0.16						
100-D-50:6 Catch basin J	J1FL24	3/24/11	0.063		0.0045	5.1		0.16						
Sample Location	**HEIS Number**	**Sample Date**	**Zinc**			**Total organic carbon**			**TPH - Diesel**			**TPH - Diesel EXT**		
			mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
100-D-50:6 Pipeline scale	J1FJ98	3/24/11	28.7		0.39									
100-D-50:6 Concrete pads	J1FL25	3/22/11	71	XN	0.37									
100-D-50:6 N central pad	J1JWF2	6/23/11	228	X	0.48									
100-D-50:6 NW pad	J1JWF3	6/23/11	81.2	X	0.35									
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11	58.7	N	0.42									
100-D-50:6 SW pad pipeline	J1KN99	8/4/11	269		1.9									
100-D-50:6 Tar drum	J1P178	4/26/12	1	C	0.34				4E+07		200000	1E+08	N	300000

Table B-6. 100-D-50:6 In-Process Sampling Results (Anions)

Sample Location	HEIS Number	Sample Date	Ammonia			Bromide			Chloride			Cyanide			Fluoride			Nitrogen in Nitrate			Nitrogen in Nitrite		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
100-D-50:6 NW pad pipeline	J1FL20	6/22/11	0.15	NM	0.022	0.18	B	0.11	14.1		0.25	0.002	U	0.002	0.76	M	0.06	0.042	U	0.042	0.049	U	0.049
100-D-50:6 NE pad pipeline	J1FL21	6/22/11	0.068	B	0.022	0.11	U	0.11	8.9		0.25	0.002	U	0.002	1.1		0.06	0.54		0.042	0.049	U	0.049
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11	0.056	BMN	0.022	0.14	B	0.11	12.9		0.25	0.002	U	0.002	1		0.06	0.042	U	0.042	0.049	U	0.049
100-D-50:6 Catch basin J	J1FL24	3/24/11	0.086	BNC	0.022	0.11	U	0.11	4		0.25	0.002	U	0.002	0.1	B	0.06	5.7		0.042	0.049	U	0.049
Sample Location	**HEIS Number**	**Sample Date**	**Ammonia**			**Bromide**			**Chloride**			**Cyanide**			**Fluoride**			**Nitrogen in Nitrate**			**Nitrogen in Nitrite**		
			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
100-D-50:6 Pipeline scale	J1FJ98	3/24/11																					
100-D-50:6 Concrete pads	J1FL25	3/22/11																					
100-D-50:6 N central pad	J1JWF2	6/23/11				0.48	U	0.48	4.6	B	2.4				7.6	N	1	0.6	B	0.39	0.41	U	0.41
100-D-50:6 NW pad	J1JWF3	6/23/11				0.39	U	0.39	10.7		2				0.83	U	0.83	0.32	U	0.32	0.34	U	0.34
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11				0.43	U	0.43	5.1	BC	2.2				0.92	UN	0.92	1	B	0.35	0.38	U	0.38
100-D-50:6 SW pad pipeline	J1KN99	8/4/11				0.39	U	0.39	15.3		2				0.82	U	0.82	0.31	B	0.31	0.34	U	0.34
100-D-50:6 Tar drum	J1P178	4/26/12				0.38	U	0.38	10		2				0.81	U	0.81	0.35	B	0.31	0.33	U	0.33

Sample Location	HEIS Number	Sample Date	Nitrogen in Nitrite and Nitrate			Phosphorous in phosphate			Sulfate			Percent moisture (wet sample)			pH Measurement			Specific Conductance			Total dissolved solids		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL				pH	Q	PQL	uS/cm	Q	PQL	mg/L	Q	PQL
100-D-50:6 NW pad pipeline	J1FL20	6/22/11	0.02	BMN	0.019	0.19	U	0.19	558	D	4.6				6.91		0.1	1140		2	840		9.4
100-D-50:6 NE pad pipeline	J1FL21	6/22/11	0.51		0.019	0.19	U	0.19	107	D	1.2				9.31		0.1	1670		2	1160		9.4
100-D-50:6 NE pad pipeline	J1FL21-A	6/27/11																					
100-D-50:6 SW pad pipeline	J1FL22	7/14/11	0.019	UN	0.019	0.19	U	0.19	398	D	2.3				9.32		0.1	983		2	1060		9.4
100-D-50:6 Catch basin J	J1FL24	3/24/11	6.2		0.019	0.28	B	0.19	22.5		0.23				8.88		0.1	556		2	809		4.7
Sample Location	**HEIS Number**	**Sample Date**	**Nitrogen in Nitrite and Nitrate**			**Phosphorous in phosphate**			**Sulfate**			**Percent moisture (wet sample)**			**pH Measurement**			**Specific Conductance**			**Total dissolved solids**		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	%	Q	PQL	pH	Q	PQL						
100-D-50:6 Pipeline scale	J1FJ98	3/24/11										10.1		0									
100-D-50:6 Concrete pads	J1FL25	3/22/11										7.5		0									
100-D-50:6 N central pad	J1JWF2	6/23/11	0.65	B	0.37	1.5	UN	1.5	675	ND	10.7	19		0	8.09		0.01						
100-D-50:6 NW pad	J1JWF3	6/23/11	0.36	B	0.3	1.2	U	1.2	162		1.7	2.5		0	9.68		0.01						
100-D-50:6 Wet Soil near leak	J1K7D3	7/14/11	0.41	B	0.34	1.4	UN	1.4	107		1.9	10.6		0	11		0.01						
100-D-50:6 SW pad pipeline	J1KN99	8/4/11	0.31	U	0.31	1.2	U	1.2	8.1		1.7	2		0	8.68		0.01						
100-D-50:6 Tar drum	J1P178	4/26/12	0.75		0.3	1.2	U	1.2	22		1.7				8.91		0.01						

Table B-7. 100-D-50:6 In-Process Sampling Results (Organics) (5 Pages)

Constituent	J1FL20			J1FL21			J1FL21-A			J1FL22			J1FL24			J1FJ98		
	6/22/11 8:25			6/22/11 9:40			6/27/11 13:45			7/14/11 14:30			3/24/11 9:15			3/24/11 10:05		
	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/kg	Q	PQL
PAHs																		
Acenaphthene																		
Acenaphthylene																		
Anthracene																		
Benzo(a)anthracene																		
Benzo(a)pyrene																		
Benzo(b)fluoranthene																		
Benzo(ghi)perylene																		
Benzo(k)fluoranthene																		
Chrysene																		
Dibenz[a,h]anthracene																		
Fluoranthene																		
Fluorene																		
Indeno(1,2,3-cd)pyrene																		
Naphthalene																		
Phenanthrene																		
Pyrene																		
PCBs																		
Aroclor-1016	0.13	U	0.13	0.13	U	0.13				0.13	U	0.13	0.15	U	0.15			
Aroclor-1221	0.22	U	0.22	0.22	U	0.22				0.22	U	0.22	0.25	U	0.25			
Aroclor-1232	0.17	U	0.17	0.17	U	0.17				0.17	U	0.17	0.2	U	0.2			
Aroclor-1242	0.11	U	0.11	0.11	U	0.11				0.11	U	0.11	0.12	U	0.12			
Aroclor-1248	0.096	U	0.096	0.094	U	0.094				0.096	U	0.096	0.11	U	0.11			
Aroclor-1254	0.12	U	0.12	0.12	U	0.12				0.12	U	0.12	0.13	U	0.13			
Aroclor-1260	0.17	U	0.17	0.17	U	0.17				0.17	U	0.17	0.19	U	0.19			
SVOCs																		
1,2,4-Trichlorobenzene	0.29	U	0.29															
1,2-Dichlorobenzene																		
1,3-Dichlorobenzene																		
1,4-Dichlorobenzene	0.33	U	0.33				0.33	U	0.33	0.33	U	0.33	0.33	U	0.33			
2,4,5-Trichlorophenol																		
2,4,6-Trichlorophenol	0.3	U	0.3															
2,4-Dichlorophenol																		
2,4-Dimethylphenol																		
2,4-Dinitrophenol																		
2,4-Dinitrotoluene	1.7	U	1.7				1.7	U	1.7	1.7	U	1.7	1.7	U	1.7			
2,6-Dinitrotoluene																		
2-Chloronaphthalene																		
2-Chlorophenol	2	U	2															
2-Methylnaphthalene	0.3	U	0.3															
2-Methylphenol (cresol, o-)	1	U	1				1	U	1	1	U	1	1	U	1			
2-Nitroaniline																		
2-Nitrophenol																		
3+4 Methylphenol (cresol, m+p)	0.26	U	0.26				0.26	U	0.26	0.26	U	0.26	0.26	U	0.26			
3,3'-Dichlorobenzidine																		
3-Nitroaniline																		
4,6-Dinitro-2-methylphenol																		
4-Bromophenylphenyl ether																		
4-Chloro-3-methylphenol	2.5	U	2.5															
4-Chloroaniline																		
4-Chlorophenylphenyl ether																		
4-Nitroaniline																		
4-Nitrophenol	1.3	U	1.3															
Acenaphthene	0.29	U	0.29															
Acenaphthylene																		
Acetophenone	0.25	U	0.25				0.25	U	0.25	0.25	U	0.25	0.25	U	0.25			
Anthracene	0.43	U	0.43															
Benzo(a)anthracene																		
Benzo(a)pyrene																		
Benzo(b)fluoranthene																		
Benzo(ghi)perylene																		
Benzo(k)fluoranthene																		

Table B-7. 100-D-50:6 In-Process Sampling Results (Organics) (5 Pages)

Constituent	J1FL20			J1FL21			J1FL21-A			J1FL22			J1FL24			J1FJ98		
	6/22/11 8:25			6/22/11 9:40			6/27/11 13:45			7/14/11 14:30			3/24/11 9:15			3/24/11 10:05		
	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/kg	Q	PQL
SVOCs																		
Benzyl alcohol	0.34	J	0.24				0.24	U	0.24	8.5	JB	0.24	0.24	U	0.24			
Bis(2-chloro-1-methylethyl)ether																		
Bis(2-Chloroethoxy)methane																		
Bis(2-chloroethyl) ether																		
Bis(2-ethylhexyl) phthalate																		
Butylbenzylphthalate																		
Carbazole	0.44	U	0.44															
Chrysene																		
Di-n-butylphthalate																		
Di-n-octylphthalate	0.36	U	0.36				0.36	U	0.36	0.36	U	0.36	0.36	U	0.36			
Dibenz[a,h]anthracene																		
Dibenzofuran																		
Diethyl phthalate																		
Dimethyl phthalate																		
Fluoranthene																		
Fluorene																		
Hexachlorobenzene																		
Hexachlorobutadiene																		
Hexachlorocyclopentadiene																		
Hexachloroethane	2.1	U	2.1				2.1	U	2.1	2.2	U	2.2	2.2	U	2.2			
Indeno(1,2,3-cd)pyrene																		
Isophorone																		
N-Nitroso-di-n-dipropylamine	0.36	U	0.36															
N-Nitrosodimethylamine	0.3	U	0.3				0.3	U	0.3	0.3	U	0.3	0.3	U	0.3			
N-Nitrosodiphenylamine																		
Naphthalene	0.3	U	0.3				0.3	U	0.3	0.3	U	0.3	0.3	U	0.3			
Nitrobenzene																		
Pentachlorophenol	20	U	20															
Phenanthrene																		
Phenol	2	U	2															
Pyrene	0.64	J	0.38															
Tributyl phosphate	1.2	U	1.2				1.2	U	1.2	1.2	U	1.2	1.2	U	1.2			
VOCs																		
1,1,1-Trichloroethane	0.16	U	0.16	0.16	U	0.16				0.16	U	0.16	0.16	U	0.16			
1,1,2-Trichloroethane	0.27	U	0.27	0.27	U	0.27				0.27	U	0.27	0.27	U	0.27			
1,1-Dichloroethane	0.22	U	0.22	0.22	U	0.22				0.22	U	0.22	0.22	U	0.22			
1,1-Dichloroethene	0.23	U	0.23	0.23	U	0.23				0.23	U	0.23	0.23	U	0.23			
1,2-Dichloroethane	0.13	U	0.13	0.13	U	0.13				0.13	U	0.13	0.13	U	0.13			
1,4-Dichlorobenzene	0.16	U	0.16	0.16	U	0.16				0.16	U	0.16	0.16	U	0.16			
1-Butanol	17	U	17	17	U	17				17	U	17	17	U	17			
2-Butanone	2	U	2	2	U	2				2	U	2	2	U	2			
2-Hexanone	1.7	U	1.7	1.7	U	1.7				1.7	U	1.7	1.7	U	1.7			
2-Pentanone	1	U	1	1	U	1				1	U	1	1	U	1			
4-Methyl-2-Pentanone	0.98	U	0.98	0.98	U	0.98				0.98	U	0.98	0.98	U	0.98			
Acetone	2.9	J	1.9	1.9	U	1.9				2.9	J	1.9	1.9	U	1.9			
Benzene	0.16	U	0.16	0.16	U	0.16				0.16	U	0.16	0.16	U	0.16			
Carbon disulfide	0.45	U	0.45	0.45	U	0.45				0.45	U	0.45	0.45	U	0.45			
Carbon tetrachloride	0.19	U	0.19	0.19	U	0.19				0.19	U	0.19	0.19	U	0.19			
Chlorobenzene	0.17	U	0.17	0.17	U	0.17				0.17	U	0.17	0.17	U	0.17			
Chloroform	0.16	U	0.16	0.16	U	0.16				0.16	U	0.16	0.16	U	0.16			
cis-1,2-Dichloroethylene	0.15	U	0.15	0.15	U	0.15				0.15	U	0.15	0.15	U	0.15			
Ethyl cyanide	3.7	U	3.7	3.7	U	3.7				3.7	U	3.7	3.7	U	3.7			
Methylenechloride	0.32	U	0.32	0.32	U	0.32				0.32	U	0.32	0.32	U	0.32			
Tetrachloroethene	0.2	U	0.2	0.2	U	0.2				0.2	U	0.2	0.2	U	0.2			
Tetrahydrofuran	2	U	2	2	U	2				2	U	2	2	U	2			
Toluene	0.17	U	0.17	0.17	U	0.17				0.32	J	0.17	4.2		0.17			
trans-1,2-Dichloroethylene	0.15	U	0.15	0.15	U	0.15				0.15	U	0.15	0.15	U	0.15			
Trichloroethene	0.16	U	0.16	0.16	U	0.16				0.16	U	0.16	0.16	U	0.16			
Vinyl chloride	0.1	U	0.1	0.1	U	0.1				0.1	U	0.1	0.1	U	0.1			
Xylenes (total)	0.19	U	0.19	0.19	U	0.19				0.19	U	0.19	0.19	U	0.19			

Table B-7. 100-D-50:6 In-Process Sampling Results (Organics) (5 Pages)

Constituent	J1FL25			J1JWF2			J1JWF3			J1K7D3			J1KN99			J1P178		
	3/22/11 8:45			6/23/11 7:55			6/23/11 8:00			7/14/11 14:00			8/4/11 9:45			4/26/12 9:25		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
PAHs																		
Acenaphthene																120	U	120
Acenaphthylene																110	UN	110
Anthracene																36	UN	36
Benzo(a)anthracene																38	UN	38
Benzo(a)pyrene																76	UN	76
Benzo(b)fluoranthene																50	UN	50
Benzo(ghi)perylene																85	UN	85
Benzo(k)fluoranthene																47	UN	47
Chrysene																57	UN	57
Dibenz[a,h]anthracene																130	UN	130
Fluoranthene																150	UN	150
Fluorene																63	UN	63
Indeno(1,2,3-cd)pyrene																140	UN	140
Naphthalene																140	UN	140
Phenanthrene																140	UN	140
Pyrene																140	UN	140
PCBs																		
Aroclor-1016										3	U	3				3000	UD	3000
Aroclor-1221										8.8	U	8.8				9200	UD	9200
Aroclor-1232										2.2	U	2.2				3000	UD	3000
Aroclor-1242										5.1	U	5.1				5400	UD	5400
Aroclor-1248										5.1	U	5.1				3300	UD	3300
Aroclor-1254										2.9	U	2.9				3300	UD	3300
Aroclor-1260										2.9	U	2.9				1600	UD	1600
SVOCs																		
1,2,4-Trichlorobenzene										31	U	31				170000	UD	170000
1,2-Dichlorobenzene										24	U	24				130000	UD	130000
1,3-Dichlorobenzene										13	U	13				71000	UD	71000
1,4-Dichlorobenzene										15	U	15				81000	UD	81000
2,4,5-Trichlorophenol										11	U	11				59000	UD	59000
2,4,6-Trichlorophenol										11	U	11				59000	UD	59000
2,4-Dichlorophenol										11	U	11				59000	UD	59000
2,4-Dimethylphenol										73	U	73				390000	UD	390000
2,4-Dinitrophenol										370	U	370				1900000	UD	2E+06
2,4-Dinitrotoluene										73	U	73				390000	UD	390000
2,6-Dinitrotoluene										31	U	31				170000	UD	170000
2-Chloronaphthalene										11	U	11				59000	UD	59000
2-Chlorophenol										23	U	23				120000	UD	120000
2-Methylnaphthalene										21	U	21				110000	UD	110000
2-Methylphenol (cresol, o-)										14	U	14				77000	UD	77000
2-Nitroaniline										55	U	55				300000	UD	300000
2-Nitrophenol										11	U	11				59000	UD	59000
3+4 Methylphenol (cresol, m+p)										36	U	36				190000	UD	190000
3,3'-Dichlorobenzidine										99	U	99				530000	UD	530000
3-Nitroaniline										81	U	81				430000	UD	430000
4,6-Dinitro-2-methylphenol										360	U	360				1900000	UD	2E+06
4-Bromophenylphenyl ether										21	U	21				110000	UD	110000
4-Chloro-3-methylphenol										73	U	73				390000	UD	390000
4-Chloroaniline										90	U	90				490000	UD	490000
4-Chlorophenylphenyl ether										23	U	23				120000	UD	120000
4-Nitroaniline										80	U	80				430000	UD	430000
4-Nitrophenol										110	U	110				570000	UD	570000
Acenaphthene										11	U	11				59000	UD	59000
Acenaphthylene										19	U	19				100000	UD	100000
Acetophenone																		
Anthracene										23	J	19				100000	UD	100000
Benzo(a)anthracene										51	J	22				120000	UD	120000
Benzo(a)pyrene										37	J	22				120000	UD	120000
Benzo(b)fluoranthene										72	JX	29				160000	UD	160000
Benzo(ghi)perylene										26	J	18				94000	UD	94000
Benzo(k)fluoranthene										44	UX	44				240000	UD	240000

Table B-7. 100-D-50:6 In-Process Sampling Results (Organics) (5 Pages)

Constituent	J1FL25			J1JWF2			J1JWF3			J1K7D3			J1KN99			J1P178		
	3/22/11 8:45			6/23/11 7:55			6/23/11 8:00			7/14/11 14:00			8/4/11 9:45			4/26/12 9:25		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
SVOCs																		
Benzyl alcohol																		
Bis(2-chloro-1-methylethyl)ether										25	U	25				140000	UD	140000
Bis(2-Chloroethoxy)methane										25	U	25				140000	UD	140000
Bis(2-chloroethyl) ether										18	U	18				98000	UD	98000
Bis(2-ethylhexyl) phthalate										51	U	51				450000	JBD	280000
Butylbenzylphthalate										47	U	47				260000	UD	260000
Carbazole										40	U	40				220000	UD	220000
Chrysene										56	J	30				160000	UD	160000
Di-n-butylphthalate										32	U	32				170000	UD	170000
Di-n-octylphthalate										16	U	16				85000	UD	85000
Dibenz[a,h]anthracene										21	U	21				110000	UD	110000
Dibenzofuran										22	U	22				120000	UD	120000
Diethyl phthalate										29	U	29				150000	UD	150000
Dimethyl phthalate										25	U	25				140000	UD	140000
Fluoranthene										89	J	40				220000	UD	220000
Fluorene										20	U	20				110000	UD	110000
Hexachlorobenzene										32	U	32				170000	UD	170000
Hexachlorobutadiene										11	U	11				59000	UD	59000
Hexachlorocyclopentadiene										55	U	55				300000	UD	300000
Hexachloroethane										24	U	24				130000	UD	130000
Indeno(1,2,3-cd)pyrene										24	U	24				130000	UD	130000
Isophorone										19	U	19				100000	UD	100000
N-Nitroso-di-n-dipropylamine										34	U	34				180000	UD	180000
N-Nitrosodimethylamine																		
N-Nitrosodiphenylamine										23	U	23				120000	UD	120000
Naphthalene										34	U	34				180000	UD	180000
Nitrobenzene										24	U	24				130000	UD	130000
Pentachlorophenol										360	U	360				1900000	UD	2E+06
Phenanthrene										81	J	19				100000	UD	100000
Phenol										20	U	20				110000	UD	110000
Pyrene										76	J	13				71000	UD	71000
Tributyl phosphate																		
VOCs																		
1,1,1-Trichloroethane																		
1,1,2-Trichloroethane																		
1,1-Dichloroethane																		
1,1-Dichloroethene																		
1,2-Dichloroethane																		
1,4-Dichlorobenzene																		
1-Butanol																		
2-Butanone																		
2-Hexanone																		
2-Pentanone																		
4-Methyl-2-Pentanone																		
Acetone																		
Benzene																		
Carbon disulfide																		
Carbon tetrachloride																		
Chlorobenzene																		
Chloroform																		
cis-1,2-Dichloroethylene																		
Ethyl cyanide																		
Methylenechloride																		
Tetrachloroethene																		
Tetrahydrofuran																		
Toluene																		
trans-1,2-Dichloroethylene																		
Trichloroethene																		
Vinyl chloride																		
Xylenes (total)																		

Table B-7. 100-D-50:6 In-Process Sampling Results (Organics) (5 Pages)												
Constituent	J1R936 (S)			J1R937 (W)			J1R938 (N)			J1R939 (E)		
	1/14/13 8:45			1/14/13 8:45			1/14/13 8:45			1/14/13 8:45		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
PAHs												
Acenaphthene	200	X	10	11	U	11	480	X	11	2600	DX	51
Acenaphthylene	9.3	U	9.3	9.5	U	9.5	9.5	U	9.5	46	UD	46
Anthracene	220		3.2	13	J	3.2	610		3.2	4100	D	16
Benzo(a)anthracene	700	N	3.3	51		3.4	1600		3.4	5900	D	16
Benzo(a)pyrene	500		6.6	31		6.8	1100		6.8	3200	D	33
Benzo(b)fluoranthene	560	X	4.3	39	X	4.4	1300	X	4.4	4600	DX	22
Benzo(ghi)perylene	330		7.4	14	JX	7.6	750		7.6	2600	D	37
Benzo(k)fluoranthene	190		4.1	15	J	4.2	410		4.2	1500	D	20
Chrysene	5880		5.0	35	J	5.1	1300		5.1	5100	DX	25
Dibenz[a,h]anthracene	89	X	11	12	U	12	190	X	12	700	DX	57
Fluoranthene	1100	N	13	77		14	2300		14	11000	D	67
Fluorene	130		5.5	5.6	U	5.6	350		5.6	3000	D	27
Indeno(1,2,3-cd)pyrene	340	N	12	35		13	790		13	2700	D	62
Naphthalene	12	U	12	13	U	13	13	U	13	1600	D	62
Phenanthrene	600	N	12	40	J	13	1500		13	11000	D	62
Pyrene	1200	N	12	82		13	2300		13	11000	D	62

Constituent	J1RC25 (S)			J1RC26 (N)			J1RC27 (E)		
	1/24/13 8:45			1/24/13 8:45			1/24/13 8:45		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
PAHs									
Acenaphthene	10	U	10	9.8	U	9.8	10	X	11
Acenaphthylene	9.4	U	9.4	8.9	U	8.9	9.3	U	9.5
Anthracene	3.2	U	3.2	3.0	U	3	3.2		3.2
Benzo(a)anthracene	3.3	U	3.3	3.1	U	3.1	3.3		3.4
Benzo(a)pyrene	6.7	U	6.7	6.3	U	6.3	6.6		6.8
Benzo(b)fluoranthene	4.4	U	4.4	4.1	U	4.1	4.3	X	4.4
Benzo(ghi)perylene	7.5	U	7.5	7.1	U	7.1	7.4		7.6
Benzo(k)fluoranthene	4.1	U	4.1	3.9	U	3.9	4.1		4.2
Chrysene	5.1	U	5.1	4.8	U	4.8	5.0		5.1
Dibenz[a,h]anthracene	12	U	12	11	U	11	11	X	12
Fluoranthene	14	U	14	13	U	13	13		14
Fluorene	5.5	U	5.5	5.2	U	5.2	5.5		5.6
Indeno(1,2,3-cd)pyrene	13	U	13	12	U	12	12		13
Naphthalene	13	U	13	12	U	12	12	U	13
Phenanthrene	13	U	13	12	U	12	12		13
Pyrene	13	U	13	12	U	12	12		13

APPENDIX C

REMEDIATION PHOTOGRAPHS

Figure C-1. Remediation, April 4, 2011.

Figure C-2. Remediation, April 26, 2011.

Figure C-3. Remediation, July 27, 2011.

Figure C-4. Remediation, August 15, 2011.

Figure C-5. Remediation, October, 2011.

Figure C-6. Remediation, April 12, 2012.

Figure C-7. Post-Remediation, June 6, 2011.

Figure C-8. Post-Remediation, June 6, 2011.

Figure C-9. Post-Remediation, June 6, 2011.

Figure C-10. Post-Remediation, June 6, 2011.

APPENDIX D

CALCULATIONS

APPENDIX D

CALCULATIONS

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

100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations, 0100D-CA-V0490, Rev. 1, Washington Closure Hanford, Richland, Washington.

100-D-50:6 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100D-CA-V0491, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-50:6 Subsite Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0494, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

The calculations provided in this appendix have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents.

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0490

Subject: 100-D-50:6 Subsite 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 = 41 Attm. 1 = 17 Total = 59	N. K. Schiffern	J. D. Skoglie	C. H. Dobie	D. F. Obenauer	3/14/13
1	Cover = 1 Sheets = 41 Attm. 1 = 17 Total = 59	N. K. Schiffern N.K. Schiffern	J. D. Skoglie	C. H. Dobie CH Dobie	D. F. Obenauer D. F. Obenauer	3/25/13

SUMMARY OF REVISION

1	Sheet 1: Line 56, The original calculation included FS-5 data, which is within the 100-D-77 waste site boundary instead of the 100-D-50:6. The second sentence under Methodology was corrected to show the right number of focused samples: four. Sheet 4: Result Summary Table, Line 11, 13, 16-17, 19, 26-31, Focused sample results were corrected after FS-5 data was eliminated. Sheet 4: Result Summary Table, Line 34 to 47 , 95% UCL results for the Pipeline Excavation were corrected to keep the significant figures minimum. Attachment Sheet 1 to 8: FS-5 data were eliminated from the tables.
WCH-DE-018 (05/08/2007)	*Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford **CALCULATION SHEET**

Originator	N. K. Schiffern	**Date**	03/19/13	**Calc. No.** 0100D-CA-V0490	**Rev. No.** 1
Project	100-D Field Remediation	**Job No.**	14655	**Checked** J. D. Skoglie	**Date** 03/19/13
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				**Sheet No.** 1 of 41

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 5 - Calculation Sheet Summary
Sheets 6 to 24 - Calculation Sheet Verification Data - Clearwell Excavation, Pipeline Excavation, Overburden, and Staging Pile Area
Sheets 25 to 36 - Ecology Software (MTCAStat) Results
Sheets 37 to 41 - Calculation Sheet - Duplicate Analysis
Attachment 1 - 100-D-50:6 Subsite Verification Sampling Results (17 pages)

Given/References:
1) Sample Results (Attachment 1).
2) 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.
3) 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.
4) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
5) 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.
6) Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
7) EPA, 1989, *Risk Assessment Guidance for Superfund:* Volume 1, *Human Health Evaluation Manual, Part A; Interim Final,* EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D. C.
8) 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 100-D-50:6 subsite. 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 100-D-50:6 subsite underwent statistical sampling at four decision units for verification sampling, consisting of clearwell excavation, pipeline excavation, overburden, and staging pile area. Also taken were four focused samples. Sample location SPA-8 exceeded RAGs for PAHs; this location underwent additional remediation and re-sampling. Asbestos was detected at sample location PIPE-4; this location also underwent remediation and re-sampling.

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 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 (2011) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance* for Superfund (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COCs/COPCs and are also not included in these calculations.

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 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 TDLs are pre-determined values for analytical methods and constituents with cleanup levels as listed in Table 2-1 of the SAP (DOE-RL 2009a). Table 2-1 includes nominal TDLs for identified methods based organic analyses. The nominal TDLs are also used in support of the RPD calculation for the methods based analytes. TDLs not included in Table 2-1 are based on the laboratory and/or methods 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) split and 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 results 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	N. K. Schiffern	**Date**	02/12/13	**Calc. No.**	0100D-CA-V0490	**Rev. No.**	0
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie	**Date**	02/12/13
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations					**Sheet No.**	3 of 41

Summary (continued)

QUALIFIER LIST

B = estimate
D = dilution
J = estimate
M = sample duplicate precision not met.
N = recovery is outside control limits
U = undetected
X (metals)= Serial dilution in the analytical batch indicates that physical and chemical interferences are present.
X (organics)= more than 40 % difference between colums, lower result reported.

ACRONYM LIST

-- = not applicable
DE = direct exposure
CLEAR = clearwell excavation
FS = focused sample
GW = groundwater
MTCA = *Model Toxics Control Act*
NA = not applicable
OB = overbuden
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyls
PIPE = pipeline
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
SPA = staging pile area
TPH = total petroleum hydrocarbons
TDL = target detection limit
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS **Date** 03/19/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 1
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 03/19/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 4 of 41

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the clearwell excavation, pipeline excavation, overburden, staging pile area, focused samples, 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 subsite.

Results Summary [a]

Analyte	Deep Zone Excavation				Shallow Zone Excavation					Units
	Pipeline Excavation		Clearwell Excavation		Overburden		Staging Pile Area		Focused	
	95% UCL Result	Maximum Result	95% UCL Result	Maximum Result	95% UCL Result	Maximum Result	95% UCL Result	Maximum Result		
Antimony	0.90	--	0.59	--	0.55	--	0.55	--	0.85	mg/kg
Arsenic	5.2	--	3.0	--	2.7	--	2.6	--	2.6	mg/kg
Barium	67.0	--	66.3	--	66.5	--	84.5	--	61.4	mg/kg
Beryllium	0.18	--	--	0.12	0.12	--	0.17	--	0.19	mg/kg
Boron	--	4.1	--	1.3	1.2	--	2.0	--	0.97	mg/kg
Cadmium	--	0.057	--	0.055	0.075	--	0.12	--	0.065	mg/kg
Chromium	16.2	--	13.3	--	11.3	--	14.2	--	14.2	mg/kg
Cobalt	8.7	--	9.5	--	8.4	--	8.0	--	9.8	mg/kg
Copper	23.4	--	18.1	--	16.4	--	15.6	--	18.9	mg/kg
Hexavalent Chromium	--	1.32	--	--	--	--	--	--	0.259	mg/kg
Lead	9.9	--	6.4	--	4.9	--	5.7	--	7.1	mg/kg
Manganese	323	--	320	--	340	--	339	--	309	mg/kg
Mercury	0.064	--	0.031	--	0.044	--	0.042	--	0.32	mg/kg
Molybdenum	--	0.76	--	0.31	--	0.40	--	1.1	0.37	mg/kg
Nickel	13.4	--	12.3	--	12.0	--	11.7	--	10.7	mg/kg
Vanadium	59.6	--	66.4	--	58.6	--	49.0	--	69.9	mg/kg
Zinc	56.5	--	46.0	--	46.5	--	43.8	--	58.3	mg/kg
Chloride	--	--	--	--	--	--	255	--	--	mg/kg
Nitrogen in Nitrate	--	--	--	--	--	--	49.4	--	--	mg/kg
Nitrogen in Nitrite and Nitrate	--	--	--	--	--	--	112	--	--	mg/kg
Sulfate	--	--	--	--	--	--	67.7	--	--	mg/kg
TPH - diesel	--	--	--	--	--	--	17	--	--	mg/kg
TPH - diesel EXT	--	--	--	--	--	--	43	--	--	mg/kg
Acenaphthene	9.4	--	--	0.38	--	2.2	--	--	0.25	mg/kg
Acenaphthylene	--	0.22	--	0.063	--	--	--	--	--	mg/kg
Anthracene	1300000	--	1066	--	--	4.2	--	0.020	0.68	mg/kg
Benzo(a)anthracene	11000	--	717	--	1.3	--	0.024	--	1.1	mg/kg
Benzo(a)pyrene	2300	--	109	--	--	2.6	0.017	--	1.1	mg/kg
Benzo(b)fluoranthene	3500	--	213	--	0.82	--	0.019	--	1.1	mg/kg
Benzo(ghi)perylene	470	--	22	--	--	1.6	--	0.040	0.65	mg/kg
Benzo(k)fluoranthene	1500	--	39	--	--	1.1	--	0.025	0.49	mg/kg
Chrysene	9100	--	234	--	1.3	--	0.017	--	1.0	mg/kg
Dibenz(a,h)anthracene	2.4		0.18		--	0.55	--	--	0.21	mg/kg
Fluoranthene	26000	--	476	--	2.7	--	0.046	--	2.4	mg/kg
Fluorene	10000		42		--	2.4	--	0.013	0.38	mg/kg
Indeno(1,2,3-cd)pyrene	2000	--	8.4	--	--	1.1	--	0.028	0.67	mg/kg
Naphthalene	--	9.7	--	0.78	--	--	--	--	--	mg/kg
Phenanthrene	61000	--	600	--	--	11	--	0.057	1.7	mg/kg
Pyrene	24000	--	537	--	2.7	--	0.041	--	2.4	mg/kg
Aroclor-1254	--	--	--	0.020	--	--	--	--	0.013	mg/kg
Aroclor-1260	--	--	--	--	--	--	--	--	0.0048	mg/kg

3-Part Test Evaluation

	Pipeline		Clearwell		Overburden		Staging Pile Area	
95% UCL or Maximum > Cleanup Limit	YES	NO	YES	YES	YES	YES	YES	YES
> 10% above Cleanup Limit?	YES	NO	YES	NO	YES	YES	YES	YES
Any sample > 2x Cleanup Limit?	YES	NO	YES	NO	YES	YES	YES	NO

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

Washington Closure Hanford **CALCULATION SHEET**

Originator	N. K. Schiffern	**Date**	02/14/13	**Calc. No.** 0100D-CA-V0490	**Rev. No.** 0
Project	100-D Field Remediation	**Job No.**	14655	**Checked** J. D. Skoglie	**Date** 02/14/13
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				**Sheet No.** 5 of 41

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the clearwell excavation, pipeline excavation, overburden, staging pile area, focused samples, 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 subsite.

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

Analyte	Duplicate Analysis			
	Pipeline Excavation	Clearwell pipeline	Overburden	Staging Pile Area
Aluminum	1.4%	0.9%	1.2%	3.5%
Barium	9.7%	4.4%		0.5%
Beryllium			1.2%	
Calcium	6.1%	4.4%		1.1%
Chromium	4.7%	11.4%	0.7%	4.2%
Cobalt			4.5%	
Copper	8.5%	3.2%	5.1%	0.7%
Iron	6.9%	0.4%	1.4%	4.1%
Magnesium	5.2%	2.6%	1.7%	1.6%
Manganese	6.4%	6.7%	1.8%	2.6%
Silicon	17.2%	2.8%	21.9%	19.5%
Sodium	23.6%	4.7%	3.3%	5.2%
Vanadium	3.8%	0.0%	6.5%	3.9%
Zinc	6.3%	1.3%	3.5%	0.4%
Sulfate				6.2%
TPH diesel				***116.5%***
TPH diesel EXT				***115.3%***
Acenaphthene	***69.8%***			***107.7%***
Anthracene				***105.6%***
Benzo(a)anthracene	***53.3%***			***95.7%***
Benzo(a)pyrene	***47.2%***			***93.3%***
Benzo(b)fluoranthene	***44.5%***			***100.6%***
Benzo(ghi)perylene	***40.0%***			***104.9%***
Benzo(k)fluoranthene	***46.6%***			***90.9%***
Crysene	***46.2%***			***97.4%***
Dibenz(a,h)anthracene	***51.4%***			***101.6%***
Fluoranthene	***66.7%***			***100.0%***
Fluorene	***87.6%***			***107.7%***
Indeno(1,2,3-cd)perylene	***35.1%***			***104.9%***
Phenanthrene	***78.8%***			***106.5%***
Pyrene	***58.1%***			***97.8%***

Grey cells indicate not applicable

[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 N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie

Rev. No. 0
Date 02/14/13
Sheet No. 6 of 41

1 **100-D-50:6 Subsite Statistical Calculations**
2 **Verification Data - Pipeline Excavation (PIPE)**

3	Sample	Sample	Sample	Antimony			Arsenic			Barium			Beryllium			Chromium			Cobalt			Copper			Lead		
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
5	PIPE-3	J1R118	9/5/2012	0.56		0.32	2.1		0.56	68.4		0.065	0.060	B	0.028	15.2		0.050	8.5		0.085	19.2		0.19	12.4		0.23
6	Replicate of J1R118	J1R128	9/5/2012	0.56	B	0.39	2.4		0.68	62.1		0.078	0.034	U	0.034	14.5		0.060	9.4		0.10	20.9		0.22	12.2		0.28
7	PIPE-1	J1R116	9/5/2012	0.69		0.36	2.5		0.63	63.6		0.072	0.078	B	0.031	8.4		0.055	9.0		0.095	18.2		0.21	6.4		0.26
8	PIPE-2	J1R117	9/5/2012	2.0		0.34	14.7		0.59	93.7		0.068	0.12	B	0.030	28.5		0.052	7.3		0.090	43.9		0.19	23.7		0.24
9	PIPE-4	J1R119	9/5/2012	0.37	U	0.37	3.5		0.64	60.8		0.074	0.17	B	0.032	13.3		0.057	5.9		0.097	14.6		0.21	4.2		0.26
10	PIPE-5	J1R120	9/5/2012	0.38	B	0.35	3.2		0.61	62.4		0.070	0.16	B	0.030	12.5		0.054	6.6		0.092	16.8		0.20	4.6		0.25
11	PIPE-6	J1R121	9/5/2012	0.61		0.37	2.8		0.64	51.7		0.074	0.099	B	0.032	11.5		0.056	7.0		0.097	14.9		0.21	5.5		0.26
12	PIPE 7	J1R122	9/5/2012	0.48	B	0.38	2.4		0.66	59.0		0.075	0.052	B	0.033	14.6		0.058	7.7		0.099	16.1		0.22	8.9		0.27
13	PIPE-8	J1R123	9/5/2012	0.86		0.37	2.0		0.64	53.4		0.074	0.033	B	0.032	8.8		0.057	7.8		0.098	18.2		0.21	4.8		0.26
14	PIPE-9	J1R124	9/5/2012	0.70		0.39	1.4		0.68	52.5		0.078	0.034	U	0.034	8.7		0.059	9.2		0.10	19.3		0.22	3.5		0.28
15	PIPE-10	J1R125	9/5/2012	0.62		0.35	1.6		0.61	64.4		0.071	0.031	U	0.031	7.0		0.054	9.4		0.093	15.6		0.20	2.8		0.25
16	PIPE-11	J1R126	9/5/2012	0.71		0.38	2.4		0.66	56.5		0.076	0.033	U	0.033	12.5		0.058	10.0		0.10	23.2		0.22	3.9		0.27
17	PIPE-12	J1R127	9/5/2012	0.41	B	0.34	3.7		0.60	58.0		0.069	0.14	B	0.030	14.9		0.053	6.0		0.091	13.8		0.20	5.3		0.24

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Antimony	Arsenic	Barium	Beryllium	Chromium	Cobalt	Copper	Lead
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
21	PIPE-3	J1R118/J1R128	9/5/2012	0.56	2.3	65.3	0.039	14.9	9.0	20.1	12.3
22	PIPE-1	J1R116	9/5/2012	0.69	2.5	63.6	0.078	8.4	9.0	18.2	6.4
23	PIPE-2	J1R117	9/5/2012	2.0	14.7	93.7	0.12	28.5	7.3	43.9	23.7
24	PIPE-4	J1R119	9/5/2012	0.19	3.5	60.8	0.17	13.3	5.9	14.6	4.2
25	PIPE-5	J1R120	9/5/2012	0.38	3.2	62.4	0.16	12.5	6.6	16.8	4.6
26	PIPE-6	J1R121	9/5/2012	0.61	2.8	51.7	0.099	11.5	7.0	14.9	5.5
27	PIPE 7	J1R122	9/5/2012	0.48	2.4	59.0	0.052	14.6	7.7	16.1	8.9
28	PIPE-8	J1R123	9/5/2012	0.86	2.0	53.4	0.033	8.8	7.8	18.2	4.8
29	PIPE-9	J1R124	9/5/2012	0.70	1.4	52.5	0.017	8.7	9.2	19.3	3.5
30	PIPE-10	J1R125	9/5/2012	0.62	1.6	64.4	0.016	7.0	9.4	15.6	2.8
31	PIPE-11	J1R126	9/5/2012	0.71	2.4	56.5	0.017	12.5	10.0	23.2	3.9
32	PIPE-12	J1R127	9/5/2012	0.41	3.7	58.0	0.14	14.9	6.0	13.8	5.3

33 **Statistical Computations**

34		Antimony	Arsenic	Barium	Beryllium	Chromium	Cobalt	Copper	Lead
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), 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), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
36	N	12	12	12	12	12	12	12	12
37	% < Detection limit	8%	0%	0%	25%	0%	0%	0%	0%
38	Mean	0.68	3.5	61.8	0.078	13.0	7.9	19.6	7.2
39	Standard deviation	0.45	3.6	11.1	0.058	5.6	1.4	8.1	5.8
40	95% UCL on mean	0.90	5.2	67.0	0.18	16.2	8.7	23.4	9.9
41	Maximum value	2.0	14.7	93.7	0.17	28.5	10.0	43.9	23.7
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	5 GW & River Protection	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection	10.2 GW & River Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	NA	NO	NA	NA	NO	NA	YES	NO
45	> 10% above Cleanup Limit?	NA	NO	NA	NA	NO	NA	YES	YES
46	Any sample > 2X Cleanup Limit?	NA	NO	NA	NA	NO	NA	NO	YES
47	**WAC 173-340 Compliance?**	Because all values are below background (5 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 (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 (15.7 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.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie JS

Rev. No. 0
Date 02/14/13
Sheet No. 7 of 41

1 **100-D-50:6 Subsite Statistical Calculations**

2 **Verification Data - Pipeline Excavation (PIPE)**

3	Sample	Sample	Sample	Manganese			Mercury			Nickel			Vanadium			Zinc			Acenaphthene			Anthracene			Benzo(a)anthracene		
4	Area	Number	Date	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
5	PIPE-3	J1R118	9/5/2012	317		0.085	0.034		0.0063	11.0		0.11	57.3		0.080	55.3		0.34	420	X	9.6	690		2.9	1100		3.1
6	Replicate of J1R118	J1R128	9/5/2012	338		0.10	0.029		0.0056	10.6		0.13	59.5		0.097	58.9		0.41	870	X	10	3.1	U	3.1	1900		3.3
7	PIPE-1	J1R116	9/5/2012	333		0.095	0.0098	B	0.0052	10.1		0.12	64.5		0.089	49.9		0.38	9.8	U	9.8	57		3.0	200		3.1
8	PIPE-2	J1R117	9/5/2012	313		0.090	0.041		0.0066	14.3		0.11	52.8		0.084	94.2		0.36	2100	DX	51	3400	DX	16	3800	D	16
9	PIPE-4	J1R119	9/5/2012	288		0.097	0.011	B	0.0048	12.5		0.12	34.8		0.092	36.1		0.39	8800	DX	98	30	UD	30	31000	D	31
10	PIPE-5	J1R120	9/5/2012	313		0.092	0.0070	U	0.0070	12.7		0.11	40.1		0.087	39.7		0.37	8200	DX	100	14000	D	30	15000	D	32
11	PIPE-6	J1R121	9/5/2012	298		0.097	0.0083	B	0.0060	13.4		0.12	45.6		0.091	38.9		0.39	260	X	9.8	3.0	U	3.0	770		3.1
12	PIPE 7	J1R122	9/5/2012	317		0.099	0.062		0.0057	13.0		0.12	48.8		0.093	43.7		0.40	5600	DX	100	16000	D	31	19000	D	32
13	PIPE-8	J1R123	9/5/2012	307		0.098	0.028		0.0057	10.4		0.12	51.3		0.092	43.2		0.39	5500	DX	49	8000	D	15	11000	D	16
14	PIPE-9	J1R124	9/5/2012	315		0.10	0.028		0.0056	10.0		0.13	66.7		0.096	57.5		0.41	62	JX	10	77		3.1	180		3.2
15	PIPE-10	J1R125	9/5/2012	316		0.093	0.0049	U	0.0049	10.9		0.11	67.0		0.087	44.8		0.37	10.0	U	10	11	J	3.0	33		3.2
16	PIPE-11	J1R126	9/5/2012	349		0.10	0.011	B	0.0051	15.7		0.12	59.8		0.094	46.6		0.40	9.9	U	9.9	14	JX	3.0	43		3.2
17	PIPE-12	J1R127	9/5/2012	285		0.091	0.0049	U	0.0049	14.3		0.11	34.9		0.085	34.7		0.36	31000	DX	490	60000	D	150	85000	D	160

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Manganese	Mercury	Nickel	Vanadium	Zinc	Acenaphthene	Anthracene	Benzo(a)anthracene
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg	ug/kg
21	PIPE-3	J1R118/J1R128	9/5/2012	328	0.032	10.8	58.4	57.1	645	346	1500
22	PIPE-1	J1R116	9/5/2012	333	0.0098	10.1	64.5	49.9	4.9	57	200
23	PIPE-2	J1R117	9/5/2012	313	0.041	14.3	52.8	94.2	2100	3400	3800
24	PIPE-4	J1R119	9/5/2012	288	0.011	12.5	34.8	36.1	8800	15	31000
25	PIPE-5	J1R120	9/5/2012	313	0.0035	12.7	40.1	39.7	8200	14000	15000
26	PIPE-6	J1R121	9/5/2012	298	0.0083	13.4	45.6	38.9	260	1.5	770
27	PIPE 7	J1R122	9/5/2012	317	0.062	13.0	48.8	43.7	5600	16000	19000
28	PIPE-8	J1R123	9/5/2012	307	0.028	10.4	51.3	43.2	5500	8000	11000
29	PIPE-9	J1R124	9/5/2012	315	0.028	10.0	66.7	57.5	62	77	180
30	PIPE-10	J1R125	9/5/2012	316	0.0025	10.9	67.0	44.8	5.0	11	33
31	PIPE-11	J1R126	9/5/2012	349	0.011	15.7	59.8	46.6	5.0	14	43
32	PIPE-12	J1R127	9/5/2012	285	0.0025	14.3	34.9	34.7	31000	60000	85000

33 **Statistical Computations**

34		Manganese	Mercury	Nickel	Vanadium	Zinc	Acenaphthene	Anthracene	Benzo(a)anthracene
35	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), 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), use MTCAStat lognormal distribution.
36	N	12	12	12	12	12	12	12	12
37	% < Detection limit	0%	25%	0%	0%	0%	25%	17%	0%
38	Mean	313	0.020	12.3	52.1	48.9	5182	8493	13961
39	Standard deviation	18.1	0.018	1.9	11.6	16.0	8790	17221	24442
40	95% UCL on mean	323	0.064	13.4	59.6	56.5	9356	1304142559	10927789
41	Maximum value	349	0.062	15.7	67.0	94.2	31000	60000	85000
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	512 GW & River Protection	0.33 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	96000 ug/kg GW Protection	240000 ug/kg GW Protection	15 ug/kg GW & River Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NO	YES	YES
45	> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NO	NO	YES
46	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NO	NO	YES
47	**WAC 173-340 Compliance?**	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	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 does not meet the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 8 of 41

1 **100-D-50:6 Subsite Statistical Calculations**

2 **Verification Data - Pipeline Excavation (PIPE)**

3	Sample	Sample	Sample	Benzo(a)pyrene			Benzo(b)fluoranthene			Benzo(ghi)perylene			Benzo(k)fluoranthene			Chrysene			Dibenz(a,h)anthracene			Fluoranthene			Fluorene		
4	Area	Number	Date	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
5	PIPE-3	J1R118	9/5/2012	680		6.1	890		4.0	460		6.9	280		3.8	1000		4.6	130	X	11	2200		12	430		5.1
6	Replicate of J1R118	J1R128	9/5/2012	1100		6.6	1400		4.3	690		7.4	450		4.1	1600		5.0	220	X	11	4400		13	1100		5.4
7	PIPE-1	J1R116	9/5/2012	160		6.3	210		4.1	120		7.1	73		3.9	210		4.7	11	U	11	460	N	13	44	X	5.2
8	PIPE-2	J1R117	9/5/2012	1600	D	33	2300	DX	22	1200	D	37	800	D	20	3100	D	25	250	DX	56	9100	D	67	2500	D	27
9	PIPE-4	J1R119	9/5/2012	15000	D	63	21000	D	41	5000	DX	71	7600	D	39	25000	D	48	2700	D	110	55000	D	130	7100	D	52
10	PIPE-5	J1R120	9/5/2012	9400	D	64	11000	D	42	5300	D	72	4100	D	39	14000	D	48	1700	DX	110	42000	D	130	8400	D	53
11	PIPE-6	J1R121	9/5/2012	430		6.3	600		4.1	300		7.0	230		3.8	790		4.7	11	U	11	1500		13	190		5.2
12	PIPE 7	J1R122	9/5/2012	7500	D	65	12000	D	43	4100	D	73	3300	D	40	15000	D	49	1500	DX	110	38000	D	130	8100	D	54
13	PIPE-8	J1R123	9/5/2012	9500	D	32	10000	D	21	5700	D	35	4000	D	19	10000	DX	24	1800	DX	54	26000	D	64	5200	D	26
14	PIPE-9	J1R124	9/5/2012	180		6.5	180		4.2	170		7.3	63		4.0	160		4.9	11	U	11	360		13	54		5.3
15	PIPE-10	J1R125	9/5/2012	27		6.4	34	X	4.2	26	JX	7.2	12	J	3.9	31	J	4.8	14	J	11	80		13	11	J	5.3
16	PIPE-11	J1R126	9/5/2012	24		6.3	35		4.2	18	J	7.1	8.7	J	3.9	30	J	4.8	11	U	11	68		13	14	J	5.2
17	PIPE-12	J1R127	9/5/2012	35000	D	320	53000	D	210	21000	D	350	17000	D	190	75000	D	240	7700	D	540	160000	D	640	32000	D	260

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene
20	Area	Number	Date	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
21	PIPE-3	J1R118/J1R128	9/5/2012	890	1145	575	365	1300	175	3300	765
22	PIPE-1	J1R116	9/5/2012	160	210	120	73	210	5.5	460	44
23	PIPE-2	J1R117	9/5/2012	1600	2300	1200	800	3100	250	9100	2500
24	PIPE-4	J1R119	9/5/2012	15000	21000	5000	7600	25000	2700	55000	7100
25	PIPE-5	J1R120	9/5/2012	9400	11000	5300	4100	14000	1700	42000	8400
26	PIPE-6	J1R121	9/5/2012	430	600	300	230	790	5.5	1500	190
27	PIPE 7	J1R122	9/5/2012	7500	12000	4100	3300	15000	1500	38000	8100
28	PIPE-8	J1R123	9/5/2012	9500	10000	5700	4000	10000	1800	26000	5200
29	PIPE-9	J1R124	9/5/2012	180	180	170	63	160	5.5	360	54
30	PIPE-10	J1R125	9/5/2012	27	34	26	12	31	14	80	11
31	PIPE-11	J1R126	9/5/2012	24	35	18	8.7	30	5.5	68	14
32	PIPE-12	J1R127	9/5/2012	35000	53000	21000	17000	75000	7700	160000	32000

33 **Statistical Computations**

34		Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene
35	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), 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), use MTCAStat lognormal distribution.
36	N	12	12	12	12	12	12	12	12
37	% < Detection limit	0%	0%	0%	0%	0%	33%	0%	0%
38	Mean	6643	9292	3626	3129	12052	1322	27989	5365
39	Standard deviation	10265	15333	5936	4989	21405	2217	45929	9041
40	95% UCL on mean	2322038	3517393	472192	1462279	9134343	2375	25740291	10259069
41	Maximum value	35000	53000	21000	17000	75000	7700	160000	32000
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)**	15 GW & River Protection	15 GW & River Protection	48000 GW Protection	15 GW & River Protection	100 River Protection	30 GW & River Protection	18000 River Protection	64000 GW Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	YES	YES	YES	YES	YES	YES	YES	YES
45	> 10% above Cleanup Limit?	YES	YES	NO	YES	YES	YES	YES	NO
46	Any sample > 2X Cleanup Limit?	YES	YES	NO	YES	YES	YES	YES	NO
47	**WAC 173-340 Compliance?**	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie

Rev. No. 0
Date 02/14/13
Sheet No. 9 of 41

1 **100-D-50:6 Subsite Statistical Calculations**

2 **Verification Data - Pipeline Excavation (PIPE)**

	Sample Area	Sample Number	Sample Date	Indeno(1,2,3-cd)pyrene ug/kg	Q	PQL	Phenanthrene ug/kg	Q	PQL	Pyrene ug/kg	Q	PQL
3–4												
5	PIPE-3	J1R118	9/5/2012	400		12	2000		12	2200		12
6	Replicate of J1R118	J1R128	9/5/2012	570		12	4600		12	4000		12
7	PIPE-1	J1R116	9/5/2012	120		12	260	N	12	420	N	12
8	PIPE-2	J1R117	9/5/2012	770	D	62	12000	D	62	8000	D	62
9	PIPE-4	J1R119	9/5/2012	8500	D	120	35000	D	120	55000	D	120
10	PIPE-5	J1R120	9/5/2012	5800	D	120	43000	D	120	39000	D	120
11	PIPE-6	J1R121	9/5/2012	210		12	930		12	1500		12
12	PIPE 7	J1R122	9/5/2012	2900	DX	120	40000	D	120	34000	D	120
13	PIPE-8	J1R123	9/5/2012	6000	D	59	22000	D	59	25000	D	59
14	PIPE-9	J1R124	9/5/2012	97	X	12	200		12	340		12
15	PIPE-10	J1R125	9/5/2012	12	U	12	48		12	73		12
16	PIPE-11	J1R126	9/5/2012	14	J	12	52		12	66		12
17	PIPE-12	J1R127	9/5/2012	16000	D	590	140000	D	590	150000	D	590

18 **Statistical Computation Input Data**

	Sample Area	Sample Number	Sample Date	Indeno(1,2,3-cd)pyrene ug/kg			Phenanthrene ug/kg			Pyrene ug/kg		
19–20												
21	PIPE-3	J1R118/J1R128	9/5/2012	485			3300			3100		
22	PIPE-1	J1R116	9/5/2012	120			260			420		
23	PIPE-2	J1R117	9/5/2012	770			12000			8000		
24	PIPE-4	J1R119	9/5/2012	8500			35000			55000		
25	PIPE-5	J1R120	9/5/2012	5800			43000			39000		
26	PIPE-6	J1R121	9/5/2012	210			930			1500		
27	PIPE 7	J1R122	9/5/2012	2900			40000			34000		
28	PIPE-8	J1R123	9/5/2012	6000			22000			25000		
29	PIPE-9	J1R124	9/5/2012	97			200			340		
30	PIPE-10	J1R125	9/5/2012	6.0			48			73		
31	PIPE-11	J1R126	9/5/2012	14			52			66		
32	PIPE-12	J1R127	9/5/2012	16000			140000			150000		

33 **Statistical Computations**

		Indeno(1,2,3-cd)pyrene			Phenanthrene			Pyrene		
34										
35	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.		
36	N	12			12			12		
37	% < Detection limit	8%			0%			0%		
38	Mean	3409			24733			26375		
39	Standard deviation	4934			39970			43228		
40	95% UCL on mean	2014140			61244670			24104059		
41	Maximum value	16000			140000			150000		
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)**	15	GW & River Protection		240000	GW Protection		48000	GW Protection	
43	**WAC 173-340 3-PART TEST**									
44	95% UCL > Cleanup Limit?	YES			YES			YES		
45	> 10% above Cleanup Limit?	YES			NO			YES		
46	Any sample > 2X Cleanup Limit?	YES			NO			YES		
47	**WAC 173-340 Compliance?**	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.			A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.			A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.		

48 Qualifiers are defined on page 3.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 10 of 41

1 **100-D-50:6 Subsite Maximum Calculations**
2 **Verification Data - Pipeline Excavation (PIPE)**

3	Sample	Sample	Sample	Boron			Cadmium			Hexavalent Chromium			Molybdenum			Acenaphthylene			Naphthalene		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	PIPE-3	J1R118	9/5/2012	1.2	B	0.84	0.055	B	0.035	0.155	U	0.155	0.26	B	0.22	36	JX	8.6	12	U	12
6	Replicate of J1R118	J1R128	9/5/2012	1.1	B	1.0	0.042	U	0.042	0.155	U	0.155	0.27	U	0.27	83	JX	9.3	12	U	12
7	PIPE-1	J1R116	9/5/2012	0.98	B	0.93	0.039	U	0.039	0.155	U	0.155	0.33	B	0.25	8.8	U	8.8	12	U	12
8	PIPE-2	J1R117	9/5/2012	4.1		0.88	0.037	U	0.037	1.32		0.155	0.76	B	0.23	46	UD	46	62	UD	62
9	PIPE-4	J1R119	9/5/2012	0.95	U	0.95	0.057	B	0.040	0.155	U	0.155	0.25	U	0.25	89	UD	89	120	UD	120
10	PIPE-5	J1R120	9/5/2012	0.91	U	0.91	0.051	B	0.038	0.155	U	0.155	0.24	U	0.24	200	JDX	90	9700	D	120
11	PIPE-6	J1R121	9/5/2012	0.95	U	0.95	0.040	U	0.040	0.155	U	0.155	0.25	U	0.25	8.8	U	8.8	12	U	12
12	PIPE 7	J1R122	9/5/2012	1.4	B	0.97	0.041	U	0.041	0.155	U	0.155	0.26	U	0.26	92	UD	92	120	UD	120
13	PIPE-8	J1R123	9/5/2012	0.96	U	0.96	0.040	U	0.040	0.155	U	0.155	0.25	U	0.25	220	JDX	44	3600	D	59
14	PIPE-9	J1R124	9/5/2012	1.0	U	1.0	0.042	U	0.042	0.155	U	0.155	0.27	U	0.27	9.1	U	9.1	12	U	12
15	PIPE-10	J1R125	9/5/2012	0.91	U	0.91	0.038	U	0.038	0.155	U	0.155	0.24	U	0.24	9.0	U	9.0	12	U	12
16	PIPE-11	J1R126	9/5/2012	0.98	U	0.98	0.041	U	0.041	0.155	U	0.155	0.26	U	0.26	8.9	U	8.9	12	U	12
17	PIPE-12	J1R127	9/5/2012	0.91	B	0.89	0.038	B	0.037	0.155	U	0.155	0.24	U	0.24	440	UD	440	590	UD	590

18
19 **Statistical Computations**

20		Boron	Cadmium	Hexavalent Chromium	Molybdenum	Acenaphthylene	Naphthalene
21	% < Detection limit	58%	67%	92%	75%	75%	83%
22	Maximum value	4.1	0.057	1.32	0.76	220	9700
23	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	320 GW Protection	0.81 GW & River Protection	2 River Protection	8 GW Protection	96000 ug/kg GW Protection	16000 ug/kg GW Protection
24	**WAC 173-340 3-PART TEST**						
25	Maximum > Cleanup Limit?	NO	NA	NO	NO	NO	NO
26	> 10% above Cleanup Limit?	NO	NA	NO	NO	NO	NO
27	Any sample > 2X Cleanup Limit?	NO	NA	NO	NO	NO	NO
28	**3-Part Test Compliance?**	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.	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.

29 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 11 of 41

1 **100-D-50:6 Subsite Statistical Calculations**

2 **Verification Data - Clearwell Excavation (CLEAR)**

3	Sample	Sample	Sample	Antimony			Arsenic			Barium			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
5	CLEAR-6	J1R1L4	9/5/2012	0.78	J	0.38	1.6		0.65	62.7		0.075	7.4		0.057	9.9		0.099	18.9		0.21	3.0		0.27	302		0.099
6	Duplicate of J1R1L4	J1R1M1	9/5/2012	0.72	J	0.37	1.6		0.65	60.0		0.075	6.6		0.057	10.3		0.098	18.3		0.21	3.2		0.26	323		0.098
7	CLEAR-1	J1R1K9	9/5/2012	0.44	BJ	0.34	3.3		0.59	57.8		0.068	11.3		0.052	5.6		0.090	13.1		0.19	3.3		0.24	251		0.090
8	CLEAR-2	J1R1L0	9/5/2012	0.56	BJ	0.38	3.2		0.65	56.8		0.075	11.3		0.057	6.5		0.099	15.6		0.21	3.6		0.27	272		0.099
9	CLEAR-3	J1R1L1	9/5/2012	0.38	UJ	0.38	2.7		0.66	66.1		0.076	9.5		0.058	7.0		0.099	15.3		0.22	4.9		0.27	294		0.099
10	CLEAR-4	J1R1L2	9/5/2012	0.52	BJ	0.36	2.8		0.63	58.6		0.073	11.1		0.056	7.9		0.096	16.7		0.21	5.5		0.26	306		0.096
11	CLEAR-5	J1R1L3	9/5/2012	0.63	J	0.38	2.1		0.66	64.2		0.076	21.0		0.058	9.2		0.10	18.6		0.22	3.6		0.27	286		0.10
12	CLEAR-7	J1R1L5	9/5/2012	0.51	BJ	0.38	2.1		0.66	65.4		0.076	7.7		0.058	10.2		0.10	18.9		0.22	7.5		0.27	368		0.10
13	CLEAR-8	J1R1L6	9/5/2012	0.67	J	0.37	1.2		0.65	61.4		0.074	6.5		0.057	9.4		0.098	16.2		0.21	2.6		0.26	297		0.098
14	CLEAR-9	J1R1L7	9/5/2012	0.55	BJ	0.38	3.4		0.66	82.6		0.076	17.6		0.058	8.1		0.10	19.0		0.22	8.0		0.27	321		0.10
15	CLEAR-10	J1R1L8	9/5/2012	0.55	BJ	0.36	1.2		0.62	65.4		0.072	7.4		0.055	11.3		0.47	19.4		1.0	3.6		1.3	318		0.094
16	CLEAR-11	J1R1L9	9/5/2012	0.46	BJ	0.35	2.4		0.61	55.0		0.070	9.8		0.053	8.0		0.092	16.5		0.20	4.0		0.25	296		0.092
17	CLEAR-12	J1R1M0	9/5/2012	0.46	BJ	0.36	2.3		0.63	59.4		0.073	8.6		0.056	8.5		0.096	18.6		0.21	9.6		0.26	323		0.096

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Antimony	Arsenic	Barium	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
21	CLEAR-6	J1R1L4/J1R1M1	9/5/2012	0.75	1.6	61.4	7.0	10.1	18.6	3.1	313
22	CLEAR-1	J1R1K9	9/5/2012	0.44	3.3	57.8	11.3	5.6	13.1	3.3	251
23	CLEAR-2	J1R1L0	9/5/2012	0.56	3.2	56.8	11.3	6.5	15.6	3.6	272
24	CLEAR-3	J1R1L1	9/5/2012	0.19	2.7	66.1	9.5	7.0	15.3	4.9	294
25	CLEAR-4	J1R1L2	9/5/2012	0.52	2.8	58.6	11.1	7.9	16.7	5.5	306
26	CLEAR-5	J1R1L3	9/5/2012	0.63	2.1	64.2	21.0	9.2	18.6	3.6	286
27	CLEAR-7	J1R1L5	9/5/2012	0.51	2.1	65.4	7.7	10.2	18.9	7.5	368
28	CLEAR-8	J1R1L6	9/5/2012	0.67	1.2	61.4	6.5	9.4	16.2	2.6	297
29	CLEAR-9	J1R1L7	9/5/2012	0.55	3.4	82.6	17.6	8.1	19.0	8.0	321
30	CLEAR-10	J1R1L8	9/5/2012	0.55	1.2	65.4	7.4	11.3	19.4	3.6	318
31	CLEAR-11	J1R1L9	9/5/2012	0.46	2.4	55.0	9.8	8.0	16.5	4.0	296
32	CLEAR-12	J1R1M0	9/5/2012	0.46	2.3	59.4	8.6	8.5	18.6	9.6	323

33 **Statistical Computations**

34		Antimony	Arsenic	Barium	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), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat normal 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), use MTCAStat lognormal distribution.
36	N	12	12	12	12	12	12	12	12
37	% < Detection limit	8%	0%	0%	0%	0%	0%	0%	0%
38	Mean	0.52	2.4	62.8	10.7	8.5	17.2	4.9	304
39	Standard deviation	0.14	0.76	7.2	4.4	1.7	1.9	2.3	29.2
40	95% UCL on mean	0.59	3.0	66.3	13.3	9.5	18.1	6.4	320
41	Maximum value	0.78	3.4	82.6	21.0	11.3	19.4	9.6	368
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	5 GW & River Protection	20 DE, GW & River Protection	200 GW 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?	NA	NA	NA	NO	NA	NA	NA	NA
45	> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
46	Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
47	**WAC 173-340 Compliance?**	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	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.	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie JS

Rev. No. 0
Date 02/14/13
Sheet No. 12 of 41

1 **100-D-50:6 Subsite Statistical Calculations**

2 **Verification Data - Clearwell Excavation (CLEAR)**

3	Sample	Sample	Sample	Mercury			Nickel			Vanadium			Zinc			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene		
4	Area	Number	Date	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	ug/kg	Q	PQL
5	CLEAR-6	J1R1L4	9/5/2012	0.0057	U	0.0057	10.0		0.12	68.4		0.093	45.3	X	0.39	3.6	JX	3.1	15		3.3	14	J	6.6	15		4.3
6	Duplicate of J1R1L4	J1R1M1	9/5/2012	0.0061	U	0.0061	9.8		0.12	68.4		0.092	45.9	X	0.39	21		2.9	31		3.1	24		6.2	30		4.1
7	CLEAR-1	J1R1K9	9/5/2012	0.0053	B	0.0049	11.9		0.11	30.5		0.084	30.9	X	0.36	2.9	UN	2.9	290	N	3.1	190	N	6.2	220	N	4.1
8	CLEAR-2	J1R1L0	9/5/2012	0.0048	U	0.0048	14.1		0.12	42.5		0.093	34.7	X	0.39	3.0	U	3.0	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
9	CLEAR-3	J1R1L1	9/5/2012	0.0098	B	0.0050	10.6		0.12	47.5		0.094	40.2	X	0.40	2.8	U	2.8	10	J	3.0	8.0	J	6.0	9.9	J	3.9
10	CLEAR-4	J1R1L2	9/5/2012	0.013	B	0.0052	11.2		0.12	50.1		0.090	41.1	X	0.38	92		2.9	210		3.0	160		6.1	180		4.0
11	CLEAR-5	J1R1L3	9/5/2012	0.028		0.0052	11.2		0.12	60.1		0.094	40.8	X	0.40	240		2.9	600		3.0	350		6.0	520		3.9
12	CLEAR-7	J1R1L5	9/5/2012	0.046		0.0060	12.1		0.12	66.3		0.094	49.9	X	0.40	25		3.1	80		3.2	53		6.4	61		4.2
13	CLEAR-8	J1R1L6	9/5/2012	0.0054	U	0.0054	9.8		0.12	66.6		0.092	45.5	X	0.39	3.0	U	3.0	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
14	CLEAR-9	J1R1L7	9/5/2012	0.014	B	0.0061	14.7		0.12	51.7		0.094	48.7	X	0.40	1900		2.9	3000		3.0	2500		6.1	2500		4.0
15	CLEAR-10	J1R1L8	9/5/2012	0.0050	U	0.0050	11.4		0.12	85.5		0.44	45.9	X	0.37	1600		2.9	2200		3.0	1700		6.1	1500		4.0
16	CLEAR-11	J1R1L9	9/5/2012	0.015	B	0.0057	10.7		0.11	52.6		0.087	40.0	X	0.37	1300		3.1	1800		3.3	1400		6.6	1400		4.3
17	CLEAR-12	J1R1M0	9/5/2012	0.0068	U	0.0068	10.4		0.12	59.7		0.090	47.3	X	0.38	140		3.0	410		3.2	300		6.4	380		4.2

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Mercury	Nickel	Vanadium	Zinc	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg
21	CLEAR-6	J1R1L4/J1R1M1	9/5/2012	0.0030	9.9	68.4	45.6	12	23	19	23
22	CLEAR-1	J1R1K9	9/5/2012	0.0053	11.9	30.5	30.9	1.5	290	190	220
23	CLEAR-2	J1R1L0	9/5/2012	0.0024	14.1	42.5	34.7	1.5	1.6	3.2	2.1
24	CLEAR-3	J1R1L1	9/5/2012	0.0098	10.6	47.5	40.2	1.4	10	8.0	10
25	CLEAR-4	J1R1L2	9/5/2012	0.013	11.2	50.1	41.1	92	210	160	180
26	CLEAR-5	J1R1L3	9/5/2012	0.028	11.2	60.1	40.8	240	600	350	520
27	CLEAR-7	J1R1L5	9/5/2012	0.046	12.1	66.3	49.9	25	80	53	61
28	CLEAR-8	J1R1L6	9/5/2012	0.0027	9.8	66.6	45.5	1.5	1.6	3.2	2.1
29	CLEAR-9	J1R1L7	9/5/2012	0.014	14.7	51.7	48.7	1900	3000	2500	2500
30	CLEAR-10	J1R1L8	9/5/2012	0.0025	11.4	85.5	45.9	1600	2200	1700	1500
31	CLEAR-11	J1R1L9	9/5/2012	0.015	10.7	52.6	40.0	1300	1800	1400	1400
32	CLEAR-12	J1R1M0	9/5/2012	0.0034	10.4	59.7	47.3	140	410	300	380

33 **Statistical Computations**

34		Mercury	Nickel	Vanadium	Zinc	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
35	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), 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
37	% < Detection limit	42%	0%	0%	0%	33%	17%	17%	17%
38	Mean	0.012	11.5	56.8	42.6	443	719	557	566
39	Standard deviation	0.013	1.5	14.3	5.7	713	1024	834	804
40	95% UCL on mean	0.031	12.3	66.4	46.0	1065550	717488	109357	212517
41	Maximum value	0.046	14.7	85.5	49.9	1900	3000	2500	2500
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	0.33 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	240000 ug/kg GW Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	NA	NA	NO	NA	YES	YES	YES	YES
45	> 10% above Cleanup Limit?	NA	NA	NO	NA	NO	YES	YES	YES
46	Any sample > 2X Cleanup Limit?	NA	NA	NO	NA	NO	YES	YES	YES
47	**WAC 173-340 Compliance?**	Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (67.8mg/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.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 13 of 41

1 **100-D-50:6 Subsite Statistical Calculations**
2 **Verification Data - Clearwell Excavation (CLEAR)**

3	Sample	Sample	Sample	Benzo(ghi)perylene			Benzo(k)fluoranthene			Chrysene			Dibenz(a,h)anthracene			Fluoranthene			Fluorene			Indeno(1,2,3-cd)pyrene			Phenanthrene		
4	Area	Number	Date	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
5	CLEAR-6	J1R1L4	9/5/2012	11	JX	7.4	5.8	J	4.0	13	J	5.0	11	U	11	33	J	13	5.4	U	5.4	12	U	12	16	J	12
6	Duplicate of J1R1L4	J1R1M1	9/5/2012	18	JX	7.0	11	J	3.8	32	J	4.7	11	U	11	69		13	8.0	J	5.1	15	J	12	48		12
7	CLEAR-1	J1R1K9	9/5/2012	110	N	7.0	73	NX	3.8	350	N	4.7	29	NX	11	630	N	13	160	N	5.1	89	N	12	610	N	12
8	CLEAR-2	J1R1L0	9/5/2012	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13	5.3	U	5.3	12	U	12	12	U	12
9	CLEAR-3	J1R1L1	9/5/2012	9.1	JX	6.7	3.7	U	3.7	12	J	4.5	10	U	10	18	J	12	4.9	U	4.9	11	U	11	11	U	11
10	CLEAR-4	J1R1L2	9/5/2012	120		6.9	66		3.8	190		4.6	23	JX	11	360		12	52		5.0	110		11	200		11
11	CLEAR-5	J1R1L3	9/5/2012	250		6.8	170		3.7	550		4.5	69	X	10	960		12	140		5.0	210		11	520		11
12	CLEAR-7	J1R1L5	9/5/2012	33		7.2	24		3.9	62		4.8	11	U	11	140		13	17	J	5.3	27	J	12	52		12
13	CLEAR-8	J1R1L6	9/5/2012	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13	5.3	U	5.3	12	U	12	12	U	12
14	CLEAR-9	J1R1L7	9/5/2012	1600		6.9	930		3.8	2400	X	4.6	500	X	10	6200		12	1100		5.0	690	X	11	5000		11
15	CLEAR-10	J1R1L8	9/5/2012	910		6.8	730		3.7	2000		4.6	320	X	10	4800		12	840		5.0	830		11	4300		11
16	CLEAR-11	J1R1L9	9/5/2012	760		7.4	600		4.0	1500	XJ	5.0	250	X	11	3900		13	860		5.4	760		12	3600		12
17	CLEAR-12	J1R1M0	9/5/2012	210		7.2	140		3.9	400		4.8	11	U	11	750		13	74	X	5.3	180		12	370		12

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Phenanthrene
20	Area	Number	Date	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
21	CLEAR-6	J1R1L4/J1R1M1	9/5/2012	15	8.4	23	5.5	51	5.4	11	32
22	CLEAR-1	J1R1K9	9/5/2012	110	73	350	29	630	160	89	610
23	CLEAR-2	J1R1L0	9/5/2012	3.6	2.0	2.4	5.5	6.5	2.7	6.0	6.0
24	CLEAR-3	J1R1L1	9/5/2012	9.1	1.9	12	5.0	18	2.5	5.5	5.5
25	CLEAR-4	J1R1L2	9/5/2012	120	66	190	23	360	52	110	200
26	CLEAR-5	J1R1L3	9/5/2012	250	170	550	69	960	140	210	520
27	CLEAR-7	J1R1L5	9/5/2012	33	24	62	5.5	140	17	27	52
28	CLEAR-8	J1R1L6	9/5/2012	3.6	2.0	2.4	5.5	6.5	2.7	6.0	6.0
29	CLEAR-9	J1R1L7	9/5/2012	1600	930	2400	500	6200	1100	690	5000
30	CLEAR-10	J1R1L8	9/5/2012	910	730	2000	320	4800	840	830	4300
31	CLEAR-11	J1R1L9	9/5/2012	760	600	1500	250	3900	860	760	3600
32	CLEAR-12	J1R1M0	9/5/2012	210	140	400	5.5	750	74	180	370

33 **Statistical Computations**

34		Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Phenanthrene
35	95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	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
37	% < Detection limit	17%	25%	17%	50%	17%	25%	25%	25%
38	Mean	335	229	624	102	1485	271	244	1225
39	Standard deviation	500	329	851	164	2180	407	320	1889
40	95% UCL on mean	22104	38826	234358	180	476248	42445	8385	600328
41	Maximum value	1600	930	2400	500	6200	1100	830	5000
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)**	48000 GW Protection	15 GW & River Protection	100 River Protection	30 GW & River Protection	18000 River Protection	64000 GW Protection	15 GW & River Protection	240000 GW Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	NO	YES	YES	YES	YES	NO	YES	YES
45	> 10% above Cleanup Limit?	NO	YES	YES	YES	NO	NO	YES	NO
46	Any sample > 2X Cleanup Limit?	NO	YES	YES	YES	NO	NO	YES	NO
47	**WAC 173-340 Compliance?**	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.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	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.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie

Rev. No. 0
Date 02/14/13
Sheet No. 14 of 41

1 **100-D-50:6 Subsite Statistical Calculations**
2 **Verification Data - Clearwell Excavation (CLEAR)**

3	Sample	Sample	Sample	Pyrene		
4	Area	Number	Date	ug/kg	Q	PQL
5	CLEAR-6	J1R1L4	9/5/2012	30	J	12
6	Duplicate of J1R1L4	J1R1M1	9/5/2012	65		12
7	CLEAR-1	J1R1K9	9/5/2012	620	N	12
8	CLEAR-2	J1R1L0	9/5/2012	12	U	12
9	CLEAR-3	J1R1L1	9/5/2012	16	J	11
10	CLEAR-4	J1R1L2	9/5/2012	390		11
11	CLEAR-5	J1R1L3	9/5/2012	960		11
12	CLEAR-7	J1R1L5	9/5/2012	150		12
13	CLEAR-8	J1R1L6	9/5/2012	12	U	12
14	CLEAR-9	J1R1L7	9/5/2012	5100		11
15	CLEAR-10	J1R1L8	9/5/2012	5100		11
16	CLEAR-11	J1R1L9	9/5/2012	3900		12
17	CLEAR-12	J1R1M0	9/5/2012	800		12

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Pyrene
20	Area	Number	Date	ug/kg
21	CLEAR-6	J1R1L4/J1R1M1	9/5/2012	48
22	CLEAR-1	J1R1K9	9/5/2012	620
23	CLEAR-2	J1R1L0	9/5/2012	6.0
24	CLEAR-3	J1R1L1	9/5/2012	16
25	CLEAR-4	J1R1L2	9/5/2012	390
26	CLEAR-5	J1R1L3	9/5/2012	960
27	CLEAR-7	J1R1L5	9/5/2012	150
28	CLEAR-8	J1R1L6	9/5/2012	6.0
29	CLEAR-9	J1R1L7	9/5/2012	5100
30	CLEAR-10	J1R1L8	9/5/2012	5100
31	CLEAR-11	J1R1L9	9/5/2012	3900
32	CLEAR-12	J1R1M0	9/5/2012	800

33 **Statistical Computations**

34		Pyrene
35	95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
36	N	12
37	% < Detection limit	17%
38	Mean	1425
39	Standard deviation	2023
40	95% UCL on mean	536855
41	Maximum value	5100
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)**	48000 GW Protection
43	**WAC 173-340 3-PART TEST**	
44	95% UCL > Cleanup Limit?	YES
45	> 10% above Cleanup Limit?	NO
46	Any sample > 2X Cleanup Limit?	NO
47	**WAC 173-340 Compliance?**	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

48 Qualifiers are defined on page 3.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie

Rev. No. 0
Date 02/14/13
Sheet No. 15 of 41

1 **100-D-50:6 Subsite Maximum Calculations**
2 **Verification Data - Clearwell Excavation (CLEAR)**

3	Sample	Sample	Sample	Beryllium			Boron			Cadmium			Molybdenum			Acenaphthene			Acenaphthylene			Naphthalene			Aroclor-1254		
4	Area	Number	Date	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	ug/kg	Q	PQL
5	CLEAR-6	J1R1L4	9/5/2012	0.033	U	0.033	0.97	U	0.97	0.041	U	0.041	0.26	U	0.26	10	U	10	9.2	U	9.2	12	U	12	2.5	U	2.5
6	Duplicate of J1R1L4	J1R1M1	9/5/2012	0.032	U	0.032	0.96	U	0.96	0.040	U	0.040	0.26	U	0.26	9.7	U	9.7	8.7	U	8.7	12	U	12	2.5	U	2.5
7	CLEAR-1	J1R1K9	9/5/2012	0.12	B	0.030	0.88	U	0.88	0.049	B	0.037	0.30	B	0.23	150	NX	9.7	8.7	U	8.7	12	U	12	2.5	U	2.5
8	CLEAR-2	J1R1L0	9/5/2012	0.074	B	0.033	0.97	U	0.97	0.040	U	0.040	0.31	B	0.26	10	U	10	9.0	U	9.0	12	U	12	2.6	U	2.6
9	CLEAR-3	J1R1L1	9/5/2012	0.038	B	0.033	0.98	U	0.98	0.046	B	0.041	0.26	U	0.26	9.3	U	9.3	8.4	U	8.4	11	U	11	2.5	U	2.5
10	CLEAR-4	J1R1L2	9/5/2012	0.032	U	0.032	0.94	U	0.94	0.039	B	0.039	0.25	U	0.25	9.6	U	9.6	8.6	U	8.6	11	U	11	2.6	U	2.6
11	CLEAR-5	J1R1L3	9/5/2012	0.033	U	0.033	0.98	U	0.98	0.043	B	0.041	0.26	U	0.26	160	X	9.4	8.4	U	8.4	11	U	11	2.5	U	2.5
12	CLEAR-7	J1R1L5	9/5/2012	0.033	U	0.033	0.98	U	0.98	0.041	U	0.041	0.26	U	0.26	10	U	10	9.0	U	9.0	12	U	12	2.5	U	2.5
13	CLEAR-8	J1R1L6	9/5/2012	0.032	U	0.032	0.96	U	0.96	0.040	U	0.040	0.25	U	0.25	10	U	10	9.0	U	9.0	12	U	12	2.5	U	2.5
14	CLEAR-9	J1R1L7	9/5/2012	0.11	B	0.033	1.3	B	0.98	0.055	B	0.041	0.26	U	0.26	380	X	9.5	53	JX	8.6	11	U	11	20		2.6
15	CLEAR-10	J1R1L8	9/5/2012	0.031	U	0.031	0.92	U	0.92	0.039	U	0.039	0.24	U	0.24	330	X	9.5	63	JX	8.6	11	U	11	2.5	U	2.5
16	CLEAR-11	J1R1L9	9/5/2012	0.030	U	0.030	0.90	U	0.90	0.038	U	0.038	0.24	U	0.24	380	X	10	26	JX	9.2	780		12	2.5	U	2.5
17	CLEAR-12	J1R1M0	9/5/2012	0.032	U	0.032	1.0	B	0.94	0.039	U	0.039	0.25	U	0.25	10	U	10	9.0	U	9.0	12	U	12	2.5	U	2.5

18
19 **Statistical Computations**

20		Beryllium	Boron	Cadmium	Molybdenum	Acenaphthene	Acenaphthylene	Naphthalene	Aroclor-1254
21	% < Detection limit	67%	83%	58%	83%	58%	75%	92%	92%
22	Maximum value	0.12	1.3	0.055	0.31	380	63	780	20
23	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	8 GW Protection	96000 ug/kg GW Protection	96000 ug/kg GW Protection	16000 ug/kg GW Protection	17 ug/kg GW & River Protection
24	**WAC 173-340 3-PART TEST**								
25	Maximum > Cleanup Limit?	NA	NO	NA	NO	NO	NO	NO	YES
26	> 10% above Cleanup Limit?	NA	NO	NA	NO	NO	NO	NO	NO
27	Any sample > 2X Cleanup Limit?	NA	NO	NA	NO	NO	NO	NO	NO
28	**3-Part Test Compliance?**	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.	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.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

29 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern NS	Date	02/14/13
Project	100-D Field Remediation	Job No.	14655
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations		

Calc. No.	0100D-CA-V0490	Rev. No.	0
Checked	J. D. Skoglie JD	Date	02/14/13
		Sheet No.	16 of 41

1 **100-D-50:6 Subsite Statistical Calculations**

2 **Verification Data - Overburden (OB)**

3	Sample	Sample	Sample	Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium			Chromium			Cobalt		
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
5	OB-9	J1R137	9/6/2012	0.36	U	0.36	2.7		0.62	60.0	X	0.071	0.11	B	0.031	0.92	U	0.92	0.060	B	0.039	10.9	X	0.055	7.6	X	0.094
6	Duplicate of J1R137	J1R141	9/6/2012	0.50	B	0.37	2.7		0.65	60.7	X	0.075	0.12	B	0.033	1.0	B	0.97	0.098	B	0.040	11.4	X	0.057	8.0	X	0.099
7	OB-1	J1R129	9/6/2012	0.63		0.38	2.2		0.67	61.4	X	0.077	0.084	BM	0.033	1.5	B	0.99	0.059	B	0.041	8.7	X	0.058	8.7	X	0.10
8	OB-2	J1R130	9/6/2012	0.49	B	0.36	3.0		0.63	63.9	X	0.073	0.12	B	0.032	0.94	U	0.94	0.071	B	0.039	11.3	X	0.055	7.4	X	0.096
9	OB-3	J1R131	9/6/2012	0.59		0.32	2.7		0.56	64.0	X	0.064	0.13	B	0.028	1.2	B	0.83	0.068	B	0.035	11.3	X	0.049	7.7	X	0.084
10	OB-4	J1R132	9/6/2012	0.49	B	0.34	2.4		0.59	69.8	X	0.068	0.10	B	0.030	1.2	B	0.88	0.077	B	0.037	10.3	X	0.052	8.4	X	0.090
11	OB-5	J1R133	9/6/2012	0.59		0.34	2.6		0.59	62.6	X	0.068	0.12	B	0.030	1.2	B	0.88	0.061	B	0.037	10.8	X	0.052	8.4	X	0.090
12	OB-6	J1R134	9/6/2012	0.40	B	0.36	2.3		0.63	61.7	X	0.073	0.089	B	0.032	0.94	U	0.94	0.058	B	0.039	9.2	X	0.056	9.1	X	0.096
13	OB-7	J1R135	9/6/2012	0.53	B	0.37	3.0		0.64	61.3	X	0.074	0.13	B	0.032	1.1	B	0.96	0.070	B	0.040	11.1	X	0.057	8.6	X	0.098
14	OB-8	J1R136	9/6/2012	0.56	B	0.38	2.3		0.66	56.8	X	0.076	0.10	B	0.033	1.0	B	0.97	0.076	B	0.041	11.9	X	0.058	8.0	X	0.099
15	OB-10	J1R138	9/6/2012	0.37	U	0.37	2.5		0.64	78.4	X	0.074	0.15	B	0.032	1.7	B	0.96	0.084	B	0.040	11.8	X	0.057	7.7	X	0.098
16	OB-11	J1R139	9/6/2012	0.55		0.35	2.3		0.61	58.3	X	0.070	0.090	B	0.030	1.0	B	0.90	0.075	B	0.038	10.6	X	0.053	8.2	X	0.092
17	OB-12	J1R140	9/6/2012	0.52	B	0.34	2.4		0.59	66.3	X	0.068	0.10	B	0.030	1.0	B	0.88	0.053	B	0.037	10.2	X	0.052	7.9	X	0.090

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
21	OB-9	J1R137/J1R141	9/6/2012	0.34	2.7	60.4	0.12	0.73	0.079	11.2	7.8
22	OB-1	J1R129	9/6/2012	0.63	2.2	61.4	0.084	1.5	0.059	8.7	8.7
23	OB-2	J1R130	9/6/2012	0.49	3.0	63.9	0.12	0.47	0.071	11.3	7.4
24	OB-3	J1R131	9/6/2012	0.59	2.7	64.0	0.13	1.2	0.068	11.3	7.7
25	OB-4	J1R132	9/6/2012	0.49	2.4	69.8	0.099	1.2	0.077	10.3	8.4
26	OB-5	J1R133	9/6/2012	0.59	2.6	62.6	0.12	1.2	0.061	10.8	8.4
27	OB-6	J1R134	9/6/2012	0.40	2.3	61.7	0.089	0.47	0.058	9.2	9.1
28	OB-7	J1R135	9/6/2012	0.53	3.0	61.3	0.13	1.1	0.070	11.1	8.6
29	OB-8	J1R136	9/6/2012	0.56	2.3	56.8	0.10	1.0	0.076	11.9	8.0
30	OB-10	J1R138	9/6/2012	0.19	2.5	78.4	0.15	1.7	0.084	11.8	7.7
31	OB-11	J1R139	9/6/2012	0.55	2.3	58.3	0.090	1.0	0.075	10.6	8.2
32	OB-12	J1R140	9/6/2012	0.52	2.4	66.3	0.10	1.0	0.053	10.2	7.9

33 **Statistical Computations**

34		Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
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), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat normal 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
37	% < Detection limit	8%	0%	0%	0%	17%	0%	0%	0%
38	Mean	0.49	2.5	63.7	0.11	1.0	0.069	10.7	8.2
39	Standard deviation	0.13	0.27	5.8	0.020	0.37	0.0096	1.0	0.50
40	95% UCL on mean	0.55	2.7	66.5	0.12	1.2	0.075	11.3	8.4
41	Maximum value	0.63	3.0	78.4	0.15	1.7	0.098	11.9	9.1
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	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
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NA
45	> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NA
46	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NA
47	**WAC 173-340 Compliance?**	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent 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.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie JDS

Rev. No. 0
Date 02/14/13
Sheet No. 17 of 41

1 **100-D-50:6 Subsite Statistical Calculations**
2 **Verification Data - Overburden (OB)**

3	Sample	Sample	Sample	Copper			Lead			Manganese			Mercury			Nickel			Vanadium			Zinc			Benzo(a)anthracene		
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	ug/kg	Q	PQL
5	OB-9	J1R137	9/6/2012	15.2		0.20	4.2		0.25	328	X	0.094	0.0054	U	0.0054	11.2	X	0.12	50.6		0.088	45.0	X	0.37	65		3.2
6	Duplicate of J1R137	J1R141	9/6/2012	16.1		0.21	4.3		0.27	322	X	0.099	0.0050	U	0.0050	11.0	X	0.12	54.0		0.093	46.6	X	0.39	9.2	J	3.2
7	OB-1	J1R129	9/6/2012	15.3		0.22	4.6		0.27	311	X	0.10	0.18		0.0053	12.5	X	0.12	61.0		0.095	46.2	X	0.40	3.2	U	3.2
8	OB-2	J1R130	9/6/2012	16.5		0.21	4.0		0.26	309	X	0.096	0.0050	U	0.0050	10.2	X	0.12	51.8		0.090	41.5	X	0.38	11	J	3.2
9	OB-3	J1R131	9/6/2012	15.9		0.18	5.1		0.23	312	X	0.084	0.0046	B	0.0046	11.7	X	0.10	54.8		0.079	44.3	X	0.34	3.2	U	3.2
10	OB-4	J1R132	9/6/2012	16.4		0.19	5.8		0.24	323	X	0.090	0.017		0.0055	12.3	X	0.11	58.5		0.084	47.5	X	0.36	3.2	U	3.2
11	OB-5	J1R133	9/6/2012	16.3		0.19	4.7		0.24	338	X	0.090	0.0067	B	0.0048	10.7	X	0.11	56.8		0.084	46.2	X	0.36	3.0	U	3.0
12	OB-6	J1R134	9/6/2012	16.7		0.21	3.8		0.26	337	X	0.096	0.0051	U	0.0051	11.5	X	0.12	61.5		0.090	47.5	X	0.38	3.1	U	3.1
13	OB-7	J1R135	9/6/2012	17.2		0.21	5.1		0.26	347	X	0.098	0.0052	B	0.0048	11.0	X	0.12	57.2		0.092	46.2	X	0.39	5.5	JX	3.1
14	OB-8	J1R136	9/6/2012	16.1		0.22	4.0		0.27	316	X	0.099	0.0048	U	0.0048	13.5	X	0.12	59.8		0.094	46.2	X	0.40	6000	D	16
15	OB-10	J1R138	9/6/2012	14.8		0.21	4.8		0.26	347	X	0.098	0.0057	U	0.0057	11.2	X	0.12	54.5		0.092	46.8	X	0.39	5.7	J	3.1
16	OB-11	J1R139	9/6/2012	16.4		0.20	4.5		0.25	331	X	0.092	0.0061	U	0.0061	11.3	X	0.11	59.5		0.087	46.4	X	0.37	3.2	U	3.2
17	OB-12	J1R140	9/6/2012	15.7		0.19	4.4		0.24	367	X	0.090	0.0060	B	0.0057	9.7	X	0.11	54.3		0.084	43.2	X	0.36	12	J	3.2

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Copper	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	Benzo(a)anthracene
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg
21	OB-9	J1R137/J1R141	9/6/2012	15.7	4.3	325	0.0026	11.1	52.3	45.8	37
22	OB-1	J1R129	9/6/2012	15.3	4.6	311	0.18	12.5	61.0	46.2	1.6
23	OB-2	J1R130	9/6/2012	16.5	4.0	309	0.0025	10.2	51.8	41.5	11
24	OB-3	J1R131	9/6/2012	15.9	5.1	312	0.0046	11.7	54.8	44.3	1.6
25	OB-4	J1R132	9/6/2012	16.4	5.8	323	0.017	12.3	58.5	47.5	1.6
26	OB-5	J1R133	9/6/2012	16.3	4.7	338	0.0067	10.7	56.8	46.2	1.5
27	OB-6	J1R134	9/6/2012	16.7	3.8	337	0.0026	11.5	61.5	47.5	1.6
28	OB-7	J1R135	9/6/2012	17.2	5.1	347	0.0052	11.0	57.2	46.2	5.5
29	OB-8	J1R136	9/6/2012	16.1	4.0	316	0.0024	13.5	59.8	46.2	6000
30	OB-10	J1R138	9/6/2012	14.8	4.8	347	0.0029	11.2	54.5	46.8	5.7
31	OB-11	J1R139	9/6/2012	16.4	4.5	331	0.0031	11.3	59.5	46.4	1.6
32	OB-12	J1R140	9/6/2012	15.7	4.4	367	0.0060	9.7	54.3	43.2	12

33 **Statistical Computations**

34		Copper	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	Benzo(a)anthracene
35	95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	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.
36	N	12	12	12	12	12	12	12	12
37	% < Detection limit	0%	0%	0%	50%	0%	0%	0%	50%
38	Mean	16.1	4.6	330	0.020	11.4	56.8	45.7	507
39	Standard deviation	0.65	0.57	17.7	0.051	1.0	3.3	1.8	1730
40	95% UCL on mean	16.4	4.9	340	0.044	12.0	58.6	46.5	1328
41	Maximum value	17.2	5.8	367	0.18	13.5	61.5	47.5	6000
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	22.0 River Protection	10.2 GW & River Protection	512 GW & River Protection	0.33 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	15 ug/kg GW & River Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	YES
45	> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	YES
46	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	YES
47	**WAC 173-340 Compliance?**	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set does not meet the 3-part test criteria when compared to the direct exposure RAG.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13
Project 100-D Field Remediation **Job No.** 14655
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Calc. No. 0100D-CA-V0490 **Rev. No.** 0
Checked J. D. Skoglie **Date** 02/14/13
Sheet No. 18 of 41

1 **100-D-50:6 Subsite Statistical Calculations**
2 **Verification Data - Overburden (OB)**

3	Sample	Sample	Sample	Benzo(b)fluoranthene			Chrysene			Fluoranthene			Pyrene		
4	Area	Number	Date	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	OB-9	J1R137	9/6/2012	43	X	4.2	47		4.8	120		13	110		12
6	Duplicate of J1R137	J1R141	9/6/2012	9.4	J	4.2	6.8	J	4.8	20	J	13	19	J	12
7	OB-1	J1R129	9/6/2012	7.9	J	4.1	5.3	J	4.8	13	U	13	12	U	12
8	OB-2	J1R130	9/6/2012	8.2	J	4.2	7.8	J	4.9	19	J	13	20	J	12
9	OB-3	J1R131	9/6/2012	4.2	U	4.2	5.0	JX	4.8	13	J	13	12	U	12
10	OB-4	J1R132	9/6/2012	5.7	J	4.2	4.8	U	4.8	13	U	13	12	U	12
11	OB-5	J1R133	9/6/2012	4.5	JX	3.9	4.5	U	4.5	12	U	12	11	U	11
12	OB-6	J1R134	9/6/2012	4.1	U	4.1	4.7	U	4.7	13	U	13	12	U	12
13	OB-7	J1R135	9/6/2012	7.5	JX	4.1	7.3	J	4.8	20	J	13	16	J	12
14	OB-8	J1R136	9/6/2012	3700	DX	21	5700	D	24	12000	D	64	12000	D	59
15	OB-10	J1R138	9/6/2012	5.6	JX	4.1	5.4	J	4.7	16	J	13	19	J	12
16	OB-11	J1R139	9/6/2012	8.8	J	4.2	7.3	J	4.8	19	J	13	17	J	12
17	OB-12	J1R140	9/6/2012	15		4.2	20	J	4.8	44		13	47		12

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Benzo(b)fluoranthene	Chrysene	Fluoranthene	Pyrene
20	Area	Number	Date	ug/kg	ug/kg	ug/kg	ug/kg
21	OB-9	J1R137/J1R141	9/6/2012	26	27	70	65
22	OB-1	J1R129	9/6/2012	7.9	5.3	6.5	6.0
23	OB-2	J1R130	9/6/2012	8.2	7.8	19	20
24	OB-3	J1R131	9/6/2012	2.1	5.0	13	6.0
25	OB-4	J1R132	9/6/2012	5.7	2.4	6.5	6.0
26	OB-5	J1R133	9/6/2012	4.5	2.3	6.0	5.5
27	OB-6	J1R134	9/6/2012	2.1	2.4	6.5	6.0
28	OB-7	J1R135	9/6/2012	7.5	7.3	20	16
29	OB-8	J1R136	9/6/2012	3700	5700	12000	12000
30	OB-10	J1R138	9/6/2012	5.6	5.4	16	19
31	OB-11	J1R139	9/6/2012	8.8	7.3	19	17
32	OB-12	J1R140	9/6/2012	15	20	44	47

33 **Statistical Computations**

34		Benzo(b)fluoranthene	Chrysene	Fluoranthene	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), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.
36	N	12	12	12	12
37	% < Detection limit	17%	25%	33%	42%
38	Mean	316	483	1019	1018
39	Standard deviation	1066	1643	3458	3459
40	95% UCL on mean	822	1263	2661	2660
41	Maximum value	3700	5700	12000	12000
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)**	15 GW & River Protection	100 River Protection	18000 River Protection	48000 GW Protection
43	**WAC 173-340 3-PART TEST**				
44	95% UCL > Cleanup Limit?	YES	YES	NO	NO
45	> 10% above Cleanup Limit?	YES	NO	NO	NO
46	Any sample > 2X Cleanup Limit?	YES	YES	NO	NO
47	**WAC 173-340 Compliance?**	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	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.

48 Qualifiers are defined on page 3.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 19 of 41

100-D-50:6 Subsite Maximum Calculations
Verification Data - Overburden (OB)

Sample Area	Sample Number	Sample Date	Molybdenum			Acenaphthene			Anthracene			Benzo(a)pyrene			Benzo(ghi)perylene			Benzo(k)fluoranthene			Dibenz(a,h)anthracene			Fluorene		
			mg/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
OB-9	J1R137	9/6/2012	0.24	U	0.24	10	U	10	27		3.0	40		6.4	37		7.2	15		3.9	11	U	11	16	J	5.3
Duplicate of J1R137	J1R141	9/6/2012	0.26	U	0.26	9.9	U	9.9	3.0	U	3.0	7.7	J	6.4	7.1	U	7.1	3.9	U	3.9	11	U	11	5.2	U	5.2
OB-1	J1R129	9/6/2012	0.40	B	0.26	9.9	U	9.9	3.0	U	3.0	6.3	U	6.3	7.1	U	7.1	3.9	U	3.9	11	U	11	5.2	U	5.2
OB-2	J1R130	9/6/2012	0.25	U	0.25	10	U	10	3.1	U	3.1	6.4	U	6.4	7.2	U	7.2	4.0	U	4.0	11	U	11	5.3	U	5.3
OB-3	J1R131	9/6/2012	0.22	U	0.22	9.9	U	9.9	3.0	U	3.0	6.4	U	6.4	7.1	U	7.1	3.9	U	3.9	11	U	11	5.2	U	5.2
OB-4	J1R132	9/6/2012	0.23	U	0.23	9.9	U	9.9	3.0	U	3.0	6.3	U	6.3	7.1	U	7.1	3.9	U	3.9	11	U	11	5.2	U	5.2
OB-5	J1R133	9/6/2012	0.23	U	0.23	9.4	U	9.4	2.9	U	2.9	6.0	U	6.0	6.7	U	6.7	3.7	U	3.7	10	U	10	4.9	U	4.9
OB-6	J1R134	9/6/2012	0.25	U	0.25	9.8	U	9.8	3.0	U	3.0	6.3	U	6.3	7.0	U	7.0	3.8	U	3.8	11	U	11	5.2	U	5.2
OB-7	J1R135	9/6/2012	0.25	U	0.25	9.8	U	9.8	3.0	U	3.0	6.3	U	6.3	7.1	U	7.1	3.9	U	3.9	11	U	11	5.2	U	5.2
OB-8	J1R136	9/6/2012	0.26	U	0.26	2200	DX	49	4200	D	15	2600	D	32	1600	D	36	1100	D	19	550	DX	54	2400	D	26
OB-10	J1R138	9/6/2012	0.25	U	0.25	9.7	U	9.7	3.0	U	3.0	6.2	U	6.2	7.0	U	7.0	3.8	U	3.8	11	U	11	5.1	U	5.1
OB-11	J1R139	9/6/2012	0.24	U	0.24	9.9	U	9.9	3.0	U	3.0	6.8	J	6.4	7.1	U	7.1	3.9	U	3.9	11	U	11	5.2	U	5.2
OB-12	J1R140	9/6/2012	0.23	U	0.23	9.9	U	9.9	3.0	U	3.0	10	J	6.4	7.2	U	7.2	6.4	J	3.9	11	U	11	5.3	U	5.3

Statistical Computations

	Molybdenum	Acenaphthene	Anthracene	Benzo(a)pyrene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Dibenz(a,h)anthracene	Fluorene
% < Detection limit	92%	92%	83%	67%	83%	75%	92%	83%
Maximum value	0.40	2200	4200	2600	1600	1100	550	2400
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	8 GW Protection	96000 ug/kg GW Protection	240000 ug/kg GW Protection	15 ug/kg GW & River Protection	48000 ug/kg GW & River Protection	15 ug/kg GW & River Protection	30 ug/kg GW & River Protection	64000 GW Protection
WAC 173-340 3-PART TEST								
Maximum > Cleanup Limit?	NO	NO	NO	YES	NO	YES	YES	NO
> 10% above Cleanup Limit?	NO	NO	NO	YES	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	NO	NO	NO	YES	NO	YES	YES	NO
3-Part Test 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.	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.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	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.

100-D-50:6 Subsite Maximum Calculations
Verification Data - Overburden (OB)

Sample Area	Sample Number	Sample Date	Indeno(1,2,3-cd)pyrene			Phenanthrene		
			ug/kg	Q	PQL	ug/kg	Q	PQL
OB-9	J1R137	9/6/2012	28	J	12	79		12
Duplicate of J1R137	J1R141	9/6/2012	12	U	12	13	J	12
OB-1	J1R129	9/6/2012	12	U	12	12	U	12
OB-2	J1R130	9/6/2012	12	U	12	12	U	12
OB-3	J1R131	9/6/2012	12	U	12	12	U	12
OB-4	J1R132	9/6/2012	12	U	12	12	U	12
OB-5	J1R133	9/6/2012	11	U	11	11	U	11
OB-6	J1R134	9/6/2012	12	U	12	12	U	12
OB-7	J1R135	9/6/2012	12	U	12	25	J	12
OB-8	J1R136	9/6/2012	1100	D	59	11000	D	59
OB-10	J1R138	9/6/2012	12	U	12	12	U	12
OB-11	J1R139	9/6/2012	12	U	12	12	U	12
OB-12	J1R140	9/6/2012	12	U	12	16	J	12

Statistical Computations

	Indeno(1,2,3-cd)pyrene	Phenanthrene
% < Detection limit	83%	67%
Maximum value	1100	11000
Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)	15 GW & River Protection	240000 GW Protection
WAC 173-340 3-PART TEST		
Maximum > Cleanup Limit?	YES	NO
> 10% above Cleanup Limit?	YES	NO
Any sample > 2X Cleanup Limit?	YES	NO
3-Part Test Compliance?	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.

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie JS

Rev. No. 0
Date 02/14/13
Sheet No. 20 of 41

1 **100-D-50:6 Subsite Statistical Calculations**
2 **Verification Data - Staging Pile Area (SPA)**

3 Sample	Sample	Sample	Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium			Chromium			Cobalt		
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
5 SPA-8	J1R149	9/6/2012	0.56	B	0.37	2.2		0.65	80.9		0.075	0.13	B	0.032	1.9	B	0.96	0.13	B	0.040	22.1		0.057	8.4	X	0.098
6 Duplicate of J1R149	J1R154	9/6/2012	0.37	B	0.35	2.3		0.60	81.3		0.069	0.16	B	0.030	1.9		0.89	0.14	B	0.037	21.2		0.053	7.9	X	0.091
7 SPA-1	J1R142	9/6/2012	0.65		0.34	2.6		0.59	77.9		0.068	0.15	B	0.029	1.7	B	0.87	0.11	B	0.037	12.5		0.052	7.4	X	0.089
8 SPA-2	J1R143	9/6/2012	0.55		0.35	2.4		0.60	79.8		0.070	0.12	B	0.030	1.6	B	0.90	0.089	B	0.038	10.8		0.053	8.1	X	0.092
9 SPA-3	J1R144	9/6/2012	0.54		0.33	2.2		0.57	67.9		0.066	0.085	B	0.029	1.7		0.85	0.096	B	0.036	12.6		0.050	7.9	X	0.087
10 SPA-4	J1R145	9/6/2012	0.48	B	0.34	2.7		0.58	94.2		0.067	0.19		0.029	2.4		0.87	0.12	B	0.036	12.3		0.051	7.9	X	0.088
11 SPA-5	J1R146	9/6/2012	0.55	B	0.37	2.4		0.64	83.2		0.074	0.14	B	0.032	2.0		0.96	0.11	B	0.040	11.3		0.057	7.6	X	0.098
12 SPA-6	J1R147	9/6/2012	0.49	B	0.36	2.4		0.63	78.6		0.072	0.14	B	0.031	2.1		0.93	0.11	B	0.039	12.5		0.055	7.7	X	0.095
13 SPA-7	J1R148	9/6/2012	0.46	B	0.34	2.4		0.59	76.3		0.068	0.16	B	0.030	1.6	B	0.88	0.099	B	0.037	12.6		0.052	7.3	X	0.090
14 SPA-9	J1R150	9/6/2012	0.37	B	0.33	3.1		0.57	83.1		0.065	0.18		0.028	1.6	B	0.84	0.086	B	0.035	12.5		0.050	7.9	X	0.086
15 SPA-10	J1R151	9/6/2012	0.44	B	0.33	2.4		0.57	81.1		0.066	0.18		0.028	1.7		0.85	0.10	B	0.035	11.6		0.050	7.2	X	0.086
16 SPA-11	J1R152	9/6/2012	0.59		0.36	2.3		0.63	88.9		0.073	0.18	B	0.032	2.5		0.94	0.14	B	0.039	12.1		0.056	8.4	X	0.096
17 SPA-12	J1R153	9/6/2012	0.46	B	0.38	2.4		0.65	80.0		0.075	0.18	B	0.033	1.5	B	0.97	0.094	B	0.041	11.8		0.057	7.8	X	0.099

18 **Statistical Computation Input Data**

19 Sample	Sample	Sample	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
20 Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
21 SPA-8	J1R149/J1R154	9/6/2012	0.47	2.3	81.1	0.15	1.9	0.14	21.7	8.2
22 SPA-1	J1R142	9/6/2012	0.65	2.6	77.9	0.15	1.7	0.11	12.5	7.4
23 SPA-2	J1R143	9/6/2012	0.55	2.4	79.8	0.12	1.6	0.089	10.8	8.1
24 SPA-3	J1R144	9/6/2012	0.54	2.2	67.9	0.085	1.7	0.096	12.6	7.9
25 SPA-4	J1R145	9/6/2012	0.48	2.7	94.2	0.19	2.4	0.12	12.3	7.9
26 SPA-5	J1R146	9/6/2012	0.55	2.4	83.2	0.14	2.0	0.11	11.3	7.6
27 SPA-6	J1R147	9/6/2012	0.49	2.4	78.6	0.14	2.1	0.11	12.5	7.7
28 SPA-7	J1R148	9/6/2012	0.46	2.4	76.3	0.16	1.6	0.099	12.6	7.3
29 SPA-9	J1R150	9/6/2012	0.37	3.1	83.1	0.18	1.6	0.086	12.5	7.9
30 SPA-10	J1R151	9/6/2012	0.44	2.4	81.1	0.18	1.7	0.10	11.6	7.2
31 SPA-11	J1R152	9/6/2012	0.59	2.3	88.9	0.18	2.5	0.14	12.1	8.4
32 SPA-12	J1R153	9/6/2012	0.46	2.4	80.0	0.18	1.5	0.094	11.8	7.8

33 **Statistical Computations**

34	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
35 95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	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.
36 N	12	12	12	12	12	12	12	12
37 % < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%
38 Mean	0.50	2.5	81.0	0.15	1.9	0.11	12.9	7.8
39 Standard deviation	0.075	0.24	6.4	0.03	0.33	0.017	2.8	0.36
40 95% UCL on mean	0.55	2.6	84.5	0.17	2.0	0.12	14.2	8.0
41 Maximum value	0.65	3.1	94.2	0.19	2.5	0.14	22.1	8.4
42 **Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	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
43 **WAC 173-340 3-PART TEST**								
44 95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NA	NO	NA
45 > 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NA	NO	NA
46 Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NA	NO	NA
47 **WAC 173-340 Compliance?**	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.81 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 (15.7 mg/kg) the WAC 173-340 3-part test is not required.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 21 of 41

1 **100-D-50:6 Subsite Statistical Calculations**
2 **Verification Data - Staging Pile Area (SPA)**

3	Sample	Sample	Sample	Copper			Lead			Manganese			Mercury			Nickel			Vanadium			Zinc			Chloride		
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
5	SPA-8	J1R149	9/6/2012	15.3		0.21	5.4		0.26	351		0.098	0.024		0.0051	11.4	X	0.12	52.6		0.092	45.1	X	0.39	30.9		1.9
6	Duplicate of J1R149	J1R154	9/6/2012	15.4		0.20	5.2		0.25	342		0.091	0.023		0.0051	11.3	X	0.11	50.6		0.085	44.9	X	0.36	29.6		2.0
7	SPA-1	J1R142	9/6/2012	15.4		0.19	5.9		0.24	318		0.089	0.17		0.0048	11.5	X	0.11	45.0		0.084	41.9	X	0.35	26.8		1.9
8	SPA-2	J1R143	9/6/2012	16.3		0.20	4.4		0.25	322		0.092	0.0047	U	0.0047	11.1	X	0.11	49.6		0.086	41.2	X	0.36	153		2.0
9	SPA-3	J1R144	9/6/2012	15.9		0.19	5.9		0.23	310		0.087	0.0093	B	0.0063	11.5	X	0.11	51.5		0.082	42.9	X	0.35	195		1.9
10	SPA-4	J1R145	9/6/2012	15.6		0.19	6.5		0.24	341		0.088	0.0071	B	0.0049	11.9	X	0.11	45.8		0.083	44.0	X	0.35	164		1.9
11	SPA-5	J1R146	9/6/2012	14.3		0.21	5.2		0.26	331		0.098	0.0070	U	0.0070	10.3	X	0.12	48.6		0.092	42.4	X	0.39	81.4		2.0
12	SPA-6	J1R147	9/6/2012	14.6		0.21	4.5		0.26	338		0.095	0.0055	U	0.0055	11.4	X	0.12	46.2		0.089	41.7	X	0.38	210		2.0
13	SPA-7	J1R148	9/6/2012	15.4		0.20	4.2		0.24	314		0.090	0.0056	U	0.0056	11.6	X	0.11	43.5		0.085	39.1	X	0.36	7.6		1.9
14	SPA-9	J1R150	9/6/2012	16.0		0.19	4.7		0.23	327		0.086	0.0051	U	0.0051	12.2	X	0.11	45.8		0.081	41.5	X	0.34	29.4		2.0
15	SPA-10	J1R151	9/6/2012	14.3		0.19	4.7		0.23	321		0.086	0.0052	B	0.0052	11.2	X	0.11	43.8		0.081	40.1	X	0.34	70.3		2.0
16	SPA-11	J1R152	9/6/2012	15.2		0.21	6.6		0.26	368		0.096	0.0064	B	0.0053	11.4	X	0.12	51.5		0.090	49.8	X	0.38	32.5		2.0
17	SPA-12	J1R153	9/6/2012	15.3		0.21	4.6		0.27	328		0.099	0.0052	U	0.0052	11.8	X	0.12	46.2		0.093	40.5	X	0.39	18.0		1.9

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Copper	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	Chloride
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
21	SPA-8	J1R149/J1R154	9/6/2012	15.4	5.3	347	0.024	11.4	51.6	45.0	30.3
22	SPA-1	J1R142	9/6/2012	15.4	5.9	318	0.17	11.5	45.0	41.9	26.8
23	SPA-2	J1R143	9/6/2012	16.3	4.4	322	0.0024	11.1	49.6	41.2	153
24	SPA-3	J1R144	9/6/2012	15.9	5.9	310	0.0093	11.5	51.5	42.9	195
25	SPA-4	J1R145	9/6/2012	15.6	6.5	341	0.0071	11.9	45.8	44.0	164
26	SPA-5	J1R146	9/6/2012	14.3	5.2	331	0.0035	10.3	48.6	42.4	81.4
27	SPA-6	J1R147	9/6/2012	14.6	4.5	338	0.0028	11.4	46.2	41.7	210
28	SPA-7	J1R148	9/6/2012	15.4	4.2	314	0.0028	11.6	43.5	39.1	7.6
29	SPA-9	J1R150	9/6/2012	16.0	4.7	327	0.0026	12.2	45.8	41.5	29.4
30	SPA-10	J1R151	9/6/2012	14.3	4.7	321	0.0052	11.2	43.8	40.1	70.3
31	SPA-11	J1R152	9/6/2012	15.2	6.6	368	0.0064	11.4	51.5	49.8	32.5
32	SPA-12	J1R153	9/6/2012	15.3	4.6	328	0.0026	11.8	46.2	40.5	18.0

33 **Statistical Computations**

34		Copper	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	Chloride
35	95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
36	N	12	12	12	12	12	12	12	12
37	% < Detection limit	0%	0%	0%	50%	0%	0%	0%	0%
38	Mean	15.3	5.2	330	0.020	11.4	47.4	42.5	84.9
39	Standard deviation	0.64	0.83	16.1	0.048	0.5	3.0	2.8	74.8
40	95% UCL on mean	15.6	5.7	339	0.042	11.7	49.0	43.8	255
41	Maximum value	16.3	6.6	368	0.17	12.2	52.6	49.8	210
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	22.0 River Protection	10.2 GW & River Protection	512 GW & River Protection	0.33 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	25000 GW Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NO
45	> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NO
46	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NO
47	**WAC 173-340 Compliance?**	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 22 of 41

1 **100-D-50:6 Subsite Statistical Calculations**
2 **Verification Data - Staging Pile Area (SPA)**

3	Sample	Sample	Sample	Nitrogen in Nitrate			Nitrogen in Nitrite and Nitrate			Sulfate			TPH - Diesel			TPH - Diesel Ext		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	SPA-8	J1R149	9/6/2012	17.0		0.31	20.8		0.30	17.3		1.7	29000		680	43000		1000
6	Duplicate of J1R149	J1R154	9/6/2012	18.6		0.32	24.6		0.30	18.4		1.7	110000		630	160000		930
7	SPA-1	J1R142	9/6/2012	72.2		0.31	37.3		0.30	18.7		1.7	1600	J	650	3900		960
8	SPA-2	J1R143	9/6/2012	10		0.31	15.9		0.30	62.8		1.7	690	J	640	950	U	950
9	SPA-3	J1R144	9/6/2012	23.7		0.31	22.2		0.30	60.6		1.7	5500		630	13000		920
10	SPA-4	J1R145	9/6/2012	61.9		0.31	70.9		0.30	20.5		1.7	1500	J	670	3900	J	990
11	SPA-5	J1R146	9/6/2012	121	D	0.63	147	D	1.5	42.2		1.7	2500	J	670	5900		980
12	SPA-6	J1R147	9/6/2012	28.8		0.32	29.7		0.30	23.5		1.7	2300	J	680	3900	J	990
13	SPA-7	J1R148	9/6/2012	7.3		0.30	7.5		0.30	10.4		1.7	1300	J	670	2300	J	990
14	SPA-9	J1R150	9/6/2012	18.7		0.31	4.0		0.30	17.8		1.7	670	U	670	1000	J	990
15	SPA-10	J1R151	9/6/2012	14.2		0.31	14.3		0.30	49.0		1.7	1800	J	680	3700	J	1000
16	SPA-11	J1R152	9/6/2012	15.1		0.31	18.6		0.30	86.4		1.7	2300	J	680	8100		990
17	SPA-12	J1R153	9/6/2012	2.3	B	0.31	2.1		0.30	68.5		1.7	1300	J	680	2100	J	990

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Nitrogen in Nitrate	Nitrogen in Nitrite and Nitrate	Sulfate	TPH - Diesel	TPH - Diesel Ext
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg
21	SPA-8	J1R137/J1R141	9/6/2012	17.8	22.7	17.9	69500	101500
22	SPA-1	J1R142	9/6/2012	72.2	37.3	18.7	1600	3900
23	SPA-2	J1R143	9/6/2012	10.0	15.9	62.8	690	475
24	SPA-3	J1R144	9/6/2012	23.7	22.2	60.6	5500	13000
25	SPA-4	J1R145	9/6/2012	61.9	70.9	20.5	1500	3900
26	SPA-5	J1R146	9/6/2012	121	147	42.2	2500	5900
27	SPA-6	J1R147	9/6/2012	28.8	29.7	23.5	2300	3900
28	SPA-7	J1R148	9/6/2012	7.3	7.5	10.4	1300	2300
29	SPA-9	J1R150	9/6/2012	18.7	4.0	17.8	335	1000
30	SPA-10	J1R151	9/6/2012	14.2	14.3	49.0	1800	3700
31	SPA-11	J1R152	9/6/2012	15.1	18.6	86.4	2300	8100
32	SPA-12	J1R153	9/6/2012	2.3	2.1	68.5	1300	2100

33 **Statistical Computations**

34		Nitrogen in Nitrate	Nitrogen in Nitrite and Nitrate	Sulfate	TPH - Diesel	TPH - Diesel Ext
35	95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
36	N	12	12	12	12	12
37	% < Detection limit	0%	0%	0%	8%	8%
38	Mean	32.8	32.7	39.9	7552	12481
39	Standard deviation	35.0	40.4	25.2	19552	28240
40	95% UCL on mean	49.4	112	67.7	16837	43353
41	Maximum value	121	147	86.4	110000	160000
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	1000 GW Protection	1000 GW Protection	25000 GW Protection	200000 ug/kg GW & River Protection	200000 ug/kg GW & River Protection
43	**WAC 173-340 3-PART TEST**					
44	95% UCL > Cleanup Limit?	NO	NO	NA	NO	NO
45	> 10% above Cleanup Limit?	NO	NO	NA	NO	NO
46	Any sample > 2X Cleanup Limit?	NO	NO	NA	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.	Because all values are below background (237 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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 23 of 41

100-D-50:6 Subsite Statistical Calculations

Verification Data - Staging Pile Area (SPA)

Sample Area	Sample Number	Sample Date	Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene			Chrysene			Fluoranthene			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
Re-sample of J1R149	J1RD54	1/24/2013	3.3	U	3.3	6.6	U	6.6	4.3	U	4.3	5.0	U	5.0	13	U	13	12	U	12
SPA-1	J1R142	9/6/2012	3.1	U	3.1	6.8	J	6.2	7.9	J	4.1	5.4	J	4.7	19	J	13	12	JX	12
SPA-2	J1R143	9/6/2012	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2	4.9	U	4.9	13	U	13	12	U	12
SPA-3	J1R144	9/6/2012	77		3.0	51		6.0	54		3.9	47		4.5	120		12	120		11
SPA-4	J1R145	9/6/2012	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2	4.8	U	4.8	13	U	13	12	U	12
SPA-5	J1R146	9/6/2012	34		3.0	25		6.1	28	X	4.0	28	J	4.6	88		12	58	X	11
SPA-6	J1R147	9/6/2012	8.9	J	3.1	8.2	J	6.3	8.1	JX	4.1	6.8	J	4.8	21	J	13	21	J	12
SPA-7	J1R148	9/6/2012	3.1	U	3.1	6.3	U	6.3	4.1	U	4.1	4.7	U	4.7	13	U	13	12	U	12
SPA-9	J1R150	9/6/2012	9.3	J	3.2	8.4	J	6.5	8.5	JX	4.2	7.8	JX	4.9	22	J	13	21	J	12
SPA-10	J1R151	9/6/2012	8.8	J	3.1	6.1	U	6.1	17		4.0	6.6	J	4.6	17	J	12	16	J	12
SPA-11	J1R152	9/6/2012	3.1	U	3.1	6.3	U	6.3	4.1	U	4.1	4.8	U	4.8	13	U	13	12	U	12
SPA-12	J1R153	9/6/2012	11	J	3.1	8.5	J	6.3	9.5	JX	4.1	9.1	J	4.8	23	J	13	21	J	12

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Benzo(a)anthracene ug/kg	Benzo(a)pyrene ug/kg	Benzo(b)fluoranthene ug/kg	Chrysene ug/kg	Fluoranthene ug/kg	Pyrene ug/kg
Re-sample of J1R149	J1RD54	1/24/2013	1.7	3.3	2.2	2.5	6.5	6.0
SPA-1	J1R142	9/6/2012	1.6	6.8	7.9	5.4	19	12
SPA-2	J1R143	9/6/2012	1.6	3.2	2.1	2.5	6.5	6.0
SPA-3	J1R144	9/6/2012	77	51	54	47	120	120
SPA-4	J1R145	9/6/2012	1.6	3.2	2.1	2.4	6.5	6.0
SPA-5	J1R146	9/6/2012	34	25	28	28	88	58
SPA-6	J1R147	9/6/2012	8.9	8.2	8.1	6.8	21	21
SPA-7	J1R148	9/6/2012	1.6	3.2	2.1	2.4	6.5	6.0
SPA-9	J1R150	9/6/2012	9.3	8.4	8.5	7.8	22	21
SPA-10	J1R151	9/6/2012	8.8	3.1	17	6.6	17	16
SPA-11	J1R152	9/6/2012	1.6	3.2	2.1	2.4	6.5	6.0
SPA-12	J1R153	9/6/2012	11	8.5	9.5	9.1	23	21

Statistical Computations

	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Chrysene	Fluoranthene	Pyrene
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), 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), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12	12
% < Detection limit	50%	50%	42%	42%	42%	42%
Mean	13	11	12	10	29	25
Standard deviation	22	14	15	14	37	33
95% UCL on mean	24	17	19	17	46	41
Maximum value	77	51	54	47	120	120
Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)	15 GW & River Protection	15 GW & River Protection	15 GW & River Protection	100 River Protection	18000 River Protection	48000 GW Protection
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	YES	YES	YES	NO	NO	NO
> 10% above Cleanup Limit?	YES	YES	YES	NO	NO	NO
Any sample > 2X Cleanup Limit?	YES	YES	YES	NO	NO	NO
WAC 173-340 Compliance?	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	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.

Qualifiers are defined on page 3.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 24 of 41

100-D-50:6 Subsite Maximum Calculations
Verification Data - Overburden

Sample Area	Sample Number	Sample Date	Molybdenum mg/kg	Q	PQL
SPA-8	J1R149	9/6/2012	0.25	U	0.25
Duplicate of J1R149	J1R154	9/6/2012	0.24	U	0.24
SPA-1	J1R142	9/6/2012	0.31	B	0.23
SPA-2	J1R143	9/6/2012	0.24	U	0.24
SPA-3	J1R144	9/6/2012	0.23	U	0.23
SPA-4	J1R145	9/6/2012	1.1	B	0.23
SPA-5	J1R146	9/6/2012	0.25	U	0.25
SPA-6	J1R147	9/6/2012	0.25	U	0.25
SPA-7	J1R148	9/6/2012	0.23	U	0.23
SPA-9	J1R150	9/6/2012	0.22	U	0.22
SPA-10	J1R151	9/6/2012	0.22	U	0.22
SPA-11	J1R152	9/6/2012	0.25	U	0.25
SPA-12	J1R153	9/6/2012	0.26	U	0.26

Statistical Computations

	Molybdenum
% < Detection limit	83%
Maximum value	1.1
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	8 GW Protection
WAC 173-340 3-PART TEST	
Maximum > Cleanup Limit?	NO
> 10% above Cleanup Limit?	NO
Any sample > 2X Cleanup Limit?	NO
3-Part Test Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.

100-D-50:6 Subsite Maximum Calculations
Verification Data - Overburden

Sample Area	Sample Number	Sample Date	Anthracene ug/kg	Q	PQL	Benzo(ghi)perylene ug/kg	Q	PQL	Benzo(k)fluoranthene ug/kg	Q	PQL	Fluorene ug/kg	Q	PQL	Indeno(1,2,3-cd)pyrene ug/kg	Q	PQL	Phenanthrene ug/kg	Q	PQL
Re-sample of J1R149	J1RD54	1/24/2013	3.1	U	3.1	7.4	U	7.4	4.0	U	4.0	5.4	U	5.4	12	U	12	12	U	12
SPA-1	J1R142	9/6/2012	3.0	U	3.0	7.0	U	7.0	3.8	U	3.8	5.1	U	5.1	12	U	12	12	U	12
SPA-2	J1R143	9/6/2012	3.1	U	3.1	7.2	U	7.2	4.0	U	4.0	5.3	U	5.3	12	U	12	12	U	12
SPA-3	J1R144	9/6/2012	20		2.9	40		6.7	25		3.7	13	JX	4.9	28	X	11	57		11
SPA-4	J1R145	9/6/2012	3.0	U	3.0	7.2	U	7.2	3.9	U	3.9	5.3	U	5.3	12	U	12	12	U	12
SPA-5	J1R146	9/6/2012	17	J	2.9	12	JX	6.8	11	J	3.7	10	J	5.0	24	J	11	49		11
SPA-6	J1R147	9/6/2012	3.0	U	3.0	7.1	U	7.1	3.9	U	3.9	5.2	U	5.2	12	U	12	12	U	12
SPA-7	J1R148	9/6/2012	3.0	U	3.0	7.1	U	7.1	3.9	U	3.9	5.2	U	5.2	12	U	12	12	U	12
SPA-9	J1R150	9/6/2012	3.2	J	3.1	7.3	U	7.3	4.0	J	4.0	5.3	U	5.3	12	U	12	16	J	12
SPA-10	J1R151	9/6/2012	2.9	U	2.9	6.9	U	6.9	3.8	U	3.8	5.1	U	5.1	12	U	12	13	J	12
SPA-11	J1R152	9/6/2012	3.0	U	3.0	7.1	U	7.1	3.9	U	3.9	5.2	U	5.2	12	U	12	12	U	12
SPA-12	J1R153	9/6/2012	3.0	U	3.0	7.1	U	7.1	3.9	U	3.9	5.2	U	5.2	12	U	12	14	J	12

Statistical Computations

	Anthracene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Phenanthrene
% < Detection limit	75%	83%	75%	83%	83%	58%
Maximum value	20	40	25	13	28	57
Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)	240000 ug/kg GW Protection	48000 ug/kg GW & River Protection	15 ug/kg GW & River Protection	64000 GW Protection	15 GW & River Protection	240000 GW Protection
WAC 173-340 3-PART TEST						
Maximum > Cleanup Limit?	NO	NO	YES	NO	YES	NO
> 10% above Cleanup Limit?	NO	NO	NO	NO	YES	NO
Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO	NO
3-Part Test 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.	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.	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.

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	**Date**	02/14/13	**Calc. No.**	0100D-CA-V0490
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 02/14/13
Sheet No. 25 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Pipeline Excavation

Antimony 95% UCL Calculation

DATA	ID
0.56	J1R118/J1R128
0.69	J1R116
2.0	J1R117
0.19	J1R119
0.38	J1R120
0.61	J1R121
0.48	J1R122
0.86	J1R123
0.70	J1R124
0.62	J1R125
0.71	J1R126
0.41	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	0.68
Censored		Lognormal mean	0.69
Detection limit or PQL		Std. devn.	0.45
Method detection limit		Median	0.62
TOTAL	12	Min.	0.19
		Max.	2.0

Lognormal distribution? r-squared is: 0.893
Normal distribution? r-squared is: 0.685
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.90

Arsenic 95% UCL Calculation

DATA	ID
2.3	J1R118/J1R128
2.5	J1R116
14.7	J1R117
3.5	J1R119
3.2	J1R120
2.8	J1R121
2.4	J1R122
2.0	J1R123
1.4	J1R124
1.6	J1R125
2.4	J1R126
3.7	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	3.5
Censored		Lognormal mean	3.4
Detection limit or PQL		Std. devn.	3.6
Method detection limit		Median	2.5
TOTAL	12	Min.	1.4
		Max.	14.7

Lognormal distribution? r-squared is: 0.773
Normal distribution? r-squared is: 0.482
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 5.2

Barium 95% UCL Calculation

DATA	ID
65.3	J1R118/J1R128
63.6	J1R116
93.7	J1R117
60.8	J1R119
62.4	J1R120
51.7	J1R121
59.0	J1R122
53.4	J1R123
52.5	J1R124
64.4	J1R125
56.5	J1R126
58.0	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	61.8
Censored		Lognormal mean	61.8
Detection limit or PQL		Std. devn.	11.1
Method detection limit		Median	59.9
TOTAL	12	Min.	51.7
		Max.	93.7

Lognormal distribution? r-squared is: 0.788
Normal distribution? r-squared is: 0.705
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 67.0

Beryllium 95% UCL Calculation

DATA	ID
0.039	J1R118/J1R128
0.078	J1R116
0.12	J1R117
0.17	J1R119
0.16	J1R120
0.099	J1R121
0.052	J1R122
0.033	J1R123
0.017	J1R124
0.016	J1R125
0.017	J1R126
0.14	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	0.078
Censored		Lognormal mean	0.085
Detection limit or PQL		Std. devn.	0.058
Method detection limit		Median	0.065
TOTAL	12	Min.	0.016
		Max.	0.17

Lognormal distribution? r-squared is: 0.923
Normal distribution? r-squared is: 0.917
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.18

Chromium 95% UCL Calculation

DATA	ID
14.9	J1R118/J1R128
8.4	J1R116
28.5	J1R117
13.3	J1R119
12.5	J1R120
11.5	J1R121
14.6	J1R122
8.8	J1R123
8.7	J1R124
7.0	J1R125
12.5	J1R126
14.9	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	13.0
Censored		Lognormal mean	13.0
Detection limit or PQL		Std. devn.	5.6
Method detection limit		Median	12.5
TOTAL	12	Min.	7.0
		Max.	28.5

Lognormal distribution? r-squared is: 0.905
Normal distribution? r-squared is: 0.760
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 16.2

Cobalt 95% UCL Calculation

DATA	ID
9.0	J1R118/J1R128
9.0	J1R116
7.3	J1R117
5.9	J1R119
6.6	J1R120
7.0	J1R121
7.7	J1R122
7.8	J1R123
9.2	J1R124
9.4	J1R125
10.0	J1R126
6.0	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	7.9
Censored		Lognormal mean	7.9
Detection limit or PQL		Std. devn.	1.4
Method detection limit		Median	7.8
TOTAL	12	Min.	5.9
		Max.	10.0

Lognormal distribution? r-squared is: 0.953
Normal distribution? r-squared is: 0.957
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.7

Copper 95% UCL Calculation

DATA	ID
20.1	J1R118/J1R128
18.2	J1R116
43.9	J1R117
14.6	J1R119
16.8	J1R120
14.9	J1R121
16.1	J1R122
18.2	J1R123
19.3	J1R124
15.6	J1R125
23.2	J1R126
13.8	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	19.6
Censored		Lognormal mean	19.5
Detection limit or PQL		Std. devn.	8.1
Method detection limit		Median	17.5
TOTAL	12	Min.	13.8
		Max.	43.9

Lognormal distribution? r-squared is: 0.756
Normal distribution? r-squared is: 0.603
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 23.4

Lead 95% UCL Calculation

DATA	ID
12.3	J1R118/J1R128
6.4	J1R116
23.7	J1R117
4.2	J1R119
4.6	J1R120
5.5	J1R121
8.9	J1R122
4.8	J1R123
3.5	J1R124
2.8	J1R125
3.9	J1R126
5.3	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	7.2
Censored		Lognormal mean	7.0
Detection limit or PQL		Std. devn.	5.8
Method detection limit		Median	5.1
TOTAL	12	Min.	2.8
		Max.	23.7

Lognormal distribution? r-squared is: 0.888
Normal distribution? r-squared is: 0.663
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 9.9

Manganese 95% UCL Calculation

DATA	ID
328	J1R118/J1R128
333	J1R116
313	J1R117
288	J1R119
313	J1R120
298	J1R121
317	J1R122
307	J1R123
315	J1R124
316	J1R125
349	J1R126
285	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	313
Censored		Lognormal mean	314
Detection limit or PQL		Std. devn.	18.1
Method detection limit		Median	314
TOTAL	12	Min.	285
		Max.	349

Lognormal distribution? r-squared is: 0.960
Normal distribution? r-squared is: 0.958
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 323

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	Date	02/14/13	Calc. No.	0100D-CA-V0490
Project	100-D Field Remediation	Job No.	14655	Checked	J. D. Skoglie
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 02/14/13
Sheet No. 26 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Pipeline Excavation

Mercury 95% UCL Calculation

DATA	ID
0.032	J1R118/J1R128
0.0098	J1R116
0.041	J1R117
0.011	J1R119
0.0035	J1R120
0.0083	J1R121
0.062	J1R122
0.028	J1R123
0.028	J1R124
0.0025	J1R125
0.011	J1R126
0.0025	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	0.020
Censored		Lognormal mean	0.023
Detection limit or PQL		Std. devn.	0.018
Method detection limit		Median	0.011
TOTAL	12	Min.	0.0025
		Max.	0.062

Lognormal distribution? r-squared is: 0.944
Normal distribution? r-squared is: 0.861
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.064

Nickel 95% UCL Calculation

DATA	ID
10.8	J1R118/J1R128
10.1	J1R118
14.3	J1R117
12.5	J1R119
12.7	J1R120
13.4	J1R121
13.0	J1R122
10.4	J1R123
10.0	J1R124
10.9	J1R125
15.7	J1R126
14.3	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	12.3
Censored		Lognormal mean	12.4
Detection limit or PQL		Std. devn.	1.9
Method detection limit		Median	12.6
TOTAL	12	Min.	10.0
		Max.	15.7

Lognormal distribution? r-squared is: 0.945
Normal distribution? r-squared is: 0.944
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 13.4

Vanadium 95% UCL Calculation

DATA	ID
58.4	J1R118/J1R128
64.5	J1R116
52.8	J1R117
34.8	J1R119
40.1	J1R120
45.6	J1R121
48.8	J1R122
51.3	J1R123
66.7	J1R124
67.0	J1R125
59.8	J1R126
34.9	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	52.1
Censored		Lognormal mean	52.2
Detection limit or PQL		Std. devn.	11.6
Method detection limit		Median	52.1
TOTAL	12	Min.	34.8
		Max.	67.0

Lognormal distribution? r-squared is: 0.937
Normal distribution? r-squared is: 0.955
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 59.6

Zinc 95% UCL Calculation

DATA	ID
57.1	J1R118/J1R128
49.9	J1R116
94.2	J1R117
36.1	J1R119
39.7	J1R120
38.9	J1R121
43.7	J1R122
43.2	J1R123
57.5	J1R124
44.8	J1R125
46.6	J1R126
34.7	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	48.9
Censored		Lognormal mean	48.8
Detection limit or PQL		Std. devn.	16.0
Method detection limit		Median	44.3
TOTAL	12	Min.	34.7
		Max.	94.2

Lognormal distribution? r-squared is: 0.852
Normal distribution? r-squared is: 0.724
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 56.5

Acenaphthene 95% UCL Calculation

DATA	ID
645	J1R118/J1R128
4.9	J1R116
2100	J1R117
8800	J1R119
8200	J1R120
260	J1R121
5600	J1R122
5500	J1R123
62	J1R124
5.0	J1R125
4.95	J1R126
31000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	5182
Censored		Lognormal mean	92887
Detection limit or PQL		Std. devn.	8790
Method detection limit		Median	1373
TOTAL	12	Min.	4.9
		Max.	31000

Lognormal distribution? r-squared is: 0.898
Normal distribution? r-squared is: 0.613
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 9356

Anthracene 95% UCL Calculation

DATA	ID
346	J1R118/J1R128
57	J1R116
3400	J1R117
15	J1R119
14000	J1R120
1.5	J1R121
16000	J1R122
8000	J1R123
77	J1R124
11	J1R125
14	J1R126
60000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	8493
Censored		Lognormal mean	170534
Detection limit or PQL		Std. devn.	17221
Method detection limit		Median	211
TOTAL	12	Min.	1.5
		Max.	60000

Lognormal distribution? r-squared is: 0.941
Normal distribution? r-squared is: 0.544
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1304142559

Benzo(a)anthracene 95% UCL Calculation

DATA	ID
1500	J1R118/J1R128
200	J1R116
3800	J1R117
31000	J1R119
15000	J1R120
770	J1R121
19000	J1R122
11000	J1R123
180	J1R124
33	J1R125
43	J1R126
85000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	13961
Censored		Lognormal mean	63846
Detection limit or PQL		Std. devn.	24442
Method detection limit		Median	2650
TOTAL	12	Min.	33
		Max.	85000

Lognormal distribution? r-squared is: 0.958
Normal distribution? r-squared is: 0.615
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10927789

Benzo(a)pyrene 95% UCL Calculation

DATA	ID
890	J1R118/J1R128
160	J1R116
1600	J1R117
15000	J1R119
9400	J1R120
430	J1R121
7500	J1R122
9500	J1R123
180	J1R124
27	J1R125
24	J1R126
35000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	6643
Censored		Lognormal mean	24885
Detection limit or PQL		Std. devn.	10265
Method detection limit		Median	1245
TOTAL	12	Min.	24
		Max.	35000

Lognormal distribution? r-squared is: 0.948
Normal distribution? r-squared is: 0.684
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2322038

Benzo(b)fluoranthene 95% UCL Calculation

DATA	ID
1145	J1R118/J1R128
210	J1R116
2300	J1R117
21000	J1R119
11000	J1R120
600	J1R121
12000	J1R122
10000	J1R123
180	J1R124
34	J1R125
35	J1R126
53000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	9292
Censored		Lognormal mean	34659
Detection limit or PQL		Std. devn.	15333
Method detection limit		Median	1723
TOTAL	12	Min.	34
		Max.	53000

Lognormal distribution? r-squared is: 0.951
Normal distribution? r-squared is: 0.643
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3517393

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern NS	Date	02/14/13	Calc. No.	0100D-CA-V0490
Project	100-D Field Remediation	Job No.	14655	Checked	J. D. Skoglie
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations			Rev. No.	0
				Date	02/14/13
				Sheet No.	27 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Pipeline Excavation

Benzo(ghi)perylene 95% UCL Calculation

DATA	ID
575	J1R118/J1R128
120	J1R116
1200	J1R117
5000	J1R119
5300	J1R120
300	J1R121
4100	J1R122
5700	J1R123
170	J1R124
26	J1R125
18	J1R126
21000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	3626
Censored		Lognormal mean	10027
Detection limit or PQL		Std. devn.	5936
Method detection limit		Median	888
TOTAL	12	Min.	18
		Max.	21000

Lognormal distribution? r-squared is: 0.954
Normal distribution? r-squared is: 0.617
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 472192

Benzo(k)fluoranthene 95% UCL Calculation

DATA	ID
365	J1R118/J1R128
73	J1R116
800	J1R117
7600	J1R119
4100	J1R120
230	J1R121
3300	J1R122
4000	J1R123
63	J1R124
12	J1R125
8.7	J1R126
17000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	3129
Censored		Lognormal mean	12748
Detection limit or PQL		Std. devn.	4989
Method detection limit		Median	583
TOTAL	12	Min.	8.7
		Max.	17000

Lognormal distribution? r-squared is: 0.955
Normal distribution? r-squared is: 0.669
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1462279

Chrysene 95% UCL Calculation

DATA	ID
1300	J1R118/J1R128
210	J1R116
3100	J1R117
25000	J1R119
14000	J1R120
790	J1R121
15000	J1R122
10000	J1R123
160	J1R124
31	J1R125
30	J1R126
75000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	12052
Censored		Lognormal mean	54944
Detection limit or PQL		Std. devn.	21405
Method detection limit		Median	2200
TOTAL	12	Min.	30
		Max.	75000

Lognormal distribution? r-squared is: 0.955
Normal distribution? r-squared is: 0.599
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 9134343

Dibenz(a,h)anthracene 95% UCL Calculation

DATA	ID
175	R118/J1R128
5.5	J1R116
250	J1R117
2700	J1R119
1700	J1R120
5.5	J1R121
1500	J1R122
1800	J1R123
5.5	J1R124
14	J1R125
5.5	J1R126
7700	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	1322
Censored		Lognormal mean	8637
Detection limit or PQL		Std. devn.	2217
Method detection limit		Median	213
TOTAL	12	Min.	5.5
		Max.	7700

Lognormal distribution? r-squared is: 0.868
Normal distribution? r-squared is: 0.633
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2375

Fluoranthene 95% UCL Calculation

DATA	ID
3300	J1R118/J1R128
460	J1R116
9100	J1R117
55000	J1R119
42000	J1R120
1500	J1R121
38000	J1R122
26000	J1R123
360	J1R124
80	J1R125
68	J1R126
160000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	27989
Censored		Lognormal mean	141205
Detection limit or PQL		Std. devn.	45929
Method detection limit		Median	6200
TOTAL	12	Min.	68
		Max.	160000

Lognormal distribution? r-squared is: 0.946
Normal distribution? r-squared is: 0.644
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 25740291

Fluorene 95% UCL Calculation

DATA	ID
765	J1R118/J1R128
44	J1R116
2500	J1R117
7100	J1R119
8400	J1R120
190	J1R121
8100	J1R122
5200	J1R123
54	J1R124
11	J1R125
14	J1R126
32000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	5365
Censored		Lognormal mean	34569
Detection limit or PQL		Std. devn.	9041
Method detection limit		Median	1633
TOTAL	12	Min.	11
		Max.	32000

Lognormal distribution? r-squared is: 0.925
Normal distribution? r-squared is: 0.609
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10259069

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

DATA	ID
485	J1R118/J1R128
120	J1R116
770	J1R117
8500	J1R119
5800	J1R120
210	J1R121
2900	J1R122
6000	J1R123
97	J1R124
6.0	J1R125
14	J1R126
16000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	3409
Censored		Lognormal mean	15696
Detection limit or PQL		Std. devn.	4934
Method detection limit		Median	628
TOTAL	12	Min.	6.0
		Max.	16000

Lognormal distribution? r-squared is: 0.954
Normal distribution? r-squared is: 0.739
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2014140

Phenanthrene 95% UCL Calculation

DATA	ID
3300	J1R118/J1R128
260	J1R116
12000	J1R117
35000	J1R119
43000	J1R120
930	J1R121
40000	J1R122
22000	J1R123
200	J1R124
48	J1R125
52	J1R126
140000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	24733
Censored		Lognormal mean	176552
Detection limit or PQL		Std. devn.	39970
Method detection limit		Median	7650
TOTAL	12	Min.	48
		Max.	140000

Lognormal distribution? r-squared is: 0.925
Normal distribution? r-squared is: 0.644
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 61244670

Pyrene 95% UCL Calculation

DATA	ID
3100	J1R118/J1R128
420	J1R116
8000	J1R117
55000	J1R119
39000	J1R120
1500	J1R121
34000	J1R122
25000	J1R123
340	J1R124
73	J1R125
66	J1R126
150000	J1R127

Number of samples		Uncensored values	
Uncensored	12	Mean	26375
Censored		Lognormal mean	132475
Detection limit or PQL		Std. devn.	43228
Method detection limit		Median	5550
TOTAL	12	Min.	66
		Max.	150000

Lognormal distribution? r-squared is: 0.946
Normal distribution? r-squared is: 0.649
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 24104059

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	**Date**	02/14/13	**Calc. No.**	0100D-CA-V0490
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 02/14/13
Sheet No. 28 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Clearwell Excavation

Antimony 95% UCL Calculation

DATA	ID
0.75	J1R1L4/J1R1M1
0.44	J1R1K9
0.56	J1R1L0
0.19	J1R1L1
0.52	J1R1L2
0.63	J1R1L3
0.51	J1R1L5
0.67	J1R1L6
0.55	J1R1L7
0.55	J1R1L8
0.46	J1R1L9
0.46	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.52
Censored		Lognormal mean	0.53
Detection limit or PQL		Std. devn.	0.14
Method detection limit		Median	0.54
TOTAL	12	Min.	0.19
		Max.	0.75

Lognormal distribution? r-squared is: 0.746
Normal distribution? r-squared is: 0.899
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.59

Arsenic 95% UCL Calculation

DATA	ID
1.6	J1R1L4/J1R1M1
3.3	J1R1K9
3.2	J1R1L0
2.7	J1R1L1
2.8	J1R1L2
2.1	J1R1L3
2.1	J1R1L5
1.2	J1R1L6
3.4	J1R1L7
1.2	J1R1L8
2.4	J1R1L9
2.3	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	2.4
Censored		Lognormal mean	2.4
Detection limit or PQL		Std. devn.	0.76
Method detection limit		Median	2.4
TOTAL	12	Min.	1.2
		Max.	3.4

Lognormal distribution? r-squared is: 0.918
Normal distribution? r-squared is: 0.959
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3.0

Barium 95% UCL Calculation

DATA	ID
61.4	J1R1L4/J1R1M1
57.8	J1R1K9
56.8	J1R1L0
66.1	J1R1L1
58.6	J1R1L2
64.2	J1R1L3
65.4	J1R1L5
61.4	J1R1L6
82.6	J1R1L7
65.4	J1R1L8
55.0	J1R1L9
59.4	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	62.8
Censored		Lognormal mean	62.9
Detection limit or PQL		Std. devn.	7.22
Method detection limit		Median	61.4
TOTAL	12	Min.	55.0
		Max.	82.6

Lognormal distribution? r-squared is: 0.836
Normal distribution? r-squared is: 0.785
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 66.3

Chromium 95% UCL Calculation

DATA	ID
7.0	J1R1L4/J1R1M1
11.3	J1R1K9
11.3	J1R1L0
9.5	J1R1L1
11.1	J1R1L2
21.0	J1R1L3
7.7	J1R1L5
6.5	J1R1L6
17.6	J1R1L7
7.4	J1R1L8
9.8	J1R1L9
8.6	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	10.7
Censored		Lognormal mean	10.7
Detection limit or PQL		Std. devn.	4.4
Method detection limit		Median	9.7
TOTAL	12	Min.	6.5
		Max.	21.0

Lognormal distribution? r-squared is: 0.916
Normal distribution? r-squared is: 0.815
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 13.3

Cobalt 95% UCL Calculation

DATA	ID
10.1	J1R1L4/J1R1M1
5.6	J1R1K9
6.5	J1R1L0
7.0	J1R1L1
7.9	J1R1L2
9.2	J1R1L3
10.2	J1R1L5
9.4	J1R1L6
8.1	J1R1L7
11.3	J1R1L8
8.0	J1R1L9
8.5	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	8.5
Censored		Lognormal mean	8.5
Detection limit or PQL		Std. devn.	1.7
Method detection limit		Median	8.3
TOTAL	12	Min.	5.6
		Max.	11.3

Lognormal distribution? r-squared is: 0.974
Normal distribution? r-squared is: 0.988
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 9.5

Copper 95% UCL Calculation

DATA	ID
18.6	J1R1L4/J1R1M1
13.1	J1R1K9
15.6	J1R1L0
15.3	J1R1L1
16.7	J1R1L2
18.6	J1R1L3
18.9	J1R1L5
16.2	J1R1L6
19.0	J1R1L7
19.4	J1R1L8
16.5	J1R1L9
18.6	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	17.2
Censored		Lognormal mean	17.2
Detection limit or PQL		Std. devn.	1.9
Method detection limit		Median	17.7
TOTAL	12	Min.	13.1
		Max.	19.4

Lognormal distribution? r-squared is: 0.877
Normal distribution? r-squared is: 0.896
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 18.1

Lead 95% UCL Calculation

DATA	ID
3.1	J1R1L4/J1R1M1
3.3	J1R1K9
3.6	J1R1L0
4.9	J1R1L1
5.5	J1R1L2
3.6	J1R1L3
7.5	J1R1L5
2.6	J1R1L6
8.0	J1R1L7
3.6	J1R1L8
4.0	J1R1L9
9.6	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	4.9
Censored		Lognormal mean	5.0
Detection limit or PQL		Std. devn.	2.3
Method detection limit		Median	3.8
TOTAL	12	Min.	2.6
		Max.	9.6

Lognormal distribution? r-squared is: 0.924
Normal distribution? r-squared is: 0.855
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.4

Manganese 95% UCL Calculation

DATA	ID
313	J1R1L4/J1R1M1
251	J1R1K9
272	J1R1L0
294	J1R1L1
306	J1R1L2
286	J1R1L3
368	J1R1L5
297	J1R1L6
321	J1R1L7
318	J1R1L8
296	J1R1L9
323	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	304
Censored		Lognormal mean	304
Detection limit or PQL		Std. devn.	29.2
Method detection limit		Median	302
TOTAL	12	Min.	251
		Max.	368

Lognormal distribution? r-squared is: 0.946
Normal distribution? r-squared is: 0.937
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 320

Mercury 95% UCL Calculation

DATA	ID
0.0030	J1R1L4/J1R1M1
0.0053	J1R1K9
0.0024	J1R1L0
0.0098	J1R1L1
0.013	J1R1L2
0.028	J1R1L3
0.046	J1R1L5
0.0027	J1R1L6
0.014	J1R1L7
0.0025	J1R1L8
0.015	J1R1L9
0.0034	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.012
Censored		Lognormal mean	0.013
Detection limit or PQL		Std. devn.	0.013
Method detection limit		Median	0.0076
TOTAL	12	Min.	0.0024
		Max.	0.046

Lognormal distribution? r-squared is: 0.920
Normal distribution? r-squared is: 0.752
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.031

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	**Date**	02/14/13	**Calc. No.**	0100D-CA-V0490
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 02/14/13
Sheet No. 29 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Clearwell Excavation

Nickel 95% UCL Calculation

DATA	ID
9.9	J1R1L4/J1R1M1
11.9	J1R1K9
14.1	J1R1L0
10.6	J1R1L1
11.2	J1R1L2
11.2	J1R1L3
12.1	J1R1L5
9.8	J1R1L6
14.7	J1R1L7
11.4	J1R1L8
10.7	J1R1L9
10.4	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	11.5
Censored		Lognormal mean	11.5
Detection limit or PQL		Std. devn.	1.53
Method detection limit		Median	11.2
TOTAL	12	Min.	9.8
		Max.	14.7

Lognormal distribution? r-squared is: 0.910
Normal distribution? r-squared is: 0.877
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 12.3

Vanadium 95% UCL Calculation

DATA	ID
68.4	J1R1L4/J1R1M1
30.5	J1R1K9
42.5	J1R1L0
47.5	J1R1L1
50.1	J1R1L2
60.1	J1R1L3
66.3	J1R1L5
66.6	J1R1L6
51.7	J1R1L7
85.5	J1R1L8
52.6	J1R1L9
59.7	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	56.8
Censored		Lognormal mean	57.0
Detection limit or PQL		Std. devn.	14.3
Method detection limit		Median	56.2
TOTAL	12	Min.	30.5
		Max.	85.5

Lognormal distribution? r-squared is: 0.944
Normal distribution? r-squared is: 0.965
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 66.4

Zinc 95% UCL Calculation

DATA	ID
45.6	J1R1L4/J1R1M1
30.9	J1R1K9
34.7	J1R1L0
40.2	J1R1L1
41.1	J1R1L2
40.8	J1R1L3
49.9	J1R1L5
45.5	J1R1L6
48.7	J1R1L7
45.9	J1R1L8
40.0	J1R1L9
47.3	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	42.6
Censored		Lognormal mean	42.6
Detection limit or PQL		Std. devn.	5.7
Method detection limit		Median	43.3
TOTAL	12	Min.	30.9
		Max.	49.9

Lognormal distribution? r-squared is: 0.904
Normal distribution? r-squared is: 0.933
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 46.0

Anthracene 95% UCL Calculation

DATA	ID
12	J1R1L4/J1R1M1
1.5	J1R1K9
1.5	J1R1L0
1.4	J1R1L1
92	J1R1L2
240	J1R1L3
25	J1R1L5
1.5	J1R1L6
1900	J1R1L7
1600	J1R1L8
1300	J1R1L9
140	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	443
Censored		Lognormal mean	2568
Detection limit or PQL		Std. devn.	713
Method detection limit		Median	59
TOTAL	12	Min.	1.4
		Max.	1900

Lognormal distribution? r-squared is: 0.903
Normal distribution? r-squared is: 0.671
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1065550

Benzo(a)anthracene 95% UCL Calculation

DATA	ID
23	J1R1L4/J1R1M1
290	J1R1K9
1.6	J1R1L0
9.5	J1R1L1
210	J1R1L2
600	J1R1L3
80	J1R1L5
1.6	J1R1L6
3000	J1R1L7
2200	J1R1L8
1800	J1R1L9
410	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	719
Censored		Lognormal mean	4111
Detection limit or PQL		Std. devn.	1024
Method detection limit		Median	250
TOTAL	12	Min.	1.6
		Max.	3000

Lognormal distribution? r-squared is: 0.934
Normal distribution? r-squared is: 0.741
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 717488

Benzo(a)pyrene 95% UCL Calculation

DATA	ID
19	J1R1L4/J1R1M1
190	J1R1K9
3.2	J1R1L0
8.0	J1R1L1
160	J1R1L2
350	J1R1L3
53	J1R1L5
3.2	J1R1L6
2500	J1R1L7
1700	J1R1L8
1400	J1R1L9
300	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	557
Censored		Lognormal mean	1737
Detection limit or PQL		Std. devn.	834
Method detection limit		Median	175
TOTAL	12	Min.	3.2
		Max.	2500

Lognormal distribution? r-squared is: 0.948
Normal distribution? r-squared is: 0.712
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 109357

Benzo(b)fluoranthene 95% UCL Calculation

DATA	ID
23	J1R1L4/J1R1M1
220	J1R1K9
2.1	J1R1L0
9.9	J1R1L1
180	J1R1L2
520	J1R1L3
61	J1R1L5
2.1	J1R1L6
2500	J1R1L7
1500	J1R1L8
1400	J1R1L9
380	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	566
Censored		Lognormal mean	2342
Detection limit or PQL		Std. devn.	804
Method detection limit		Median	200
TOTAL	12	Min.	2.1
		Max.	2500

Lognormal distribution? r-squared is: 0.942
Normal distribution? r-squared is: 0.743
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 212517

Benzo(ghi)perylene 95% UCL Calculation

DATA	ID
15	J1R1L4/J1R1M1
110	J1R1K9
3.6	J1R1L0
9.1	J1R1L1
120	J1R1L2
250	J1R1L3
33	J1R1L5
3.6	J1R1L6
1600	J1R1L7
910	J1R1L8
760	J1R1L9
210	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	335
Censored		Lognormal mean	750
Detection limit or PQL		Std. devn.	500
Method detection limit		Median	115
TOTAL	12	Min.	3.6
		Max.	1600

Lognormal distribution? r-squared is: 0.956
Normal distribution? r-squared is: 0.712
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 22104

Benzo(k)fluoranthene 95% UCL Calculation

DATA	ID
8.4	J1R1L4/J1R1M1
73	J1R1K9
2.0	J1R1L0
1.9	J1R1L1
66	J1R1L2
170	J1R1L3
24	J1R1L5
2.0	J1R1L6
930	J1R1L7
730	J1R1L8
600	J1R1L9
140	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	229
Censored		Lognormal mean	692
Detection limit or PQL		Std. devn.	329
Method detection limit		Median	70
TOTAL	12	Min.	1.9
		Max.	930

Lognormal distribution? r-squared is: 0.928
Normal distribution? r-squared is: 0.730
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 38826

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	**Date**	02/14/13	**Calc. No.**	0100D-CA-V0490
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 02/14/13
Sheet No. 30 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Clearwell Excavation

Chrysene 95% UCL Calculation

DATA	ID
23	J1R1L4/J1R1M1
350	J1R1K9
2.4	J1R1L0
12	J1R1L1
190	J1R1L2
550	J1R1L3
62	J1R1L5
2.4	J1R1L6
2400	J1R1L7
2000	J1R1L8
1500	J1R1L9
400	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	624
Censored		Lognormal mean	2613
Detection limit or PQL		Std. devn.	851
Method detection limit		Median	270
TOTAL	12	Min.	2.4
		Max.	2400

Lognormal distribution? r-squared is: 0.935
Normal distribution? r-squared is: 0.760
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 234358

Dibenz(a,h)anthracene 95% UCL Calculation

DATA	ID
5.5	J1R1L4/J1R1M1
29	J1R1K9
5.5	J1R1L0
5.0	J1R1L1
23	J1R1L2
69	J1R1L3
5.5	J1R1L5
5.5	J1R1L6
500	J1R1L7
320	J1R1L8
250	J1R1L9
5.5	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	102
Censored		Lognormal mean	125
Detection limit or PQL		Std. devn.	164
Method detection limit		Median	14
TOTAL	12	Min.	5.0
		Max.	500

Lognormal distribution? r-squared is: 0.825
Normal distribution? r-squared is: 0.666
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 180

Fluoranthene 95% UCL Calculation

DATA	ID
51	J1R1L4/J1R1M1
630	J1R1K9
6.5	J1R1L0
18	J1R1L1
360	J1R1L2
960	J1R1L3
140	J1R1L5
6.5	J1R1L6
6200	J1R1L7
4800	J1R1L8
3900	J1R1L9
750	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	1485
Censored		Lognormal mean	5498
Detection limit or PQL		Std. devn.	2180
Method detection limit		Median	495
TOTAL	12	Min.	6.5
		Max.	6200

Lognormal distribution? r-squared is: 0.944
Normal distribution? r-squared is: 0.718
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 476248

Fluorene 95% UCL Calculation

DATA	ID
5.4	J1R1L4/J1R1M1
160	J1R1K9
2.7	J1R1L0
2.5	J1R1L1
52	J1R1L2
140	J1R1L3
17	J1R1L5
2.65	J1R1L6
1100	J1R1L7
840	J1R1L8
860	J1R1L9
74	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	271
Censored		Lognormal mean	735
Detection limit or PQL		Std. devn.	407
Method detection limit		Median	63
TOTAL	12	Min.	2.5
		Max.	1100

Lognormal distribution? r-squared is: 0.923
Normal distribution? r-squared is: 0.694
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 42445

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

DATA	ID
11	J1R1L4/J1R1M1
89	J1R1K9
6.0	J1R1L0
5.5	J1R1L1
110	J1R1L2
210	J1R1L3
27	J1R1L5
6.0	J1R1L6
690	J1R1L7
830	J1R1L8
760	J1R1L9
180	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	244
Censored		Lognormal mean	465
Detection limit or PQL		Std. devn.	320
Method detection limit		Median	100
TOTAL	12	Min.	5.5
		Max.	830

Lognormal distribution? r-squared is: 0.914
Normal distribution? r-squared is: 0.748
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8385

Phenanthrene 95% UCL Calculation

DATA	ID
32	J1R1L4/J1R1M1
610	J1R1K9
6.0	J1R1L0
5.5	J1R1L1
200	J1R1L2
520	J1R1L3
52	J1R1L5
6.0	J1R1L6
5000	J1R1L7
4300	J1R1L8
3600	J1R1L9
370	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	1225
Censored		Lognormal mean	4712
Detection limit or PQL		Std. devn.	1889
Method detection limit		Median	285
TOTAL	12	Min.	5.5
		Max.	5000

Lognormal distribution? r-squared is: 0.930
Normal distribution? r-squared is: 0.683
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 600328

Pyrene 95% UCL Calculation

DATA	ID
48	J1R1L4/J1R1M1
620	J1R1K9
6.0	J1R1L0
16	J1R1L1
390	J1R1L2
960	J1R1L3
150	J1R1L5
6.0	J1R1L6
5100	J1R1L7
5100	J1R1L8
3900	J1R1L9
800	J1R1M0

Number of samples		Uncensored values	
Uncensored	12	Mean	1425
Censored		Lognormal mean	5700
Detection limit or PQL		Std. devn.	2023
Method detection limit		Median	505
TOTAL	12	Min.	6.0
		Max.	5100

Lognormal distribution? r-squared is: 0.932
Normal distribution? r-squared is: 0.713
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 536855

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	**Date**	02/14/13	**Calc. No.**	0100D-CA-V0490
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 02/14/13
Sheet No. 31 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Overburden (OB)

Antimony 95% UCL Calculation

DATA	ID
0.34	J1R137/J1R141
0.63	J1R129
0.49	J1R130
0.59	J1R131
0.49	J1R132
0.59	J1R133
0.40	J1R134
0.53	J1R135
0.56	J1R136
0.19	J1R138
0.55	J1R139
0.52	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	0.49
Censored		Lognormal mean	0.50
Detection limit or PQL		Std. devn.	0.13
Method detection limit		Median	0.53
TOTAL	12	Min.	0.19
		Max.	0.63

Lognormal distribution? r-squared is: 0.733
Normal distribution? r-squared is: 0.857
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.55

Arsenic 95% UCL Calculation

DATA	ID
2.7	J1R137/J1R141
2.2	J1R129
3.0	J1R130
2.7	J1R131
2.4	J1R132
2.6	J1R133
2.3	J1R134
3.0	J1R135
2.3	J1R136
2.5	J1R138
2.3	J1R139
2.4	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	2.5
Censored		Lognormal mean	2.5
Detection limit or PQL		Std. devn.	0.27
Method detection limit		Median	2.5
TOTAL	12	Min.	2.2
		Max.	3.0

Lognormal distribution? r-squared is: 0.925
Normal distribution? r-squared is 0.910
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.7

Barium 95% UCL Calculation

DATA	ID
60.4	J1R137/J1R141
61.4	J1R129
63.9	J1R130
64.0	J1R131
69.8	J1R132
62.6	J1R133
61.7	J1R134
61.3	J1R135
56.8	J1R136
78.4	J1R138
58.3	J1R139
66.3	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	63.7
Censored		Lognormal mean	63.7
Detection limit or PQL		Std. devn.	5.8
Method detection limit		Median	62.2
TOTAL	12	Min.	56.8
		Max.	78.4

Lognormal distribution? r-squared is: 0.880
Normal distribution? r-squared 0.846
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 66.5

Beryllium 95% UCL Calculation

DATA	ID
0.12	J1R137/J1R141
0.084	J1R129
0.12	J1R130
0.13	J1R131
0.099	J1R132
0.12	J1R133
0.089	J1R134
0.13	J1R135
0.095	J1R136
0.15	J1R138
0.090	J1R139
0.10	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	0.11
Censored		Lognormal mean	0.11
Detection limit or PQL		Std. devn.	0.020
Method detection limit		Median	0.11
TOTAL	12	Min.	0.084
		Max.	0.15

Lognormal distribution? r-squared is: 0.957
Normal distribution? r-squared is: 0.944
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.12

Boron 95% UCL Calculation

DATA	ID
0.73	J1R137/J1R141
1.5	J1R129
0.47	J1R130
1.2	J1R131
1.2	J1R132
1.2	J1R133
0.47	J1R134
1.1	J1R135
1.0	J1R136
1.7	J1R138
1.0	J1R139
1.0	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	1.0
Censored		Lognormal mean	1.1
Detection limit or PQL		Std. devn.	0.37
Method detection limit		Median	1.1
TOTAL	12	Min.	0.47
		Max.	1.7

Lognormal distribution? r-squared is: 0.885
Normal distribution? r-squared is 0.944
Recommendations:
Use normal distribution.

UCL (t-statistic) is 1.2

Cadmium 95% UCL Calculation

DATA	ID
0.079	J1R137/J1R141
0.059	J1R129
0.071	J1R130
0.068	J1R131
0.077	J1R132
0.061	J1R133
0.058	J1R134
0.070	J1R135
0.076	J1R136
0.084	J1R138
0.075	J1R139
0.053	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	0.069
Censored		Lognormal mean	0.069
Detection limit or PQL		Std. devn.	0.010
Method detection limit		Median	0.071
TOTAL	12	Min.	0.053
		Max.	0.084

Lognormal distribution? r-squared is: 0.954
Normal distribution? r-squared 0.966
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.075

Chromium 95% UCL Calculation

DATA	ID
11.2	J1R137/J1R141
8.7	J1R129
11.3	J1R130
11.3	J1R131
10.3	J1R132
10.8	J1R133
9.2	J1R134
11.1	J1R135
11.9	J1R136
11.8	J1R138
10.6	J1R139
10.2	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	10.7
Censored		Lognormal mean	10.7
Detection limit or PQL		Std. devn.	0.97
Method detection limit		Median	11.0
TOTAL	12	Min.	8.7
		Max.	11.9

Lognormal distribution? r-squared is: 0.900
Normal distribution? r-squared is: 0.922
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.3

Cobalt 95% UCL Calculation

DATA	ID
7.8	J1R137/J1R141
8.7	J1R129
7.4	J1R130
7.7	J1R131
8.4	J1R132
8.4	J1R133
9.1	J1R134
8.6	J1R135
8.0	J1R136
7.7	J1R138
8.2	J1R139
7.9	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	8.2
Censored		Lognormal mean	8.2
Detection limit or PQL		Std. devn.	0.50
Method detection limit		Median	8.1
TOTAL	12	Min.	7.4
		Max.	9.1

Lognormal distribution? r-squared is: 0.979
Normal distribution? r-squared is 0.974
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.4

Copper 95% UCL Calculation

DATA	ID
15.7	J1R137/J1R141
15.3	J1R129
16.5	J1R130
15.9	J1R131
16.4	J1R132
16.3	J1R133
16.7	J1R134
17.2	J1R135
16.1	J1R136
14.8	J1R138
16.4	J1R139
15.7	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	16.1
Censored		Lognormal mean	16.1
Detection limit or PQL		Std. devn.	0.65
Method detection limit		Median	16.2
TOTAL	12	Min.	14.8
		Max.	17.2

Lognormal distribution? r-squared is: 0.970
Normal distribution? r-squared 0.975
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 16.4

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie

Rev. No. 0
Date 02/14/13
Sheet No. 32 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Overburden (OB)

Lead 95% UCL Calculation

DATA	ID
4.3	J1R137/J1R141
4.6	J1R129
4.0	J1R130
5.1	J1R131
5.8	J1R132
4.7	J1R133
3.8	J1R134
5.1	J1R135
4.0	J1R136
4.8	J1R138
4.5	J1R139
4.4	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	4.6
Censored		Lognormal mean	4.6
Detection limit or PQL		Std. devn.	0.57
Method detection limit		Median	4.6
TOTAL	12	Min.	3.8
		Max.	5.8

Lognormal distribution? r-squared is: 0.974
Normal distribution? r-squared is: 0.956
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 4.9

Manganese 95% UCL Calculation

DATA	ID
325	J1R137/J1R141
311	J1R129
309	J1R130
312	J1R131
323	J1R132
338	J1R133
337	J1R134
347	J1R135
316	J1R136
347	J1R138
331	J1R139
367	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	330
Censored		Lognormal mean	330
Detection limit or PQL		Std. devn.	17.7
Method detection limit		Median	328
TOTAL	12	Min.	309
		Max.	367

Lognormal distribution? r-squared is: 0.951
Normal distribution? r-squared is 0.943
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 340

Mercury 95% UCL Calculation

DATA	ID
0.0026	J1R137/J1R141
0.18	J1R129
0.0025	J1R130
0.0046	J1R131
0.017	J1R132
0.0067	J1R133
0.0026	J1R134
0.0052	J1R135
0.0024	J1R136
0.0029	J1R138
0.0031	J1R139
0.0060	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	0.020
Censored		Lognormal mean	0.012
Detection limit or PQL		Std. devn.	0.051
Method detection limit		Median	0.0038
TOTAL	12	Min.	0.0024
		Max.	0.18

Lognormal distribution? r-squared is: 0.684
Normal distribution? r-squared 0.350
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.044

Nickel 95% UCL Calculation

DATA	ID
11.1	J1R137/J1R141
12.5	J1R129
10.2	J1R130
11.7	J1R131
12.3	J1R132
10.7	J1R133
11.5	J1R134
11.0	J1R135
13.5	J1R136
11.2	J1R138
11.3	J1R139
9.7	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	11.4
Censored		Lognormal mean	11.4
Detection limit or PQL		Std. devn.	1.0
Method detection limit		Median	11.3
TOTAL	12	Min.	9.7
		Max.	13.5

Lognormal distribution? r-squared is: 0.977
Normal distribution? r-squared is: 0.968
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 12.0

Vanadium 95% UCL Calculation

DATA	ID
52.3	J1R137/J1R141
61.0	J1R129
51.8	J1R130
54.8	J1R131
58.5	J1R132
56.8	J1R133
61.5	J1R134
57.2	J1R135
59.8	J1R136
54.5	J1R138
59.5	J1R139
54.3	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	56.8
Censored		Lognormal mean	56.8
Detection limit or PQL		Std. devn.	3.3
Method detection limit		Median	57.0
TOTAL	12	Min.	51.8
		Max.	61.5

Lognormal distribution? r-squared is: 0.963
Normal distribution? r-squared is 0.964
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 58.6

Zinc 95% UCL Calculation

DATA	ID
45.8	J1R137/J1R141
46.2	J1R129
41.5	J1R130
44.3	J1R131
47.5	J1R132
46.2	J1R133
47.5	J1R134
46.2	J1R135
46.2	J1R136
46.8	J1R138
46.4	J1R139
43.2	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	45.7
Censored		Lognormal mean	45.7
Detection limit or PQL		Std. devn.	1.8
Method detection limit		Median	46.2
TOTAL	12	Min.	41.5
		Max.	47.5

Lognormal distribution? r-squared is: 0.815
Normal distribution? r-squared 0.826
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 46.5

Benzo(a)anthracene 95% UCL Calculation

DATA	ID
37	J1R137/J1R141
1.6	J1R129
11	J1R130
1.6	J1R131
1.6	J1R132
1.5	J1R133
1.6	J1R134
5.5	J1R135
6000	J1R136
5.7	J1R138
1.6	J1R139
12	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	507
Censored		Lognormal mean	119
Detection limit or PQL		Std. devn.	1730
Method detection limit		Median	3.6
TOTAL	12	Min.	1.5
		Max.	6000

Lognormal distribution? r-squared is: 0.666
Normal distribution? r-squared is: NA
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 1328

Benzo(b)fluoranthene 95% UCL Calculation

DATA	ID
26	J1R137/J1R141
7.9	J1R129
8.2	J1R130
2.1	J1R131
5.7	J1R132
4.5	J1R133
2.1	J1R134
7.5	J1R135
3700	J1R136
5.6	J1R138
8.8	J1R139
15	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	316
Censored		Lognormal mean	77
Detection limit or PQL		Std. devn.	1066
Method detection limit		Median	7.7
TOTAL	12	Min.	2.1
		Max.	3700

Lognormal distribution? r-squared is: 0.642
Normal distribution? r-squared is NA
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 822

Chrysene 95% UCL Calculation

DATA	ID
27	J1R137/J1R141
5.3	J1R129
7.8	J1R130
5.0	J1R131
2.4	J1R132
2.3	J1R133
2.4	J1R134
7.3	J1R135
5700	J1R136
5.4	J1R138
7.3	J1R139
20	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	483
Censored		Lognormal mean	102
Detection limit or PQL		Std. devn.	1643
Method detection limit		Median	6.4
TOTAL	12	Min.	2.3
		Max.	5700

Lognormal distribution? r-squared is: 0.632
Normal distribution? r-squared NA
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 1263

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern

Project 100-D Field Remediation

Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13

Job No. 14655

Calc. No. 0100D-CA-V0490

Checked J. D. Skoglie

Rev. No. 0

Date 02/14/13

Sheet No. 33 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Overburden (OB)

Fluoranthene 95% UCL Calculation

DATA	ID
70	J1R137/J1R141
6.5	J1R129
19	J1R130
13	J1R131
6.5	J1R132
6.0	J1R133
6.5	J1R134
20	J1R135
12000	J1R136
16	J1R138
19	J1R139
44	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	1019
Censored		Lognormal mean	227
Detection limit or PQL		Std. devn.	3458
Method detection limit		Median	18
TOTAL	12	Min.	6.0
		Max.	12000

Lognormal distribution? r-squared is: 0.636

Normal distribution? r-squared is: NA

Recommendations:

Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2661

Pyrene 95% UCL Calculation

DATA	ID
65	J1R137/J1R141
6.0	J1R129
20	J1R130
6.0	J1R131
6.0	J1R132
5.5	J1R133
6.0	J1R134
16	J1R135
12000	J1R136
19	J1R138
17	J1R139
47	J1R140

Number of samples		Uncensored values	
Uncensored	12	Mean	1018
Censored		Lognormal mean	230
Detection limit or PQL		Std. devn.	3459
Method detection limit		Median	17
TOTAL	12	Min.	5.5
		Max.	12000

Lognormal distribution? r-squared is: 0.642

Normal distribution? r-squared is NA

Recommendations:

Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2660

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	Date	02/14/13	Calc. No.	0100D-CA-V0490
Project	100-D Field Remediation	Job No.	14655	Checked	J. D. Skoglie
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 02/14/13
Sheet No. 34 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Staging Pile Area (SPA)

Antimony 95% UCL Calculation

DATA	ID
0.47	J1R149/J1R154
0.65	J1R142
0.55	J1R143
0.54	J1R144
0.48	J1R145
0.55	J1R146
0.49	J1R147
0.46	J1R148
0.37	J1R150
0.44	J1R151
0.59	J1R152
0.46	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	0.50
Censored		Lognormal mean	0.50
Detection limit or PQL		Std. devn.	0.075
Method detection limit		Median	0.49
TOTAL	12	Min.	0.37
		Max.	0.65

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

UCL (Land's method) is 0.55

Arsenic 95% UCL Calculation

DATA	ID
2.3	J1R149/J1R154
2.6	J1R142
2.4	J1R143
2.2	J1R144
2.7	J1R145
2.4	J1R146
2.4	J1R147
2.4	J1R148
3.1	J1R150
2.4	J1R151
2.3	J1R152
2.4	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	2.5
Censored		Lognormal mean	2.5
Detection limit or PQL		Std. devn.	0.24
Method detection limit		Median	2.4
TOTAL	12	Min.	2.2
		Max.	3.1

Lognormal distribution? r-squared is: 0.801
Normal distribution? r-squared is: 0.766
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2.6

Barium 95% UCL Calculation

DATA	ID
81.1	J1R149/J1R154
77.9	J1R142
79.8	J1R143
67.9	J1R144
94.2	J1R145
83.2	J1R146
78.6	J1R147
76.3	J1R148
83.1	J1R150
81.1	J1R151
88.9	J1R152
80.0	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	81.0
Censored		Lognormal mean	81.0
Detection limit or PQL		Std. devn.	6.45
Method detection limit		Median	80.6
TOTAL	12	Min.	67.9
		Max.	94.2

Lognormal distribution? r-squared is: 0.909
Normal distribution? r-squared is: 0.912
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 84.5

Beryllium 95% UCL Calculation

DATA	ID
0.15	J1R149/J1R154
0.15	J1R142
0.12	J1R143
0.085	J1R144
0.19	J1R145
0.14	J1R146
0.14	J1R147
0.16	J1R148
0.18	J1R150
0.18	J1R151
0.18	J1R152
0.18	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	0.15
Censored		Lognormal mean	0.15
Detection limit or PQL		Std. devn.	0.031
Method detection limit		Median	0.16
TOTAL	12	Min.	0.085
		Max.	0.19

Lognormal distribution? r-squared is: 0.832
Normal distribution? r-squared is: 0.894
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.17

Boron 95% UCL Calculation

DATA	ID
1.9	J1R149/J1R154
1.7	J1R142
1.6	J1R143
1.7	J1R144
2.4	J1R145
2.0	J1R146
2.1	J1R147
1.6	J1R148
1.6	J1R150
1.7	J1R151
2.5	J1R152
1.5	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	1.9
Censored		Lognormal mean	1.9
Detection limit or PQL		Std. devn.	0.33
Method detection limit		Median	1.7
TOTAL	12	Min.	1.5
		Max.	2.5

Lognormal distribution? r-squared is: 0.900
Normal distribution? r-squared is: 0.872
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.0

Cadmium 95% UCL Calculation

DATA	ID
0.14	J1R149/J1R154
0.11	J1R142
0.089	J1R143
0.096	J1R144
0.12	J1R145
0.11	J1R146
0.11	J1R147
0.099	J1R148
0.086	J1R150
0.10	J1R151
0.14	J1R152
0.094	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	0.11
Censored		Lognormal mean	0.11
Detection limit or PQL		Std. devn.	0.017
Method detection limit		Median	0.11
TOTAL	12	Min.	0.086
		Max.	0.14

Lognormal distribution? r-squared is: 0.953
Normal distribution? r-squared is: 0.927
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.12

Chromium 95% UCL Calculation

DATA	ID
21.7	J1R149/J1R154
12.5	J1R142
10.8	J1R143
12.6	J1R144
12.3	J1R145
11.3	J1R146
12.5	J1R147
12.6	J1R148
12.5	J1R150
11.6	J1R151
12.1	J1R152
11.8	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	12.9
Censored		Lognormal mean	12.8
Detection limit or PQL		Std. devn.	2.8
Method detection limit		Median	12.4
TOTAL	12	Min.	10.8
		Max.	21.7

Lognormal distribution? r-squared is: 0.553
Normal distribution? r-squared is: 0.483
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 14.2

Cobalt 95% UCL Calculation

DATA	ID
8.2	J1R149/J1R154
7.4	J1R142
8.1	J1R143
7.9	J1R144
7.9	J1R145
7.6	J1R146
7.7	J1R147
7.3	J1R148
7.9	J1R150
7.2	J1R151
8.4	J1R152
7.8	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	7.8
Censored		Lognormal mean	7.8
Detection limit or PQL		Std. devn.	0.36
Method detection limit		Median	7.85
TOTAL	12	Min.	7.2
		Max.	8.4

Lognormal distribution? r-squared is: 0.975
Normal distribution? r-squared is: 0.977
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.0

Copper 95% UCL Calculation

DATA	ID
15.4	J1R149/J1R154
15.4	J1R142
16.3	J1R143
15.9	J1R144
15.6	J1R145
14.3	J1R146
14.6	J1R147
15.4	J1R148
16.0	J1R150
14.3	J1R151
15.2	J1R152
15.3	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	15.3
Censored		Lognormal mean	15.3
Detection limit or PQL		Std. devn.	0.637
Method detection limit		Median	15.4
TOTAL	12	Min.	14.3
		Max.	16.3

Lognormal distribution? r-squared is: 0.937
Normal distribution? r-squared is: 0.943
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 15.6

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie JS

Rev. No. 0
Date 02/14/13
Sheet No. 35 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Staging Pile Area (SPA)

Lead 95% UCL Calculation

DATA	ID
5.3	J1R149/J1R154
5.9	J1R142
4.4	J1R143
5.9	J1R144
6.5	J1R145
5.2	J1R146
4.5	J1R147
4.2	J1R148
4.7	J1R150
4.7	J1R151
6.6	J1R152
4.6	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	5.2
Censored		Lognormal mean	5.2
Detection limit or PQL		Std. devn.	0.83
Method detection limit		Median	5.0
TOTAL	12	Min.	4.2
		Max.	6.6

Lognormal distribution? r-squared is: 0.932
Normal distribution? r-squared is: 0.916
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 5.7

Manganese 95% UCL Calculation

DATA	ID
347	J1R149/J1R154
318	J1R142
322	J1R143
310	J1R144
341	J1R145
331	J1R146
338	J1R147
314	J1R148
327	J1R150
321	J1R151
368	J1R152
328	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	330
Censored		Lognormal mean	330
Detection limit or PQL		Std. devn.	16.1
Method detection limit		Median	328
TOTAL	12	Min.	310
		Max.	368

Lognormal distribution? r-squared is: 0.935
Normal distribution? r-squared is: 0.922
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 339

Mercury 95% UCL Calculation

DATA	ID
0.024	J1R149/J1R154
0.17	J1R142
0.00235	J1R143
0.0093	J1R144
0.0071	J1R145
0.0035	J1R146
0.00275	J1R147
0.0028	J1R148
0.00255	J1R150
0.0052	J1R151
0.0064	J1R152
0.0026	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	0.020
Censored		Lognormal mean	0.014
Detection limit or PQL		Std. devn.	0.048
Method detection limit		Median	0.0044
TOTAL	12	Min.	0.0024
		Max.	0.17

Lognormal distribution? r-squared is: 0.757
Normal distribution? r-squared is: 0.381
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.042

Nickel 95% UCL Calculation

DATA	ID
11.4	J1R149/J1R154
11.5	J1R142
11.1	J1R143
11.5	J1R144
11.9	J1R145
10.3	J1R146
11.4	J1R147
11.6	J1R148
12.2	J1R150
11.2	J1R151
11.4	J1R152
11.8	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	11.4
Censored		Lognormal mean	11.4
Detection limit or PQL		Std. devn.	0.471
Method detection limit		Median	11.5
TOTAL	12	Min.	10.3
		Max.	12.2

Lognormal distribution? r-squared is: 0.884
Normal distribution? r-squared is: 0.899
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 11.7

Vanadium 95% UCL Calculation

DATA	ID
51.6	J1R149/J1R154
45.0	J1R142
49.6	J1R143
51.5	J1R144
45.8	J1R145
48.6	J1R146
46.2	J1R147
43.5	J1R148
45.8	J1R150
43.8	J1R151
51.5	J1R152
46.2	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	47.4
Censored		Lognormal mean	47.4
Detection limit or PQL		Std. devn.	3.0
Method detection limit		Median	46.2
TOTAL	12	Min.	43.5
		Max.	51.6

Lognormal distribution? r-squared is: 0.915
Normal distribution? r-squared is: 0.909
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 49.0

Zinc 95% UCL Calculation

DATA	ID
45.0	J1R149/J1R154
41.9	J1R142
41.2	J1R143
42.9	J1R144
44.0	J1R145
42.4	J1R146
41.7	J1R147
39.1	J1R148
41.5	J1R150
40.1	J1R151
49.8	J1R152
40.5	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	42.5
Censored		Lognormal mean	42.5
Detection limit or PQL		Std. devn.	2.8
Method detection limit		Median	41.8
TOTAL	12	Min.	39.1
		Max.	49.8

Lognormal distribution? r-squared is: 0.872
Normal distribution? r-squared is: 0.845
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 43.8

Chloride 95% UCL Calculation

DATA	ID
30.3	J1R149/J1R154
26.8	J1R142
153	J1R143
195	J1R144
164	J1R145
81.4	J1R146
210	J1R147
7.6	J1R148
29.4	J1R150
70.3	J1R151
32.5	J1R152
18.0	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	84.9
Censored		Lognormal mean	95.7
Detection limit or PQL		Std. devn.	74.8
Method detection limit		Median	51.4
TOTAL	12	Min.	7.6
		Max.	210

Lognormal distribution? r-squared is: 0.939
Normal distribution? r-squared is: 0.860
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 255

Nitrogen in Nitrate 95% UCL Calculation

DATA	ID
17.8	J1R149/J1R154
72.2	J1R142
10.0	J1R143
23.7	J1R144
61.9	J1R145
121	J1R146
28.8	J1R147
7.3	J1R148
18.7	J1R150
14.2	J1R151
15.1	J1R152
2.3	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	32.8
Censored		Lognormal mean	35.9
Detection limit or PQL		Std. devn.	35.0
Method detection limit		Median	18.3
TOTAL	12	Min.	2.3
		Max.	121

Lognormal distribution? r-squared is: 0.964
Normal distribution? r-squared is: 0.761
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 49.4

Nitrogen in Nitrite and Nitrate 95% UCL Calculation

DATA	ID
22.7	J1R149/J1R154
37.3	J1R142
15.9	J1R143
22.2	J1R144
70.9	J1R145
147	J1R146
29.7	J1R147
7.5	J1R148
4.0	J1R150
14.3	J1R151
18.6	J1R152
2.1	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	32.7
Censored		Lognormal mean	36.3
Detection limit or PQL		Std. devn.	40.4
Method detection limit		Median	20.4
TOTAL	12	Min.	2.1
		Max.	147

Lognormal distribution? r-squared is: 0.971
Normal distribution? r-squared is: 0.674
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 112

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	**Date**	02/14/13	**Calc. No.**	0100D-CA-V0490
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie
Subject	100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 02/14/13
Sheet No. 36 of 41

Ecology Software (MTCAStat) Results, 100-D-50:6 Subsite Staging Pile Area (SPA)

Sulfate 95% UCL Calculation

DATA	ID
17.9	J1R149/J1R154
18.7	J1R142
62.8	J1R143
60.6	J1R144
20.5	J1R145
42.2	J1R146
23.5	J1R147
10.4	J1R148
17.8	J1R150
49.0	J1R151
86.4	J1R152
68.5	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	39.9
Censored		Lognormal mean	41.2
Detection limit or PQL		Std. devn.	25.2
Method detection limit		Median	32.9
TOTAL	12	Min.	10.4
		Max.	86.4

Lognormal distribution? r-squared is: 0.931
Normal distribution? r-squared is: 0.907
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 67.7

TPH - Diesel 95% UCL Calculation

DATA	ID
69500	J1R149/J1R154
1600	J1R142
690	J1R143
5500	J1R144
1500	J1R145
2500	J1R146
2300	J1R147
1300	J1R148
335	J1R150
1800	J1R151
2300	J1R152
1300	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	7552
Censored		Lognormal mean	4929
Detection limit or PQL		Std. devn.	19552
Method detection limit		Median	1700
TOTAL	12	Min.	335
		Max.	69500

Lognormal distribution? r-squared is: 0.789
Normal distribution? r-squared is: 0.348
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 16837

TPH - Diesel Ext 95% UCL Calculation

DATA	ID
101500	J1R149/J1R154
3900	J1R142
475	J1R143
13000	J1R144
3900	J1R145
5900	J1R146
3900	J1R147
2300	J1R148
1000	J1R150
3700	J1R151
8100	J1R152
2100	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	12481
Censored		Lognormal mean	10306
Detection limit or PQL		Std. devn.	28240
Method detection limit		Median	3900
TOTAL	12	Min.	475
		Max.	101500

Lognormal distribution? r-squared is: 0.901
Normal distribution? r-squared is: 0.396
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 43353

Benzo(a)anthracene 95% UCL Calculation

DATA	ID
1.7	J1RD54
1.6	J1R142
1.6	J1R143
77	J1R144
1.6	J1R145
34	J1R146
8.9	J1R147
1.6	J1R146
9.3	J1R150
8.8	J1R151
1.6	J1R152
11	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	13
Censored		Lognormal mean	13
Detection limit or PQL		Std. devn.	22
Method detection limit		Median	5.2
TOTAL	12	Min.	1.6
		Max.	77

Lognormal distribution? r-squared is: 0.829
Normal distribution? r-squared is: 0.572
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 24

Benzo(a)pyrene 95% UCL Calculation

DATA	ID
3.3	J1RD54
6.8	J1R142
3.2	J1R143
51	J1R144
3.2	J1R145
25	J1R146
8.2	J1R147
3.2	J1R148
8.4	J1R150
3.1	J1R151
3.2	J1R152
8.5	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	11
Censored		Lognormal mean	10
Detection limit or PQL		Std. devn.	14
Method detection limit		Median	5.1
TOTAL	12	Min.	3.1
		Max.	51

Lognormal distribution? r-squared is: 0.799
Normal distribution? r-squared is: 0.574
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 17

Benzo(b)fluoranthene 95% UCL Calculation

DATA	ID
2.2	J1RD54
7.9	J1R142
2.1	J1R143
54	J1R144
2.1	J1R145
28	J1R146
8.1	J1R147
2.1	J1R148
8.5	J1R150
17	J1R151
2.1	J1R152
9.5	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	12
Censored		Lognormal mean	12
Detection limit or PQL		Std. devn.	15
Method detection limit		Median	8.0
TOTAL	12	Min.	2.1
		Max.	54

Lognormal distribution? r-squared is: 0.883
Normal distribution? r-squared is: 0.678
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 19

Chrysene 95% UCL Calculation

DATA	ID
2.5	J1RD54
5.4	J1R142
2.5	J1R143
47	J1R144
2.4	J1R145
28	J1R146
6.8	J1R147
2.4	J1R148
7.8	J1R150
6.6	J1R151
2.4	J1R152
9.1	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	10
Censored		Lognormal mean	9.8
Detection limit or PQL		Std. devn.	14
Method detection limit		Median	6.0
TOTAL	12	Min.	2.4
		Max.	47

Lognormal distribution? r-squared is: 0.855
Normal distribution? r-squared is: 0.617
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 17

Fluoranthene 95% UCL Calculation

DATA	ID
6.5	J1RD54
19	J1R142
6.5	J1R143
120	J1R144
6.5	J1R145
88	J1R146
21	J1R147
6.5	J1R148
22	J1R150
17	J1R151
6.5	J1R152
23	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	29
Censored		Lognormal mean	28
Detection limit or PQL		Std. devn.	37
Method detection limit		Median	18
TOTAL	12	Min.	6.5
		Max.	120

Lognormal distribution? r-squared is: 0.840
Normal distribution? r-squared is: 0.631
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 46

Pyrene 95% UCL Calculation

DATA	ID
6.0	J1RD54
12	J1R142
6.0	J1R143
120	J1R144
6.0	J1R145
58	J1R146
21	J1R147
6.0	J1R148
21	J1R150
16	J1R151
6.0	J1R152
21	J1R153

Number of samples		Uncensored values	
Uncensored	12	Mean	25
Censored		Lognormal mean	24
Detection limit or PQL		Std. devn.	33
Method detection limit		Median	14
TOTAL	12	Min.	6.0
		Max.	120

Lognormal distribution? r-squared is: 0.853
Normal distribution? r-squared is: 0.601
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 41

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie JDS

Rev. No. 0
Date 02/14/13
Sheet No. 37 of 41

Duplicate Analysis - 100-D-50:6 Subsite Pipeline Excavation (PIPE)

Sampling Area	Sample Number	Sample Date	Aluminium			Antimony			Arsenic			Barium			Boron			Calcium			Chromium			Cobalt			Copper		
			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
PIPE-3	J1R118	9/5/2012	5780		1.3	0.56		0.32	2.1		0.56	68.4		0.065	1.2	B	0.84	10200		12.1	15.2		0.050	8.5		0.085	19.2		0.19
Replicate of J1R118	J1R128	9/5/2012	5860		1.6	0.56	B	0.39	2.4		0.68	62.1		0.078	1.1	B	1.0	9600		14.5	14.5		0.060	9.4		0.10	20.9		0.22

Analysis:

		Aluminium	Antimony	Arsenic	Barium	Boron	Calcium	Chromium	Cobalt	Copper
TDL		5	0.6	10	2	2	100	1	2	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)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD	1.4%			9.7%		6.1%	4.7%		8.5%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - 100-D-50:6 Subsite Pipeline Excavation (PIPE)

Sampling Area	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Nickel			Potassium			Silicon			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
PIPE-3	J1R118	9/5/2012	23700		3.2	12.4		0.23	4660		3.2	317		0.085	0.034		0.0063	11.0		0.11	986		35.0	234	X	4.8	318		50.4
Replicate of J1R118	J1R128	9/5/2012	25400		3.9	12.2		0.28	4910		3.8	338		0.10	0.029		0.0056	10.6		0.13	987		42.2	278	X	5.8	403		60.8

Analysis:

		Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Silicon	Sodium
TDL		5	5	75	5	0.2	4	400	2	50
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)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	6.9%		5.2%	6.4%				17.2%	23.6%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable

Duplicate Analysis - 100-D-50:6 Subsite Pipeline Excavation (PIPE)

Sampling Area	HEIS Number	Sample Date	Vanadium			Zinc			Acenaphthene			Acenaphthylene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene			Benzo(ghi)perylene			Benzo(k)fluoranthene		
			mg/kg	Q	PQL	mg/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
PIPE-3	J1R118	9/5/2012	57.3		0.080	55.3		0.34	420	X	9.6	36	JX	8.6	1100		3.1	680		6.1	890		4.0	460		6.9	280		3.8
Replicate of J1R118	J1R128	9/5/2012	59.5		0.097	58.9		0.41	870	X	10	83	JX	9.3	1900		3.3	1100		6.6	1400		4.3	690		7.4	450		4.1

Analysis:

		Vanadium	Zinc	Acenaphthene	Acenaphthylene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene
TDL		2.5	1	15	15	15	15	15	15	15
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)**	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	3.8%	6.3%	*69.8%*		*53.3%*	*47.2%*	*44.5%*	*40.0%*	*46.6%*
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Yes - assess further	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

Duplicate Analysis - 100-D-50:6 Subsite Pipeline Excavation (PIPE)

Sampling Area	HEIS Number	Sample Date	Chrysene			Dibenz(a,h)anthracene			Fluoranthene			Fluorene			Indeno(1,2,3-			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
PIPE-3	J1R118	9/5/2012	1000		4.6	130	X	11	2200		12	430		5.1	400		12	2000		12	2200		12
Replicate of J1R118	J1R128	9/5/2012	1600		5.0	220	X	11	4400		13	1100		5.4	570		12	4600		12	4000		12

Analysis:

		Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-	Phenanthrene	Pyrene
TDL		15	15	15	15	15	15	15
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	*46.2%*	*51.4%*	*66.7%*	*87.6%*	*35.1%*	*78.8%*	*58.1%*
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie

Rev. No. 0
Date 02/14/13
Sheet No. 38 of 41

Duplicate Analysis - 100-D-50:6 Subsite Clearwell Excavation (CLEAR)

Sampling Area	Sample Number	Sample Date	Aluminium			Antimony			Arsenic			Barium			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
CLEAR-6	J1R1L4	9/5/2012	5400		1.5	0.78	J	0.38	1.6		0.65	62.7		0.075	7950	J	13.9	7.4		0.057	9.9		0.099	18.9		0.21	24200		3.8
Duplicate of J1R1L4	J1R1M1	9/5/2012	5450		1.5	0.72	J	0.37	1.6		0.65	60.0		0.075	8310	J	13.8	6.6		0.057	10.3		0.098	18.3		0.21	24100		3.7

Analysis:

TDL		5	0.6	10	2	100	1	2	1	5
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)**	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	0.9%			4.4%	4.4%	11.4%		3.2%	0.4%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable

Duplicate Analysis - 100-D-50:6 Subsite Clearwell Pipeline Excavation (CLEAR)

Sampling Area	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
CLEAR-6	J1R1L4	9/5/2012	3.0		0.27	4680		3.7	302		0.099	10		0.12	769		40.5	252	J	5.6	479		58.3	68.4		0.093	45.3	X	0.39
Duplicate of J1R1L4	J1R1M1	9/5/2012	3.2		0.26	4560		3.6	323		0.098	9.8		0.12	764		40.2	245	J	5.6	502		57.9	68.4		0.092	45.9	X	0.39

Analysis:

TDL		5	75	5	4	400	2	50	2.5	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?	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD		2.6%	6.7%			2.8%	4.7%	0.0%	1.3%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable

Duplicate Analysis - 100-D-50:6 Subsite Clearwell Pipeline Excavation (CLEAR)

Sampling Area	HEIS Number	Sample Date	Anthracene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene			Benzo(ghi)perylene			Benzo(k)fluoranthene			Chrysene			Fluoranthene			Phenanthrene		
			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	ug/kg	Q	PQL
CLEAR-6	J1R1L4	9/5/2012	3.6	JX	3.1	15		3.3	14	J	6.6	15		4.3	11	JX	7.4	5.8	J	4.0	13	J	5.0	33	J	13	16	J	12
Duplicate of J1R1L4	J1R1M1	9/5/2012	21		2.9	31		3.1	24		6.2	30		4.1	18	JX	7.0	11	J	3.8	32	J	4.7	69		13	48		12

Analysis:

TDL		15	15	15	15	15	15	15	15	15
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	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	No - acceptable	Yes - assess further	Yes - assess further

Duplicate Analysis - 100-D-50:6 Subsite Clearwell Pipeline Excavation (CLEAR)

Sampling Area	HEIS Number	Sample Date	Pyrene		
			ug/kg	Q	PQL
CLEAR-6	J1R1L4	9/5/2012	30	J	12
Duplicate of J1R1L4	J1R1M1	9/5/2012	65		12

Analysis:

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

Qualifiers are defined

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/12/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie

Rev. No. 0
Date 02/12/13
Sheet No. 39 of 41

Duplicate Analysis - 100-D-50:6 Subsite Overburden (OB)

Sampling Area	Sample Number	Sample Date	Aluminium			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium			Cobalt			Copper		
			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
OB-9	J1R137	9/6/2012	7440		1.5	2.7		0.62	60.0	X	0.071	0.11	B	0.031	0.060	B	0.039	8130	X	13.3	10.9	X	0.055	7.6	X	0.094	15.2		0.20
Duplicate of J1R137	J1R141	9/6/2012	7530		1.5	2.7		0.65	60.7	X	0.075	0.12	B	0.033	0.098	B	0.040	8190	X	13.9	11.4	X	0.057	8.0	X	0.099	16.1		0.21

Analysis:

TDL		5	10	2	0.2	0.2	100	1	2	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)	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	1.2%			1.2%			0.7%	4.5%	5.1%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable

Duplicate Analysis - 100-D-50:6 Subsite Overburden (OB)

Sampling Area	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
OB-9	J1R137	9/6/2012	20900	X	3.6	4.2		0.25	4800	X	3.5	328	X	0.094	11.2	X	0.12	1140		38.6	341		5.3	298		55.5	50.6		0.088
Duplicate of J1R137	J1R141	9/6/2012	21200	X	3.7	4.3		0.27	4720	X	3.6	322	X	0.099	11.0	X	0.12	1190		40.4	425		5.6	308		58.1	54.0		0.093

Analysis:

TDL		5	5	75	5	4	400	2	50	2.5
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)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	1.4%		1.7%	1.8%			21.9%	3.3%	6.5%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable

Duplicate Analysis - 100-D-50:6 Subsite Overburden (OB)

Sampling Area	HEIS Number	Sample Date	Zinc			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene			Chrysene			Fluoranthene			Phenanthrene			Pyrene		
			mg/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
OB-9	J1R137	9/6/2012	45.0	X	0.37	65		3.2	40		6.4	43	X	4.2	47		4.8	120		13	79		12	110		12
Duplicate of J1R137	J1R141	9/6/2012	46.6	X	0.39	9.2	J	3.2	7.7	J	6.4	9.4	J	4.2	6.8	J	4.8	20	J	13	13	J	12	19	J	12

Analysis:

TDL		1	15	15	15	15	15	15	15
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	3.5%							
	Difference > 2 TDL?	Not applicable	Yes - assess further	Yes - assess further	Yes - assess further	Yes - assess further	Yes - assess further	Yes - assess further	Yes - assess further

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations

Date 02/14/13
Job No. 14655

Calc. No. 0100D-CA-V0490
Checked J. D. Skoglie JJS

Rev. No. 0
Date 02/14/13
Sheet No. 40 of 41

Duplicate Analysis - 100-D-50:6 Subsite Staging Pile Area (SPA)

Sampling Area	Sample Number	Sample Date	Aluminium			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-8	J1R149	9/6/2012	8590		1.5	0.56	B	0.37	2.2		0.65	80.9		0.075	0.13	B	0.032	1.9	B	0.96	0.13	B	0.04	4370		13.8	22.1		0.057
Duplicate of J1R149	J1R154	9/6/2012	8900		1.4	0.37	B	0.35	2.3		0.60	81.3		0.069	0.16	B	0.030	1.9		0.89	0.14	B	0.037	4420		12.8	21.2		0.053

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	3.5%			0.5%				1.1%	4.2%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable

Duplicate Analysis - 100-D-50:6 Subsite Staging Pile Area (SPA)

Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead			Magnesium			Manganese			Mercury			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-8	J1R149	9/6/2012	8.4	X	0.098	15.3		0.21	22200		3.7	5.4		0.26	4400		3.6	351		0.098	0.024		0.0051	11.4	X	0.12	1700		40.2
Duplicate of J1R149	J1R154	9/6/2012	7.9	X	0.091	15.4		0.20	21300		3.5	5.2		0.25	4330		3.4	342		0.091	0.023		0.0051	11.3	X	0.11	1780		37.2

Analysis:

TDL		2	1	5	5	75	5	0.2	4	400
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD		0.7%	4.1%		1.6%	2.6%			
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Duplicate Analysis - 100-D-50:6 Subsite Staging Pile Area (SPA)

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc			Chloride			Fluoride			Nitrogen in Nitrate			Nitrogen in Nitrite and Nitrate			Phosphorous in phosphate		
			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	ug/kg	Q	PQL	ug/kg	Q	PQL
SPA-8	J1R149	9/6/2012	348		5.6	264		57.9	52.6		0.092	45.1	X	0.39	30.9		1.9	1.3	B	0.81	17.0		0.31	20.8		0.30	2.5	B	1.2
Duplicate of J1R149	J1R154	9/6/2012	423		5.1	278		53.6	50.6		0.085	44.9	X	0.36	29.6		2.0	1.2	B	0.83	18.6		0.32	24.6		0.30	2.4	B	1.2

Analysis:

TDL		2	50	2.5	1	15	15	15	15	15
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)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	19.5%	5.2%	3.9%	0.4%					
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

Qualifiers are defined on page 3.

Washington Closure Hanford

Originator N. K. Schiffern **Date** 02/14/13 **Calc. No.** 0100D-CA-V0490 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 02/14/13
Subject 100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 41 of 41

Duplicate Analysis - 100-D-50:6 Subsite Staging Pile Area (SPA)

Sampling Area	HEIS Number	Sample Date	Sulfate			TPH - Diesel			TPH - Diesel Ext			Acenaphthene			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene			Benzo(ghi)perylene		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/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
SPA-8	J1R149	9/6/2012	17.3		1.7	29000		680	43000		1000	390	X	10	680		3.0	1200		3.2	800		6.4	860		4.2	530		7.2
Duplicate of J1R149	J1R154	9/6/2012	18.4		1.7	110000		630	160000		930	1300	DX	47	2200	D	14	3400	D	15	2200	D	30	2600	D	20	1700	D	34

Analysis:

TDL			2			50			2.5			15			15			15			15			15			15		
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)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**		
	RPD		*6.2%*			*116.5%*			*115.3%*			*107.7%*			*105.6%*			*95.7%*			*93.3%*			*100.6%*			*104.9%*		
	Difference > 2 TDL?		Not applicable			Not applicable			Not applicable			Not applicable			Not applicable			Not applicable			Not applicable			Not applicable			Not applicable		

Duplicate Analysis - 100-D-50:6 Subsite Staging Pile Area (SPA)

Sampling Area	HEIS Number	Sample Date	Benzo(k)fluoranthene			Chrysene			Dibenz(a,h)anthracene			Fluoranthene			Fluorene			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	ug/kg	Q	PQL	ug/kg	Q	PQL
SPA-8	J1R149	9/6/2012	330		3.9	1000		4.8	150	X	11	2200		13	360		5.3	530		12	1800		12	2300		12
Duplicate of J1R149	J1R154	9/6/2012	880	D	19	2900	D	23	460	DX	52	6600	D	62	1200	D	25	1700	D	57	5900	D	57	6700	D	57

Analysis:

TDL			15			15			15			15			15			15			15			15		
Duplicate Analysis	Both > PQL?		**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			**Yes (continue)**		
	Both >5xTDL?		**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**			**Yes (calc RPD)**		
	RPD		*90.9%*			*97.4%*			*101.6%*			*100.0%*			*107.7%*			*104.9%*			*106.5%*			*97.8%*		
	Difference > 2 TDL?		Not applicable			Not applicable			Not applicable			Not applicable			Not applicable			Not applicable			Not applicable			Not applicable		

Qualifiers are defined on page 3.

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
PIPE-3	J1R118	9/5/2012	5780		1.3	0.56		0.32	2.1		0.56	68.4		0.065
Replicate of J1R118	J1R128	9/5/2012	5860		1.6	0.56	B	0.39	2.4		0.68	62.1		0.078
PIPE-1	J1R116	9/5/2012	6670		1.5	0.69		0.36	2.5		0.63	63.6		0.072
PIPE-2	J1R117	9/5/2012	8170		1.4	2.0		0.34	14.7		0.59	93.7		0.068
PIPE-4	J1R119	9/5/2012	6650		1.5	0.37	U	0.37	3.5		0.64	60.8		0.074
PIPE-5	J1R120	9/5/2012	6920		1.4	0.38	B	0.35	3.2		0.61	62.4		0.070
PIPE-6	J1R121	9/5/2012	6120		1.5	0.61		0.37	2.8		0.64	51.7		0.074
PIPE 7	J1R122	9/5/2012	5730		1.5	0.48	B	0.38	2.4		0.66	59.0		0.075
PIPE-8	J1R123	9/5/2012	5520		1.5	0.86		0.37	2.0		0.64	53.4		0.074
PIPE-9	J1R124	9/5/2012	5510		1.6	0.70		0.39	1.4		0.68	52.5		0.078
PIPE-10	J1R125	9/5/2012	5490		1.4	0.62		0.35	1.6		0.61	64.4		0.071
PIPE-11	J1R126	9/5/2012	6140		1.6	0.71		0.38	2.4		0.66	56.5		0.076
PIPE-12	J1R127	9/5/2012	6670		1.4	0.41	B	0.34	3.7		0.60	58.0		0.069
CLEAR-6	J1R1L4	9/5/2012	5400		1.5	0.78	J	0.38	1.6		0.65	62.7		0.075
Duplicate of J1R1L4	J1R1M1	9/5/2012	5450		1.5	0.72	J	0.37	1.6		0.65	60.0		0.075
CLEAR-1	J1R1K9	9/5/2012	6040		1.4	0.44	BJ	0.34	3.3		0.59	57.8		0.068
CLEAR-2	J1R1L0	9/5/2012	6310		1.5	0.56	BJ	0.38	3.2		0.65	56.8		0.075
CLEAR-3	J1R1L1	9/5/2012	6350		1.5	0.38	UJ	0.38	2.7		0.66	66.1		0.076
CLEAR-4	J1R1L2	9/5/2012	6190		1.5	0.52	BJ	0.36	2.8		0.63	58.6		0.073
CLEAR-5	J1R1L3	9/5/2012	5570		1.6	0.63	J	0.38	2.1		0.66	64.2		0.076
CLEAR-7	J1R1L5	9/5/2012	7460		1.6	0.51	BJ	0.38	2.1		0.66	65.4		0.076
CLEAR-8	J1R1L6	9/5/2012	4920		1.5	0.67	J	0.37	1.2		0.65	61.4		0.074
CLEAR-9	J1R1L7	9/5/2012	8900		1.6	0.55	BJ	0.38	3.4		0.66	82.6		0.076
CLEAR-10	J1R1L8	9/5/2012	5430		1.5	0.55	BJ	0.36	1.2		0.62	65.4		0.072
CLEAR-11	J1R1L9	9/5/2012	6320		1.4	0.46	BJ	0.35	2.4		0.61	55.0		0.070
CLEAR-12	J1R1M0	9/5/2012	6240		1.5	0.46	BJ	0.36	2.3		0.63	59.4		0.073
OB-9	J1R137	9/6/2012	7440		1.5	0.36	U	0.36	2.7		0.62	60.0	X	0.071
Duplicate of J1R137	J1R141	9/6/2012	7530		1.5	0.50	B	0.37	2.7		0.65	60.7	X	0.075
OB-1	J1R129	9/6/2012	6670		1.6	0.63		0.38	2.2		0.67	61.4	X	0.077
OB-2	J1R130	9/6/2012	7130		1.5	0.49	B	0.36	3.0		0.63	63.9	X	0.073
OB-3	J1R131	9/6/2012	7740		1.3	0.59		0.32	2.7		0.56	64.0	X	0.064
OB-4	J1R132	9/6/2012	7590		1.4	0.49	B	0.34	2.4		0.59	69.8	X	0.068
OB-5	J1R133	9/6/2012	7870		1.4	0.59		0.34	2.6		0.59	62.6	X	0.068
OB-6	J1R134	9/6/2012	7520		1.5	0.40	B	0.36	2.3		0.63	61.7	X	0.073
OB-7	J1R135	9/6/2012	8400		1.5	0.53	B	0.37	3.0		0.64	61.3	X	0.074
OB-8	J1R136	9/6/2012	7450		1.5	0.56	B	0.38	2.3		0.66	56.8	X	0.076
OB-10	J1R138	9/6/2012	9020		1.5	0.37	U	0.37	2.5		0.64	78.4	X	0.074
OB-11	J1R139	9/6/2012	7400		1.4	0.55		0.35	2.3		0.61	58.3	X	0.070
OB-12	J1R140	9/6/2012	7240		1.4	0.52	B	0.34	2.4		0.59	66.3	X	0.068
SPA-8	J1R149	9/6/2012	8590		1.5	0.56	B	0.37	2.2		0.65	80.9		0.075
Duplicate of J1R149	J1R154	9/6/2012	8900		1.4	0.37	B	0.35	2.3		0.60	81.3		0.069
SPA-1	J1R142	9/6/2012	8300		1.4	0.65		0.34	2.6		0.59	77.9		0.068
SPA-2	J1R143	9/6/2012	8340		1.4	0.55		0.35	2.4		0.60	79.8		0.070
SPA-3	J1R144	9/6/2012	7810		1.3	0.54		0.33	2.2		0.57	67.9		0.066
SPA-4	J1R145	9/6/2012	9680		1.4	0.48	B	0.34	2.7		0.58	94.2		0.067
SPA-5	J1R146	9/6/2012	8590		1.5	0.55	B	0.37	2.4		0.64	83.2		0.074
SPA-6	J1R147	9/6/2012	9070		1.5	0.49	B	0.36	2.4		0.63	78.6		0.072
SPA-7	J1R148	9/6/2012	8910		1.4	0.46	B	0.34	2.4		0.59	76.3		0.068
SPA-9	J1R150	9/6/2012	9330		1.3	0.37	B	0.33	3.1		0.57	83.1		0.065
SPA-10	J1R151	9/6/2012	8650		1.3	0.44	B	0.33	2.4		0.57	81.1		0.066
SPA-11	J1R152	9/6/2012	9420		1.5	0.59		0.36	2.3		0.63	88.9		0.073
SPA-12	J1R153	9/6/2012	8970		1.5	0.46	B	0.38	2.4		0.65	80.0		0.075
FS-1	J1R156	9/4/2012	6770	X	1.5	0.85	M	0.36	2.6		0.63	56.3	X	0.072
FS-2	J1R157	9/4/2012	5170	X	1.5	0.60		0.36	1.1		0.63	43.2	X	0.073
FS-3	J1R158	9/4/2012	5950	X	1.5	0.51	B	0.37	2.2		0.64	57.4	X	0.074
FS-4	J1R159	9/4/2012	4410	X	1.4	0.55		0.34	0.59	U	0.59	61.4	X	0.068
Equiipment Blank	J1R155	9/6/2012	294		1.5	0.37	U	0.37	0.64	U	0.64	2.8		0.073

Grey cells indicate not applicable or data will not be used.

[a] Sample Location SPA-8 exceeded RAGs for PAHs; This location underwent additional remediation and re-sampling.

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

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

B = blank contamination (inorganic constituents)

CLEAR = clearwell excavation

D = dilution.

FS = focused

HEIS = Hanford Environmental Information System

J = estimate

M = sample duplicate precision not met.

N = recovery exceeds upper or lower control limits.

ND = nondetect

OB = overburden

PAH = polycyclic aromatic hydrocarbons

PCB = polychlorinated biphenyls

PIPE = pipeline excavation

PQL = practical quantitation limit

Q = qualifier

RAG = remedial action goal

SPA = staging pile area

TPH = total petroleum hydrocarbons

X (metals) = Serial dilution in the analytical batch indicates that physical and chemical interferences are present.

X (organics)= more than 40 % difference between colums, lower result reported.

U = undetected

Attachment	1	Sheet No.	1 of 17
Originator	N. K. Schiffern NS	Date	03/21/13
Checked	J. D. Skoglie	Date	03/21/13
Calc. No.	0100D-CA-V0490	Rev. No.	1

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
PIPE-3	J1R118	9/5/2012	0.060	B	0.028	1.2	B	0.84	0.055	B	0.035	10200		12.1
Replicate of J1R118	J1R128	9/5/2012	0.034	U	0.034	1.1	B	1.0	0.042	U	0.042	9600		14.5
PIPE-1	J1R116	9/5/2012	0.078	B	0.031	0.98	B	0.93	0.039	U	0.039	8250		13.4
PIPE-2	J1R117	9/5/2012	0.12	B	0.030	4.1		0.88	0.037	U	0.037	41000		12.7
PIPE-4	J1R119	9/5/2012	0.17	B	0.032	0.95	U	0.95	0.057	B	0.040	9440		13.7
PIPE-5	J1R120	9/5/2012	0.16	B	0.030	0.91	U	0.91	0.051	B	0.038	9050		13.0
PIPE-6	J1R121	9/5/2012	0.099	B	0.032	0.95	U	0.95	0.040	U	0.040	7960		13.6
PIPE 7	J1R122	9/5/2012	0.052	B	0.033	1.4	B	0.97	0.041	U	0.041	8120		14.0
PIPE-8	J1R123	9/5/2012	0.033	B	0.032	0.96	U	0.96	0.040	U	0.040	7130		13.7
PIPE-9	J1R124	9/5/2012	0.034	U	0.034	1.0	U	1.0	0.042	U	0.042	6740		14.4
PIPE-10	J1R125	9/5/2012	0.031	U	0.031	0.91	U	0.91	0.038	U	0.038	6870		13.1
PIPE-11	J1R126	9/5/2012	0.033	U	0.033	0.98	U	0.98	0.041	U	0.041	7680		14.1
PIPE-12	J1R127	9/5/2012	0.14	B	0.030	0.91	B	0.89	0.038	B	0.037	9220		12.8
CLEAR-6	J1R1L4	9/5/2012	0.033	U	0.033	0.97	U	0.97	0.041	U	0.041	7950	J	13.9
Duplicate of J1R1L4	J1R1M1	9/5/2012	0.032	U	0.032	0.96	U	0.96	0.040	U	0.040	8310	J	13.8
CLEAR-1	J1R1K9	9/5/2012	0.12	B	0.030	0.88	U	0.88	0.049	B	0.037	8380	J	12.6
CLEAR-2	J1R1L0	9/5/2012	0.074	B	0.033	0.97	U	0.97	0.040	U	0.040	8050	J	13.9
CLEAR-3	J1R1L1	9/5/2012	0.038	B	0.033	0.98	U	0.98	0.046	B	0.041	7790	J	14.0
CLEAR-4	J1R1L2	9/5/2012	0.032	U	0.032	0.94	U	0.94	0.039	B	0.039	8390	J	13.5
CLEAR-5	J1R1L3	9/5/2012	0.033	U	0.033	0.98	U	0.98	0.043	B	0.041	7320	J	14.1
CLEAR-7	J1R1L5	9/5/2012	0.033	U	0.033	0.98	U	0.98	0.041	U	0.041	6640	J	14.1
CLEAR-8	J1R1L6	9/5/2012	0.032	U	0.032	0.96	U	0.96	0.040	U	0.040	6910	J	13.8
CLEAR-9	J1R1L7	9/5/2012	0.11	B	0.033	1.3	B	0.98	0.055	B	0.041	12800	J	14.1
CLEAR-10	J1R1L8	9/5/2012	0.031	U	0.031	0.92	U	0.92	0.039	U	0.039	7210	J	13.3
CLEAR-11	J1R1L9	9/5/2012	0.030	U	0.030	0.90	U	0.90	0.038	U	0.038	7870	J	13.0
CLEAR-12	J1R1M0	9/5/2012	0.032	U	0.032	1.0	B	0.94	0.039	U	0.039	7700	J	13.5
OB-9	J1R137	9/6/2012	0.11	B	0.031	0.92	U	0.92	0.060	B	0.039	8130	X	13.3
Duplicate of J1R137	J1R141	9/6/2012	0.12	B	0.033	1.0	B	0.97	0.098	B	0.040	8190	X	13.9
OB-1	J1R129	9/6/2012	0.084	BM	0.033	1.5	B	0.99	0.059	B	0.041	6260	X	14.2
OB-2	J1R130	9/6/2012	0.12	B	0.032	0.94	U	0.94	0.071	B	0.039	8000	X	13.5
OB-3	J1R131	9/6/2012	0.13	B	0.028	1.2	B	0.83	0.068	B	0.035	8890	X	11.9
OB-4	J1R132	9/6/2012	0.099	B	0.030	1.2	B	0.88	0.077	B	0.037	7750	X	12.6
OB-5	J1R133	9/6/2012	0.12	B	0.030	1.2	B	0.88	0.061	B	0.037	7320	X	12.7
OB-6	J1R134	9/6/2012	0.089	B	0.032	0.94	U	0.94	0.058	B	0.039	8580	X	13.5
OB-7	J1R135	9/6/2012	0.13	B	0.032	1.1	B	0.96	0.070	B	0.040	7620	X	13.8
OB-8	J1R136	9/6/2012	0.095	B	0.033	1.0	B	0.97	0.076	B	0.041	7470	X	14.0
OB-10	J1R138	9/6/2012	0.15	B	0.032	1.7	B	0.96	0.084	B	0.040	4670	X	13.7
OB-11	J1R139	9/6/2012	0.090	B	0.030	1.0	B	0.90	0.075	B	0.038	7480	X	13.0
OB-12	J1R140	9/6/2012	0.10	B	0.030	1.0	B	0.88	0.053	B	0.037	7110	X	12.7
SPA-8	J1R149	9/6/2012	0.13	B	0.032	1.9	B	0.96	0.13	B	0.040	4370		13.8
Duplicate of J1R149	J1R154	9/6/2012	0.16	B	0.030	1.9		0.89	0.14	B	0.037	4420		12.8
SPA-1	J1R142	9/6/2012	0.15	B	0.029	1.7	B	0.87	0.11	B	0.037	5830		12.6
SPA-2	J1R143	9/6/2012	0.12	B	0.030	1.6	B	0.90	0.089	B	0.038	4920		12.9
SPA-3	J1R144	9/6/2012	0.085	B	0.029	1.7		0.85	0.096	B	0.036	6590		12.2
SPA-4	J1R145	9/6/2012	0.19		0.029	2.4		0.87	0.12	B	0.036	4350		12.5
SPA-5	J1R146	9/6/2012	0.14	B	0.032	2.0		0.96	0.11	B	0.040	4370		13.7
SPA-6	J1R147	9/6/2012	0.14	B	0.031	2.1		0.93	0.11	B	0.039	4330		13.4
SPA-7	J1R148	9/6/2012	0.16	B	0.030	1.6	B	0.88	0.099	B	0.037	3890		12.7
SPA-9	J1R150	9/6/2012	0.18		0.028	1.6	B	0.84	0.086	B	0.035	4170		12.1
SPA-10	J1R151	9/6/2012	0.18		0.028	1.7		0.85	0.10	B	0.035	3800		12.2
SPA-11	J1R152	9/6/2012	0.18	B	0.032	2.5		0.94	0.14	B	0.039	4360		13.5
SPA-12	J1R153	9/6/2012	0.18	B	0.033	1.5	B	0.97	0.094	B	0.041	3940		13.9
FS-1	J1R156	9/4/2012	0.19		0.031	0.97	B	0.93	0.065	BM	0.039	12800	X	13.4
FS-2	J1R157	9/4/2012	0.13	B	0.032	0.94	U	0.94	0.039	U	0.039	6210	X	13.5
FS-3	J1R158	9/4/2012	0.17	B	0.032	0.95	U	0.95	0.045	B	0.040	7160	X	13.7
FS-4	J1R159	9/4/2012	0.12	B	0.030	0.88	U	0.88	0.037	U	0.037	5770	X	12.7
Equiipment Blank	J1R155	9/6/2012	0.046	B	0.032	0.94	U	0.94	0.039	U	0.039	61.5		13.6

Attachment	1	Sheet No.	2 of 17
Originator	N. K. Schiffern	Date	03/19/13
Checked	J. D. Skoglie	Date	03/19/13
Calc. No.	0100D-CA-V0490	Rev. No.	1

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
PIPE-3	J1R118	9/5/2012	15.2		0.050	8.5		0.085	19.2		0.19	0.155	U	0.155
Replicate of J1R118	J1R128	9/5/2012	14.5		0.060	9.4		0.10	20.9		0.22	0.155	U	0.155
PIPE-1	J1R116	9/5/2012	8.4		0.055	9.0		0.095	18.2		0.21	0.155	U	0.155
PIPE-2	J1R117	9/5/2012	28.5		0.052	7.3		0.090	43.9		0.19	1.32		0.155
PIPE-4	J1R119	9/5/2012	13.3		0.057	5.9		0.097	14.6		0.21	0.155	U	0.155
PIPE-5	J1R120	9/5/2012	12.5		0.054	6.6		0.092	16.8		0.20	0.155	U	0.155
PIPE-6	J1R121	9/5/2012	11.5		0.056	7.0		0.097	14.9		0.21	0.155	U	0.155
PIPE 7	J1R122	9/5/2012	14.6		0.058	7.7		0.099	16.1		0.22	0.155	U	0.155
PIPE-8	J1R123	9/5/2012	8.8		0.057	7.8		0.098	18.2		0.21	0.155	U	0.155
PIPE-9	J1R124	9/5/2012	8.7		0.059	9.2		0.10	19.3		0.22	0.155	U	0.155
PIPE-10	J1R125	9/5/2012	7.0		0.054	9.4		0.093	15.6		0.20	0.155	U	0.155
PIPE-11	J1R126	9/5/2012	12.5		0.058	10.0		0.10	23.2		0.22	0.155	U	0.155
PIPE-12	J1R127	9/5/2012	14.9		0.053	6.0		0.091	13.8		0.20	0.155	U	0.155
CLEAR-6	J1R1L4	9/5/2012	7.4		0.057	9.9		0.099	18.9		0.21	0.155	U	0.155
Duplicate of J1R1L4	J1R1M1	9/5/2012	6.6		0.057	10.3		0.098	18.3		0.21	0.155	U	0.155
CLEAR-1	J1R1K9	9/5/2012	11.3		0.052	5.6		0.090	13.1		0.19	0.155	U	0.155
CLEAR-2	J1R1L0	9/5/2012	11.3		0.057	6.5		0.099	15.6		0.21	0.155	U	0.155
CLEAR-3	J1R1L1	9/5/2012	9.5		0.058	7.0		0.099	15.3		0.22	0.155	U	0.155
CLEAR-4	J1R1L2	9/5/2012	11.1		0.056	7.9		0.096	16.7		0.21	0.155	U	0.155
CLEAR-5	J1R1L3	9/5/2012	21.0		0.058	9.2		0.10	18.6		0.22	0.155	U	0.155
CLEAR-7	J1R1L5	9/5/2012	7.7		0.058	10.2		0.10	18.9		0.22	0.155	U	0.155
CLEAR-8	J1R1L6	9/5/2012	6.5		0.057	9.4		0.098	16.2		0.21	0.155	U	0.155
CLEAR-9	J1R1L7	9/5/2012	17.6		0.058	8.1		0.10	19.0		0.22	0.155	U	0.155
CLEAR-10	J1R1L8	9/5/2012	7.4		0.055	11.3		0.47	19.4		1.0	0.155	U	0.155
CLEAR-11	J1R1L9	9/5/2012	9.8		0.053	8.0		0.092	16.5		0.20	0.155	U	0.155
CLEAR-12	J1R1M0	9/5/2012	8.6		0.056	8.5		0.096	18.6		0.21	0.155	U	0.155
OB-9	J1R137	9/6/2012	10.9	X	0.055	7.6	X	0.094	15.2		0.20	0.155	U	0.155
Duplicate of J1R137	J1R141	9/6/2012	11.4	X	0.057	8.0	X	0.099	16.1		0.21	0.155	U	0.155
OB-1	J1R129	9/6/2012	8.7	X	0.058	8.7	X	0.10	15.3		0.22	0.155	U	0.155
OB-2	J1R130	9/6/2012	11.3	X	0.055	7.4	X	0.096	16.5		0.21	0.155	U	0.155
OB-3	J1R131	9/6/2012	11.3	X	0.049	7.7	X	0.084	15.9		0.18	0.155	U	0.155
OB-4	J1R132	9/6/2012	10.3	X	0.052	8.4	X	0.090	16.4		0.19	0.155	U	0.155
OB-5	J1R133	9/6/2012	10.8	X	0.052	8.4	X	0.090	16.3		0.19	0.155	U	0.155
OB-6	J1R134	9/6/2012	9.2	X	0.056	9.1	X	0.096	16.7		0.21	0.155	U	0.155
OB-7	J1R135	9/6/2012	11.1	X	0.057	8.6	X	0.098	17.2		0.21	0.155	U	0.155
OB-8	J1R136	9/6/2012	11.9	X	0.058	8.0	X	0.099	16.1		0.22	0.155	U	0.155
OB-10	J1R138	9/6/2012	11.8	X	0.057	7.7	X	0.098	14.8		0.21	0.155	U	0.155
OB-11	J1R139	9/6/2012	10.6	X	0.053	8.2	X	0.092	16.4		0.20	0.155	U	0.155
OB-12	J1R140	9/6/2012	10.2	X	0.052	7.9	X	0.090	15.7		0.19	0.155	U	0.155
SPA-8	J1R149	9/6/2012	22.1		0.057	8.4	X	0.098	15.3		0.21	0.155	U	0.155
Duplicate of J1R149	J1R154	9/6/2012	21.2		0.053	7.9	X	0.091	15.4		0.20	0.155	U	0.155
SPA-1	J1R142	9/6/2012	12.5		0.052	7.4	X	0.089	15.4		0.19	0.155	U	0.155
SPA-2	J1R143	9/6/2012	10.8		0.053	8.1	X	0.092	16.3		0.20	0.155	U	0.155
SPA-3	J1R144	9/6/2012	12.6		0.050	7.9	X	0.087	15.9		0.19	0.155	U	0.155
SPA-4	J1R145	9/6/2012	12.3		0.051	7.9	X	0.088	15.6		0.19	0.155	U	0.155
SPA-5	J1R146	9/6/2012	11.3		0.057	7.6	X	0.098	14.3		0.21	0.155	U	0.155
SPA-6	J1R147	9/6/2012	12.5		0.055	7.7	X	0.095	14.6		0.21	0.155	U	0.155
SPA-7	J1R148	9/6/2012	12.6		0.052	7.3	X	0.090	15.4		0.20	0.155	U	0.155
SPA-9	J1R150	9/6/2012	12.5		0.050	7.9	X	0.086	16.0		0.19	0.155	U	0.155
SPA-10	J1R151	9/6/2012	11.6		0.050	7.2	X	0.086	14.3		0.19	0.155	U	0.155
SPA-11	J1R152	9/6/2012	12.1		0.056	8.4	X	0.096	15.2		0.21	0.155	U	0.155
SPA-12	J1R153	9/6/2012	11.8		0.057	7.8	X	0.099	15.3		0.21	0.155	U	0.155
FS-1	J1R156	9/4/2012	7.6	X	0.055	9.0	X	0.095	18.9	X	0.21	0.259		0.155
FS-2	J1R157	9/4/2012	5.3	X	0.055	9.5	X	0.096	16.7	X	0.21	0.155	U	0.155
FS-3	J1R158	9/4/2012	14.2	X	0.056	8.3	X	0.097	17.8	X	0.21	0.155	U	0.155
FS-4	J1R159	9/4/2012	4.7	X	0.052	9.8	X	0.090	16.8	X	0.20	0.155	U	0.155
Equipment Blank	J1R155	9/6/2012	0.15	B	0.056	0.16	BX	0.096	0.35	B	0.21			

Attachment	1	Sheet No.	3 of 17
Originator	N. K. Schiffern	Date	03/19/13
Checked	J. D. Skoglie	Date	03/19/13
Calc. No.	0100D-CA-V0490	Rev. No.	1

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
PIPE-3	J1R118	9/5/2012	23700		3.2	12.4		0.23	4660		3.2	317		0.085
Replicate of J1R118	J1R128	9/5/2012	25400		3.9	12.2		0.28	4910		3.8	338		0.10
PIPE-1	J1R116	9/5/2012	24200		3.6	6.4		0.26	4880		3.5	333		0.095
PIPE-2	J1R117	9/5/2012	23900		3.4	23.7		0.24	4780		3.3	313		0.090
PIPE-4	J1R119	9/5/2012	17100		3.7	4.2		0.26	4870		3.6	288		0.097
PIPE-5	J1R120	9/5/2012	17400		3.5	4.6		0.25	5140		3.4	313		0.092
PIPE-6	J1R121	9/5/2012	21500		3.7	5.5		0.26	4720		3.6	298		0.097
PIPE 7	J1R122	9/5/2012	21200		3.8	8.9		0.27	4800		3.7	317		0.099
PIPE-8	J1R123	9/5/2012	20900		3.7	4.8		0.26	4410		3.6	307		0.098
PIPE-9	J1R124	9/5/2012	25100		3.9	3.5		0.28	4610		3.8	315		0.10
PIPE-10	J1R125	9/5/2012	23700		3.5	2.8		0.25	4640		3.4	316		0.093
PIPE-11	J1R126	9/5/2012	31300		3.8	3.9		0.27	4920		3.7	349		0.10
PIPE-12	J1R127	9/5/2012	16500		3.4	5.3		0.24	5260		3.4	285		0.091
CLEAR-6	J1R1L4	9/5/2012	24200		3.8	3.0		0.27	4680		3.7	302		0.099
Duplicate of J1R1L4	J1R1M1	9/5/2012	24100		3.7	3.2		0.26	4560		3.6	323		0.098
CLEAR-1	J1R1K9	9/5/2012	14000		3.4	3.3		0.24	4490		3.3	251		0.090
CLEAR-2	J1R1L0	9/5/2012	16900		3.8	3.6		0.27	4580		3.7	272		0.099
CLEAR-3	J1R1L1	9/5/2012	18400		3.8	4.9		0.27	4410		3.7	294		0.099
CLEAR-4	J1R1L2	9/5/2012	19900		3.6	5.5		0.26	4460		3.5	306		0.096
CLEAR-5	J1R1L3	9/5/2012	22200		3.8	3.6		0.27	4270		3.7	286		0.10
CLEAR-7	J1R1L5	9/5/2012	24500		3.8	7.5		0.27	5090		3.7	368		0.10
CLEAR-8	J1R1L6	9/5/2012	23100		3.7	2.6		0.26	4490		3.6	297		0.098
CLEAR-9	J1R1L7	9/5/2012	20600		3.8	8.0		0.27	5200		3.7	321		0.10
CLEAR-10	J1R1L8	9/5/2012	23800		3.6	3.6		1.3	4590		3.5	318		0.094
CLEAR-11	J1R1L9	9/5/2012	19400		3.5	4.0		0.25	4440		3.4	296		0.092
CLEAR-12	J1R1M0	9/5/2012	22300		3.6	9.6		0.26	4610		3.6	323		0.096
OB-9	J1R137	9/6/2012	20900	X	3.6	4.2		0.25	4800	X	3.5	328	X	0.094
Duplicate of J1R137	J1R141	9/6/2012	21200	X	3.7	4.3		0.27	4720	X	3.6	322	X	0.099
OB-1	J1R129	9/6/2012	23800	X	3.8	4.6		0.27	4500	X	3.7	311	X	0.10
OB-2	J1R130	9/6/2012	20700	X	3.6	4.0		0.26	4690	X	3.5	309	X	0.096
OB-3	J1R131	9/6/2012	21900	X	3.2	5.1		0.23	4800	X	3.1	312	X	0.084
OB-4	J1R132	9/6/2012	23200	X	3.4	5.8		0.24	4900	X	3.3	323	X	0.090
OB-5	J1R133	9/6/2012	22400	X	3.4	4.7		0.24	4760	X	3.3	338	X	0.090
OB-6	J1R134	9/6/2012	23800	X	3.6	3.8		0.26	5160	X	3.5	337	X	0.096
OB-7	J1R135	9/6/2012	23200	X	3.7	5.1		0.26	4920	X	3.6	347	X	0.098
OB-8	J1R136	9/6/2012	22400	X	3.8	4.0		0.27	4910	X	3.7	316	X	0.099
OB-10	J1R138	9/6/2012	21700	X	3.7	4.8		0.26	4450	X	3.6	347	X	0.098
OB-11	J1R139	9/6/2012	22400	X	3.5	4.5		0.25	4840	X	3.4	331	X	0.092
OB-12	J1R140	9/6/2012	22100	X	3.4	4.4		0.24	4250	X	3.3	367	X	0.090
SPA-8	J1R149	9/6/2012	22200		3.7	5.4		0.26	4400		3.6	351		0.098
Duplicate of J1R149	J1R154	9/6/2012	21300		3.5	5.2		0.25	4330		3.4	342		0.091
SPA-1	J1R142	9/6/2012	20100		3.4	5.9		0.24	4570		3.3	318		0.089
SPA-2	J1R143	9/6/2012	21500		3.5	4.4		0.25	4630		3.4	322		0.092
SPA-3	J1R144	9/6/2012	21100		3.3	5.9		0.23	4640		3.2	310		0.087
SPA-4	J1R145	9/6/2012	21700		3.4	6.5		0.24	4490		3.3	341		0.088
SPA-5	J1R146	9/6/2012	20700		3.7	5.2		0.26	4180		3.6	331		0.098
SPA-6	J1R147	9/6/2012	20200		3.6	4.5		0.26	4550		3.5	338		0.095
SPA-7	J1R148	9/6/2012	19600		3.4	4.2		0.24	4420		3.3	314		0.090
SPA-9	J1R150	9/6/2012	20300		3.3	4.7		0.23	4700		3.2	327		0.086
SPA-10	J1R151	9/6/2012	19300		3.3	4.7		0.23	4130		3.2	321		0.086
SPA-11	J1R152	9/6/2012	21900		3.6	6.6		0.26	4600		3.5	368		0.096
SPA-12	J1R153	9/6/2012	20300		3.8	4.6		0.27	4470		3.7	328		0.099
FS-1	J1R156	9/4/2012	22700	X	3.6	7.1		0.26	4540	X	3.5	309	X	0.095
FS-2	J1R157	9/4/2012	23300	X	3.6	2.7		0.26	4470	X	3.5	287	X	0.096
FS-3	J1R158	9/4/2012	20800	X	3.7	3.6		0.26	4590	X	3.6	293	X	0.097
FS-4	J1R159	9/4/2012	24000	X	3.4	2.4		0.24	4410	X	3.3	302	X	0.090
Equiipment Blank	J1R155	9/6/2012	416		3.7	0.39	B	0.26	41.8		3.6	8.3		0.096

Attachment	1	Sheet No.	4 of 17
Originator	N. K. Schiffern	Date	03/19/13
Checked	J. D. Skoglie	Date	03/19/13
Calc. No.	0100D-CA-V0490	Rev. No.	1

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
PIPE-3	J1R118	9/5/2012	0.034		0.0063	0.26	B	0.22	11.0		0.11	986		35.0
Replicate of J1R118	J1R128	9/5/2012	0.029		0.0056	0.27	U	0.27	10.6		0.13	987		42.2
PIPE-1	J1R116	9/5/2012	0.0098	B	0.0052	0.33	B	0.25	10.1		0.12	1030		39.0
PIPE-2	J1R117	9/5/2012	0.041		0.0066	0.76	B	0.23	14.3		0.11	1230		36.8
PIPE-4	J1R119	9/5/2012	0.011	B	0.0048	0.25	U	0.25	12.5		0.12	1240		40.0
PIPE-5	J1R120	9/5/2012	0.0070	U	0.0070	0.24	U	0.24	12.7		0.11	1220		37.9
PIPE-6	J1R121	9/5/2012	0.0083	B	0.0060	0.25	U	0.25	13.4		0.12	977		39.7
PIPE 7	J1R122	9/5/2012	0.062		0.0057	0.26	U	0.26	13.0		0.12	974		40.7
PIPE-8	J1R123	9/5/2012	0.028		0.0057	0.25	U	0.25	10.4		0.12	899		40.0
PIPE-9	J1R124	9/5/2012	0.028		0.0056	0.27	U	0.27	10.0		0.13	801		42.0
PIPE-10	J1R125	9/5/2012	0.0049	U	0.0049	0.24	U	0.24	10.9		0.11	778		38.1
PIPE-11	J1R126	9/5/2012	0.011	B	0.0051	0.26	U	0.26	15.7		0.12	934		41.1
PIPE-12	J1R127	9/5/2012	0.0049	U	0.0049	0.24	U	0.24	14.3		0.11	1140		37.2
CLEAR-6	J1R1L4	9/5/2012	0.0057	U	0.0057	0.26	U	0.26	10.0		0.12	769		40.5
Duplicate of J1R1L4	J1R1M1	9/5/2012	0.0061	U	0.0061	0.26	U	0.26	9.8		0.12	764		40.2
CLEAR-1	J1R1K9	9/5/2012	0.0053	B	0.0049	0.30	B	0.23	11.9		0.11	1100		36.8
CLEAR-2	J1R1L0	9/5/2012	0.0048	U	0.0048	0.31	B	0.26	14.1		0.12	1100		40.5
CLEAR-3	J1R1L1	9/5/2012	0.0098	B	0.0050	0.26	U	0.26	10.6		0.12	994		40.8
CLEAR-4	J1R1L2	9/5/2012	0.013	B	0.0052	0.25	U	0.25	11.2		0.12	1020		39.3
CLEAR-5	J1R1L3	9/5/2012	0.028		0.0052	0.26	U	0.26	11.2		0.12	805		41.1
CLEAR-7	J1R1L5	9/5/2012	0.046		0.0060	0.26	U	0.26	12.1		0.12	1100		41.0
CLEAR-8	J1R1L6	9/5/2012	0.0054	U	0.0054	0.25	U	0.25	9.8		0.12	651		40.2
CLEAR-9	J1R1L7	9/5/2012	0.014	B	0.0061	0.26	U	0.26	14.7		0.12	1480		41.1
CLEAR-10	J1R1L8	9/5/2012	0.0050	U	0.0050	0.24	U	0.24	11.4		0.12	720		38.6
CLEAR-11	J1R1L9	9/5/2012	0.015	B	0.0057	0.24	U	0.24	10.7		0.11	1030		37.7
CLEAR-12	J1R1M0	9/5/2012	0.0068	U	0.0068	0.25	U	0.25	10.4		0.12	969		39.4
OB-9	J1R137	9/6/2012	0.0054	U	0.0054	0.24	U	0.24	11.2	X	0.12	1140		38.6
Duplicate of J1R137	J1R141	9/6/2012	0.0050	U	0.0050	0.26	U	0.26	11.0	X	0.12	1190		40.4
OB-1	J1R129	9/6/2012	0.18		0.0053	0.40	B	0.26	12.5	X	0.12	953		41.3
OB-2	J1R130	9/6/2012	0.0050	U	0.0050	0.25	U	0.25	10.2	X	0.12	1090		39.2
OB-3	J1R131	9/6/2012	0.0046	B	0.0046	0.22	U	0.22	11.7	X	0.10	1210		34.6
OB-4	J1R132	9/6/2012	0.017		0.0055	0.23	U	0.23	12.3	X	0.11	1190		36.7
OB-5	J1R133	9/6/2012	0.0067	B	0.0048	0.23	U	0.23	10.7	X	0.11	1240		36.8
OB-6	J1R134	9/6/2012	0.0051	U	0.0051	0.25	U	0.25	11.5	X	0.12	1060		39.3
OB-7	J1R135	9/6/2012	0.0052	B	0.0048	0.25	U	0.25	11.0	X	0.12	1340		40.1
OB-8	J1R136	9/6/2012	0.0048	U	0.0048	0.26	U	0.26	13.5	X	0.12	1090		40.8
OB-10	J1R138	9/6/2012	0.0057	U	0.0057	0.25	U	0.25	11.2	X	0.12	1760		40.0
OB-11	J1R139	9/6/2012	0.0061	U	0.0061	0.24	U	0.24	11.3	X	0.11	1090		37.8
OB-12	J1R140	9/6/2012	0.0060	B	0.0057	0.23	U	0.23	9.7	X	0.11	1120		36.8
SPA-8	J1R149	9/6/2012	0.024		0.0051	0.25	U	0.25	11.4	X	0.12	1700		40.2
Duplicate of J1R149	J1R154	9/6/2012	0.023		0.0051	0.24	U	0.24	11.3	X	0.11	1780		37.2
SPA-1	J1R142	9/6/2012	0.17		0.0048	0.31	B	0.23	11.5	X	0.11	1570		36.5
SPA-2	J1R143	9/6/2012	0.0047	U	0.0047	0.24	U	0.24	11.1	X	0.11	1330		37.6
SPA-3	J1R144	9/6/2012	0.0093	B	0.0063	0.23	U	0.23	11.5	X	0.11	1340		35.6
SPA-4	J1R145	9/6/2012	0.0071	B	0.0049	1.1	B	0.23	11.9	X	0.11	1970		36.3
SPA-5	J1R146	9/6/2012	0.0070	U	0.0070	0.25	U	0.25	10.3	X	0.12	1810		40.0
SPA-6	J1R147	9/6/2012	0.0055	U	0.0055	0.25	U	0.25	11.4	X	0.12	1830		38.9
SPA-7	J1R148	9/6/2012	0.0056	U	0.0056	0.23	U	0.23	11.6	X	0.11	1610		36.9
SPA-9	J1R150	9/6/2012	0.0051	U	0.0051	0.22	U	0.22	12.2	X	0.11	1500		35.1
SPA-10	J1R151	9/6/2012	0.0052	B	0.0052	0.22	U	0.22	11.2	X	0.11	1710		35.4
SPA-11	J1R152	9/6/2012	0.0064	B	0.0053	0.25	U	0.25	11.4	X	0.12	2090		39.3
SPA-12	J1R153	9/6/2012	0.0052	U	0.0052	0.26	U	0.26	11.8	X	0.12	1740		40.5
FS-1	J1R156	9/4/2012	0.32		0.0065	0.37	B	0.25	10.0	X	0.12	982		39.1
FS-2	J1R157	9/4/2012	0.020		0.0052	0.35	B	0.25	10.1	X	0.12	632		39.2
FS-3	J1R158	9/4/2012	0.018		0.0047	0.25	U	0.25	10.7	X	0.12	898		39.8
FS-4	J1R159	9/4/2012	0.0049	U	0.0049	0.23	U	0.23	8.4	X	0.11	518		36.9
Equiipment Blank	J1R155	9/6/2012	0.0053	U	0.0053	0.25	U	0.25	0.17	BX	0.12	72.6	B	39.5

Attachment	1	Sheet No.	5 of 17
Originator	N. K. Schiffern	Date	03/19/13
Checked	J. D. Skoglie	Date	03/19/13
Calc. No.	0100D-CA-V0490	Rev. No.	1

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
PIPE-3	J1R118	9/5/2012	0.74	U	0.74	234	X	4.8	0.14	U	0.14	318		50.4
Replicate of J1R118	J1R128	9/5/2012	0.89	U	0.89	278	X	5.8	0.16	U	0.16	403		60.8
PIPE-1	J1R116	9/5/2012	0.82	U	0.82	306	X	5.4	0.15	U	0.15	307		56.2
PIPE-2	J1R117	9/5/2012	0.77	U	0.77	170	X	5.1	0.14	U	0.14	650		53.0
PIPE-4	J1R119	9/5/2012	0.84	U	0.84	382	X	5.5	0.16	U	0.16	263		57.5
PIPE-5	J1R120	9/5/2012	0.79	U	0.79	335	X	5.2	0.15	U	0.15	285		54.5
PIPE-6	J1R121	9/5/2012	0.83	U	0.83	320	X	5.5	0.15	U	0.15	255		57.1
PIPE 7	J1R122	9/5/2012	0.85	U	0.85	258	X	5.6	0.16	U	0.16	329		58.6
PIPE-8	J1R123	9/5/2012	0.84	U	0.84	251	X	5.5	0.16	U	0.16	333		57.5
PIPE-9	J1R124	9/5/2012	0.88	U	0.88	211	X	5.8	0.16	U	0.16	411		60.4
PIPE-10	J1R125	9/5/2012	0.80	U	0.80	234	X	5.3	0.15	U	0.15	433		54.8
PIPE-11	J1R126	9/5/2012	0.86	U	0.86	248	X	5.7	0.16	U	0.16	368		59.2
PIPE-12	J1R127	9/5/2012	0.78	U	0.78	329	X	5.1	0.15	U	0.15	357		53.5
CLEAR-6	J1R1L4	9/5/2012	0.85	U	0.85	252	J	5.6	0.16	U	0.16	479		58.3
Duplicate of J1R1L4	J1R1M1	9/5/2012	0.84	U	0.84	245	J	5.6	0.16	U	0.16	502		57.9
CLEAR-1	J1R1K9	9/5/2012	0.77	U	0.77	346	J	5.1	0.14	U	0.14	241		52.9
CLEAR-2	J1R1L0	9/5/2012	0.85	U	0.85	330	J	5.6	0.16	U	0.16	240		58.3
CLEAR-3	J1R1L1	9/5/2012	0.86	U	0.86	406	J	5.6	0.16	U	0.16	267		58.7
CLEAR-4	J1R1L2	9/5/2012	0.82	U	0.82	330	J	5.4	0.15	U	0.15	308		56.6
CLEAR-5	J1R1L3	9/5/2012	0.86	U	0.86	334	J	5.7	0.16	U	0.16	294		59.1
CLEAR-7	J1R1L5	9/5/2012	0.86	U	0.86	384	J	5.7	0.16	U	0.16	307		59.0
CLEAR-8	J1R1L6	9/5/2012	0.84	U	0.84	211	J	5.5	0.16	U	0.16	442		57.8
CLEAR-9	J1R1L7	9/5/2012	0.86	U	0.86	420	J	5.7	0.16	U	0.16	332		59.2
CLEAR-10	J1R1L8	9/5/2012	0.81	U	0.81	220	J	5.3	0.15	U	0.15	296		55.5
CLEAR-11	J1R1L9	9/5/2012	0.79	U	0.79	266	J	5.2	0.15	U	0.15	324		54.3
CLEAR-12	J1R1M0	9/5/2012	0.83	U	0.83	377	J	5.4	0.15	U	0.15	315		56.7
OB-9	J1R137	9/6/2012	0.81	U	0.81	341		5.3	0.15	U	0.15	298		55.5
Duplicate of J1R137	J1R141	9/6/2012	0.85	U	0.85	425		5.6	0.16	U	0.16	308		58.1
OB-1	J1R129	9/6/2012	0.87	U	0.87	372		5.7	0.16	U	0.16	353		59.5
OB-2	J1R130	9/6/2012	0.82	U	0.82	395		5.4	0.15	U	0.15	279		56.4
OB-3	J1R131	9/6/2012	0.73	U	0.73	361		4.8	0.14	U	0.14	304		49.8
OB-4	J1R132	9/6/2012	0.77	U	0.77	388		5.1	0.14	U	0.14	351		52.8
OB-5	J1R133	9/6/2012	0.77	U	0.77	375		5.1	0.14	U	0.14	306		53.0
OB-6	J1R134	9/6/2012	0.82	U	0.82	382		5.4	0.15	U	0.15	388		56.5
OB-7	J1R135	9/6/2012	0.84	U	0.84	414		5.5	0.16	U	0.16	310		57.6
OB-8	J1R136	9/6/2012	0.86	U	0.86	422		5.6	0.16	U	0.16	334		58.7
OB-10	J1R138	9/6/2012	0.84	U	0.84	421		5.5	0.16	U	0.16	282		57.5
OB-11	J1R139	9/6/2012	0.79	U	0.79	390		5.2	0.15	U	0.15	315		54.4
OB-12	J1R140	9/6/2012	0.77	U	0.77	407		5.1	0.14	U	0.14	334		52.9
SPA-8	J1R149	9/6/2012	0.84	U	0.84	348		5.6	0.16	U	0.16	264		57.9
Duplicate of J1R149	J1R154	9/6/2012	0.78	U	0.78	423		5.1	0.15	U	0.15	278		53.6
SPA-1	J1R142	9/6/2012	0.77	U	0.77	295		5.0	0.14	UN	0.14	268		52.6
SPA-2	J1R143	9/6/2012	0.79	U	0.79	404		5.2	0.15	U	0.15	297		54.1
SPA-3	J1R144	9/6/2012	0.75	U	0.75	354		4.9	0.14	U	0.14	346		51.3
SPA-4	J1R145	9/6/2012	0.76	U	0.76	395		5.0	0.14	U	0.14	278		52.2
SPA-5	J1R146	9/6/2012	0.84	U	0.84	437		5.5	0.16	U	0.16	262		57.5
SPA-6	J1R147	9/6/2012	0.82	U	0.82	371		5.4	0.15	U	0.15	252		56.0
SPA-7	J1R148	9/6/2012	0.77	U	0.77	480		5.1	0.14	U	0.14	216		53.0
SPA-9	J1R150	9/6/2012	0.74	U	0.74	386		4.8	0.14	U	0.14	251		50.5
SPA-10	J1R151	9/6/2012	0.74	U	0.74	322		4.9	0.14	U	0.14	222		50.9
SPA-11	J1R152	9/6/2012	0.82	U	0.82	448		5.4	0.15	U	0.15	273		56.6
SPA-12	J1R153	9/6/2012	0.85	U	0.85	400		5.6	0.16	U	0.16	240		58.3
FS-1	J1R156	9/4/2012	0.82	U	0.82	242	N	5.4	0.15	U	0.15	464		56.2
FS-2	J1R157	9/4/2012	0.82	U	0.82	154	N	5.4	0.15	U	0.15	377		56.3
FS-3	J1R158	9/4/2012	0.83	U	0.83	253	N	5.5	0.16	U	0.16	387		57.2
FS-4	J1R159	9/4/2012	0.77	U	0.77	125	N	5.1	0.14	U	0.14	370		53.2
Equipment Blank	J1R155	9/6/2012	0.83	U	0.83	148		5.5	0.15	U	0.15	56.8	U	56.8

Attachment	1	Sheet No.	6 of 17
Originator	N. K. Schiffern	Date	03/19/13
Checked	J. D. Skoglie	Date	03/19/13
Calc. No.	0100D-CA-V0490	Rev. No.	1

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Metals and Physical

Sample Location	HEIS Number	Sample Date	Vanadium			Zinc			Percent moisture (wet sample)			pH Measurement		
			mg/kg	Q	PQL	mg/kg	Q	PQL	%	Q	PQL	pH	Q	PQL
PIPE-3	J1R118	9/5/2012	57.3		0.080	55.3		0.34	2.5		0.10			
Replicate of J1R118	J1R128	9/5/2012	59.5		0.097	58.9		0.41	2.9		0.10			
PIPE-1	J1R116	9/5/2012	64.5		0.089	49.9		0.38	0.90		0.10			
PIPE-2	J1R117	9/5/2012	52.8		0.084	94.2		0.36	3.1		0.10			
PIPE-4	J1R119	9/5/2012	34.8		0.092	36.1		0.39	0.37		0.10			
PIPE-5	J1R120	9/5/2012	40.1		0.087	39.7		0.37	0.66		0.10			
PIPE-6	J1R121	9/5/2012	45.6		0.091	38.9		0.39	0.62		0.10			
PIPE 7	J1R122	9/5/2012	48.8		0.093	43.7		0.40	3.1		0.10			
PIPE-8	J1R123	9/5/2012	51.3		0.092	43.2		0.39	2.3		0.10			
PIPE-9	J1R124	9/5/2012	66.7		0.096	57.5		0.41	3.3		0.10			
PIPE-10	J1R125	9/5/2012	67.0		0.087	44.8		0.37	1.3		0.10			
PIPE-11	J1R126	9/5/2012	59.8		0.094	46.6		0.40	2.3		0.10			
PIPE-12	J1R127	9/5/2012	34.9		0.085	34.7		0.36	0.62		0.10			
CLEAR-6	J1R1L4	9/5/2012	68.4		0.093	45.3	X	0.39	2.7		0.10			
Duplicate of J1R1L4	J1R1M1	9/5/2012	68.4		0.092	45.9	X	0.39	3.0		0.10			
CLEAR-1	J1R1K9	9/5/2012	30.5		0.084	30.9	X	0.36	0.43		0.10			
CLEAR-2	J1R1L0	9/5/2012	42.5		0.093	34.7	X	0.39	0.72		0.10			
CLEAR-3	J1R1L1	9/5/2012	47.5		0.094	40.2	X	0.40	0.49		0.10			
CLEAR-4	J1R1L2	9/5/2012	50.1		0.090	41.1	X	0.38	1.6		0.10			
CLEAR-5	J1R1L3	9/5/2012	60.1		0.094	40.8	X	0.40	2.1		0.10			
CLEAR-7	J1R1L5	9/5/2012	66.3		0.094	49.9	X	0.40	2.9		0.10			
CLEAR-8	J1R1L6	9/5/2012	66.6		0.092	45.5	X	0.39	1.8		0.10			
CLEAR-9	J1R1L7	9/5/2012	51.7		0.094	48.7	X	0.40	2.2		0.10			
CLEAR-10	J1R1L8	9/5/2012	85.5		0.440	45.9	X	0.37	2.5		0.10			
CLEAR-11	J1R1L9	9/5/2012	52.6		0.087	40.0	X	0.37	3.0		0.10			
CLEAR-12	J1R1M0	9/5/2012	59.7		0.090	47.3	X	0.38	0.83		0.10			
OB-9	J1R137	9/6/2012	50.6		0.088	45.0	X	0.37	0.62		0.10			
Duplicate of J1R137	J1R141	9/6/2012	54.0		0.093	46.6	X	0.39	0.50		0.10			
OB-1	J1R129	9/6/2012	61.0		0.095	46.2	X	0.40	0.77		0.10			
OB-2	J1R130	9/6/2012	51.8		0.090	41.5	X	0.38	0.42		0.10			
OB-3	J1R131	9/6/2012	54.8		0.079	44.3	X	0.34	0.44		0.10			
OB-4	J1R132	9/6/2012	58.5		0.084	47.5	X	0.36	0.31		0.10			
OB-5	J1R133	9/6/2012	56.8		0.084	46.2	X	0.36	0.56		0.10			
OB-6	J1R134	9/6/2012	61.5		0.090	47.5	X	0.38	0.62		0.10			
OB-7	J1R135	9/6/2012	57.2		0.092	46.2	X	0.39	0.62		0.10			
OB-8	J1R136	9/6/2012	59.8		0.094	46.2	X	0.40	0.47		0.10			
OB-10	J1R138	9/6/2012	54.5		0.092	46.8	X	0.39	0.43		0.10			
OB-11	J1R139	9/6/2012	59.5		0.087	46.4	X	0.37	0.44		0.10			
OB-12	J1R140	9/6/2012	54.3		0.084	43.2	X	0.36	0.48		0.10			
SPA-8	J1R149	9/6/2012	52.6		0.092	45.1	X	0.39	1.0		0.10	8.33		0.100
Duplicate of J1R149	J1R154	9/6/2012	50.6		0.085	44.9	X	0.36	0.78		0.10	8.28		0.100
Re-sample of J1R149	J1RD54	1/24/2013							5.3		0.10			
SPA-1	J1R142	9/6/2012	45.0		0.084	41.9	X	0.35	0.70		0.10	7.36		0.100
SPA-2	J1R143	9/6/2012	49.6		0.086	41.2	X	0.36	0.78		0.10	7.77		0.100
SPA-3	J1R144	9/6/2012	51.5		0.082	42.9	X	0.35	0.76		0.10	8.13		0.100
SPA-4	J1R145	9/6/2012	45.8		0.083	44.0	X	0.35	0.82		0.10	7.53		0.100
SPA-5	J1R146	9/6/2012	48.6		0.092	42.4	X	0.39	1.4		0.10	7.53		0.100
SPA-6	J1R147	9/6/2012	46.2		0.089	41.7	X	0.38	0.64		0.10	7.79		0.100
SPA-7	J1R148	9/6/2012	43.5		0.085	39.1	X	0.36	0.69		0.10	8.39		0.100
SPA-9	J1R150	9/6/2012	45.8		0.081	41.5	X	0.34	1.1		0.10	8.42		0.100
SPA-10	J1R151	9/6/2012	43.8		0.081	40.1	X	0.34	1.0		0.10	7.67		0.100
SPA-11	J1R152	9/6/2012	51.5		0.090	49.8	X	0.38	0.66		0.10	7.27		0.100
SPA-12	J1R153	9/6/2012	46.2		0.093	40.5	X	0.39	0.77		0.10	7.80		0.100
FS-1	J1R156	9/4/2012	60.8	X	0.090	58.3	X	0.38	3.8		0.10			
FS-2	J1R157	9/4/2012	66.4	X	0.090	41.4	X	0.38	3.1		0.10			
FS-3	J1R158	9/4/2012	56.9	X	0.091	39.6	X	0.39	1.8		0.10			
FS-4	J1R159	9/4/2012	69.9	X	0.085	41.3	X	0.36	2.6		0.10			
Equiipment Blank	J1R155	9/6/2012	0.56	B	0.091	1.8	X	0.38	0.19		0.10			

Attachment	1	Sheet No.	7 of 17
Originator	N. K. Schiffern	Date	03/19/13
Checked	J. D. Skoglie	Date	03/19/13
Calc. No.	0100D-CA-V0490	Rev. No.	1

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Anions and TPH

Sample Location	HEIS Number	Sample Date	Bromide			Chloride			Fluoride			Nitrogen in Nitrate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-8	J1R149	9/6/2012	0.38	U	0.38	30.9		1.9	1.3	B	0.81	17.0		0.31
Duplicate of J1R149	J1R154	9/6/2012	0.39	U	0.39	29.6		2.0	1.2	B	0.83	18.6		0.32
SPA-1	J1R142	9/6/2012	0.38	U	0.38	26.8		1.9	1.4	B	0.81	72.2		0.31
SPA-2	J1R143	9/6/2012	0.39	U	0.39	153		2.0	1.3	B	0.82	10.0		0.31
SPA-3	J1R144	9/6/2012	0.38	U	0.38	195		1.9	1.4	B	0.80	23.7		0.31
SPA-4	J1R145	9/6/2012	0.38	U	0.38	164		1.9	1.3	B	0.81	61.9		0.31
SPA-5	J1R146	9/6/2012	0.39	U	0.39	81.4		2.0	1.7	B	0.83	121	D	0.63
SPA-6	J1R147	9/6/2012	0.39	U	0.39	210		2.0	1.2	B	0.83	28.8		0.32
SPA-7	J1R148	9/6/2012	0.38	U	0.38	7.6		1.9	1.2	B	0.80	7.3		0.30
SPA-9	J1R150	9/6/2012	0.38	U	0.38	29.4		2.0	1.1	B	0.81	18.7		0.31
SPA-10	J1R151	9/6/2012	0.39	U	0.39	70.3		2.0	0.82	U	0.82	14.2		0.31
SPA-11	J1R152	9/6/2012	0.39	U	0.39	32.5		2.0	1.1	B	0.82	15.1		0.31
SPA-12	J1R153	9/6/2012	0.38	U	0.38	18.0		1.9	0.81	U	0.81	2.3	B	0.31

Sample Location	HEIS Number	Sample Date	Nitrogen in Nitrite			Nitrogen in Nitrite and Nitrate			Phosphorous in phosphate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-8	J1R149	9/6/2012	0.33	U	0.33	20.8		0.30	2.5	B	1.2	17.3		1.7
Duplicate of J1R149	J1R154	9/6/2012	0.34	U	0.34	24.6		0.30	2.4	B	1.2	18.4		1.7
SPA-1	J1R142	9/6/2012	0.33	U	0.33	37.3		0.30	2.3	B	1.2	18.7		1.7
SPA-2	J1R143	9/6/2012	0.34	U	0.34	15.9		0.30	1.2	U	1.2	62.8		1.7
SPA-3	J1R144	9/6/2012	0.33	U	0.33	22.2		0.30	1.9	B	1.2	60.6		1.7
SPA-4	J1R145	9/6/2012	0.33	U	0.33	70.9		0.30	2.7	B	1.2	20.5		1.7
SPA-5	J1R146	9/6/2012	0.34	U	0.34	147	D	1.5	2.1	B	1.2	42.2		1.7
SPA-6	J1R147	9/6/2012	0.34	U	0.34	29.7		0.30	1.5	B	1.2	23.5		1.7
SPA-7	J1R148	9/6/2012	0.33	U	0.33	7.5		0.30	1.2	U	1.2	10.4		1.7
SPA-9	J1R150	9/6/2012	0.33	U	0.33	4.0		0.30	2.7	B	1.2	17.8		1.7
SPA-10	J1R151	9/6/2012	0.34	U	0.34	14.3		0.30	1.5	B	1.2	49		1.7
SPA-11	J1R152	9/6/2012	0.33	U	0.33	18.6		0.30	3.7	B	1.2	86.4		1.7
SPA-12	J1R153	9/6/2012	0.33	U	0.33	2.1		0.30	1.2	U	1.2	68.5		1.7

Sample Location	HEIS Number	Sample Date	TPH - Diesel			TPH - Diesel Ext		
			ug/kg	Q	PQL	ug/kg	Q	PQL
SPA-8	J1R149	9/6/2012	29000		680	43000		1000
Duplicate of J1R149	J1R154	9/6/2012	110000		630	160000		930
SPA-1	J1R142	9/6/2012	1600	J	650	3900		960
SPA-2	J1R143	9/6/2012	690	J	640	950	U	950
SPA-3	J1R144	9/6/2012	5500		630	13000		920
SPA-4	J1R145	9/6/2012	1500	J	670	3900	J	990
SPA-5	J1R146	9/6/2012	2500	J	670	5900		980
SPA-6	J1R147	9/6/2012	2300	J	680	3900	J	990
SPA-7	J1R148	9/6/2012	1300	J	670	2300	J	990
SPA-9	J1R150	9/6/2012	670	U	670	1000	J	990
SPA-10	J1R151	9/6/2012	1800	J	680	3700	J	1000
SPA-11	J1R152	9/6/2012	2300	J	680	8100		990
SPA-12	J1R153	9/6/2012	1300	J	680	2100	J	990
FS-4	J1R159	9/4/2012	690	U	690	1000	U	1000

Attachment	1	Sheet No.	8 of 17
Originator	N. K. Schiffern	Date	03/19/13
Checked	J. D. Skoglie	Date	03/19/13
Calc. No.	0100D-CA-V0490	Rev. No.	1

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R118, PIPE-3			J1R128, Duplicate of J1R118			J1R116, PIPE-1			J1R117, PIPE-2		
		9/5/2012			9/5/2012			9/5/2012			9/5/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	420	X	9.6	870	X	10	9.8	U	9.8	2100	DX	51
Acenaphthylene	PAH	36	JX	8.6	83	JX	9.3	8.8	U	8.8	46	UD	46
Anthracene	PAH	690		2.9	3.1	U	3.1	57		3.0	3400	DX	16
Benzo(a)anthracene	PAH	1100		3.1	1900		3.3	200		3.1	3800	D	16
Benzo(a)pyrene	PAH	680		6.1	1100		6.6	160		6.3	1600	D	33
Benzo(b)fluoranthene	PAH	890		4.0	1400		4.3	210		4.1	2300	DX	22
Benzo(ghi)perylene	PAH	460		6.9	690		7.4	120		7.1	1200	D	37
Benzo(k)fluoranthene	PAH	280		3.8	450		4.1	73		3.9	800	D	20
Chrysene	PAH	1000		4.6	1600		5.0	210		4.7	3100	D	25
Dibenz[a,h]anthracene	PAH	130	X	11	220	X	11	11	U	11	250	DX	56
Fluoranthene	PAH	2200		12	4400		13	460	N	13	9100	D	67
Fluorene	PAH	430		5.1	1100		5.4	44	X	5.2	2500	D	27
Indeno(1,2,3-cd)pyrene	PAH	400		12	570		12	120		12	770	D	62
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	62	UD	62
Phenanthrene	PAH	2000		12	4600		12	260	N	12	12000	D	62
Pyrene	PAH	2200		12	4000		12	420	N	12	8000	D	62
Aroclor-1016	PCB	2.7	U	2.7	2.6	U	2.6	2.7	U	2.7	2.9	U	2.9
Aroclor-1221	PCB	7.9	U	7.9	7.6	U	7.6	7.7	U	7.7	8.3	U	8.3
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9	2.1	U	2.1
Aroclor-1242	PCB	4.6	U	4.6	4.4	U	4.4	4.5	U	4.5	4.8	U	4.8
Aroclor-1248	PCB	4.6	U	4.6	4.4	U	4.4	4.5	U	4.5	4.8	U	4.8
Aroclor-1254	PCB	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.7	U	2.7
Aroclor-1260	PCB	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.7	U	2.7

CONSTITUENT	CLASS	J1R119, PIPE-4			J1R120, PIPE-5			J1R121, PIPE-6			J1R122, PIPE-7		
		9/5/2012			9/5/2012			9/5/2012			9/5/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	8800	DX	98	8200	DX	100	260	X	9.8	5600	DX	100
Acenaphthylene	PAH	89	UD	89	200	JDX	90	8.8	U	8.8	92	UD	92
Anthracene	PAH	30	UD	30	14000	D	30	3.0	U	3.0	16000	D	31
Benzo(a)anthracene	PAH	31000	D	31	15000	D	32	770		3.1	19000	D	32
Benzo(a)pyrene	PAH	15000	D	63	9400	D	64	430		6.3	7500	D	65
Benzo(b)fluoranthene	PAH	21000	D	41	11000	D	42	600		4.1	12000	D	43
Benzo(ghi)perylene	PAH	5000	DX	71	5300	D	72	300		7.0	4100	D	73
Benzo(k)fluoranthene	PAH	7600	D	39	4100	D	39	230		3.8	3300	D	40
Chrysene	PAH	25000	D	48	14000	D	48	790		4.7	15000	D	49
Dibenz[a,h]anthracene	PAH	2700	D	110	1700	DX	110	11	U	11	1500	DX	110
Fluoranthene	PAH	55000	D	130	42000	D	130	1500		13	38000	D	130
Fluorene	PAH	7100	D	52	8400	D	53	190		5.2	8100	D	54
Indeno(1,2,3-cd)pyrene	PAH	8500	D	120	5800	D	120	210		12	2900	DX	120
Naphthalene	PAH	120	UD	120	9700	D	120	12	U	12	120	UD	120
Phenanthrene	PAH	35000	D	120	43000	D	120	930		12	40000	D	120
Pyrene	PAH	55000	D	120	39000	D	120	1500		12	34000	D	120
Aroclor-1016	PCB	2.6	U	2.6	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7
Aroclor-1221	PCB	7.6	U	7.6	7.7	U	7.7	7.9	U	7.9	7.8	U	7.8
Aroclor-1232	PCB	1.9	U	1.9	1.9	U	1.9	2	U	2.0	1.9	U	1.9
Aroclor-1242	PCB	4.4	U	4.4	4.5	U	4.5	4.6	U	4.6	4.5	U	4.5
Aroclor-1248	PCB	4.4	U	4.4	4.5	U	4.5	4.6	U	4.6	4.5	U	4.5
Aroclor-1254	PCB	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5
Aroclor-1260	PCB	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5

Attachment	1	Sheet No.	9 of 17
Originator	N. K. Schiffern	Date	02/14/13
Checked	J. D. Skoglie	Date	02/14/13
Calc. No.	0100D-CA-V0490	Rev. No.	0

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R123, PIPE-8			J1R124, PIPE-9			J1R125, PIPE-10			J1R126, PIPE-11		
		9/5/2012			9/5/2012			9/5/2012			9/5/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	5500	DX	49	62	JX	10	10	U	10	9.9	U	9.9
Acenaphthylene	PAH	220	JDX	44	9.1	U	9.1	9.0	U	9.0	8.9	U	8.9
Anthracene	PAH	8000	D	15	77		3.1	11	J	3.0	14	JX	3.0
Benzo(a)anthracene	PAH	11000	D	16	180		3.2	33		3.2	43		3.2
Benzo(a)pyrene	PAH	9500	D	32	180		6.5	27		6.4	24		6.3
Benzo(b)fluoranthene	PAH	10000	D	21	180		4.2	34	X	4.2	35		4.2
Benzo(ghi)perylene	PAH	5700	D	35	170		7.3	26	JX	7.2	18	J	7.1
Benzo(k)fluoranthene	PAH	4000	D	19	63		4.0	12	J	3.9	8.7	J	3.9
Chrysene	PAH	10000	DX	24	160		4.9	31	J	4.8	30	J	4.8
Dibenz[a,h]anthracene	PAH	1800	DX	54	11	U	11	14	J	11	11	U	11
Fluoranthene	PAH	26000	D	64	360		13	80		13	68		13
Fluorene	PAH	5200	D	26	54		5.3	11	J	5.3	14	J	5.2
Indeno(1,2,3-cd)pyrene	PAH	6000	D	59	97	X	12	12	U	12	14	J	12
Naphthalene	PAH	3600	D	59	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	22000	D	59	200		12	48		12	52		12
Pyrene	PAH	25000	D	59	340		12	73		12	66		12
Aroclor-1016	PCB	2.7	U	2.7	2.8	U	2.8	2.6	U	2.6	2.8	U	2.8
Aroclor-1221	PCB	7.9	U	7.9	8.1	U	8.1	7.5	U	7.5	8.0	U	8.0
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0
Aroclor-1242	PCB	4.6	U	4.6	4.7	U	4.7	4.4	U	4.4	4.6	U	4.6
Aroclor-1248	PCB	4.6	U	4.6	4.7	U	4.7	4.4	U	4.4	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6

CONSTITUENT	CLASS	J1R127, PIPE-12			J1R1L4, CLEAR-6			J1R1M1, Duplicate of J1R1L4			J1R1K9, CLEAR-1		
		9/5/2012			9/5/2012			9/5/2012			9/5/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	31000	DX	490	10	UJ	10	9.7	UJ	9.7	150	NX	9.7
Acenaphthylene	PAH	440	UD	440	9.2	U	9.2	8.7	U	8.7	8.7	U	8.7
Anthracene	PAH	60000	D	150	3.6	JXJ	3.1	21	J	2.9	2.9	UNJ	2.9
Benzo(a)anthracene	PAH	85000	D	160	15	J	3.3	31	J	3.1	290	NJ	3.1
Benzo(a)pyrene	PAH	35000	D	320	14	J	6.6	24	J	6.2	190	NJ	6.2
Benzo(b)fluoranthene	PAH	53000	D	210	15	J	4.3	30	J	4.1	220	NJ	4.1
Benzo(ghi)perylene	PAH	21000	D	350	11	JX	7.4	18	JX	7.0	110	NJ	7.0
Benzo(k)fluoranthene	PAH	17000	D	190	5.8	J	4.0	11	J	3.8	73	NXJ	3.8
Chrysene	PAH	75000	D	240	13	J	5.0	32	J	4.7	350	NJ	4.7
Dibenz[a,h]anthracene	PAH	7700	D	540	11	U	11	11	U	11	29	NX	11
Fluoranthene	PAH	160000	D	640	33	J	13	69	J	13	630	NJ	13
Fluorene	PAH	32000	D	260	5.4	UJ	5.4	8.0	J	5.1	160	NJ	5.1
Indeno(1,2,3-cd)pyrene	PAH	16000	D	590	12	UJ	12	15	J	12	89	NJ	12
Naphthalene	PAH	590	UD	590	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	140000	D	590	16	J	12	48	J	12	610	NJ	12
Pyrene	PAH	150000	D	590	30	J	12	65	J	12	620	NJ	12
Aroclor-1016	PCB	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7
Aroclor-1221	PCB	7.9	U	7.9	7.8	U	7.8	7.8	U	7.8	7.8	U	7.8
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9
Aroclor-1242	PCB	4.6	U	4.6	4.6	U	4.6	4.5	U	4.5	4.5	U	4.5
Aroclor-1248	PCB	4.6	U	4.6	4.6	U	4.6	4.5	U	4.5	4.5	U	4.5
Aroclor-1254	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5
Aroclor-1260	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5

Attachment	1	Sheet No.	10 of 17
Originator	N. K. Schiffern	Date	02/14/13
Checked	J. D. Skoglie	Date	02/14/13
Calc. No.	0100D-CA-V0490	Rev. No.	0

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R1L0, CLEAR-2			J1R1L1, CLEAR-3			J1R1L2, CLEAR-4			J1R1L3, CLEAR-5		
		9/5/2012			9/5/2012			9/5/2012			9/5/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	UJ	10	9.3	UJ	9.3	9.6	UJ	9.6	160	X	9.4
Acenaphthylene	PAH	9.0	U	9.0	8.4	U	8.4	8.6	U	8.6	8.4	U	8.4
Anthracene	PAH	3.0	UJ	3.0	2.8	UJ	2.8	92	J	2.9	240	J	2.9
Benzo(a)anthracene	PAH	3.2	UJ	3.2	9.5	J	3.0	210	J	3.0	600	J	3.0
Benzo(a)pyrene	PAH	6.4	UJ	6.4	8.0	J	6.0	160	J	6.1	350	J	6.0
Benzo(b)fluoranthene	PAH	4.2	UJ	4.2	9.9	J	3.9	180	J	4.0	520	J	3.9
Benzo(ghi)perylene	PAH	7.2	UJ	7.2	9.1	JX	6.7	120	J	6.9	250	J	6.8
Benzo(k)fluoranthene	PAH	3.9	UJ	3.9	3.7	UJ	3.7	66	J	3.8	170	J	3.7
Chrysene	PAH	4.8	UJ	4.8	12	J	4.5	190	J	4.6	550	J	4.5
Dibenz[a,h]anthracene	PAH	11	U	11	10	U	10	23	JX	11	69	X	10
Fluoranthene	PAH	13	UJ	13	18	J	12	360	J	12	960	J	12
Fluorene	PAH	5.3	UJ	5.3	4.9	UJ	4.9	52	J	5.0	140	J	5.0
Indeno(1,2,3-cd)pyrene	PAH	12	UJ	12	11	UJ	11	110	J	11	210	J	11
Naphthalene	PAH	12	U	12	11	U	11	11	U	11	11	U	11
Phenanthrene	PAH	12	UJ	12	11	UJ	11	200	J	11	520	J	11
Pyrene	PAH	12	UJ	12	16	J	11	390	J	11	960	J	11
Aroclor-1016	PCB	2.8	U	2.8	2.6	U	2.6	2.8	U	2.8	2.7	U	2.7
Aroclor-1221	PCB	8.0	U	8.0	7.6	U	7.6	8.1	U	8.1	7.8	U	7.8
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9
Aroclor-1242	PCB	4.6	U	4.6	4.4	U	4.4	4.7	U	4.7	4.5	U	4.5
Aroclor-1248	PCB	4.6	U	4.6	4.4	U	4.4	4.7	U	4.7	4.5	U	4.5
Aroclor-1254	PCB	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5
Aroclor-1260	PCB	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5

CONSTITUENT	CLASS	J1R1L5, CLEAR-7			J1R1L6, CLEAR-8			J1R1L7, CLEAR-9			J1R1L8, CLEAR-10		
		9/5/2012			9/5/2012			9/5/2012			9/5/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	UJ	10	10	UJ	10	380	XJ	9.5	330	XJ	9.5
Acenaphthylene	PAH	9.0	U	9.0	9.0	U	9.0	53	JX	8.6	63	JX	8.6
Anthracene	PAH	25	J	3.1	3.0	UJ	3.0	1900	J	2.9	1600	J	2.9
Benzo(a)anthracene	PAH	80	J	3.2	3.2	UJ	3.2	3000	J	3.0	2200	J	3.0
Benzo(a)pyrene	PAH	53	J	6.4	6.4	UJ	6.4	2500	J	6.1	1700	J	6.1
Benzo(b)fluoranthene	PAH	61	J	4.2	4.2	UJ	4.2	2500	J	4.0	1500	J	4.0
Benzo(ghi)perylene	PAH	33	J	7.2	7.2	UJ	7.2	1600	J	6.9	910	J	6.8
Benzo(k)fluoranthene	PAH	24	J	3.9	3.9	UJ	3.9	930	J	3.8	730	J	3.7
Chrysene	PAH	62	J	4.8	4.8	UJ	4.8	2400	XJ	4.6	2000	J	4.6
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	500	XJ	10	320	X	10
Fluoranthene	PAH	140	J	13	13	UJ	13	6200	J	12	4800	J	12
Fluorene	PAH	17	J	5.3	5.3	UJ	5.3	1100	J	5.0	840	J	5.0
Indeno(1,2,3-cd)pyrene	PAH	27	J	12	12	UJ	12	690	XJ	11	830	J	11
Naphthalene	PAH	12	U	12	12	U	12	11	U	11	11	U	11
Phenanthrene	PAH	52	J	12	12	UJ	12	5000	J	11	4300	J	11
Pyrene	PAH	150	J	12	12	UJ	12	5100	J	11	5100	J	11
Aroclor-1016	PCB	2.6	U	2.6	2.6	U	2.6	2.8	U	2.8	2.7	U	2.7
Aroclor-1221	PCB	7.6	U	7.6	7.6	U	7.6	8.0	U	8.0	7.9	U	7.9
Aroclor-1232	PCB	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.4	U	4.4	4.4	U	4.4	4.6	U	4.6	4.6	U	4.6
Aroclor-1248	PCB	4.4	U	4.4	4.4	U	4.4	4.6	U	4.6	4.6	U	4.6
Aroclor-1254	PCB	2.5	U	2.5	2.5	U	2.5	20		2.6	2.5	U	2.5
Aroclor-1260	PCB	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5

Attachment	1	Sheet No.	11 of 17
Originator	N. K. Schiffern	Date	02/14/13
Checked	J. D. Skoglie	Date	02/14/13
Calc. No.	0100D-CA-V0490	Rev. No.	0

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R1L9, CLEAR-11			J1R1M0, CLEAR-12			J1R137, OB-9			J1R141, Duplicate of J1R137		
		9/5/2012			9/5/2012			9/6/2012			9/6/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	380	XJ	10	10	UJ	10	10	U	10	9.9	U	9.9
Acenaphthylene	PAH	26	JX	9.2	9.0	UJ	9.0	9.0	U	9.0	8.9	U	8.9
Anthracene	PAH	1300	J	3.1	140	J	3.0	27		3.0	3.0	U	3.0
Benzo(a)anthracene	PAH	1800	J	3.3	410	J	3.2	65		3.2	9.2	J	3.2
Benzo(a)pyrene	PAH	1400	J	6.6	300	J	6.4	40		6.4	7.7	J	6.4
Benzo(b)fluoranthene	PAH	1400	J	4.3	380	J	4.2	43	X	4.2	9.4	J	4.2
Benzo(ghi)perylene	PAH	760	J	7.4	210	J	7.2	37		7.2	7.1	U	7.1
Benzo(k)fluoranthene	PAH	600	J	4.0	140	J	3.9	15		3.9	3.9	U	3.9
Chrysene	PAH	1500	XJ	5.0	400	J	4.8	47		4.8	6.8	J	4.8
Dibenz[a,h]anthracene	PAH	250	X	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	3900	J	13	750	J	13	120		13	20	J	13
Fluorene	PAH	860	J	5.4	74	XJ	5.3	16	J	5.3	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	760	J	12	180	J	12	28	J	12	12	U	12
Naphthalene	PAH	780		12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	3600	J	12	370	J	12	79		12	13	J	12
Pyrene	PAH	3900	J	12	800	J	12	110		12	19	J	12
Aroclor-1016	PCB	2.6	U	2.6	2.7	U	2.7	2.5	U	2.5	2.7	U	2.7
Aroclor-1221	PCB	7.6	U	7.6	7.7	U	7.7	7.3	U	7.3	7.7	U	7.7
Aroclor-1232	PCB	1.9	U	1.9	1.9	U	1.9	1.8	U	1.8	1.9	U	1.9
Aroclor-1242	PCB	4.4	U	4.4	4.5	U	4.5	4.3	U	4.3	4.5	U	4.5
Aroclor-1248	PCB	4.4	U	4.4	4.5	U	4.5	4.3	U	4.3	4.5	U	4.5
Aroclor-1254	PCB	2.5	U	2.5	2.5	U	2.5	2.4	U	2.4	2.5	U	2.5
Aroclor-1260	PCB	2.5	U	2.5	2.5	U	2.5	2.4	U	2.4	2.5	U	2.5

CONSTITUENT	CLASS	J1R129, OB-1			J1R130, OB-2			J1R131, OB-3			J1R132, OB-4		
		9/6/2012			9/6/2012			9/6/2012			9/6/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.9	U	9.9	10	U	10	9.9	U	9.9	9.9	U	9.9
Acenaphthylene	PAH	8.9	U	8.9	9.0	U	9.0	8.9	U	8.9	8.9	U	8.9
Anthracene	PAH	3.0	U	3.0	3.1	U	3.1	3.0	U	3.0	3.0	U	3.0
Benzo(a)anthracene	PAH	3.2	U	3.2	11	J	3.2	3.2	U	3.2	3.2	U	3.2
Benzo(a)pyrene	PAH	6.3	U	6.3	6.4	U	6.4	6.4	U	6.4	6.3	U	6.3
Benzo(b)fluoranthene	PAH	7.9	J	4.1	8.2	J	4.2	4.2	U	4.2	5.7	J	4.2
Benzo(ghi)perylene	PAH	7.1	U	7.1	7.2	U	7.2	7.1	U	7.1	7.1	U	7.1
Benzo(k)fluoranthene	PAH	3.9	U	3.9	4.0	U	4.0	3.9	U	3.9	3.9	U	3.9
Chrysene	PAH	5.3	J	4.8	7.8	J	4.9	5.0	JX	4.8	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	19	J	13	13	J	13	13	U	13
Fluorene	PAH	5.2	U	5.2	5.3	U	5.3	5.2	U	5.2	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12
Pyrene	PAH	12	U	12	20	J	12	12	U	12	12	U	12
Aroclor-1016	PCB	2.8	U	2.8	2.7	U	2.7	2.6	U	2.6	2.6	U	2.6
Aroclor-1221	PCB	8.0	U	8.0	7.9	U	7.9	7.4	U	7.4	7.5	U	7.5
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	1.8	U	1.8	1.9	U	1.9
Aroclor-1242	PCB	4.7	U	4.7	4.6	U	4.6	4.3	U	4.3	4.4	U	4.4
Aroclor-1248	PCB	4.7	U	4.7	4.6	U	4.6	4.3	U	4.3	4.4	U	4.4
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.4	U	2.4	2.4	U	2.4
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	2.4	U	2.4	2.4	U	2.4

Attachment	1	Sheet No.	12 of 17
Originator	N. K. Schiffern	Date	02/14/13
Checked	J. D. Skoglie	Date	02/14/13
Calc. No.	0100D-CA-V0490	Rev. No.	0

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R133, OB-5			J1R134, OB-6			J1R135, OB-7			J1R136, OB-8		
		9/6/2012			9/6/2012			9/6/2012			9/6/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.4	U	9.4	9.8	U	9.8	9.8	U	9.8	2200	DX	49
Acenaphthylene	PAH	8.4	U	8.4	8.8	U	8.8	8.8	U	8.8	44	UD	44
Anthracene	PAH	2.9	U	2.9	3.0	U	3.0	3.0	U	3.0	4200	D	15
Benzo(a)anthracene	PAH	3.0	U	3.0	3.1	U	3.1	5.5	JX	3.1	6000	D	16
Benzo(a)pyrene	PAH	6.0	U	6.0	6.3	U	6.3	6.3	U	6.3	2600	D	32
Benzo(b)fluoranthene	PAH	4.5	JX	3.9	4.1	U	4.1	7.5	JX	4.1	3700	DX	21
Benzo(ghi)perylene	PAH	6.7	U	6.7	7.0	U	7.0	7.1	U	7.1	1600	D	36
Benzo(k)fluoranthene	PAH	3.7	U	3.7	3.8	U	3.8	3.9	U	3.9	1100	D	19
Chrysene	PAH	4.5	U	4.5	4.7	U	4.7	7.3	J	4.8	5700	D	24
Dibenz[a,h]anthracene	PAH	10	U	10	11	U	11	11	U	11	550	DX	54
Fluoranthene	PAH	12	U	12	13	U	13	20	J	13	12000	D	64
Fluorene	PAH	4.9	U	4.9	5.2	U	5.2	5.2	U	5.2	2400	D	26
Indeno(1,2,3-cd)pyrene	PAH	11	U	11	12	U	12	12	U	12	1100	D	59
Naphthalene	PAH	11	U	11	12	U	12	12	U	12	59	UD	59
Phenanthrene	PAH	11	U	11	12	U	12	25	J	12	11000	D	59
Pyrene	PAH	11	U	11	12	U	12	16	J	12	12000	D	59
Aroclor-1016	PCB	2.6	U	2.6	2.7	U	2.7	2.7	U	2.7	2.6	U	2.6
Aroclor-1221	PCB	7.6	U	7.6	7.7	U	7.7	7.7	U	7.7	7.5	U	7.5
Aroclor-1232	PCB	1.9	U	1.9	1.9	U	1.9	1.9	U	1.9	1.9	U	1.9
Aroclor-1242	PCB	4.4	U	4.4	4.5	U	4.5	4.5	U	4.5	4.3	U	4.3
Aroclor-1248	PCB	4.4	U	4.4	4.5	U	4.5	4.5	U	4.5	4.3	U	4.3
Aroclor-1254	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.4	U	2.4
Aroclor-1260	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.4	U	2.4

CONSTITUENT	CLASS	J1R138, OB-10			J1R139, OB-11			J1R140, OB-12			J1R149, SPA-8 [a]		
		9/6/2012			9/6/2012			9/6/2012			9/6/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.7	U	9.7	9.9	U	9.9	9.9	U	9.9	390	X	10
Acenaphthylene	PAH	8.7	U	8.7	8.9	U	8.9	9.0	U	9.0	9.0	U	9.0
Anthracene	PAH	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	680		3.0
Benzo(a)anthracene	PAH	5.7	J	3.1	3.2	U	3.2	12	J	3.2	1200		3.2
Benzo(a)pyrene	PAH	6.2	U	6.2	6.8	J	6.4	10	J	6.4	800		6.4
Benzo(b)fluoranthene	PAH	5.6	JX	4.1	8.8	J	4.2	15		4.2	860		4.2
Benzo(ghi)perylene	PAH	7.0	U	7.0	7.1	U	7.1	7.2	U	7.2	530		7.2
Benzo(k)fluoranthene	PAH	3.8	U	3.8	3.9	U	3.9	6.4	J	3.9	330		3.9
Chrysene	PAH	5.4	J	4.7	7.3	J	4.8	20	J	4.8	1000		4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	150	X	11
Fluoranthene	PAH	16	J	13	19	J	13	44		13	2200		13
Fluorene	PAH	5.1	U	5.1	5.2	U	5.2	5.3	U	5.3	360		5.3
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	530		12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	16	J	12	1800		12
Pyrene	PAH	19	J	12	17	J	12	47		12	2300		12
Aroclor-1016	PCB	2.6	U	2.6	2.6	U	2.6	2.7	U	2.7	2.8	U	2.8
Aroclor-1221	PCB	7.7	U	7.7	7.7	U	7.7	7.8	U	7.8	8.1	U	8.1
Aroclor-1232	PCB	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6	4.7	U	4.7
Aroclor-1248	PCB	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6	4.7	U	4.7
Aroclor-1254	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6
Aroclor-1260	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6

Attachment	1	Sheet No.	13 of 17
Originator	N. K. Schiffern	Date	02/14/13
Checked	J. D. Skoglie	Date	02/14/13
Calc. No.	0100D-CA-V0490	Rev. No.	0

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R154, Duplicate of J1R149 [a]			J1RD54, Re-sample of J1R149			J1R142, SPA-1			J1R143, SPA-2		
		9/6/2012			1/24/2013			9/6/2012			9/6/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	1300	DX	47	10	U	10	9.7	U	9.7	10	U	10
Acenaphthylene	PAH	43	UD	43	9.2	U	9.2	8.7	U	8.7	9.0	U	9.0
Anthracene	PAH	2200	D	14	3.1	U	3.1	3.0	U	3.0	3.1	U	3.1
Benzo(a)anthracene	PAH	3400	D	15	3.3	U	3.3	3.1	U	3.1	3.2	U	3.2
Benzo(a)pyrene	PAH	2200	D	30	6.6	U	6.6	6.8	J	6.2	6.4	U	6.4
Benzo(b)fluoranthene	PAH	2600	D	20	4.3	U	4.3	7.9	J	4.1	4.2	U	4.2
Benzo(ghi)perylene	PAH	1700	D	34	7.4	U	7.4	7.0	U	7.0	7.2	U	7.2
Benzo(k)fluoranthene	PAH	880	D	19	4.0	U	4.0	3.8	U	3.8	4.0	U	4.0
Chrysene	PAH	2900	D	23	5.0	U	5.0	5.4	J	4.7	4.9	U	4.9
Dibenz[a,h]anthracene	PAH	460	DX	52	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	6600	D	62	13	U	13	19	J	13	13	U	13
Fluorene	PAH	1200	D	25	5.4	U	5.4	5.1	U	5.1	5.3	U	5.3
Indeno(1,2,3-cd)pyrene	PAH	1700	D	57	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	57	UD	57	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	5900	D	57	12	U	12	12	U	12	12	U	12
Pyrene	PAH	6700	D	57	12	U	12	12	JX	12	12	U	12
Aroclor-1016	PCB	2.5	U	2.5				2.7	U	2.7	2.8	U	2.8
Aroclor-1221	PCB	7.4	U	7.4				7.9	U	7.9	8.0	U	8.0
Aroclor-1232	PCB	1.8	U	1.8				2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.3	U	4.3				4.6	U	4.6	4.7	U	4.7
Aroclor-1248	PCB	4.3	U	4.3				4.6	U	4.6	4.7	U	4.7
Aroclor-1254	PCB	2.4	U	2.4				2.6	U	2.6	2.6	U	2.6
Aroclor-1260	PCB	2.4	U	2.4				2.6	U	2.6	2.6	U	2.6

CONSTITUENT	CLASS	J1R144, SPA-3			J1R145, SPA-4			J1R146, SPA-5			J1R147, SPA-6		
		9/6/2012			9/6/2012			9/6/2012			9/6/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.4	U	9.4	9.9	U	9.9	9.5	U	9.5	9.9	U	9.9
Acenaphthylene	PAH	8.4	U	8.4	9.0	U	9.0	8.5	U	8.5	8.9	U	8.9
Anthracene	PAH	20		2.9	3.0	U	3.0	17	J	2.9	3.0	U	3.0
Benzo(a)anthracene	PAH	77		3.0	3.2	U	3.2	34		3.0	8.9	J	3.1
Benzo(a)pyrene	PAH	51		6.0	6.4	U	6.4	25		6.1	8.2	J	6.3
Benzo(b)fluoranthene	PAH	54		3.9	4.2	U	4.2	28	X	4.0	8.1	JX	4.1
Benzo(ghi)perylene	PAH	40		6.7	7.2	U	7.2	12	JX	6.8	7.1	U	7.1
Benzo(k)fluoranthene	PAH	25		3.7	3.9	U	3.9	11	J	3.7	3.9	U	3.9
Chrysene	PAH	47		4.5	4.8	U	4.8	28	J	4.6	6.8	J	4.8
Dibenz[a,h]anthracene	PAH	10	U	10	11	U	11	10	U	10	11	U	11
Fluoranthene	PAH	120		12	13	U	13	88		12	21	J	13
Fluorene	PAH	13	JX	4.9	5.3	U	5.3	9.6	J	5.0	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	28	X	11	12	U	12	24	J	11	12	U	12
Naphthalene	PAH	11	U	11	12	U	12	11	U	11	12	U	12
Phenanthrene	PAH	57		11	12	U	12	49		11	12	U	12
Pyrene	PAH	120		11	12	U	12	58	X	11	21	J	12
Aroclor-1016	PCB	2.8	U	2.8	2.6	U	2.6	2.8	U	2.8	2.6	U	2.6
Aroclor-1221	PCB	8.0	U	8.0	7.5	U	7.5	8.1	U	8.1	7.4	U	7.4
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9
Aroclor-1242	PCB	4.6	U	4.6	4.4	U	4.4	4.7	U	4.7	4.3	U	4.3
Aroclor-1248	PCB	4.6	U	4.6	4.4	U	4.4	4.7	U	4.7	4.3	U	4.3
Aroclor-1254	PCB	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6	2.4	U	2.4
Aroclor-1260	PCB	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6	2.4	U	2.4

Attachment	I	Sheet No.	14 of 17
Originator	N. K. Schiffern	Date	02/14/13
Checked	J. D. Skoglie	Date	02/14/13
Calc. No.	0100D-CA-V0490	Rev. No.	0

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R148, SPA-7			J1R150, SPA-9			J1R151, SPA-10			J1R152, SPA-11		
		9/6/2012			9/6/2012			9/6/2012			9/6/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.8	U	9.8	10	U	10	9.6	U	9.6	9.9	U	9.9
Acenaphthylene	PAH	8.8	U	8.8	9.1	U	9.1	8.6	U	8.6	8.9	U	8.9
Anthracene	PAH	3.0	U	3.0	3.2	J	3.1	2.9	U	2.9	3.0	U	3.0
Benzo(a)anthracene	PAH	3.1	U	3.1	9.3	J	3.2	8.8	J	3.1	3.1	U	3.1
Benzo(a)pyrene	PAH	6.3	U	6.3	8.4	J	6.5	6.1	U	6.1	6.3	U	6.3
Benzo(b)fluoranthene	PAH	4.1	U	4.1	8.5	JX	4.2	17		4.0	4.1	U	4.1
Benzo(ghi)perylene	PAH	7.1	U	7.1	7.3	U	7.3	6.9	U	6.9	7.1	U	7.1
Benzo(k)fluoranthene	PAH	3.9	U	3.9	4.0	J	4.0	3.8	U	3.8	3.9	U	3.9
Chrysene	PAH	4.7	U	4.7	7.8	JX	4.9	6.6	J	4.6	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	22	J	13	17	J	12	13	U	13
Fluorene	PAH	5.2	U	5.2	5.3	U	5.3	5.1	U	5.1	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	16	J	12	13	J	12	12	U	12
Pyrene	PAH	12	U	12	21	J	12	16	J	12	12	U	12
Aroclor-1016	PCB	2.8	U	2.8	2.6	U	2.6	2.8	U	2.8	2.8	U	2.8
Aroclor-1221	PCB	8.0	U	8.0	7.5	U	7.5	8.1	U	8.1	8.0	U	8.0
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.6	U	4.6	4.4	U	4.4	4.7	U	4.7	4.6	U	4.6
Aroclor-1248	PCB	4.6	U	4.6	4.4	U	4.4	4.7	U	4.7	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6	2.6	U	2.6
Aroclor-1260	PCB	2.6	U	2.6	2.4	U	2.4	2.6	U	2.6	2.6	U	2.6

CONSTITUENT	CLASS	J1R153, SPA-12			J1R156, FS-1			J1R157, FS-2			J1R158, FS-3		
		9/6/2012			9/4/2012			9/4/2012			9/4/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.8	U	9.8	10	U	10	9.9	U	9.9	250	X	9.9
Acenaphthylene	PAH	8.9	U	8.9	9.2	U	9.2	9.0	U	9.0	8.9	U	8.9
Anthracene	PAH	3.0	U	3.0	6.2	JX	3.1	3.5	J	3.0	680		3.0
Benzo(a)anthracene	PAH	11	J	3.1	30		3.3	3.8	JX	3.2	1100		3.2
Benzo(a)pyrene	PAH	8.5	J	6.3	28		6.6	8.7	J	6.4	1100		6.3
Benzo(b)fluoranthene	PAH	9.5	JX	4.1	25		4.3	10	J	4.2	1100		4.2
Benzo(ghi)perylene	PAH	7.1	U	7.1	20	J	7.4	7.2	U	7.2	650		7.1
Benzo(k)fluoranthene	PAH	3.9	U	3.9	14	J	4.0	3.9	U	3.9	490		3.9
Chrysene	PAH	9.1	J	4.8	22	J	5.0	7.9	JX	4.8	1000		4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	210	X	11
Fluoranthene	PAH	23	J	13	44		13	20	J	13	2400		13
Fluorene	PAH	5.2	U	5.2	5.4	U	5.4	5.3	U	5.3	380		5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	17	J	12	12	U	12	670		12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	14	J	12	24	J	12	12	U	12	1700		12
Pyrene	PAH	21	J	12	44		12	19	J	12	2400		12
Aroclor-1016	PCB	2.7	U	2.7	2.8	U	2.8	2.6	U	2.6	2.8	U	2.8
Aroclor-1221	PCB	7.7	U	7.7	8.2	U	8.2	7.6	U	7.6	8.2	U	8.2
Aroclor-1232	PCB	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0
Aroclor-1242	PCB	4.5	U	4.5	4.7	U	4.7	4.4	U	4.4	4.7	U	4.7
Aroclor-1248	PCB	4.5	U	4.5	4.7	U	4.7	4.4	U	4.4	4.7	U	4.7
Aroclor-1254	PCB	2.5	U	2.5	13		2.6	2.5	U	2.5	2.6	U	2.6
Aroclor-1260	PCB	2.5	U	2.5	4.8	JN	2.6	2.5	U	2.5	2.6	U	2.6

Attachment	1	Sheet No.	15 of 17
Originator	N. K. Schiffern	Date	02/14/13
Checked	J. D. Skoglie	Date	02/14/13
Calc. No.	0100D-CA-V0490	Rev. No.	0

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R159, FS-4 9/4/2012		
		ug/kg	Q	PQL
Acenaphthene	PAH	9.6	U	9.6
Acenaphthylene	PAH	8.7	U	8.7
Anthracene	PAH	26		2.9
Benzo(a)anthracene	PAH	43		3.1
Benzo(a)pyrene	PAH	44		6.2
Benzo(b)fluoranthene	PAH	41		4.0
Benzo(ghi)perylene	PAH	6.9	U	6.9
Benzo(k)fluoranthene	PAH	18		3.8
Chrysene	PAH	41		4.7
Dibenz[a,h]anthracene	PAH	11	U	11
Fluoranthene	PAH	99		13
Fluorene	PAH	16	J	5.1
Indeno(1,2,3-cd)pyrene	PAH	24	J	12
Naphthalene	PAH	12	U	12
Phenanthrene	PAH	65		12
Pyrene	PAH	92		12
Aroclor-1016	PCB	2.7	U	2.7
Aroclor-1221	PCB	7.9	U	7.9
Aroclor-1232	PCB	2.0	U	2.0
Aroclor-1242	PCB	4.6	U	4.6
Aroclor-1248	PCB	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6
Aroclor-1260	PCB	2.6	U	2.6

Attachment	1	Sheet No.	16 of 17
Originator	N. K. Schiffern	Date	02/14/13
Checked	J. D. Skoglie	Date	02/14/13
Calc. No.	0100D-CA-V0490	Rev. No.	0

Attachment 1. 100-D-50:6 Subsite Verification Sampling Results - Asbestos [a]

Sample Location	HEIS Number	Sample Date	Chrysotile	Amosite	Crocidolite	Tremolite	Actinolite	Anthophyllite
			%	%	%	%	%	%
PIPE-3	J1R163	9/5/2012	ND	ND	ND	ND	ND	ND
Replicate of J1R118	J1R173	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE-1	J1R161	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE-2	J1R162	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE-4 [b]	J1R164	9/5/2012	3	ND	ND	ND	ND	ND
Re-sample of J1R164	J1RD53	1/23/2013	ND	ND	ND	ND	ND	ND
PIPE-5	J1R165	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE-6	J1R166	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE 7	J1R167	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE-8	J1R168	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE-9	J1R169	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE-10	J1R170	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE-11	J1R171	9/5/2012	ND	ND	ND	ND	ND	ND
PIPE-12	J1R172	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-6	J1R1K1	9/5/2012	ND	ND	ND	ND	ND	ND
Duplicate of J1R1K1	J1R1K8	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-1	J1R1J6	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-2	J1R1J7	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-3	J1R1J8	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-4	J1R1J9	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-5	J1R1K0	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-7	J1R1K2	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-8	J1R1K3	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-9	J1R1K4	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-10	J1R1K5	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-11	J1R1K6	9/5/2012	ND	ND	ND	ND	ND	ND
CLEAR-12	J1R1K7	9/5/2012	ND	ND	ND	ND	ND	ND
OB-9	J1R182	9/6/2012	ND	ND	ND	ND	ND	ND
Duplicate of J1R137	J1R186	9/6/2012	ND	ND	ND	ND	ND	ND
OB-1	J1R174	9/6/2012	ND	ND	ND	ND	ND	ND
OB-2	J1R175	9/6/2012	ND	ND	ND	ND	ND	ND
OB-3	J1R176	9/6/2012	ND	ND	ND	ND	ND	ND
OB-4	J1R177	9/6/2012	ND	ND	ND	ND	ND	ND
OB-5	J1R178	9/6/2012	ND	ND	ND	ND	ND	ND
OB-6	J1R179	9/6/2012	ND	ND	ND	ND	ND	ND
OB-7	J1R180	9/6/2012	ND	ND	ND	ND	ND	ND
OB-8	J1R181	9/6/2012	ND	ND	ND	ND	ND	ND
OB-10	J1R183	9/6/2012	ND	ND	ND	ND	ND	ND
OB-11	J1R184	9/6/2012	ND	ND	ND	ND	ND	ND
OB-12	J1R185	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-8	J1R194	9/6/2012	ND	ND	ND	ND	ND	ND
Duplicate of J1R149	J1R199	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-1	J1R187	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-2	J1R188	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-3	J1R189	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-4	J1R190	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-5	J1R191	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-6	J1R192	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-7	J1R193	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-9	J1R195	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-10	J1R196	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-11	J1R197	9/6/2012	ND	ND	ND	ND	ND	ND
SPA-12	J1R198	9/6/2012	ND	ND	ND	ND	ND	ND
FS-1	J1R1C0	9/4/2012	ND	ND	ND	ND	ND	ND
FS-2	J1R1C1	9/4/2012	ND	ND	ND	ND	ND	ND
FS-3	J1R1C2	9/4/2012	ND	ND	ND	ND	ND	ND
FS-4	J1R1C3	9/4/2012	ND	ND	ND	ND	ND	ND

[a] the required detection limit for asbestos is 1 %.

[b] Sample location PIPE-4 was detected for asbestos. This location underwent additional remediation and re-sampling.

Attachment	1	Sheet No.	17 of 17
Originator	N. K. Schiffern	Date	02/12/13
Checked	J. D. Skoglie	Date	02/12/13
Calc. No.	0100D-CA-V0490	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-D Area Field Remediation **Job No. 14655**

Area: 100-D

Discipline: Environmental Calculation No: 0100D-CA-V0491

Subject: 100-D-50:6 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculation

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 4 Total =5	N. K. Schiffern N K Schiffern	J. D. Skoglie	C. H. Dobie C H Dobie	D. F. Obenauer D. F. Obenauer	3/14/13

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	2/19/2013	Calc. No.:	0100D-CA-V0491	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	2/19/2013
Subject:	100-D-50:6 Subsite 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 100-D-50:6 subsite. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009b), 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, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2009b, *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.

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

4) WCH, 2013, *Remaining Sites Verification Package for the 100-D-50:6, 183-DR Clearwell Pipelines Subsite*, Attachment to Waste Site Reclassification Form 2013-011, 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 2009b).

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 2009b).

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:	N. K. Schiffern	Date:	2/19/2013	Calc. No.:	0100D-CA-V0491	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	2/19/2013
Subject:	100-D-50:6 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 4	

METHODOLOGY:

The 100-D-50:6 subsite underwent statistical sampling at four decision units for verification sampling, consisting of clearwell excavation, pipeline excavation, overburden, and staging pile area. Also collected were five focused samples. The direct contact hazard quotient and carcinogenic risk calculations for the 100-D-50:6 subsite were conservatively calculated using the greater of the maximum or statistical soil sample results from the shallow zone excavation: overburden and staging pile area (WCH 2013). Of the contaminants of potential concern (COPCs) for this subsite, nitrogen in nitrite and nitrate requires HQ and risk calculations because this analyte was detected above background value. Boron, molybdenum, and detected polycyclic aromatic hydrocarbons (PAHs) require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Although total petroleum hydrocarbons (diesel range extended) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. 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 statistical value for boron is 2.0 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 2.8×10^{-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 8.3×10^{-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)pyrene is 2.6 mg/kg, divided by 0.137 mg/kg, and multiplied as indicated, produces a value of 1.9×10^{-5}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is not 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 2.3×10^{-5}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is not 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 $>1 \times 10^{-6}$: benzo(a)pyrene, 1.9×10^{-5}

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	2/19/2013	Calc. No.:	0100D-CA-V0491	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	2/19/2013
Subject:	100-D-50:6 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 4	

4) List the cumulative excess cancer risk for carcinogens >1 x 10^{-5}: 2.3 x 10^{-5}

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

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-D-50:6 Subsite.

Contaminants of Potential Concern	Statistical or Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	2.0	7,200	2.8E-04	--	--
Molybdenum	1.1	400	2.8E-03	--	--
Anions					
Nitrite and Nitrate (as Nitrogen)	112	128,000	8.8E-04	--	--
Polycyclic Aromatic Hydrocarbons					
Acenapthene	2.2	4,800	4.6E-04	--	--
Anthracene	4.2	24,000	1.8E-04	--	--
Benzo(a)anthracene	1.3	--	--	1.37	9.5E-07
Benzo(a)pyrene	2.6	--	--	0.137	1.9E-05
Benzo(b)fluoranthene	0.82	--	--	1.37	6.0E-07
Benzo(ghi)perylene[c]	1.6	2,400	6.7E-04	--	--
Benzo(k)fluoranthene	1.1	--	--	1.37	8.0E-07
Chrysene	1.3	--	--	13.7	9.5E-08
Dibenz(a,h)anthracene	0.55	--	--	1.37	4.0E-07
Fluoranthene	2.7	3,200	8.4E-04	--	--
Fluorene	2.4	3,200	7.5E-04	--	--
Indeno(1,2,3-cd)pyrene	1.1	--	--	1.37	8.0E-07
Phenanthrene[c]	11	24,000	4.6E-04	--	--
Pyrene	2.7	2,400	1.1E-03	--	--
Total Petroleum Hydrocarbon					
TPH-diesel EXT [d]	43	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**8.4E-03**		
Cumulative Excess Cancer Risk:					**2.3E-05**

Notes:

[a] = From WCH (2013).

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

[c] = Toxicity data for these chemicals are not available. The cleanup levels are based on use of surrogate chemicals.
benzo(g,h,i)perylene surrogate: pyrene
phenanthrene surrogate: anthracene

[d] = The risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation.

-- = not applicable

RAG = remedial action goal

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	2/19/2013	Calc. No.:	0100D-CA-V0491	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	2/19/2013
Subject:	100-D-50:6 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	4 of 4

CONCLUSION:

The calculations in Table 1 demonstrate that the 100-50:6 subsite does not meet the requirements for the hazard quotients and carcinogenic (excess cancer) risk as identified in the RDR/RAWP (DOE-RL 2009b) and SAP (DOE-RL 2009a). The hazard quotients and carcinogenic (excess cancer) risk and RPD calculations are for use in the RSVP for this subsite.

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-D Area Field Remediation **Job No. 14655**

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0494

Subject: 100-D-50:6 Subsite Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater

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 = 3 Total = 4	N. K. Schiffern N K Schiffern	J. D. Skoglie [signature]	C. H. Dobie C H Dobie	D. F. Obenauer D. F. Obenauer	3/14/13

SUMMARY OF REVISION

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern NS	Date:	2/14/2013	Calc. No.:	0100D-CA-V0494	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie JS	Date:	2/14/2013
Subject:	100-D-50:6 Subsite Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 1 of 3	

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for the 100-D-50:6 subsite. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009), 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) BHI, 2005, *100 Area Analogous Sites RESRAD Evaluation*, Calculation No. 0100X-CA-V0050 Rev 0, Bechtel Hanford, Inc., Richland, Washington.

2) DOE-RL, 2009, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas*, DOE/RL-96-17, Rev. 6, 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, 2013, *100-D-50:6 Subsite Cleanup Verification 95% UCL Calculations*, 0100D-CA-V0490, Rev. 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate a HQ for each noncarcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

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

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	2/19/2013	Calc. No.:	0100D-CA-V0494	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	2/19/2013
Subject:	100-D-50:6 Subsite Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 2 of 3	

METHODOLOGY:

The 100-D-50:6 subsite was divided into four decision units for the purpose of verification sampling; clearwell excavation, pipeline excavation, overburden, and staging pile area. Also collected were five focused samples. Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at the 100-D-50:6 subsite were conservatively calculated for the entire subsite using the greater of the statistical or maximum value for each analyte in all decision units from the 95% UCL calculation (WCH 2013). Based on this model and a vadose zone of approximately 15 m (49.2 ft) thickness, a distribution coefficient (K_d) of 4.9 or greater is required to show no predicted migration to groundwater in 1,000 years. Of the contaminants of potential concern (COPCs) for this site, boron, hexavalent chromium, and naphthalene are included because no Washington State or Hanford background value has been established and the K_d is less than necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (BHI 2005). Nitrogen in nitrite and nitrate requires HQ and risk calculations because this analyte was detected above background and the K_d is less than necessary. All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than or equal to 4.9. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (mg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720(3)(a)(ii)(A), 1996) x 100 x 1 mg/1000 mg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii)(A) (1996). For example, the maximum value for boron of 4.1 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg is 1.3×10^{-3}. Comparing this value 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 cumulative HQ for the 100-D-50:6 subsite is 9.5×10^{-1}. 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, and then multiplied by 1×10^{-6}. The 100-D-50:6 subsite doesn't have any constituents with carcinogen RAG, the criterion for excess cancer risk is met. Consequently, the criterion for cumulative excess cancer risk for carcinogens is also met.

4) The soil cleanup RAGs for protection of groundwater are based on the "100 times" provision in WAC 173-340-740(3)(a)(ii)(A). WAC 173-340-740(3)(a)(ii)(A) (1996) provides the "100 times rule" but also states "unless it can be demonstrated that a higher soil concentration is protective of ground water at the site." When the "100 times rule" values are exceeded, RESRAD was used to demonstrate that higher soil concentrations may be protective of groundwater.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	2/19/2013	Calc. No.:	0100D-CA-V0494	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	2/19/2013
Subject:	100-D-50:6 Subsite Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 3 of 3	

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 x 10^{-6}: None
4) List the cumulative excess cancer risk for carcinogens >1 x 10^{-5}: None.

Table 1 shows the results of the calculations.

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 100-D-50:6 Subsite.

Contaminants of Potential Concern[a]	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	4.1	320	1.3E-02	--	--
Chromium, hexavalent	1.32	4.8	2.8E-01	--	--
Polycyclic Aromatic Hydrocarbons					
Naphthalene	9.7	16	6.1E-01	--	--
Anions					
Nitrogen in nitrite and nitrate	112	2,560	4.4E-02	--	--
Totals					
Cumulative Hazard Quotient:			**9.4E-01**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:
[a] = From WCH (2013).
[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 100-D-50:6 subsite meets the requirements for the hazard quotients and excess carcinogenic risk for protection of groundwater as identified in the RDR/RAWP (DOE-RL 2009).

APPENDIX E

DATA QUALITY ASSESSMENT

APPENDIX E

DATA QUALITY ASSESSMENT

CONFIRMATORY SAMPLING

This data quality assessment (DQA) review was performed in accordance with WCH-EE-01, *Environmental Investigations Procedures*. Specific data quality objectives for the site are found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009). To ensure quality data sets, the SAP data quality assurance requirements, as well as the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) are followed, where appropriate.

A review of the work instructions (WCH 2005c, 2006d), the field logbooks (WCH 2005a, 2005b, 2006a), and applicable analytical data packages has been performed as part of this DQA. All 100-D-50:6 confirmatory samples were collected per the sample design, except as follows: (1) samples of mastic pipe coating and liquid discovered inside a catch basin in service area 1 were collected in addition to the samples specified; (2) a sample of pipeline contents was not collected in service area 2, due to accessibility restrictions; and (3) a sample of pipeline contents was not collected in service area 3, due to previous demolition activities and accessibility issues (in discussion with the Washington State Department of Ecology, an additional sample was collected from underlying soils instead).

Not all 100-D-50:2 confirmatory sample locations identified in the sample design could be accessed. The field logbook documents the inaccessibility to the western end of the north cooling water pipes in the north tunnel, as well as the absence of sample material in the eastern end of same. The sample plan called for up to two samples of the main process supply lines, with an alternative of compositing samples in the case of insufficient sample material availability. Because of insufficient material in pipes to make individual samples, a composite sample was made from material from both ends of both pipes in the south tunnel. There was insufficient material to perform all analyses identified for the field duplicate of this sample. Based on the analytical priority identified in the work instruction, only hexavalent chromium analysis could be performed for the field duplicate. The remaining sampling locations identified for the 100-D-50:2 pipelines are associated with small-diameter pipelines that are not relevant to the data comparison for the 100-D-50:6 subsite and are not considered further in this DQA.

The 100-D-50:6 confirmatory sampling work instruction (WCH 2005c) listed inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, kinetic phosphorescence analysis, gross alpha, gross beta, and gamma spectroscopy as analytical methods for the 100-D-50:6 subsite. All of the confirmation data generated for the subsite are in the following sample delivery groups (SDGs):

- SDG J00015 (sample J10L65)
- SDG J00016 (sample J10LD8)
- SDG K0099 (sample J10L61)

- SDG K0100 (samples J10L69 and J10L70)
- SDG K0107 (samples J10L62, J10L63, J10L71, and J10L72)
- SDG K0109 (sample J10LD7).

Third-party validation was performed on SDG K0107 (WCH 2006b). No major deficiencies were found. Minor deficiencies are discussed below. All of the 100-D-50:6 confirmatory data were found to be usable for decision-making purposes.

The confirmatory sample data collected at the 100-D-50:2 subsite were provided by the laboratories in two SDGs:

- SDG K0571 (samples J13H93 and J13H94)
- SDG J00100 (samples J13HC2 and J13HC3).

SDG K0571 was submitted for third-party validation (WCH 2006c). A major deficiency was identified in the analytical data set. Major and minor deficiencies are discussed below. As described previously, due to the quantified concentrations reported in the analyses of ICP metals, mercury, hexavalent chromium, and polychlorinated biphenyls (PCBs) within confirmatory samples, service areas 1 and 2 will be remediated, and these analytical methods retained for the verification sampling effort. This DQA includes no further discussion on those analytical methods that will be subject to DQA under the verification sampling effort at the 100-D-50:6 subsite.

SDGs J00015, J00016, and J00100

Not reviewed because associated service area failed remedial action goals (RAGs) for hexavalent chromium and a DQA will be performed on verification data.

SDG K0099

Inductively coupled plasma and mercury analysis not reviewed because associated service area failed RAGs for arsenic and a DQA will be performed on verification metals data.

In the radiochemistry analyses, there are no issues.

SDG K0100

In the ICP metals, mercury, and hexavalent chromium analyses, no deficiencies were noted except for sample J10L69, associated with service area 1. This service area will be remediated and additional DQA performed on verification metals data.

In the radiochemistry analyses, no deficiencies were noted.

SDG K0107

In the ICP metals analysis, third-party validation applied qualification to sample data due to method blank (MB) contamination, low matrix spike (MS) recoveries, and/or low recoveries in the laboratory control sample (LCS). Calcium and zinc data in sample J10L72 were qualified "UJ" as estimated nondetects. All molybdenum results in the SDG were qualified as estimated nondetects and flagged "UJ." The analytes calcium and antimony had MS recoveries below the acceptance criteria at 60.6% and 44%, respectively, and were flagged "J" as estimated in all samples. All of the silicon data in the SDG were qualified "J" as estimated due to LCS recovery. Chromium data were also qualified "J" as estimated due to relative percent difference (RPD) values. The data remain usable for decision-making purposes.

In the hexavalent chromium analysis, there were no deficiencies noted.

No qualification was applied to the results of the radiochemistry analyses.

SDG K0109

In the ICP metals and mercury analyses, the RPD values for three analytes were outside of laboratory criteria. These samples met the RPD criteria identified in the SAP and the data remain usable for decision-making purposes.

In the radiochemistry analyses, no issues were noted.

SDG K0571

In the anion analyses, the holding time requirement of 48 hours was exceeded by greater than twice the limit for nitrate, nitrite, and phosphate. Third-party validation rejected the phosphate and nitrite nondetected results, and flagged the values "UR". Third-party validation qualified the detected nitrate results as estimated with a "J" flag. Estimated or "J"-flagged data are considered acceptable for the intended use of the data. Anions were not identified as contaminants of potential concern (COPCs) for the 100-D-50:2 subsite, and analysis was requested to provide additional characterization data. The nitrate data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for eight ICP metals (aluminum, chromium, iron, manganese, mercury, selenium, silicon, and zinc) are out of acceptance criteria. For most of these analytes, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS result is a reflection of the analytical variability of the native concentration, rather than a measure of the sample recovery. To confirm quantitation, post digestion spikes and serial dilutions were prepared for all eight analytes with acceptable results. Selenium did not have mismatched spike and native concentrations in the original MS. This analyte has been qualified by third-party validation as estimated with "J" flags for all samples in SDG K0571. The original MS recovery for selenium was 57%. Estimated or "J"-flagged data are usable for decision-making purposes.

Third-party validation qualified as estimated and assigned a "J" flag to all silicon results, as the LCS recovery was below quality control (QC) limits at 8%. Estimated data are usable for decision-making purposes.

No deficiencies were noted in the radiochemistry and PCB analyses.

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

The DQA review for the 100-D-50:6 subsite found the results to be accurate within the standard errors associated with the methods, including sampling and sample handling. The DQA review for the 100-D-50:6 subsite and applicable 100-D-50:2 data concludes that the data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of quality assurance (QA) and QC deficiencies.
All analytical data were found acceptable for decision-making purposes. The confirmatory sample analytical data are stored in the Environmental Restoration (ENRE) project-specific database prior to archiving in the Hanford Environmental Information System (HEIS) and are summarized in Appendix D.

VERIFICATION SAMPLING

A DQA was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2012b). This DQA was performed in accordance with site-specific data quality objectives found in the SAP (DOE-RL 2009).

A review of the sample design (WCH 2012b), the field logbooks (WCH 2012a, 2013), 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 and the data validation procedures for chemical analysis (BHI 2000a) 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 data from samples collected at the 100-D-50:6 subsite were provided by the laboratories in 14 SDGs: SDG MA05538, SDG MA05553, SDG MA05552, SDG MA05556, SDG MA05557, SDG MA05986, SDG J01561, SDG JP0409, SDG JP0410, SDG JP0411, SDG JP0412, SDG JP0440, SDG JP0445, and SDG JP0446. SDG JP0409 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 100-D-50:6 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

MINOR DEFICIENCIES

SDG MA05538

This SDG comprises four focused soil samples (J1R1C0 through J1RC3) collected from the excavation area and analyzed for asbestos.

No minor deficiencies were found in SDG MA05538.

SDG MA05552

This SDG comprises 13 statistical soil samples (J1R161 through J1R173) collected from the clearwell pipeline area and analyzed for asbestos.

No minor deficiencies were found in SDG MA05552.

SDG MA05553

This SDG comprises 13 statistical soil samples (J1R1J6 through J1R1J9, J1R1K0 through J1R1K8) collected from the excavation area and analyzed for asbestos.

No minor deficiencies were found in SDG MA05553.

SDG MA05556

This SDG comprises 13 statistical soil samples (J1R187 through J1R199) collected from the clearwell staging pile area and analyzed for asbestos.

No minor deficiencies were found in SDG MA05556.

SDG MA05557

This SDG comprises 13 statistical soil samples (J1R174 through J1R186) collected from the overburden area and analyzed for asbestos.

No minor deficiencies were found in SDG MA05557.

SDG MA05986

This SDG comprises one soil sample (J1RD53) collected from the clearwell pipelines area, location pipe-4, and analyzed for asbestos.

No minor deficiencies were found in SDG MA05986.

SDG J01591

This SDG comprises five focused soil samples (J1R156 through J1R160) collected from the 100-D-50:6 subsite excavation area. Samples J1R156 through J1R159 were analyzed for ICP metals, mercury, hexavalent chromium, polycyclic aromatic hydrocarbons (PAH), and PCBs. Sample J1R160 was analyzed for ICP metals, mercury, hexavalent chromium, anions, nitrite/nitrate, pH, and total petroleum hydrocarbons (TPH). Minor deficiencies are as follows:

In the hexavalent chromium analysis, all results may be considered estimated due to an RPD above QC limits at 50%. Estimated data are usable for decision-making purposes.

In the PCB analysis, to reduce matrix interferences, the laboratory performed a sulfuric acid cleanup on sample J1R156. In addition, shared peaks were noted in sample J1R156 suggesting that there is more than one aroclor component. All PCB results for sample J1R156 may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, the laboratory duplicate RPD for aroclor-1260 was outside the project QC limit of 30%, at 42%. All aroclor-1260 data in SDG J01591 may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, the matrix spike duplicate (MSD) recovery for aroclor-1260 is above QA measures. All results for aroclor-1260 in SDG J01591 may be considered estimated. Estimated data are usable for decision-making purposes.

In the TPH analysis, the C10-C36 and C10-C28 were detected in the MB. The laboratory qualified these results as estimated, with "J" flags. Estimated data are usable for decision-making purposes.

In the PAH analysis, the laboratory identified chemical and/or physical interference was present for several analytes. The laboratory has qualified the associated data with "X" flags due to the interference. Acceptable LCS recoveries confirm the analytical system was operating within acceptable parameters. The qualified data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, zinc was detected in the MB at low levels. Zinc was detected at significantly lower concentrations than its associated most stringent cleanup limit, and is detected at significantly higher concentrations in field samples. The data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon is below the laboratory and project recovery limits, at 9%. All silicon results in SDG J01591 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were outside the project acceptance criteria for five analytes (aluminum [1,139%], antimony [47%], iron [2,187%], manganese [185%], silicon [17%]). For aluminum, iron, and manganese, the spiking concentration was insignificant

compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the MS. All antimony and silicon results for SDG J01591 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory duplicate RPD for antimony (43%) was outside the project QC limit of 30%. All antimony data in SDG J01591 may be considered estimated. Estimated data are usable for decision-making purposes.

In the nitrate/nitrite analysis, a low level of N-soluble nitrate/nitrite was detected in the MB. The nitrate/nitrite results for sample J1R160 may be considered estimated. Estimated data are usable for decision-making purposes.

In the anions analysis, the MSD recovery for phosphate is below the QC limits. Phosphate is not a regulated chemical under *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act-Cleanup."

SDG JP0409

This SDG comprises 13 statistical verification samples (J1R1K9, J1R1L0 through J1R1L9, J1R1M0 through J1R1M1) collected from the excavation area. All samples were analyzed for ICP metals, mercury, hexavalent chromium, PAH, and PCBs. This SDG also includes one field duplicate pair (J1R1L3/J1R1M1). SDG JP0409 was submitted for third-party validation. Minor deficiencies are as follows:

In the PAH analysis, an initial calibration error affected the results for acenaphthene. Acenaphthene was switched with 1-methylnaphthalene on one channel of the HPLC instrument, resulting in acenaphthene data being incorrectly reported as below the detection limit. This error was identified during an internal QC review. All data were reprocessed and the data package was revised to show the correct results. The samples affected included J1R1K9 and J1R1L3. Because these sample results were corrected, the data are appropriate and usable for decision-making purposes.

In the PAH analysis, the MS recoveries were outside the project acceptance criteria for 13 analytes (acenaphthene [336%], anthracene [254%], benzo[a]anthracene [370%], benzo[a]pyrene [264%], benzo[b]fluoranthene [295%], benzo[g,h,i]perylene [197%], benzo[k]fluoranthene [157%], chrysene [310%], fluoranthene [624%], fluorene [157%], indeno[1,2,3-cd]pyrene [210%], phenanthrene [440%], and pyrene [630%]). In addition, the RPDs for these 13 analytes was outside the QC limits (acenaphthene [96%], anthracene [81%], benzo[a]anthracene [108%], benzo[a]pyrene [90%], benzo[b]fluoranthene [92%], benzo[g,h,i]perylene [63%], benzo[k]fluoranthene [43%], chrysene [94%], fluoranthene [134%], fluorene [41%], indeno[1,2,3-cd]pyrene [64%], phenanthrene [112%], and pyrene [134%]). Third-party validation qualified all these PAH results for SDG JP0409 as estimates, with "J" flags. Estimated data are usable for decision-making purposes.

In the PAH analysis, due to a surrogate recovery (terphenyl-d14 [145%]) outside the laboratory QC limits, all detected PAH results in sample J1R1L7 where qualified by third-party validation as estimates, with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon is below the laboratory and project recovery limits, at 14%. All silicon results in SDG JP0409 were qualified by third-party validation as estimates, with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were outside the project acceptance criteria for five analytes (aluminum [1,407%], antimony [61%], calcium [135%], iron [2,525%], manganese [166%], silicon [20%]). For aluminum, iron and manganese the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony, calcium, and silicon did not have mismatched spike and native concentrations in the MS. All antimony and silicon results for SDG JP0409 were qualified by third-party validation as estimates, with "J" flags. Estimated data are usable for decision-making purposes.

SDG JP0410

This SDG comprises 13 statistical verification samples (J1R116 through J1R128) collected from the clearwell pipelines area. All samples were analyzed for ICP metals, mercury, hexavalent chromium, PAH, and PCBs. This SDG also includes one field duplicate pair (J1R118/J1R128). Minor deficiencies are as follows:

In the PAH analysis, an initial calibration error affected the results for acenaphthene. Acenaphthene was switched with 1-methylnaphthalene on one channel of the HPLC instrument, resulting in acenaphthene data being incorrectly reported as below the detection limit. This error was identified during an internal QC review. All data were reprocessed and the data package was revised to show the correct results. The samples affected included J1R117, J1R118, J1R119, J1R120, J1R121, J1R122, J1R123, J1R124, J1R127, and J1R128. Because these sample results were corrected, the data are appropriate and usable for decision-making purposes.

In the PCB analysis, to reduce matrix interferences, the laboratory performed a sulfuric acid cleanup on samples in SDG JP0410. Surrogate recoveries in samples J1R120 and J1R121 were outside the QC limits, suggesting that matrix interference is present. Sample chromatographs showed multiple nontarget peaks, interfering with recovery and quantitation of the surrogates. All PCB results in samples J1R120 and J1R121 may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, matrix interference and high concentrations of target analytes required that some of the sample extract had to be diluted prior to analysis. All sample results resulting from diluted extracts were flagged "D" by the laboratory. Some surrogate recoveries were also flagged "D" by the laboratory, as they are considered unreliable. All PAH data in SDG JP0410 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, barium, calcium, and zinc were detected in the MB at low levels. Barium and zinc was detected at significantly lower concentrations than its associated most stringent cleanup limit, and is detected at significantly higher concentrations in field samples. Calcium is not a regulated chemical under WAC 173-340, "Model Toxics Control Act-Cleanup." The data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon is below the laboratory and project recovery limits, at 17%. All silicon results in SDG JP0410 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were outside the project acceptance criteria for five analytes (aluminum [1,312%], antimony [54%], iron [1,561%], manganese [186%], silicon [20%]). For aluminum, iron, and manganese the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the MS. All antimony and silicon results for SDG JP0410 may be considered estimated. Estimated data are usable for decision-making purposes.

SDG JP0411

This SDG comprises 13 statistical verification samples (J1R129 through J1R141) collected from the overburden area. All samples were analyzed for ICP metals, mercury, hexavalent chromium, PAH, and PCBs. This SDG also includes one field duplicate pair (J1R137/J1R141). Minor deficiencies are as follows:

In the hexavalent chromium analysis, MS recovery was below the project acceptance criteria at 68%. All hexavalent chromium results in SDG JP0411 may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, an initial calibration error affected the results for acenaphthene. Acenaphthene was switched with 1-methylnaphthalene on one channel of the HPLC instrument, resulting in acenaphthene data being incorrectly reported as below the detection limit. This error was identified during an internal QC review. All data were reprocessed and the data package was revised to show the correct results. Sample J1R136 was affected in SDG JP0411. Because these sample results were corrected, the data are appropriate and usable for decision-making purposes.

In the PAH analysis, matrix interference and high concentrations of target analytes required that some of the sample extract had to be diluted prior to analysis. All sample results resulting from diluted extracts were flagged "D" by the laboratory. Some surrogate recoveries were also flagged "D" by the laboratory, as they are considered unreliable. Surrogate recovery in sample J1R136 was calculated from a diluted sample, flagged "D" by the laboratory, and is considered unreliable. Acceptable LCS, MS, and MSD recoveries confirm the analytical system was operating within acceptable parameters. All PAH data in sample J1R136 and data reported from dilutions may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, barium was detected in the MB at low levels. Barium was detected at significantly smaller concentrations than its associated most stringent cleanup limit, and is detected at significantly higher concentrations in field samples. The data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon (18%) is below the laboratory and project recovery limits. All silicon results in SDG JP0411 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were outside the project acceptance criteria for five analytes (aluminum [1,197%], antimony [53%], iron [1,385%], manganese [186%], silicon [23%]). For aluminum, iron and manganese the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the MS. All antimony and silicon results for SDG JP0411 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory duplicate RPD for beryllium was outside the project QC limit of 30%, at 35%. All beryllium data in SDG JP0411 may be considered estimated. Estimated data are usable for decision-making purposes.

SDG JP0412

This SDG comprises 13 statistical verification samples (J1R142 through J1R155) collected from the staging pile area. All samples were analyzed for ICP metals, mercury, hexavalent chromium, PAH, PCBs, pH, nitrate/nitrite, and IC anions. This SDG also includes one field duplicate pair (J1R149/J1R154). Minor deficiencies are as follows:

In the hexavalent chromium analysis, MS recovery was below the project acceptance criteria at 55%. A post-digestive MS was performed and recovered at 90% and the insoluble MS recovery was at 99%. Acceptable LCS recovery confirms the analytical system was operating within acceptable parameters. Hexavalent chromium is a reactive species. It is possible that the sample matrix was slightly reductive and reacted with the spiked hexavalent chromium. All hexavalent chromium results in SDG JP0412 may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, an initial calibration error affected the results for acenaphthene. Acenaphthene was switched with 1-methylnaphthalene on one channel of the HPLC instrument, resulting in acenaphthene data being incorrectly reported as below the detection limit. This error was identified during an internal QC review. All data were reprocessed, and the data package was revised to show the correct results. The samples affected included J1R149 and J1R154. Because these samples result were corrected, the data are appropriate and usable for decision-making purposes.

In the PAH analysis, matrix interference and high concentrations of target analytes required that some of the sample extract had to be diluted prior to analysis. All sample results resulting from diluted extracts were flagged "D" by the laboratory. Some surrogate recoveries were flagged "D" by the laboratory, as they are considered unreliable. Acceptable LCS, MS, and MSD recoveries confirm the analytical system was operating within acceptable parameters. All PAH data in sample J1R154 may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, to reduce matrix interferences, the laboratory performed a sulfuric acid cleanup on sample J1R149. Surrogate (tetrachloro-m-xylene [247 %]) recovery was above the QC limits for sample J1R149. The laboratory noted that matrix interference was present in the sample chromatogram and the extract was dark amber in color. However, the PCBs were undetected in this sample. All PCB results for sample J1R149 may be considered estimated. Estimated data are usable for decision-making purposes.

In the nitrate/nitrite analysis, due to high constituent concentration, the nitrate/nitrite result for sample J1R146 was reported from a dilution; therefore, the associated result was flagged "D" by the laboratory. The nitrate/nitrite result for sample J1R146 may be considered estimated. Estimated data are usable for decision-making purposes.

In the IC anions analysis, due to the high constituent concentration, the nitrate result for sample J1R146 was reported from a dilution; therefore, the associated result was flagged "D" by the laboratory. The nitrate result for sample J1R146 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon is below the laboratory and project recovery limits, at 14%. All silicon results in SDG JP0412 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were outside the project acceptance criteria for five analytes (aluminum [1,310%], antimony [49%], iron [1,927%], manganese [139%], silicon [24%]). For aluminum, iron, and manganese the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the MS. All antimony and silicon results for SDG JP0412 may be considered estimated. Estimated data are usable for decision-making purposes.

SDG JP0446

This SDG comprises one verification sample (J1RD54) collected from the staging pile area location SPA-8, following additional remediation. This sample was analyzed for PAH.

No minor deficiencies were found in SDG JP0446.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field QA/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2012a), are shown in Table E-1. The main and QA/QC sample results are presented in Appendix D.

Table E-1. Field Quality Assurance/Quality Control Samples.

Sample Area	Main Sample	Duplicate Sample
Excavation - pipeline	J1R118	J1R128
Excavation - clearwell	J1R1L4	J1R1M1
Overburden stockpile	J1R137	J1R141
Staging pile area	J1R149	J1R154

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each COPC. Relative percent difference are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the target detection limit (TDL). Relative percent differences of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The calculation brief in Appendix D provides details on duplicate pair evaluation and RPD calculation.

The calculated acenaphthene (69.8%), benzo(a)anthracene (53.3%), benzo(a)pyrene (47.2%), benzo(b)fluoranthene (44.5%), benzo(ghi)perylene (40.0%), benzo(k)fluoranthene (46.6%), chrysene (46.2%), dibenz(a,h)anthracene (51.4%), fluoranthene (66.7%), fluorene (87.6%), indeno(1,2,3-cd) pyrene (35.1%), phenanthrene (78.8%), and pyrene (58.1%) RPDs for the pipeline excavation duplicate analysis are above the acceptance criteria of 30%. The calculated TPH-diesel (116.5%), TPH-diesel range extended (115.3%), acenaphthene (107.7%), anthracene (105.6%), benzo(a)anthracene (95.7%), benzo(a)pyrene (93.3%), benso(b)fluoranthene 100.6%), benzo(ghi)perylene (104.9%), benzo(k)fluoranthene (90.9%), chrysene (97.4%), dibenz(a,h)anthracene (101.6%), fluoranthene (100.0%), fluorene (107.7%), indeno(1,2,3-cd)pyrene (104.9%), phenanthrene (106.5%), and pyrene (97.8%) RPDs for the clearwell excavation duplicate analysis are above the acceptance criteria of 30%. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. There is no indication that the analytical system was operating out of control. The data are usable 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 five times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix D) to indicate that a visual check of the data is required by the reviewer. Acenaphthene from the pipeline excavation required this check. Phenanthrene and pyrene from the clearwell excavation required this check. In addition, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene from the overburden stockpile 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 usable for decision-making purposes.

The elevated PAH results were from minute asphaltic particulates that fell from the pipelines during remediation activities. Due to the high concentrations of target analytes, samples were diluted at the lab. The concentrations received from the lab were adjusted based on this dilution in order to achieve accurate results. High concentrations due to these particulates are not systemic throughout 100-D-50:6 waste subsite.

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 100-D-50:6 subsite 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 100-D-50:6 subsite concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes.

The verification sample analytical data are stored in the ENRE project-specific database prior to being submitted for inclusion in the HEIS database. The verification sample analytical data are also summarized in Appendix D.

REFERENCES

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

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

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

EPA, 2006, *Guidance on Systematic Planning using the Data Quality Objectives Process*, EPA QA/G-4, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2005a, *Remaining Sites Field Sampling*, Logbook EL-1578-7, Washington Closure Hanford, Richland, Washington.

WCH, 2005b, *Remaining Sites Field Sampling*, Logbook EL-1578-9, Washington Closure Hanford, Richland, Washington.

WCH, 2005c, *Work Instruction for 100-D-50:6, 183-DR Clearwell Drain Pipelines*, 0100D-WI-G0014, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2006a, *100D-Remaining Sites*, Logbook EL-1601, Washington Closure Hanford, Richland, Washington.

WCH, 2006b, *Final Validation Package for SDG K0107*, Washington Closure Hanford, Richland, Washington.

WCH, 2006c, *Final Validation Package for SDG K0571*, Washington Closure Hanford, Richland, Washington.

WCH, 2006d, *Work Instruction for Confirmatory Sampling of the 100-D-50:2 Reactor Cooling Water Pipelines*, 0100D-WI-G0023, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2012a, *100-D Field Remediation and Sampling*, Logbook EL-1607-14, pp. 69-85, Washington Closure Hanford, Richland, Washington.

WCH, 2012b, *Work Instruction for Confirmatory Sampling of the 100-D-50:6, 183-DR Clearwell Drain Pipelines Waste Site,* Work Instruction No. 0100D-WI-G0109, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2013, *100-D Field Remediation and Sampling*, Logbook EL-1607-15, pp. 79-81, 84-87, Washington Closure Hanford, Richland, Washington.

WCH-EE-01, *Environmental Investigations Procedures*, Washington Closure Hanford, Richland, Washington.