1216393

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

12-AMRP-0145

AUG 23 2012

Ms. J. A. Hedges, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Ms. Hedges:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM NO. 2012-026 AND SUPPORTING DOCUMENTATION FOR THE 100-D-50:4 GAS RECIRCULATION PIPELINES, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2012-026, and supporting "Remaining Sites Verification Package for the 100-D-50:4 Gas Recirculation Pipelines," Rev.0. If you have questions, please contact me or your staff may contact Tom Post, of my staff, at (509) 376-3232.

Sincerely,

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

AMRP:TCP

Attachment

cc w/attach:
N. M. Menard, Ecology
Administrative Record, H6-08

cc w/o attach:
R. D. Cantwell, WCH
S. L. Feaster, WCH
D. L. Plung, WCH
M. L. Proctor, WCH
J. P. Shearer, CHPRC

100 DR·1

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2012-026

Waste Site Code(s)/Subsite Code(s): 100-D-50:4

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-50:4 Gas Recirculation Pipelines were part of the 100-D-50 site, which has been divided into 10 separate subsites for purposes of environmental evaluation and response. The 100-D-50:4 subsite was composed of two 0.41-m (16-in.) steel pipelines with a combined length of approximately 270 m (900 ft). The 100-D-50:4 pipelines were formerly used for the recirculation of helium and carbon dioxide cover gases between the 105-DR Reactor and the filters and driers in the 115-D/DR facility. These pipelines were buried in situ in the collapsed subsurface tunnel between the former 115-D/DR Gas Recirculation Facility and the 105-DR Reactor when the 115-D/DR facility and adjoining tunnels were decommissioned in 1985 and 1986. Remediation of the 100-D-50:4 subsite was performed between May 5 and July 12, 2011. Excavation continued until all debris and contamination associated with the 100-D-50:4 subsite had been removed. Verification sampling was conducted at the 100-D-50:4 subsite on January 5 and March 15, 2012, per 0100D-WI-G0108, *Work Instruction for Verification Sampling of the 100-D-50:4 Gas Recirculation Pipelines*. Remediation, verification sampling, and comparison of residual contaminant concentrations against cleanup levels have been performed in accordance with remedial action objectives and goals established by the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. The selected remedy involved (1) excavating the subsite to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the subsite for reclassification as Interim Closed Out.

Basis for reclassification:

Cleanup verification sampling results were evaluated in comparison to the remedial action goals (RAGs). In accordance with this evaluation, the verification sampling results support a reclassification of this subsite to Interim Closed Out. The current site conditions achieve the remedial action objectives and the corresponding RAGs established in the Remaining Sites ROD. The evaluation (which may include fate-and-transport modeling) of all verification sample data collected from the waste site resulted in a determination 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 basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-D-50:4 Gas Recirculation Pipelines Waste Site* (attached). Site contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2012-026

Waste Site Code(s)/Subsite Code(s): 100-D-50:4

Project Manager comments:

Approval of this WSRF documents regulator agreement that the 100-D-50:4 subsite qualifies for "Interim Closed Out" under this Interim Action ROD. In addition, Ecology has evaluated the data for this subsite against WAC 173-340 (2007) clean-up levels for direct contact, groundwater protection, and river protection. This evaluation is documented in the letter transmitting Ecology's approval of the subsite's interim reclassification to "Interim Closed Out."

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:

J. P. Neath	[signature]	7/31/12
DOE Federal Project Director (printed)	Signature	Date
N. Menard	Nina M. Menard	8/2/12
Ecology Project Manager (printed)	Signature	Date
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-50:4 GAS RECIRCULATION PIPELINES

Attachment to Waste Site Reclassification Form 2012-026

August 2012

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-50:4 GAS RECIRCULATION PIPELINES

EXECUTIVE SUMMARY

The 100-D-50:4 Gas Recirculation Pipelines were part of the 100-D-50 site, which has been divided into 10 separate subsites for purposes of environmental evaluation and response. The 100-D-50:4 subsite was composed of two 0.41-m (16-in.) steel pipelines with a combined length of approximately 270 m (900 ft). The 100-D-50:4 pipelines were formerly used for the recirculation of helium and carbon dioxide cover gases between the 105-DR Reactor and the filters and driers in the 115-D/DR facility. These pipelines were buried in situ in the collapsed subsurface tunnel between the former 115-D/DR Gas Recirculation Facility and the 105-DR Reactor when the 115-D/DR facility and adjoining tunnels were decommissioned in 1985 and 1986 (UNC 1987).

Remediation of the 100-D-50:4 gas recirculation pipelines and tunnels was performed from May 5, 2011, through July 12, 2011. The excavation extended to a depth of 3.5 m (11.5 ft) below ground surface. Approximately 370 m^3 (13,000 ft^3) of contaminated soil, concrete, and piping was excavated and loaded for disposal at the Environmental Restoration Disposal Facility (ERDF). No anomalous materials were encountered during the excavation. Waste material was stockpiled in a staging pile area east of the excavation prior to disposal at ERDF. No overburden material was associated with the subsite.

Verification sampling was conducted at the 100-D-50:4 subsite on January 5, 2012, and March 15, 2012, per the *Work Instruction for Verification Sampling of the 100-D-50:4 Gas Recirculation Pipelines* (WCH 2011). The results indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs). A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 100-D-50:4 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 subsite 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 *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Site contamination did not extend into the deep zone soils (i.e., below 4.6 m [15 ft]); therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Table ES-1. Summary of Remedial Action Goals for the 100-D-50:4 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15 mrem/yr above background for 1,000 years.	All individual radionuclide COC/COPC concentrations are below direct exposure RAGs.	Yes
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All 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 (7.0×10^{-3}) is <1.	
	Attain an excess cancer risk of <1×10^{-6} for individual carcinogens.	The excess cancer risk for carcinogens is <1×10^{-6}.	
	Attain a cumulative excess cancer risk of <1×10^{-5} for carcinogens.	The total excess cancer risk (1.2×10^{-6}) is <1×10^{-5}.	
Groundwater/River Protection – Radionuclides	Attain single-COPC groundwater and river protection RAGs.	Radionuclides were not quantified above groundwater/river protection soil lookup values.	Yes
	Attain national primary drinking water standards [a]: 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.	Radionuclides were not quantified above groundwater/river protection soil lookup values.	
	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 [b].	No nonuranium alpha-emitting radionuclides were detected.	
	Meet total uranium standard of 30 µg/L (21.2 pCi/L) [c].	Uranium is not a COPC/COC for this site.	
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Residual concentrations of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene within the site excavation and/or staging pile area are above the soil RAGs for groundwater and/or river protection. However, RESRAD modeling predicts these constituents will not reach groundwater (and, therefore, the Columbia River) within 1,000 years [d].	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and the Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).
[d] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not expected to migrate more than 2 m (6 ft) vertically in 1,000 years (based on the constituent with the lowest distribution coefficient of 30 mL/g for lead). The vadose zone underlying the soil below the excavation and staging pile area is a minimum of 20.5 m (67 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

COC = contaminant of concern
COPC = contaminant of potential concern
MCL = maximum contaminant level
RAG = remedial action goal
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the ROD, a comparison against ecological risk screening levels has been made for the site contaminants of potential concern and other constituents. Those constituents exceeding the ecological screening level in the 2007 *Washington Administrative Code* (WAC) Chapter 173-340, Table 749-3 were boron, vanadium, and dibenzofuran. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, lead, manganese, vanadium, and zinc. Exceeding screening values does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, vanadium, and zinc are below background levels, 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 ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site. A table showing contaminant concentrations from the 100-D-50:4 subsite that exceed ecological screening levels is provided in Appendix A.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-50:4 GAS RECIRCULATION PIPELINES

STATEMENT OF PROTECTIVENESS

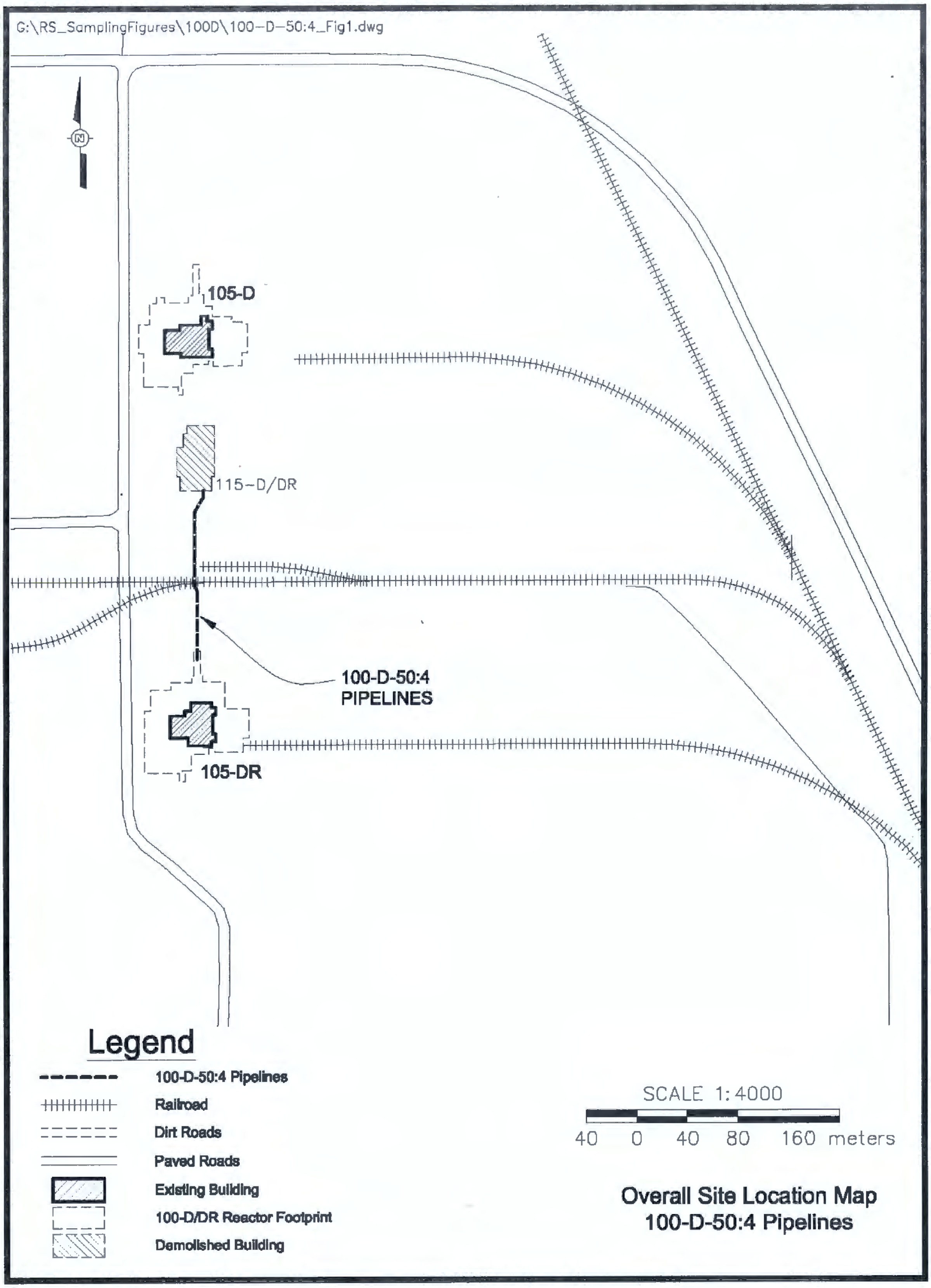
The 100-D-50:4 Gas Recirculation Pipelines verification sampling data, site evaluations, and supporting documentation demonstrate that this site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]), and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Site contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the ROD, a comparison against ecological risk screening levels has been made for the site contaminants of potential concern (COPCs) and other constituents. Those constituents exceeding the ecological screening level in the 2007 *Washington Administrative Code* (WAC) Chapter 173-340, Table 749-3 were boron, vanadium, and dibenzofuran. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, lead, manganese, vanadium, and zinc. Exceeding screening values does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, vanadium, and zinc are below background levels, 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 ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site. A table showing contaminant concentrations from the 100-D-50:4 subsite that exceed ecological screening levels is provided in Appendix A.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-D-50:4 subsite is part of the 100-DR-1 Operable Unit. The 100-D-50:4 subsite is south of the former 115-D/DR facility, between the 105-D and 105-DR Reactors (Figure 1).

Figure 1. Location of the 100-D-50:4 Waste Site.



The 100-D-50:4 Gas Recirculation Pipelines were part of the 100-D-50 site, which has been divided into 10 separate subsites for purposes of environmental evaluation and response. The 100-D-50:4 subsite was composed of two 0.41-m (16-in.) steel pipelines with a combined length of approximately 270 m (900 ft). The pipelines were formerly used for the recirculation of helium and carbon dioxide cover gases between the 105-DR Reactor and the filters and driers in the 115-D/DR facility. The original 115-D facility, constructed in 1943, was modified between 1947 and 1948 to provide service for the 105-DR Reactor. Operational use of the 105-DR Reactor equipment and 100-D-50:4 pipelines began in 1950 and ceased in 1964. The 115-D/DR facility was decommissioned in 1985 and 1986. The 100-D-50:4 pipelines were buried in situ (with a portion of the demolition rubble from the 115-D/DR facility) when the pipeline tunnel roofs were collapsed into the tunnels (WHC 1993).

REMEDIATION ACTION SUMMARY

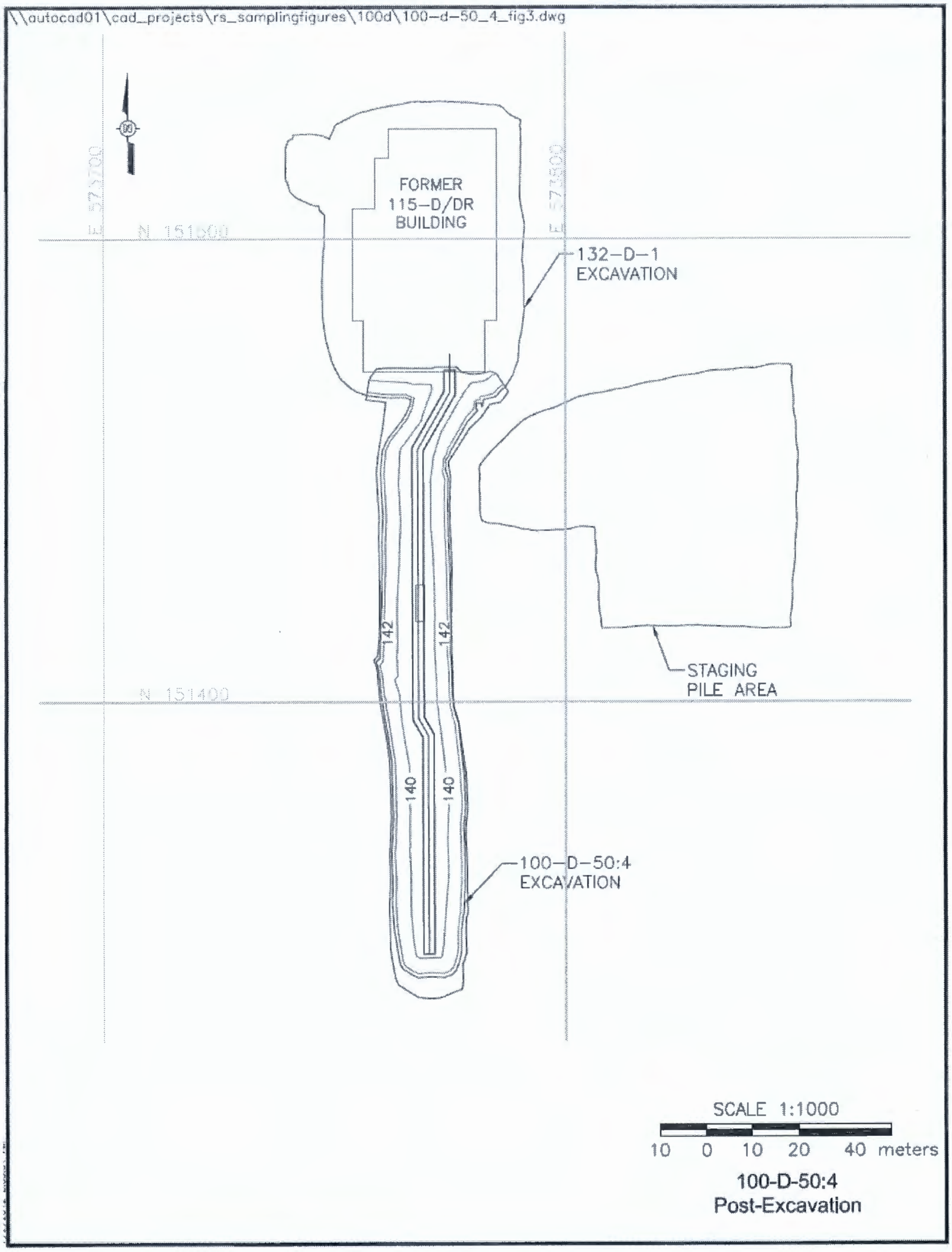
Remediation of the 100-D-50:4 gas recirculation pipelines and tunnels was performed from May 5, 2011, through July 12, 2011. The excavation extended to a depth of 3.5 m (11.5 ft) below ground surface. Approximately 370 m^3 (13,000 ft^3) of contaminated soil, concrete, and piping was excavated and loaded for disposal at the Environmental Restoration Disposal Facility (ERDF). No anomalous materials were encountered during the excavation. Waste material was stockpiled in a staging pile area east of the excavation prior to disposal at ERDF. No overburden material was associated with the subsite. The post-excavation civil survey of the subsite is provided in Figure 2.

VERIFICATION SAMPLING ACTIVITIES

This section describes the basis for selection of a verification sampling design for the 100-D-50:4 subsite. Statistical sampling was the method chosen for selecting the sampling locations. The area identified for the purpose of statistical verification sampling for the 100-D-50:4 subsite consists of two decision units, the excavated area and the staging pile area.

Verification sampling was conducted at the 100-D-50:4 subsite on January 5, 2012, and March 15, 2012, to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). Separate statistical sampling designs were used to collect verification soil samples from the 100-D-50:4 excavated area and the staging pile area. 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 subsite.

Figure 2. Post-Excavation Civil Survey for the 100-D-50:4 Subsite.



Contaminants of Concern for Verification Sampling

The COPCs for the 100-D-50 site were identified in the *100 Area Remedial Action Sampling and analysis Plan* (DOE-RL 2009a) based on existing historical information for the site. This COPC list included cobalt-60, cesium-137, europium-152, europium-154, strontium-90, lead, hexavalent chromium, and metals. In this context, "metals" is taken to mean the *Resource Conservation and Recovery Act of 1976*-listed metals: arsenic, barium, cadmium, total chromium, lead, mercury, selenium, and silver.

Based on analytical results from analogous pipelines at the 105-H Reactor, polychlorinated biphenyls, semivolatile organic compounds, total petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAH), carbon-14, americium-241, plutonium-239/240 have also been included as COPCs. Based on analytical results from sampling of the 115-D/DR facility at the time of demolition, tritium and europium-155 have also been included as COPCs.

Although not considered COPCs, analysis for the expanded list of inductively coupled plasma metals (antimony, beryllium, boron, cobalt, copper, manganese, molybdenum, nickel, vanadium, and zinc) will also be included for remedial verification samples.

Verification Sampling Design

The statistical sampling design for the 100-D-50:4 subsite was developed using Visual Sample Plan[1] (VSP). The areas identified for the purpose of statistical verification sampling for the 100-D-50:4 subsite 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 soil samples were collected on the grid within each of the two decision units at the 100-D-50:4 subsite. A triangular grid is used based on studies that indicate triangular grids are superior to square grids (Gilbert 1987). Additional details concerning the use of VSP to develop the statistical sampling designs and derive the number of verification samples to collect are discussed in *Work Instruction for Verification Sampling of the 100-D-50:4 Gas Recirculation Pipelines* (WCH 2011). The 100-D-50:4 subsite sample locations are shown in Figure 3.

A summary of the verification samples collected and laboratory analyses performed is provided in Table 1. Additional information related to verification sampling can be found in the field sampling logbooks (WCH 2012a, 2012b).

Verification Sampling Results

All verification samples were analyzed using analytical methods approved by EPA (DOE-RL 2009b). Evaluation of the verification data from the 100-D-50:4 subsite was performed by direct comparison of the statistical or maximum sample results for each COPC against cleanup criteria.

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

Figure 3. The 100-D-50:4 Subsite Verification Sample Locations.

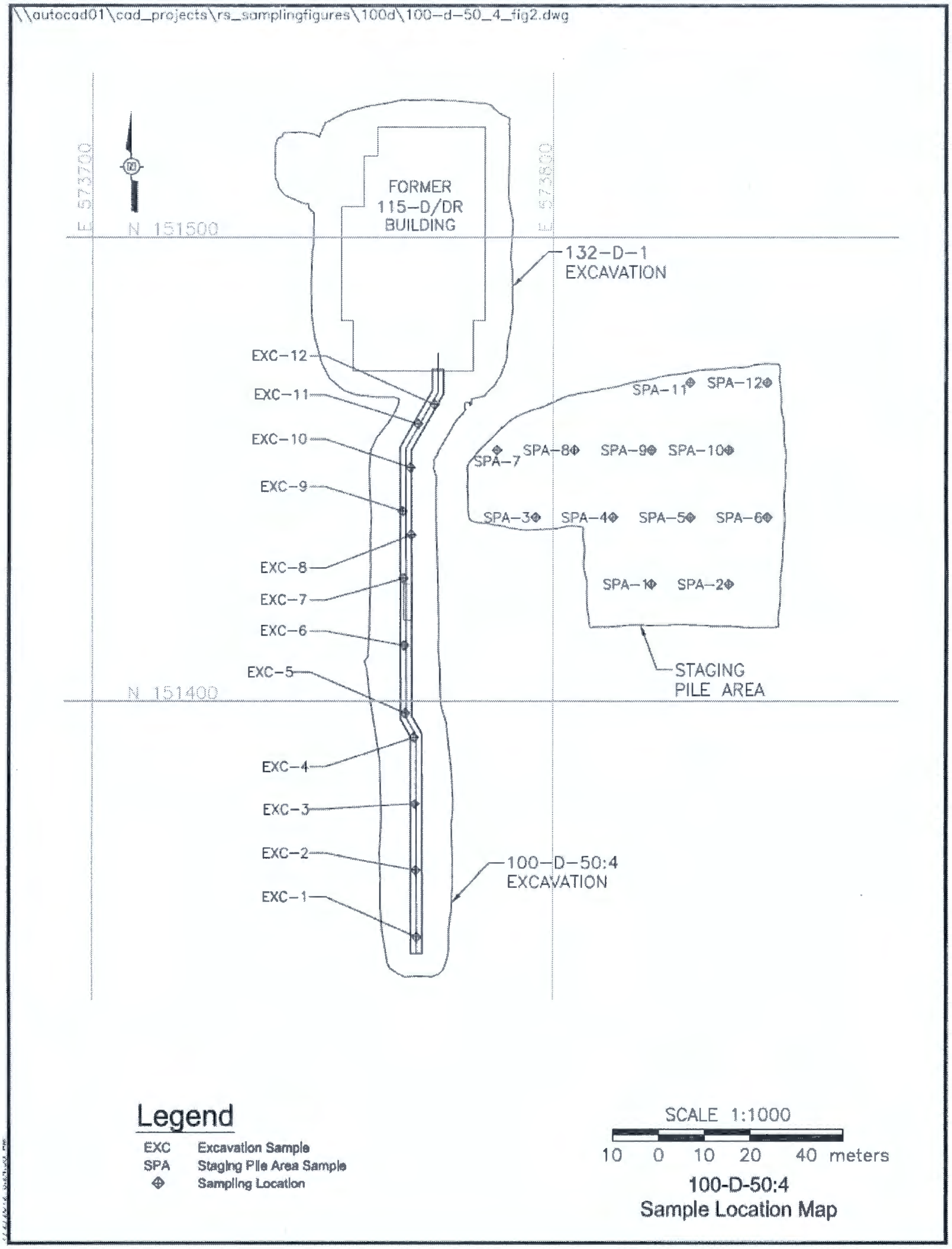

Table 1. 100-D-50:4 Gas Recirculation Pipelines Sample Summary.

Sample Location	HEIS Sample Number	WSP Coordinates		Sample Analysis
		Northing	Easting	
EXC-1	J1N1R7	151348.5	573770.4	ICP metals [a], mercury, hexavalent chromium, PCB, SVOA[b], PAH[b], TPH, isotopic plutonium, carbon-14, strontium-90, tritium, and GEA
EXC-2	J1N1R8	151363.1	573770.2	
EXC-3	J1N1R9	151377.6	573770.0	
EXC-4	J1N1T0	151392.2	573769.9	
EXC-5	J1N1T1	151397.4	573768.0	
EXC-6	J1N1T2	151411.9	573767.8	
EXC-7	J1N1T3	151426.5	573767.6	
EXC-8	J1N1T4	151435.9	573769.3	
EXC-9	J1N1T5	151441.0	573767.4	
EXC-10	J1N1T6	151450.4	573769.1	
EXC-11	J1N1T7	151459.8	573770.7	
EXC-12	J1N1T8	151464.0	573774.3	
EXC-11 Duplicate	J1N1T9	151459.8	573770.7	
SPA-1	J1N1V2	151425.2	573821.3	
SPA-2	J1N1V3	151425.2	573838.1	
SPA-3	J1N1V4	151439.7	573796.2	
SPA-4	J1N1V5	151439.7	573813.0	
SPA-5	J1N1V6	151439.7	573829.7	
SPA-6	J1N1V7	151439.7	573846.5	
SPA-7	J1N1V8	151454.2	573787.9	
SPA-8	J1N1V9	151454.2	573804.6	
SPA-9	J1N1W0	151454.2	573821.3	
SPA-10	J1N1W1	151454.2	573838.1	
SPA-11	J1N1W2	151468.7	573829.7	
SPA-12	J1N1W3	151468.7	573846.5	
SPA-7 Duplicate	J1N1W4	151454.2	573787.9	
Equipment blank	J1N1V0	NA	NA	ICP metals [a], mercury, SVOA

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

[b] Because method 8310 is specifically meant to analyze for PAH, data from this method was used preferentially over method 8270 data for site evaluation of the PAH analytes.

GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbons
WSP = Washington State Plane

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-50:4 decision units as specified by the

RDR/RAWP (DOE-RL 2009b). The calculations are provided in Appendix B. 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 remedial action goals (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-50:4 decision units are listed in Tables 2 and 3. 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 Environmental Restoration (ENRE) project-specific database prior to submitting to the Hanford Environmental Information System (HEIS) for archiving and are provided in Appendix B.

Table 2. Comparison of Contaminant Concentrations to Action Levels for the 100-D-50:4 Excavation Statistical Verification Samples. (2 Pages)

COPC or Other Analyte	Statistical or Maximum Result [b] (pCi/g)	Soil Lookup Values (pCi/g) [a]			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Soil Lookup Value for Groundwater Protection	Soil Lookup Value for River Protection		
Carbon-14	0.237	8.69	-- [c]	-- [c]	No	--
Cesium-137	0.258	6.2	1,465	2,930	No	--
Tritium	0.150	459	12.6	25.2	No	--
COPC	**Statistical or Maximum Result [b] (mg/kg)**	**Remedial Action Goals (mg/kg) [a]**			**Does the Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Antimony	1.1 (<BG)	32	5 [d]	5 [d]	No	--
Arsenic	4.8 (<BG)	20 [d]	20 [d]	20 [d]	No	--
Barium	68.9 (<BG)	5,600	200	400	No	--
Beryllium	0.92 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Boron [f]	0.96	7,200	320	-- [g]	No	--
Cadmium	0.062 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium	10.3 (<BG)	80,000	18.5 [d]	18.5 [d]	No	--
Cobalt	9.0 (<BG)	24	15.7 [d]	-- [g]	No	--
Copper	17.2 (<BG)	2,960	59.2	22.0 [d]	No	--
Hexavalent chromium [f]	0.391	2.1	4.8	2	No	--
Lead	8.2 (<BG)	353	10.2 [d]	10.2 [d]	No	--
Manganese	317 (<BG)	3,760	512 [d]	512 [d]	No	--
Mercury	0.019 (<BG)	24	0.33 [d]	0.33 [d]	No	--
Molybdenum [f]	0.72	400	8	-- [g]	No	--
Nickel	10.1 (<BG)	1,600	19.1 [d]	27.4	No	--
Vanadium	66.0 (<BG)	560	85.1 [d]	-- [g]	No	--

Table 2. Comparison of Contaminant Concentrations to Action Levels for the 100-D-50:4 Excavation Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Zinc	65.3 (<BG)	24,000	480	67.8 [d]	No	--
Benzo(a)pyrene	0.0072	0.137	0.015 [h]	0.015 [h]	No	--
Benzo(b)fluoranthene	0.020	1.37	0.015 [h]	0.015 [h]	Yes	Yes [i]
Benzo(k)fluoranthene	0.0067	1.37	0.015 [h]	0.015 [h]	No	--
Chrysene	0.023	13.7	0.12	0.1 [h]	No	--
Fluoranthene	0.099	3,200	64	18	No	--
Phenanthrene [j]	0.140	24,000	240	1,920	No	--
Pyrene	0.065	2,400	48	192	No	--
Aroclor-1260	0.012	0.5	0.017 [h]	0.017 [h]	No	--
TPH – diesel range	12.2	200 [k]	200 [k]	200 [k]	No	--
TPH – diesel range-EXT	17.4	200 [k]	200 [k]	200 [k]	No	--

[a] Lookup values and RAGs obtained from the RDR/RAWP (DOE-RL 2009b).

[b] Maximum or 95% UCL, depending on data censorship, as described in the *100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations* (Appendix B).

[c] No value; because the distribution coefficient (K_d) for this contaminant is greater than 80 mL/g, RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) predicts that the contamination will show no migration within the 100 Area vadose zone, and no impact on groundwater or the Columbia River.

[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 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).

[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3]) 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 (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).

[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid turnaround analyses. Prior notification and concurrence with the laboratory may be necessary to analyze to meet this RDL. Actual detection limits may differ from any RDL.

[i] Based on the RESRAD modeling discussed in Appendix B of the RDR/RAWP (DOE-RL 2009b), residual concentrations of benzo(b)fluoranthene are not expected to migrate vertically in 1,000 years (based on the K_d of 803 mL/g). Therefore, residual concentrations of benzo(b)fluoranthene are predicted to be protective of groundwater and the Columbia River.

[j] Toxicity data for this chemical are not available. Cleanup levels are based on the following surrogate chemicals: Contaminant: phenanthrene, surrogate: anthracene.

[k] The soil cleanup value for TPH is from WAC 173-340-740(2), Table 2, "Method A Cleanup Levels – Soil" (Ecology 1996), for diesel and other.

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

Table 3. Comparison of Contaminant Concentrations to Action Levels for the 100-D-50:4 Staging Pile Area Statistical Verification Samples. (2 Pages)

COPC or Other Analyte	Statistical or Maximum Result [b] (pCi/g)	Soil Lookup Values (pCi/g) [a]			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Soil Lookup Value for Groundwater Protection	Soil Lookup Value for River Protection		
Cesium-137	0.111 (<BG)	6.2	1,465	2,930	No	--
Tritium	0.0291	459	12.6	25.2	No	--
COPC	**Statistical or Maximum Result [b] (mg/kg)**	**Remedial Action Goals (mg/kg) [a]**			**Does the Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Antimony	0.52 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	3.4 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	79.7 (<BG)	5,600	200	400	No	--
Beryllium	0.60 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	2.1	7,200	320	-- [f]	No	--
Cadmium	0.15 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium	10.2 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	7.5 (<BG)	24	15.7 [c]	-- [f]	No	--
Copper	17.5 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	1.11	2.1	4.8	2	No	--
Lead	22.4	353	10.2 [c]	10.2 [c]	Yes	Yes [g]
Manganese	317 (<BG)	3,760	512 [c]	512 [c]	No	--
Mercury	0.024 (<BG)	24	0.33 [c]	0.33 [c]	No	--
Molybdenum [e]	0.33	400	8	-- [f]	No	--
Nickel	12.6 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	54.4 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	59.0 (<BG)	24,000	480	67.8 [c]	No	--
Aroclor-1260	0.0089	0.5	0.017 [h]	0.017 [h]	No	--
Acenaphthene	0.017	4,800	96	129	No	--
Anthracene	0.0072	24,000	240	1,920	No	--
Benzo(a)anthracene	0.063	1.37	0.015 [h]	0.015 [h]	Yes	Yes [g]
Benzo(a)pyrene	0.063	0.137	0.015 [h]	0.015 [h]	Yes	Yes [g]
Benzo(b)fluoranthene	0.077	1.37	0.015 [h]	0.015 [h]	Yes	Yes [g]
Benzo(ghi)perylene [i]	0.032	2,400	48	192	No	--
Benzo(k)fluoranthene	0.030	1.37	0.015 [h]	0.015 [h]	Yes	Yes [g]
Bis(2-ethylhexyl)phthalate	0.105	71.4	0.6	0.36	No	--
Chrysene	0.058	13.7	0.12	0.1 [h]	No	--
Dibenzofuran	0.020	160	3.2	-- [f]	No	--
Fluoranthene	0.082	3,200	64	18	No	--
Fluorene	0.014	3,200	64	260	No	--
Indeno(1,2,3-cd)pyrene	0.046	1.37	0.33 [h]	0.33 [h]	No	--
Phenanthrene [i]	0.078	24,000	240	1,920	No	--
Pyrene	0.097	2,400	48	192	No	--
TPH - diesel range	35.3	200 [j]	200 [j]	200 [j]	No	--

Table 3. Comparison of Contaminant Concentrations to Action Levels for the 100-D-50:4 Staging Pile Area Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
TPH-diesel range- EXT	119	200[j]	200[j]	200[j]	No	--

[a] Lookup values and RAGs obtained from the RDR/RAWP (DOE-RL 2009b).
[b] Maximum or 95% UCL, depending on data censorship, as described in the *100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations* (Appendix B).
[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 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (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]).
[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 (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).
[g] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not expected to migrate more than 2 m (6 ft) vertically in 1,000 years (based on the constituent with the lowest distribution coefficient of 30 mL/g for lead). With approximately 25 m (82 ft) of vadose zone below the staging pile area, residual concentrations of COPCs are predicted to be protective of groundwater and the Columbia River.
[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on approved analytical methods that may not be available for rapid turnaround analysis. Prior notification and concurrence with the laboratory may be necessary to analyze to meet this RDL. Actual detection limits may differ from any RDL.
[i] Toxicity data for this chemical are not available. Cleanup levels are based on the following surrogate chemicals:
Contaminant: benzo(ghi)perylene, surrogate: pyrene.
Contaminant: phenanthrene, surrogate: anthracene.
[j] The soil cleanup value for TPH is from WAC 173-340-740(2), Table 2, "Method A Cleanup Levels – Soil" (Ecology 1996), for diesel and other.

-- = 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)
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = *Washington Administrative Code*

DATA EVALUATION

This section demonstrates that remedial actions at the 100-D-50:4 subsite have achieved 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 RDR/RAWP (DOE-RL 2009b).

Attainment of Radionuclide RAGS

Evaluation of RAG attainment for radionuclides was performed using the single radionuclide dose-equivalence lookup values. Because the analytical results for the three detected radionuclides were less than one-tenth of the single radionuclide dose-equivalence lookup values, a site-specific cleanup verification model was not developed. The model used to develop these dose-equivalence lookup values is presented in Appendix B of the RDR/RAWP (DOE-RL 2009b).

Attainment of Nonradionuclide RAGS

All COPCs for all sampling areas were quantified below their respective soil RAGs or lookup values with the exception of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene in comparison against the soil RAGs for groundwater and/or river protection in the near-surface side excavation decision unit. However, given the lowest soil-partitioning coefficient for these constituents (30 mL/g for lead), none would be expected to migrate more than 2 m (6 ft) vertically in 1,000 years based on RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b). Therefore, residual concentrations of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are predicted to be protective of groundwater (and thus the Columbia River).

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-50:4 subsite is included in the statistical calculations, where half or more of the data set was detected (Appendix B). The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs, with the exception of lead. One statistical sample from the excavation had a lead concentration that exceeded two times the cleanup criteria for protection of groundwater and the Columbia River. In the staging pile area, the statistical samples for lead failed all three of the three-part test criteria for protection of groundwater and the Columbia River. However, the residual concentrations of lead are not expected to migrate more than 2 m (6 ft) vertically in 1,000 years (based on the distribution coefficient [K_d] of 30 mL/g for lead). With approximately 20.5 m (67 ft) of vadose zone below the excavation and 25 m (82 ft) of vadose zone below the staging pile area, 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 which 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(b)fluoranthene in the excavation and benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and benzo(k)fluoranthene in the staging pile area, in comparison against the soil RAGs for groundwater and/or river protection. However, the residual concentrations of constituents will not migrate vertically in 1,000 years based on the lowest soil-partitioning coefficient of 360 mL/g for benzo(a)anthracene. 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 an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1 x 10^{-6}, and a cumulative carcinogenic risk of less than 1 x 10^{-5}. For the 100-D-50:4 subsite, these risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background. All individual hazard quotients for noncarcinogenic constituents were less than 1.0. The cumulative hazard quotient for those noncarcinogenic constituents above background or detected levels is 7.0 x 10^{-3}. The individual carcinogenic risk values for the carcinogenic constituents detected above background are less than 1 x 10^{-6}, and the cumulative carcinogenic risk value was 1.2 x 10^{-6}, which is less than 1 x 10^{-5}. The 100-D-50:4 subsite meets the requirements for the direct contact hazard quotient and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2009b).

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 100-D-50:4 subsite included calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides. The requirements include an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than 1 x 10^{-6}, and a cumulative excess carcinogenic risk of less than 1 x 10^{-5}. These risk values were conservatively calculated for the entire subsite using the highest value for each COPC from each of the decision units. Risk values were calculated for constituents that were detected at concentrations above Hanford Site or Washington State background values or for which there is no background value. In addition, the K_ds for these contaminants are less than that necessary to show no migration to groundwater in 1,000 years based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b). Based on this model and a vadose zone of approximately 20.5 m (67 ft) in thickness at the excavation, a K_d of 3.6 or greater is required to show no predicted migration to groundwater in 1,000 years. All individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the 100-D-50:4 subsite is 2.4 x 10^{-1}, which is less than 1.0. The 100-D-50:4 subsite does not have any carcinogenic constituents subject to groundwater cancer risk calculation; therefore, the criterion for excess cancer risk is met. Nonradionuclide risk requirements related to groundwater are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach, the field logbooks (WCH 2012a, 2012b), 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-50:4 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 B. The detailed DQA is presented in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 100-D-50:4 subsite has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2009b). Verification sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at this subsite meet the RAOs for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the verification sampling results support a reclassification of the 100-D-50:4 subsite to Interim Closed Out. Site contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

REFERENCES

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

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WCH, 2012a, *100D Field Remediation Miscellaneous Sampling Activities*, Logbook EL-1662, pp. 46-48, Washington Closure Hanford, Richland, Washington.

WCH, 2012b, *100D Field Remediation Miscellaneous Sampling Activities*, Logbook EL-1662-01, pp. 3-4, Washington Closure Hanford, Richland, Washington.

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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-50:4 Subsite [a]

Hazardous Substance		2007 WAC 173-340, Table 749-3			EPA Ecological Soil Screening Levels [b]				Waste Site Analyses
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
Metals (mg/kg):									
	Background								
Antimony	5	5				78		0.27	1.1 (<BG)
Boron [d]		0.5							2.1
Lead	10.2	50	500	118	120	1,700	11	56	22.4
Manganese	512	1,100 [e]		1,500	220	450	4,300	4,000	317 (<BG)
Vanadium	85.1	2					7.8	280	66.0 (<BG)
Zinc	67.8	86 [e]	200	360	160	120	46	79	65.3 (<BG)
Chlorinated dibenzofurans (total) [d]				2.00E-06					0.020

NOTE: Shaded cells are exceeded by the maximum or the statistical result.
Blank cells = Values not available.

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

[e] Benchmark replaced by Washington State natural background concentration from Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication 94-115, Washington State Department of Ecology, Olympia, Washington.

BG = background
EPA = U.S. Environmental Protection Agency
WAC = *Washington Administrative Code*

APPENDIX B

CALCULATIONS

APPENDIX B

CALCULATION BRIEFS

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

100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations, 0100D-CA-V0455, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-50:4 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100D-CA-V0456, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-50:4 Subsite Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation, 0100D-CA-V0457, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0455

Subject: 100-D-50:4 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 = 21 Attm. 1 = 18 Total = 40	N. K. Schiffern *N.K. Schiffern*	I. B. Berezovskiy *IB Berezovskiy*	J. D. Skoglie *[signature]*	D. F. Obenauer *D. F. Obenauer*	*8/6/12*

SUMMARY OF REVISION

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

Washington Closure Hanford CALCULATION SHEET

Originator N. K. Schiffern	Date 05/07/12	Calc. No. 0100D-CA-V0455	Rev. No. 0
Project 100-D Field Remediation	Job No. 14655	Checked I. B. Berezovskiy	Date 05/07/12
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations			Sheet No. 1 of 21

Summary

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

Table of Contents:
Sheets 1 to 4 - Calculation Sheet Summary
Sheets 5 to 13 - Calculation Sheet Verification Data - North Excavation, South Excavation, and Staging Pile Area
Sheets 14 to 18 - Ecology Software (MTCAStat) Results
Sheets 19 to 21 - Calculation Sheet - Duplicate Analysis
Attachment 1 - 100-D-50:4 Subsite, Verification Sampling Results (18 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-50:4 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-50:4 subsite underwent statistical sampling. The 100-D-50:4 subsite has two decision units for verification sampling, consisting of excavation and staging pile area.

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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. The 95% UCL values were not calculated for potassium-40, radium-226, radium-228, thorium-228, and thorium-232 based on natural occurence at the Hanford Site.

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

For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets (n<10), the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2009b) and MTCAStat coding and due to a limitation in the MTCAStat coding (no direct capability to address variable quantitation limits within a data set), substitutions for censored data are performed before software input and the resulting data set treated as uncensored.

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

The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed in Table II-1 of the SAP (DOE-RL 2009a). 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.

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

Results Summary - Excavation [a]

Analyte	95% UCL Result	Maximum Result	Units
Carbon-14	0.237	--	pCi/g
Cesium-137	0.258	--	pCi/g
Tritium	0.150	--	pCi/g
Antimony	--	1.1	mg/kg
Arsenic	4.8	--	mg/kg
Barium	68.9	--	mg/kg
Beryllium	0.92	--	mg/kg
Boron	--	0.96	mg/kg
Cadmium	0.062	--	mg/kg
Chromium	10.3	--	mg/kg
Cobalt	9.0	--	mg/kg
Copper	17.2	--	mg/kg
Hexavalent chromium	--	0.391	mg/kg
Lead	8.2	--	mg/kg
Manganese	317	--	mg/kg
Mercury	--	0.019	mg/kg
Molybdenum	--	0.72	mg/kg
Nickel	10.1	--	mg/kg
Vanadium	66.0	--	mg/kg
Zinc	65.3	--	mg/kg
TPH - diesel	12221	--	ug/kg
TPH - diesel EXT	17352	--	ug/kg
Aroclor-1260	--	12	ug/kg
Benzo(a)pyrene - PAH	--	7.2	ug/kg
Benzo(b)fluoranthene - PAH	--	20	ug/kg
Benzo(k)fluoranthene - PAH	--	6.7	ug/kg
Chrysene - PAH	--	23	ug/kg
Fluoranthene - PAH	--	99	ug/kg
Phenenthrene - PAH	--	140	ug/kg
Pyrene - PAH	--	65	ug/kg

3-Part Test Evaluation

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

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

Results Summary - Staging Pile Area [a]

Analyte	95% UCL Result	Maximum Result	Units
Cesium-137	0.111	--	pCi/g
Tritium	0.0291	--	pCi/g
Antimony	--	0.52	mg/kg
Arsenic	3.4	--	mg/kg
Barium	79.7	--	mg/kg
Beryllium	0.60	--	mg/kg
Boron	2.1	--	mg/kg
Cadmium	0.15	--	mg/kg
Chromium	10.2	--	mg/kg
Cobalt	7.5	--	mg/kg
Copper	17.5	--	mg/kg
Hexavalent chromium	--	1.11	mg/kg
Lead	22.4	--	mg/kg
Manganese	317	--	mg/kg
Mercury	0.024	--	mg/kg
Molybdenum	--	0.33	mg/kg
Nickel	12.6	--	mg/kg
Vanadium	54.4	--	mg/kg
Zinc	59.0	--	mg/kg
TPH - diesel	35280	--	ug/kg
TPH - diesel EXT	118551	--	ug/kg
Aroclor-1260	8.9	--	ug/kg
Acenaphthene - PAH	--	17	ug/kg
Anthracene - PAH	--	7.2	ug/kg
Benzo(a)anthracene - PAH	--	63	ug/kg
Benzo(a)pyrene - PAH	--	63	ug/kg
Benzo(b)fluoranthene - PAH	--	77	ug/kg
Benzo(ghi)perylene - PAH	--	32	ug/kg
Benzo(k)fluoranthene - PAH	--	30	ug/kg
Chrysene - PAH	58	--	ug/kg
Fluoranthene - PAH	82	--	ug/kg
Fluorene - PAH	--	14	ug/kg
Indeno(1,2,3-cd)pyrene - PAH	--	46	ug/kg
Phenanthrene - PAH	--	78	ug/kg
Pyrene - PAH	97	--	ug/kg
Bis(2-ethylhexyl)phthalate - SVOA	105	--	ug/kg
Dibenzofuran - SVOA	--	20	ug/kg

3-Part Test Evaluation

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

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

-- = not applicable
B = blank contamination (inorganic constituents)
DE = direct exposure
GW = groundwater
J = estimate
M = sample duplicate precision not met
MTCA = *Model Toxics Control Act*
P = RPD between the primary and confirmation columns exceeded 25% for aroclor 1260.
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
TDL = target detection limit
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code
X (metals) = Serial dilution in the analytical batch indicates that physical and chemical interferences are present.
X (SVOAs) = MS, MSD: recovery exceeds upper or lower control limits.

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Summary (continued)

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

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

Analyte	Duplicate Analysis	
	Excavation	Staging Pile Area
Aluminum	10.3%	2.1%
Barium	3.5%	10.8%
Calcium	1.0%	44.4%
Chromium	4.5%	11.0%
Copper	1.3%	10.7%
Iron	0.5%	19.0%
Magnesium	7.6%	0.2%
Manganese	4.2%	1.6%
Silicon	10.0%	19.4%
Sodium	0.9%	8.3%
Vanadium	1.5%	7.5%
Zinc	2.7%	5.6%
TPH - diesel EXT		41.7%

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.

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Verification Data -Excavation

Sample Area	Sample Number	Sample Date	Carbon-14 pCi/g	Carbon-14 Q	Carbon-14 MDA	Cesium-137 pCi/g	Cesium-137 Q	Cesium-137 MDA	Tritium pCi/g	Tritium Q	Tritium MDA
EXC-11	J1N1T7	1/5/2012	-0.189	UJ	0.472	0.0871		0.0211	0.0214	J	0.0159
Duplicate of J1N1T7	J1N1T9	1/5/2012	0.0684	UJ	0.472	0.0408	U	0.0288	0.0197	J	0.0159
EXC-1	J1N1R7	1/5/2012	-0.0657	UJ	0.472	0.0456		0.0198	0.0156	UJ	0.0158
EXC-2	J1N1R8	1/5/2012	0.327	UJ	0.472	0.555		0.0333	0.0556	J	0.0166
EXC-3	J1N1R9	1/5/2012	0.321	UJ	0.470	0.184		0.0242	0.0565	J	0.0181
EXC-4	J1N1T0	1/5/2012	0.238	UJ	0.470	0.106		0.0381	0.0711	J	0.0159
EXC-5	J1N1T1	1/5/2012	0.687	J	0.472	0.304		0.0256	0.0622	J	0.0185
EXC-6	J1N1T2	1/5/2012	-0.106	UJ	0.470	0.121		0.0254	0.0374	J	0.0143
EXC-7	J1N1T3	1/5/2012	-0.180	UJ	0.471	0.0138	U	0.0372	0.0177	J	0.0115
EXC-8	J1N1T4	1/5/2012	0.0448	UJ	0.472	0.238		0.0370	0.156	J	0.0160
EXC-9	J1N1T5	1/5/2012	-0.0866	UJ	0.473	0.160		0.0198	0.101	J	0.0157
EXC-10	J1N1T6	1/5/2012	0.313	UJ	0.472	0.365		0.0331	0.461	J	0.0145
EXC-12	J1N1T8	1/5/2012	-0.0726	UJ	0.472	0.0270	U	0.0391	0.0399	J	0.0164

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Carbon-14 pCi/g	Cesium-137 pCi/g	Tritium pCi/g
EXC-11	J1N1T7/J1N1T9	1/5/2012	-0.0603	0.0640	0.0206
EXC-1	J1N1R7	1/5/2012	-0.0657	0.0456	0.0156
EXC-2	J1N1R8	1/5/2012	0.327	0.555	0.0556
EXC-3	J1N1R9	1/5/2012	0.321	0.184	0.0565
EXC-4	J1N1T0	1/5/2012	0.238	0.106	0.0711
EXC-5	J1N1T1	1/5/2012	0.687	0.304	0.0622
EXC-6	J1N1T2	1/5/2012	-0.106	0.121	0.0374
EXC-7	J1N1T3	1/5/2012	-0.180	0.0138	0.0177
EXC-8	J1N1T4	1/5/2012	0.0448	0.238	0.156
EXC-9	J1N1T5	1/5/2012	-0.0866	0.160	0.101
EXC-10	J1N1T6	1/5/2012	0.313	0.365	0.461
EXC-12	J1N1T8	1/5/2012	-0.0726	0.0270	0.0399

Statistical Computations

	Carbon-14	Cesium-137	Tritium
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
N	12	12	12
% < Detection limit	92%	17%	8%
Mean	0.113	0.182	0.0912
Standard deviation	0.261	0.161	0.123
Z-statistic	1.64	1.64	1.64
95% UCL on mean	0.237	0.258	0.150
Maximum value	0.687	0.555	0.461

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1 **100-D-50:4 Subsite Statistical Calculations**

2 **Verification Data - Excavation**

Row	Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Arsenic Q	Arsenic PQL	Barium mg/kg	Barium Q	Barium PQL	Beryllium mg/kg	Beryllium Q	Beryllium PQL	Cadmium mg/kg	Cadmium Q	Cadmium PQL	Chromium mg/kg	Chromium Q	Chromium PQL	Cobalt mg/kg	Cobalt Q	Cobalt PQL	Copper mg/kg	Copper Q	Copper PQL	Lead mg/kg	Lead Q	Lead PQL
5	EXC-11	J1N1T7	1/5/2012	3.6		0.66	62.4	X	0.077	0.82		0.033	0.061	B	0.041	9.0	X	0.058	8.0	X	0.10	15.1	X	0.22	4.0		0.27
6	Duplicate of J1N1T7	J1N1T9	1/5/2012	3.1		0.67	64.6	X	0.077	0.77		0.033	0.055	B	0.042	8.6	X	0.059	8.2	X	0.10	14.9	X	0.22	3.6		0.27
7	EXC-1	J1N1R7	1/5/2012	2.1		0.60	58.1	X	0.069	0.85		0.030	0.042	BM	0.037	7.6	X	0.053	8.3	X	0.091	13.5	X	0.20	3.2		0.25
8	EXC-2	J1N1R8	1/5/2012	3.2		0.69	61.3	X	0.079	0.81		0.035	0.083	B	0.043	7.9	X	0.061	8.0	X	0.10	15.5	X	0.23	4.9		0.28
9	EXC-3	J1N1R9	1/5/2012	5.8		0.68	60.0	X	0.078	0.94		0.034	0.050	B	0.042	5.7	X	0.060	8.7	X	0.10	16.9	X	0.22	3.6		0.28
10	EXC-4	J1N1T0	1/5/2012	3.4		0.68	52.0	X	0.078	0.95		0.034	0.042	U	0.042	6.8	X	0.059	9.0	X	0.10	15.4	X	0.22	4.2		0.28
11	EXC-5	J1N1T1	1/5/2012	9.2		0.64	74.3	X	0.074	0.83		0.032	0.040	U	0.040	22.0	X	0.057	9.9	X	0.10	21.2	X	0.21	23.4		0.26
12	EXC-6	J1N1T2	1/5/2012	2.0		0.68	97.2	X	0.078	0.95	B	0.17	0.042	B	0.042	6.2	X	0.059	9.3	X	0.51	18.6	X	1.1	3.3		1.4
13	EXC-7	J1N1T3	1/5/2012	1.5		0.65	48.5	X	0.075	0.94	B	0.16	0.040	U	0.040	4.6	X	0.057	9.3	X	0.49	16.2	X	1.1	2.5		1.3
14	EXC-8	J1N1T4	1/5/2012	3.3		0.64	60.0	X	0.074	0.94		0.032	0.085	B	0.040	7.1	X	0.056	8.3	X	0.10	15.1	X	0.21	4.8		0.26
15	EXC-9	J1N1T5	1/5/2012	2.6		0.61	57.9	X	0.070	0.90		0.031	0.056	B	0.038	5.7	X	0.054	8.5	X	0.093	17.5	X	0.20	3.9		0.25
16	EXC-10	J1N1T6	1/5/2012	3.2		0.61	61.7	X	0.071	0.90		0.031	0.069	B	0.038	7.2	X	0.054	8.6	X	0.093	15.2	X	0.20	4.3		0.25
17	EXC-12	J1N1T8	1/5/2012	2.5		0.67	62.0	X	0.077	0.88		0.034	0.055	B	0.042	8.1	X	0.059	8.3	X	0.10	15.1	X	0.22	3.8		0.27

18 **Statistical Computation Input Data**

Row	Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Lead mg/kg
21	EXC-11	J1N1T7/J1N1T9	1/5/2012	3.4	63.5	0.80	0.058	8.8	8.1	15.0	3.8
22	EXC-1	J1N1R7	1/5/2012	2.1	58.1	0.85	0.042	7.6	8.3	13.5	3.2
23	EXC-2	J1N1R8	1/5/2012	3.2	61.3	0.81	0.083	7.9	8.0	15.5	4.9
24	EXC-3	J1N1R9	1/5/2012	5.8	60.0	0.94	0.050	5.7	8.7	16.9	3.6
25	EXC-4	J1N1T0	1/5/2012	3.4	52.0	0.95	0.021	6.8	9.0	15.4	4.2
26	EXC-5	J1N1T1	1/5/2012	9.2	74.3	0.83	0.020	22.0	9.9	21.2	23.4
27	EXC-6	J1N1T2	1/5/2012	2.0	97.2	0.95	0.042	6.2	9.3	18.6	3.3
28	EXC-7	J1N1T3	1/5/2012	1.5	48.5	0.94	0.020	4.6	9.3	16.2	2.5
29	EXC-8	J1N1T4	1/5/2012	3.3	60.0	0.94	0.085	7.1	8.3	15.1	4.8
30	EXC-9	J1N1T5	1/5/2012	2.6	57.9	0.90	0.056	5.7	8.5	17.5	3.9
31	EXC-10	J1N1T6	1/5/2012	3.2	61.7	0.90	0.069	7.2	8.6	15.2	4.3
32	EXC-12	J1N1T8	1/5/2012	2.5	62.0	0.88	0.055	8.1	8.3	15.1	3.8

33 **Statistical Computations**

Row		Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
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 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), 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%	25%	0%	0%	0%	0%
38	Mean	3.5	63.0	0.89	0.050	8.1	8.7	16.3	5.5
39	Standard deviation	2.1	12.4	0.057	0.023	4.5	0.57	2.0	5.7
40	95% UCL on mean	4.8	68.9	0.92	0.062	10.3	9.0	17.2	8.2
41	Maximum value	9.2	97.2	1.0	0.085	22.0	9.9	21.2	23
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	0.81 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	NA	NA	NA	NO	NA	NA	NO
45	> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NO
46	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	YES
47	**WAC 173-340 Compliance?**	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.	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.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern
Project 100-D Field Remediation
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations

Date 05/07/12
Job No. 14655

Calc. No. 0100D-CA-V0455
Checked I. B. Berezovskiy

Rev. No. 0
Date 05/07/12
Sheet No. 7 of 21

100-D-50:4 Subsite Statistical Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Manganese mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL	TPH - diesel ug/kg	Q	PQL	TPH - diesel EXT ug/kg	Q	PQL
EXC-11	J1N1T7	1/5/2012	290	X	0.10	10.7	X	0.12	53.0	X	0.095	41.4	X	0.40	1300	J	710	3800	J	1000
Duplicate of J1N1T7	J1N1T9	1/5/2012	278	X	0.10	9.7	X	0.12	52.2	X	0.095	40.3	X	0.40	2900	J	670	6900		980
EXC-1	J1N1R7	1/5/2012	283	X	0.091	11.3	X	0.11	57.0	X	0.086	40.0	X	0.36	8100		650	25000		960
EXC-2	J1N1R8	1/5/2012	273	X	0.10	9.4	X	0.13	51.6	X	0.098	46.2	X	0.42	12000		680	36000		1000
EXC-3	J1N1R9	1/5/2012	268	X	0.10	8.7	X	0.13	60.7	X	0.097	53.3	X	0.41	2400	J	780	6400		1100
EXC-4	J1N1T0	1/5/2012	283	X	0.10	11.4	X	0.13	61.9	X	0.096	47.9	X	0.41	1500	J	670	4000		980
EXC-5	J1N1T1	1/5/2012	413	X	0.098	10.5	X	0.12	54.4	X	0.092	128	X	0.39	9600		710	21000		1000
EXC-6	J1N1T2	1/5/2012	335	X	0.10	9.4	X	0.13	83.9	X	0.48	47.4	X	0.41	2800	J	680	8700		1000
EXC-7	J1N1T3	1/5/2012	307	X	0.098	7.3	X	0.12	76.7	X	0.46	42.1	X	0.39	670	U	670	990	U	990
EXC-8	J1N1T4	1/5/2012	289	X	0.097	8.8	X	0.12	61.2	X	0.091	59.8	X	0.39	6600		670	15000		980
EXC-9	J1N1T5	1/5/2012	275	X	0.093	7.3	X	0.11	59.3	X	0.087	43.8	X	0.37	3300	J	690	9000		1000
EXC-10	J1N1T6	1/5/2012	277	X	0.093	8.4	X	0.11	59.1	X	0.088	43.6	X	0.37	3700	J	700	14000		1000
EXC-12	J1N1T8	1/5/2012	284	X	0.10	9.1	X	0.13	58.7	X	0.096	53.0	X	0.41	1400	J	680	3900	J	1000

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Manganese mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	TPH - diesel ug/kg	TPH - diesel EXT ug/kg
EXC-11	J1N1T7/J1N1T9	1/5/2012	284	10.2	52.6	40.9	2100	5350
EXC-1	J1N1R7	1/5/2012	283	11.3	57.0	40.0	8100	25000
EXC-2	J1N1R8	1/5/2012	273	9.4	51.6	46.2	12000	36000
EXC-3	J1N1R9	1/5/2012	268	8.7	60.7	53.3	2400	6400
EXC-4	J1N1T0	1/5/2012	283	11.4	61.9	47.9	1500	4000
EXC-5	J1N1T1	1/5/2012	413	10.5	54.4	128	9600	21000
EXC-6	J1N1T2	1/5/2012	335	9.4	83.9	47.4	2800	8700
EXC-7	J1N1T3	1/5/2012	307	7.3	76.7	42.1	335	495
EXC-8	J1N1T4	1/5/2012	289	8.8	61.2	59.8	6600	15000
EXC-9	J1N1T5	1/5/2012	275	7.3	59.3	43.8	3300	9000
EXC-10	J1N1T6	1/5/2012	277	8.4	59.1	43.6	3700	14000
EXC-12	J1N1T8	1/5/2012	284	9.1	58.7	53.0	1400	3900

Statistical Computations

	Manganese	Nickel	Vanadium	Zinc	TPH - diesel	TPH - diesel EXT
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), 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.
N	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	8%	8%
Mean	298	9.3	61.4	53.8	4486	12404
Standard deviation	40.6	1.4	9.5	24.1	3702	10421
95% UCL on mean	317	10.1	66.0	65.3	12221	17352
Maximum value	413	11.4	83.9	128	12000	36000
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	512 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200000 ug/kg DE, GW & River Protection	200000 ug/kg DE, GW & River Protection
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	NA	NA	NA	NO	NO	NO
> 10% above Cleanup Limit?	NA	NA	NA	NO	NO	NO
Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NO	NO
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 (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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern [initials] Date 05/07/12 Calc. No. 0100D-CA-V0455 Rev. No. 0
Project 100-D Field Remediation Job No. 14655 Checked I. B. Berezovskiy [initials] Date 05/07/12
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations Sheet No. 8 of 21

100-D-50:4 Subsite Maximum Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Antimony			Boron			Hexavalent Chromium			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1N1T7	1/5/2012	0.38	UJ	0.38	0.99	U	0.99	0.155	U	0.155	0.0060	U	0.0060
Duplicate of J1N1T7	J1N1T9	1/5/2012	0.39	UJ	0.39	0.99	U	0.99	0.155	U	0.155	0.0071	U	0.0071
EXC-1	J1N1R7	1/5/2012	0.40	BJ	0.35	0.90	U	0.90	0.155	U	0.155	0.0065	U	0.0065
EXC-2	J1N1R8	1/5/2012	0.40	UJ	0.40	1.0	U	1.0	0.155	U	0.155	0.0064	U	0.0064
EXC-3	J1N1R9	1/5/2012	0.84	J	0.39	1.0	U	1.0	0.155	U	0.155	0.0068	U	0.0068
EXC-4	J1N1T0	1/5/2012	0.47	BJ	0.39	1.0	U	1.0	0.391		0.155	0.0063	U	0.0063
EXC-5	J1N1T1	1/5/2012	1.1	J	0.37	0.96	U	0.96	0.242		0.155	0.0067	U	0.0067
EXC-6	J1N1T2	1/5/2012	0.39	UJ	0.39	1.0	U	1.0	0.155	U	0.155	0.0058	U	0.0058
EXC-7	J1N1T3	1/5/2012	0.39	BJ	0.37	0.96	U	0.96	0.155	U	0.155	0.0054	U	0.0054
EXC-8	J1N1T4	1/5/2012	0.37	UJ	0.37	0.96	B	0.95	0.155	U	0.155	0.019	B	0.0066
EXC-9	J1N1T5	1/5/2012	0.35	UJ	0.35	0.91	U	0.91	0.155	U	0.155	0.013	B	0.0059
EXC-10	J1N1T6	1/5/2012	0.35	UJ	0.35	0.91	U	0.91	0.155	U	0.155	0.0057	B	0.0054
EXC-12	J1N1T8	1/5/2012	0.39	UJ	0.39	1.0	U	1.0	0.155	U	0.155	0.0071	U	0.0071

Sample Area	Molybdenum			Benzo(a)pyrene			Benzo(b)fluoranthene			Benzo(k)fluoranthene		
	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC-11	0.26	U	0.26	6.6	U	6.6	4.3	U	4.3	4.0	U	4.0
Duplicate of J1N1T7	0.26	U	0.26	6.4	U	6.4	4.2	U	4.2	4.0	U	4.0
EXC-1	0.24	B	0.24	6.4	U	6.4	4.2	U	4.2	3.9	U	3.9
EXC-2	0.57	B	0.27	6.5	U	6.5	4.3	U	4.3	4.0	U	4.0
EXC-3	0.28	B	0.27	7.3	U	7.3	4.8	U	4.8	4.5	U	4.5
EXC-4	0.27	U	0.27	6.6	U	6.6	4.3	U	4.3	4.1	U	4.1
EXC-5	0.72	B	0.25	7.2	J	6.6	20		4.3	6.7	J	4.0
EXC-6	0.27	U	0.27	6.5	U	6.5	4.3	U	4.3	4.0	U	4.0
EXC-7	0.26	U	0.26	6.5	U	6.5	4.3	U	4.3	4.0	U	4.0
EXC-8	0.25	B	0.25	6.5	U	6.5	4.3	U	4.3	4.0	U	4.0
EXC-9	0.24	U	0.24	6.5	U	6.5	4.3	U	4.3	4.0	U	4.0
EXC-10	0.24	U	0.24	6.7	U	6.7	4.4	U	4.4	4.1	U	4.1
EXC-12	0.26	U	0.26	6.6	U	6.6	4.3	U	4.3	4.1	U	4.1

Statistical Computations

	Antimony	Boron	Hexavalent Chromium	Mercury	Molybdenum	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
% < Detection limit	58%	92%	83%	75%	58%	92%	92%	92%
Maximum value	1.1	0.96	0.391	0.019	0.72	7.2	20	6.7
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	5 GW & River Protection	320 GW Protection	2 River Protection	0.33 GW & River Protection	8 GW Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection
WAC 173-340 3-PART TEST								
Maximum > Cleanup Limit?	NA	NO	NO	NA	NO	NO	YES	NO
> 10% above Cleanup Limit?	NA	NO	NO	NA	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	NA	NO	NO	NA	NO	NO	NO	NO
3-Part Test 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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.33 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 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.

Sample Area	Sample Number	Sample Date	Chrysene			Fluoranthene			Phenanthrene			Pyrene			Aroclor-1260		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC-11	J1N1T7	1/5/2012	5.0	U	5.0	13	U	13	12	U	12	12	U	12	2.6	U	2.6
Duplicate of J1N1T7	J1N1T9	1/5/2012	4.9	U	4.9	13	U	13	12	U	12	12	U	12	2.5	U	2.5
EXC-1	J1N1R7	1/5/2012	4.8	U	4.8	13	U	13	12	U	12	12	U	12	12		2.6
EXC-2	J1N1R8	1/5/2012	4.9	U	4.9	13	U	13	12	U	12	12	U	12	2.5	U	2.5
EXC-3	J1N1R9	1/5/2012	5.5	U	5.5	15	U	15	14	U	14	14	U	14	3.0	U	3.0
EXC-4	J1N1T0	1/5/2012	5.0	U	5.0	13	U	13	12	U	12	12	U	12	2.6	U	2.6
EXC-5	J1N1T1	1/5/2012	23	J	5.0	99		13	140		12	65		12	4.3	J	2.7
EXC-6	J1N1T2	1/5/2012	4.9	U	4.9	13	U	13	12	U	12	12	U	12	2.7	U	2.7
EXC-7	J1N1T3	1/5/2012	4.9	U	4.9	13	U	13	12	U	12	12	U	12	2.4	U	2.4
EXC-8	J1N1T4	1/5/2012	4.9	U	4.9	13	U	13	12	U	12	12	U	12	2.5	U	2.5
EXC-9	J1N1T5	1/5/2012	4.9	U	4.9	13	U	13	12	U	12	12	U	12	2.7	U	2.7
EXC-10	J1N1T6	1/5/2012	5.0	U	5.0	14	U	14	13	U	13	13	U	13	2.7	U	2.7
EXC-12	J1N1T8	1/5/2012	5.0	U	5.0	13	U	13	12	U	12	12	U	12	2.7	U	2.7

Statistical Computations

	Chrysene	Fluoranthene	Phenanthrene	Pyrene	Aroclor-1260
% < Detection limit	92%	92%	92%	92%	83%
Maximum value	23	99	140	65	12
Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)	100 River Protection	18000 River Protection	240000 GW Protection	48000 GW Protection	17 GW & River Protection
WAC 173-340 3-PART TEST					
Maximum > Cleanup Limit?	NO	NO	NO	NO	NO
> 10% above Cleanup Limit?	NO	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

CALCULATION SHEET

Washington Closure Hanford

Originator: N. K. Schiffern
Project: 100-D Field Remediation
Subject: 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations

Date: 05/07/12
Job No.: 14655

Calc. No.: 0100D-CA-V0455
Checked: I. B. Berezovskiy

Rev. No.: 0
Date: 05/07/12
Sheet No.: 9 of 21

100-D-50:4 Subsite Statistical Calculations

Verification Data -Staging pile Area

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g	Q	MDA	Tritium pCi/g	Q	MDA
SPA-7	J1N1V8	3/15/2012	0.136		0.0348	0.0158	J	0.0314
Duplicate of J1N1V8	J1N1W4	3/15/2012	0.131		0.0426	-0.00205	U	0.0323
SPA-1	J1N1V2	3/15/2012	0.00964	U	0.0363	0.0379		0.0377
SPA-2	J1N1V3	3/15/2012	0.0599		0.0255	0.0342		0.0311
SPA-3	J1N1V4	3/15/2012	0.0312		0.0227	0.0176	U	0.0361
SPA-4	J1N1V5	3/15/2012	0.0677		0.0339	0.0218	U	0.0315
SPA-5	J1N1V6	3/15/2012	0.0345	U	0.0411	0.0208	U	0.0302
SPA-6	J1N1V7	3/15/2012	0.00598	U	0.0350	0.0457		0.0311
SPA-8	J1N1V9	3/15/2012	0.0247	U	0.0393	0.00654	U	0.0277
SPA-9	J1N1W0	3/15/2012	0.120		0.0243	0.0174	U	0.0275
SPA-10	J1N1W1	3/15/2012	0.0512	U	0.0414	0.0148	U	0.0324
SPA-11	J1N1W2	3/15/2012	0.245		0.0244	0.0227		0.0226
SPA-12	J1N1W3	3/15/2012	0.148		0.0296	0.0335		0.0289

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g	Tritium pCi/g
SPA-7	J1N1V8/J1N1W4	3/15/2012	0.134	0.00688
SPA-1	J1N1V2	3/15/2012	0.00964	0.0379
SPA-2	J1N1V3	3/15/2012	0.0599	0.0342
SPA-3	J1N1V4	3/15/2012	0.0312	0.0176
SPA-4	J1N1V5	3/15/2012	0.0677	0.0218
SPA-5	J1N1V6	3/15/2012	0.0345	0.0208
SPA-6	J1N1V7	3/15/2012	0.00598	0.0457
SPA-8	J1N1V9	3/15/2012	0.0247	0.00654
SPA-9	J1N1W0	3/15/2012	0.120	0.0174
SPA-10	J1N1W1	3/15/2012	0.0512	0.0148
SPA-11	J1N1W2	3/15/2012	0.245	0.0227
SPA-12	J1N1W3	3/15/2012	0.148	0.0335

Statistical Computations

	Cesium-137	Tritium
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
N	12	12
% < Detection limit	42%	50%
Mean	0.0776	0.0233
Standard deviation	0.0711	0.0122
Z-statistic	1.64	1.64
95% UCL on mean	0.111	0.0291
Maximum value	0.245	0.0457

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NKS **Date** 05/07/12 **Calc. No.** 0100D-CA-V0455 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** I. B. Berezovskiy IBB **Date** 05/07/12
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations **Sheet No.** 10 of 21

100-D-50:4 Subsite Statistical Calculations

Verification Data - Staging Pile Area

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Arsenic Q	Arsenic PQL	Barium mg/kg	Barium Q	Barium PQL	Beryllium mg/kg	Beryllium Q	Beryllium PQL	Boron mg/kg	Boron Q	Boron PQL	Cadmium mg/kg	Cadmium Q	Cadmium PQL	Chromium mg/kg	Chromium Q	Chromium PQL	Cobalt mg/kg	Cobalt Q	Cobalt PQL	Copper mg/kg	Copper Q	Copper PQL
SPA-7	J1N1V8	3/15/2012	3.0		0.67	77.4	X	0.077	0.55		0.034	1.8	B	1.0	0.17	B	0.042	11.5		0.059	7.2	X	0.10	18.7		0.22
Duplicate of J1N1V8	J1N1W4	3/15/2012	3.4		0.62	69.5	X	0.072	0.52		0.031	1.7	B	0.93	0.15	B	0.039	10.3		0.055	6.4	X	0.095	16.8		0.21
SPA-1	J1N1V2	3/15/2012	3.5		0.63	77.9	X	0.072	0.56		0.031	1.0	BM	0.93	0.12	B	0.039	9.5		0.055	6.9	X	0.095	16.4		0.21
SPA-2	J1N1V3	3/15/2012	2.7		0.60	70.4	X	0.069	0.56		0.030	1.4	B	0.89	0.11	B	0.037	12.5		0.053	6.9	X	0.091	16.3		0.20
SPA-3	J1N1V4	3/15/2012	2.5		0.58	69.2	X	0.067	0.61		0.029	1.6	B	0.87	0.14	B	0.036	8.5		0.051	8.5	X	0.089	17.1		0.19
SPA-4	J1N1V5	3/15/2012	3.0		0.63	68.0	X	0.073	0.56		0.032	1.7	B	0.94	0.13	B	0.039	8.8		0.056	7.4	X	0.096	18.1		0.21
SPA-5	J1N1V6	3/15/2012	2.9		0.62	65.6	X	0.072	0.54		0.031	1.2	B	0.93	0.12	B	0.039	9.7		0.055	7.0	X	0.094	16.8		0.21
SPA-6	J1N1V7	3/15/2012	2.4		0.64	60.1	X	0.074	0.56		0.032	1.0	U	0.95	0.072	B	0.040	8.9		0.056	7.5	X	0.097	16.4		0.21
SPA-8	J1N1V9	3/15/2012	5.4		0.67	80.0	X	0.078	0.62		0.034	2.2		1.0	0.099	B	0.042	9.3		0.059	7.1	X	0.10	17.6		0.22
SPA-9	J1N1W0	3/15/2012	2.3		0.64	74.2	X	0.074	0.53		0.032	1.5	B	0.96	0.13	B	0.040	10.0		0.057	6.0	X	0.098	16.4		0.21
SPA-10	J1N1W1	3/15/2012	3.2		0.66	75.7	X	0.076	0.62		0.033	1.7	B	0.98	0.14	B	0.041	9.5		0.058	7.8	X	0.10	18.0		0.22
SPA-11	J1N1W2	3/15/2012	2.4		0.66	78.4	X	0.076	0.57		0.033	2.2		0.98	0.17	B	0.041	8.7		0.058	6.4	X	0.10	16.9		0.22
SPA-12	J1N1W3	3/15/2012	2.8		0.64	99.8	X	0.074	0.65		0.032	4.0		0.96	0.14	B	0.040	8.1		0.057	7.4	X	0.098	17.8		0.21

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg
SPA-7	J1N1V8/J1N1W4	3/15/2012	3.2	73.5	0.54	1.8	0.16	10.9	6.8	17.8
SPA-1	J1N1V2	3/15/2012	3.5	77.9	0.56	1.0	0.12	9.5	6.9	16.4
SPA-2	J1N1V3	3/15/2012	2.7	70.4	0.56	1.4	0.11	12.5	6.9	16.3
SPA-3	J1N1V4	3/15/2012	2.5	69.2	0.61	1.6	0.14	8.5	8.5	17.1
SPA-4	J1N1V5	3/15/2012	3.0	68.0	0.56	1.7	0.13	8.8	7.4	18.1
SPA-5	J1N1V6	3/15/2012	2.9	65.6	0.54	1.2	0.12	9.7	7.0	16.8
SPA-6	J1N1V7	3/15/2012	2.4	60.1	0.56	0.48	0.072	8.9	7.5	16.4
SPA-8	J1N1V9	3/15/2012	5.4	80.0	0.62	2.2	0.099	9.3	7.1	17.6
SPA-9	J1N1W0	3/15/2012	2.3	74.2	0.53	1.5	0.13	10.0	6.0	16.4
SPA-10	J1N1W1	3/15/2012	3.2	75.7	0.62	1.7	0.14	9.5	7.8	18.0
SPA-11	J1N1W2	3/15/2012	2.4	78.4	0.57	2.2	0.17	8.7	6.4	16.9
SPA-12	J1N1W3	3/15/2012	2.8	99.8	0.65	4.0	0.14	8.1	7.4	17.8

Statistical Computations

	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
95% UCL based on	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), 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.
N	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	8%	0%	0%	0%	0%
Mean	3.0	74.4	0.58	1.7	0.13	9.5	7.1	17.1
Standard deviation	0.84	9.9	0.039	0.86	0.026	1.2	0.65	0.69
95% UCL on mean	3.4	79.7	0.60	2.1	0.15	10.2	7.5	17.5
Maximum value	5.4	99.8	0.65	4.0	0.17	12.5	8.5	18.7
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
WAC 173-340 Compliance?	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.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern [initials] Date 05/07/12 Calc. No. 0100D-CA-V0455 Rev. No. 0
Project 100-D Field Remediation Job No. 14655 Checked I. B. Berezovskiy [initials] Date 05/07/12
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations Sheet No. 11 of 21

1 **100-D-50:4 Subsite Statistical Calculations**

2 **Verification Data - Staging Pile Area**

	Sample Area	Sample Number	Sample Date	Lead			Manganese			Mercury			Nickel			Vanadium			Zinc			TPH - diesel			TPH diesel EXT		
3/4				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	SPA-7	J1N1V8	3/15/2012	33.6		0.27	319	X	0.10	0.015	B	0.0065	11.9	X	0.12	48.3	X	0.095	48.4	X	0.40	17000		690	57000		1000
6	Duplicate of J1N1V8	J1N1W4	3/15/2012	12.2		0.26	324	X	0.095	0.019		0.0058	11.1	X	0.12	44.8	X	0.089	51.2	X	0.38	24000		640	87000		950
7	SPA-1	J1N1V2	3/15/2012	10.3		0.26	308	X	0.095	0.0086	BM	0.0052	9.8	X	0.12	52.3	X	0.090	49.3	XM	0.38	71000		660	200000		980
8	SPA-2	J1N1V3	3/15/2012	6.4		0.25	302	X	0.091	0.0067	U	0.0067	12.7	X	0.11	49.7	X	0.086	42.0	X	0.36	12000		710	32000		1000
9	SPA-3	J1N1V4	3/15/2012	6.6		0.24	330	X	0.089	0.0076	B	0.0052	20.4	X	0.11	56.8	X	0.083	45.1	X	0.35	5700		690	13000		1000
10	SPA-4	J1N1V5	3/15/2012	9.6		0.26	305	X	0.096	0.013	B	0.0050	11.6	X	0.12	53.4	X	0.090	57.8	X	0.38	25000		680	74000		1000
11	SPA-5	J1N1V6	3/15/2012	6.5		0.26	313	X	0.094	0.013	B	0.0051	10.1	X	0.12	47.3	X	0.089	55.3	X	0.38	23000		680	65000		990
12	SPA-6	J1N1V7	3/15/2012	4.2		0.26	321	X	0.097	0.0063	U	0.0063	9.4	X	0.12	53.0	X	0.091	40.8	X	0.39	3600	J	690	8200		1000
13	SPA-8	J1N1V9	3/15/2012	19.3		0.28	319	X	0.10	0.0058	U	0.0058	10.3	X	0.13	54.0	X	0.096	42.6	X	0.41	9200		680	30000		1000
14	SPA-9	J1N1W0	3/15/2012	12.6		0.26	279	X	0.098	0.048		0.0058	9.3	X	0.12	49.6	X	0.092	50.6	X	0.39	6300		690	14000		1000
15	SPA-10	J1N1W1	3/15/2012	7.9		0.27	324	X	0.10	0.0086	B	0.0064	9.6	X	0.12	55.8	X	0.094	48.2	X	0.40	18000		680	49000		1000
16	SPA-11	J1N1W2	3/15/2012	50.5		0.27	278	X	0.10	0.0090	B	0.0051	9.0	X	0.12	53.2	X	0.094	95.2	X	0.40	5700		670	14000		990
17	SPA-12	J1N1W3	3/15/2012	10.9		0.26	314	X	0.098	0.015	B	0.0060	9.5	X	0.12	57.6	X	0.092	49.0	X	0.39	4200		680	10000		1000

18 **Statistical Computation Input Data**

19/20	Sample Area	Sample Number	Sample Date	Lead mg/kg	Manganese mg/kg	Mercury mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	TPH - diesel ug/kg	TPH diesel EXT ug/kg
21	SPA-7	J1N1V8/J1N1W4	3/15/2012	22.9	322	0.017	11.5	46.6	49.8	20500	72000
22	SPA-1	J1N1V2	3/15/2012	10.3	308	0.0086	9.8	52.3	49.3	71000	200000
23	SPA-2	J1N1V3	3/15/2012	6.4	302	0.0034	12.7	49.7	42.0	12000	32000
24	SPA-3	J1N1V4	3/15/2012	6.6	330	0.0076	20.4	56.8	45.1	5700	13000
25	SPA-4	J1N1V5	3/15/2012	9.6	305	0.013	11.6	53.4	57.8	25000	74000
26	SPA-5	J1N1V6	3/15/2012	6.5	313	0.013	10.1	47.3	55.3	23000	65000
27	SPA-6	J1N1V7	3/15/2012	4.2	321	0.0032	9.4	53.0	40.8	3600	8200
28	SPA-8	J1N1V9	3/15/2012	19.3	319	0.0029	10.3	54.0	42.6	9200	30000
29	SPA-9	J1N1W0	3/15/2012	12.6	279	0.048	9.3	49.6	50.6	6300	14000
30	SPA-10	J1N1W1	3/15/2012	7.9	324	0.0086	9.6	55.8	48.2	18000	49000
31	SPA-11	J1N1W2	3/15/2012	50.5	278	0.0090	9.0	53.2	95.2	5700	14000
32	SPA-12	J1N1W3	3/15/2012	10.9	314	0.015	9.5	57.6	49.0	4200	10000

33 **Statistical Computations**

34		Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	TPH - diesel	TPH diesel EXT
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), 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%	25%	0%	0%	0%	0%	0%
38	Mean	14.0	310	0.012	11.1	52.4	52.1	17017	48433
39	Standard deviation	12.7	16.6	0.012	3.1	3.5	14.5	18656	53758
40	95% UCL on mean	22.4	317	0.024	12.6	54.4	59.0	35280	118551
41	Maximum value	50.5	330	0.048	20.4	57.6	95.2	71000	200000
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	10.2 GW & River Protection	512 GW Protection	0.33 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200000 ug/kg DE, GW & River Protection	200000 ug/kg DE, GW & River Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	YES	NA	NA	NO	NA	NO	NO	NO
45	> 10% above Cleanup Limit?	YES	NA	NA	NO	NA	NO	NO	NO
46	Any sample > 2X Cleanup Limit?	YES	NA	NA	NO	NA	NO	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.	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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern
Project 100-D Field Remediation
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations

Date 05/07/12
Job No. 14655

Calc. No. 0100D-CA-V0455
Checked I. B. Berezovskiy

Rev. No. 0
Date 05/07/12
Sheet No. 12 of 21

100-D-50:4 Subsite Statistical Calculations

Verification Data - Staging Pile Area

Sample Area	Sample Number	Sample Date	Chrysene ug/kg	Q	PQL	Fluoranthene ug/kg	Q	PQL	Pyrene ug/kg	Q	PQL	Aroclor-1260 ug/kg	Q	PQL	Bis(2-ethylhexyl) phthalate ug/kg	Q	PQL
SPA-7	J1N1V8	3/15/2012	62		4.9	110	X	13	130		12	4.3	JP	2.5	97	JB	46
Duplicate of J1N1V8	J1N1W4	3/15/2012	38	J	5.0	69		13	74	X	12	4.2	JP	2.6	110	JB	47
SPA-1	J1N1V2	3/15/2012	13	JX	4.8	30	JX	13	26	JX	12	3.4	JP	2.7	47	U	47
SPA-2	J1N1V3	3/15/2012	9.2	J	5.0	14	J	13	14	JX	12	2.7	U	2.7	98	JB	45
SPA-3	J1N1V4	3/15/2012	5.0	U	5.0	13	U	13	12	U	12	2.5	U	2.5	88	JB	48
SPA-4	J1N1V5	3/15/2012	9.1	J	4.9	16	J	13	16	JX	12	6.5	J	2.5	98	JB	46
SPA-5	J1N1V6	3/15/2012	5.6	J	4.8	19	JX	13	16	JX	12	19		2.5	98	JB	46
SPA-6	J1N1V7	3/15/2012	4.7	U	4.7	13	U	13	12	U	12	2.5	U	2.5	94	JB	47
SPA-8	J1N1V9	3/15/2012	7.0	J	5.0	13	U	13	16	J	12	2.7	U	2.7	96	JB	47
SPA-9	J1N1W0	3/15/2012	38	J	4.7	49	X	13	63		12	10		2.6	110	JB	44
SPA-10	J1N1W1	3/15/2012	7.8	J	4.9	14	J	13	14	JX	12	9.2	J	2.5	97	JB	45
SPA-11	J1N1W2	3/15/2012	77		4.8	130		13	160		12	14		2.5	120	JB	46
SPA-12	J1N1W3	3/15/2012	17	J	4.9	27	J	13	27	JX	12	2.6	U	2.6	96	JB	46

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Chrysene ug/kg	Fluoranthene ug/kg	Pyrene ug/kg	Aroclor-1260 ug/kg	Bis(2-ethylhexyl) phthalate ug/kg
SPA-7	J1N1V8/J1N1W4	3/15/2012	50	90	102	4.3	104
SPA-1	J1N1V2	3/15/2012	13	30	26	3.4	24
SPA-2	J1N1V3	3/15/2012	9.2	14	14	1.4	98
SPA-3	J1N1V4	3/15/2012	2.5	6.5	6	1.3	88
SPA-4	J1N1V5	3/15/2012	9.1	16	16	6.5	98
SPA-5	J1N1V6	3/15/2012	5.6	19	16	19	98
SPA-6	J1N1V7	3/15/2012	2.4	6.5	6.0	1.3	94
SPA-8	J1N1V9	3/15/2012	7.0	6.5	16	1.4	96
SPA-9	J1N1W0	3/15/2012	38	49	63	10	110
SPA-10	J1N1W1	3/15/2012	7.8	14	14	9.2	97
SPA-11	J1N1W2	3/15/2012	77	130	160	14	120
SPA-12	J1N1W3	3/15/2012	17	27	27	1.3	96

Statistical Computations

	Chrysene	Fluoranthene	Pyrene	Aroclor-1260	Bis(2-ethylhexyl) phthalate
95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12
% < Detection limit	17%	25%	17%	42%	8%
Mean	20	34	39	6.1	94
Standard deviation	23	38	47	5.9	24
95% UCL on mean	58	82	97	8.9	105
Maximum value	77	130	160	19	120
Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)	100 GW Protection	18000 River Protection	48000 GW Protection	17 GW & River Protection	360 GW Protection
WAC 173-340 3-PART TEST					
95% UCL > Cleanup Limit?	NO	NO	NO	NO	NO
> 10% above Cleanup Limit?	NO	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO
WAC 173-340 Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations

Date 05/07/12
Job No. 14655

Calc. No. 0100D-CA-V0455
Checked I. B. Berezovskiy

Rev. No. 0
Date 05/07/12
Sheet No. 13 of 21

100-D-50:4 Subsite Maximum Calculations

Verification Data - Staging Pilea Area

Sample Area	Sample Number	Sample Date	Antimony			Hexavalent Chromium			Molybdenum			Acenaphthene			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene		
			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-7	J1N1V8	3/15/2012	0.39	U	0.39	1.11		0.0155	0.26	U	0.26	10	U	10	6.3	J	3.1	56	X	3.2	50		6.5	48		4.2
Duplicate of J1N1V8	J1N1W4	3/15/2012	0.36	U	0.36	0.195		0.0155	0.25	U	0.25	10	U	10	3.1	U	3.1	29	X	3.3	29		6.6	31		4.3
SPA-1	J1N1V2	3/15/2012	0.52	B	0.36	0.171		0.0155	0.33	B	0.25	17	J	10	3.0	U	3.0	3.2	U	3.2	36	X	6.4	4.2	U	4.2
SPA-2	J1N1V3	3/15/2012	0.35	B	0.35	0.0155	U	0.0155	0.28	B	0.24	10	U	10	3.2	U	3.2	3.3	U	3.3	6.6	U	6.6	4.3	U	4.3
SPA-3	J1N1V4	3/15/2012	0.34	U	0.34	0.0155	U	0.0155	0.23	U	0.23	10	U	10	3.1	U	3.1	3.3	U	3.3	6.6	U	6.6	4.3	U	4.3
SPA-4	J1N1V5	3/15/2012	0.36	U	0.36	0.196		0.0155	0.25	U	0.25	10	U	10	3.1	U	3.1	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
SPA-5	J1N1V6	3/15/2012	0.36	U	0.36	0.0155	U	0.0155	0.25	U	0.25	10	U	10	3.0	U	3.0	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
SPA-6	J1N1V7	3/15/2012	0.37	U	0.37	0.0155	U	0.0155	0.25	U	0.25	9.7	U	9.7	3.0	U	3.0	3.1	U	3.1	6.2	U	6.2	4.1	U	4.1
SPA-8	J1N1V9	3/15/2012	0.39	U	0.39	0.0155	U	0.0155	0.27	U	0.27	10	U	10	3.2	U	3.2	3.3	U	3.3	6.6	U	6.6	4.3	U	4.3
SPA-9	J1N1W0	3/15/2012	0.37	U	0.37	0.216		0.0155	0.25	U	0.25	9.6	U	9.6	2.9	U	2.9	29		3.1	30		6.2	40	X	4.0
SPA-10	J1N1W1	3/15/2012	0.38	U	0.38	0.0155	U	0.0155	0.26	U	0.26	10	U	10	3.1	U	3.1	3.2	U	3.2	6.5	U	6.5	4.2	U	4.2
SPA-11	J1N1W2	3/15/2012	0.38	U	0.38	0.282		0.0155	0.27	B	0.26	9.9	U	9.9	7.2	J	3.0	63		3.2	63		6.3	77		4.2
SPA-12	J1N1W3	3/15/2012	0.37	U	0.37	0.0155	U	0.0155	0.25	U	0.25	10	U	10	3.1	U	3.1	17		3.2	13	J	6.5	13	JX	4.3

Statistical Computations

	Antimony	Hexavalent Chromium	Molybdenum	Acenaphthene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
% < Detection limit	83%	58%	75%	92%	83%	67%	58%	67%
Maximum value	0.52	1.11	0.33	17	7.2	63	63	77
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	5 GW & River Protection	2 River Protection	8 GW Protection	96000 ug/kg GW Protection	240000 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 GW & River Protection
WAC 173-340 3-PART TEST								
Maximum > Cleanup Limit?	NA	NO	NO	NO	NO	YES	YES	YES
> 10% above Cleanup Limit?	NA	NO	NO	NO	NO	YES	YES	YES
Any sample > 2X Cleanup Limit?	NA	NO	NO	NO	NO	YES	YES	YES
3-Part Test 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.	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.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

Sample Area	Sample Number	Sample Date	Benzo(ghi)perylene			Benzo(k)fluoranthene			Fluorene			Indeno(1,2,3-cd)pyrene			Phenanthrene			Dibenzofuran		
			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-7	J1N1V8	3/15/2012	7.3	U	7.3	22		4.0	5.3	U	5.3	28	J	12	78		12	20	U	20
Duplicate of J1N1V8	J1N1W4	3/15/2012	7.4	U	7.4	13	J	4.0	5.4	U	5.4	12	U	12	41		12	20	U	20
SPA-1	J1N1V2	3/15/2012	7.2	U	7.2	3.9	U	3.9	5.3	U	5.3	12	U	12	12	J	12	20	U	20
SPA-2	J1N1V3	3/15/2012	7.4	U	7.4	4.1	U	4.1	5.5	U	5.5	12	U	12	12	U	12	20	U	20
SPA-3	J1N1V4	3/15/2012	7.4	U	7.4	4.0	U	4.0	5.4	U	5.4	12	U	12	12	U	12	21	U	21
SPA-4	J1N1V5	3/15/2012	7.2	U	7.2	4.0	U	4.0	5.3	U	5.3	12	U	12	12	U	12	20	U	20
SPA-5	J1N1V6	3/15/2012	7.2	U	7.2	3.9	U	3.9	14	J	5.3	12	U	12	30	JX	12	20	J	20
SPA-6	J1N1V7	3/15/2012	7.0	U	7.0	3.8	U	3.8	5.1	U	5.1	12	U	12	12	U	12	21	U	21
SPA-8	J1N1V9	3/15/2012	7.5	U	7.5	4.1	U	4.1	5.5	U	5.5	12	U	12	12	U	12	20	U	20
SPA-9	J1N1W0	3/15/2012	19	J	6.9	22		3.8	5.1	U	5.1	27	J	12	17	J	12	19	U	19
SPA-10	J1N1W1	3/15/2012	7.3	U	7.3	4.0	U	4.0	5.3	U	5.3	12	U	12	12	U	12	19	U	19
SPA-11	J1N1W2	3/15/2012	32		7.1	30		3.9	5.2	U	5.2	46		12	58		12	20	U	20
SPA-12	J1N1W3	3/15/2012	7.3	U	7.3	4.0	U	4.0	5.4	U	5.4	12	U	12	12	U	12	20	U	20

Statistical Computations

	Benzo(ghi)perylene	Benzo(k)fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Phenanthrene	Dibenzofuran
% < Detection limit	83%	75%	92%	75%	58%	92%
Maximum value	32	30	14	46	78	20
Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)	48000 GW Protection	15 GW & River Protection	64000 GW Protection	330 GW & River Protection	240000 GW Protection	3200 GWProtection
WAC 173-340 3-PART TEST						
Maximum > Cleanup Limit?	NO	YES	NO	NO	NO	NO
> 10% above Cleanup Limit?	NO	YES	NO	NO	NO	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.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

CALCULATION SHEET

Washington Closure Hanford					
Originator N. K. Schiffern [initials]	**Date**	05/07/12	**Calc. No.**	0100D-CA-V0455	**Rev. No.** 0
Project 100-D Field Remediation	**Job No.**	14655	**Checked**	I. B. Berezovskiy [initials]	**Date** 05/07/12
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations					**Sheet No.** 14 of 21

Ecology Software (MTCAStat) Results, 100-D-50:4 Subsite Excavation

Arsenic 95% UCL Calculation

DATA	ID
3.4	J1N1T7/J1N1T9
2.1	J1N1R7
3.2	J1N1R8
5.8	J1N1R9
3.4	J1N1T0
9.2	J1N1T1
2.0	J1N1T2
1.5	J1N1T3
3.3	J1N1T4
2.6	J1N1T5
3.2	J1N1T6
2.5	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	3.5
Censored		Lognormal mean	3.5
Detection limit or PQL		Std. devn.	2.1
Method detection limit		Median	3.2
TOTAL	12	Min.	1.5
		Max.	9.2

Lognormal distribution? r-squared is: 0.904
Normal distribution? r-squared is: 0.724
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 4.8

Barium 95% UCL Calculation

DATA	ID
63.5	J1N1T7/J1N1T9
58.1	J1N1R7
61.3	J1N1R8
60.0	J1N1R9
52.0	J1N1T0
74.3	J1N1T1
97.2	J1N1T2
48.5	J1N1T3
60.0	J1N1T4
57.9	J1N1T5
61.7	J1N1T6
62.0	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	63.0
Censored		Lognormal mean	63.1
Detection limit or PQL		Std. devn.	12.4
Method detection limit		Median	60.7
TOTAL	12	Min.	48.5
		Max.	97.2

Lognormal distribution? r-squared is: 0.819
Normal distribution? r-squared is: 0.742
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 68.9

Beryllium 95% UCL Calculation

DATA	ID
0.80	J1N1T7/J1N1T9
0.85	J1N1R7
0.81	J1N1R8
0.94	J1N1R9
0.95	J1N1T0
0.83	J1N1T1
0.95	J1N1T2
0.94	J1N1T3
0.94	J1N1T4
0.90	J1N1T5
0.90	J1N1T6
0.88	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.89
Censored		Lognormal mean	0.89
Detection limit or PQL		Std. devn.	0.057
Method detection limit		Median	0.90
TOTAL	12	Min.	0.80
		Max.	0.95

Lognormal distribution? r-squared is: 0.899
Normal distribution? r-squared is: 0.903
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 0.92

Cadmium 95% UCL Calculation

DATA	ID
0.058	J1N1T7/J1N1T9
0.042	J1N1R7
0.083	J1N1R8
0.050	J1N1R9
0.021	J1N1T0
0.020	J1N1T1
0.042	J1N1T2
0.020	J1N1T3
0.085	J1N1T4
0.056	J1N1T5
0.069	J1N1T6
0.055	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.050
Censored		Lognormal mean	0.051
Detection limit or PQL		Std. devn.	0.023
Method detection limit		Median	0.053
TOTAL	12	Min.	0.020
		Max.	0.085

Lognormal distribution? r-squared is: 0.892
Normal distribution? r-squared is: 0.945
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 0.062

Chromium 95% UCL Calculation

DATA	ID
8.8	J1N1T7/J1N1T9
7.6	J1N1R7
7.9	J1N1R8
5.7	J1N1R9
6.8	J1N1T0
22	J1N1T1
6.2	J1N1T2
4.6	J1N1T3
7.1	J1N1T4
5.7	J1N1T5
7.2	J1N1T6
8.1	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	8.1
Censored		Lognormal mean	8.0
Detection limit or PQL		Std. devn.	4.5
Method detection limit		Median	7.2
TOTAL	12	Min.	4.6
		Max.	22.0

Lognormal distribution? r-squared is: 0.754
Normal distribution? r-squared is: 0.551
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 10.3

Cobalt 95% UCL Calculation

DATA	ID
8.1	J1N1T7/J1N1T9
8.3	J1N1R7
8.0	J1N1R8
8.7	J1N1R9
9.0	J1N1T0
9.9	J1N1T1
9.3	J1N1T2
9.3	J1N1T3
8.3	J1N1T4
8.5	J1N1T5
8.6	J1N1T6
8.3	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	8.7
Censored		Lognormal mean	8.7
Detection limit or PQL		Std. devn.	0.57
Method detection limit		Median	8.6
TOTAL	12	Min.	8.0
		Max.	9.9

Lognormal distribution? r-squared is: 0.933
Normal distribution? r-squared is: 0.921
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 9.0

Copper 95% UCL Calculation

DATA	ID
15.0	J1N1T7/J1N1T9
13.5	J1N1R7
15.5	J1N1R8
16.9	J1N1R9
15.4	J1N1T0
21.2	J1N1T1
18.6	J1N1T2
16.2	J1N1T3
15.1	J1N1T4
17.5	J1N1T5
15.2	J1N1T6
15.1	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	16.3
Censored		Lognormal mean	16.3
Detection limit or PQL		Std. devn.	2.0
Method detection limit		Median	15.5
TOTAL	12	Min.	13.5
		Max.	21.2

Lognormal distribution? r-squared is: 0.893
Normal distribution? r-squared is: 0.859
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 17.2

Lead 95% UCL Calculation

DATA	ID
3.8	J1N1T7/J1N1T9
3.2	J1N1R7
4.9	J1N1R8
3.6	J1N1R9
4.2	J1N1T0
23.4	J1N1T1
3.3	J1N1T2
2.5	J1N1T3
4.8	J1N1T4
3.9	J1N1T5
4.3	J1N1T6
3.8	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	5.5
Censored		Lognormal mean	5.1
Detection limit or PQL		Std. devn.	5.7
Method detection limit		Median	3.9
TOTAL	12	Min.	2.5
		Max.	23.4

Lognormal distribution? r-squared is: 0.616
Normal distribution? r-squared is: 0.406
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 8.2

Manganese 95% UCL Calculation

DATA	ID
284	J1N1T7/J1N1T9
283	J1N1R7
273	J1N1R8
268	J1N1R9
283	J1N1T0
413	J1N1T1
335	J1N1T2
307	J1N1T3
289	J1N1T4
275	J1N1T5
277	J1N1T6
284	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	298
Censored		Lognormal mean	298
Detection limit or PQL		Std. devn.	40.6
Method detection limit		Median	284
TOTAL	12	Min.	268
		Max.	413

Lognormal distribution? r-squared is: 0.685
Normal distribution? r-squared is: 0.641
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 317

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	Date	05/07/12	Calc. No.	0100D-CA-V0455
Project	100-D Field Remediation	Job No.	14655	Checked	I. B. Berezovskiy
Subject	100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations			Rev. No.	0
				Date	05/07/12
				Sheet No.	15 of 21

Ecology Software (MTCAStat) Results, 100-D-50:4 Subsite Excavation

Nickel 95% UCL Calculation

DATA	ID
10.2	J1N1T7/J1N1T9
11.3	J1N1R7
9.4	J1N1R8
8.7	J1N1R9
11.4	J1N1T0
10.5	J1N1T1
9.4	J1N1T2
7.3	J1N1T3
8.8	J1N1T4
7.3	J1N1T5
8.4	J1N1T6
9.1	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	9.3
Censored		Lognormal mean	9.3
Detection limit or PQL		Std. devn.	1.4
Method detection limit		Median	9.3
TOTAL	12	Min.	7.3
		Max.	11.4

Lognormal distribution? r-squared is: 0.960
Normal distribution? r-squared is: 0.964
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.1

Vanadium 95% UCL Calculation

DATA	ID
52.6	J1N1T7/J1N1T9
57.0	J1N1R7
51.6	J1N1R8
60.7	J1N1R9
61.9	J1N1T0
54.4	J1N1T1
83.9	J1N1T2
76.7	J1N1T3
61.2	J1N1T4
59.3	J1N1T5
59.1	J1N1T6
58.7	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	61.4
Censored		Lognormal mean	61.4
Detection limit or PQL		Std. devn.	9.5
Method detection limit		Median	59.2
TOTAL	12	Min.	51.6
		Max.	83.9

Lognormal distribution? r-squared is: 0.840
Normal distribution? r-squared is: 0.793
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 66.0

Zinc 95% UCL Calculation

DATA	ID
40.9	J1N1T7/J1N1T9
40.0	J1N1R7
46.2	J1N1R8
53.3	J1N1R9
47.9	J1N1T0
128	J1N1T1
47.4	J1N1T2
42.1	J1N1T3
59.8	J1N1T4
43.8	J1N1T5
43.6	J1N1T6
53.0	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	53.8
Censored		Lognormal mean	53.4
Detection limit or PQL		Std. devn.	24.1
Method detection limit		Median	46.8
TOTAL	12	Min.	40.0
		Max.	128.0

Lognormal distribution? r-squared is: 0.653
Normal distribution? r-squared is: 0.517
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 65.3

TPH-diesel 95% UCL Calculation

DATA	ID
2100	J1N1T7/J1N1T9
8100	J1N1R7
12000	J1N1R8
2400	J1N1R9
1500	J1N1T0
9600	J1N1T1
2800	J1N1T2
335	J1N1T3
6600	J1N1T4
3300	J1N1T5
3700	J1N1T6
1400	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	4486
Censored		Lognormal mean	5083
Detection limit or PQL		Std. devn.	3702
Method detection limit		Median	3050
TOTAL	12	Min.	335
		Max.	12000

Lognormal distribution? r-squared is: 0.941
Normal distribution? r-squared is: 0.886
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 12221

TPH- diesel EXT 95% UCL Calculation

DATA	ID
5350	J1N1T7/J1N1T9
25000	J1N1R7
36000	J1N1R8
6400	J1N1R9
4000	J1N1T0
21000	J1N1T1
8700	J1N1T2
495	J1N1T3
15000	J1N1T4
9000	J1N1T5
14000	J1N1T6
3900	J1N1T8

Number of samples		Uncensored values	
Uncensored	12	Mean	12404
Censored		Lognormal mean	15463
Detection limit or PQL		Std. devn.	10421
Method detection limit		Median	8850
TOTAL	12	Min.	495
		Max.	36000

Lognormal distribution? r-squared is: 0.895
Normal distribution? r-squared is: 0.892
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 17352

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	**Date**	05/07/12	**Calc. No.**	0100D-CA-V0455
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	I. B. Berezovskiy
Subject	100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations	**Rev. No.**	0	**Date**	05/07/12
		Sheet No.	16 of 21		

Ecology Software (MTCAStat) Results, 100-D-50:4 Subsite Staging Pile Area

Arsenic 95% UCL Calculation

DATA	ID
3.2	J1N1V8/J1N1W4
3.5	J1N1V2
2.7	J1N1V3
2.5	J1N1V4
3.0	J1N1V5
2.9	J1N1V6
2.4	J1N1V7
5.4	J1N1V9
2.3	J1N1W0
3.2	J1N1W1
2.4	J1N1W2
2.8	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	3.0
Censored		Lognormal mean	3.0
Detection limit or PQL		Std. devn.	0.84
Method detection limit		Median	2.9
TOTAL	12	Min.	2.3
		Max.	5.4

Lognormal distribution? r-squared is: 0.835
Normal distribution? r-squared is: 0.723
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 3.4

Barium 95% UCL Calculation

DATA	ID
73.5	J1N1V8/J1N1W4
77.9	J1N1V2
70.4	J1N1V3
69.2	J1N1V4
68.0	J1N1V5
65.6	J1N1V6
60.1	J1N1V7
80.0	J1N1V9
74.2	J1N1W0
75.7	J1N1W1
78.4	J1N1W2
99.8	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	74.4
Censored		Lognormal mean	74.4
Detection limit or PQL		Std. devn.	9.9
Method detection limit		Median	73.8
TOTAL	12	Min.	60.1
		Max.	99.8

Lognormal distribution? r-squared is: 0.910
Normal distribution? r-squared is: 0.862
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 79.7

Beryllium 95% UCL Calculation

DATA	ID
0.54	J1N1V8/J1N1W4
0.56	J1N1V2
0.56	J1N1V3
0.61	J1N1V4
0.56	J1N1V5
0.54	J1N1V6
0.56	J1N1V7
0.62	J1N1V9
0.53	J1N1W0
0.62	J1N1W1
0.57	J1N1W2
0.65	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.58
Censored		Lognormal mean	0.58
Detection limit or PQL		Std. devn.	0.039
Method detection limit		Median	0.56
TOTAL	12	Min.	0.53
		Max.	0.65

Lognormal distribution? r-squared is 0.906
Normal distribution? r-squared is 0.897
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.60

Boron 95% UCL Calculation

DATA	ID
1.8	J1N1V8/J1N1W4
1.0	J1N1V2
1.4	J1N1V3
1.6	J1N1V4
1.7	J1N1V5
1.2	J1N1V6
0.48	J1N1V7
2.2	J1N1V9
1.5	J1N1W0
1.7	J1N1W1
2.2	J1N1W2
4.0	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	1.7
Censored		Lognormal mean	1.8
Detection limit or PQL		Std. devn.	0.86
Method detection limit		Median	1.7
TOTAL	12	Min.	0.48
		Max.	4.0

Lognormal distribution? r-squared is: 0.893
Normal distribution? r-squared is: 0.825
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2.1

Cadmium 95% UCL Calculation

DATA	ID
0.16	J1N1V8/J1N1W4
0.12	J1N1V2
0.11	J1N1V3
0.14	J1N1V4
0.13	J1N1V5
0.12	J1N1V6
0.072	J1N1V7
0.099	J1N1V9
0.13	J1N1W0
0.14	J1N1W1
0.17	J1N1W2
0.14	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.13
Censored		Lognormal mean	0.13
Detection limit or PQL		Std. devn.	0.026
Method detection limit		Median	0.13
TOTAL	12	Min.	0.072
		Max.	0.17

Lognormal distribution? r-squared is: 0.900
Normal distribution? r-squared is: 0.957
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 0.15

Chromium 95% UCL Calculation

DATA	ID
10.9	J1N1V8/J1N1W4
9.5	J1N1V2
12.5	J1N1V3
8.5	J1N1V4
8.8	J1N1V5
9.7	J1N1V6
8.9	J1N1V7
9.3	J1N1V9
10.0	J1N1W0
9.5	J1N1W1
8.7	J1N1W2
8.1	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	9.5
Censored		Lognormal mean	9.5
Detection limit or PQL		Std. devn.	1.2
Method detection limit		Median	9.4
TOTAL	12	Min.	8.1
		Max.	12.5

Lognormal distribution? r-squared is 0.907
Normal distribution? r-squared is 0.865
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.2

Cobalt 95% UCL Calculation

DATA	ID
6.8	J1N1V8/J1N1W4
6.9	J1N1V2
6.9	J1N1V3
8.5	J1N1V4
7.4	J1N1V5
7.0	J1N1V6
7.5	J1N1V7
7.1	J1N1V9
6.0	J1N1W0
7.8	J1N1W1
6.4	J1N1W2
7.4	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	7.1
Censored		Lognormal mean	7.1
Detection limit or PQL		Std. devn.	0.65
Method detection limit		Median	7.1
TOTAL	12	Min.	6.0
		Max.	8.5

Lognormal distribution? r-squared is: 0.965
Normal distribution? r-squared is: 0.959
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 7.5

Copper 95% UCL Calculation

DATA	ID
17.8	J1N1V8/J1N1W4
16.4	J1N1V2
16.3	J1N1V3
17.1	J1N1V4
18.1	J1N1V5
16.8	J1N1V6
16.4	J1N1V7
17.6	J1N1V9
16.4	J1N1W0
18.0	J1N1W1
16.9	J1N1W2
17.8	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	17.1
Censored		Lognormal mean	17.1
Detection limit or PQL		Std. devn.	0.69
Method detection limit		Median	17.0
TOTAL	12	Min.	16.3
		Max.	18.1

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

UCL (Land's method) is 17.5

Lead 95% UCL Calculation

DATA	ID
22.9	J1N1V8/J1N1W4
10.3	J1N1V2
6.4	J1N1V3
6.6	J1N1V4
9.6	J1N1V5
6.5	J1N1V6
4.2	J1N1V7
19.3	J1N1V9
12.6	J1N1W0
7.9	J1N1W1
50.5	J1N1W2
10.9	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	14.0
Censored		Lognormal mean	13.7
Detection limit or PQL		Std. devn.	12.7
Method detection limit		Median	10.0
TOTAL	12	Min.	4.2
		Max.	50.5

Lognormal distribution? r-squared is 0.922
Normal distribution? r-squared is 0.667
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 22.4

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	**Date**	05/07/12	**Calc. No.**	0100D-CA-V0455
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	I. B. Berezovskiy
Subject	100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations	**Rev. No.**	0	**Date**	05/07/12
				Sheet No.	17 of 21

Ecology Software (MTCAStat) Results, 100-D-50:4 Subsite Staging Pile Area

Manganese 95% UCL Calculation

DATA	ID
322	J1N1V8/J1N1W4
308	J1N1V2
302	J1N1V3
330	J1N1V4
305	J1N1V5
313	J1N1V6
321	J1N1V7
319	J1N1V9
279	J1N1W0
324	J1N1W1
278	J1N1W2
314	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	310
Censored		Lognormal mean	310
Detection limit or PQL		Std. devn.	16.6
Method detection limit		Median	314
TOTAL	12	Min.	278
		Max.	330

Lognormal distribution? r-squared is: 0.870
Normal distribution? r-squared is: 0.885
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 317

Mercury 95% UCL Calculation

DATA	ID
0.017	J1N1V8/J1N1W4
0.0086	J1N1V2
0.0034	J1N1V3
0.0076	J1N1V4
0.013	J1N1V5
0.013	J1N1V6
0.0032	J1N1V7
0.0029	J1N1V9
0.048	J1N1W0
0.0086	J1N1W1
0.0090	J1N1W2
0.015	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.012
Censored		Lognormal mean	0.013
Detection limit or PQL		Std. devn.	0.012
Method detection limit		Median	0.0088
TOTAL	12	Min.	0.0029
		Max.	0.048

Lognormal distribution? r-squared is: 0.926
Normal distribution? r-squared is: 0.661
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.024

Nickel 95% UCL Calculation

DATA	ID
11.5	J1N1V8/J1N1W4
9.8	J1N1V2
12.7	J1N1V3
20.4	J1N1V4
11.6	J1N1V5
10.1	J1N1V6
9.4	J1N1V7
10.3	J1N1V9
9.3	J1N1W0
9.6	J1N1W1
9.0	J1N1W2
9.5	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	11.1
Censored		Lognormal mean	11.1
Detection limit or PQL		Std. devn.	3.1
Method detection limit		Median	10.0
TOTAL	12	Min.	9.0
		Max.	20.4

Lognormal distribution? r-squared is 0.707
Normal distribution? r-squared is 0.609
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 12.6

Vanadium 95% UCL Calculation

DATA	ID
46.6	J1N1V8/J1N1W4
52.3	J1N1V2
49.7	J1N1V3
56.8	J1N1V4
53.4	J1N1V5
47.3	J1N1V6
53.0	J1N1V7
54.0	J1N1V9
49.6	J1N1W0
55.8	J1N1W1
53.2	J1N1W2
57.6	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	52.4
Censored		Lognormal mean	52.4
Detection limit or PQL		Std. devn.	3.5
Method detection limit		Median	53.1
TOTAL	12	Min.	46.6
		Max.	57.6

Lognormal distribution? r-squared is: 0.958
Normal distribution? r-squared is: 0.964
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 54.4

Zinc 95% UCL Calculation

DATA	ID
49.8	J1N1V8/J1N1W4
49.3	J1N1V2
42.0	J1N1V3
45.1	J1N1V4
57.8	J1N1V5
55.3	J1N1V6
40.8	J1N1V7
42.6	J1N1V9
50.6	J1N1W0
48.2	J1N1W1
95.2	J1N1W2
49.0	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	52.1
Censored		Lognormal mean	52.1
Detection limit or PQL		Std. devn.	14.5
Method detection limit		Median	49.2
TOTAL	12	Min.	40.8
		Max.	95.2

Lognormal distribution? r-squared is: 0.747
Normal distribution? r-squared is: 0.632
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 59.0

TPH - diesel 95% UCL Calculation

DATA	ID
20500	J1N1V8/J1N1W4
71000	J1N1V2
12000	J1N1V3
5700	J1N1V4
25000	J1N1V5
23000	J1N1V6
3600	J1N1V7
9200	J1N1V9
6300	J1N1W0
18000	J1N1W1
5700	J1N1W2
4200	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	17017
Censored		Lognormal mean	17019
Detection limit or PQL		Std. devn.	18656
Method detection limit		Median	10600
TOTAL	12	Min.	3600
		Max.	71000

Lognormal distribution? r-squared is 0.945
Normal distribution? r-squared is 0.668
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 35280

TPH - diesel EXT 95% UCL Calculation

DATA	ID
72000	J1N1V8/J1N1W4
200000	J1N1V2
32000	J1N1V3
13000	J1N1V4
74000	J1N1V5
65000	J1N1V6
8200	J1N1V7
30000	J1N1V9
14000	J1N1W0
49000	J1N1W1
14000	J1N1W2
10000	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	48433
Censored		Lognormal mean	49965
Detection limit or PQL		Std. devn.	53758
Method detection limit		Median	31000
TOTAL	12	Min.	8200
		Max.	200000

Lognormal distribution? r-squared is: 0.946
Normal distribution? r-squared is: 0.704
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 118551

Chrysene 95% UCL Calculation

DATA	ID
50	J1N1V8/J1N1W4
13	J1N1V2
9.2	J1N1V3
2.5	J1N1V4
9.1	J1N1V5
5.6	J1N1V6
2.4	J1N1V7
7.0	J1N1V9
38	J1N1W0
7.8	J1N1W1
77	J1N1W2
17	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	20
Censored		Lognormal mean	21
Detection limit or PQL		Std. devn.	23
Method detection limit		Median	9.2
TOTAL	12	Min.	2.4
		Max.	77

Lognormal distribution? r-squared is: 0.959
Normal distribution? r-squared is: 0.739
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 58

Fluoranthene 95% UCL Calculation

DATA	ID
90	J1N1V8/J1N1W4
30	J1N1V2
14	J1N1V3
6.5	J1N1V4
16	J1N1V5
19	J1N1V6
6.5	J1N1V7
6.5	J1N1V9
49	J1N1W0
14	J1N1W1
130	J1N1W2
27	J1N1W3

Number of samples		Uncensored values	
Uncensored	12	Mean	34
Censored		Lognormal mean	34
Detection limit or PQL		Std. devn.	38
Method detection limit		Median	18
TOTAL	12	Min.	6.5
		Max.	130

Lognormal distribution? r-squared is 0.941
Normal distribution? r-squared is 0.727
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 82

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	Date	05/07/12	Calc. No.	0100D-CA-V0455
Project	100-D Field Remediation	Job No.	14655	Checked	I. B. Berezovskiy
Subject	100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations			Rev. No.	0
				Date	05/07/12
				Sheet No.	18 of 21

Ecology Software (MTCAStat) Results, 100-D-50:4 Subsite Staging Pile Area

Pyrene 95% UCL Calculation

DATA	ID				
102	J1N1V8/J1N1W4				
26	J1N1V2				
14	J1N1V3	Number of samples		Uncensored values	
6.0	J1N1V4	Uncensored	12	Mean	39
16	J1N1V5	Censored		Lognormal mean	39
16	J1N1V6	Detection limit or PQL		Std. devn.	47
6.0	J1N1V7	Method detection limit		Median	16
16	J1N1V9	TOTAL	12	Min.	6.0
63	J1N1W0			Max.	160
14	J1N1W1				
160	J1N1W2				
27	J1N1W3				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.917		r-squared is: 0.687	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is	97		

Aroclor-1260 95% UCL Calculation

DATA	ID				
4.3	J1N1V8/J1N1W4				
3.4	J1N1V2				
1.4	J1N1V3	Number of samples		Uncensored values	
1.3	J1N1V4	Uncensored	12	Mean	6.1
6.5	J1N1V5	Censored		Lognormal mean	6.5
19	J1N1V6	Detection limit or PQL		Std. devn.	5.9
1.3	J1N1V7	Method detection limit		Median	3.8
1.4	J1N1V9	TOTAL	12	Min.	1.3
10	J1N1W0			Max.	19
9.2	J1N1W1				
14	J1N1W2				
1.3	J1N1W3				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.889		r-squared is: 0.837	
		Recommendations:			
		Reject BOTH lognormal and normal distributions.			
		UCL (based on Z-statistic) is	8.9		

Bis(2-ethylhexyl)phthalate 95% UCL Calculation

DATA	ID				
104	J1N1V8/J1N1W4				
24	J1N1V2				
98	J1N1V3	Number of samples		Uncensored values	
88	J1N1V4	Uncensored	12	Mean	94
98	J1N1V5	Censored		Lognormal mean	97
98	J1N1V6	Detection limit or PQL		Std. devn.	24
94	J1N1V7	Method detection limit		Median	98
96	J1N1V9	TOTAL	12	Min.	24
110	J1N1W0			Max.	120
97	J1N1W1				
120	J1N1W2				
96	J1N1W3				
		Lognormal distribution?		Normal distribution?	
		r-squared is 0.463		r-squared is 0.611	
		Recommendations:			
		Reject BOTH lognormal and normal distributions.			
		UCL (based on Z-statistic) is	105		

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern
Project 100-D Field Remediation
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations

Date 05/07/12
Job No. 14655

Calc. No. 0100D-CA-V0455
Checked I. B. Berezovskiy

Rev. No. 0
Date 05/07/12
Sheet No. 19 of 21

Duplicate Analysis - 100-D-50:4 Subsite Excavation

Sampling	Sample	Sample	Tritium			Aluminum			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium		
Area	**Number**	**Date**	**pCi/g**	**Q**	**MDA**	**mg/kg**	**Q**	**PQL**	**mg/kg**	**Q**	**PQL**	**mg/kg**	**Q**	**PQL**	**mg/kg**	**Q**	**PQL**	**mg/kg**	**Q**	**PQL**	**mg/kg**	**Q**	**PQL**	**mg/kg**	**Q**	**PQL**
EXC-11	J1N1T7	1/5/2012	0.0214	J	0.0159	7020	X	1.6	3.6		0.66	62.4	X	0.077	0.82		0.033	0.061	B	0.041	8370	X	14.2	9.0	X	0.058
Duplicate of J1N1T7	J1N1T9	1/5/2012	0.0197	J	0.0159	6330	X	1.6	3.1		0.67	64.6	X	0.077	0.77		0.033	0.055	B	0.042	8450	X	14.3	8.6	X	0.059

Analysis:

TDL		Tritium	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium
TDL		10	5	10	2	0.2	0.2	100	1
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD		10.3%		3.5%			1.0%	4.5%
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable

Duplicate Analysis - 100-D-50:4 Subsite Excavation

Sampling	HEIS	Sample	Cobalt			Copper			Iron			Lead			Magnesium			Manganese			Nickel			Potassium		
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**
EXC-11	J1N1T7	1/5/2012	8.0	X	0.10	15.1	X	0.22	20900	X	3.8	4.0		0.27	4670	X	3.7	290	X	0.10	10.7	X	0.12	1190		41.3
Duplicate of J1N1T7	J1N1T9	1/5/2012	8.2	X	0.10	14.9	X	0.22	20800	X	3.9	3.6		0.27	4330	X	3.7	278	X	0.10	9.7	X	0.12	1070		41.6

Analysis:

TDL		Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Nickel	Potassium
TDL		2	1	5	5	75	5	4	400
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**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)
	RPD		1.3%	0.5%		7.6%	4.2%		
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

Duplicate Analysis - 100-D-50:4 Subsite Excavation

Sampling	HEIS	Sample	Silicon			Sodium			Vanadium			Zinc			TPH - diesel			TPH - diesel EXT		
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**
EXC-11	J1N1T7	1/5/2012	347	J	5.7	534		59.4	53.0	X	0.095	41.4	X	0.40	1300	J	710	3800	J	1000
Duplicate of J1N1T7	J1N1T9	1/5/2012	314	J	5.7	539		59.8	52.2	X	0.095	40.3	X	0.40	2900	J	670	6900		980

Analysis:

TDL		Silicon	Sodium	Vanadium	Zinc	TPH - diesel	TPH - diesel EXT
TDL		2	50	2.5	1	5000	5000
Duplicate Analysis	Both > PQL?	**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)
	RPD	10.0%	0.9%	1.5%	2.7%		
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	Date	05/07/12	Calc. No.	0100D-CA-V0455
Project	100-D Field Remediation	Job No.	14655	Checked	I. B. Berezovskiy
Subject	100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations			Rev. No.	0
				Date	05/07/12
				Sheet No.	20 of 21

Duplicate Analysis - 100-D-50:4 Subsite Staging Pile Area

Sampling Area	Sample Number	Sample Date	Cesium-137			Aluminum			Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium		
			pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-7	J1N1V8	3/15/2012	0.136		0.0348	7220	X	1.6	3.0		0.67	77.4	X	0.077	0.55		0.034	1.8	B	1.0	0.17	B	0.042	6290	X	14.3
Duplicate of J1N1V8	J1N1W4	3/15/2012	0.131		0.0426	7070	X	1.5	3.4		0.62	69.5	X	0.072	0.52		0.031	1.7	B	0.93	0.15	B	0.039	9880	X	13.3

Analysis:

		Cesium-137	Aluminum	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium
TDL		0.05	5	10	2	0.2	2	0.2	100
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD		2.1%		10.8%				*44.4%*
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 100-D-50:4 Subsite Staging Pile Area

Sampling Area	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead			Magnesium			Manganese		
			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-7	J1N1V8	3/15/2012	11.5		0.059	7.2	X	0.10	18.7		0.22	1.11		0.0155	21900	X	3.9	33.6		0.27	4370	X	3.8	319	X	0.10
Duplicate of J1N1V8	J1N1W4	3/15/2012	10.3		0.055	6.4	X	0.095	16.8		0.21	0.195		0.0155	18100	X	3.6	12.2		0.26	4360	X	3.5	324	X	0.095

Analysis:

		Chromium	Cobalt	Copper	Hexavalent Chromium	Iron	Lead	Magnesium	Manganese
TDL		1	2	1	0.5	5	5	75	5
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)	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	11.0%		10.7%		19.0%		0.2%	1.6%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Yes - assess further	Not applicable	Not applicable

Duplicate Analysis - 100-D-50:4 Subsite Staging Pile Area

Sampling Area	HEIS Number	Sample Date	Mercury			Nickel			Potassium			Silicon			Sodium			Vanadium			Zinc			TPH - diesel		
			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
SPA-7	J1N1V8	3/15/2012	0.015	B	0.0065	11.9	X	0.12	1240		41.6	627	X	5.7	289		59.9	48.3	X	0.095	48.4	X	0.40	17000		690
Duplicate of J1N1V8	J1N1W4	3/15/2012	0.019		0.0058	11.1	X	0.12	1200		38.8	516	X	5.4	266		55.8	44.8	X	0.089	51.2	X	0.38	24000		640

Analysis:

		Mercury	Nickel	Potassium	Silicon	Sodium	Vanadium	Zinc	TPH - diesel
TDL		0.2	4	400	2	50	2.5	1	5000
Duplicate Analysis	Both > PQL?	**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)	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)
	RPD				19.4%	8.3%	7.5%	5.6%	
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable

Duplicate Analysis - 100-D-50:4 Subsite Staging Pile Area

Sampling Area	HEIS Number	Sample Date	TPH - diesel EXT			Benzo(a)anthracene - PAH			Benzo(a)pyrene - PAH			Benzo(b)fluoranthene -PAH			Benzo(k)fluoranthene - PAH			Chrysene - PAH			Fluoranthene - PAH			Phenanthrene - PAH		
			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-7	J1N1V8	3/15/2012	57000		1000	56	X	3.2	50		6.5	48		4.2	22		4.0	62		4.9	110	X	13	78		12
Duplicate of J1N1V8	J1N1W4	3/15/2012	87000		950	29	X	3.3	29		6.6	31		4.3	13	J	4.0	38	J	5.0	69		13	41		12

Analysis:

		TPH - diesel EXT	Benzo(a)anthracene - PAH	Benzo(a)pyrene - PAH	Benzo(b)fluoranthene -PAH	Benzo(k)fluoranthene - PAH	Chrysene - PAH	Fluoranthene - PAH	Phenanthrene - PAH
TDL		5000	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	*41.7%*							
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Yes - assess further	Yes - assess further

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS | **Date** 05/07/12 | **Calc. No.** 0100D-CA-V0455 | **Rev. No.** 0
Project 100-D Field Remediation | **Job No.** 14655 | **Checked** I. B. Berezovskiy | **Date** 05/07/12
Subject 100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations | **Sheet No.** 21 of 21

Duplicate Analysis - 100-D-50:4 Subsite Staging Pile Area

Sampling Area	Sample Number	Sample Date	Pyrene - PAH			Aroclor-1260			Benzo(a)anthracene - SVOA			Benzo(a)pyrene - SVOA			Benzo(b)fluoranthene SVOA			Benzo(ghi)perylene - SVOA			Bis(2-ethylhexyl) phthalate - SVOA			Chrysene - SVOA		
			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-7	J1N1V8	3/15/2012	130		12	4.3	JP	2.5	45	J	20	92	J	20	170	JK	26	33	J	16	97	JB	46	78	J	27
Duplicate of J1N1V8	J1N1W4	3/15/2012	74	X	12	4.2	JP	2.6	27	J	20	82	J	20	150	JK	27	37	J	16	110	JB	47	48	J	28

Analysis:

		Pyrene - PAH	Aroclor-1260	Benzo(a)anthracene - SVOA	Benzo(a)pyrene - SVOA	Benzo(b)fluoranthene SVOA	Benzo(ghi)perylene - SVOA	Bis(2-ethylhexyl) phthalate - SVOA	Chrysene - SVOA
TDL		15	20	660	660	660	660	660	660
Duplicate Analysis	Both > PQL?	**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)
	RPD								
	Difference > 2 TDL?	Yes - assess further	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

Duplicate Analysis - 100-D-50:4 Subsite Staging Pile Area

Sampling Area	HEIS Number	Sample Date	Fluoranthene - SVOA			Phenanthrene - SVOA			Pyrene - SVOA		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
SPA-7	J1N1V8	3/15/2012	99	J	36	55	J	17	100	J	12
Duplicate of J1N1V8	J1N1W4	3/15/2012	62	J	37	36	J	17	48	J	12

Analysis:

		Fluoranthene - SVOA	Phenanthrene - SVOA	Pyrene - SVOA
TDL		660	660	660
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD			
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable

Attachment 1. 100-D-50:4 Subsite Verification Sampling Results - Radionuclides

Sample Location	HEIS Number	Sample Date	Americium-241 GEA			Carbon-14			Cesium-137 GEA			Cobalt-60 GEA			Europium-152 GEA			Europium-154 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-11	J1N1T7	1/5/2012	0.0594	U	0.148	-0.189	UJ	0.472	0.0871		0.0211	0.0115	U	0.0256	0.00976	U	0.0556	0.00872	U	0.0762
Duplicate of J1N1T7	J1N1T9	1/5/2012	0.0367	U	0.143	0.0684	UJ	0.472	0.0408	U	0.0288	0.0195	U	0.0283	0.00325	U	0.0533	0.0174	U	0.0788
EXC-1	J1N1R7	1/5/2012	-0.0191	U	0.127	-0.0657	UJ	0.472	0.0456		0.0198	-0.00265	U	0.0219	-0.00558	U	0.0485	-0.00596	U	0.0698
EXC-2	J1N1R8	1/5/2012	0.00321	U	0.107	0.327	UJ	0.472	0.555		0.0333	-0.00278	U	0.0314	-0.0275	U	0.0797	-0.0273	U	0.0966
EXC-3	J1N1R9	1/5/2012	-0.173	U	0.202	0.321	UJ	0.470	0.184		0.0242	0.00202	U	0.0266	0.0281	U	0.0682	-0.0259	U	0.0764
EXC-4	J1N1T0	1/5/2012	-0.00841	U	0.0579	0.238	UJ	0.470	0.106		0.0381	-0.0156	U	0.0314	0.0352	U	0.0938	-0.0132	U	0.114
EXC-5	J1N1T1	1/5/2012	-0.0509	U	0.229	0.687	J	0.472	0.304		0.0256	-0.0120	U	0.0249	-0.00755	U	0.0655	0.0735	U	0.0941
EXC-6	J1N1T2	1/5/2012	-0.0255	U	0.117	-0.106	UJ	0.470	0.121		0.0254	-0.00553	U	0.0239	0.00291	U	0.0706	-0.0515	U	0.0691
EXC-7	J1N1T3	1/5/2012	0.0255	U	0.105	-0.180	UJ	0.471	0.0138	U	0.0372	-0.00413	U	0.0350	-0.0148	U	0.0803	-0.00948	U	0.103
EXC-8	J1N1T4	1/5/2012	-0.0405	U	0.0580	0.0448	UJ	0.472	0.238		0.0370	-0.00392	U	0.0365	-0.0134	U	0.0944	-0.0135	U	0.104
EXC-9	J1N1T5	1/5/2012	-0.0570	U	0.123	-0.0866	UJ	0.473	0.160		0.0198	-0.00116	U	0.0193	0.00277	U	0.0514	0.00483	U	0.0711
EXC-10	J1N1T6	1/5/2012	-0.0161	U	0.101	0.313	UJ	0.472	0.365		0.0331	-0.0105	U	0.0312	-0.0576	U	0.0782	-0.0562	U	0.0923
EXC-12	J1N1T8	1/5/2012	-0.0482	U	0.0963	-0.0726	UJ	0.472	0.0270	U	0.0391	0.00369	U	0.0306	-0.00207	U	0.0818	0.0261	U	0.111
SPA-7	J1N1V8	3/15/2012	0.0315	U	0.112	0.0922	U	0.454	0.136		0.0348	0.00412	U	0.0384	0.0131	U	0.0927	-0.0734	U	0.0989
Duplicate of J1N1V8	J1N1W4	3/15/2012	-0.0546	U	0.0694	0.183	U	0.453	0.131		0.0426	-0.0107	U	0.0379	-0.0181	U	0.103	0.00474	U	0.118
SPA-1	J1N1V2	3/15/2012	-0.0538	U	0.0648	0.157	U	0.458	0.00964	U	0.0363	-0.0237	U	0.0276	-0.00301	U	0.0820	-0.0339	U	0.100
SPA-2	J1N1V3	3/15/2012	0.00604	U	0.0378	-0.0350	U	0.454	0.0599		0.0255	-0.00624	U	0.0259	-0.00638	U	0.0585	-0.0160	U	0.0746
SPA-3	J1N1V4	3/15/2012	-0.0624	U	0.209	0.102	U	0.454	0.0312		0.0227	-0.00106	U	0.0242	-0.0121	U	0.0572	-0.0253	U	0.0831
SPA-4	J1N1V5	3/15/2012	0.00732	U	0.100	-0.0340	U	0.456	0.0677		0.0339	0.00166	U	0.0330	-0.00652	U	0.0805	0.0388	U	0.110
SPA-5	J1N1V6	3/15/2012	-0.00501	U	0.0628	0.0633	U	0.454	0.0345	U	0.0411	0.00905	U	0.0338	-0.00340	U	0.0878	0.00434	U	0.102
SPA-6	J1N1V7	3/15/2012	-0.0261	U	0.0655	0.0624	U	0.453	0.00598	U	0.0350	-0.00234	U	0.0331	-0.0540	U	0.0794	0.0323	U	0.105
SPA-8	J1N1V9	3/15/2012	-0.0354	U	0.0649	0.212	U	0.453	0.0247	U	0.0393	-0.00296	U	0.0313	0.0274	U	0.0940	0.0152	U	0.117
SPA-9	J1N1W0	3/15/2012	0.0397	U	0.218	0.179	U	0.454	0.120		0.0243	0.00727	U	0.0267	0.00648	U	0.0571	0.0114	U	0.0857
SPA-10	J1N1W1	3/15/2012	0.0399	U	0.0650	0.248	U	0.456	0.0512	U	0.0414	-0.000536	U	0.0325	0.0643	U	0.0859	-0.0181	U	0.0984
SPA-11	J1N1W2	3/15/2012	0.000357	U	0.0394	-0.126	U	0.456	0.245		0.0244	-0.00276	U	0.0247	0.000733	U	0.0600	0.000804	U	0.0769
SPA-12	J1N1W3	3/15/2012	0.00635	U	0.0987	0.215	U	0.457	0.148		0.0296	0.0163	U	0.0328	-0.0509	U	0.0783	0.0128	U	0.112

Grey cells indicate not applicable or data will not be used.

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.

AEA = Alpha Spectroscopy

B = blank contamination (inorganic constituents)

C = detected in both the sample and the associated QC blank, and the sample concentration was </=5X the blank concentration.

GEA = Gamma Spectroscopy

HEIS = Hanford Environmental Information System

J = estimate

K = Benzo(b&k)fluoranthene are unresolved due to matrix, result is reported as benzo(b)fluoranthene.

M = sample duplicate precision not met.

N= recovery exceeds upper or lower control limits.

P = RPD between the primary and confirmation columns exceeded 25% for aroclor 1260.

PAH = polycyclic aromatice hydrocarbon

PCB = polychlorinated biphenyl

PQL = practical quantitation limit

Q = qualifier

R = detected, but due to a major QA deficiency, the data is unusable.

RAG = remedial action goal

SVOA = semivolatile organic compounds

TPH = total petroleum hydrocarbon

U = undetected

X (metals) = Serial dilution in the analytical batch indicates that physical and chemical interferences are present.

X (SVOAs) = MS, MSD: recovery exceeds upper or lower control limits.

Attachment	1	Sheet No.	1 of 18
Originator	N. K. Schiffern	Date	05/07/12
Checked	I. B. Berezovskiy	Date	05/07/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sampling Results - Radionuclides

Sample Location	HEIS Number	Sample Date	Europium-155 GEA			Nickel-63			Plutonium-238 AEA			Plutonium-239/240 AEA			Total beta radiostrontium			Tritium		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-11	J1N1T7	1/5/2012	0.0433	U	0.0647	-2.54	U	14.0	0	UJ	0.106	0	U	0.106	0.0386	U	0.154	0.0214	J	0.0159
Duplicate of J1N1T7	J1N1T9	1/5/2012	0.0514	U	0.0669	-3.43	U	14.3	0	UJ	0.0786	0	U	0.0786	0.0757	U	0.159	0.0197	J	0.0159
EXC-1	J1N1R7	1/5/2012	0.0101	U	0.0588	2.18	U	13.9	-0.00146	UJ	0.0608	-0.00582	U	0.0822	0.0606	U	0.155	0.0156	UJ	0.0158
EXC-2	J1N1R8	1/5/2012	0.0744	U	0.0863	4.09	U	13.9	0.0196	UJ	0.0909	-0.00218	U	0.0909	0.0769	U	0.171	0.0556	J	0.0166
EXC-3	J1N1R9	1/5/2012	0.0122	U	0.0771	2.21	U	14.0	-0.00312	UJ	0.0753	-0.00452	U	0.126	0.0882	U	0.169	0.0565	J	0.0181
EXC-4	J1N1T0	1/5/2012	0.0624	U	0.0890	1.57	U	13.8	0	UJ	0.0807	0	U	0.0807	0.0100	U	0.166	0.0711	J	0.0159
EXC-5	J1N1T1	1/5/2012	0.0557	U	0.0806	3.30	U	14.6	-0.00270	UJ	0.113	0.0243	U	0.113	0.0575	U	0.150	0.0622	J	0.0185
EXC-6	J1N1T2	1/5/2012	0.0279	U	0.0887	1.50	U	13.9	-0.00218	UJ	0.0911	0.0195	U	0.165	-0.0140	U	0.172	0.0374	J	0.0143
EXC-7	J1N1T3	1/5/2012	0.0464	U	0.0861	-3.70	U	15.7	-0.00181	UJ	0.0754	-0.00181	U	0.0753	0.0266	U	0.173	0.0177	J	0.0115
EXC-8	J1N1T4	1/5/2012	0.00221	U	0.0895	3.31	U	14.1	-0.00315	UJ	0.0752	0.0157	U	0.0656	0.0624	U	0.147	0.156	J	0.0160
EXC-9	J1N1T5	1/5/2012	0.0254	U	0.0580	3.57	U	14.2	0.0156	UJ	0.0937	0	U	0.0817	0.0720	U	0.171	0.101	J	0.0157
EXC-10	J1N1T6	1/5/2012	0.0447	U	0.0797	0.478	U	13.7	0	UJ	0.0841	-0.00403	U	0.0963	-0.00929	U	0.167	0.461	J	0.0145
EXC-12	J1N1T8	1/5/2012	0.0511	U	0.0785	5.35	U	26.7	-0.00432	UJ	0.103	0	U	0.0903	0.0440	U	0.148	0.0399	J	0.0164
SPA-7	J1N1V8	3/15/2012	0.0409	U	0.0898	-1.52	U	12.3	-0.00165	U	0.0688	0.0164	U	0.0687	0.0775	U	0.164	0.0158	J	0.0314
Duplicate of J1N1V8	J1N1W4	3/15/2012	0.00831	U	0.0987	0.794	U	12.7	-0.000754	U	0.0686	-0.000753	U	0.0685	0.0234	U	0.159	-0.00205	U	0.0323
SPA-1	J1N1V2	3/15/2012	0.0170	U	0.0938	1.68	U	12.9	-0.00158	U	0.0660	0.0158	U	0.0660	0.0407	U	0.152	0.0379		0.0377
SPA-2	J1N1V3	3/15/2012	0.0552	U	0.0615	3.88	U	14.1	-0.00139	U	0.0581	-0.00139	U	0.0580	0.0705	U	0.163	0.0342		0.0311
SPA-3	J1N1V4	3/15/2012	0.0376	U	0.0720	2.47	U	12.8	-0.00176	U	0.0735	-0.00176	U	0.0735	0.0217	U	0.165	0.0176	U	0.0361
SPA-4	J1N1V5	3/15/2012	0.0276	U	0.0834	2.81	U	12.2	-0.00463	U	0.0811	-0.0108	U	0.102	0.0297	U	0.176	0.0218	U	0.0315
SPA-5	J1N1V6	3/15/2012	0.0383	U	0.0934	-1.22	U	13.0	-0.00161	U	0.0673	-0.00322	U	0.0771	0.0966	U	0.155	0.0208	U	0.0302
SPA-6	J1N1V7	3/15/2012	0.0213	U	0.0922	5.35	U	12.8	-0.00144	U	0.0602	-0.00288	U	0.0689	0.0497	U	0.176	0.0457		0.0311
SPA-8	J1N1V9	3/15/2012	0.0665	U	0.0984	-0.388	U	12.5	-0.00412	U	0.0987	0	U	0.0861	0.109	U	0.160	0.00654	U	0.0277
SPA-9	J1N1W0	3/15/2012	0.0479	U	0.0725	-1.29	U	13.0	-0.000630	U	0.0573	0.0157	U	0.0573	0.0454	U	0.176	0.0174	U	0.0275
SPA-10	J1N1W1	3/15/2012	0.0247	U	0.0948	2.77	U	12.5	-0.00153	U	0.0772	-0.000767	U	0.0697	0.00295	U	0.159	0.0148	U	0.0324
SPA-11	J1N1W2	3/15/2012	0.0335	U	0.0555	4.31	U	12.2	-0.000701	U	0.0638	0	U	0.0637	0.0640	U	0.168	0.0227		0.0226
SPA-12	J1N1W3	3/15/2012	0.0401	U	0.0806	0.855	U	12.5	-0.00125	U	0.0629	0.0150	U	0.0568	0.0512	U	0.158	0.0335		0.0289

Attachment	1	Sheet No.	2 of 18
Originator	N. K. Schiffern	Date	05/07/12
Checked	I. B. Berezovskiy	Date	05/07/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1N1T7	1/5/2012	7020	X	1.6	0.38	UJ	0.38	3.6		0.66	62.4	X	0.077	0.82		0.033	0.99	U	0.99
Duplicate of J1N1T7	J1N1T9	1/5/2012	6330	X	1.6	0.39	UJ	0.39	3.1		0.67	64.6	X	0.077	0.77		0.033	0.99	U	0.99
EXC-1	J1N1R7	1/5/2012	5620	X	1.4	0.40	BJ	0.35	2.1		0.60	58.1	X	0.069	0.85		0.030	0.90	U	0.90
EXC-2	J1N1R8	1/5/2012	6350	X	1.6	0.40	UJ	0.40	3.2		0.69	61.3	X	0.079	0.81		0.035	1.0	U	1.0
EXC-3	J1N1R9	1/5/2012	5490	X	1.6	0.84	J	0.39	5.8		0.68	60.0	X	0.078	0.94		0.034	1.0	U	1.0
EXC-4	J1N1T0	1/5/2012	6020	X	1.6	0.47	BJ	0.39	3.4		0.68	52.0	X	0.078	0.95		0.034	1.0	U	1.0
EXC-5	J1N1T1	1/5/2012	6510	X	1.5	1.1	J	0.37	9.2		0.64	74.3	X	0.074	0.83		0.032	0.96	U	0.96
EXC-6	J1N1T2	1/5/2012	6090	X	1.6	0.39	UJ	0.39	2.0		0.68	97.2	X	0.078	0.95	B	0.17	1.0	U	1.0
EXC-7	J1N1T3	1/5/2012	4420	X	1.5	0.39	BJ	0.37	1.5		0.65	48.5	X	0.075	0.94	B	0.16	0.96	U	0.96
EXC-8	J1N1T4	1/5/2012	6320	X	1.5	0.37	UJ	0.37	3.3		0.64	60.0	X	0.074	0.94		0.032	0.96	B	0.95
EXC-9	J1N1T5	1/5/2012	5460	X	1.4	0.35	UJ	0.35	2.6		0.61	57.9	X	0.070	0.90		0.031	0.91	U	0.91
EXC-10	J1N1T6	1/5/2012	5760	X	1.4	0.35	UJ	0.35	3.2		0.61	61.7	X	0.071	0.90		0.031	0.91	U	0.91
EXC-12	J1N1T8	1/5/2012	5930	X	1.6	0.39	UJ	0.39	2.5		0.67	62.0	X	0.077	0.88		0.034	1.0	U	1.0
SPA-7	J1N1V8	3/15/2012	7220	X	1.6	0.39	U	0.39	3.0		0.67	77.4	X	0.077	0.55		0.034	1.8	B	1.0
Duplicate of J1N1V8	J1N1W4	3/15/2012	7070	X	1.5	0.36	U	0.36	3.4		0.62	69.5	X	0.072	0.52		0.031	1.7	B	0.93
SPA-1	J1N1V2	3/15/2012	6650	X	1.5	0.52	B	0.36	3.5		0.63	77.9	X	0.072	0.56		0.031	1.0	BM	0.93
SPA-2	J1N1V3	3/15/2012	7050	X	1.4	0.35	B	0.35	2.7		0.60	70.4	X	0.069	0.56		0.030	1.4	B	0.89
SPA-3	J1N1V4	3/15/2012	6460	X	1.4	0.34	U	0.34	2.5		0.58	69.2	X	0.067	0.61		0.029	1.6	B	0.87
SPA-4	J1N1V5	3/15/2012	6570	X	1.5	0.36	U	0.36	3.0		0.63	68.0	X	0.073	0.56		0.032	1.7	B	0.94
SPA-5	J1N1V6	3/15/2012	6600	X	1.5	0.36	U	0.36	2.9		0.62	65.6	X	0.072	0.54		0.031	1.2	B	0.93
SPA-6	J1N1V7	3/15/2012	5930	X	1.5	0.37	U	0.37	2.4		0.64	60.1	X	0.074	0.56		0.032	0.95	U	0.95
SPA-8	J1N1V9	3/15/2012	7470	X	1.6	0.39	U	0.39	5.4		0.67	80.0	X	0.078	0.62		0.034	2.2		1.0
SPA-9	J1N1W0	3/15/2012	5820	X	1.5	0.37	U	0.37	2.3		0.64	74.2	X	0.074	0.53		0.032	1.5	B	0.96
SPA-10	J1N1W1	3/15/2012	7210	X	1.5	0.38	U	0.38	3.2		0.66	75.7	X	0.076	0.62		0.033	1.7	B	0.98
SPA-11	J1N1W2	3/15/2012	5710	X	1.6	0.38	U	0.38	2.4		0.66	78.4	X	0.076	0.57		0.033	2.2		0.98
SPA-12	J1N1W3	3/15/2012	6370	X	1.5	0.37	U	0.37	2.8		0.64	99.8	X	0.074	0.65		0.032	4.0		0.96
Equipment Blank	J1N1V0	1/5/2012	224	X	1.5	0.37	UJ	0.37	0.63	U	0.63	2.0	X	0.073	0.032	U	0.032	0.94	U	0.94

Attachment	1	Sheet No.	3 of 18
Originator	N. K. Schiffern	Date	05/07/12
Checked	I. B. Berezovskiy	Date	05/07/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sampling Results - Metals

Sample Location	HEIS 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
EXC-11	J1N1T7	1/5/2012	0.061	B	0.041	8370	X	14.2	9.0	X	0.058	8.0	X	0.10	15.1	X	0.22	0.155	U	0.155
Duplicate of J1N1T7	J1N1T9	1/5/2012	0.055	B	0.042	8450	X	14.3	8.6	X	0.059	8.2	X	0.10	14.9	X	0.22	0.155	U	0.155
EXC-1	J1N1R7	1/5/2012	0.042	BM	0.037	6370	X	12.9	7.6	X	0.053	8.3	X	0.091	13.5	X	0.20	0.155	U	0.155
EXC-2	J1N1R8	1/5/2012	0.083	B	0.043	9900	X	14.7	7.9	X	0.061	8.0	X	0.10	15.5	X	0.23	0.155	U	0.155
EXC-3	J1N1R9	1/5/2012	0.050	B	0.042	12200	X	14.5	5.7	X	0.060	8.7	X	0.10	16.9	X	0.22	0.155	U	0.155
EXC-4	J1N1T0	1/5/2012	0.042	U	0.042	8650	X	14.4	6.8	X	0.059	9.0	X	0.10	15.4	X	0.22	0.391		0.155
EXC-5	J1N1T1	1/5/2012	0.040	U	0.040	19000	X	13.8	22.0	X	0.057	9.9	X	0.098	21.2	X	0.21	0.242		0.155
EXC-6	J1N1T2	1/5/2012	0.042	B	0.042	6820	X	14.4	6.2	X	0.059	9.3	X	0.51	18.6	X	1.1	0.155	U	0.155
EXC-7	J1N1T3	1/5/2012	0.040	U	0.040	5570	X	13.9	4.6	X	0.057	9.3	X	0.49	16.2	X	1.1	0.155	U	0.155
EXC-8	J1N1T4	1/5/2012	0.085	B	0.040	12800	X	13.7	7.1	X	0.056	8.3	X	0.097	15.1	X	0.21	0.155	U	0.155
EXC-9	J1N1T5	1/5/2012	0.056	B	0.038	8420	X	13.1	5.7	X	0.054	8.5	X	0.093	17.5	X	0.20	0.155	U	0.155
EXC-10	J1N1T6	1/5/2012	0.069	B	0.038	8710	X	13.1	7.2	X	0.054	8.6	X	0.093	15.2	X	0.20	0.155	U	0.155
EXC-12	J1N1T8	1/5/2012	0.055	B	0.042	7700	X	14.3	8.1	X	0.059	8.3	X	0.10	15.1	X	0.22	0.155	U	0.155
SPA-7	J1N1V8	3/15/2012	0.17	B	0.042	6290	X	14.3	11.5		0.059	7.2	X	0.10	18.7		0.22	1.11		0.0155
Duplicate of J1N1V8	J1N1W4	3/15/2012	0.15	B	0.039	9880	X	13.3	10.3		0.055	6.4	X	0.095	16.8		0.21	0.195		0.0155
SPA-1	J1N1V2	3/15/2012	0.12	B	0.039	9430	X	13.4	9.5		0.055	6.9	X	0.095	16.4		0.21	0.171		0.0155
SPA-2	J1N1V3	3/15/2012	0.11	B	0.037	6590	X	12.8	12.5		0.053	6.9	X	0.091	16.3		0.20	0.0155	U	0.0155
SPA-3	J1N1V4	3/15/2012	0.14	B	0.036	6740	X	12.5	8.5		0.051	8.5	X	0.089	17.1		0.19	0.0155	U	0.0155
SPA-4	J1N1V5	3/15/2012	0.13	B	0.039	7690	X	13.5	8.8		0.056	7.4	X	0.096	18.1		0.21	0.196		0.0155
SPA-5	J1N1V6	3/15/2012	0.12	B	0.039	6570	X	13.3	9.7		0.055	7.0	X	0.094	16.8		0.21	0.0155	U	0.0155
SPA-6	J1N1V7	3/15/2012	0.072	B	0.040	7110	X	13.7	8.9		0.056	7.5	X	0.097	16.4		0.21	0.0155	U	0.0155
SPA-8	J1N1V9	3/15/2012	0.099	B	0.042	7190	X	14.4	9.3		0.059	7.1	X	0.10	17.6		0.22	0.0155	U	0.0155
SPA-9	J1N1W0	3/15/2012	0.13	B	0.040	7030	X	13.7	10.0		0.057	6.0	X	0.098	16.4		0.21	0.216		0.0155
SPA-10	J1N1W1	3/15/2012	0.14	B	0.041	8920	X	14.1	9.5		0.058	7.8	X	0.10	18.0		0.22	0.0155	U	0.0155
SPA-11	J1N1W2	3/15/2012	0.17	B	0.041	5650	X	14.1	8.7		0.058	6.4	X	0.10	16.9		0.22	0.282		0.0155
SPA-12	J1N1W3	3/15/2012	0.14	B	0.040	8400	X	13.7	8.1		0.057	7.4	X	0.098	17.8		0.21	0.0155	U	0.0155
Equipment Blank	J1N1V0	1/5/2012	0.039	U	0.039	43.2	BX	13.6	0.16	BXCUJ	0.056	0.12	BX	0.096	0.21	BX	0.21			

Attachment	1	Sheet No.	4 of 18
Originator	N. K. Schiffern	Date	05/07/12
Checked	I. B. Berezovskiy	Date	05/07/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sampling Results - Metals

Sample Location	HEIS 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
EXC-11	J1N1T7	1/5/2012	20900	X	3.8	4.0		0.27	4670	X	3.7	290	X	0.10	0.0060	U	0.0060	0.26	U	0.26
Duplicate of J1N1T7	J1N1T9	1/5/2012	20800	X	3.9	3.6		0.27	4330	X	3.7	278	X	0.10	0.0071	U	0.0071	0.26	U	0.26
EXC-1	J1N1R7	1/5/2012	21500	X	3.5	3.2		0.25	4670	X	3.4	283	X	0.091	0.0065	U	0.0065	0.24	B	0.24
EXC-2	J1N1R8	1/5/2012	20300	X	4.0	4.9		0.28	4080	X	3.9	273	X	0.10	0.0064	U	0.0064	0.57	B	0.27
EXC-3	J1N1R9	1/5/2012	22700	X	3.9	3.6		0.28	4170	X	3.8	268	X	0.10	0.0068	U	0.0068	0.28	B	0.27
EXC-4	J1N1T0	1/5/2012	23200	X	3.9	4.2		0.28	4540	X	3.8	283	X	0.10	0.0063	U	0.0063	0.27	U	0.27
EXC-5	J1N1T1	1/5/2012	57700	X	3.7	23.4		0.26	3730	X	3.6	413	X	0.098	0.0067	U	0.0067	0.72	B	0.25
EXC-6	J1N1T2	1/5/2012	24400	X	3.9	3.3		1.4	4520	X	3.8	335	X	0.10	0.0058	U	0.0058	0.27	U	0.27
EXC-7	J1N1T3	1/5/2012	25200	X	3.7	2.5		1.3	4010	X	3.6	307	X	0.098	0.0054	U	0.0054	0.26	U	0.26
EXC-8	J1N1T4	1/5/2012	22500	X	3.7	4.8		0.26	4050	X	3.6	289	X	0.097	0.019	B	0.0066	0.25	B	0.25
EXC-9	J1N1T5	1/5/2012	23200	X	3.5	3.9		0.25	4030	X	3.4	275	X	0.093	0.013	B	0.0059	0.24	U	0.24
EXC-10	J1N1T6	1/5/2012	22300	X	3.5	4.3		0.25	4040	X	3.4	277	X	0.093	0.0057	B	0.0054	0.24	U	0.24
EXC-12	J1N1T8	1/5/2012	22200	X	3.9	3.8		0.27	4100	X	3.8	284	X	0.10	0.0071	U	0.0071	0.26	U	0.26
SPA-7	J1N1V8	3/15/2012	21900	X	3.9	33.6		0.27	4370	X	3.8	319	X	0.10	0.015	B	0.0065	0.26	U	0.26
Duplicate of J1N1V8	J1N1W4	3/15/2012	18100	X	3.6	12.2		0.26	4360	X	3.5	324	X	0.095	0.019		0.0058	0.25	U	0.25
SPA-1	J1N1V2	3/15/2012	20200	X	3.6	10.3		0.26	4360	X	3.5	308	X	0.095	0.0086	BM	0.0052	0.33	B	0.25
SPA-2	J1N1V3	3/15/2012	19800	X	3.5	6.4		0.25	4510	X	3.4	302	X	0.091	0.0067	U	0.0067	0.28	B	0.24
SPA-3	J1N1V4	3/15/2012	23200	X	3.4	6.6		0.24	5530	X	3.3	330	X	0.089	0.0076	B	0.0052	0.23	U	0.23
SPA-4	J1N1V5	3/15/2012	20900	X	3.6	9.6		0.26	4470	X	3.6	305	X	0.096	0.013	B	0.0050	0.25	U	0.25
SPA-5	J1N1V6	3/15/2012	19800	X	3.6	6.5		0.26	4270	X	3.5	313	X	0.094	0.013	B	0.0051	0.25	U	0.25
SPA-6	J1N1V7	3/15/2012	20800	X	3.7	4.2		0.26	4640	X	3.6	321	X	0.097	0.0063	U	0.0063	0.25	U	0.25
SPA-8	J1N1V9	3/15/2012	21100	X	3.9	19.3		0.28	4330	X	3.8	319	X	0.10	0.0058	U	0.0058	0.27	U	0.27
SPA-9	J1N1W0	3/15/2012	18300	X	3.7	12.6		0.26	3760	X	3.6	279	X	0.098	0.048		0.0058	0.25	U	0.25
SPA-10	J1N1W1	3/15/2012	21200	X	3.8	7.9		0.27	4490	X	3.7	324	X	0.10	0.0086	B	0.0064	0.26	U	0.26
SPA-11	J1N1W2	3/15/2012	19600	X	3.8	50.5		0.27	4130	X	3.7	278	X	0.10	0.0090	B	0.0051	0.27	B	0.26
SPA-12	J1N1W3	3/15/2012	21500	X	3.7	10.9		0.26	4600	X	3.6	314	X	0.098	0.015	B	0.0060	0.25	U	0.25
Equipment Blank	J1N1V0	1/5/2012	268	X	3.7	0.40	B	0.26	23.0	X	3.6	5.9	X	0.096	0.0049	U	0.0049	0.25	U	0.25

Attachment	1	Sheet No.	5 of 18
Originator	N. K. Schiffern	Date	05/07/12
Checked	I. B. Berezovskiy	Date	05/07/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sampling Results - Metals

Sample Location	HEIS 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
EXC-11	J1N1T7	1/5/2012	10.7	X	0.12	1190		41.3	0.87	U	0.87	347	J	5.7	0.16	U	0.16	534		59.4
Duplicate of J1N1T7	J1N1T9	1/5/2012	9.7	X	0.12	1070		41.6	0.87	U	0.87	314	J	5.7	0.16	U	0.16	539		59.8
EXC-1	J1N1R7	1/5/2012	11.3	X	0.11	787		37.5	0.79	U	0.79	330	NJ	5.2	0.15	U	0.15	279		53.9
EXC-2	J1N1R8	1/5/2012	9.4	X	0.13	972		42.9	0.90	U	0.90	288	J	5.9	0.17	U	0.17	344		61.7
EXC-3	J1N1R9	1/5/2012	8.7	X	0.13	803		42.1	0.88	U	0.88	298	J	5.8	0.16	U	0.16	594		60.6
EXC-4	J1N1T0	1/5/2012	11.4	X	0.13	840		42.0	0.88	U	0.88	316	J	5.8	0.16	U	0.16	753		60.4
EXC-5	J1N1T1	1/5/2012	10.5	X	0.12	981		40.0	0.84	U	0.84	329	J	5.5	0.16	U	0.16	441		57.6
EXC-6	J1N1T2	1/5/2012	9.4	X	0.13	1140		41.9	0.88	U	0.88	302	J	5.8	0.16	U	0.16	387		60.4
EXC-7	J1N1T3	1/5/2012	7.3	X	0.12	598		40.3	0.85	U	0.85	246	J	5.6	0.16	U	0.16	301		58.0
EXC-8	J1N1T4	1/5/2012	8.8	X	0.12	1000		39.9	0.84	U	0.84	382	J	5.5	0.16	U	0.16	406		57.4
EXC-9	J1N1T5	1/5/2012	7.3	X	0.11	836		38.0	0.80	U	0.80	320	J	5.2	0.15	U	0.15	356		54.6
EXC-10	J1N1T6	1/5/2012	8.4	X	0.11	847		38.2	0.80	U	0.80	286	J	5.3	0.15	U	0.15	417		54.9
EXC-12	J1N1T8	1/5/2012	9.1	X	0.13	892		41.7	0.88	U	0.88	301	J	5.8	0.16	U	0.16	424		60.0
SPA-7	J1N1V8	3/15/2012	11.9	X	0.12	1240		41.6	0.87	U	0.87	627	X	5.7	0.16	U	0.16	289		59.9
Duplicate of J1N1V8	J1N1W4	3/15/2012	11.1	X	0.12	1200		38.8	0.81	U	0.81	516	X	5.4	0.15	U	0.15	266		55.8
SPA-1	J1N1V2	3/15/2012	9.8	X	0.12	1090		39.1	0.82	U	0.82	491	XN	5.4	0.15	U	0.15	345		56.3
SPA-2	J1N1V3	3/15/2012	12.7	X	0.11	1200		37.4	0.78	U	0.78	311	X	5.2	0.15	U	0.15	264		53.8
SPA-3	J1N1V4	3/15/2012	20.4	X	0.11	1100		36.3	0.76	U	0.76	375	X	5.0	0.14	U	0.14	272		52.3
SPA-4	J1N1V5	3/15/2012	11.6	X	0.12	1050		39.4	0.83	U	0.83	482	X	5.4	0.15	U	0.15	300		56.6
SPA-5	J1N1V6	3/15/2012	10.1	X	0.12	1170		38.7	0.81	U	0.81	323	X	5.3	0.15	U	0.15	285		55.7
SPA-6	J1N1V7	3/15/2012	9.4	X	0.12	949		39.8	0.84	U	0.84	496	X	5.5	0.16	U	0.16	300		57.3
SPA-8	J1N1V9	3/15/2012	10.3	X	0.13	1270		41.9	0.88	U	0.88	434	X	5.8	0.16	U	0.16	293		60.3
SPA-9	J1N1W0	3/15/2012	9.3	X	0.12	936		40.0	0.84	U	0.84	517	X	5.5	0.16	U	0.16	300		57.5
SPA-10	J1N1W1	3/15/2012	9.6	X	0.12	1120		40.9	0.86	U	0.86	438	X	5.6	0.16	U	0.16	377		58.9
SPA-11	J1N1W2	3/15/2012	9.0	X	0.12	941		41.1	0.86	U	0.86	451	X	5.7	0.16	U	0.16	294		59.1
SPA-12	J1N1W3	3/15/2012	9.5	X	0.12	1160		40.0	0.84	U	0.84	494	X	5.5	0.16	U	0.16	302		57.5
Equipment Blank	J1N1V0	1/5/2012	0.12	UX	0.12	49.1	B	39.4	0.83	U	0.83	148	J	5.4	0.15	U	0.15	56.7	U	56.7

Attachment	1	Sheet No.	6 of 18
Originator	N. K. Schiffern	Date	05/07/12
Checked	I. B. Berezovskiy	Date	05/07/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sampling Results - Metals, TPH, and Physical

Sample Location	HEIS Number	Sample Date	Vanadium			Zinc			TPH - diesel			TPH diesel EXT			Percent moisture (wet sample)		
			mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	pH unit	Q	PQL
EXC-11	J1N1T7	1/5/2012	53.0	X	0.095	41.4	X	0.40	1300	J	710	3800	J	1000	4.5		0.10
Duplicate of J1N1T7	J1N1T9	1/5/2012	52.2	X	0.095	40.3	X	0.40	2900	J	670	6900		980	4.2		0.10
EXC-1	J1N1R7	1/5/2012	57.0	X	0.086	40.0	X	0.36	8100		650	25000		960	4.0	M	0.10
EXC-2	J1N1R8	1/5/2012	51.6	X	0.098	46.2	X	0.42	12000		680	36000		1000	4.4		0.10
EXC-3	J1N1R9	1/5/2012	60.7	X	0.097	53.3	X	0.41	2400	J	780	6400		1100	14.6		0.10
EXC-4	J1N1T0	1/5/2012	61.9	X	0.096	47.9	X	0.41	1500	J	670	4000		980	4.3		0.10
EXC-5	J1N1T1	1/5/2012	54.4	X	0.092	128	X	0.39	9600		710	21000		1000	5.1		0.10
EXC-6	J1N1T2	1/5/2012	83.9	X	0.48	47.4	X	0.41	2800	J	680	8700		1000	4.2		0.10
EXC-7	J1N1T3	1/5/2012	76.7	X	0.46	42.1	X	0.39	670	U	670	990	U	990	3.1		0.10
EXC-8	J1N1T4	1/5/2012	61.2	X	0.091	59.8	X	0.39	6600		670	15000		980	3.9		0.10
EXC-9	J1N1T5	1/5/2012	59.3	X	0.087	43.8	X	0.37	3300	J	690	9000		1000	4.4		0.10
EXC-10	J1N1T6	1/5/2012	59.1	X	0.088	43.6	X	0.37	3700	J	700	14000		1000	4.1		0.10
EXC-12	J1N1T8	1/5/2012	58.7	X	0.096	53.0	X	0.41	1400	J	680	3900	J	1000	4.6		0.10
SPA-7	J1N1V8	3/15/2012	48.3	X	0.095	48.4	X	0.40	17000		690	57000		1000	4.4		0.10
Duplicate of J1N1V8	J1N1W4	3/15/2012	44.8	X	0.089	51.2	X	0.38	24000		640	87000		950	3.8		0.10
SPA-1	J1N1V2	3/15/2012	52.3	X	0.090	49.3	XM	0.38	71000		660	200000		980	3.8		0.10
SPA-2	J1N1V3	3/15/2012	49.7	X	0.086	42.0	X	0.36	12000		710	32000		1000	4.6		0.10
SPA-3	J1N1V4	3/15/2012	56.8	X	0.083	45.1	X	0.35	5700		690	13000		1000	4.4		0.10
SPA-4	J1N1V5	3/15/2012	53.4	X	0.090	57.8	X	0.38	25000		680	74000		1000	4.4		0.10
SPA-5	J1N1V6	3/15/2012	47.3	X	0.089	55.3	X	0.38	23000		680	65000		990	3.8		0.10
SPA-6	J1N1V7	3/15/2012	53.0	X	0.091	40.8	X	0.39	3600	J	690	8200		1000	3.8		0.10
SPA-8	J1N1V9	3/15/2012	54.0	X	0.096	42.6	X	0.41	9200		680	30000		1000	4.0		0.10
SPA-9	J1N1W0	3/15/2012	49.6	X	0.092	50.6	X	0.39	6300		690	14000		1000	3.3		0.10
SPA-10	J1N1W1	3/15/2012	55.8	X	0.094	48.2	X	0.40	18000		680	49000		1000	3.7		0.10
SPA-11	J1N1W2	3/15/2012	53.2	X	0.094	95.2	X	0.40	5700		670	14000		990	3.0		0.10
SPA-12	J1N1W3	3/15/2012	57.6	X	0.092	49.0	X	0.39	4200		680	10000		1000	4.2		0.10
Equipment Blank	J1N1V0	1/5/2012	0.32	BX	0.090	1.2	X	0.38							0.10	U	0.10

Attachment	1	Sheet No.	7 of 18
Originator	N. K. Schiffern	Date	05/07/12
Checked	I. B. Berezovskiy	Date	05/07/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (SVOAs).

CONSTITUENT	CLASS	J1N1T7, EXC-11			J1N1T9, Duplicate of J1N1T7			J1N1R7, EXC-1			J1N1R8, EXC-2		
		1/5/12 8:42			1/5/12 8:42			1/5/12 8:22			1/5/12 8:24		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	28	U	28	29	U	29	28	U	28	28	U	28
1,2-Dichlorobenzene	SVOA	22	U	22	23	U	23	22	U	22	22	U	22
1,3-Dichlorobenzene	SVOA	12	U	12	12	U	12	12	U	12	12	U	12
1,4-Dichlorobenzene	SVOA	14	U	14	14	U	14	14	U	14	13	U	13
2,4,5-Trichlorophenol	SVOA	10	U	10	10	U	10	10	U	10	9.8	U	9.8
2,4,6-Trichlorophenol	SVOA	10	U	10	10	U	10	10	U	10	9.8	U	9.8
2,4-Dichlorophenol	SVOA	10	U	10	10	U	10	10	U	10	9.8	U	9.8
2,4-Dimethylphenol	SVOA	67	U	67	69	U	69	67	U	67	65	U	65
2,4-Dinitrophenol	SVOA	340	U	340	350	U	350	340	U	340	330	U	330
2,4-Dinitrotoluene	SVOA	67	U	67	69	U	69	67	U	67	65	U	65
2,6-Dinitrotoluene	SVOA	28	U	28	29	U	29	28	U	28	28	U	28
2-Chloronaphthalene	SVOA	10	U	10	10	U	10	10	U	10	9.8	U	9.8
2-Chlorophenol	SVOA	21	U	21	22	U	22	21	U	21	21	U	21
2-Methylnaphthalene	SVOA	19	U	19	20	U	20	19	U	19	19	U	19
2-Methylphenol (cresol, o-)	SVOA	13	U	13	14	U	14	13	U	13	13	U	13
2-Nitroaniline	SVOA	51	U	51	52	U	52	50	U	50	49	U	49
2-Nitrophenol	SVOA	10	U	10	10	U	10	10	U	10	9.8	U	9.8
3+4 Methylphenol (cresol, m+p)	SVOA	33	U	33	34	U	34	33	U	33	32	U	32
3,3'-Dichlorobenzidine	SVOA	91	U	91	94	U	94	91	U	91	88	U	88
3-Nitroaniline	SVOA	74	U	74	76	U	76	74	U	74	72	U	72
4,6-Dinitro-2-methylphenol	SVOA	330	U	330	340	U	340	330	U	330	320	U	320
4-Bromophenylphenyl ether	SVOA	19	U	19	20	U	20	19	U	19	19	U	19
4-Chloro-3-methylphenol	SVOA	67	U	67	69	U	69	67	U	67	65	U	65
4-Chloroaniline	SVOA	83	U	83	85	U	85	83	U	83	81	U	81
4-Chlorophenylphenyl ether	SVOA	21	U	21	22	U	22	21	U	21	21	U	21
4-Nitroaniline	SVOA	73	U	73	75	U	75	73	U	73	71	U	71
4-Nitrophenol	SVOA	98	U	98	100	U	100	98	U	98	95	U	95
Acenaphthene	SVOA	10	U	10	11	U	11	10	U	10	10	U	10
Acenaphthylene	SVOA	17	U	17	18	U	18	17	U	17	17	U	17
Anthracene	SVOA	17	U	17	18	U	18	17	U	17	17	U	17
Benzo(a)anthracene	SVOA	20	U	20	21	U	21	20	U	20	20	U	20
Benzo(a)pyrene	SVOA	20	U	20	21	U	21	20	U	20	20	U	20
Benzo(b)fluoranthene	SVOA	27	U	27	27	U	27	26	U	26	26	U	26
Benzo(ghi)perylene	SVOA	16	U	16	17	U	17	16	U	16	16	U	16
Benzo(k)fluoranthene	SVOA	41	U	41	42	U	42	40	U	40	39	U	39
Bis(2-chloro-1-methylethyl)ether	SVOA	23	U	23	24	U	24	23	U	23	23	U	23
Bis(2-Chloroethoxy)methane	SVOA	23	U	23	24	U	24	23	U	23	23	U	23
Bis(2-chloroethyl) ether	SVOA	17	U	17	17	U	17	17	U	17	16	U	16
Bis(2-ethylhexyl) phthalate	SVOA	47	U	47	48	U	48	46	U	46	45	U	45
Butylbenzylphthalate	SVOA	44	U	44	45	U	45	43	U	43	42	U	42
Carbazole	SVOA	36	U	36	37	U	37	36	U	36	35	U	35
Chrysene	SVOA	27	U	27	28	U	28	27	U	27	27	U	27
Di-n-butylphthalate	SVOA	29	U	29	30	U	30	29	U	29	29	U	29
Di-n-octylphthalate	SVOA	15	U	15	15	U	15	15	U	15	14	U	14
Dibenz[a,h]anthracene	SVOA	19	U	19	20	U	20	19	U	19	19	U	19
Dibenzofuran	SVOA	20	U	20	21	U	21	20	U	20	20	U	20
Diethyl phthalate	SVOA	26	U	26	27	U	27	26	U	26	26	U	26
Dimethyl phthalate	SVOA	660	U	23	660	U	24	660	U	23	660	U	23
Fluoranthene	SVOA	36	U	36	37	U	37	36	U	36	35	U	35
Fluorene	SVOA	18	U	18	19	U	19	18	U	18	18	U	18
Hexachlorobenzene	SVOA	29	U	29	30	U	30	29	U	29	29	U	29
Hexachlorobutadiene	SVOA	10	U	10	10	U	10	10	U	10	9.8	U	9.8
Hexachlorocyclopentadiene	SVOA	51	U	51	52	U	52	50	U	50	49	U	49
Hexachloroethane	SVOA	22	U	22	22	U	22	21	U	21	21	U	21
Indeno(1,2,3-cd)pyrene	SVOA	22	U	22	23	U	23	22	U	22	22	U	22
Isophorone	SVOA	17	U	17	18	U	18	17	U	17	17	U	17
N-Nitroso-di-n-dipropylamine	SVOA	31	U	31	32	U	32	31	U	31	30	U	30
N-Nitrosodiphenylamine	SVOA	21	U	21	22	U	22	21	U	21	21	U	21
Naphthalene	SVOA	31	U	31	32	U	32	31	U	31	30	U	30
Nitrobenzene	SVOA	22	U	22	23	U	23	22	U	22	22	U	22
Pentachlorophenol	SVOA	330	U	330	340	U	340	330	U	330	320	U	320
Phenanthrene	SVOA	17	U	17	18	U	18	17	U	17	17	U	17
Phenol	SVOA	18	U	18	19	U	19	18	U	18	18	U	18
Pyrene	SVOA	12	U	12	13	U	13	14	J	12	12	U	12

Attachment	1	Sheet No.	8 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (SVOAs).

CONSTITUENT	CLASS	J1N1R9, EXC-3 1/5/12 8:26			J1N1T0, EXC-4 1/5/12 8:28			J1N1T1, EXC-5 1/5/12 8:30			J1N1T2, EXC-6 1/5/12 8:32		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	31	U	31	29	U	29	29	U	29	29	U	29
1,2-Dichlorobenzene	SVOA	24	U	24	22	U	22	23	U	23	23	U	23
1,3-Dichlorobenzene	SVOA	13	U	13	12	U	12	12	U	12	12	U	12
1,4-Dichlorobenzene	SVOA	15	U	15	14	U	14	14	U	14	14	U	14
2,4,5-Trichlorophenol	SVOA	11	U	11	10	U	10	10	U	10	10	U	10
2,4,6-Trichlorophenol	SVOA	11	U	11	10	U	10	10	U	10	10	U	10
2,4-Dichlorophenol	SVOA	11	U	11	10	U	10	10	U	10	10	U	10
2,4-Dimethylphenol	SVOA	72	U	72	67	U	67	68	U	68	68	U	68
2,4-Dinitrophenol	SVOA	360	U	360	340	U	340	340	U	340	340	U	340
2,4-Dinitrotoluene	SVOA	72	U	72	67	U	67	68	U	68	68	U	68
2,6-Dinitrotoluene	SVOA	31	U	31	29	U	29	29	U	29	29	U	29
2-Chloronaphthalene	SVOA	11	U	11	10	U	10	10	U	10	10	U	10
2-Chlorophenol	SVOA	23	U	23	21	U	21	22	U	22	22	U	22
2-Methylnaphthalene	SVOA	21	U	21	19	U	19	20	U	20	20	U	20
2-Methylphenol (cresol, o-)	SVOA	14	U	14	13	U	13	13	U	13	13	U	13
2-Nitroaniline	SVOA	55	U	55	51	U	51	52	U	52	51	U	51
2-Nitrophenol	SVOA	11	U	11	10	U	10	10	U	10	10	U	10
3+4 Methylphenol (cresol, m+p)	SVOA	36	U	36	34	U	34	34	U	34	34	U	34
3,3'-Dichlorobenzidine	SVOA	98	U	98	92	U	92	93	U	93	93	U	93
3-Nitroaniline	SVOA	80	U	80	75	U	75	75	U	75	75	U	75
4,6-Dinitro-2-methylphenol	SVOA	360	U	360	340	U	340	340	U	340	340	U	340
4-Bromophenylphenyl ether	SVOA	21	U	21	19	U	19	20	U	20	20	U	20
4-Chloro-3-methylphenol	SVOA	72	U	72	67	U	67	68	U	68	68	U	68
4-Chloroaniline	SVOA	89	U	89	84	U	84	85	U	85	84	U	84
4-Chlorophenylphenyl ether	SVOA	23	U	23	21	U	21	22	U	22	22	U	22
4-Nitroaniline	SVOA	79	U	79	74	U	74	75	U	75	75	U	75
4-Nitrophenol	SVOA	110	U	110	99	U	99	100	U	100	100	U	100
Acenaphthene	SVOA	11	U	11	11	U	11	11	U	11	11	U	11
Acenaphthylene	SVOA	19	U	19	17	U	17	18	U	18	18	U	18
Anthracene	SVOA	19	U	19	17	U	17	18	U	18	18	U	18
Benzo(a)anthracene	SVOA	22	U	22	20	U	20	21	U	21	21	U	21
Benzo(a)pyrene	SVOA	22	U	22	20	U	20	21	U	21	21	U	21
Benzo(b)fluoranthene	SVOA	29	U	29	27	U	27	27	U	27	27	U	27
Benzo(ghi)perylene	SVOA	17	U	17	16	U	16	17	U	17	16	U	16
Benzo(k)fluoranthene	SVOA	44	U	44	41	U	41	41	U	41	41	U	41
Bis(2-chloro-1-methylethyl)ether	SVOA	25	U	25	23	U	23	24	U	24	24	U	24
Bis(2-Chloroethoxy)methane	SVOA	25	U	25	23	U	23	24	U	24	24	U	24
Bis(2-chloroethyl) ether	SVOA	18	U	18	17	U	17	17	U	17	17	U	17
Bis(2-ethylhexyl) phthalate	SVOA	50	U	50	47	U	47	48	U	48	47	U	47
Butylbenzylphthalate	SVOA	47	U	47	44	U	44	44	U	44	44	U	44
Carbazole	SVOA	39	U	39	37	U	37	37	U	37	37	U	37
Chrysene	SVOA	29	U	29	28	U	28	28	U	28	28	U	28
Di-n-butylphthalate	SVOA	32	U	32	30	U	30	30	U	30	30	U	30
Di-n-octylphthalate	SVOA	16	U	16	15	U	15	15	U	15	15	U	15
Dibenz[a,h]anthracene	SVOA	21	U	21	19	U	19	20	U	20	20	U	20
Dibenzofuran	SVOA	22	U	22	20	U	20	21	U	21	21	U	21
Diethyl phthalate	SVOA	28	U	28	27	U	27	27	U	27	27	U	27
Dimethyl phthalate	SVOA	660	U	25	660	U	23	660	U	24	660	U	24
Fluoranthene	SVOA	39	U	39	37	U	37	37	U	37	37	U	37
Fluorene	SVOA	20	U	20	18	U	18	19	U	19	19	U	19
Hexachlorobenzene	SVOA	32	U	32	30	U	30	30	U	30	30	U	30
Hexachlorobutadiene	SVOA	11	U	11	10	U	10	10	U	10	10	U	10
Hexachlorocyclopentadiene	SVOA	55	U	55	51	U	51	52	U	52	51	U	51
Hexachloroethane	SVOA	23	U	23	22	U	22	22	U	22	22	U	22
Indeno(1,2,3-cd)pyrene	SVOA	24	U	24	22	U	22	23	U	23	23	U	23
Isophorone	SVOA	19	U	19	17	U	17	18	U	18	18	U	18
N-Nitroso-di-n-dipropylamine	SVOA	34	U	34	32	U	32	32	U	32	32	U	32
N-Nitrosodiphenylamine	SVOA	23	U	23	21	U	21	22	U	22	22	U	22
Naphthalene	SVOA	34	U	34	32	U	32	32	U	32	32	U	32
Nitrobenzene	SVOA	24	U	24	22	U	22	23	U	23	23	U	23
Pentachlorophenol	SVOA	360	U	360	340	U	340	340	U	340	340	U	340
Phenanthrene	SVOA	19	U	19	17	U	17	18	U	18	18	U	18
Phenol	SVOA	20	U	20	18	U	18	19	U	19	19	U	19
Pyrene	SVOA	13	U	13	12	U	12	13	U	13	12	U	12

Attachment	1	Sheet No.	9 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (SVOAs).

CONSTITUENT	CLASS	J1N1T3, EXC-7 1/5/12 8:34			J1N1T4, EXC-8 1/5/12 8:36			J1N1T5, EXC-9 1/5/12 8:38			J1N1T6, EXC-10 1/5/12 8:40		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	29	U	29	28	U	28	28	U	28	29	U	29
1,2-Dichlorobenzene	SVOA	23	U	23	22	U	22	22	U	22	22	U	22
1,3-Dichlorobenzene	SVOA	12	U	12	12	U	12	12	U	12	12	U	12
1,4-Dichlorobenzene	SVOA	14	U	14	14	U	14	14	U	14	14	U	14
2,4,5-Trichlorophenol	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
2,4,6-Trichlorophenol	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
2,4-Dichlorophenol	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
2,4-Dimethylphenol	SVOA	68	U	68	67	U	67	67	U	67	67	U	67
2,4-Dinitrophenol	SVOA	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dinitrotoluene	SVOA	68	U	68	67	U	67	67	U	67	67	U	67
2,6-Dinitrotoluene	SVOA	29	U	29	28	U	28	28	U	28	29	U	29
2-Chloronaphthalene	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
2-Chlorophenol	SVOA	22	U	22	21	U	21	21	U	21	21	U	21
2-Methylnaphthalene	SVOA	20	U	20	19	U	19	19	U	19	19	U	19
2-Methylphenol (cresol, o-)	SVOA	13	U	13	13	U	13	13	U	13	13	U	13
2-Nitroaniline	SVOA	51	U	51	51	U	51	51	U	51	51	U	51
2-Nitrophenol	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
3+4 Methylphenol (cresol, m+p)	SVOA	34	U	34	33	U	33	34	U	34	34	U	34
3,3'-Dichlorobenzidine	SVOA	93	U	93	91	U	91	91	U	91	92	U	92
3-Nitroaniline	SVOA	75	U	75	74	U	74	74	U	74	75	U	75
4,6-Dinitro-2-methylphenol	SVOA	340	U	340	330	U	330	340	U	340	340	U	340
4-Bromophenylphenyl ether	SVOA	20	U	20	19	U	19	19	U	19	19	U	19
4-Chloro-3-methylphenol	SVOA	68	U	68	67	U	67	67	U	67	67	U	67
4-Chloroaniline	SVOA	84	U	84	83	U	83	83	U	83	84	U	84
4-Chlorophenylphenyl ether	SVOA	22	U	22	21	U	21	21	U	21	21	U	21
4-Nitroaniline	SVOA	75	U	75	73	U	73	74	U	74	74	U	74
4-Nitrophenol	SVOA	100	U	100	98	U	98	99	U	99	99	U	99
Acenaphthene	SVOA	11	U	11	10	U	10	10	U	10	11	U	11
Acenaphthylene	SVOA	17	U	17	17	U	17	17	U	17	17	U	17
Anthracene	SVOA	17	U	17	17	U	17	17	U	17	17	U	17
Benzo(a)anthracene	SVOA	21	U	21	20	U	20	20	U	20	20	U	20
Benzo(a)pyrene	SVOA	21	U	21	20	U	20	20	U	20	20	U	20
Benzo(b)fluoranthene	SVOA	27	U	27	27	U	27	27	U	27	27	U	27
Benzo(ghi)perylene	SVOA	16	U	16	16	U	16	16	U	16	16	U	16
Benzo(k)fluoranthene	SVOA	41	U	41	41	U	41	41	U	41	41	U	41
Bis(2-chloro-1-methylethyl)ether	SVOA	24	U	24	23	U	23	23	U	23	24	U	24
Bis(2-Chloroethoxy)methane	SVOA	24	U	24	23	U	23	23	U	23	24	U	24
Bis(2-chloroethyl) ether	SVOA	17	U	17	17	U	17	17	U	17	17	U	17
Bis(2-ethylhexyl) phthalate	SVOA	47	U	47	47	U	47	47	U	47	47	U	47
Butylbenzylphthalate	SVOA	44	U	44	44	U	44	44	U	44	44	U	44
Carbazole	SVOA	37	U	37	36	U	36	37	U	37	37	U	37
Chrysene	SVOA	28	U	28	27	U	27	27	U	27	28	U	28
Di-n-butylphthalate	SVOA	30	U	30	29	U	29	29	U	29	30	U	30
Di-n-octylphthalate	SVOA	15	U	15	15	U	15	15	U	15	15	U	15
Dibenz[a,h]anthracene	SVOA	20	U	20	19	U	19	19	U	19	19	U	19
Dibenzofuran	SVOA	21	U	21	20	U	20	20	U	20	20	U	20
Diethyl phthalate	SVOA	27	U	27	26	U	26	26	U	26	27	U	27
Dimethyl phthalate	SVOA	660	U	24	660	U	23	660	U	23	660	U	24
Fluoranthene	SVOA	37	U	37	36	U	36	37	U	37	37	U	37
Fluorene	SVOA	19	U	19	18	U	18	18	U	18	18	U	18
Hexachlorobenzene	SVOA	30	U	30	29	U	29	29	U	29	30	U	30
Hexachlorobutadiene	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
Hexachlorocyclopentadiene	SVOA	51	U	51	51	U	51	51	U	51	51	U	51
Hexachloroethane	SVOA	22	U	22	22	U	22	22	U	22	22	U	22
Indeno(1,2,3-cd)pyrene	SVOA	23	U	23	22	U	22	22	U	22	22	U	22
Isophorone	SVOA	17	U	17	17	U	17	17	U	17	17	U	17
N-Nitroso-di-n-dipropylamine	SVOA	32	U	32	31	U	31	31	U	31	32	U	32
N-Nitrosodiphenylamine	SVOA	22	U	22	21	U	21	21	U	21	21	U	21
Naphthalene	SVOA	32	U	32	31	U	31	31	U	31	32	U	32
Nitrobenzene	SVOA	23	U	23	22	U	22	22	U	22	22	U	22
Pentachlorophenol	SVOA	340	U	340	330	U	330	340	U	340	340	U	340
Phenanthrene	SVOA	17	U	17	17	U	17	17	U	17	17	U	17
Phenol	SVOA	19	U	19	18	U	18	18	U	18	18	U	18
Pyrene	SVOA	12	U	12	12	U	12	12	U	12	12	U	12

Attachment	1	Sheet No.	10 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (SVOAs).

CONSTITUENT	CLASS	J1N1T8, EXC-12			J1N1V8, SPA-7			J1N1W4, Duplicate of J1N1V8			J1N1V2, SPA-1		
		1/5/12 8:44			3/15/12 9:50			3/15/12 9:50			3/15/12 9:20		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	28	U	28	28	U	28	29	U	29	29	U	29
1,2-Dichlorobenzene	SVOA	22	U	22	22	U	22	22	U	22	22	U	22
1,3-Dichlorobenzene	SVOA	12	U	12	12	U	12	12	U	12	12	U	12
1,4-Dichlorobenzene	SVOA	14	U	14	14	U	14	14	U	14	14	U	14
2,4,5-Trichlorophenol	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
2,4,6-Trichlorophenol	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
2,4-Dichlorophenol	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
2,4-Dimethylphenol	SVOA	67	U	67	67	U	67	67	U	67	67	U	67
2,4-Dinitrophenol	SVOA	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dinitrotoluene	SVOA	67	U	67	67	U	67	67	U	67	67	U	67
2,6-Dinitrotoluene	SVOA	28	U	28	28	U	28	29	U	29	29	U	29
2-Chloronaphthalene	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
2-Chlorophenol	SVOA	21	U	21	21	U	21	21	U	21	21	U	21
2-Methylnaphthalene	SVOA	19	U	19	19	U	19	19	U	19	19	U	19
2-Methylphenol (cresol, o-)	SVOA	13	U	13	13	U	13	13	U	13	13	U	13
2-Nitroaniline	SVOA	50	U	50	50	U	50	51	U	51	51	U	51
2-Nitrophenol	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
3+4 Methylphenol (cresol, m+p)	SVOA	33	U	33	33	U	33	34	U	34	34	U	34
3,3'-Dichlorobenzidine	SVOA	91	U	91	91	UX	91	92	UX	92	92	UX	92
3-Nitroaniline	SVOA	74	U	74	74	UX	74	74	UX	74	74	UX	74
4,6-Dinitro-2-methylphenol	SVOA	330	U	330	330	U	330	340	U	340	340	U	340
4-Bromophenylphenyl ether	SVOA	19	U	19	19	U	19	19	U	19	19	U	19
4-Chloro-3-methylphenol	SVOA	67	U	67	67	U	67	67	U	67	67	U	67
4-Chloroaniline	SVOA	83	U	83	83	U	83	84	U	84	83	U	83
4-Chlorophenylphenyl ether	SVOA	21	U	21	21	U	21	21	U	21	21	U	21
4-Nitroaniline	SVOA	73	U	73	73	U	73	74	U	74	74	U	74
4-Nitrophenol	SVOA	98	U	98	98	U	98	99	U	99	99	U	99
Acenaphthene	SVOA	10	U	10	10	U	10	11	U	11	10	U	10
Acenaphthylene	SVOA	17	U	17	17	U	17	17	U	17	17	U	17
Anthracene	SVOA	17	U	17	17	U	17	17	U	17	17	U	17
Benzo(a)anthracene	SVOA	20	U	20	45	J	20	27	J	20	20	U	20
Benzo(a)pyrene	SVOA	20	U	20	92	J	20	82	J	20	64	J	20
Benzo(b)fluoranthene	SVOA	26	U	26	170	JK	26	150	JK	27	120	JK	27
Benzo(ghi)perylene	SVOA	16	U	16	33	J	16	37	J	16	25	J	16
Benzo(k)fluoranthene	SVOA	40	U	40	40	UK	40	41	UK	41	41	UK	41
Bis(2-chloro-1-methylethyl)ether	SVOA	23	U	23	23	U	23	23	U	23	23	U	23
Bis(2-Chloroethoxy)methane	SVOA	23	U	23	23	U	23	23	U	23	23	U	23
Bis(2-chloroethyl) ether	SVOA	17	U	17	17	U	17	17	U	17	17	U	17
Bis(2-ethylhexyl) phthalate	SVOA	46	U	46	97	JB	46	110	JB	47	47	U	47
Butylbenzylphthalate	SVOA	43	U	43	43	U	43	44	U	44	44	U	44
Carbazole	SVOA	36	U	36	36	U	36	37	U	37	37	U	37
Chrysene	SVOA	27	U	27	78	J	27	48	J	28	30	J	28
Di-n-butylphthalate	SVOA	29	U	29	29	U	29	30	U	30	30	U	30
Di-n-octylphthalate	SVOA	15	U	15	15	U	15	15	U	15	15	U	15
Dibenz[a,h]anthracene	SVOA	19	U	19	19	U	19	19	U	19	19	U	19
Dibenzofuran	SVOA	20	U	20	20	U	20	20	U	20	20	U	20
Diethyl phthalate	SVOA	26	U	26	26	U	26	27	U	27	26	U	26
Dimethyl phthalate	SVOA	660	U	23	23	U	23	23	U	23	23	U	23
Fluoranthene	SVOA	36	U	36	99	J	36	62	J	37	37	U	37
Fluorene	SVOA	18	U	18	18	U	18	18	U	18	18	U	18
Hexachlorobenzene	SVOA	29	U	29	29	U	29	30	U	30	30	U	30
Hexachlorobutadiene	SVOA	10	U	10	10	U	10	10	U	10	10	U	10
Hexachlorocyclopentadiene	SVOA	50	U	50	50	U	50	51	U	51	51	U	51
Hexachloroethane	SVOA	21	U	21	21	U	21	22	U	22	22	U	22
Indeno(1,2,3-cd)pyrene	SVOA	22	U	22	29	J	22	22	U	22	22	U	22
Isophorone	SVOA	17	U	17	17	U	17	17	U	17	17	U	17
N-Nitroso-di-n-dipropylamine	SVOA	31	U	31	31	U	31	32	U	32	32	U	32
N-Nitrosodiphenylamine	SVOA	21	U	21	21	U	21	21	U	21	21	U	21
Naphthalene	SVOA	31	U	31	31	U	31	32	U	32	32	U	32
Nitrobenzene	SVOA	22	U	22	22	U	22	22	U	22	22	U	22
Pentachlorophenol	SVOA	330	U	330	330	U	330	340	U	340	340	U	340
Phenanthrene	SVOA	17	U	17	55	J	17	36	J	17	31	J	17
Phenol	SVOA	18	U	18	18	U	18	18	U	18	18	U	18
Pyrene	SVOA	12	U	12	100	J	12	48	J	12	45	J	12

Attachment	1	Sheet No.	11 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (SVOAs).

CONSTITUENT	CLASS	J1N1V3, SPA-2 3/15/12 9:25			J1N1V4, SPA-3 3/15/12 9:30			J1N1V5, SPA-4 3/15/12 9:35			J1N1V6, SPA-5 3/15/12 9:40		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	27	U	27	29	U	29	28	U	28	28	U	28
1,2-Dichlorobenzene	SVOA	22	U	22	23	U	23	22	U	22	22	U	22
1,3-Dichlorobenzene	SVOA	12	U	12	12	U	12	12	U	12	12	U	12
1,4-Dichlorobenzene	SVOA	13	U	13	14	U	14	14	U	14	14	U	14
2,4,5-Trichlorophenol	SVOA	9.8	U	9.8	10	U	10	10	U	10	10	U	10
2,4,6-Trichlorophenol	SVOA	9.8	U	9.8	10	U	10	10	U	10	10	U	10
2,4-Dichlorophenol	SVOA	9.8	U	9.8	10	U	10	10	U	10	10	U	10
2,4-Dimethylphenol	SVOA	65	U	65	68	U	68	66	U	66	66	U	66
2,4-Dinitrophenol	SVOA	330	U	330	340	U	340	330	U	330	330	U	330
2,4-Dinitrotoluene	SVOA	65	U	65	68	U	68	66	U	66	66	U	66
2,6-Dinitrotoluene	SVOA	27	U	27	29	U	29	28	U	28	28	U	28
2-Chloronaphthalene	SVOA	9.8	U	9.8	10	U	10	10	U	10	10	U	10
2-Chlorophenol	SVOA	21	U	21	22	U	22	21	U	21	21	U	21
2-Methylnaphthalene	SVOA	19	U	19	20	U	20	19	U	19	19	U	19
2-Methylphenol (cresol, o-)	SVOA	13	U	13	13	U	13	13	U	13	13	U	13
2-Nitroaniline	SVOA	49	U	49	52	U	52	50	U	50	50	U	50
2-Nitrophenol	SVOA	9.8	U	9.8	10	U	10	10	U	10	10	U	10
3+4 Methylphenol (cresol, m+p)	SVOA	32	U	32	34	U	34	33	U	33	33	U	33
3,3'-Dichlorobenzidine	SVOA	88	UX	88	93	UX	93	90	UX	90	90	UX	90
3-Nitroaniline	SVOA	71	UX	71	76	UX	76	73	UX	73	73	UX	73
4,6-Dinitro-2-methylphenol	SVOA	320	U	320	340	U	340	330	U	330	330	U	330
4-Bromophenylphenyl ether	SVOA	19	U	19	20	U	20	19	U	19	19	U	19
4-Chloro-3-methylphenol	SVOA	65	U	65	68	U	68	66	U	66	66	U	66
4-Chloroaniline	SVOA	80	U	80	85	U	85	82	U	82	82	U	82
4-Chlorophenylphenyl ether	SVOA	21	U	21	22	U	22	21	U	21	21	U	21
4-Nitroaniline	SVOA	71	U	71	75	U	75	72	U	72	72	U	72
4-Nitrophenol	SVOA	95	U	95	100	U	100	97	U	97	97	U	97
Acenaphthene	SVOA	10	U	10	11	U	11	10	U	10	33	J	10
Acenaphthylene	SVOA	17	U	17	18	U	18	17	U	17	17	U	17
Anthracene	SVOA	17	U	17	18	U	18	17	U	17	17	U	17
Benzo(a)anthracene	SVOA	20	U	20	21	U	21	20	U	20	20	U	20
Benzo(a)pyrene	SVOA	62	J	20	61	J	21	64	J	20	61	J	20
Benzo(b)fluoranthene	SVOA	110	JK	26	110	JK	27	110	JK	26	110	JK	26
Benzo(ghi)perylene	SVOA	16	U	16	17	U	17	16	U	16	16	U	16
Benzo(k)fluoranthene	SVOA	39	UK	39	41	UK	41	40	UK	40	40	UK	40
Bis(2-chloro-1-methylethyl)ether	SVOA	23	U	23	24	U	24	23	U	23	23	U	23
Bis(2-Chloroethoxy)methane	SVOA	23	U	23	24	U	24	23	U	23	23	U	23
Bis(2-chloroethyl) ether	SVOA	16	U	16	17	U	17	17	U	17	17	U	17
Bis(2-ethylhexyl) phthalate	SVOA	98	JB	45	88	JB	48	98	JB	46	98	JB	46
Butylbenzylphthalate	SVOA	42	U	42	45	U	45	43	U	43	43	U	43
Carbazole	SVOA	35	U	35	37	U	37	36	U	36	36	U	36
Chrysene	SVOA	26	U	26	28	U	28	27	U	27	27	U	27
Di-n-butylphthalate	SVOA	28	U	28	30	U	30	29	U	29	29	U	29
Di-n-octylphthalate	SVOA	14	U	14	15	U	15	14	U	14	14	U	14
Dibenz[a,h]anthracene	SVOA	19	U	19	20	U	20	19	U	19	19	U	19
Dibenzofuran	SVOA	20	U	20	21	U	21	20	U	20	20	J	20
Diethyl phthalate	SVOA	25	U	25	27	U	27	26	U	26	26	U	26
Dimethyl phthalate	SVOA	23	U	23	24	U	24	23	U	23	23	U	23
Fluoranthene	SVOA	35	U	35	37	U	37	36	U	36	36	U	36
Fluorene	SVOA	18	U	18	19	U	19	18	U	18	26	J	18
Hexachlorobenzene	SVOA	28	U	28	30	U	30	29	U	29	29	U	29
Hexachlorobutadiene	SVOA	9.8	U	9.8	10	U	10	10	U	10	10	U	10
Hexachlorocyclopentadiene	SVOA	49	U	49	52	U	52	50	U	50	50	U	50
Hexachloroethane	SVOA	21	U	21	22	U	22	21	U	21	21	U	21
Indeno(1,2,3-cd)pyrene	SVOA	22	U	22	23	U	23	22	U	22	22	U	22
Isophorone	SVOA	17	U	17	18	U	18	17	U	17	17	U	17
N-Nitroso-di-n-dipropylamine	SVOA	30	U	30	32	U	32	31	U	31	31	U	31
N-Nitrosodiphenylamine	SVOA	21	U	21	22	U	22	21	U	21	21	U	21
Naphthalene	SVOA	30	U	30	32	U	32	31	U	31	31	U	31
Nitrobenzene	SVOA	22	U	22	23	U	23	22	U	22	22	U	22
Pentachlorophenol	SVOA	320	U	320	340	U	340	330	U	330	330	U	330
Phenanthrene	SVOA	17	U	17	18	U	18	17	U	17	66	J	17
Phenol	SVOA	18	U	18	19	U	19	18	U	18	18	U	18
Pyrene	SVOA	25	J	12	13	U	13	21	J	12	27	J	12

Attachment	1	Sheet No.	12 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (SVOAs).

CONSTITUENT	CLASS	J1N1V7, SPA-6 3/15/12 9:45			J1N1V9, SPA-8 3/15/12 9:55			J1N1W0, SPA-9 3/15/12 10:00			J1N1W1, SPA-10 3/15/12 10:05		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	29	U	29	28	U	28	27	U	27	27	U	27
1,2-Dichlorobenzene	SVOA	23	U	23	22	U	22	21	U	21	21	U	21
1,3-Dichlorobenzene	SVOA	12	U	12	12	U	12	11	U	11	12	U	12
1,4-Dichlorobenzene	SVOA	14	U	14	14	U	14	13	U	13	13	U	13
2,4,5-Trichlorophenol	SVOA	10	U	10	10	U	10	9.5	U	9.5	9.7	U	9.7
2,4,6-Trichlorophenol	SVOA	10	U	10	10	U	10	9.5	U	9.5	9.7	U	9.7
2,4-Dichlorophenol	SVOA	10	U	10	10	U	10	9.5	U	9.5	9.7	U	9.7
2,4-Dimethylphenol	SVOA	68	U	68	67	U	67	63	U	63	64	U	64
2,4-Dinitrophenol	SVOA	340	U	340	340	U	340	320	U	320	320	U	320
2,4-Dinitrotoluene	SVOA	68	U	68	67	U	67	63	U	63	64	U	64
2,6-Dinitrotoluene	SVOA	29	U	29	28	U	28	27	U	27	27	U	27
2-Chloronaphthalene	SVOA	10	U	10	10	U	10	9.5	U	9.5	9.7	U	9.7
2-Chlorophenol	SVOA	22	U	22	21	U	21	20	U	20	20	U	20
2-Methylnaphthalene	SVOA	20	U	20	19	U	19	18	U	18	18	U	18
2-Methylphenol (cresol, o-)	SVOA	13	U	13	13	U	13	12	U	12	13	U	13
2-Nitroaniline	SVOA	52	U	52	51	U	51	47	U	47	49	U	49
2-Nitrophenol	SVOA	10	U	10	10	U	10	9.5	U	9.5	9.7	U	9.7
3+4 Methylphenol (cresol, m+p)	SVOA	34	U	34	33	U	33	31	U	31	32	U	32
3,3'-Dichlorobenzidine	SVOA	93	UX	93	91	UX	91	85	UX	85	88	UX	88
3-Nitroaniline	SVOA	75	UX	75	74	UX	74	69	UX	69	71	UX	71
4,6-Dinitro-2-methylphenol	SVOA	340	U	340	330	U	330	310	U	310	320	U	320
4-Bromophenylphenyl ether	SVOA	20	U	20	19	U	19	18	U	18	18	U	18
4-Chloro-3-methylphenol	SVOA	68	U	68	67	U	67	63	U	63	64	U	64
4-Chloroaniline	SVOA	85	U	85	83	U	83	78	U	78	80	U	80
4-Chlorophenylphenyl ether	SVOA	22	U	22	21	U	21	20	U	20	20	U	20
4-Nitroaniline	SVOA	75	U	75	74	U	74	69	U	69	71	U	71
4-Nitrophenol	SVOA	100	U	100	98	U	98	92	U	92	94	U	94
Acenaphthene	SVOA	11	U	11	10	U	10	9.8	U	9.8	10	U	10
Acenaphthylene	SVOA	18	U	18	17	U	17	16	U	16	17	U	17
Anthracene	SVOA	18	U	18	17	U	17	16	U	16	17	U	17
Benzo(a)anthracene	SVOA	21	U	21	20	U	20	32	J	19	19	U	19
Benzo(a)pyrene	SVOA	21	U	21	61	J	20	86	J	19	60	J	19
Benzo(b)fluoranthene	SVOA	27	U	27	100	JK	27	160	JK	25	110	JK	25
Benzo(ghi)perylene	SVOA	17	U	17	16	U	16	40	J	15	16	U	16
Benzo(k)fluoranthene	SVOA	41	U	41	41	UK	41	38	UK	38	39	UK	39
Bis(2-chloro-1-methylethyl)ether	SVOA	24	U	24	23	U	23	22	U	22	22	U	22
Bis(2-Chloroethoxy)methane	SVOA	24	U	24	23	U	23	22	U	22	22	U	22
Bis(2-chloroethyl) ether	SVOA	17	U	17	17	U	17	16	U	16	16	U	16
Bis(2-ethylhexyl) phthalate	SVOA	94	JB	47	96	JB	47	110	JB	44	97	JB	45
Butylbenzylphthalate	SVOA	44	U	44	44	U	44	41	U	41	42	U	42
Carbazole	SVOA	37	U	37	37	U	37	34	U	34	35	U	35
Chrysene	SVOA	28	U	28	27	U	27	53	J	26	26	U	26
Di-n-butylphthalate	SVOA	30	U	30	29	U	29	27	U	27	28	U	28
Di-n-octylphthalate	SVOA	15	U	15	15	U	15	14	U	14	14	U	14
Dibenz[a,h]anthracene	SVOA	20	U	20	19	U	19	18	U	18	18	U	18
Dibenzofuran	SVOA	21	U	21	20	U	20	19	U	19	19	U	19
Diethyl phthalate	SVOA	27	U	27	26	U	26	25	U	25	25	U	25
Dimethyl phthalate	SVOA	24	U	24	23	U	23	22	U	22	22	U	22
Fluoranthene	SVOA	37	U	37	37	U	37	59	J	34	35	U	35
Fluorene	SVOA	19	U	19	18	U	18	17	U	17	18	U	18
Hexachlorobenzene	SVOA	30	U	30	29	U	29	27	U	27	28	U	28
Hexachlorobutadiene	SVOA	10	U	10	10	U	10	9.5	U	9.5	9.7	U	9.7
Hexachlorocyclopentadiene	SVOA	52	U	52	51	U	51	47	U	47	49	U	49
Hexachloroethane	SVOA	22	U	22	22	U	22	20	U	20	21	U	21
Indeno(1,2,3-cd)pyrene	SVOA	23	U	23	22	U	22	32	J	21	21	U	21
Isophorone	SVOA	18	U	18	17	U	17	16	U	16	17	U	17
N-Nitroso-di-n-dipropylamine	SVOA	32	U	32	31	U	31	29	U	29	30	U	30
N-Nitrosodiphenylamine	SVOA	22	U	22	21	U	21	20	U	20	20	U	20
Naphthalene	SVOA	32	U	32	31	U	31	29	U	29	30	U	30
Nitrobenzene	SVOA	23	U	23	22	U	22	21	U	21	21	U	21
Pentachlorophenol	SVOA	340	U	340	330	U	330	310	U	310	320	U	320
Phenanthrene	SVOA	18	U	18	17	U	17	30	J	16	17	U	17
Phenol	SVOA	19	U	19	18	U	18	17	U	17	18	U	18
Pyrene	SVOA	12	U	12	12	U	12	61	J	11	18	J	12

Attachment	1	Sheet No.	13 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (SVOAs).

CONSTITUENT	CLASS	J1N1W2, SPA-11			J1N1W3, SPA-12			J1N1V0, Equipment Blank		
		3/15/12 10:10			3/15/12 10:50			1/5/12 8:20		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	28	U	28	28	U	28	27	U	27
1,2-Dichlorobenzene	SVOA	22	U	22	22	U	22	21	U	21
1,3-Dichlorobenzene	SVOA	12	U	12	12	U	12	12	U	12
1,4-Dichlorobenzene	SVOA	14	U	14	14	U	14	13	U	13
2,4,5-Trichlorophenol	SVOA	10	U	10	10	U	10	9.8	U	9.8
2,4,6-Trichlorophenol	SVOA	10	U	10	10	U	10	9.8	U	9.8
2,4-Dichlorophenol	SVOA	10	U	10	10	U	10	9.8	U	9.8
2,4-Dimethylphenol	SVOA	66	U	66	66	U	66	64	U	64
2,4-Dinitrophenol	SVOA	330	U	330	330	U	330	330	U	330
2,4-Dinitrotoluene	SVOA	66	U	66	66	U	66	64	U	64
2,6-Dinitrotoluene	SVOA	28	U	28	28	U	28	27	U	27
2-Chloronaphthalene	SVOA	10	U	10	10	U	10	9.8	U	9.8
2-Chlorophenol	SVOA	21	U	21	21	U	21	21	U	21
2-Methylnaphthalene	SVOA	19	U	19	19	U	19	19	U	19
2-Methylphenol (cresol, o-)	SVOA	13	U	13	13	U	13	13	U	13
2-Nitroaniline	SVOA	50	U	50	50	U	50	49	U	49
2-Nitrophenol	SVOA	10	U	10	10	U	10	9.8	U	9.8
3+4 Methylphenol (cresol, m+p)	SVOA	33	U	33	33	U	33	32	U	32
3,3'-Dichlorobenzidine	SVOA	90	UX	90	90	UX	90	88	U	88
3-Nitroaniline	SVOA	73	UX	73	73	UX	73	71	U	71
4,6-Dinitro-2-methylphenol	SVOA	330	U	330	330	U	330	320	U	320
4-Bromophenylphenyl ether	SVOA	19	U	19	19	U	19	19	U	19
4-Chloro-3-methylphenol	SVOA	66	U	66	66	U	66	64	U	64
4-Chloroaniline	SVOA	82	U	82	82	U	82	80	U	80
4-Chlorophenylphenyl ether	SVOA	21	U	21	21	U	21	21	U	21
4-Nitroaniline	SVOA	73	U	73	72	U	72	71	U	71
4-Nitrophenol	SVOA	97	U	97	97	U	97	95	U	95
Acenaphthene	SVOA	10	U	10	10	U	10	10	U	10
Acenaphthylene	SVOA	17	U	17	17	U	17	17	U	17
Anthracene	SVOA	17	U	17	17	U	17	17	U	17
Benzo(a)anthracene	SVOA	47	J	20	21	J	20	20	U	20
Benzo(a)pyrene	SVOA	99	J	20	66	J	20	20	U	20
Benzo(b)fluoranthene	SVOA	190	JK	26	120	JK	26	26	U	26
Benzo(ghi)perylene	SVOA	34	J	16	16	U	16	16	U	16
Benzo(k)fluoranthene	SVOA	40	UK	40	40	UK	40	39	U	39
Bis(2-chloro-1-methylethyl)ether	SVOA	23	U	23	23	U	23	22	U	22
Bis(2-Chloroethoxy)methane	SVOA	23	U	23	23	U	23	22	U	22
Bis(2-chloroethyl) ether	SVOA	17	U	17	17	U	17	16	U	16
Bis(2-ethylhexyl) phthalate	SVOA	120	JB	46	96	JB	46	45	U	45
Butylbenzylphthalate	SVOA	43	U	43	43	U	43	42	U	42
Carbazole	SVOA	36	U	36	36	U	36	35	U	35
Chrysene	SVOA	74	J	27	27	U	27	26	U	26
Di-n-butylphthalate	SVOA	29	U	29	29	U	29	28	U	28
Di-n-octylphthalate	SVOA	14	U	14	14	U	14	14	U	14
Dibenz[a,h]anthracene	SVOA	19	U	19	19	U	19	19	U	19
Dibenzofuran	SVOA	20	U	20	20	U	20	20	U	20
Diethyl phthalate	SVOA	26	U	26	26	U	26	25	U	25
Dimethyl phthalate	SVOA	23	U	23	23	U	23	660	U	22
Fluoranthene	SVOA	78	J	36	36	U	36	35	U	35
Fluorene	SVOA	18	U	18	18	U	18	18	U	18
Hexachlorobenzene	SVOA	29	U	29	29	U	29	28	U	28
Hexachlorobutadiene	SVOA	10	U	10	10	U	10	9.8	U	9.8
Hexachlorocyclopentadiene	SVOA	50	U	50	50	U	50	49	U	49
Hexachloroethane	SVOA	21	U	21	21	U	21	21	U	21
Indeno(1,2,3-cd)pyrene	SVOA	29	J	22	22	U	22	21	U	21
Isophorone	SVOA	17	U	17	17	U	17	17	U	17
N-Nitroso-di-n-dipropylamine	SVOA	31	U	31	31	U	31	30	U	30
N-Nitrosodiphenylamine	SVOA	21	U	21	21	U	21	21	U	21
Naphthalene	SVOA	31	U	31	31	U	31	30	U	30
Nitrobenzene	SVOA	22	U	22	22	U	22	21	U	21
Pentachlorophenol	SVOA	330	U	330	330	U	330	320	U	320
Phenanthrene	SVOA	36	J	17	17	U	17	17	U	17
Phenol	SVOA	18	U	18	18	U	18	18	U	18
Pyrene	SVOA	82	J	12	31	J	12	12	U	12

Attachment	1	Sheet No.	14 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (Oraganics).

CONSTITUENT	CLASS	J1N1T7, EXC-11			J1N1T9, Duplicate of J1N1T7			J1N1R7, EXC-1			J1N1R8, EXC-2		
		1/5/12 8:42			1/5/12 8:42			1/5/12 8:22			1/5/12 8:24		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	10	U	10	10	U	10	10	U	10
Acenaphthylene	PAH	9.2	U	9.2	9.0	U	9.0	9.0	U	9.0	9.2	U	9.2
Anthracene	PAH	3.1	U	3.1	3.1	U	3.1	3.0	U	3.0	3.1	U	3.1
Benzo(a)anthracene	PAH	3.3	U	3.3	3.2	U	3.2	3.2	U	3.2	3.3	U	3.3
Benzo(a)pyrene	PAH	6.6	U	6.6	6.4	U	6.4	6.4	U	6.4	6.5	U	6.5
Benzo(b)fluoranthene	PAH	4.3	U	4.3	4.2	U	4.2	4.2	U	4.2	4.3	U	4.3
Benzo(ghi)perylene	PAH	7.4	U	7.4	7.2	U	7.2	7.2	U	7.2	7.4	U	7.4
Benzo(k)fluoranthene	PAH	4.0	U	4.0	4.0	U	4.0	3.9	U	3.9	4.0	U	4.0
Chrysene	PAH	5.0	U	5.0	4.9	U	4.9	4.8	U	4.8	4.9	U	4.9
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	13	U	13
Fluorene	PAH	5.4	U	5.4	5.3	U	5.3	5.3	U	5.3	5.4	U	5.4
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	12	U	12	12	U	12	12	U	12
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	7.7	U	7.7
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	4.7	U	4.7	4.4	U	4.4	4.7	U	4.7	4.5	U	4.5
Aroclor-1248	PCB	4.7	U	4.7	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	12		2.6	2.5	U	2.5

CONSTITUENT	CLASS	J1N1R9, EXC-3			J1N1T0, EXC-4			J1N1T1, EXC-5			J1N1T2, EXC-6		
		1/5/12 8:26			1/5/12 8:28			1/5/12 8:30			1/5/12 8:32		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	11	U	11	10	U	10	10	U	10	10	U	10
Acenaphthylene	PAH	10	U	10	9.3	U	9.3	9.2	U	9.2	9.2	U	9.2
Anthracene	PAH	3.5	U	3.5	3.1	U	3.1	3.1	U	3.1	3.1	U	3.1
Benzo(a)anthracene	PAH	3.6	U	3.6	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3
Benzo(a)pyrene	PAH	7.3	U	7.3	6.6	U	6.6	7.2	J	6.6	6.5	U	6.5
Benzo(b)fluoranthene	PAH	4.8	U	4.8	4.3	U	4.3	20		4.3	4.3	U	4.3
Benzo(ghi)perylene	PAH	8.2	U	8.2	7.4	U	7.4	7.4	U	7.4	7.3	U	7.3
Benzo(k)fluoranthene	PAH	4.5	U	4.5	4.1	U	4.1	6.7	J	4.0	4.0	U	4.0
Chrysene	PAH	5.5	U	5.5	5.0	U	5.0	23	J	5.0	4.9	U	4.9
Dibenz[a,h]anthracene	PAH	12	U	12	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	15	U	15	13	U	13	99		13	13	U	13
Fluorene	PAH	6.0	U	6.0	5.4	U	5.4	5.4	U	5.4	5.4	U	5.4
Indeno(1,2,3-cd)pyrene	PAH	14	U	14	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	14	U	14	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	14	U	14	12	U	12	140		12	12	U	12
Pyrene	PAH	14	U	14	12	U	12	65		12	12	U	12
Aroclor-1016	PCB	3.2	U	3.2	2.8	U	2.8	2.8	U	2.8	2.8	U	2.8
Aroclor-1221	PCB	9.4	U	9.4	8.2	U	8.2	8.2	U	8.2	8.2	U	8.2
Aroclor-1232	PCB	2.3	U	2.3	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	5.4	U	5.4	4.7	U	4.7	4.8	U	4.8	4.8	U	4.8
Aroclor-1248	PCB	5.4	U	5.4	4.7	U	4.7	4.8	U	4.8	4.8	U	4.8
Aroclor-1254	PCB	3.0	U	3.0	2.6	U	2.6	2.7	U	2.7	2.7	U	2.7
Aroclor-1260	PCB	3.0	U	3.0	2.6	U	2.6	4.3	J	2.7	2.7	U	2.7

Attachment	1	Sheet No.	15 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (Oraganics).

CONSTITUENT	CLASS	J1N1T3, EXC-7			J1N1T4, EXC-8			J1N1T5, EXC-9			J1N1T6, EXC-10		
		1/5/12 8:34			1/5/12 8:36			1/5/12 8:38			1/5/12 8:40		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	10	U	10	10	U	10	10	U	10
Acenaphthylene	PAH	9.2	U	9.2	9.2	U	9.2	9.1	U	9.1	9.4	U	9.4
Anthracene	PAH	3.1	U	3.1	3.1	U	3.1	3.1	U	3.1	3.2	U	3.2
Benzo(a)anthracene	PAH	3.2	U	3.2	3.3	U	3.3	3.2	U	3.2	3.3	U	3.3
Benzo(a)pyrene	PAH	6.5	U	6.5	6.5	U	6.5	6.5	U	6.5	6.7	U	6.7
Benzo(b)fluoranthene	PAH	4.3	U	4.3	4.3	U	4.3	4.3	U	4.3	4.4	U	4.4
Benzo(ghi)perylene	PAH	7.3	U	7.3	7.3	U	7.3	7.3	U	7.3	7.5	U	7.5
Benzo(k)fluoranthene	PAH	4.0	U	4.0	4.0	U	4.0	4.0	U	4.0	4.1	U	4.1
Chrysene	PAH	4.9	U	4.9	4.9	U	4.9	4.9	U	4.9	5.0	U	5.0
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	14	U	14
Fluorene	PAH	5.4	U	5.4	5.4	U	5.4	5.3	U	5.3	5.5	U	5.5
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	13	U	13
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	13	U	13
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	13	U	13
Pyrene	PAH	12	U	12	12	U	12	12	U	12	13	U	13
Aroclor-1016	PCB	2.6	U	2.6	2.7	U	2.7	2.8	U	2.8	2.9	U	2.9
Aroclor-1221	PCB	7.5	U	7.5	7.7	U	7.7	8.2	U	8.2	8.3	U	8.3
Aroclor-1232	PCB	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	2.1	U	2.1
Aroclor-1242	PCB	4.4	U	4.4	4.5	U	4.5	4.8	U	4.8	4.8	U	4.8
Aroclor-1248	PCB	4.4	U	4.4	4.5	U	4.5	4.8	U	4.8	4.8	U	4.8
Aroclor-1254	PCB	2.4	U	2.4	2.5	U	2.5	2.7	U	2.7	2.7	U	2.7
Aroclor-1260	PCB	2.4	U	2.4	2.5	U	2.5	2.7	U	2.7	2.7	U	2.7

CONSTITUENT	CLASS	J1N1T8, EXC-12			J1N1V8, SPA-7			J1N1W4, Duplicate of J1N1V8			J1N1V2, SPA-1		
		1/5/12 8:44			3/15/12 9:50			3/15/12 9:50			3/15/12 9:20		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	10	U	10	10	U	10	17	J	10
Acenaphthylene	PAH	9.3	U	9.3	9.1	U	9.1	9.2	U	9.2	9.0	U	9.0
Anthracene	PAH	3.2	U	3.2	6.3	J	3.1	3.1	U	3.1	3.0	U	3.0
Benzo(a)anthracene	PAH	3.3	U	3.3	56	X	3.2	29	X	3.3	3.2	U	3.2
Benzo(a)pyrene	PAH	6.6	U	6.6	50		6.5	29		6.6	36	X	6.4
Benzo(b)fluoranthene	PAH	4.3	U	4.3	48		4.2	31		4.3	4.2	U	4.2
Benzo(ghi)perylene	PAH	7.4	U	7.4	7.3	U	7.3	7.4	U	7.4	7.2	U	7.2
Benzo(k)fluoranthene	PAH	4.1	U	4.1	22		4.0	13	J	4.0	3.9	U	3.9
Chrysene	PAH	5.0	U	5.0	62		4.9	38	J	5.0	13	JX	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	110	X	13	69		13	30	JX	13
Fluorene	PAH	5.5	U	5.5	5.3	U	5.3	5.4	U	5.4	5.3	U	5.3
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	28	J	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	78		12	41		12	12	J	12
Pyrene	PAH	12	U	12	130		12	74	X	12	26	JX	12
Aroclor-1016	PCB	2.9	U	2.9	2.7	U	2.7	2.7	U	2.7	2.8	U	2.8
Aroclor-1221	PCB	8.4	U	8.4	7.8	U	7.8	7.9	U	7.9	8.2	U	8.2
Aroclor-1232	PCB	2.1	U	2.1	2.0	U	2.0	2.0	U	2.0	2.1	U	2.1
Aroclor-1242	PCB	4.9	U	4.9	4.6	U	4.6	4.6	U	4.6	4.8	U	4.8
Aroclor-1248	PCB	4.9	U	4.9	4.6	U	4.6	4.6	U	4.6	4.8	U	4.8
Aroclor-1254	PCB	2.7	U	2.7	2.5	U	2.5	2.6	U	2.6	2.7	U	2.7
Aroclor-1260	PCB	2.7	U	2.7	4.3	JP	2.5	4.2	JP	2.6	3.4	JP	2.7

Attachment	1	Sheet No.	16 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (Oraganics).

CONSTITUENT	CLASS	J1N1V3, SPA-2 3/15/12 9:25			J1N1V4, SPA-3 3/15/12 9:30			J1N1V5, SPA-4 3/15/12 9:35			J1N1V6, SPA-5 3/15/12 9:40		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	10	U	10	10	U	10	10	U	10
Acenaphthylene	PAH	9.3	U	9.3	9.2	U	9.2	9.0	U	9.0	9.0	U	9.0
Anthracene	PAH	3.2	U	3.2	3.1	U	3.1	3.1	U	3.1	3.0	U	3.0
Benzo(a)anthracene	PAH	3.3	U	3.3	3.3	U	3.3	3.2	U	3.2	3.2	U	3.2
Benzo(a)pyrene	PAH	6.6	U	6.6	6.6	U	6.6	6.4	U	6.4	6.4	U	6.4
Benzo(b)fluoranthene	PAH	4.3	U	4.3	4.3	U	4.3	4.2	U	4.2	4.2	U	4.2
Benzo(ghi)perylene	PAH	7.4	U	7.4	7.4	U	7.4	7.2	U	7.2	7.2	U	7.2
Benzo(k)fluoranthene	PAH	4.1	U	4.1	4.0	U	4.0	4.0	U	4.0	3.9	U	3.9
Chrysene	PAH	9.2	J	5.0	5.0	U	5.0	9.1	J	4.9	5.6	J	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	14	J	13	13	U	13	16	J	13	19	JX	13
Fluorene	PAH	5.5	U	5.5	5.4	U	5.4	5.3	U	5.3	14	J	5.3
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	30	JX	12
Pyrene	PAH	14	JX	12	12	U	12	16	JX	12	16	JX	12
Aroclor-1016	PCB	2.9	U	2.9	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7
Aroclor-1221	PCB	8.3	U	8.3	7.8	U	7.8	7.8	U	7.8	7.9	U	7.9
Aroclor-1232	PCB	2.1	U	2.1	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0
Aroclor-1242	PCB	4.8	U	4.8	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6
Aroclor-1248	PCB	4.8	U	4.8	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6
Aroclor-1254	PCB	2.7	U	2.7	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5
Aroclor-1260	PCB	2.7	U	2.7	2.5	U	2.5	6.5	J	2.5	19		2.5

CONSTITUENT	CLASS	J1N1V7, SPA-6 3/15/12 9:45			J1N1V9, SPA-8 3/15/12 9:55			J1N1W0, SPA-9 3/15/12 10:00			J1N1W1, SPA-10 3/15/12 10:05		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.7	U	9.7	10	U	10	9.6	U	9.6	10	U	10
Acenaphthylene	PAH	8.8	U	8.8	9.3	U	9.3	8.7	U	8.7	9.1	U	9.1
Anthracene	PAH	3.0	U	3.0	3.2	U	3.2	2.9	U	2.9	3.1	U	3.1
Benzo(a)anthracene	PAH	3.1	U	3.1	3.3	U	3.3	29		3.1	3.2	U	3.2
Benzo(a)pyrene	PAH	6.2	U	6.2	6.6	U	6.6	30		6.2	6.5	U	6.5
Benzo(b)fluoranthene	PAH	4.1	U	4.1	4.3	U	4.3	40	X	4.0	4.2	U	4.2
Benzo(ghi)perylene	PAH	7.0	U	7.0	7.5	U	7.5	19	J	6.9	7.3	U	7.3
Benzo(k)fluoranthene	PAH	3.8	U	3.8	4.1	U	4.1	22		3.8	4.0	U	4.0
Chrysene	PAH	4.7	U	4.7	7.0	J	5.0	38	J	4.7	7.8	J	4.9
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	13	U	13	49	X	13	14	J	13
Fluorene	PAH	5.1	U	5.1	5.5	U	5.5	5.1	U	5.1	5.3	U	5.3
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	27	J	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	17	J	12	12	U	12
Pyrene	PAH	12	U	12	16	J	12	63		12	14	JX	12
Aroclor-1016	PCB	2.6	U	2.6	2.8	U	2.8	2.8	U	2.8	2.6	U	2.6
Aroclor-1221	PCB	7.6	U	7.6	8.2	U	8.2	8.0	U	8.0	7.6	U	7.6
Aroclor-1232	PCB	1.9	U	1.9	2.1	U	2.1	2.0	U	2.0	1.9	U	1.9
Aroclor-1242	PCB	4.4	U	4.4	4.8	U	4.8	4.6	U	4.6	4.4	U	4.4
Aroclor-1248	PCB	4.4	U	4.4	4.8	U	4.8	4.6	U	4.6	4.4	U	4.4
Aroclor-1254	PCB	2.5	U	2.5	2.7	U	2.7	2.6	U	2.6	2.5	U	2.5
Aroclor-1260	PCB	2.5	U	2.5	2.7	U	2.7	10		2.6	9.2	J	2.5

Attachment	1	Sheet No.	17 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Attachment 1. 100-D-50:4 Subsite Verification Sample Results (Oraganics).

CONSTITUENT	CLASS	J1N1W2, SPA-11			J1N1W3, SPA-12		
		3/15/12 10:10			3/15/12 10:50		
		ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.9	U	9.9	10	U	10
Acenaphthylene	PAH	8.9	U	8.9	9.1	U	9.1
Anthracene	PAH	7.2	J	3.0	3.1	U	3.1
Benzo(a)anthracene	PAH	63		3.2	17		3.2
Benzo(a)pyrene	PAH	63		6.3	13	J	6.5
Benzo(b)fluoranthene	PAH	77		4.2	13	JX	4.3
Benzo(ghi)perylene	PAH	32		7.1	7.3	U	7.3
Benzo(k)fluoranthene	PAH	30		3.9	4.0	U	4.0
Chrysene	PAH	77		4.8	17	J	4.9
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11
Fluoranthene	PAH	130		13	27	J	13
Fluorene	PAH	5.2	U	5.2	5.4	U	5.4
Indeno(1,2,3-cd)pyrene	PAH	46		12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12
Phenanthrene	PAH	58		12	12	U	12
Pyrene	PAH	160		12	27	JX	12
Aroclor-1016	PCB	2.6	U	2.6	2.7	U	2.7
Aroclor-1221	PCB	7.7	U	7.7	7.9	U	7.9
Aroclor-1232	PCB	1.9	U	1.9	2.0	U	2.0
Aroclor-1242	PCB	4.5	U	4.5	4.6	U	4.6
Aroclor-1248	PCB	4.5	U	4.5	4.6	U	4.6
Aroclor-1254	PCB	2.5	U	2.5	2.6	U	2.6
Aroclor-1260	PCB	14		2.5	2.6	U	2.6

Attachment	1	Sheet No.	18 of 18
Originator	N. K. Schiffern	Date	5/7/12
Checked	I. B. Berezovskiy	Date	5/7/12
Calc. No.	0100D-CA-V0455	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0456

Subject: 100-D-50:4 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 Sheets = 4 Total = 5	N. K. Schiffern *N.K. Schiffern*	J. D. Skoglie *[signature]*	I. B. Berezovskiy *[signature]*	D. F. Obenauer *D.F. Obenauer*	8/6/12

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	Date:	05/08/12	Calc. No.:	0100D-CA-V0456	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	05/08/12
Subject:	100-D-50:4 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					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-50:4 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) DOE-RL, 2009a, *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.

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

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

4) WCH, 2012, *100-D-50:4 Subsite Cleanup Verification 95% UCL Calculation*, 0100D-CA-V0455, Rev. 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

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

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

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	05/07/12	Calc. No.:	0100D-CA-V0456	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	05/07/12
Subject:	100-D-50:4 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No. 2 of 4	

METHODOLOGY:

The 100-D-50:4 subsite is comprised of two decision units for verification sampling. The direct contact hazard quotient and carcinogenic risk calculations for the 100-D-50:4 subsite were conservatively calculated for the entire waste site using the greater of the statistical or maximum value for each analyte in all decision units from WCH (2012). Of the contaminants of potential concern (COPCs) for this site, boron, hexavalent chromium, molybdenum, detected polycyclic aromatic hydrocarbons (PAHs), detected semivolatiles, and polychlorinated biphenyls require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead was detected above background; however, lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake. 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 2.1 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 2.9×10^{-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 7.0×10^{-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, and then multiplied by 1.0×10^{-6}. For example, the statistical value for bis(2-ethylhexyl) phthalate is 0.105 mg/kg, divided by 71.4 mg/kg, and multiplied as indicated, is 1.5×10^{-9}. Comparing the value for bis(2-ethylhexyl) phthalate, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 1.2×10^{-6}. Comparing these values to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

Table 1 shows the results of the calculations.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	05/07/12	Calc. No.:	0100D-CA-V0456	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	05/07/12
Subject:	100-D-50:4 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	3 of 4

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-D-50:4 Subsite

Contaminant 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	2.1	7,200	2.9E-04	--	--
Chromium, hexavalent[c]	1.11	240	4.6E-03	2.1	5.3E-07
Lead[d]	22.4	353	--	--	--
Molybdenum	0.72	400	1.8E-03	--	--
Polycyclic Aromatic Hydrocarbons					
Acenapthene	0.017	4800	3.5E-06	--	--
Anthracene	0.0072	24,000	3.0E-07	--	--
Benzo(a)anthracene	0.063	--	--	1.37	4.6E-08
Benzo(a)pyrene	0.063	--	--	0.137	4.6E-07
Benzo(b)fluoranthene	0.077	--	--	1.37	5.6E-08
Benzo(ghi)perylene[e]	0.032	2,400	1.3E-05	--	--
Benzo(k)fluoranthene	0.030	--	--	1.37	2.2E-08
Chrysene	0.058	--	--	13.7	4.2E-09
Fluorene	0.014	3,200	4.4E-06	--	--
Fluoranthene	0.099	3,200	3.1E-05	--	--
Indeno(1,2,3-cd) pyrene	0.046	--	--	1.37	3.4E-08
Phenanthrene[e]	0.140	24,000	5.8E-06	--	--
Pyrene	0.097	2,400	4.0E-05	--	--
Semivolatiles					
Bis(2-ethylhexyl)phthalate	0.105	1,600	6.6E-05	71.4	1.5E-09
Dibenzofuran	0.020	160	1.3E-04	--	--
Polychlorinated Biphenyls					
Aroclor-1260	0.012	--	--	0.5	2.4E-08
Total Petroleum Hydrocarbon					
TPH-diesel range extended[f]	119	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**7.0E-03**		
Cumulative Excess Cancer Risk:					**1.2E-06**

Note:

[a] = From WCH (2012).

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

[c] = Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3), 1996.

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

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

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

-- = not applicable

RAG = remedial action goal

PAH = polycyclic aromatic hydrocarbons

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	05/07/12	Calc. No.:	0100D-CA-V0456	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	05/07/12
Subject:	100-D-50:4 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	4 of 4

CONCLUSION:

The calculations in Table 1 demonstrate that the 100-D-50:4 subsite meets the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk, respectively, as identified in the RDR/RAWP (DOE-RL 2009a) and SAP (DOE-RL 2009b). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

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-V0457

Subject: 100-D-50:4 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	I. B. Berezovskiy I. B. Berezovskiy	H. D. Skoglie [signature]	D. F. Obenauer D. F. Obenauer	8/6/12

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	Date:	5/7/2012	Calc. No.:	0100D-CA-V0457	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	5/7/2012
Subject:	100-D-50:4 Subsite Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation					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-50:4 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, 2012, *100-D-50:4 Subsite Cleanup Verification 95% UCL Calculations*, 0100D-CA-V0455, 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:	5/8/2012	Calc. No.:	0100D-CA-V0457	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	5/8/2012
Subject:	100-D-50:4 Subsite Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation					Sheet No. 2 of 3	

METHODOLOGY:

The 100-D-50:4 subsite was divided into two decision units for the purpose of verification sampling; excavation and staging pile area. Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at the 100-D-50:4 subsite were conservatively calculated for the entire waste site using the greater of the statistical or maximum value for each analyte in all decision units from the 95% UCL calculation (WCH 2012). Of the contaminants of potential concern (COPCs) for this site, boron and hexavalent chromium are included because no Hanford background value has been established and the distribution coefficients are less than that necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (BHI 2005). Based on this model and a vadose zone of approximately 20.5 m (67 ft) thickness, a K_d of 3.6 or greater is required to show no predicted migration to groundwater in 1,000 years. All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than or equal to 3.6. 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 statistical value for boron of 2.1 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg is 6.6×10^{-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-50:4 subsite is 2.4×10^{-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-50:4 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:	5/8/2012	Calc. No.:	0100D-CA-V0457	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	5/8/2012
Subject:	100-D-50:4 Subsite Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation					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 $>1 \times 10^{-6}$: None
4) List the cumulative excess cancer risk for carcinogens $>1 \times 10^{-5}$: None.

Table 1 shows the results of the calculations.

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 100-D-50:4 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	2.1	320	6.6E-03	--	--
Chromium, hexavalent	1.11	4.8	2.3E-01	--	--
Totals					
Cumulative Hazard Quotient:			**2.4E-01**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:
[a] = From WCH (2012).
[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-50:4 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 C

DATA QUALITY ASSESSMENT

APPENDIX C

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2011). This DQA was performed in accordance with site specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009).

A review of the sample designs (WCH 2011), the field logbooks (WCH 2012a, 2012b), 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 and radiochemical analysis (BHI 2000a, 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 100-D-50:4 waste subsite were provided by the laboratories in two sample delivery groups (SDGs): SDG J01389 and SDG JP0373. SDG J01389 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 100-D-50:4 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.

SDG J01389

This SDG comprises 13 statistical soil samples (J1N1R7 through J1N1R9, J1N1T0 through J1N1T9) from the 100-D-50:4 excavation. This SDG includes a field duplicate pair (J1N1T7/J1N1T9). These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), carbon-14 and tritium by liquid scintillation counting, strontium-90, isotopic plutonium, and by gamma energy analysis (GEA). In addition, one equipment blank (J0N1V0) was collected and analyzed for ICP metals, mercury, and SVOCs. SDG J01366 was submitted for third-party validation. Minor deficiencies are as follows:

In the radionuclide analysis, all of the carbon-14 and tritium results were qualified by third-party validation as estimated with "J" flags, due to lack of a matrix spike (MS) analysis. Estimated or "J"-flagged data are acceptable for decision-making purposes.

In the radionuclide analysis, all of the plutonium-238 results were qualified by third-party validation as estimated with "J" flags, due to lack of a laboratory control sample (LCS) analysis. Estimated or "J"-flagged data are acceptable for decision-making purposes.

In the SVOC analysis, the dimethyl phthalate results are of similar magnitude as the method blank result. Third-party validation raised all dimethyl phthalate results to the required quantitation limit of 660 µg/kg and qualified the results as undetected and flagged "U." The data are usable for decision-making purposes.

In the ICP metals analysis, the chromium result for sample J1N1V0 is of a similar magnitude as the method blank result. Third-party validation qualified the chromium result as undetected and flagged "UJ." The data is usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for five analytes (aluminum, iron, manganese, antimony, and silicon). 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 analytical 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 original MS. The original MS recoveries for antimony and silicon were 58% and 14%, respectively. All antimony and silicon data for SDG J01389 were considered estimated and flagged "J" by third-party validation due to the MS recoveries outside the quality control (QC) limits. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, all silicon results were considered estimated and flagged "J" by third-party validation due to an LCS below QC limits at 19%. Estimated data are usable for decision-making purposes.

SDG JP0348

This SDG comprises 13 statistical soil samples (J1N1V2 through J1N1V9, J1N1W0 through J1N1W4) from the 100-D-50:4 waste staging pile footprint. This SDG includes a field duplicate pair (J1N1V8/J1N1W4). These samples were analyzed for ICP metals, mercury, hexavalent chromium, PAH, SVOCs, PCBs, carbon-14 and tritium by liquid scintillation counting, strontium-90, isotopic plutonium, and by GEA. Minor deficiencies are as follows:

In the radionuclide analysis, all of the carbon-14 and tritium results may be considered estimated due to lack of an MS analysis. The data are acceptable for decision-making purposes.

In the radionuclide analysis, all of the plutonium-238 results may be considered estimated due to lack of an LCS analysis. Estimated data are acceptable for decision-making purposes.

In the hexavalent chromium analysis, the relative percent difference (RPD) was above the QC criteria at 69.5%; therefore, all hexavalent chromium data may be considered estimated. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the detected bis(2-ethylhexyl)phthalate results may be considered estimated due to method blank contamination. The data are usable for decision-making purposes.

In the SVOC analysis, the LCS recoveries for 4-chloroaniline (42%), 3,3'-dichlorobenzidine (15%), and 3-nitroaniline (45%) were below the QC criteria. The results for these SVOCs may be considered estimated. The data are acceptable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for five analytes (aluminum, iron, manganese, antimony, and silicon). 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 analytical 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 original MS. The original MS recoveries for antimony and silicon were 46% and 5%, respectively. All antimony and silicon data for SDG JP0348 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, all silicon results may be considered estimated due to an LCS below QC limits at 14%. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the RPDs for boron (36%), mercury (34%), and zinc (96%) are above the QC criteria of 30%. Therefore, the results for these constituents may be considered estimated. Estimated data are usable for decision-making purposes.

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 quality assurance (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, 2012b) are shown in Table C-1. The main and QA/QC sample results are presented in Appendix B.

Table C-1. Field Quality Assurance/Quality Control Samples.

Sample Area	Main Sample	Duplicate Sample
Excavation	J1N1T7	J1N1T9
Staging pile area	J1N1V8	J1N1W4

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 contaminant of potential concern. Relative percent differences 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 B provides details on duplicate pair evaluation and RPD calculation.

The RPDs for calcium (44.4%) and TPH-diesel (41.7%) in the staging pile area duplicate are above the acceptance criteria of 30%. A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. The lead, fluoranthene, phenanthrene, and pyrene data for the staging pile area duplicate 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.

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-50:4 waste site verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for the 100-D-50:4 waste 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 Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix B.

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, EPA/240/B-06/001, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2011, *Work Instruction for Verification Sampling of the 100-D-50:4, Gas Recirculation Pipelines,* Work Instruction No. 0100D-WI-G0108, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2012a, *100D Field Remediation Miscellaneous Sampling Activities*, Logbook EL-1662, pp. 46-48, Washington Closure Hanford, Richland, Washington.

WCH, 2012b, *100D Field Remediation Miscellaneous Sampling Activities*, Logbook EL-1662-01, pp. 3-4, Washington Closure Hanford, Richland, Washington.