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

0098533

11-AMRC-0203

AUG 31 2011

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 AND SUPPORTING DOCUMENTATION FOR THE 116-D-5, 1904-D OUTFALL STRUCTURE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2010-012 and supporting "Remaining Sites Verification Package for the 116-D-5, 1904-D Outfall Structure," Revision 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

AMRC:TCP

Attachment

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

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

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Date Submitted: 4/07/2010 Originator: M. L. Proctor Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-DR-1 Waste Site Code: 116-D-5 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2010-012

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

Description of current waste site condition:
The 116-D-5, 1904-D Outfall Structure was a liquid waste site that operated from 1944 to 1967, for the disposal of reactor cooling water and continued to operate until 1975, for the disposal of 100-D Area process sewer effluents. Reactor cooling water collected and was temporarily stored in the 116-D-7, 107-D Retention Basin and 116-DR-9, 107-DR Retention Basin before being discharged to the Columbia River via the outfall structure and associated 100-D-60 river effluent pipelines. Process sewer wastes were discharged directly to the 116-D-5 outfall structure via the 100-D-31:7 process sewer main line. The outfall structure was demolished and caved into itself and backfilled with soil in 1998.

Remediation, verification sampling, and comparison of residual contaminant concentrations against cleanup levels have been performed in accordance with remedial action objectives (RAOs) and remedial action goals (RAGs) established by the *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland, Washington and the *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 site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for reclassification:
In accordance with this evaluation, the verification sampling results support a reclassification of the 116-D-5 site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs established in the Remaining Sites ROD. The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The analytical results also demonstrate that residual contaminant concentrations at the site are protective of groundwater and the Columbia River. The 116-D-5 site was originally excavated to a depth of 5 m (16 ft) on the northwestern side of the excavation and 10 m (33 ft) on the southeastern side of the excavation. Additional remediation was conducted in the deep zone of the site resulting in the maximum depth of approximately 6 m (20 ft) on the northwestern side of the excavation and 11 m (36 ft) on the southeastern side of the excavation. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 116-D-5, 1904-D Outfall Structure* (attached).

Regulator Comments:
Approval of this WSRF documents regulator agreement that the 116-D-5 waste site qualifies for "Interim Closed Out" under this Interim Action ROD. In addition, Ecology has evaluated the data for this site 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 site'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.

M. S. French DOE Federal Project Director (printed)	MS French Signature	8/10/11 Date
N. Menard Ecology Project Manager (printed)	Nina M. Menard Signature	8/10/11 Date
N/A		

REMAINING SITES VERIFICATION PACKAGE FOR THE 116-D-5, 1904-D OUTFALL STRUCTURE

Attachment to Waste Site Reclassification Form 2010-012

April 2010

REMAINING SITES VERIFICATION PACKAGE FOR THE 116-D-5, 1904-D OUTFALL STRUCTURE

EXECUTIVE SUMMARY

The 116-D-5, 1904-D Outfall Structure waste site, part of the 100-DR-1 Operable Unit, was a liquid waste site on the bank of the Columbia River that operated from 1944 to 1967, for the disposal of reactor cooling water and continued to operate until 1975, for the disposal of 100-D Area process sewer effluents (WHC 1993). Reactor cooling water collected and was temporarily stored in the 116-D-7, 107-D Retention Basin and 116-DR-9, 107-DR Retention Basin before being discharged to the Columbia River via the outfall structure and associated 100-D-60 river effluent pipelines. Process sewer wastes were discharged directly to the 116-D-5 outfall structure via the 100-D-31:7 process sewer main line. Influents to the outfall structure discharged into the upper chamber of the concrete outfall structure, flowed through a bar grillwork, and fell about 6 m (20 ft) to the lower chamber of the outfall structure. It then overflowed from the lower chamber into the outfall pipe (100-D-60) to the river. In the event that the outfall pipeline could not accommodate the full discharge capacity, the outfall structure was designed so that effluent would overflow into an emergency spillway (100-D-65) that discharged to the river. The outfall structure was demolished and caved into itself and backfilled with soil in 1998.

Remedial action at the 116-D-5 waste site was performed between February 6 and April 1, 2009. Additional remediation was conducted on March 15, 2011 to remove residual contamination identified after the initial round of verification sampling. The site was originally excavated to a depth of approximately 5 m (16 ft) on the northwestern side of the excavation and 10 m (33 ft) on the southeastern side of the excavation. The depth of the excavation following additional remediation is approximately 6 m (20 ft) on the northwestern side and 11 m (36 ft) on the southeastern side of the excavation. The engineered structure was completely removed. The entire excavation resulted in approximately 2,275 bank cubic meters (2,976 bank cubic yards) of contaminated soil and debris being removed for disposal to the Environmental Restoration Disposal Facility (ERDF). Some of the material removed from the excavation was placed in a staging pile area prior to being loaded out for disposal at ERDF.

Following site remediation, verification sampling was conducted in November 2009. Replacement samples were collected on March 16, 2011, for those locations that required additional remediation after the first round of verification samples indicated residual contamination present in the deep zone of the site. The results of the verification sampling indicate that remedial action objectives (RAOs) and remedial action goals (RAGs) for direct exposure, protection of groundwater, and protection of the Columbia River have been met. 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 a reclassification decision for the 116-D-5 site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2007).

In accordance with this evaluation, the verification sampling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs 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).

Table ES-1. Summary of Remedial Action Goals for the 116-D-5 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of less than 15-mrem/yr above background over 1,000 years.	Activities of radionuclide contaminants were less than 1/10th of the shallow zone lookup values equivalent to a 15 mrem/yr dose rate. Therefore, cumulative radionuclide activities are below the 15 mrem/yr dose rate.	Yes
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COC/COPC concentrations are below the direct exposure RAGs.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COCs/COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for the 116-D-5 waste site (7.9×10^{-3}) is <1.	
	Attain excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	Excess cancer risk values for individual nonradionuclide COCs/COPCs is $<1 \times 10^{-6}$.	
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess carcinogenic risk for the 116-D-5 waste site (9.0×10^{-7}) is $<1 \times 10^{-5}$.	
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 regulations:[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 more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide from DOE Order 5400.5.[b]	Activity of the only alpha-emitting radionuclide COPC detected, plutonium 239/240, is less than lookup values.	
	Meet total uranium standard of 21.2 pCi/L.[c]	The uranium results were less than background; therefore, the uranium standard of 21.2 pCi/L has been met.	

Table ES-1. Summary of Remedial Action Goals for the 116-D-5 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Residual concentrations of chromium, silver, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, and 4,4'-DDE exceed soil RAGs for groundwater and/or river protection. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), it is predicted that these constituents will not reach groundwater (and thus the Columbia River) within 1,000 years.	Yes

[a] "National Primary Drinking Water Regulations" (40 CFR 141).
[b] *Radiation Protection of the Public and the Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the Hanford Site background, the 30 µg/L uranium MCL (40 CFR 141.66) 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).

CFR = *Code of Federal Regulations*
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*
RESRAD = RESidual RADioactivity (dose model)

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 analytical results also demonstrate that residual contaminant concentrations at the site are protective of groundwater and the Columbia River. The 116-D-5 site was excavated to a maximum depth of 6 m (20 ft) on the northwestern side of the excavation and 11 m (36 ft) on the southeastern side of the excavation. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil 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 Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 116-D-5 waste site contaminants of concern/contaminants of potential concern and other constituents (Appendix A). The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for manganese, vanadium, and zinc. Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for boron and vanadium. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of manganese, vanadium, and zinc are below site background levels per the RDR/RAWP (DOE-RL 2009b), it is believed that the presence of these constituents does not pose a risk to ecological receptors. No established background value is available for boron; a final cleanup level for boron, including consideration of background, will be established through the remedial investigation/feasibility study process. Exceedences for boron will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 116-D-5, 1904-D OUTFALL STRUCTURE

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 116-D-5, 1904-D Outfall Structure waste site meets the objectives for Interim Closed Out as 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). 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 analytical results also demonstrate that residual contaminant concentrations at the site are protective of groundwater and the Columbia River. The 116-D-5 site was excavated to a maximum depth of 6 m (20 ft) on the northwestern side of the excavation and 11 m (36 ft) on the southeastern side of the excavation. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil 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 Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 116-D-5 waste site contaminants of concern/contaminants of potential concern (COCs/COPCs), and other constituents (Appendix A). The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for manganese, vanadium, and zinc. Ecological screening levels from *Washington Administrative Code* (WAC) 173-340 were exceeded for boron and vanadium. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of manganese, vanadium, and zinc are below site background levels per the RDR/RAWP (DOE-RL 2009b), it is believed that the presence of these constituents does not pose a risk to ecological receptors. No established background value is available for boron; a final cleanup level for boron, including consideration of background, will be established through the remedial investigation/feasibility study (RI/FS) process. Exceedences for boron will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 116-D-5, 1904-D Outfall Structure was located on the bank of the Columbia River approximately 122 m (400 ft) west of the former location of the 116-D-7, 107-D Retention Basin (removed and disposed from 1997 to 1998) (Figure 1).

The 116-D-5 waste site, part of the 100-DR-1 Operable Unit, was a liquid waste site that operated from 1944 to 1967, for the disposal of reactor cooling water and continued to operate until 1975, for the disposal of 100-D Area process sewer effluents (WHC 1993). Reactor

cooling water collected and was temporarily stored in the 116-D-7, 107-D Retention Basin and 116-DR-9, 107-DR Retention Basin before being discharged to the Columbia River via the outfall structure and associated 100-D-60 river effluent pipelines. Process sewer wastes were discharged directly to the 116-D-5 outfall structure via the 100-D-31:7 process sewer main line. Influents to the outfall structure discharged into the upper chamber of the concrete outfall structure, flowed through a bar grillwork, and fell about 6 m (20 ft) to the lower chamber of the outfall structure. It then overflowed from the lower chamber into the discharge pipe (100-D-60) to the river. In the event that the outfall pipeline could not accommodate the full discharge capacity, effluent would overflow to the river via an emergency overflow spillway (100-D-65). The outfall structure was demolished and caved into itself and backfilled with soil in 1998.

REMEDIAL ACTION SUMMARY

Remedial action at the 116-D-5 waste site was performed between February 6 and April 1, 2009. Additional remediation was conducted on March 15, 2011 to remove residual contamination identified after the initial round of verification sampling. The site was originally excavated to a depth of approximately 5 m (16 ft) on the northwestern side of the excavation and 10 m (33 ft) on the southeastern side of the excavation. The depth of the excavation following additional remediation is approximately 6 m (20 ft) on the northwestern side and 11 m (36 ft) on the southeastern side of the excavation. The engineered structure was completely removed. The entire excavation resulted in approximately 2,275 bank cubic meters (2,976 bank cubic yards) of contaminated soil and debris removed for disposal to the Environmental Restoration Disposal Facility (ERDF). The engineered structure was completely removed. A post-excavation topographic survey is shown in Figure 2. Some of the material removed from the excavation was placed in a staging pile area prior to being loaded out for disposal to ERDF.

The southern edge of the 116-D-5 footprint is collocated with a section of concrete pipeline associated with the 100-D-31:7 waste site. Overburden material has been removed from over the top of the northernmost end of the pipeline where it enters the 116-D-5 outfall. The area associated with the 100-D-31:7 remediation is shown in Figure 3. A photograph of the southern edge of the 116-D-5 waste site where the 100-D-31:7 pipeline enters the 116-D-5 outfall is shown in Figure 4.

A photograph of the 116-D-5 waste site following remediation is shown in Figure 5. The photograph is taken from the eastern side of the excavation looking towards the west. The 100-D-31:7 pipeline is visible on the southern side of the excavation.

Figure 1. 116-D-5 Waste Site Location Map.

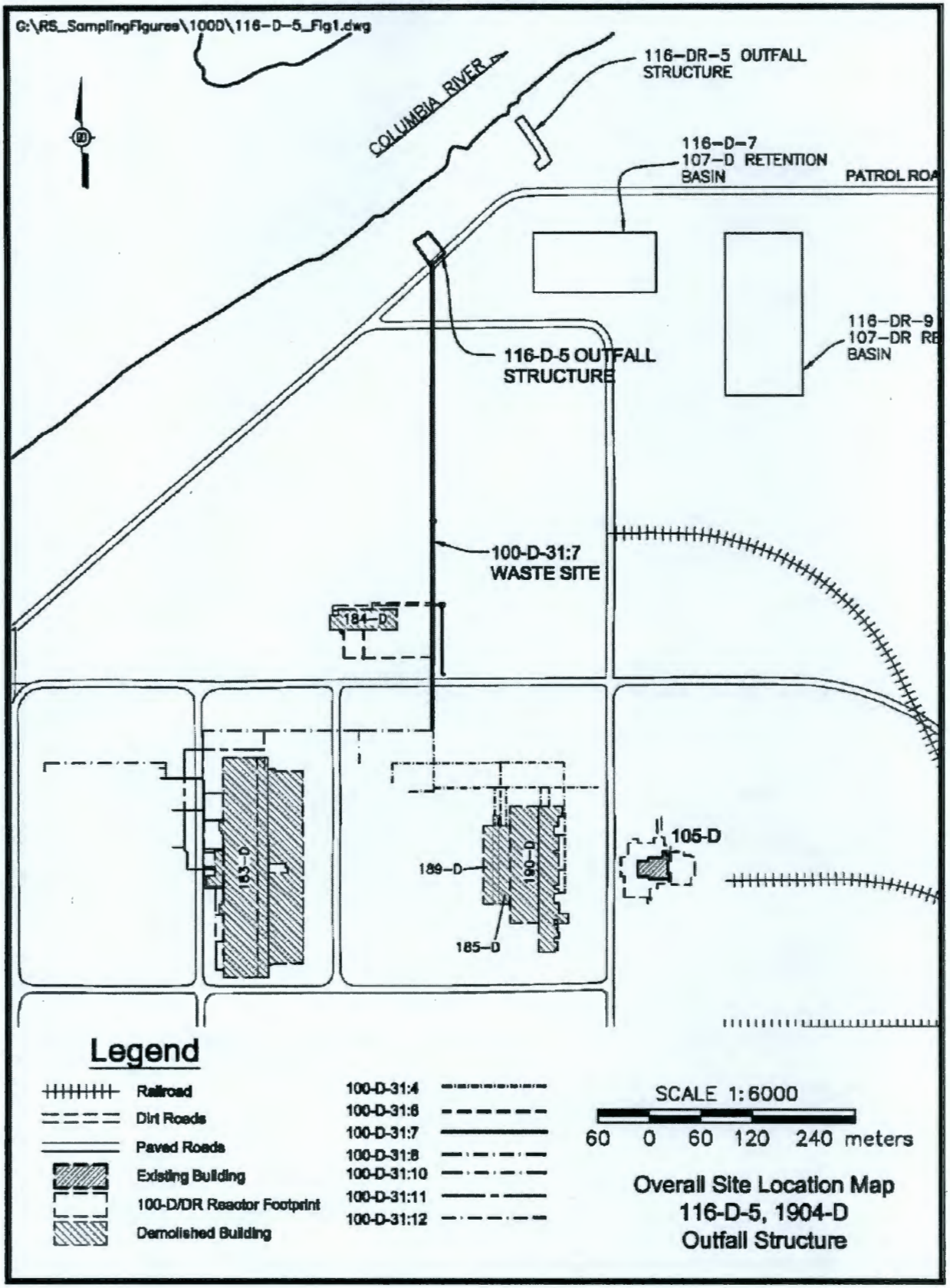

Figure 2. 116-D-5 Post-Excavation Topographic Survey.

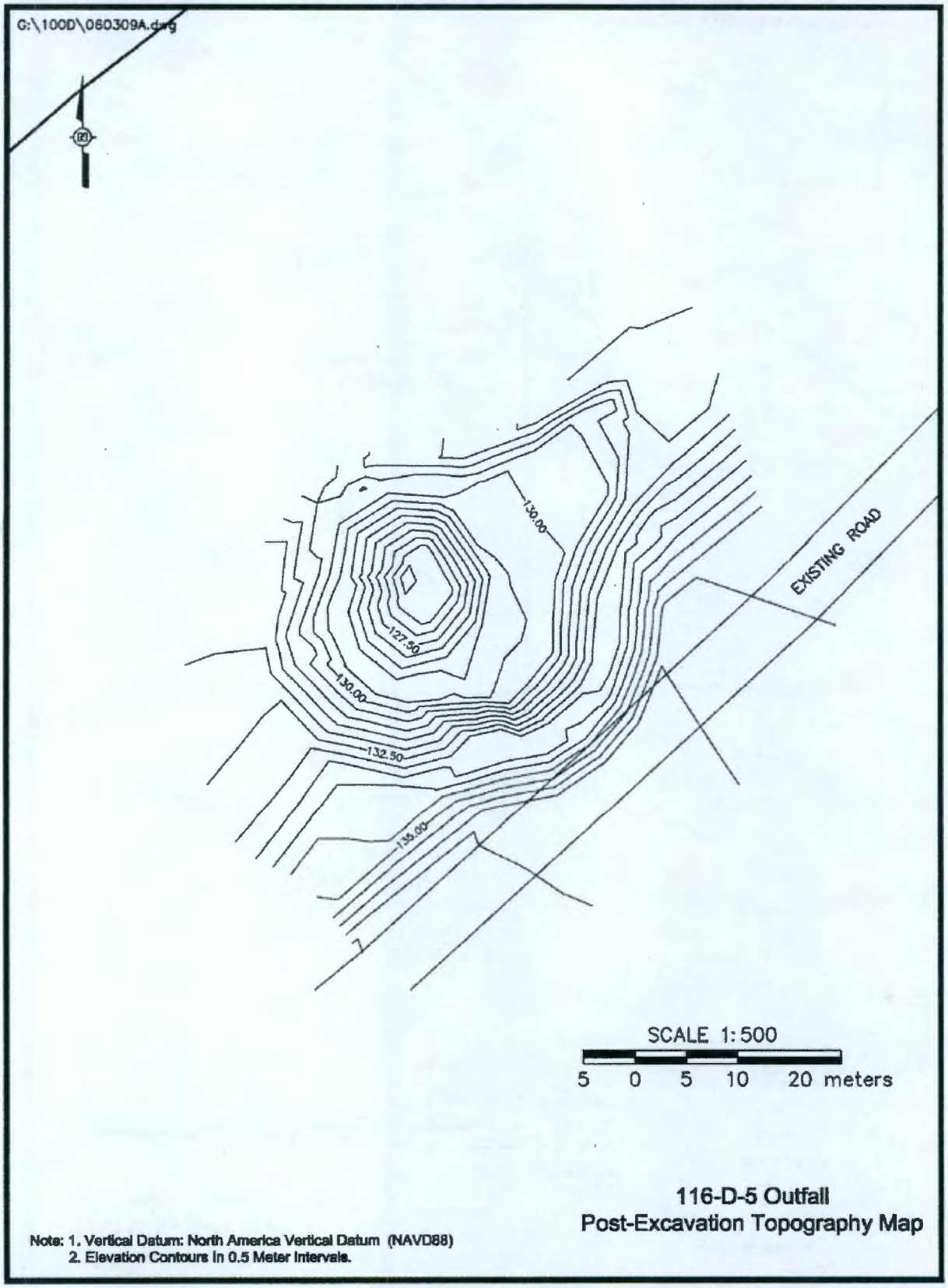

Figure 3. 116-D-5 Excavation Boundary.

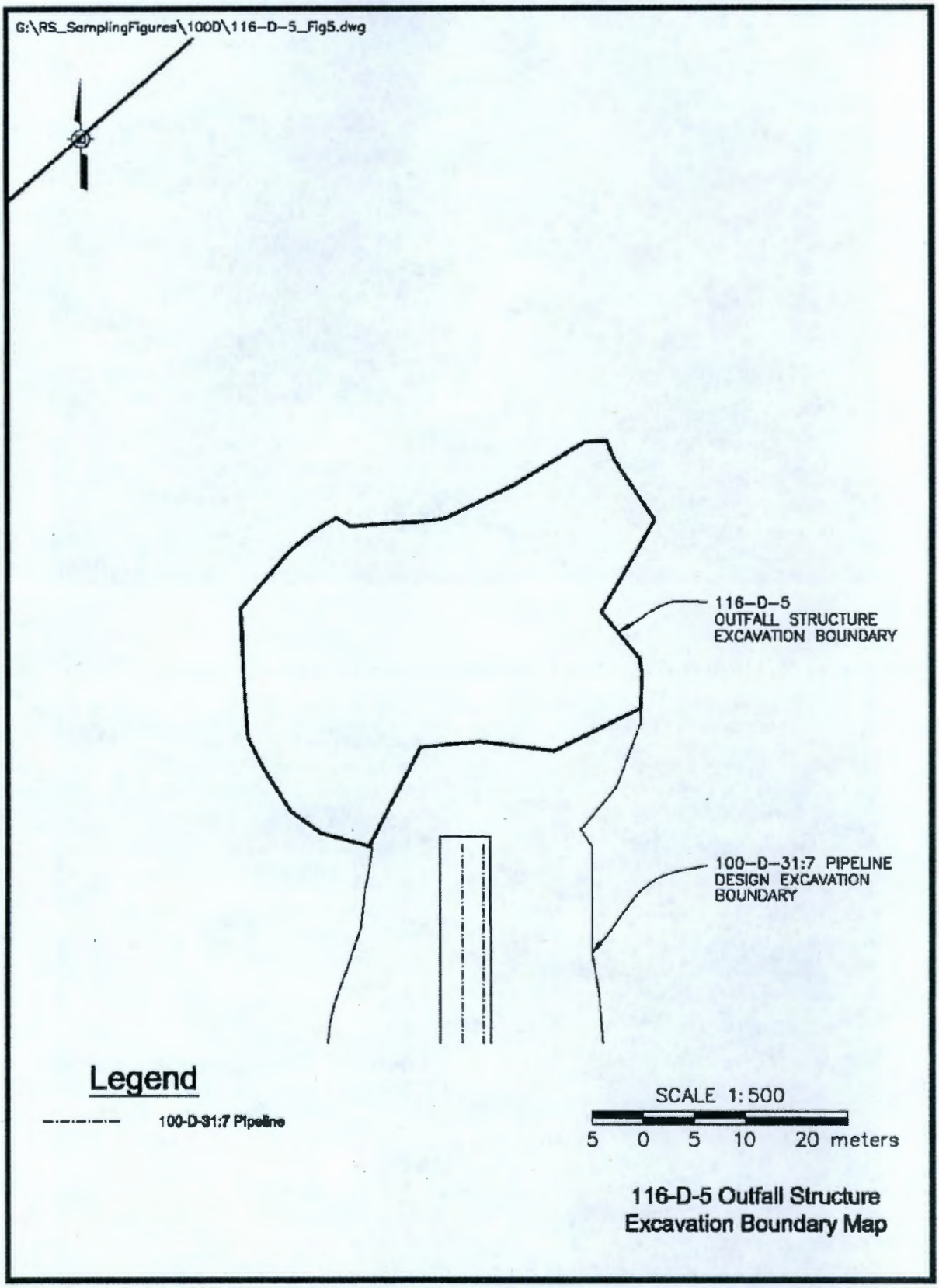

Figure 4. 116-D-5 Excavation South Looking Towards 100-D-31:7 Pipeline.

Figure 5. 116-D-5 Waste Site Post-Remediation Photograph (Looking West).

Global Positioning Environmental Radiological Surveyor (GPERS) surveys capable of detecting gamma radiation were conducted at the 116-D-5 waste site upon completion of remedial action activities (Appendix B). Areas exhibiting elevated radiological activity were identified near the base of the excavation as indicated on the GPERS radiological survey gamma track map (Figure B-1). The highest activity reported is 3,893 gross counts per minute. The radiological activity is present at a depth of greater than 4.6 m (15 ft) below ground surface, taking into account the slope of the surface at the site. Therefore, the site was stratified into a deep zone decision unit and a shallow zone decision unit as provided for in the RDR/RAWP (DOE-RL 2009b).

No additional material was removed, and no further radiological surveys were conducted within the excavation. Figure B-2 shows the radiological survey of the footprint of the waste staging pile area. No elevated radiological activity was detected. The overburden soil stockpiles were surveyed in 1-m (3-ft) lifts. No elevated radiological activity was detected as indicated on the GPERS radiological survey gamma track maps (Figures B-3 and B-4).

VERIFICATION SAMPLING

Verification sampling for the 116-D-5 waste site was conducted in November 2009, to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The original verification sample results indicated residual contamination present in the deep zone of the site; therefore, additional remediation and resampling was conducted. Replacement sampling following additional remediation was conducted on March 16, 2011. The verification sample results, provided in Appendix C, indicate that the waste removal action achieved compliance with the remedial action objectives for the site.

Contaminants of Concern/Contaminants of Potential Concern

The COCs and COPCs for the 116-D-5, 1904-D Outfall Structure, specified in the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a) are identified as carbon-14, cesium-137, strontium-90, uranium-235, uranium-238, and plutonium-239/240. Based on process knowledge, analyses of shallow and deep zone samples at the 116-D-7 retention basin (BHI 2000), and identification as COCs/COPCs for other outfall waste sites, cobalt-60, europium-152, europium-154, europium-155, nickel-63, plutonium-238, lead, mercury, chromium (total), and hexavalent chromium have also been identified as COPCs for the 116-D-5 waste site. Americium-241, uranium-234, pesticides, SVOCs, polycyclic aromatic hydrocarbons (PAH), and ion chromatography (IC) anions were also added, as they were identified as COCs/COPCs for the 100-D-31:7 pipeline that fed into the 116-D-5 outfall. Although not considered COCs/COPCs, antimony, arsenic, barium, beryllium, boron, cadmium, cobalt, copper, manganese, magnesium, molybdenum, nickel, silver, selenium, vanadium, and zinc will be evaluated by performing analyses for the constituents of the expanded inductively coupled plasma (ICP) metals lists.

Verification Sample Design

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples that were collected. The 116-D-5 waste site was divided into four decision units for verification sampling: the shallow zone excavation, the deep zone excavation, the staging pile area, and the overburden soil stockpile.

The decision rule for demonstrating compliance with the cleanup criteria requires comparison of the true population mean, as estimated by the 95% upper confidence limit (UCL) on the sample mean, with the cleanup level. Therefore, a statistical sampling design is the preferred verification sampling approach for this site because the distribution of potential residual soil contamination over the site is uncertain. The Washington State Department of Ecology (Ecology) publication *Guidance on Sampling and Data Analysis Methods* (Ecology 1995) recommends that systematic sampling with sample locations distributed over the entire study area be used. This sampling approach is referred to by Ecology as "area-wide sampling." Therefore, sampling locations were distributed over the entire footprint of the four decision units, using a random-start systematic grid in an effort to determine the potential residual presence of contamination.

Visual Sample Plan[1] was used as a tool to develop the statistical sampling design for the verification sampling. The post-excavation global positioning survey was used to determine the boundaries of the deep and shallow zone excavation, the staging pile area, and the overburden soil stockpile decision units that require soil verification sampling. A total of 12 soil samples were collected from each of the four decision units on a random-start, triangular grid (Figures 6 through 9). A triangular grid is used based on studies that indicate triangular grids are superior to square grids (Gilbert 1987). A summary of the samples collected and the respective analyses is provided in Table 1.

Verification Sample Results

Comparisons of the statistical results for the site COCs/COPCs against the remedial action goals (RAGs) for each decision unit are summarized in Tables 2 through 5. The laboratory-reported verification data results for all constituents are stored in the Environmental Restoration (ENRE) project-specific database prior to archival in the Hanford Environmental Information System (HEIS) and are presented as Attachment 1 of the 95% UCL calculation (Appendix C).

The primary statistical calculation to evaluate compliance with cleanup standards is the 95% UCL on the arithmetic mean of the data. The 95% UCL values for each COC/COPC are computed for each of the 116-D-5 waste site decision units as specified by the RDR/RAWP (DOE-RL 2009b), with calculations provided in Appendix C. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for a decision unit, the maximum detected value was used for comparison to the RAGs. If no detections for a given COC/COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COC/COPC.

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

Figure 6. 116-D-5 Verification Sample Locations.

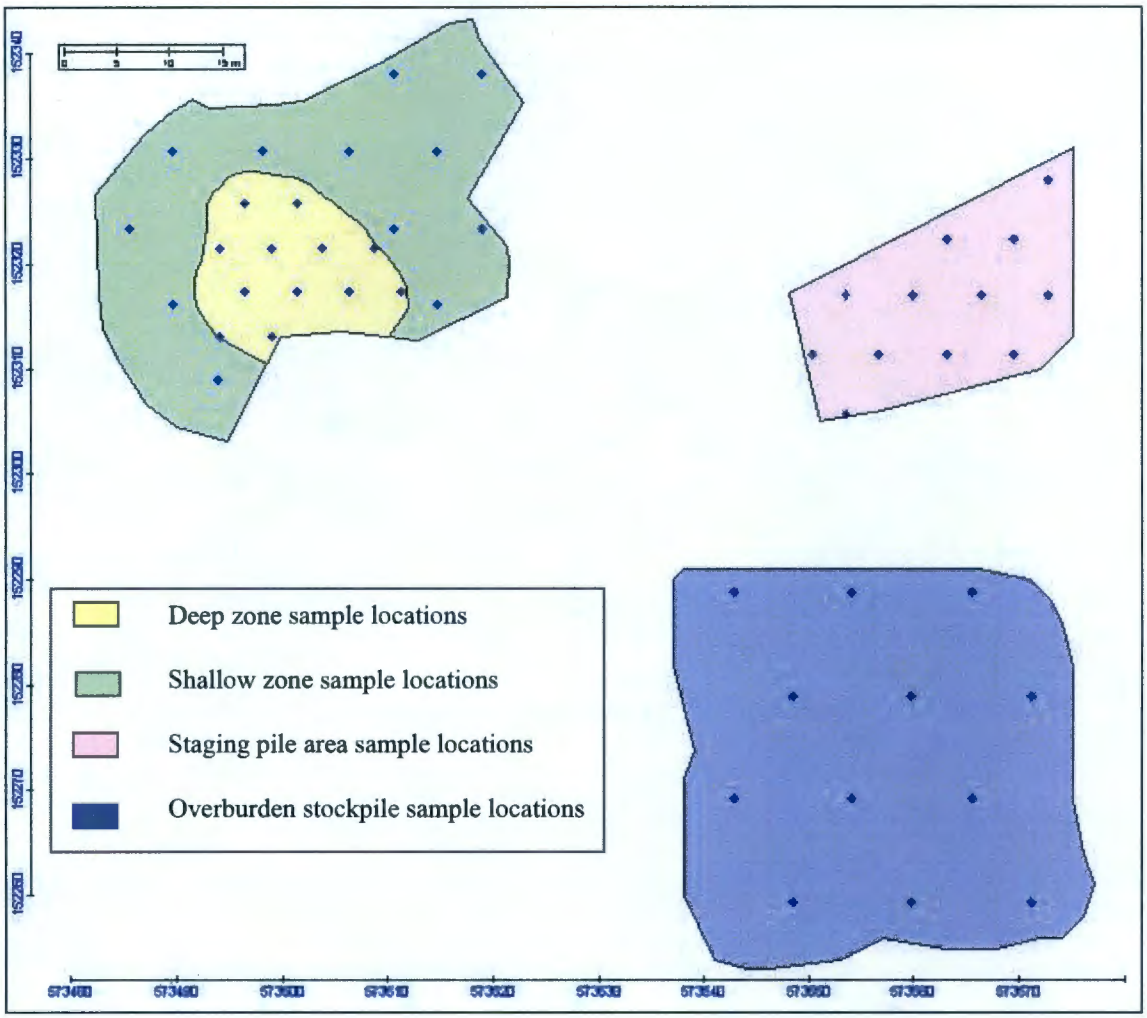

Figure 7. Excavation Shallow and Deep Zone Sample Locations.

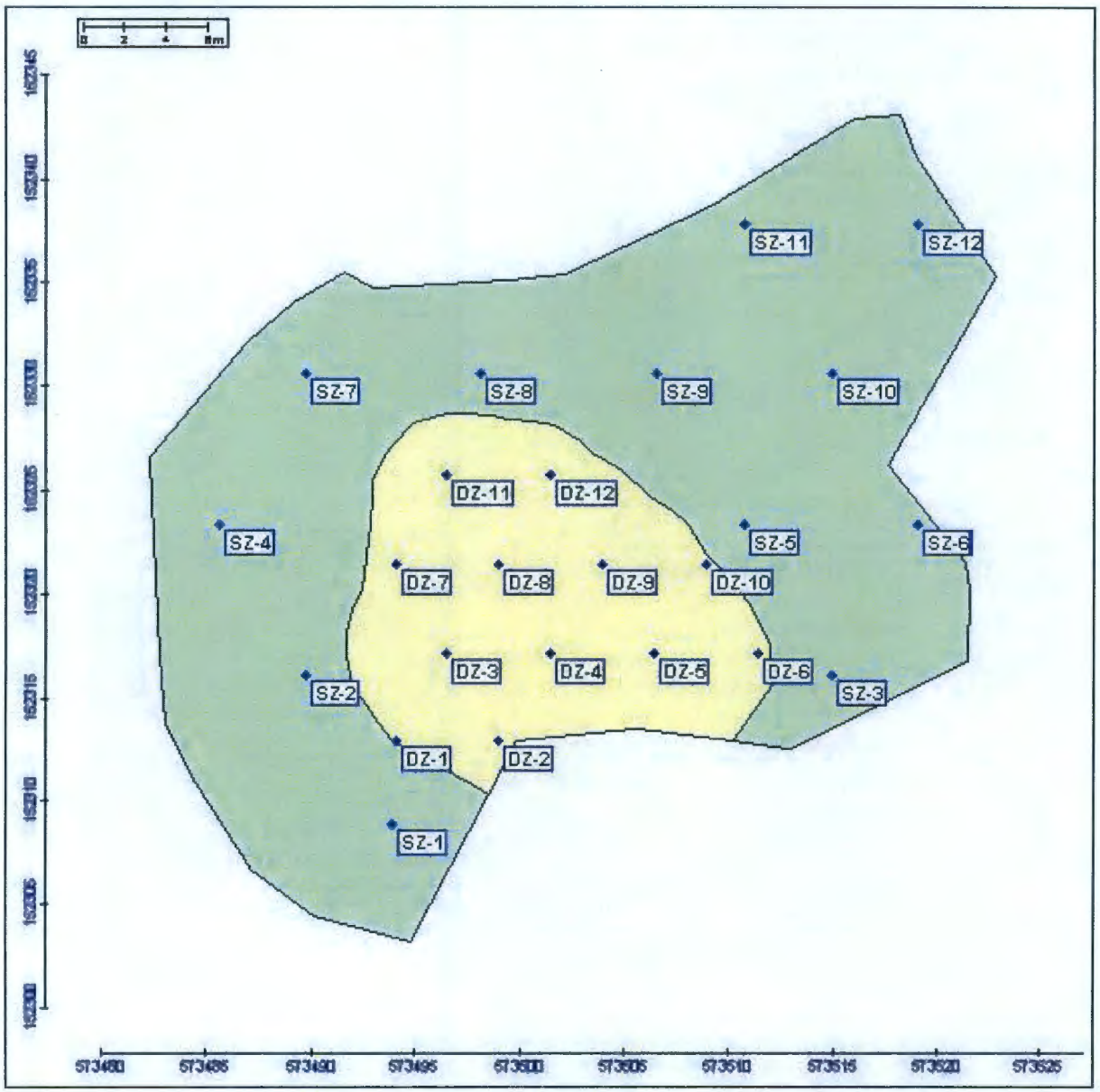

Figure 8. Overburden Soil Stockpile Sample Locations.

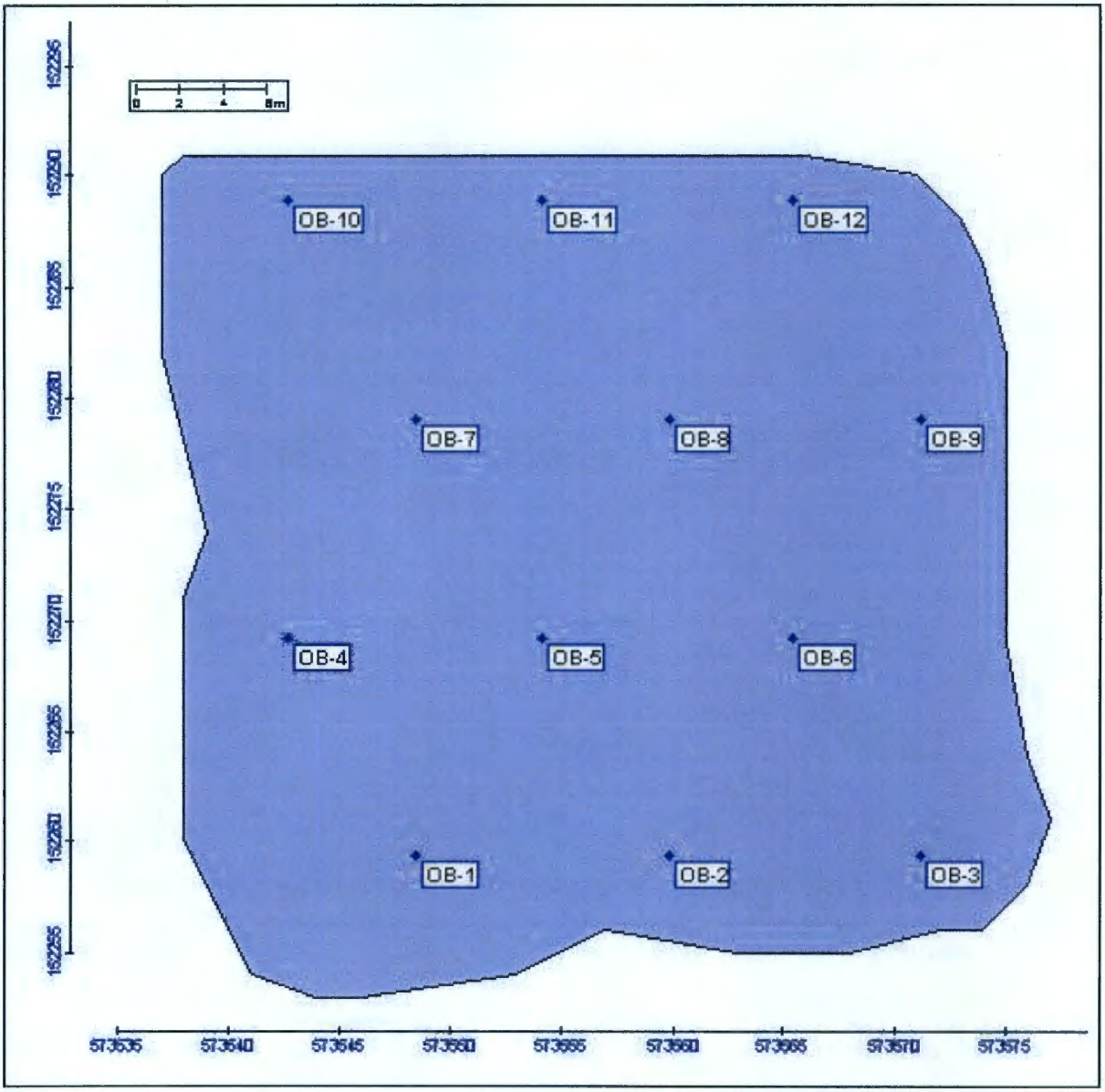

Figure 9. Waste Staging Pile Area Sample Locations.

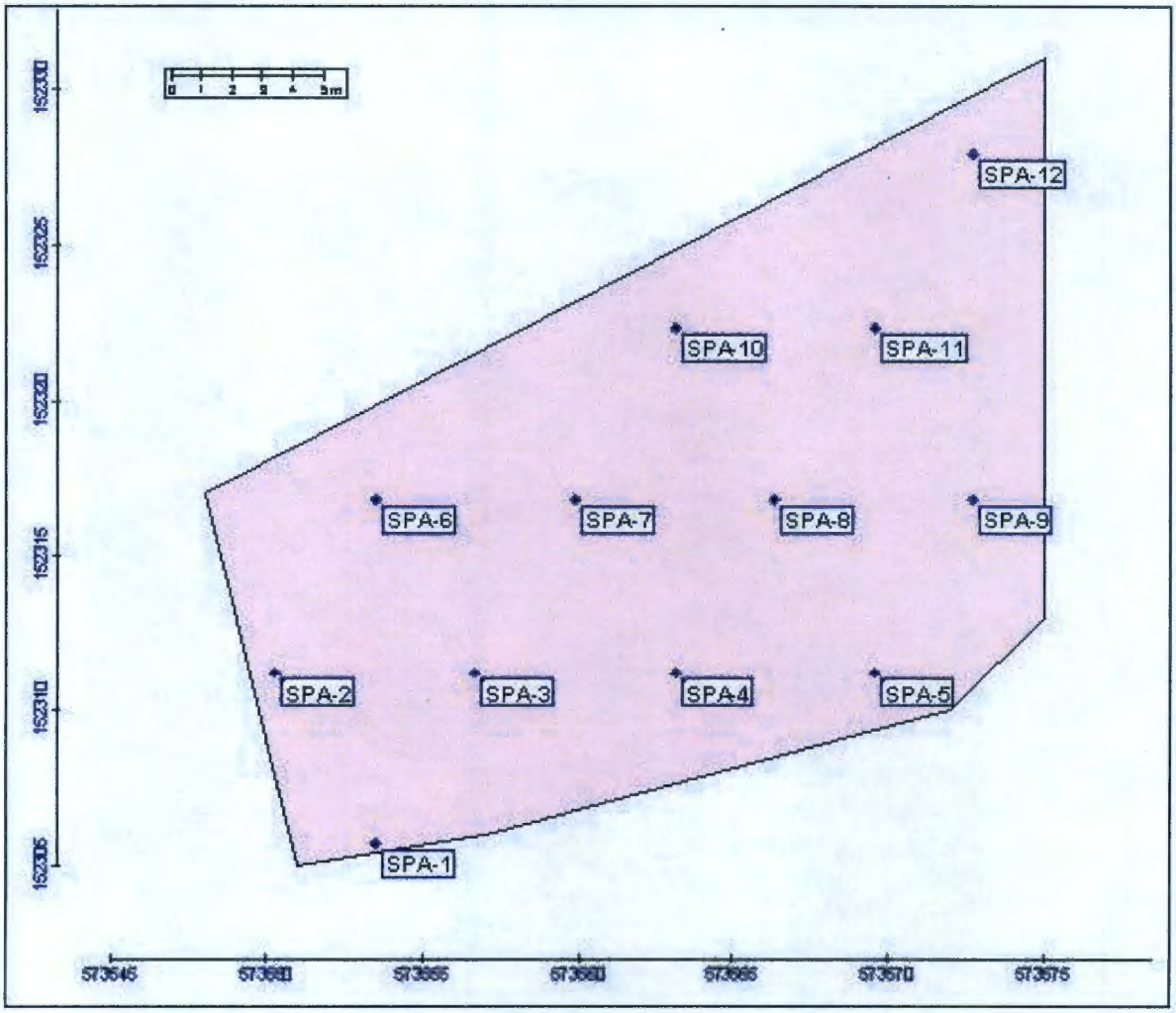

Table 1. 116-D-5, 1904-D Outfall Structure Sample Summary. (2 Pages)

Sample Location	HEIS Sample Number	Northing	Easting	Sample Analysis
SZ-1	J19CC6	152308.8	573494.0	ICP metals,[a] Hg, Cr^{+6}, pesticides, SVOA, PAH[b], IC anions, NO_2/NO_3,[c] GEA, C-14, Ni-63, Sr-90, Iso-U, Iso-Pu
SZ-2	J19CC7	152316.1	573489.8	
SZ-3	J19CC8	152316.1	573514.9	
SZ-4	J19CC9	152323.3	573485.6	
SZ-5	J19CD0	152323.3	573510.7	
SZ-6	J19CD1	152323.3	573519.1	
SZ-7	J19CD2	152330.6	573489.8	
SZ-8	J19CD3	152330.6	573498.1	
SZ-9	J19CD4	152330.6	573506.5	
SZ-10	J19CD5	152330.6	573514.9	
SZ-11	J19CD6	152337.8	573510.7	
SZ-12	J19CD7	152337.8	573519.1	
Duplicate of SZ-3	J19CD8	152316.1	573514.9	
DZ-1	J19CD9	152312.9	573494.1	ICP metals,[a] Hg, Cr^{+6}, pesticides, SVOA, PAH[b], IC anions, NO_2/NO_3,[c] GEA, C-14, Ni-63, Sr-90, Iso-U, Iso-Pu
DZ-2	J19CF0	152312.9	573499.0	
DZ-3	J19CF1	152317.2	573496.6	
DZ-4	J19CF2	152317.2	573501.5	
DZ-4[d]	J1F1J3	152317.2	573501.5	
DZ-5	J19CF3	152317.2	573506.4	
DZ-5[d]	J1F1J4	152317.2	573506.4	
DZ-6	J19CF4	152317.2	573511.4	
DZ-6[d]	J1F1J5	152317.2	573511.4	
DZ-7	J19CF5	152321.5	573494.1	
DZ-8	J19CF6	152321.5	573499.0	
DZ-8[d]	J1F1J6	152321.5	573499.0	
DZ-9	J19CF7	152321.5	573504.0	
DZ-10	J19CF8	152321.5	573508.9	
DZ-10[d]	J1F1J7	152321.5	573508.9	
DZ-11	J19CF9	152325.7	573496.6	
DZ-12	J19CH0	152325.7	573501.5	
Duplicate of DZ-4	J19CH1	152317.2	573501.5	
Duplicate of DZ-4[d]	J1F1J8	152317.2	573501.5	
OB-1	J19CB4	152259.4	573548.5	ICP metals,[a] Hg, Cr^{+6}, pesticides, SVOA, PAH[b], IC anions, NO_2/NO_3,[c] GEA, C-14, Ni-63, Sr-90, Iso-U, Iso-Pu
OB-2	J19CB5	152259.4	573559.8	
OB-3	J19CB6	152259.4	573571.1	
OB-4	J19CB7	152269.2	573542.8	
OB-5	J19CB8	152269.2	573554.1	
OB-6	J19CB9	152269.2	573565.5	
OB-7	J19CC0	152279.0	573548.5	
OB-8	J19CC1	152279.0	573559.8	

Table 1. 116-D-5, 1904-D Outfall Structure Sample Summary. (2 Pages)

Sample Location	HEIS Sample Number	Northing	Easting	Sample Analysis
OB-9	J19CC2	152279.0	573571.1	ICP metals,[a] Hg, Cr^{+6}, pesticides, SVOA, PAH[b], IC anions, NO_2/NO_3,[c] GEA, C-14, Ni-63, Sr-90, Iso-U, Iso-Pu
OB-10	J19CC3	152288.8	573542.8	
OB-11	J19CC4	152288.8	573554.1	
OB-12	J19CC5	152288.8	573565.5	
SPA-1	J19CH2	152305.7	573553.5	ICP metals,[a] Hg, Cr^{+6}, pesticides, SVOA, PAH[b], IC anions, NO_2/NO_3,[c] GEA, C-14, Ni-63, Sr-90, Iso-U, Iso-Pu
SPA-2	J19CH3	152311.2	573550.3	
SPA-3	J19CH4	152311.2	573556.7	
SPA-4	J19CH5	152311.2	573563.1	
SPA-5	J19CH6	152311.2	573569.5	
SPA-6	J19CH7	152316.8	573553.5	
SPA-7	J19CH8	152316.8	573559.9	
SPA-8	J19CH9	152316.8	573566.3	
SPA-9	J19CJ0	152316.8	573572.7	
SPA-10	J19CJ1	152322.4	573563.1	
SPA-11	J19CJ2	152322.4	573569.5	
SPA-12	J19CJ3	152327.9	573572.7	
Duplicate of SPA-1	J19CJ4	152305.7	573553.5	
Equipment Blank	J19CB3	--	--	ICP metals,[a] mercury

[a] The expanded list of ICP metals was requested to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium(total), cobalt, copper, lead, manganese, magnesium, molybdenum, nickel, silver, selenium, vanadium, zinc.
[b] Because Method 8310 is specifically meant to analyze for PAHs, data from this method will be used preferentially over the Method 8270 data for evaluation of PAH analyses.
[c] To preclude holding time issues associated with IC anions (EPA Method 300.0) for nitrites and nitrates, NO_2/NO_3 (EPA Method 353) was performed.
[d] Additional remediation and resampling conducted at this location.

-- = not applicable
EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
IC = ion chromatography
ICP = inductively coupled plasma
PAH = polycyclic aromatic hydrocarbons
SVOA = semivolatile organic analysis

Table 2. Comparison of Statistical Contaminant Concentrations to Action Levels for the 116-D-5 Shallow Zone Excavation Verification Samples. (3 Pages)

COC/COPC	Statistical or Maximum Result[b] (pCi/g)	Site Lookup Values[a] (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.374 (<BG)	6.2	1,465	2,930	No	--
Europium-152	0.255	3.3	--[c]	--[c]	No	--

Table 2. Comparison of Statistical Contaminant Concentrations to Action Levels for the 116-D-5 Shallow Zone Excavation Verification Samples. (3 Pages)

COC/COPC	Statistical or Maximum Result [b] (pCi/g)	Site Lookup Values [a] (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Nickel-63	2.30	4,013	83	166	No	--
Plutonium-239/240	0.012	35.1	-- [c]	-- [c]	No	--
Uranium-233/234	0.646 (<BG)	1.1 [d]	1.1 [d]	1.1 [d]	No	--
Uranium-238	0.639 (<BG)	1.1 [d]	1.1 [d]	1.1 [d]	No	--
COC/COPC	**Statistical or Maximum Result [b] (mg/kg)**	**Remedial Action Goals [a] (mg/kg)**			**Does the Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Arsenic	2.86 (<BG)	20	20	20	No	--
Barium	63.5 (<BG)	5,600	200	400	No	--
Beryllium	0.210 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Boron [f]	1.16	7,200	320	NA	No	--
Cadmium	0.0685 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium	11.0 (<BG)	80,000	18.5 [d]	18.5 [d]	No	--
Cobalt	8.85 (<BG)	24	15.7 [d]	NA	No	--
Copper	16.8 (<BG)	2,960	59.2	22.0 [d]	No	--
Hexavalent chromium [f]	0.18	2.1 [e]	4.8	2	No	--
Lead	3.67 (<BG)	353	10.2 [d]	10.2 [d]	No	--
Manganese	326 (<BG)	3,760	512 [d]	512 [d]	No	--
Mercury	0.0651 (<BG)	24	0.33 [d]	0.33 [d]	No	--
Molybdenum [f]	0.316	400	8	NA	No	--
Nickel	12.0 (<BG)	1,600	19.1 [d]	27.4	No	--
Silver	1.30	400	8	0.73 [d]	Yes	Yes [g]
Vanadium	63.7 (<BG)	560	85.1 [d]	NA	No	--
Zinc	50.9 (<BG)	24,000	480	67.8 [d]	No	--
Chloride	13.9 (<BG)	NA	25,000	NA	No	--
Fluoride	1.1 (<BG)	4,8000	96	400	No	--
Nitrogen in nitrite and nitrate [h]	3.53 (<BG)	128,000	1,000	2,000	No	--
Sulfate	18.3 (<BG)	NA	25,000	NA	No	--
Benzo(a)anthracene (8310)	0.0118	1.37	0.015 [i]	0.015 [i]	No	--
Benzo(a)pyrene (8310)	0.00856	0.137	0.015 [i]	0.015 [i]	No	--
Benzo(b)fluoranthene (8310)	0.0152	1.37	0.015 [i]	0.015 [i]	Yes	Yes [g]
Benzo(k)fluoranthene (8310)	0.00501	1.37	0.015 [i]	0.015 [i]	No	--
Chrysene (8310)	0.0128	13.7	0.12	0.1 [i]	No	--
Fluoranthene (8310)	0.0105	3,200	64	18.0	No	--

Table 2. Comparison of Statistical Contaminant Concentrations to Action Levels for the 116-D-5 Shallow Zone Excavation Verification Samples. (3 Pages)

COC/COPC	Statistical or Maximum Result[b] (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Indeno(1,2,3-cd)pyrene (8310)	0.00634	1.37	0.33[i]	0.33[i]	No	--
Phenanthrene (8310)	0.00616	24,000	240	1,920	No	--
Pyrene (8310)	0.0139	2,4000	48	192	No	--

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

[b] Maximum or 95% upper confidence limit result, depending on data censorship, as described in the *116-D-5 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix C).

[c] No value; because the soil-partitioning coefficient values for europium-152 and plutonium-239/240 are greater than 80 mL/g, RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) predicts the contaminants will not reach groundwater within 1,000 years.

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

[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340 750[3] [Ecology 1996]) using an airborne particulate mass-loading rate of 0.0001 g/m3 (WDOH 1997).

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

[g] Because the soil-partitioning coefficient values for silver and benzo(b)fluoranthene are greater than 80 mL/g (90 mL/g and 803 mL/g, respectively), RESRAD modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), predicts the contaminants will not reach groundwater within 1,000 years. The vadose zone beneath the 116-D-5 excavation is approximately 7 m (23 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 10 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years. Therefore, residual concentration of silver and benzo(b)fluoranthene are predicted to be protective of groundwater and the Columbia River.

[h] Due to an excessive sample holding time exceedance for EPA Method 300.0 (anions) nitrate and nitrite, the reported results are from EPA Method 353.2 (nitrogen in nitrate/nitrite). Method 353.2 nitrogen results are assumed to exist entirely as nitrate based on the environmental fate of nitrite.

[i] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996, DOE-RL 2009b).

-- = not applicable
BG = background (obtained from DOE-RL [1996] and DOE-RL [2001], unless otherwise noted)
COC = contaminant of concern
COPC = contaminant of potential concern
NA = not available
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 assessment model)
WAC = *Washington Administrative Code*

Table 3. Comparison of Statistical Contaminant Concentrations to Action Levels for the 116-D-5 Staging Pile Area Verification Samples. (2 Pages)

COC/COPC	Statistical or Maximum Result[b] (pCi/g)	Site Lookup Values [a] (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Uranium-233/234	0.581 (<BG)	1.1 [c]	1.1 [c]	1.1 [c]	No	--
Uranium-238	0.589 (<BG)	1.1 [c]	1.1 [c]	1.1 [c]	No	--
COC/COPC	**Statistical or Maximum Result[b] (mg/kg)**	**Remedial Action Goals[a] (mg/kg)**			**Does the Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Antimony	0.239 (<BG)	32	5[c]	5[c]	No	--
Arsenic	2.35 (<BG)	20	20	20	No	--
Barium	62.1 (<BG)	5,600	200	400	No	--
Beryllium	0.187 (<BG)	10.4[d]	1.51[c]	1.51[c]	No	--
Boron [e]	1.12	7,200	320	NA	No	--
Cadmium	0.0666 (<BG)	13.9[d]	0.81[c]	0.81[c]	No	--
Chromium	8.00 (<BG)	80,000	18.5[c]	18.5[c]	No	--
Cobalt	7.29 (<BG)	24	15.7[c]	NA	No	--
Copper	12.3 (<BG)	2,960	59.2	22.0[c]	No	--
Hexavalent chromium[e]	0.16	2.1[d]	4.8	2	No	--
Lead	3.24 (<BG)	353	10.2[c]	10.2[c]	No	--
Manganese	277 (<BG)	3,760	512[c]	512[c]	No	--
Molybdenum [e]	0.280	400	8	NA	No	--
Nickel	10.1 (<BG)	1,600	19.1 [c]	27.4	No	--
Silver	0.228 (<BG)	400	8	0.73[c]	No	--
Vanadium	52.3 (<BG)	560	85.1[c]	NA	No	--
Zinc	42.2 (<BG)	24,000	480	67.8[c]	No	--
Chloride	74.8 (<BG)	NA	25,000	NA	No	--
Fluoride	0.3 (<BG)	48,000	96	400	No	--
Nitrogen in nitrite and nitrate [f]	3.15 (<BG)	128,000	1,000	2,000	No	--
Sulfate	26.5 (<BG)	NA	25,000	NA	No	--
4,4'-DDE	0.00657	2.94	0.0257	0.0033[g]	Yes	Yes[h]
Beta-1,2,3,4,5,6-Hexachlorocyclohexane	0.00151	0.556	0.00486	0.00554	No	--
Endrin (ketone and aldehyde)	0.01858	24	0.2	0.039	No	--
Methoxychlor	0.0196	400	4	1.67	No	--
Benzo(a)anthracene (8310)	0.00377	1.37	0.015[g]	0.015[g]	No	--
Benzo(a)pyrene (8310)	0.00448	0.137	0.015[g]	0.015[g]	No	--

Table 3. Comparison of Statistical Contaminant Concentrations to Action Levels for the 116-D-5 Staging Pile Area Verification Samples. (2 Pages)

COC/COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Benzo(b)fluoranthene (8310)	0.00458	1.37	0.015[g]	0.015[g]	No	--
Benzo(ghi)perylene (8310)	0.00275	2,400	48	192	No	--
Benzo(k)fluoranthene (8310)	0.00391	1.37	0.015[g]	0.015[g]	No	--
Chrysene (8310)	0.00532	13.7	0.12	0.1[g]	No	--
Fluoranthene (8310)	0.00766	3,200	64	18.0	No	--
Phenanthrene (8310)	0.00311	24,000	240	1920	No	--
Pyrene (8310)	0.00896	2,400	48	192	No	--
Dibenz(a,h)anthracene (8310)	0.00139	1.37	0.03[g]	0.03[g]	No	--

[a] Lookup values and RAGs obtained from RDR/RAWP (DOE-RL 2009b).
[b] Maximum or 95% upper confidence limit result, depending on data censorship, as described in the *116-D-5 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix C).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700[4][d] (Ecology 1996).
[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/m3 (WDOH 1997).
[e] No Hanford Site-specific or Washington State background value available.
[f] Due to an excessive sample holding time exceedance for EPA Method 300.0 (anions) nitrate and nitrite, the reported results are from EPA Method 353.2 (nitrogen in nitrate/nitrite). Method 353.2 nitrogen results are assumed to exist entirely as nitrate based on the environmental fate of nitrite.
[g] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996, DOE-RL 2009b).
[h] Because the soil-partitioning coefficient value for 4,4'-DDE (86.4 mL/g) is greater than 80 mL/g, RESRAD modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), predicts the contaminant will not reach groundwater within 1,000 years. The vadose zone beneath the 116-D-5 excavation is approximately 7 m (23 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 10 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years. Therefore, residual concentrations of 4,4'-DDE are predicted to be protective of groundwater and the Columbia River.

-- = not applicable
BG = background (obtained from DOE-RL [1996] and DOE-RL [2001], unless otherwise noted)
COC = contaminant of concern
COPC = contaminant of potential concern
4,4'-DDE = dichlorodiphenyldichloroethylene
NA = not available
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 assessment model)
WAC = *Washington Administrative Code*

Table 4. Comparison of Statistical Contaminant Concentrations to Action Levels for the 116-D-5 Overburden Verification Samples. (2 Pages)

COC/COPC	Statistical or Maximum Result[b] (pCi/g)	Site Lookup Values[a] (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.102 (<BG)	6.2	1,465	2,930	No	--
Europium-152	0.082	3.3	--[c]	--[c]	No	--
Nickel-63	2.46	4,013	83	166	No	--
Uranium-233/234	0.596 (<BG)	1.1[d]	1.1[d]	1.1[d]	No	--
Uranium-238	0.702 (<BG)	1.1[d]	1.1[d]	1.1[d]	No	--
COC/COPC	**Statistical or Maximum Result[b] (mg/kg)**	**Remedial Action Goals[a] (mg/kg)**			**Does the Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.13 (<BG)	20	20	20	No	--
Barium	58.5 (<BG)	5,600	200	400	No	--
Beryllium	0.177 (<BG)	10.4[e]	1.51[d]	1.51[d]	No	--
Boron[f]	0.850	7,200	320	NA	No	--
Cadmium	0.0625 (<BG)	13.9[e]	0.81[d]	0.81[d]	No	--
Chromium	6.99 (<BG)	80,000	18.5[d]	18.5[d]	No	--
Cobalt	7.55 (<BG)	24	15.7[d]	NA	No	--
Copper	15.1 (<BG)	2,960	59.2	22.0[d]	No	--
Hexavalent chromium[f]	0.18	2.1[e]	4.8	2	No	--
Lead	2.62 (<BG)	353	10.2[d]	10.2[d]	No	--
Manganese	285 (<BG)	3,760	512[d]	512[d]	No	--
Mercury	0.0276 (<BG)	24	0.33[d]	0.33[d]	No	--
Molybdenum[f]	0.304	400	8	NA	No	--
Nickel	8.79 (<BG)	1,600	19.1[d]	27.4	No	--
Vanadium	56.4 (<BG)	560	85.1[d]	NA	No	--
Zinc	43.7 (<BG)	24,000	480	67.8[d]	No	--
Chloride	59.0 (<BG)	NA	25,000	NA	No	--
Nitrogen in nitrite and nitrate[g]	5.34 (<BG)	128,000	1,000	2,000	No	--
Sulfate	22.3 (<BG)	NA	25,000	NA	No	--
Heptachlor epoxide	0.00151	0.11	0.002[h]	0.002[h]	No	--
Anthracene (8310)	0.0122	24,000	240	1,920	No	--
Benzo(a)anthracene (8310)	0.0726	1.37	0.015[h]	0.015[h]	Yes	Yes[i]
Benzo(a)pyrene (8310)	0.0495	0.137	0.015[h]	0.015[h]	Yes	Yes[i]
Benzo(b)fluoranthene (8310)	0.0680	1.37	0.015[h]	0.015[h]	Yes	Yes[i]
Benzo(ghi)perylene (8310)	0.0264	2,400	48	192	No	--
Benzo(k)fluoranthene (8310)	0.0183	1.37	0.015[h]	0.015[h]	Yes	Yes[i]

Table 4. Comparison of Statistical Contaminant Concentrations to Action Levels for the 116-D-5 Overburden Verification Samples. (2 Pages)

COC/COPC	Statistical or Maximum Result[b] (mg/kg)	Remedial Action Goals[a] (mg/kg)			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Chrysene (8310)	0.0467	13.7	0.12	0.1[h]	No	--
Dibenz(a,h)anthracene (8310)	0.00673	1.37	0.03[h]	0.03[h]	No	--
Fluoranthene (8310)	0.0748	3,200	64	18.0	No	--
Indeno(1,2,3-cd)pyrene (8310)	0.0125	1.37	0.33[h]	0.33[h]	No	--
Phenanthrene[i] (8310)	0.0271	24,000	240	1,920	No	--
Pyrene (8310)	0.296	2,400	48	192	No	--
Bis(2-ethylhexyl)phthalate (8270)	0.854	71.4	0.6	0.36	Yes	Yes[i]

[a] Lookup values and RAGs obtained from the RDR/RAWP (DOE-RL 2009b).
[b] Maximum or 95% upper confidence limit result, depending on data censorship, as described in the *116-D-5 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix C).
[c] No value; because the soil-partitioning coefficient value for europium-152 is greater than 80 mL/g, RESRAD modeling, discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009), predicts the contaminant will not reach groundwater within 1,000 years.
[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700[4][d] (Ecology 1996).
[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340 750[3] [Ecology 1996]) using an airborne particulate mass-loading rate of 0.0001 g/m3 (WDOH 1997).
[f] No Hanford Site-specific or Washington State background value available.
[g] Due to an excessive sample holding time exceedance for EPA Method 300.0 (anions) nitrate and nitrite, the reported results are from EPA Method 353.2 (nitrogen in nitrate/nitrite). Method 353.2 nitrogen results are assumed to exist entirely as nitrate based on the environmental fate of nitrite.
[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996, DOE-RL 2009b).
[i] Because the soil-partitioning coefficient values for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, and chrysene are greater than 80 mL/g (the lowest soil-partitioning coefficient [for bis(2-ethylhexyl)phthalate] is 110 mL/g), RESRAD modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), predicts the contaminants will not reach groundwater within 1,000 years. The vadose zone beneath the 116-D-5 excavation is approximately 7 m (23 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 10 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.

-- = not applicable
BG = background (obtained from DOE-RL [1996] and DOE-RL [2001], unless otherwise noted)
COC/COPC = contaminant of concern/contaminant of potential concern
NA = not available
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 assessment model)
WAC = *Washington Administrative Code*

Table 5. Comparison of Statistical Contaminant Concentrations to Action Levels for the 116-D-5 Deep Zone Excavation Verification Samples. (3 Pages)

COC/COPC	Statistical or Maximum Result[b] (pCi/g)	Site Lookup Values [a] (pCi/g)		Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	1.02 (<BG)	1,465	2,930	No	--
Europium-152	0.449	--[c]	--[c]	No	--
Strontium-90	0.130 (<BG)	27.6	55.2	No	--
Uranium-233/234	0.531 (<BG)	1.1[d]	1.1[d]	No	--
Uranium-238	0.572 (<BG)	1.1[d]	1.1[d]	No	--
COC/COPC	**Statistical or Maximum Result[b] (mg/kg)**	**Remedial Action Goals [a] (mg/kg)**		**Does the Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Soil Cleanup Level for Groundwater Protection	**Soil Cleanup Level for River Protection**		
Antimony	0.438 (<BG)	5[d]	5[d]	No	--
Arsenic	3.08(<BG)	20	20	No	--
Barium	72.3 (<BG)	200	400	No	--
Beryllium	0.255 (<BG)	1.51[d]	1.51[d]	No	--
Boron [e]	0.934	320	NA	No	--
Cadmium	0.0897 (<BG)	0.81[d]	0.81[d]	No	--
Chromium	19.7	18.5[d]	18.5[d]	Yes	Yes [f]
Cobalt	8.97 (<BG)	15.7[d]	NA	No	--
Copper	18.0 (<BG)	59.2	22.0[d]	No	--
Hexavalent chromium [e]	0.34	4.8	2	No	--
Lead	5.63 (<BG)	10.2[d]	10.2[d]	No	--
Manganese	334 (<BG)	512[d]	512[d]	No	--
Mercury	0.126 (<BG)	0.33[d]	0.33[d]	No	--
Molybdenum [e]	0.315	8	NA	No	--
Nickel	12.9 (<BG)	19.1[d]	27.4	No	--
Vanadium	58.6 (<BG)	85.1[d]	NA	No	--
Zinc	49.8 (<BG)	480	67.8[d]	No	--
Chloride	9.05 (<BG)	25,000	NA	No	--
Fluoride	1.1 (<BG)	96	400	No	--
Nitrogen in nitrite and nitrate [g]	10.6 (<BG)	1,000	2,000	No	--
Sulfate	55.0 (<BG)	25,000	NA	No	--
4,4'-DDT	0.00100				
Benzo(a)anthracene (8310)	0.0871	0.015[h]	0.015[h]	Yes	Yes[f]

Table 5. Comparison of Statistical Contaminant Concentrations to Action Levels for the 116-D-5 Deep Zone Excavation Verification Samples. (3 Pages)

COC/COPC	Statistical or Maximum Result[b] (mg/kg)	Remedial Action Goals[a] (mg/kg)		Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Benzo(a)pyrene (8310)	0.0572	0.015[h]	0.015[h]	Yes	Yes[f]
Benzo(b)fluoranthene (8310)	0.0875	0.015[h]	0.015[h]	Yes	Yes[f]
Benzo(ghi)perylene (8310)	0.190	48	192	No	--
Benzo(k)fluoranthene (8310)	0.0489	0.015[h]	0.015[h]	Yes	Yes[f]
Bis(2-ethylhexyl)phthalate	0.120	0.6	0.36	No	--
Chrysene (8310)	0.0801	0.12	0.1[h]	No	--
Dibenz(a,h)anthracene (8310)	0.0360	0.03[h]	0.03[h]	Yes	Yes[f]
Fluoranthene (8310)	0.0836	64	18.0	No	--
Indeno(1,2,3-cd)pyrene (8310)	0.220	0.33[h]	0.33[h]	No	--
Phenanthrene (8310)	0.0430	240	1,920	No	--
Pyrene (8310)	0.600	48	192	No	--

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

[b] Maximum or 95% upper confidence limit result, depending on data censorship, as described in the *116-D-5 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix C).

[c] No value; because the soil-partitioning coefficient values for europium-152 and plutonium-239/240 are greater than 80 mL/g, RESRAD modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), predicts the contaminants will not reach groundwater within 1,000 years.

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

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

[f] Because the soil-partitioning coefficient values for chromium, heptachlor epoxide, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene are greater than 80 mL/g (the lowest soil-partitioning coefficient [for heptachlor epoxide] is 83.2 mL/g), RESRAD modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), predicts the contaminants will not reach groundwater within 1,000 years. The vadose zone beneath the 116-D-5 excavation is approximately 7 m (23 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 10 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.

[g] Due to an excessive sample holding time exceedance EPA Method 300.0 (anions) nitrate and nitrite, the reported results are from EPA Method 353.2 (nitrogen in nitrate/nitrite). Method 353.2 nitrogen results are assumed to exist entirely as nitrate based on the environmental fate of nitrite.

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

-- = not applicable
BG = background (obtained from DOE-RL [1996] and DOE-RL [2001], unless otherwise noted)
COC = contaminant of concern
COPC = contaminant of potential concern
NA = not available
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 assessment model)
WAC = *Washington Administrative Code*

DATA EVALUATION

Evaluation of the results listed in Tables 2, 3, 4, and 5 from the verification sampling at the 116-D-5 waste site indicates that all COCs/COPCs were undetected and/or quantified below RAGs and lookup values, except for chromium, silver, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, and 4,4'-DDE. Because the soil-partitioning coefficient for these contaminants are greater than 80 mL/g (the lowest soil-partitioning coefficient [for 4,4'-DDE] is 86.4), RESidual RADioactivity (RESRAD) modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), predicts the contaminants will not reach groundwater within 1,000 years. The vadose zone beneath the 116-D-5 excavation is approximately 7 m (23 ft) thick. Based on RESRAD modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), constituents with a soil-partitioning coefficient of 10 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater within 1,000 years. Therefore, residual concentrations of chromium, silver, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, and 4,4'-DDE are predicted to be protective of groundwater and the Columbia River.

WAC Three-Part Test for Nonradionuclides

When using a statistical sampling approach, 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 116-D-5 site is included in the 95% UCL calculation (Appendix C). The results of the evaluation indicate that chromium, copper, mercury, nickel, silver, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, bis(2-ethylhexyl)phthalate, and 4'4-DDE fail one or more components of the three-part test when compared to the most stringent RAG (soil RAG for the protection of groundwater and/or the Columbia River). Copper is the most mobile of the contaminants having the lowest soil-partitioning coefficient (22 mL/g) and is not expected to migrate more than 3 m (10 ft) vertically in 1,000 years based on RESRAD modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b). Therefore, chromium, copper, mercury, nickel, silver, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, bis(2-ethylhexyl)phthalate, and 4'4-DDE are not anticipated to migrate to groundwater or the Columbia River in 1,000 years. All of these contaminants satisfy the three-part test criteria in comparison to the direct exposure RAG for the shallow zone soils, overburden, and waste SPA.

Direct Contact and Groundwater Protection Risk Evaluation for Nonradionuclides

Assessment of the risk requirements for the 116-D-5 waste site was determined by calculation of the hazard quotient and excess carcinogenic risk values for direct contact and groundwater protection for nonradionuclides (Appendix C). The requirements include an individual noncarcinogenic hazard quotient of less than 1.0, a cumulative noncarcinogenic hazard quotient

of less than 1.0, an individual excess noncarcinogenic cancer risk of less than 1.0×10^{-6}, and a cumulative excess carcinogenic cancer risk of less than 1×10^{-5}. These risk values were calculated for the entire waste site using the highest values from each of the decision units. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values.

The calculations indicated that all individual hazard quotients for noncarcinogenic constituents for direct contact and groundwater protection are less than 1.0. The cumulative direct contact hazard quotient for noncarcinogenic constituents is 7.9×10^{-3}, and the cumulative noncarcinogenic hazard quotient for the protection of groundwater is 7.4×10^{-2}. Both are below the risk requirement of less than 1.0. All individual hazard quotients for carcinogenic constituents for direct contact and groundwater protection are less than 1.0×10^{-6}. The cumulative direct contact excess cancer risk for carcinogenic constituents is 9.0×10^{-7}, and the cumulative excess cancer risk for the protection of groundwater is 3.1×10^{-7}, which are both less than the risk requirement of 1.0×10^{-5}.

Comparison of Sample Data to Ecological Risk Screening Levels

A comparison against ecological risk screening levels has been made for the site COCs/COPCs and other constituents. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for manganese, vanadium, and zinc. Ecological screening levels from WAC 173-340 were exceeded for boron and vanadium. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of manganese, vanadium, and zinc are below site background levels per the RDR/RAWP (DOE-RL 2009b), it is believed that the presence of these constituents does not pose a risk to ecological receptors. No established background value is available for boron; a final cleanup level for boron, including consideration of background, will be established through the RI/FS process. Exceedences for boron will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach and analytical data with the sampling and data requirements specified in the verification work instruction (WCH 2009). The DQA for the 116-D-5 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The data set was found to be acceptable for decision-making purposes. 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 HEIS and are summarized in Appendix C. The detailed DQA is presented in Appendix D.

SUMMARY FOR INTERIM CLOSURE

The 116-D-5 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2009b). The remaining soils at this site have been sampled, analyzed, and modeled. The results indicate that the residual concentrations of COCs/COPCs at this site do not preclude any futures uses (as bounded by a rural-residential scenario) and allow for unrestricted use of the shallow-zone soil (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations at the bottom of the excavation are protective of groundwater and the Columbia River. In accordance with this evaluation, the verification sampling results support a reclassification of the 116-D-5 waste site to Interim Closed Out.

REFERENCES

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

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DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

Ecology, 1995, *Guidance on Sampling and Data Analysis Methods,* Publication No. 94-49, Washington State Department of Ecology, Olympia, Washington.

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

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

Gilbert, R. O., 1987, *Statistical Methods for Environmental Pollution Monitoring,* Wiley & Sons, Inc., New York, New York.

WCH, 2009, *Work Instruction for Verification Sampling of 116-D-5, 1904-D Outfall Structure,* 0100D-WI-G0059, Rev. 0, Washington Closure Hanford, Richland, Washington.

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

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

APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Maximum Contaminant Concentrations that Exceed Ecological Screening Levels for the 116-D-5 Waste Site.[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**								
Boron		0.5							1.16
Manganese	512	1,100		1,500	220	450	4,300	4,000	285 (<BG)
Vanadium	85.1	2					7.8	280	63.7 (<BG)
Zinc	67.8	86	200	360	160	120	46	79	50.9 (<BG)

NOTE: Shaded cells are exceeded by the maximum of the focused or statistical result. Blank cells indicate that a value was 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 Columbia 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.

BG = background

EPA = U.S. Environmental Protection Agency

WAC = *Washington Administrative Code*

APPENDIX B

GLOBAL POSITIONING ENVIRONMENTAL RADIOLOGICAL SURVEYOR MAPS

Figure B-1. GPERS Survey of the 116-D-5, 1904-D Outfall Structure.

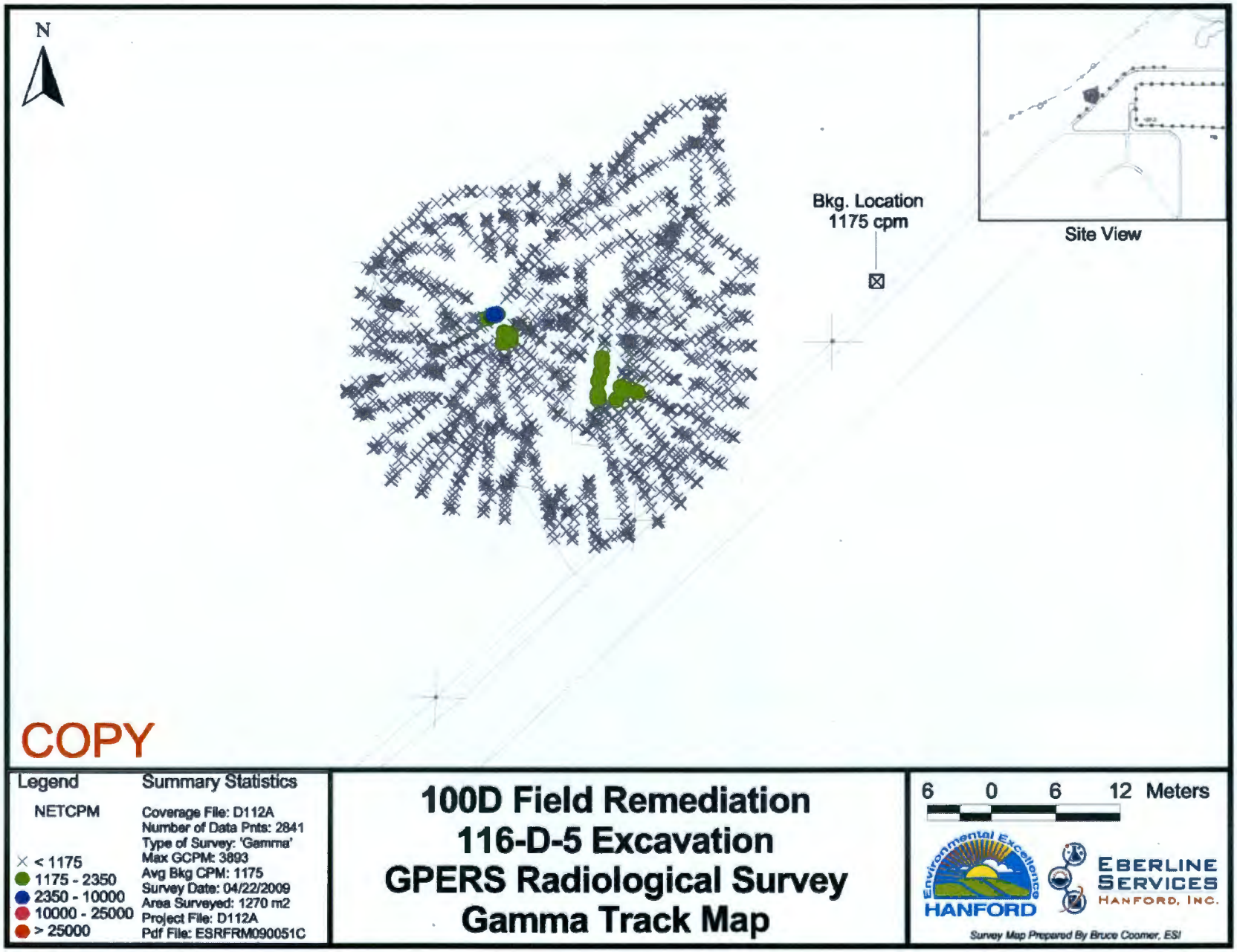


Figure B-2. GPERS Survey of the 116-D-5 Waste Staging Pile Area.

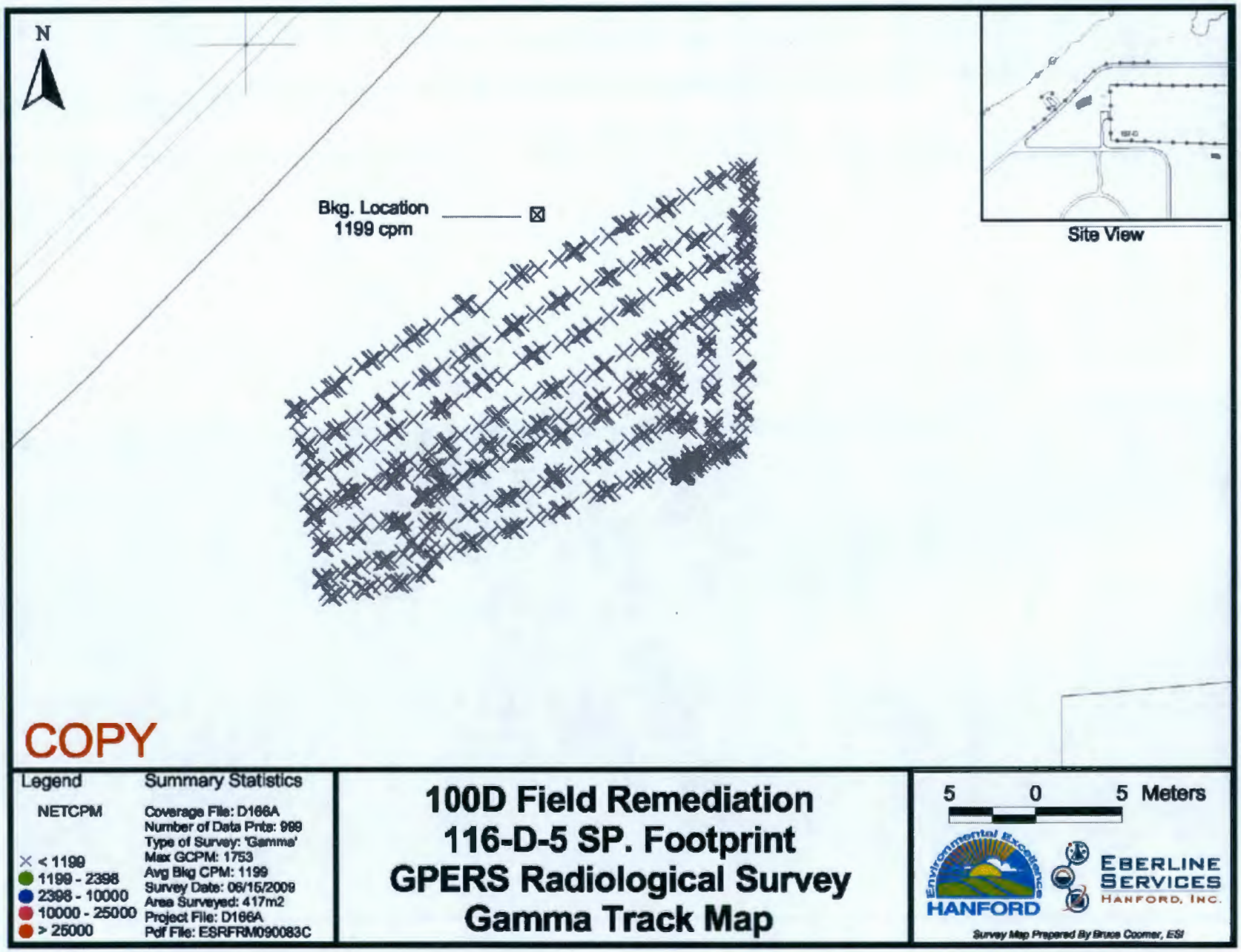


Figure B-3. GPERS Survey of the 116-D-5 Overburden Pile First Lift.

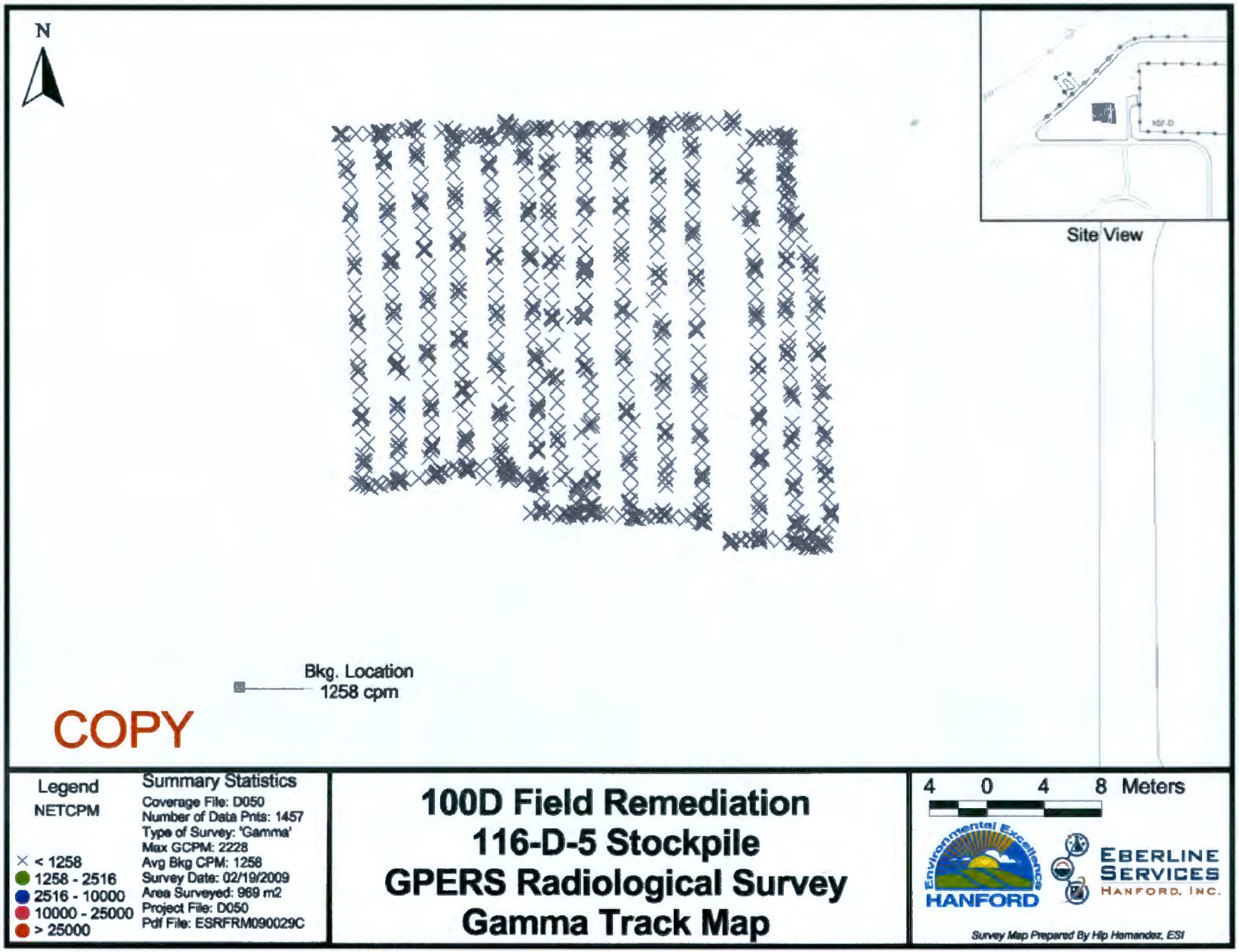
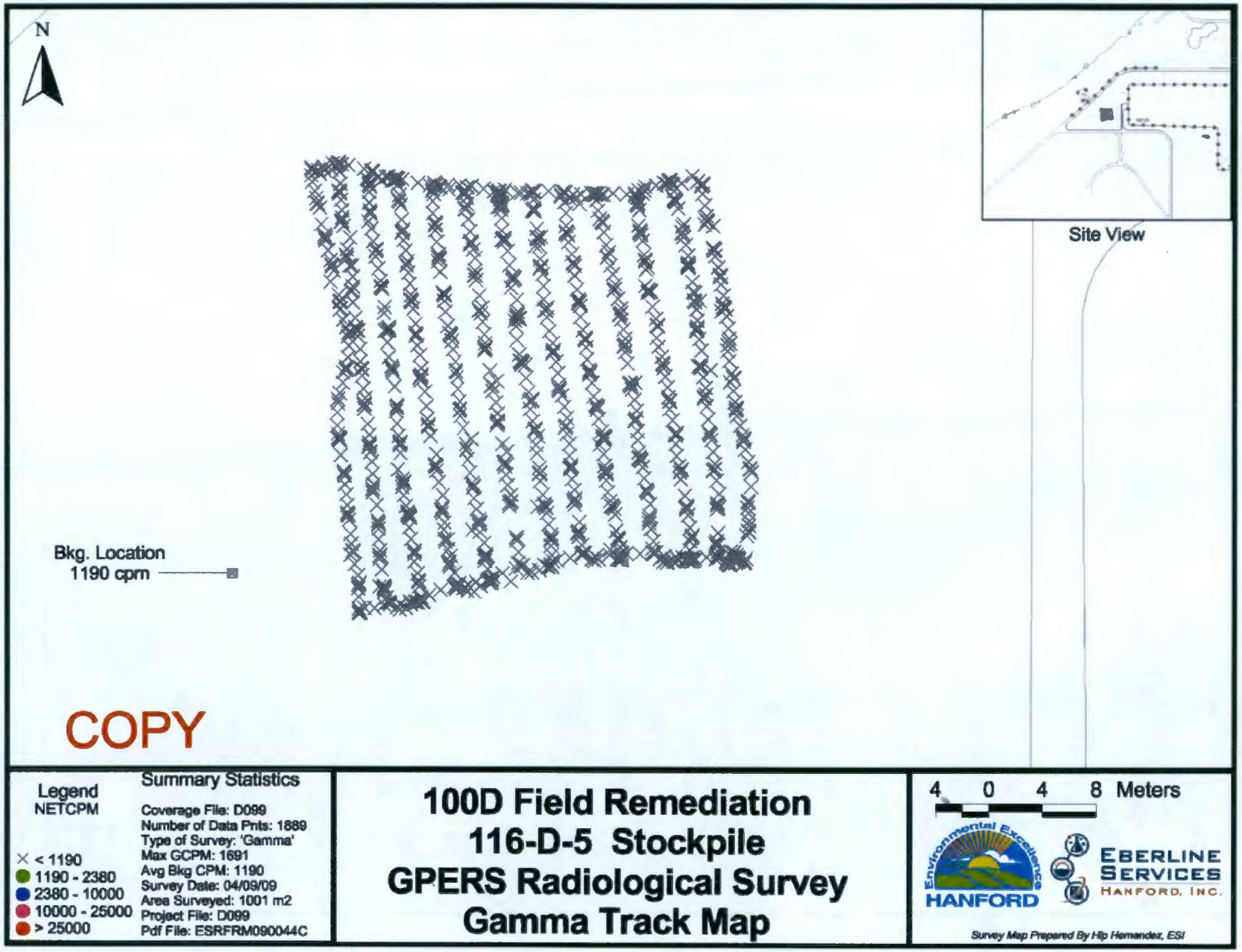


Figure B-4. GPERS Survey of the 116-D-5 Overburden Pile Second Lift.



APPENDIX C

CALCULATIONS

APPENDIX C

CALCULATION BRIEFS

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

116-D-5 Waste Site Cleanup Verification 95% UCL Calculation, 0100D-CA-V0352, Rev. 4, Washington Closure Hanford, Richland, Washington.

116-D-5 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100D-CA-V0354, Rev. 2, Washington Closure Hanford, Richland, Washington.

116-D-5 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0355, Rev. 2, 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-V0352

Subject: 116-D-5 Waste Site Cleanup Verification 95% UCL Calculation

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 45 Attm. 1 = 44 Total = 90	J. D. Skoglie	B. L. Vedder	T. E. Queen	D. F. Obenauer	Signed 2/22/10
1	Cover = 1 Sheets = 45 Attm. 1 = 44 Total = 90	J. D. Skoglie	B. L. Vedder	T. E. Queen	D. F. Obenauer	Signed 3/24/10
2	Cover = 1 Sheets = 45 Attm. 1 = 44 Total = 90	J. D. Skoglie	T. E. Queen	NA	D. F. Obenauer	Signed 3/31/10
3	Cover = 2 Sheets = 53 Attm. 1 = 48 Total = 103	J. D. Skoglie	T. E. Queen	NA	D. F. Obenauer	Signed 4/19/11
4	Cover = 2 Sheets = 53 Attm. 1 = 48 Total = 103	J. D. Skoglie	T. E. Queen	NA	D. F. Obenauer	5/2/11

SUMMARY OF REVISION

1	Page 1, line 45: changed the word "Cleanup" to "Remaining Sites". Page 3, line 4: added all decision units to the summary text. Pages 3-5: all nonradionuclide units were converted to mg/kg Pages 3, 8, 24 and attachment 1 (page 41): nitrite and nitrate values changed due to lab error. Pages 17, 18, and 21: minor changes in values due to significant figures. Page 43 & 44: corrected units for constituents to match attachment pages. Attachment pages 1-8: deleted "Metals" added "Radionuclides" to heading of each page.
2	Pages 3, 9, & 26: added "Nitrogen in Nitrite and Nitrate" to shallow zone statistical calculation.

Acrobat 8.0

CALCULATION COVER SHEET

3	Revision to entire calculation due to pagination. Due to sample holding time exceedance all "nitrogen in nitrate" will be taken out of the calculation and footnotes added to "nitrogen in nitrite and nitrate". Re-sample data added at locations DZ-4, DZ-4 duplicate, DZ-5, DZ-6, DZ-8, & DZ-10 throughout calculation. Sheet 1: table of contents revised. Sheet 2, lines 39-41: deleted discussion about not performing 3-part test on maximum values. Sheet 4: Deep zone results summary table revised. Sheet 5: revised RPD results table for the deep zone decision unit due to re-sampled data. Sheets 10, 11, 17, 18, 23, 24, & 30: Added maximum value 3-part test results pages to all decision units. Sheets 12-18: Analytes deleted on deep zone statistical pages due to re-sample data: Co-60, Ni-63, Pu-239/240, Sb, Benzo(ghi)perylene, phenanthrene, & pyrene. Sheets 6, 12, 19 & 25: deleted "background" and "statistical value above background" rows. Sheets 35-39: Deep zone MTCA pages revised due to re-sample data. Sheet 51: Corrected deep zone RPD pages. Attachment 1, sheet 1: added the definition for the qualifier "X".
4	Sheet 4, lines 31-33: chloride, nitrogen in nitrite and nitrate, and sulfate converted to show correct units. Sheets 6-30: footnotes arranged properly throughout calculation and listed alphabetically on sheet 6.

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

Washington Closure Hanford

CALCULATION SHEET

Originator J. D. Skoglie		**Date** 04/15/11	**Calc. No.** 0100D-CA-V0352	**Rev. No.** 3	
Project 100-D Field Remediation		**Job No.** 14655	**Checked** T. E. Queen	**Date** 04/15/11	
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations				**Sheet No.** 1 of 53	

Summary

Purpose:

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

Table of Contents:

Sheets 1 to 5 - Calculation Sheet Summary
Sheet 6 to 11- Calculation Sheet Verification Data - Shallow Zone
Sheet 12 to 18 - Calculation Sheet Verification Data - Deep Zone
Sheet 19 to 24- Calculation Sheet Verification Data - Staging Pile Area
Sheet 25 to 30 - Calculation Sheet Verification Data - Overburden
Sheet 31 to 48 - Ecology Software (MTCAStat) Results
Sheet 49 to 53 - Calculation Sheet Duplicate Analysis
Attachment 1 - 116-D-5, Verification Sampling Results (48 sheets)

Given/References:

1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2005b), DOE-RL (2001), and Ecology (1996).
3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
6) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
7) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets),* Publication #92-54, Washington Department of Ecology, Olympia, Washington.
8) Ecology, 1996, *Model Toxic Control Act Cleanup Levels and Risk Calculations (CLARC II),* Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
9) 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 116-D-5 Waste Site. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2009b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:

The excavation area of 116-D-5 waste site underwent statistical sampling. The 116-D-5 waste site is divided into four decision units for verification sampling: the shallow zone, deep zone, staging pile area, and the overburden stockpile. No focused samples were taken.

Summary (continued)

Methodology, continued:

Analytical results for all sampling locations are summarized in the tables provided on sheets 3, 4, and 5. Further information of the sample data quality is presented in the data quality assessment section of the associated RSVP.

For nonradioactive analytes with ≤50% of the data below detection limits, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with >50% of the data below detection limits, as determined by direct inspection of the sample results (Attachment 1), the maximum detected value for the data set (which includes primary and duplicate samples) is used instead of the 95% UCL, and no further calculations are performed for those data sets. For convenience, these maximum detected values are included in the summary tables that follow. The 95% UCL was not calculated for data sets with no reported detections. The 95% UCL values were not calculated for radium-226, radium-228, thorium-228, thorium-232, and potassium-40 based on natural occurrence 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) for certain constituents with cleanup levels. All other constituents will have there own pre-determined TDL's based on the laboratory and method used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

where, M = Main Sample Value S = Split (or duplicate) Sample Value

For quality assurance/quality control (QA/QC) 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/split 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/split results exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable RSVP.

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie **Date** 04/15/11 **Calc. No.** 0100D-CA-V0352 **Rev. No.** 3
Project 100-D Field Remediation **Job No.** 14655 **Checked** T. E. Queen **Date** 04/15/11
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 3 of 53

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the shallow zone, deep zone, staging pile area, and overburden 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 - Shallow Zone [a]

Analyte	95% UCL Result	Maximum Result	Units
Cesium-137	0.374	–	pCi/g
Europium-152	0.255	–	pCi/g
Nickel-63	2.89	–	pCi/g
Plutonium-239/240	0.048	–	pCi/g
Uranium-233/234	0.646	–	pCi/g
Uranium-238	0.639	–	pCi/g
Arsenic	2.86	–	mg/kg
Barium	63.5	–	mg/kg
Beryllium	0.210	–	mg/kg
Boron	1.16	–	mg/kg
Cadmium	0.0685	–	mg/kg
Chromium	11.0	–	mg/kg
Cobalt	8.85	–	mg/kg
Copper	16.8	–	mg/kg
Hexavalent Chromium	0.18	–	mg/kg
Lead	3.67	–	mg/kg
Manganese	326	–	mg/kg
Molybdenum	0.316	–	mg/kg
Nickel	12.0	–	mg/kg
Vanadium	63.7	–	mg/kg
Zinc	50.9	–	mg/kg
Fluoranthene (8310)	0.0105	–	mg/kg
Fluoride	1.1	–	mg/kg
Nitrogen in Nitrite and Nitrate[b]	3.53	–	mg/kg
Sulfate	18.3	–	mg/kg
Mercury	–	0.0651	mg/kg
Silver	–	1.30	mg/kg
Benzo(a)anthracene (8310)	–	0.0118	mg/kg
Benzo(a)pyrene (8310)	–	0.00856	mg/kg
Benzo(b)fluoranthene (8310)	–	0.0152	mg/kg
Benzo(k)fluoranthene (8310)	–	0.00501	mg/kg
Chrysene (8310)	–	0.0128	mg/kg
Indeno(1,2,3-cd)pyrene (8310)	–	0.00634	mg/kg
Phenanthrene (8310)	–	0.00616	mg/kg
Pyrene (8310)	–	0.0139	mg/kg
Chloride	–	13.9	mg/kg

-- = not applicable
B = blank contamination (inorganic constituents)
C = Sample was </= 5X the blank concentration
DE = direct exposure
GW = groundwater
J = estimate
L = dilution indicating physical and chemical interference are present
M = sample duplicate precision not met
MTCA = *Model Toxics Control Act*
PQL = practical quantitation limit
Q = qualifier
QA/QC = quality assurance/quality control
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
RSVP = remaining sites verification package
SAP = sampling and analysis plan
TDL = target detection limit
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

3-Part Test Evaluation:

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

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

[b] Due to an excessive sample holding time exceedance for EPA Method 300.0 (anions) nitrate and nitrite, the reported results are from EPA Method 353.2 (nitrogen in nitrite and nitrate).

Washington Closure Hanford

CALCULATION SHEET

Originator J. D. Skoglie **Date** 04/28/11 **Calc. No.** 0100D-CA-V0352 **Rev. No.** 4
Project 100-D Field Remediation **Job No.** 14655 **Checked** T. E. Queen **Date** 04/28/11
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 4 of 53

1 **Summary (continued)**

2 **Results Summary - Deep Zone [a]**

3 Analyte	95% UCL Result	Maximum Result	Units
4 Cesium-137	1.02	–	pCi/g
5 Europium-152	0.449	–	pCi/g
6 Strontium-90	0.130	–	pCi/g
7 Uranium-233/234	0.531	–	pCi/g
8 Uranium-238	0.572	–	pCi/g
9 Arsenic	3.08	–	mg/kg
10 Barium	72.3	–	mg/kg
11 Beryllium	0.255	–	mg/kg
12 Boron	0.934	–	mg/kg
13 Cadmium	0.0897	–	mg/kg
14 Chromium	19.7	–	mg/kg
15 Cobalt	8.97	–	mg/kg
16 Copper	18.0	–	mg/kg
17 Hexavalent Chromium	0.34	–	mg/kg
18 Lead	5.63	–	mg/kg
19 Manganese	334	–	mg/kg
20 Mercury	0.126	–	mg/kg
21 Molybdenum	0.315	–	mg/kg
22 Nickel	12.9	–	mg/kg
23 Vanadium	58.6	–	mg/kg
24 Zinc	49.8	–	mg/kg
25 Benzo(a)anthracene (8310)	0.0871	–	mg/kg
26 Benzo(a)pyrene (8310)	0.0572	–	mg/kg
27 Benzo(b)fluoranthene (8310)	0.0875	–	mg/kg
28 Benzo(k)fluoranthene (8310)	0.0489	–	mg/kg
29 Chrysene (8310)	0.0801	–	mg/kg
30 Fluoranthene (8310)	0.0836	–	mg/kg
31 Chloride	9.05	–	mg/kg
32 Nitrogen in Nitrite and Nitrate[b]	10.6	–	mg/kg
33 Sulfate	55.0	–	mg/kg
34 Antimony	–	0.438	mg/kg
35 Bis(2-ethylhexyl)phthalate	–	0.120	mg/kg
36 Benzo(ghi)perylene (8310)	–	0.190	mg/kg
37 Dibenz[a,h]anthracene (8310)	–	0.0360	mg/kg
38 Indeno(1,2,3-cd)pyrene (8310)	–	0.220	mg/kg
39 Phenanthrene (8310)	–	0.0430	mg/kg
40 Pyrene (8310)	–	0.600	mg/kg
41 4,4'-DDT	–	0.00100	mg/kg
42 Fluoride	–	1.1	mg/kg

43 **3-Part Test Evaluation:**

44		
45 95% UCL or		
46 Maximum[a] > Cleanup Limit?	YES	YES
47 > 10% above Cleanup Limit?	YES	NO
48 Any sample > 2x Cleanup Limit?	YES	NO

Results Summary - Staging Pile Area [a]

Analyte	95% UCL Result	Maximum Result	Units
Uranium-233/234	0.581	–	pCi/g
Uranium-238	0.589	–	pCi/g
Arsenic	2.35	–	mg/kg
Barium	62.1	–	mg/kg
Beryllium	0.187	–	mg/kg
Boron	1.12	–	mg/kg
Cadmium	0.0666	–	mg/kg
Chromium	8.00	–	mg/kg
Cobalt	7.29	–	mg/kg
Copper	12.3	–	mg/kg
Hexavalent Chromium	0.16	–	mg/kg
Lead	3.24	–	mg/kg
Manganese	277	–	mg/kg
Molybdenum	0.280	–	mg/kg
Nickel	10.1	–	mg/kg
Vanadium	52.3	–	mg/kg
Zinc	42.2	–	mg/kg
Benzo(a)anthracene (8310)	0.00377	–	mg/kg
Benzo(b)fluoranthene (8310)	0.00458	–	mg/kg
Chrysene (8310)	0.00532	–	mg/kg
Fluoranthene (8310)	0.00766	–	mg/kg
Nitrogen in Nitrite and Nitrate[b]	3.15	–	mg/kg
Sulfate	26.5	–	mg/kg
Antimony	–	0.239	mg/kg
Silver	–	0.228	mg/kg
Benzo(a)pyrene (8310)	–	0.00448	mg/kg
Benzo(ghi)perylene (8310)	–	0.00275	mg/kg
Benzo(k)fluoranthene (8310)	–	0.00391	mg/kg
Dibenz[a,h]anthracene (8310)	–	0.00139	mg/kg
Phenathrene (8310)	–	0.00311	mg/kg
Pyrene (8310)	–	0.00896	mg/kg
beta-BHC	–	0.00151	mg/kg
4,4'-DDE	–	0.00657	mg/kg
Endrin aldehyde	–	0.00138	mg/kg
Endrin ketone	–	0.0172	mg/kg
Methoxychlor	–	0.0196	mg/kg
Chloride		74.8	mg/kg
Fluoride		0.30	mg/kg

3-Part Test Evaluation:

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

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

[b] Due to an excessive sample holding time exceedance for EPA Method 300.0 (anions) nitrate and nitrite, the reported results are from EPA Method 353.2 (nitrogen in nitrite and nitrate).

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Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie	**Date** 04/15/11	**Calc. No.** 0100D-CA-V0352		**Rev. No.**	3
Project 100-D Field Remediation	**Job No.** 14655	**Checked** T. E. Queen		**Date**	04/15/11
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations				**Sheet No.**	5 of 53

Summary (continued)

Results Summary - Overburden [a]

Analyte	95% UCL Result	Maximum Result	Units
Cesium-137	0.102	–	pCi/g
Europium-152	0.082	–	pCi/g
Nickel-63	2.46	–	pCi/g
Uranium-233/234	0.596	–	pCi/g
Uranium-238	0.702	–	pCi/g
Arsenic	2.13	–	mg/kg
Barium	58.5	–	mg/kg
Beryllium	0.177	–	mg/kg
Boron	0.850	–	mg/kg
Cadmium	0.0625	–	mg/kg
Chromium	6.99	–	mg/kg
Cobalt	7.55	–	mg/kg
Copper	15.1	–	mg/kg
Lead	2.62	–	mg/kg
Manganese	285	–	mg/kg
Molybdenum	0.304	–	mg/kg
Nickel	8.79	–	mg/kg
Vanadium	56.4	–	mg/kg
Zinc	43.7	–	mg/kg
Benzo(a)anthracene (8310)	0.0726	–	mg/kg
Benzo(a)pyrene (8310)	0.0495	–	mg/kg
Benzo(b)fluoranthene (8310)	0.068	–	mg/kg
Benzo(ghi)perylene (8310)	0.0264	–	mg/kg
Benzo(k)fluoranthene (8310)	0.0183	–	mg/kg
Chrysene (8310)	0.0467	–	mg/kg
Fluoranthene (8310)	0.0748	–	mg/kg
Indeno(1,2,3-cd)pyrene	0.0125	–	mg/kg
Phenanthrene (8310)	0.0271	–	mg/kg
Pyrene (8310)	0.296	–	mg/kg
Chloride	59.0	–	mg/kg
Nitrogen in Nitrite and Nitrate[b]	5.34	–	mg/kg
Sulfate	22.3	–	mg/kg
Hexavalent Chromium	–	0.18	mg/kg
Mercury	–	0.0276	mg/kg
Bis(2-ethylhexyl)phthalate (8270)	–	0.854	mg/kg
Anthracene (8310)	–	0.0122	mg/kg
Dibenz[a,h]anthracene (8310)	–	0.00673	mg/kg
Heptachlor epoxide	–	0.00151	mg/kg

3-Part Test Evaluation:

95% UCL or		
Maximum[a] > Cleanup Limit?	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.

[b] Due to an excessive sample holding time exceedance for EPA Method 300.0 (anions) nitrate and nitrite, the reported results are from EPA Method 353.2 (nitrogen in nitrite and nitrate).

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

Analyte	Excavation Duplicate Analysis		
	SZ	DZ	SPA
Potasium-40	5.9%	0.0%	5.5%
Radium-226	22.8%		0.4%
Aluminum	5.6%	17.7%	4.1%
Barium	3.2%	10.9%	9.8%
Calcium	11.8%	18.9%	3.1%
Chromium	14.2%	11.3%	21.0%
Copper	21.9%	19.6%	3.5%
Iron	8.0%	10.1%	7.3%
Lead	9.8%		0.3%
Magnesium	4.4%	22.9%	8.3%
Manganese	3.1%	7.8%	0.4%
Silicon	26.7%	3.4%	11.7%
Sodium		41.0%	
Vanadium	16.9%	4.3%	17.9%
Zinc	8.7%	7.6%	9.2%

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

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

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1 **116-D-5 Statistical Calculations**
2 **Verification Data - Shallow Zone**

3				Cesium-137			Europium-152			Nickel-63			Plutonium-239/240			Uranium-233/234			Uranium-238		
4	Sample Area	Sample Number	Sample Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
5	SZ-3	J19CC8	11/10/09	0.083		0.043	0.113	U	0.113	-0.098	U	3.23	0.006	U	0.024	0.559		0.171	0.514		0.171
6	Duplicate of J19CC8	J19CD8	11/10/09	0.062		0.032	0.073	U	0.073	1.61	U	3.23	0	U	0.142	0.487		0.177	0.579		0.177
7	SZ-1	J19CC6	11/10/09	0.014	U	0.014	0.045	U	0.045	1.50	U	3.09	0.016	U	0.048	0.661	J	0.187	0.734	J	0.187
8	SZ-2	J19CC7	11/10/09	0.033	U	0.033	0.094	U	0.094	1.09	U	3.42	0	U	0.038	0.674		0.166	0.434		0.166
9	SZ-4	J19CC9	11/10/09	0.025	U	0.025	0.064	U	0.064	1.08	U	3.09	0	U	0.035	0.539		0.229	0.419		0.229
10	SZ-5	J19CD0	11/10/09	1.62		0.033	1.04		0.071	7.49		3.49	0.045		0.043	0.534		0.255	0.501		0.255
11	SZ-6	J19CD1	11/10/09	0.022	U	0.022	0.047	U	0.047	-0.105	U	3.48	-0.005	U	0.052	0.477		0.152	0.338		0.152
12	SZ-7	J19CD2	11/10/09	0.027	U	0.027	0.078	U	0.078	-0.084	U	2.76	0.007	U	0.031	0.270		0.188	0.393		0.188
13	SZ-8	J19CD3	11/10/09	0.020	U	0.020	0.051	U	0.051	-0.591	U	3.25	-0.007	U	0.040	0.794		0.156	0.570		0.156
14	SZ-9	J19CD4	11/10/09	0.029		0.017	0.050	U	0.050	1.96	U	3.42	-0.015	U	0.116	0.650		0.166	0.953		0.166
15	SZ-10	J19CD5	11/10/09	0.027	U	0.027	0.067	U	0.067	0.752	U	3.31	0.017	U	0.133	0.542		0.166	0.347		0.166
16	SZ-11	J19CD6	11/10/09	0.034		0.027	0.061	U	0.061	1.42	U	3.02	0	U	0.110	0.667		0.176	0.575		0.176
17	SZ-12	J19CD7	11/10/09	0.027	U	0.027	0.066	U	0.066	0.495	U	2.97	0	U	0.139	0.664		0.175	0.779		0.175

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19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Cesium-137	Europium-152	Nickel-63	Plutonium-239/240	Uranium-233/234	Uranium-238
21	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
22	SZ-3	J19CC8/ J19CD8	11/10/09	0.073	0.047	1.62	0.042	0.523	0.547
23	SZ-1	J19CC6	11/10/09	0.007	0.023	1.55	0.024	0.661	0.734
24	SZ-2	J19CC7	11/10/09	0.017	0.047	1.71	0.019	0.674	0.434
25	SZ-4	J19CC9	11/10/09	0.013	0.032	1.55	0.018	0.539	0.419
26	SZ-5	J19CD0	11/10/09	1.62	1.04	7.49	0.045	0.534	0.501
27	SZ-6	J19CD1	11/10/09	0.011	0.024	1.74	0.026	0.477	0.338
28	SZ-7	J19CD2	11/10/09	0.014	0.039	1.38	0.016	0.270	0.393
29	SZ-8	J19CD3	11/10/09	0.010	0.026	1.63	0.020	0.794	0.570
30	SZ-9	J19CD4	11/10/09	0.029	0.025	1.71	0.058	0.650	0.953
31	SZ-10	J19CD5	11/10/09	0.014	0.034	1.66	0.067	0.542	0.347
32	SZ-11	J19CD6	11/10/09	0.034	0.031	1.51	0.055	0.667	0.575
33	SZ-12	J19CD7	11/10/09	0.014	0.033	1.49	0.070	0.664	0.779

34 **Statistical Computations**

35		Cesium-137	Europium-152	Nickel-63	Plutonium-239/240	Uranium-233/234	Uranium-238
36	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.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
37	N	12	12	12	12	12	12
38	% < Detection limit	67%	92%	92%	92%	0%	0%
39	Mean	0.154	0.117	2.08	0.038	0.583	0.549
40	Standard deviation	0.462	0.291	1.71	0.020	0.133	0.189
41	Z-statistic	1.64	1.64	1.64	1.64	1.64	1.64
42	95% UCL on mean	0.374	0.255	2.89	0.048	0.646	0.639
43	Maximum value	1.62	1.04	7.49	0.045	0.794	0.953

Note: The following footnotes apply to all statistical and maximum calculation pages.

[a] Due to a sample holding time exceedance, non-detected Method 300.0 nitrite data were rejected; and all detected Method 300.0 nitrate and nitrite data are considered estimated. It was anticipated that the hold time requirement for IC anions (Method 300.0) would not be met; therefore EPA Method 353.2 was also requested. Data from EPA Method 353.2 was used to calculate the 95% UCL. Method 353.2 nitrogen results are assumed to exist entirely as nitrate based on the environmental fate of nitrite.

[b] Department of Ecology requested additional remediation and re-samples taken at these locations. Original samples are for information only.

CALCULATION SHEET
Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 3
Date 04/15/11
Sheet No. 7 of 53

1 **116-D-5 Statistical Calculations**
Verification Data - Shallow Zone

	Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL
3	SZ-3	J19CC8	11/10/09	2.93		0.688	62.3		0.344	0.178		0.138	1.12	B	1.38	0.0728	B	0.138	11.1	J	0.138	6.22		1.38	15.2		0.688
4	Duplicate of J19CC8	J19CD8	11/10/09	3.19		0.706	64.3		0.353	0.172		0.141	0.949	B	1.41	0.0750	B	0.141	12.8	J	0.141	5.82		1.41	12.2		0.706
5	SZ-1	J19CC6	11/10/09	2.14		0.751	44.4		0.376	0.147	B	0.150	0.400	B	1.50	0.0474	B	0.150	6.66	J	0.150	9.01		1.50	15.5		0.751
6	SZ-2	J19CC7	11/10/09	4.63		0.884	69.5		0.442	0.332		0.177	0.897	B	1.77	0.0658	B	0.177	20.3	J	0.177	10.2		1.77	23.7		0.884
7	SZ-4	J19CC9	11/10/09	2.37		0.885	66.6		0.443	0.213		0.177	1.17	B	1.77	0.0702	B	0.177	8.01	J	0.177	8.60		1.77	15.5		0.885
8	SZ-5	J19CD0	11/10/09	1.99		0.646	57.9		0.323	0.171		0.129	0.705	B	1.29	0.0878	B	0.129	9.63	J	0.129	8.11		1.29	14.7		0.646
9	SZ-6	J19CD1	11/10/09	2.82		0.727	60.6		0.363	0.156		0.145	0.764	B	1.45	0.0562	B	0.145	10.2	J	0.145	5.92		1.45	12.1		0.727
10	SZ-7	J19CD2	11/10/09	1.72		0.753	57.2		0.377	0.169		0.151	0.701	B	1.51	0.0423	B	0.151	5.53	J	0.151	8.97		1.51	14.4		0.753
11	SZ-8	J19CD3	11/10/09	1.61		0.693	57.6		0.346	0.156		0.139	0.445	B	1.39	0.0370	B	0.139	6.32	J	0.139	9.14		1.39	14.1		0.693
12	SZ-9	J19CD4	11/10/09	2.49		0.833	56.4		0.416	0.195		0.167	0.692	B	1.67	0.0528	B	0.167	9.87	J	0.167	8.34		1.67	16.4		0.833
13	SZ-10	J19CD5	11/10/09	1.96		0.804	53.5		0.402	0.155	B	0.161	0.675	B	1.61	0.0589	B	0.161	6.11	J	0.161	8.71		1.61	15.4		0.804
14	SZ-11	J19CD6	11/10/09	2.26		0.710	62.7		0.355	0.188		0.142	1.98		1.42	0.0686	B	0.142	7.66	J	0.142	7.64		1.42	14.9		0.710
15	SZ-12	J19CD7	11/10/09	2.11		0.712	64.6		0.356	0.186		0.142	1.10	B	1.42	0.0506	B	0.142	7.03	J	0.142	8.49		1.42	14.5		0.712

17 **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
20	SZ-3	J19CC8/ J19CD8	11/10/09	3.06	63.3	0.175	1.03	0.0739	12.0	6.02	13.7
21	SZ-1	J19CC6	11/10/09	2.14	44.4	0.147	0.400	0.0474	6.66	9.01	15.5
22	SZ-2	J19CC7	11/10/09	4.63	69.5	0.332	0.897	0.0658	20.3	10.2	23.7
23	SZ-4	J19CC9	11/10/09	2.37	66.6	0.213	1.17	0.0702	8.01	8.60	15.5
24	SZ-5	J19CD0	11/10/09	1.99	57.9	0.171	0.705	0.0878	9.63	8.11	14.7
25	SZ-6	J19CD1	11/10/09	2.82	60.6	0.156	0.764	0.0562	10.2	5.92	12.1
26	SZ-7	J19CD2	11/10/09	1.72	57.2	0.169	0.701	0.0423	5.53	8.97	14.4
27	SZ-8	J19CD3	11/10/09	1.61	57.6	0.156	0.445	0.0370	6.32	9.14	14.1
28	SZ-9	J19CD4	11/10/09	2.49	56.4	0.195	0.692	0.0528	9.87	8.34	16.4
29	SZ-10	J19CD5	11/10/09	1.96	53.5	0.155	0.675	0.0589	6.11	8.71	15.4
30	SZ-11	J19CD6	11/10/09	2.26	62.7	0.188	1.98	0.0686	7.66	7.64	14.9
31	SZ-12	J19CD7	11/10/09	2.11	64.6	0.186	1.10	0.0506	7.03	8.49	14.5

32 **Statistical Computations**

		Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
34	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), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
35	N	12	12	12	12	12	12	12	12
36	% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%
37	Mean	2.43	59.5	0.187	0.880	0.0593	9.11	8.26	15.4
38	Standard deviation	0.809	6.66	0.0496	0.420	0.0145	4.03	1.24	2.83
39	95% UCL on mean	2.86	63.5	0.210	1.16	0.0685	11.0	8.85	16.8
40	Maximum value	4.63	69.5	0.332	1.98	0.0878	20.3	10.2	23.7
41	**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
42	**WAC 173-340 3-PART TEST**								
43	95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	NO	NA	NO
44	> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NO	NA	NO
45	Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NO	NA	NO
46	**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.	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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

CALCULATION SHEET
Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 3
Date 04/15/11
Sheet No. 8 of 53

1 **116-D-5 Statistical Calculations**
Verification Data - Shallow Zone

1	Sample	Sample	Sample	Hexavalent Chromium			Lead			Manganese			Molybdenum			Nickel			Vanadium			Zinc			Fluoranthene		
2	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL
3	SZ-3	J19CC8	11/10/09	0.17	B	0.21	3.10		0.344	263		3.44	0.265	B	1.38	10.8		2.75	42.4	J	1.72	38.2		6.88	24.1		3.43
4	Duplicate of J19CC8	J19CD8	11/10/09	0.18	B	0.20	2.81		0.353	255		3.53	0.218	B	1.41	11.2		2.82	35.8	J	1.76	35.0		7.06	7.62		3.39
5	SZ-1	J19CC6	11/10/09	0.19	B	0.20	1.99		0.376	332		3.76	0.366	B	1.50	9.32		3.01	76.8	J	1.88	51.7		7.51	3.38	U	3.38
6	SZ-2	J19CC7	11/10/09	0.15	B	0.22	7.44		0.442	398		4.42	0.362	B	1.77	20.8		3.54	49.3	J	2.21	62.1		8.84	3.60	U	3.60
7	SZ-4	J19CC9	11/10/09	0.12	B	0.21	2.76		0.443	327		4.43	0.281	B	1.77	9.18		3.54	56.9	J	2.21	47.1		8.85	3.37	U	3.37
8	SZ-5	J19CD0	11/10/09	0.17	B	0.21	2.37		0.323	282		3.23	0.275	B	1.29	9.07		2.58	55.2	J	1.62	48.1		6.46	30.5		3.34
9	SZ-6	J19CD1	11/10/09	0.18	B	0.20	2.33		0.363	250		3.63	0.215	B	1.45	10.7		2.91	40.7	J	1.82	35.8		7.27	3.36	U	3.36
10	SZ-7	J19CD2	11/10/09	0.19	B	0.20	1.60		0.377	307		3.77	0.292	B	1.51	7.80		3.01	65.4	J	1.88	48.6		7.53	3.33	U	3.33
11	SZ-8	J19CD3	11/10/09	0.20	B	0.21	1.38		0.346	302		3.46	0.298	B	1.39	8.25		2.77	68.4	J	1.73	50.1		6.93	3.43	U	3.43
12	SZ-9	J19CD4	11/10/09	0.18	B	0.21	2.97		0.416	313		4.16	0.287	B	1.67	10.6		3.33	54.4	J	2.08	48.4		8.33	6.54		3.45
13	SZ-10	J19CD5	11/10/09	0.11	B	0.21	3.44		0.402	306		4.02	0.309	B	1.61	8.91		3.22	61.5	J	2.01	49.2		8.04	2.06	J	3.44
14	SZ-11	J19CD6	11/10/09	0.17	B	0.20	3.22		0.355	285		3.55	0.268	B	1.42	9.16		2.84	52.9	J	1.77	46.3		7.10	8.52		3.41
15	SZ-12	J19CD7	11/10/09	0.20	B	0.20	2.74		0.356	297		3.56	0.299	B	1.42	9.26		2.85	62.1	J	1.78	48.3		7.12	2.22	J	3.42

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17 **Statistical Computation Input Data**

18	Sample	Sample	Sample	Hexavalent Chromium	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc	Fluoranthene
19	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg
20	SZ-3	J19CC8/ J19CD8	11/10/09	0.18	2.96	259	0.242	11.0	39.1	36.6	15.9
21	SZ-1	J19CC6	11/10/09	0.19	1.99	332	0.366	9.32	76.8	51.7	1.69
22	SZ-2	J19CC7	11/10/09	0.15	7.44	398	0.362	20.8	49.3	62.1	1.80
23	SZ-4	J19CC9	11/10/09	0.12	2.76	327	0.281	9.18	56.9	47.1	1.69
24	SZ-5	J19CD0	11/10/09	0.17	2.37	282	0.275	9.07	55.2	48.1	30.5
25	SZ-6	J19CD1	11/10/09	0.18	2.33	250	0.215	10.7	40.7	35.8	1.68
26	SZ-7	J19CD2	11/10/09	0.19	1.60	307	0.292	7.80	65.4	48.6	1.67
27	SZ-8	J19CD3	11/10/09	0.20	1.38	302	0.298	8.25	68.4	50.1	1.72
28	SZ-9	J19CD4	11/10/09	0.18	2.97	313	0.287	10.6	54.4	48.4	6.54
29	SZ-10	J19CD5	11/10/09	0.11	3.44	306	0.309	8.91	61.5	49.2	2.06
30	SZ-11	J19CD6	11/10/09	0.17	3.22	285	0.268	9.16	52.9	46.3	8.52
31	SZ-12	J19CD7	11/10/09	0.20	2.74	297	0.299	9.26	62.1	48.3	2.22

32 **Statistical Computations**

33		Hexavalent Chromium	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc	Fluoranthene
34	95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	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.
35	N	12	12	12	12	12	12	12	12
36	% < Detection limit	0%	0%	0%	0%	0%	0%	0%	50%
37	Mean	0.17	2.93	305	0.291	10.3	56.9	47.7	6.33
38	Standard deviation	0.03	1.55	38.2	0.0429	3.43	10.9	6.74	8.76
39	95% UCL on mean	0.18	3.67	326	0.316	12.0	63.7	50.9	10.5
40	Maximum value	0.20	7.44	398	0.366	20.8	76.8	62.1	30.5
41	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) Unless otherwise noted**	2 River Protection	10.2 GW & River Protection	512 GW & River Protection	8 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	18000 ug/kg River Protection
42	**WAC 173-340 3-PART TEST**								
43	95% UCL > Cleanup Limit?	NO	NA	NA	NO	NO	NA	NA	NO
44	> 10% above Cleanup Limit?	NO	NA	NA	NO	NO	NA	NA	NO
45	Any sample > 2X Cleanup Limit?	NO	NA	NA	NO	NO	NA	NA	NO
46	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	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 (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

CALCULATION SHEET
Washington Closure Hanford

Originator J. D. Skoglie	**Date** 04/28/11	**Calc. No.** 0100D-CA-V0352	**Rev. No.** 4
Project 100-D Field Remediation	**Job No.** 14655	**Checked** T. E. Queen	**Date** 04/28/11
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 9 of 53

1 **116-D-5 Statistical Calculations**
Verification Data - Shallow Zone

1	Sample	Sample	Sample	Fluoride			Nitrogen in Nitrate and Nitrite (Method 353.2)[a]			Sulfate		
2	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
3	SZ-3	J19CC8	11/10/09	0.4	B	2.4	3.34		0.20	11.1		2.4
4	Duplicate of J19CC8	J19CD8	11/10/09	0.5	B	2.6	2.76		0.21	7.0		2.6
5	SZ-1	J19CC6	11/10/09	2.6	U	2.6	0.64		0.19	3.7		2.6
6	SZ-2	J19CC7	11/10/09	2.6	U	2.6	1.28		0.23	10.9		2.6
7	SZ-4	J19CC9	11/10/09	0.4	B	2.4	0.26		0.20	5.3		2.4
8	SZ-5	J19CD0	11/10/09	2.6	U	2.6	2.48		0.21	23.3		2.6
9	SZ-6	J19CD1	11/10/09	0.5	B	2.7	0.53		0.21	11.0		2.7
10	SZ-7	J19CD2	11/10/09	0.3	B	2.6	0.92		0.21	3.6		2.6
11	SZ-8	J19CD3	11/10/09	2.4	U	2.4	0.23		0.21	1.9	B	2.4
12	SZ-9	J19CD4	11/10/09	2.6	U	2.6	3.52		0.20	25.2		2.6
13	SZ-10	J19CD5	11/10/09	2.3	U	2.3	0.91		0.20	7.9		2.3
14	SZ-11	J19CD6	11/10/09	2.5	U	2.5	3.16	D	0.42	11.2		2.5
15	SZ-12	J19CD7	11/10/09	0.3	B	2.4	0.66		0.20	4.7		2.4

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17 **Statistical Computation Input Data**

18	Sample	Sample	Sample	Fluoride			Nitrogen in Nitrate and Nitrite (Method 353.2)[a]			Sulfate		
19	Area	Number	Date	mg/kg			mg/kg			mg/kg		
20	SZ-3	J19CC8/ J19CD8	11/10/09	0.5			3.05			9.05		
21	SZ-1	J19CC6	11/10/09	1.3			0.64			3.70		
22	SZ-2	J19CC7	11/10/09	1.3			1.28			10.9		
23	SZ-4	J19CC9	11/10/09	0.4			0.26			5.30		
24	SZ-5	J19CD0	11/10/09	1.3			2.48			23.3		
25	SZ-6	J19CD1	11/10/09	0.5			0.53			11.0		
26	SZ-7	J19CD2	11/10/09	0.3			0.92			3.60		
27	SZ-8	J19CD3	11/10/09	1.2			0.23			1.90		
28	SZ-9	J19CD4	11/10/09	1.3			3.52			25.2		
29	SZ-10	J19CD5	11/10/09	1.2			0.91			7.90		
30	SZ-11	J19CD6	11/10/09	1.3			3.16			11.2		
31	SZ-12	J19CD7	11/10/09	0.3			0.66			4.70		

32 **Statistical Computations**

33		Fluoride			Nitrogen in Nitrate and Nitrite (Method 353.2)[a]			Sulfate		
34	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.		
35	N	12			12			12		
36	% < Detection limit	58%			0%			0%		
37	Mean	0.9			1.47			9.81		
38	Standard deviation	0.5			1.22			7.46		
39	95% UCL on mean	1.1			3.53			18.3		
40	Maximum value	2.6			3.52			25.2		
41	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	96 GW Protection			1000 GW Protection			25000 GW Protection		
42	**WAC 173-340 3-PART TEST**									
43	95% UCL > Cleanup Limit?	NA			NO			NA		
44	> 10% above Cleanup Limit?	NA			NO			NA		
45	Any sample > 2X Cleanup Limit?	NA			NO			NA		
46	**WAC 173-340 Compliance?**	Because all values are below background (2.81 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 (237 mg/kg) the WAC 173-340 3-part test is not required.		

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-D Area Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

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1 **116-D-5 Waste Site**
2 **Verification Data - Shallow zone**

3	Sample	Sample	Sample	Mercury			Silver			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene			Benzo(k)fluoranthene			Chrysene			Indeno(1,2,3-cd)pyrene		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	SZ-3	J19CC8	11/10/09	0.0265	U	0.0265	0.138	U	0.138	10.1		3.43	8.56		3.43	13.9		3.43	4.62		3.43	3.42	J	3.43	5.82		3.43
6	Duplicate of J19CC8	J19CD8	11/10/09	0.0277	U	0.0277	0.141	U	0.141	3.39	J	3.39	2.54	J	3.39	7.11		3.39	1.52	J	3.39	3.05	J	3.39	3.39	U	3.39
7	SZ-1	J19CC6	11/10/09	0.0279	U	0.0279	0.150	U	0.150	3.38	U	3.38	3.38	U	3.38	3.38	U	3.38	3.38	U	3.38	3.38	U	3.38	3.38	U	3.38
8	SZ-2	J19CC7	11/10/09	0.0145	B	0.0303	0.177	U	0.177	3.60	U	3.60	3.60	U	3.60	3.60	U	3.60	3.6	U	3.60	3.6	U	3.60	3.6	U	3.60
9	SZ-4	J19CC9	11/10/09	0.0298	U	0.0298	0.177	U	0.177	3.37	U	3.37	3.37	U	3.37	3.37	U	3.37	3.37	U	3.37	3.37	U	3.37	3.37	U	3.37
10	SZ-5	J19CD0	11/10/09	0.0651		0.0251	0.129	U	0.129	11.8		3.34	8.34		3.34	15.2		3.34	5.01		3.34	12.8		3.34	6.34		3.34
11	SZ-6	J19CD1	11/10/09	0.0277	U	0.0277	0.145	U	0.145	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36	3.36	U	3.36
12	SZ-7	J19CD2	11/10/09	0.0288	U	0.0288	1.30		0.151	3.33	U	3.33	3.33	U	3.33	3.33	U	3.33	3.33	U	3.33	3.33	U	3.33	3.33	U	3.33
13	SZ-8	J19CD3	11/10/09	0.0280	U	0.0280	0.139	U	0.139	3.43	U	3.43	3.43	U	3.43	3.43	U	3.43	3.43	U	3.43	3.43	U	3.43	3.43	U	3.43
14	SZ-9	J19CD4	11/10/09	0.0258	U	0.0258	0.167	U	0.167	2.75	J	3.45	3.45	U	3.45	4.13		3.45	1.38	J	3.45	1.89	J	3.45	2.75	J	3.45
15	SZ-10	J19CD5	11/10/09	0.0232	U	0.0232	0.161	U	0.161	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44
16	SZ-11	J19CD6	11/10/09	0.0236	U	0.0236	0.142	U	0.142	1.53	J	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	2.73	J	3.41
17	SZ-12	J19CD7	11/10/09	0.0263	U	0.0263	0.142	U	0.142	3.42	U	3.42	3.42	U	3.42	1.37	J	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42

18 **3-Part Test Evaluations**

19		Mercury	Silver	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Chrysene	Indeno(1,2,3-cd)pyrene
20	% < Detection limit	83%	92%	67%	83%	67%	75%	75%	67%
21	Maximum value	0.0651	1.30	11.8	8.56	15.2	5.01	12.8	6.34
22	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	0.33 GW & River Protection	0.73 River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	100 ug/kg River Protection	330 ug/kg GW & River Protection
23	**3-PART TEST**								
24	Maximum > Cleanup Limit?	NA	YES	NO	NO	YES	NO	NO	NO
25	> 10% above Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO	NO
26	Any sample > 2X Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO	NO
27	**3-Part Test Compliance?**	Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	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.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-D Area Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/18/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 3
Date 04/18/11
Sheet No. 11 of 53

1 **116-D-5 Waste Site**
2 **Verification Data - Shallow zone**

3	Sample	Sample	Sample	Phenanthrene			Pyrene			Chloride		
4	Area	Number	Date	ug/kg	Q	PQL	ug/kg	Q	PQL	mg/kg	Q	PQL
5	SZ-3	J19CC8	11/10/09	6.16		3.43	10.3		3.43	12		2.4
6	Duplicate of J19CC8	J19CD8	11/10/09	1.19	J	3.39	2.71	J	3.39	2.6	U	2.6
7	SZ-1	J19CC6	11/10/09	3.38	U	3.38	3.38	U	3.38	2.6	U	2.6
8	SZ-2	J19CC7	11/10/09	3.60	U	3.60	3.60	U	3.60	2.6	U	2.6
9	SZ-4	J19CC9	11/10/09	3.37	U	3.37	3.37	U	3.37	2.4	U	2.4
10	SZ-5	J19CD0	11/10/09	4.51		3.34	13.9		3.34	13.9		2.6
11	SZ-6	J19CD1	11/10/09	3.36	U	3.36	3.36	U	3.36	4.6		2.7
12	SZ-7	J19CD2	11/10/09	3.33	U	3.33	3.33	U	3.33	2.6	U	2.6
13	SZ-8	J19CD3	11/10/09	3.43	U	3.43	3.43	U	3.43	2.4	U	2.4
14	SZ-9	J19CD4	11/10/09	3.45	U	3.45	3.45	U	3.45	12.8		2.6
15	SZ-10	J19CD5	11/10/09	3.44	U	3.44	3.44	U	3.44	2.3	U	2.3
16	SZ-11	J19CD6	11/10/09	2.55	J	3.41	3.41	U	3.41	2.5	U	2.5
17	SZ-12	J19CD7	11/10/09	3.42	U	3.42	3.42	U	3.42	2.3	B	2.4

18 **3-Part Test Evaluations**

19		Phenanthrene	Pyrene	Chloride
20	% < Detection limit	75%	83%	58%
21	Maximum value	6.16	13.9	13.9
22	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless notes otherwise**	240000 ug/kg GW Protection	48000 ug/kg GW Protection	25000 GW Protection
23	**3-PART TEST**			
24	Maximum > Cleanup Limit?	NO	NO	NA
25	> 10% above Cleanup Limit?	NO	NO	NA
26	Any sample > 2X Cleanup Limit?	NO	NO	NA
27	**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.	Because all values are below background (100 mg/kg) the WAC 173-340 3 part test is not required.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 4
Date 04/28/11
Sheet No. 12 of 53

1 116-D-5 Statistical Calculations
2 Verification Data - Deep Zone

3	Sample	Sample	Sample	Cesium-137			Europium-152			Strontium-90			Uranium-233/234			Uranium-238		
4	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
5	DZ-4 [b]	J1F1J3	3/16/11	0.238		0.0552	0.271	U	0.158	0.134	U	0.193	0.182		0.169	0.199		0.187
6	DZ-4	J19CF2	11/10/09	0.434		0.035	1.50		0.070	0.0380	U	0.307	0.572		0.175	0.617		0.175
7	Duplicate of J1F1J3 [b]	J1F1J8	3/16/11	0.192		0.0276	0.258	U	0.103	0.159	U	0.199	0.174		0.151	0.204		0.154
8	Duplicate of J19CF2	J19CH1	11/10/09	0.495		0.018	1.65		0.035	-0.124	U	0.344	0.524		0.174	0.547		0.174
9	DZ-1	J19CD9	11/10/09	1.78		0.055	0.909		0.108	0.0930	U	0.239	0.528		0.168	0.418		0.168
10	DZ-2	J19CF0	11/10/09	0.171		0.025	0.110		0.059	0.006	U	0.315	0.756		0.242	0.883		0.193
11	DZ-3	J19CF1	11/10/09	0.236		0.035	0.329		0.075	0.130	U	0.316	0.603		0.178	0.719		0.178
12	DZ-5 [b]	J1F1J4	3/16/11	1.72		0.0482	0.0536	U	0.123	0.280		0.205	0.186	U	0.195	0.252		0.172
13	DZ-5	J19CF3	11/10/09	12.4		0.068	4.29		0.144	0.231		0.211	0.562		0.172	0.562		0.172
14	DZ-6 [b]	J1F1J5	3/16/11	1.33		0.0703	0.353	U	0.228	0.0783	U	0.189	0.145		0.0880	0.186		0.095
15	DZ-6	J19CF4	11/10/09	3.37		0.095	7.98		0.174	0.0870	U	0.383	0.395		0.159	0.416		0.159
16	DZ-7	J19CF5	11/10/09	0.019	U	0.019	0.061	U	0.061	0.0920	U	0.326	0.545		0.139	0.454		0.139
17	DZ-8 [b]	J1F1J6	3/16/11	0.886		0.0317	0.788		0.103	0.154	U	0.229	0.156		0.0838	0.177		0.0934
18	DZ-8	J19CF6	11/10/09	0.588		0.049	1.62		0.100	0.126	U	0.211	0.515		0.303	0.515		0.303
19	DZ-9	J19CF7	11/10/09	0.935		0.035	0.379		0.068	0.0440	U	0.322	0.669		0.213	0.752		0.213
20	DZ-10 [b]	J1F1J7	3/16/11	1.10		0.0278	0.455		0.0714	0.0200	U	0.224	0.328		0.123	0.219		0.111
21	DZ-10	J19CF8	11/10/09	16.4		0.075	3.56		0.195	0.365		0.205	0.562		0.166	0.346		0.166
22	DZ-11	J19CF9	11/10/09	0.007	U	0.007	0.019	U	0.019	0.0610	U	0.330	0.376		0.169	0.508		0.169
23	DZ-12	J19CH0	11/10/09	0.027		0.006	0.015	U	0.015	0.0030	U	0.324	0.627		0.229	0.657		0.229

24
25 Statistical Computation Input Data

26	Sample	Sample	Sample	Cesium-137	Europium-152	Strontium-90	Uranium-233/234	Uranium-238
27	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
28	DZ-4 [b]	J1F1J3/ J1F1J8	3/16/11	0.215	0.265	0.147	0.178	0.202
29	DZ-1	J19CD9	11/10/09	1.78	0.909	0.0930	0.528	0.418
30	DZ-2	J19CF0	11/10/09	0.171	0.110	0.0060	0.756	0.883
31	DZ-3	J19CF1	11/10/09	0.236	0.329	0.130	0.603	0.719
32	DZ-5 [b]	J1F1J4	3/16/11	1.72	0.0536	0.280	0.186	0.252
33	DZ-6 [b]	J1F1J5	3/16/11	1.33	0.353	0.0783	0.145	0.186
34	DZ-7	J19CF5	11/10/09	0.0095	0.0305	0.0920	0.545	0.454
35	DZ-8 [b]	J1F1J6	3/16/11	0.886	0.788	0.154	0.156	0.177
36	DZ-9	J19CF7	11/10/09	0.935	0.379	0.0440	0.669	0.752
37	DZ-10 [b]	J1F1J7	3/16/11	1.10	0.455	0.0200	0.328	0.219
38	DZ-11	J19CF9	11/10/09	0.0035	0.0095	0.0610	0.376	0.508
39	DZ-12	J19CH0	11/10/09	0.027	0.0075	0.0030	0.627	0.657

40 Statistical Computations

41		Cesium-137	Europium-152	Strontium-90	Uranium-233/234	Uranium-238
42	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.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
43	N	12	12	12	12	12
44	% < Detection limit	15%	54%	92%	8%	0%
45	Mean	0.70	0.307	0.0923	0.425	0.452
46	Standard deviation	0.67	0.299	0.0784	0.223	0.252
47	Z-statistic	1.64	1.64	1.64	1.64	1.64
48	95% UCL on mean	1.02	0.449	0.130	0.531	0.572
49	Maximum value	1.78	0.909	0.280	0.756	0.883

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CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 4
Date 04/28/11
Sheet No. 13 of 53

1 **116-D-5 Statistical Calculations**
2 **Verification Data - Deep Zone**

3	Sample	Sample	Sample	Arsenic			Barium			Beryllium			Boron			Cadmium			Chromium			Cobalt			Copper		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	DZ-4 [b]	J1F1J3	3/16/11	2.10		0.600	51.1	X	0.069	0.100	B	0.030	0.890	B	0.890	0.0710	B	0.0370	13.3	X	0.053	7.10	X	0.091	14.7	X	0.20
6	DZ-4	J19CF2	11/10/09	2.31		0.717	63.5		0.358	0.211		0.143	0.821	B	1.43	0.0851	B	0.143	10.5		0.143	7.74		1.43	15.1		0.717
7	Duplicate of J1F1J3 [b]	J1F1J8	3/16/11	2.30		0.670	57.0	X	0.077	0.120	B	0.033	0.990	U	0.990	0.0760	B	0.0420	14.9	X	0.059	8.80	X	0.100	17.9	X	0.22
8	Duplicate of J19CF2	J19CH1	11/10/09	2.77		0.736	69.6		0.368	0.227		0.147	0.994	B	1.47	0.0716	B	0.147	11.7		0.147	7.73		1.47	15.5		0.736
9	DZ-1	J19CD9	11/10/09	4.51		0.747	88.0		0.373	0.396		0.149	1.02	B	1.49	0.109	B	0.149	25.9		0.149	10.8		1.49	26.8		0.747
10	DZ-2	J19CF0	11/10/09	2.20		0.688	53.7		0.344	0.180		0.138	0.637	B	1.38	0.0529	B	0.138	8.67		0.138	8.37		1.38	14.5		0.688
11	DZ-3	J19CF1	11/10/09	2.16		0.783	56.8		0.391	0.209		0.157	0.509	B	1.57	0.0711	B	0.157	13.1		0.157	8.46		1.57	15.4		0.783
12	DZ-5 [b]	J1F1J4	3/16/11	1.60		0.670	70.5	X	0.077	0.054	B	0.033	0.990	U	0.990	0.0600	B	0.0410	15.3	X	0.058	9.50	X	0.100	16.6	X	0.22
13	DZ-5	J19CF3	11/10/09	2.96		0.768	71.6		0.384	0.249		0.154	0.409	B	1.54	0.615		0.154	35.8		0.154	6.86		1.54	16.1		0.768
14	DZ-6 [b]	J1F1J5	3/16/11	3.20		0.640	72.2	X	0.074	0.120	B	0.032	1.10	B	0.950	0.100	B	0.0400	16.2	X	0.056	8.40	X	0.097	15.3	X	0.21
15	DZ-6	J19CF4	11/10/09	3.28		0.738	82.2		0.369	0.247		0.148	0.824	B	1.48	0.352		0.148	38.2		0.148	7.54		1.48	15.6		0.738
16	DZ-7	J19CF5	11/10/09	3.48		0.828	66.3		0.414	0.256		0.166	1.26	B	1.66	0.0755	B	0.166	12.5		0.166	8.20		1.66	16.3		0.828
17	DZ-8 [b]	J1F1J6	3/16/11	2.50		0.640	69.4	X	0.073	0.130	B	0.032	0.940	U	0.940	0.0820	B	0.0390	16.6	X	0.056	7.50	X	0.096	15.2	X	0.21
18	DZ-8	J19CF6	11/10/09	3.66		0.958	80.3		0.479	0.296		0.192	1.68	B	1.92	0.0995	B	0.192	16.0		0.192	7.56		1.92	15.8		0.958
19	DZ-9	J19CF7	11/10/09	2.25		0.764	81.1		0.382	0.238		0.153	1.53	U	1.53	0.0936	B	0.153	24.1		0.153	8.29		1.53	15.9		0.764
20	DZ-10 [b]	J1F1J7	3/16/11	2.50		0.670	68.2	X	0.077	0.110	B	0.033	0.990	B	0.990	0.0960	B	0.0410	16.7	X	0.058	8.50	X	0.100	16.3	X	0.22
21	DZ-10	J19CF8	11/10/09	6.12		0.978	117		0.489	0.486		0.196	0.902	B	1.96	0.327		0.196	41.0		0.196	12.4		1.96	31.8		0.978
22	DZ-11	J19CF9	11/10/09	1.94		0.840	55.9		0.420	0.169		0.168	0.568	B	1.68	0.0523	B	0.168	5.63		0.168	8.63		1.68	13.6		0.840
23	DZ-12	J19CH0	11/10/09	2.84		0.837	54.6		0.419	0.185		0.167	0.649	B	1.67	0.0473	B	0.167	8.33		0.167	8.27		1.67	14.6		0.837

24
25 **Statistical Computation Input Data**

26	Sample	Sample	Sample	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
27	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
28	DZ-4 [b]	J1F1J3/ J1F1J8	3/16/11	2.20	54.1	0.110	0.693	0.0735	14.1	7.95	16.3
29	DZ-1	J19CD9	11/10/09	4.51	88.0	0.396	1.02	0.109	25.9	10.8	26.8
30	DZ-2	J19CF0	11/10/09	2.20	53.7	0.180	0.637	0.0529	8.67	8.37	14.5
31	DZ-3	J19CF1	11/10/09	2.16	56.8	0.209	0.509	0.0711	13.1	8.46	15.4
32	DZ-5 [b]	J1F1J4	3/16/11	1.60	70.5	0.054	0.495	0.0600	15.3	9.50	16.6
33	DZ-6 [b]	J1F1J5	3/16/11	3.20	72.2	0.120	1.10	0.100	16.2	8.40	15.3
34	DZ-7	J19CF5	11/10/09	3.48	66.3	0.256	1.26	0.0755	12.5	8.20	16.3
35	DZ-8 [b]	J1F1J6	3/16/11	2.50	69.4	0.130	0.470	0.0820	16.6	7.50	15.2
36	DZ-9	J19CF7	11/10/09	2.25	81.1	0.238	0.765	0.0936	24.1	8.29	15.9
37	DZ-10 [b]	J1F1J7	3/16/11	2.50	68.2	0.110	0.990	0.096	16.7	8.50	16.3
38	DZ-11	J19CF9	11/10/09	1.94	55.9	0.169	0.568	0.0523	5.63	8.63	13.6
39	DZ-12	J19CH0	11/10/09	2.84	54.6	0.185	0.649	0.0473	8.33	8.27	14.6

40 **Statistical Computations**

41		Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
42	95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
43	N	12	12	12	12	12	12	12	12
44	% < Detection limit	0%	0%	0%	31%	0%	0%	0%	0%
45	Mean	2.62	65.9	0.180	0.763	0.0761	14.8	8.57	16.4
46	Standard deviation	0.79	11.3	0.090	0.265	0.0205	5.96	0.84	3.40
47	95% UCL on mean	3.08	72.3	0.255	0.934	0.0897	19.7	8.97	18.0
48	Maximum value	4.51	88.0	0.396	1.53	0.109	25.9	10.8	26.8
49	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
50	WAC 173-340 3-PART TEST								
51	95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	YES	NA	NO
52	> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	YES	NA	YES
53	Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NO	NA	NO
54	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.	A detailed assessment will be performed.The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed.The data set meets the 3-part test criteria when compared to the direct exposure RAG.

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 4
Date 04/28/11
Sheet No. 14 of 53

1 116-D-5 Statistical Calculations
2 Verification Data - Deep Zone

3	Sample	Sample	Sample	Hexavalent Chromium			Lead			Manganese			Mercury			Molybdenum			Nickel			Vanadium			Zinc		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	DZ-4 [b]	J1F1J3	3/16/11	0.22		0.15	3.00		0.290	272	X	0.091	0.0130	B	0.0056	0.240	B	0.240	9.00	X	0.110	47.8	X	0.085	36.8	X	0.36
6	DZ-4	J19CF2	11/10/09	0.19	B	0.21	3.36		0.358	291		3.58	0.0605		0.0290	0.363	B	1.43	8.34		2.87	60.4		1.79	49.4		7.17
7	Duplicate of J1F1J3 [b]	J1F1J8	3/16/11	0.19		0.15	3.00		0.280	294	X	0.10	0.0230		0.0052	0.260	U	0.260	13.0	X	0.120	49.9	X	0.095	39.7	X	0.40
8	Duplicate of J19CF2	J19CH1	11/10/09	0.17	B	0.21	3.34		0.368	280		3.68	0.0595		0.0258	0.378	B	1.47	9.45		2.94	49.6		1.84	46.9		7.36
9	DZ-1	J19CD9	11/10/09	0.19	B	0.21	9.15		0.373	456		3.73	0.0535		0.0308	0.386	B	1.49	23.1		2.99	45.1		1.87	65.8		7.47
10	DZ-2	J19CF0	11/10/09	0.20	B	0.21	2.64		0.344	301		3.44	0.0273	U	0.0273	0.361	B	1.38	8.86		2.75	59.1		1.72	46.0		6.88
11	DZ-3	J19CF1	11/10/09	0.16	B	0.21	3.78		0.391	317		3.91	0.0303		0.0262	0.338	B	1.57	10.7		3.13	55.5		1.96	45.2		7.83
12	DZ-5 [b]	J1F1J4	3/16/11	0.45		0.15	2.60		1.30	307	X	0.10	0.0072	B	0.0059	0.260	U	0.260	8.20	X	0.120	68.0	X	0.095	44.5	X	0.40
13	DZ-5	J19CF3	11/10/09	0.15	B	0.21	4.05		0.384	302		3.84	0.0711		0.0281	0.294	B	1.54	12.4		3.07	39.0		1.92	60.1		7.68
14	DZ-6 [b]	J1F1J5	3/16/11	0.24		0.15	3.90		0.280	294	X	0.097	0.0220		0.0060	0.250	U	0.250	11.3	X	0.120	50.7	X	0.091	40.9	X	0.39
15	DZ-6	J19CF4	11/10/09	0.16	B	0.21	4.88		0.369	300		3.69	0.7230		0.0242	0.353	B	1.48	12.3		2.95	54.5		1.85	67.6		7.38
16	DZ-7	J19CF5	11/10/09	0.20	B	0.21	4.21		0.414	323		4.14	0.0250	U	0.0250	0.329	B	1.66	11.6		3.31	50.7		2.07	47.8		8.28
17	DZ-8 [b]	J1F1J6	3/16/11	0.70		0.15	7.60		0.280	273	X	0.096	0.50		0.0053	0.250	U	0.250	9.50	X	0.120	49.1	X	0.09	39.8	X	0.38
18	DZ-8	J19CF6	11/10/09	0.20	B	0.21	5.19		0.479	316		4.79	0.4810		0.0296	0.300	B	1.92	12.5		3.83	41.2		2.40	47.7		9.58
19	DZ-9	J19CF7	11/10/09	0.14	B	0.21	4.57		0.382	292		3.82	0.0170	B	0.0292	0.325	B	1.53	10.3		3.05	55.3		1.91	47.9		7.64
20	DZ-10 [b]	J1F1J7	3/16/11	0.30		0.16	4.60		0.260	320	X	0.10	0.0190		0.0058	0.260	U	0.260	11.4	X	0.120	52.0	X	0.095	42.7	X	0.40
21	DZ-10	J19CF8	11/10/09	0.17	B	0.22	11.5		0.489	518		4.89	0.0451		0.0299	0.381	B	1.96	29.8		3.91	44.1		2.45	84.3		9.78
22	DZ-11	J19CF9	11/10/09	0.20	B	0.20	1.93		0.420	277		4.20	0.0279	U	0.0279	0.367	B	1.68	6.47		3.36	64.1		2.10	50.0		8.40
23	DZ-12	J19CH0	11/10/09	0.18	B	0.20	2.44		0.419	286		4.19	0.0287	U	0.0287	0.344	B	1.67	8.73		3.35	60.0		2.09	48.4		8.37

24
25 Statistical Computation Input Data

26	Sample	Sample	Sample	Hexavalent Chromium	Lead	Manganese	Mercury	Molybdenum	Nickel	Vanadium	Zinc
27	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
28	DZ-4 [b]	J1F1J3/ J1F1J8	3/16/11	0.21	3.00	283	0.0180	0.185	11.0	48.9	38.3
29	DZ-1	J19CD9	11/10/09	0.19	9.15	456	0.0535	0.386	23.1	45.1	65.8
30	DZ-2	J19CF0	11/10/09	0.20	2.64	301	0.0137	0.361	8.86	59.1	46.0
31	DZ-3	J19CF1	11/10/09	0.16	3.78	317	0.0303	0.338	10.7	55.5	45.2
32	DZ-5 [b]	J1F1J4	3/16/11	0.45	2.60	307	0.0072	0.130	8.20	68.0	44.5
33	DZ-6 [b]	J1F1J5	3/16/11	0.24	3.90	294	0.0220	0.125	11.3	50.7	40.9
34	DZ-7	J19CF5	11/10/09	0.20	4.21	323	0.0125	0.329	11.6	50.7	47.8
35	DZ-8 [b]	J1F1J6	3/16/11	0.70	7.60	273	0.500	0.125	9.50	49.1	39.8
36	DZ-9	J19CF7	11/10/09	0.14	4.57	292	0.0170	0.325	10.3	55.3	47.9
37	DZ-10 [b]	J1F1J7	3/16/11	0.30	4.60	320	0.0190	0.130	11.4	52.0	42.7
38	DZ-11	J19CF9	11/10/09	0.20	1.93	277	0.0140	0.367	6.47	64.1	50.0
39	DZ-12	J19CH0	11/10/09	0.18	2.44	286	0.0144	0.344	8.73	60.0	48.4

40 Statistical Computations

41		Hexavalent Chromium	Lead	Manganese	Mercury	Molybdenum	Nickel	Vanadium	Zinc
42	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), 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.
43	N	12	12	12	12	12	12	12	12
44	% < Detection limit	0%	0%	0%	31%	39%	0%	0%	0%
45	Mean	0.26	4.20	311	0.0601	0.262	10.9	54.9	46.4
46	Standard deviation	0.16	2.16	48.7	0.139	0.111	4.13	6.81	7.11
47	95% UCL on mean	0.34	5.63	334	0.126	0.315	12.9	58.6	49.8
48	Maximum value	0.70	9.15	456	0.500	0.386	23.1	68.0	65.8
49	Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	2 River Protection	10.2 GW & River Protection	512 GW & River Protection	0.33 GW & River Protection	8 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection
50	WAC 173-340 3-PART TEST								
51	95% UCL > Cleanup Limit?	NO	NO	NO	NO	NO	NO	NA	NO
52	> 10% above Cleanup Limit?	NO	NO	NO	YES	NO	YES	NA	NO
53	Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO	NO	NA	NO
54	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.	A detailed assessment will be performed.The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed.The data set meets the 3-part test criteria when compared to the direct exposure RAG.	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.

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 4
Date 04/28/11
Sheet No. 15 of 53

1 116-D-5 Statistical Calculations
2 Verification Data - Deep Zone

3	Sample	Sample	Sample	Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene			Benzo(k)fluoranthene			Chrysene			Fluoranthene			Chloride			Nitrogen in Nitrate and Nitrite (Method 353.2)[a]		
4	Area	Number	Date	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	DZ-4[b]	J1F1J3	3/16/11	3.50	U	3.50	6.90	U	6.90	4.60	U	4.60	4.30	U	4.30	5.20	U	5.20	14	U	14	2.1	U	2.1	0.39	U	0.39
6	DZ-4	J19CF2	11/10/09	186		3.39	134		3.39	284		3.39	71.8		3.39	163		3.39	564		3.39	8.5		2.6	2.20	J	0.22
7	Duplicate of J1F1J3[b]	J1F1J8	3/16/11	3.40	U	3.40	6.80	U	6.80	4.50	U	4.50	4.20	U	4.20	5.10	U	5.10	14.0	U	14.0	2.1	U	2.1	0.42	B	0.38
8	Duplicate of J19CF2	J19CH1	11/10/09	118		3.30	85.1		3.30	175		3.30	49.2		3.30	76.8		3.30	328		3.30	11		2.5	4.24		0.19
9	DZ-1	J19CD9	11/10/09	3.49	U	3.49	3.49	U	3.49	3.49	U	3.49	3.49	U	3.49	3.49	U	3.49	3.49	U	3.49	5.9		2.6	1.22	J	0.22
10	DZ-2	J19CF0	11/10/09	4.26		3.28	3.28	J	3.28	5.90		3.28	2.29	J	3.28	2.46	J	3.28	11.0		3.28	3.1		2.4	1.91	J	0.20
11	DZ-3	J19CF1	11/10/09	1.88	J	3.43	1.37	J	3.43	4.11		3.43	1.37	J	3.43	1.37	J	3.43	3.94		3.43	4.5		2.5	4.03	J	0.20
12	DZ-5[b]	J1F1J4	3/16/11	3.30	U	3.30	6.60	U	6.60	4.30	U	4.30	4.00	U	4.00	5.00	U	5.00	13.0	U	13.0	2.0	U	2.0	0.35	U	0.35
13	DZ-5	J19CF3	11/10/09	3.39	J	3.40	2.71	J	3.40	7.29		3.40	2.71	J	3.40	2.20	J	3.40	9.15		3.40	19.8		2.4	14.4	D	1.03
14	DZ-6[b]	J1F1J5	3/16/11	360		3.30	230		6.70	360		4.40	200		4.10	330		5.10	340		14.0	29.1		2.1	0.64	B	0.37
15	DZ-6	J19CF4	11/10/09	1040	D	13.8	1090	D	13.8	1900	D	13.8	586	D	13.8	917	D	13.8	2010	D	13.8	418	DJ	48.2	49.3	DJ	1.99
16	DZ-7	J19CF5	11/10/09	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	2.5	U	2.5	1.24		0.20
17	DZ-8[b]	J1F1J6	3/16/11	41.0		3.40	39.0		6.90	38.0		4.50	23.0		4.20	40.0	J	5.20	14.0	U	14.0	5.9		2.2	14.3		0.37
18	DZ-8	J19CF6	11/10/09	79.2		3.49	52.8		3.49	122		3.49	35.4		3.49	62.3		3.49	197		3.49	27.9		2.6	27.3	D	2.19
19	DZ-9	J19CF7	11/10/09	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	2.5	U	2.5	6.60		0.22
20	DZ-10[b]	J1F1J7	3/16/11	38.0		3.50	21.0		7.10	38.0	X	4.60	23.0		4.30	39.0	J	5.30	49.0		14.0	2.1	B	2.1	0.54	B	0.38
21	DZ-10	J19CF8	11/10/09	1.83	J	3.66	1.64	J	3.66	5.11		3.66	3.65	J	3.66	3.66	U	3.66	5.48		3.66	61.9		2.5	65.6	D	2.11
22	DZ-11	J19CF9	11/10/09	7.10		3.39	6.76		3.39	11.2		3.39	3.89		3.39	2.20	J	3.39	21.3		3.39	2.4	U	2.4	0.81		0.19
23	DZ-12	J19CH0	11/10/09	1.87	J	3.40	1.53	J	3.40	2.55	J	3.40	1.02	J	3.40	3.40	U	3.40	4.92		3.40	7.6		2.5	1.53		0.20

24
25 Statistical Computation Input Data

26	Sample	Sample	Sample	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Chrysene	Fluoranthene	Chloride	Nitrogen in Nitrate and Nitrite (Method 353.2)[a]
27	Area	Number	Date	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	mg/kg
28	DZ-4[b]	J1F1J3/ J1F1J8	3/16/11	1.73	3.43	2.28	2.13	2.58	7.00	1.1	0.31
29	DZ-1	J19CD9	11/10/09	1.75	1.75	1.75	1.75	1.75	1.75	5.9	1.22
30	DZ-2	J19CF0	11/10/09	4.26	3.28	5.90	2.29	2.46	11.0	3.1	1.91
31	DZ-3	J19CF1	11/10/09	1.88	1.37	4.11	1.37	1.37	3.94	4.5	4.03
32	DZ-5[b]	J1F1J4	3/16/11	1.65	3.30	2.15	2.00	2.50	6.50	1.0	0.18
33	DZ-6[b]	J1F1J5	3/16/11	360	230	360	200	330	340	29.1	0.64
34	DZ-7	J19CF5	11/10/09	1.67	1.67	1.67	1.67	1.67	1.67	1.3	1.24
35	DZ-8[b]	J1F1J6	3/16/11	41.0	39.0	38.0	23.0	40.0	7.00	5.9	14.3
36	DZ-9	J19CF7	11/10/09	1.71	1.71	1.71	1.71	1.71	1.71	1.3	6.60
37	DZ-10[b]	J1F1J7	3/16/11	38.0	21.0	38.0	23.0	39.0	49.0	2.1	0.54
38	DZ-11	J19CF9	11/10/09	7.10	6.76	11.2	3.89	2.20	21.3	1.2	0.81
39	DZ-12	J19CH0	11/10/09	1.87	1.53	2.55	1.02	1.70	4.92	7.6	1.53

40 Statistical Computations

41		Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Chrysene	Fluoranthene	Chloride	Nitrogen in Nitrate and Nitrite (Method 353.2)[a]
42	95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.
43	N	12	12	12	12	12	12	12	12
44	% < Detection limit	46%	46%	46%	46%	54%	54%	46%	8%
45	Mean	39	26.2	39.1	22.0	35.6	38.0	5.33	2.78
46	Standard deviation	102	65.2	102	56.6	93.8	96.0	7.83	4.07
47	95% UCL on mean	87.1	57.2	87.5	48.9	80.1	83.6	9.05	10.6
48	Maximum value	360	230	360	200	330	340	29.1	14.3
49	Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection	100 ug/kg River Protection	18000 ug/kg River Protection	25000 GW Protection	1000 GW Protection
50	WAC 173-340 3-PART TEST								
51	95% UCL > Cleanup Limit?	YES	YES	YES	YES	NO	NO	NO	NO
52	> 10% above Cleanup Limit?	YES	YES	YES	YES	YES	NO	NO	NO
53	Any sample > 2X Cleanup Limit?	YES	YES	YES	YES	YES	NO	NO	NO
54	WAC 173-340 Compliance?	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to 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.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to direct exposure RAG.

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CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

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116-D-5 Statistical Calculations
Verification Data - Deep Zone

	Sample Area	Sample Number	Sample Date	Sulfate mg/kg	Q	PQL
1						
2						
3	DZ-4 [b]	J1F1J3	3/16/11	3.90	B	1.8
4	DZ-4	J19CF2	11/10/09	21.9		2.6
5	Duplicate of J1F1J3 [b]	J1F1J8	3/16/11	4.40	B	1.8
6	Duplicate of J19CF2	J19CH1	11/10/09	30.1		2.5
7	DZ-1	J19CD9	11/10/09	85.1		2.6
8	DZ-2	J19CF0	11/10/09	28.3		2.4
9	DZ-3	J19CF1	11/10/09	34.4		2.5
10	DZ-5 [b]	J1F1J4	3/16/11	4.30	B	1.7
11	DZ-5	J19CF3	11/10/09	221	D	12.0
12	DZ-6 [b]	J1F1J5	3/16/11	29.3		1.9
13	DZ-6	J19CF4	11/10/09	769	DJ	48.2
14	DZ-7	J19CF5	11/10/09	4.80		2.5
15	DZ-8 [b]	J1F1J6	3/16/11	27.1		1.9
16	DZ-8	J19CF6	11/10/09	198	D	12.9
17	DZ-9	J19CF7	11/10/09	17.0		2.5
18	DZ-10 [b]	J1F1J7	3/16/11	8.30		1.9
19	DZ-10	J19CF8	11/10/09	239	D	12.7
20	DZ-11	J19CF9	11/10/09	5.80		2.4
21	DZ-12	J19CH0	11/10/09	16.7		2.5

22

23 **Statistical Computation Input Data**

	Sample Area	Sample Number	Sample Date	Sulfate mg/kg		
24						
25						
26	DZ-4 [b]	J1F1J3/ J1F1J8	3/16/11	4.15		
27	DZ-1	J19CD9	11/10/09	85.1		
28	DZ-2	J19CF0	11/10/09	28.3		
29	DZ-3	J19CF1	11/10/09	34.4		
30	DZ-5 [b]	J1F1J4	3/16/11	4.30		
31	DZ-6 [b]	J1F1J5	3/16/11	29.3		
32	DZ-7	J19CF5	11/10/09	4.80		
33	DZ-8 [b]	J1F1J6	3/16/11	27.1		
34	DZ-9	J19CF7	11/10/09	17.0		
35	DZ-10 [b]	J1F1J7	3/16/11	8.30		
36	DZ-11	J19CF9	11/10/09	5.80		
37	DZ-12	J19CH0	11/10/09	16.7		

38 **Statistical Computations**

		Sulfate		
39				
40	95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.		
41	N	12		
42	% < Detection limit	0%		
43	Mean	22.1		
44	Standard deviation	22.7		
45	95% UCL on mean	55.0		
46	Maximum value	85.1		
47	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	25000	GW Protection	
48	**WAC 173-340 3-PART TEST**			
49	95% UCL > Cleanup Limit?	NO		
50	> 10% above Cleanup Limit?	NO		
51	Any sample > 2X Cleanup Limit?	NO		
52	**WAC 173-340 Compliance?**	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 J. D. Skoglie
Project 100-D Area Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
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1 **116-D-5 Waste Site**
2 **Verification Data - Deep Zone**

3	Sample	Sample	Sample	Antimony			Bis(2-ethylhexyl)phthalate			Benzo(ghi)perylene			Dibenz[a,h]anthracene			Indeno(1,2,3-cd)pyrene			Phenanthrene			Pyrene			4,4'-DDT		
4	Area	Number	Date	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	DZ-4 [b]	J1F1J3	3/16/11	0.340	U	0.340	110	JB	48	7.8	U	7.8	12.0	U	12.0	13.0	U	13.0	13.0	U	13.0	13.0	U	13.0	0.64	U	0.64
6	DZ-4	J19CF2	11/10/09	0.449	J	0.430	681	UD	681	93.3		3.39	20.3		3.39	81.6		3.39	117		3.39	386		3.39	1.36	UD	1.36
7	Duplicate of J1F1J3 [b]	J1F1J8	3/16/11	0.390	U	0.390	110	JB	48	7.60	U	7.60	12.0	U	12.0	13.0	U	13.0	13.0	U	13.0	13.0	U	13.0	0.63	U	0.63
8	Duplicate of J19CF2	J19CH1	11/10/09	0.442	UJ	0.442	340	U	340	67.0		3.30	11.7		3.30	57.1		3.30	49.7		3.30	240		3.30	1.36	UD	1.36
9	DZ-1	J19CD9	11/10/09	0.438	BJ	0.448	350	U	350	3.49	U	3.49	3.49	U	3.49	3.49	U	3.49	3.49	U	3.49	3.49	U	3.49	1.40	UD	1.40
10	DZ-2	J19CF0	11/10/09	0.393	BJ	0.413	341	U	341	3.28	J	3.28	3.28	U	3.28	3.28	U	3.28	3.77		3.28	4.26		3.28	1.36	UD	1.36
11	DZ-3	J19CF1	11/10/09	0.328	BJ	0.470	346	U	346	3.43	U	3.43	3.43	U	3.43	3.43	U	3.43	1.03	J	3.43	3.43	U	3.43	1.38	UD	1.38
12	DZ-5 [b]	J1F1J4	3/16/11	0.380	U	0.380	120	JB	48	7.40	U	7.40	11.0	U	11.0	12.0	U	12.0	12.0	U	12.0	12.0	U	12.0	0.61	U	0.61
13	DZ-5	J19CF3	11/10/09	0.293	BJ	0.461	339	U	339	3.4	U	3.40	3.4	U	3.40	3.40	U	3.40	3.4	U	3.40	1.86	J	3.40	1.36	UD	1.36
14	DZ-6 [b]	J1F1J5	3/16/11	0.370	U	0.370	120	JB	49	190		7.5	36.0	X	12.0	220		13.0	43.0		13.0	600		13.0	1.00	J	0.62
15	DZ-6	J19CF4	11/10/09	0.296	BJ	0.443	1730	UD	1730	784	D	13.8	160	D	13.8	723	D	13.8	98.8	D	13.8	2110	D	13.8	1.38	UD	1.38
16	DZ-7	J19CF5	11/10/09	0.251	BJ	0.497	339	U	339	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	3.34	U	3.34	1.36	UD	1.36
17	DZ-8 [b]	J1F1J6	3/16/11	0.370	U	0.370	120	JB	50	7.70	U	7.70	12.0	U	12.0	22.0	J	13.0	13.0	U	13.0	21.0	J	13.0	0.64	U	0.64
18	DZ-8	J19CF6	11/10/09	0.575	UJ	0.575	348	U	348	46.7		3.49	9.59		3.49	47.4		3.49	23.4		3.49	138		3.49	1.39	UD	1.39
19	DZ-9	J19CF7	11/10/09	0.458	UJ	0.458	343	U	343	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	1.37	UD	1.37
20	DZ-10 [b]	J1F1J7	3/16/11	0.380	U	0.380	120	JB	51	7.90	U	7.90	12.0	U	12.0	20.0	J	13.0	13.0	U	13.0	56.0		13.0	0.89	J	0.66
21	DZ-10	J19CF8	11/10/09	0.378	BJ	0.587	362	U	362	3.66	U	3.66	3.66	U	3.66	3.66	U	3.66	3.66	U	3.66	3.66	U	3.66	1.45	UD	1.45
22	DZ-11	J19CF9	11/10/09	0.252	BJ	0.504	338	U	338	6.76		3.39	3.39	U	3.39	6.43		3.39	3.89		3.39	9.81		3.39	1.35	UD	1.35
23	DZ-12	J19CH0	11/10/09	0.502	UJ	0.502	337	U	337	3.40	U	3.40	3.40	U	3.40	3.40	U	3.40	1.53	J	3.4	3.4	U	3.4	1.35	UD	1.35

24 **3-Part Test Evaluations**

25		Antimony	Bis(2-ethylhexyl)phthalate	Benzo(ghi)perylene	Dibenz[a,h]anthracene	Indeno(1,2,3-cd)pyrene	Phenanthrene	Pyrene	4,4'-DDT
26	% < Detection limit	54%	54%	77%	92%	69%	62%	62%	85%
27	Maximum value	0.438	120	190	36.0	220	43.0	600	1.00
28	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	5 GW & River Protection	360 ug/kg River Protection	48000 ug/kg GW Protection	30 ug/kg GW & River Protection	330 ug/kg GW & River Protection	240000 ug/kg GW Protection	48000 ug/kg GW Protection	3.3 ug/kg DE, GW, & River Protection
29	**3-PART TEST**								
30	Maximum > Cleanup Limit?	NA	NO	NO	YES	NO	NO	NO	NO
31	> 10% above Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO	NO
32	Any sample > 2X Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO	NO
33	**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.	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.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

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Sheet No. 18 of 53

1 **116-D-5 Waste Site**
2 **Verification Data - Deep Zone**

3	Sample	Sample	Sample	Fluoride		
4	Area	Number	Date	mg/kg	Q	PQL
5	DZ-4 [b]	J1F1J3	3/16/11	0.88	U	0.88
6	DZ-4	J19CF2	11/10/09	2.6	U	2.6
7	Duplicate of J1F1J3 [b]	J1F1J8	3/18/11	0.87	U	0.87
8	Duplicate of J19CF2	J19CH1	11/10/09	2.5	U	2.5
9	DZ-1	J19CD9	11/10/09	2.6	U	2.6
10	DZ-2	J19CF0	11/10/09	2.4	U	2.4
11	DZ-3	J19CF1	11/10/09	2.5	U	2.5
12	DZ-5 [b]	J1F1J4	3/16/11	0.83	U	0.83
13	DZ-5	J19CF3	11/10/09	2.4	U	2.4
14	DZ-6 [b]	J1F1J5	3/16/11	1.1	B	0.89
15	DZ-6	J19CF4	11/10/09	2.4	U	2.4
16	DZ-7	J19CF5	11/10/09	2.5	U	2.5
17	DZ-8 [b]	J1F1J6	3/16/11	0.90	U	0.90
18	DZ-8	J19CF6	11/10/09	0.3	B	2.6
19	DZ-9	J19CF7	11/10/09	2.5	U	2.5
20	DZ-10 [b]	J1F1J7	3/16/11	1.1	B	0.89
21	DZ-10	J19CF8	11/10/09	2.5	U	2.5
22	DZ-11	J19CF9	11/10/09	2.4	U	2.4
23	DZ-12	J19CH0	11/10/09	2.5	U	2.5

24 **3-Part Test Evaluations**

25		Fluoride		
26	% < Detection limit	85%		
27	Maximum value	1.1		
28	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	96 GW Protection		
29	**3-PART TEST**			
30	Maximum > Cleanup Limit?	NA		
31	> 10% above Cleanup Limit?	NA		
32	Any sample > 2X Cleanup Limit?	NA		
33	**3-Part Test Compliance?**	Because all values are below background (2.81 mg/kg) the WAC 173-340 3-part test is not required.		

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

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1 **116-D-5 Statistical Calculations**
2 **Verification Data - Staging Pile Area**

3	Sample	Sample	Sample	Uranium-233/234			Uranium-238		
4	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA
5	SPA-1	J19CH2	11/9/09	0.468		0.115	0.362		0.115
6	Duplicate of J19CH2	J19CJ4	11/9/09	0.422		0.216	0.338		0.216
7	SPA-2	J19CH3	11/9/09	0.343		0.181	0.637		0.125
8	SPA-3	J19CH4	11/9/09	0.496		0.157	0.368		0.108
9	SPA-4	J19CH5	11/9/09	0.531		0.081	0.553		0.081
10	SPA-5	J19CH6	11/9/09	0.479		0.110	0.599		0.076
11	SPA-6	J19CH7	11/9/09	0.414		0.113	0.568		0.090
12	SPA-7	J19CH8	11/9/09	0.625		0.100	0.534		0.100
13	SPA-8	J19CH9	11/9/09	0.729		0.112	0.517		0.090
14	SPA-9	J19CJ0	11/9/09	0.742		0.284	0.742		0.284
15	SPA-10	J19CJ1	11/9/09	0.586		0.224	0.674		0.224
16	SPA-11	J19CJ2	11/9/09	0.464		0.177	0.440		0.177
17	SPA-12	J19CJ3	11/9/09	0.392		0.187	0.343		0.187

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19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Uranium-233/234			Uranium-238		
21	Area	Number	Date	pCi/g			pCi/g		
22	SPA-1	J19CH2/ J19CJ4	11/9/09	0.445			0.350		
23	SPA-2	J19CH3	11/9/09	0.343			0.637		
24	SPA-3	J19CH4	11/9/09	0.496			0.368		
25	SPA-4	J19CH5	11/9/09	0.531			0.553		
26	SPA-5	J19CH6	11/9/09	0.479			0.599		
27	SPA-6	J19CH7	11/9/09	0.414			0.568		
28	SPA-7	J19CH8	11/9/09	0.625			0.534		
29	SPA-8	J19CH9	11/9/09	0.729			0.517		
30	SPA-9	J19CJ0	11/9/09	0.742			0.742		
31	SPA-10	J19CJ1	11/9/09	0.586			0.674		
32	SPA-11	J19CJ2	11/9/09	0.464			0.440		
33	SPA-12	J19CJ3	11/9/09	0.392			0.343		

34 **Statistical Computations**

35		Uranium-233/234			Uranium-238		
36	95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.		
37	N	12			12		
38	% < Detection limit	0%			0%		
39	Mean	0.521			0.527		
40	Standard deviation	0.127			0.130		
41	Z-statistic	1.64			1.64		
42	95% UCL on mean	0.581			0.589		
43	Maximum value	0.742			0.742		

CALCULATION SHEET
Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
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1 **116-D-5 Statistical Calculations**
2 **Verification Data - Staging Pile Area**

3	Sample	Sample	Sample	Arsenic			Barium			Beryllium			Boron			Cadmium			Chromium			Cobalt			Copper		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	SPA-1	J19CH2	11/9/09	2.62		0.343	51.7		0.343	0.160		0.137	0.571	B	1.37	0.0564	B	0.137	10.7		0.137	5.13		1.37	11.3		0.686
6	Duplicate of J19CH2	J19CJ4	11/9/09	2.25		0.430	57.0		0.430	0.164	B	0.172	0.791	B	1.72	0.0627	B	0.172	8.67		0.172	5.53		1.72	11.7		0.859
7	SPA-2	J19CH3	11/9/09	2.50		0.491	60.0		0.491	0.197		0.196	1.59	B	1.96	0.0577	B	0.196	8.21		0.196	7.15		1.96	16.2		0.981
8	SPA-3	J19CH4	11/9/09	2.28		0.346	51.3		0.346	0.151		0.139	0.657	B	1.39	0.0459	B	0.139	7.30		0.139	5.86		1.39	12.7		0.693
9	SPA-4	J19CH5	11/9/09	1.97		0.395	55.7		0.395	0.154	B	0.158	0.609	B	1.58	0.0449	B	0.158	5.91		0.158	7.01		1.58	13.2		0.791
10	SPA-5	J19CH6	11/9/09	1.93		0.399	67.8		0.399	0.151	B	0.160	0.811	B	1.60	0.0564	B	0.160	7.64		0.160	6.65		1.60	13.4		0.799
11	SPA-6	J19CH7	11/9/09	2.29		0.373	69.9		0.373	0.214		0.149	0.963	B	1.49	0.0595	B	0.149	7.59		0.149	7.37		1.49	13.9		0.747
12	SPA-7	J19CH8	11/9/09	1.91		0.415	49.5		0.415	0.178		0.166	0.777	B	1.66	0.0431	B	0.166	6.56		0.166	7.66		1.66	14.7		0.830
13	SPA-8	J19CH9	11/9/09	1.73		0.339	55.5		0.339	0.175		0.135	0.823	B	1.35	0.135	U	0.135	6.13		0.135	7.48		1.35	13.8		0.677
14	SPA-9	J19CJ0	11/9/09	2.48		0.473	61.0		0.473	0.184	B	0.189	1.04	B	1.89	0.189	U	0.189	6.82		0.189	7.81		1.89	14.1		0.945
15	SPA-10	J19CJ1	11/9/09	1.19		0.341	43.3		0.341	0.125	B	0.136	0.449	B	1.36	0.0343	B	0.136	4.32		0.136	6.79		1.36	12.2		0.682
16	SPA-11	J19CJ2	11/9/09	2.01		0.442	60.4		0.442	0.179		0.177	1.04	B	1.77	0.0579	B	0.177	6.80		0.177	7.09		1.77	13.5		0.884
17	SPA-12	J19CJ3	11/9/09	2.79		0.397	63.0		0.397	0.197		0.159	1.31	B	1.59	0.0658	B	0.159	8.44		0.159	6.84		1.59	14.1		0.794

18
19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
21	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
22	SPA-1	J19CH2/ J19CJ4	11/9/09	2.44	54.4	0.162	0.681	0.0596	9.69	5.33	11.5
23	SPA-2	J19CH3	11/9/09	2.50	60.0	0.197	1.59	0.0577	8.21	7.15	16.2
24	SPA-3	J19CH4	11/9/09	2.28	51.3	0.151	0.657	0.0459	7.30	5.86	12.7
25	SPA-4	J19CH5	11/9/09	1.97	55.7	0.154	0.609	0.0449	5.91	7.01	13.2
26	SPA-5	J19CH6	11/9/09	1.93	67.8	0.151	0.811	0.0564	7.64	6.65	13.4
27	SPA-6	J19CH7	11/9/09	2.29	69.9	0.214	0.963	0.0595	7.59	7.37	13.9
28	SPA-7	J19CH8	11/9/09	1.91	49.5	0.178	0.777	0.0431	6.56	7.66	14.7
29	SPA-8	J19CH9	11/9/09	1.73	55.5	0.175	0.823	0.0675	6.13	7.48	13.8
30	SPA-9	J19CJ0	11/9/09	2.48	61.0	0.184	1.04	0.0945	6.82	7.81	14.1
31	SPA-10	J19CJ1	11/9/09	1.19	43.3	0.125	0.449	0.0343	4.32	6.79	12.2
32	SPA-11	J19CJ2	11/9/09	2.01	60.4	0.179	1.04	0.0579	6.80	7.09	13.5
33	SPA-12	J19CJ3	11/9/09	2.79	63.0	0.197	1.31	0.0658	8.44	6.84	14.1

34 **Statistical Computations**

35		Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
36	95% UCL based on	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.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
37	N	12	12	12	12	12	12	12	12
38	% < Detection limit	0%	0%	0%	0%	17%	0%	0%	0%
39	Mean	2.13	57.6	0.172	0.896	0.0573	7.12	6.92	13.6
40	Standard deviation	0.43	7.62	0.025	0.318	0.0153	1.38	0.719	1.21
41	95% UCL on mean	2.35	62.1	0.187	1.12	0.0666	8.00	7.29	12.3
42	Maximum value	2.79	69.9	0.214	1.59	0.189	10.7	7.81	16.2
43	**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
44	**WAC 173-340 3-PART TEST**								
45	95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
46	> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
47	Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
48	**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 J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 3
Date 04/15/11
Sheet No. 21 of 53

1 **116-D-5 Statistical Calculations**
2 **Verification Data - Staging Pile Area**

3	Sample	Sample	Sample	Hexavalent Chromium			Lead			Manganese			Molybdenum			Nickel			Vanadium			Zinc			Benzo(a)anthracene		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL
5	SPA-1	J19CH2	11/9/09	0.17		0.21	2.87		0.343	235		3.43	0.208	B	1.37	9.99		2.75	34.0		1.72	32.1		6.86	3.44	U	3.44
6	Duplicate of J19CH2	J19CJ4	11/9/09	0.17		0.21	2.86		0.430	234		4.30	0.219	B	1.72	9.23		3.44	40.7		2.15	35.2		8.59	2.30	J	3.44
7	SPA-2	J19CH3	11/9/09	0.12		0.20	3.47		0.491	282		4.91	0.331	B	1.96	10.4		3.92	51.1		2.45	41.2		9.81	1.07	J	3.41
8	SPA-3	J19CH4	11/9/09	0.17		0.21	2.76		0.346	240		3.46	0.251	B	1.39	10.1		2.77	41.0		1.73	38.6		6.93	3.42	U	3.42
9	SPA-4	J19CH5	11/9/09	0.10		0.21	2.70		0.395	272		3.95	0.266	B	1.58	7.65		3.16	51.7		1.98	40.7		7.91	1.01	J	3.43
10	SPA-5	J19CH6	11/9/09	0.14		0.21	2.72		0.399	261		3.99	0.261	B	1.60	12.0		3.19	48.2		2.00	38.0		7.99	10.2		3.47
11	SPA-6	J19CH7	11/9/09	0.14		0.21	3.64		0.373	309		3.73	0.254	B	1.49	9.02		2.99	53.9		1.87	44.5		7.47	3.44	U	3.44
12	SPA-7	J19CH8	11/9/09	0.06		0.21	2.86		0.415	279		4.15	0.295	B	1.66	8.67		3.32	54.4		2.08	42.4		8.30	3.44	U	3.44
13	SPA-8	J19CH9	11/9/09	0.10		0.21	2.72		0.339	263		3.39	0.258	B	1.35	8.49		2.71	54.5		1.69	41.7		6.77	3.44	U	3.44
14	SPA-9	J19CJ0	11/9/09	0.18		0.21	2.92		0.473	271		4.73	0.277	B	1.89	8.57		3.78	51.7		2.36	42.9		9.45	2.42	J	3.54
15	SPA-10	J19CJ1	11/9/09	0.16		0.20	1.88		0.341	238		3.41	0.259	B	1.36	8.22		2.73	51.9		1.71	37.6		6.82	3.42	U	3.42
16	SPA-11	J19CJ2	11/9/09	0.07		0.20	2.85		0.442	263		4.42	0.260	B	1.77	9.60		3.53	52.9		2.21	40.6		8.84	3.42	U	3.42
17	SPA-12	J19CJ3	11/9/09	0.13		0.21	4.22		0.397	278		3.97	0.277	B	1.59	10.4		3.18	48.0		1.98	43.5		7.94	3.87		3.45

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19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Hexavalent Chromium	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc	Benzo(a)anthracene
21	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg
22	SPA-1	J19CH2/ J19CJ4	11/9/09	0.17	2.87	235	0.214	9.61	37.4	33.7	2.01
23	SPA-2	J19CH3	11/9/09	0.12	3.47	282	0.331	10.4	51.1	41.2	1.07
24	SPA-3	J19CH4	11/9/09	0.17	2.76	240	0.251	10.1	41.0	38.6	1.71
25	SPA-4	J19CH5	11/9/09	0.10	2.70	272	0.266	7.65	51.7	40.7	1.01
26	SPA-5	J19CH6	11/9/09	0.14	2.72	261	0.261	12.0	48.2	38.0	10.2
27	SPA-6	J19CH7	11/9/09	0.14	3.64	309	0.254	9.02	53.9	44.5	1.72
28	SPA-7	J19CH8	11/9/09	0.06	2.86	279	0.295	8.67	54.4	42.4	1.72
29	SPA-8	J19CH9	11/9/09	0.10	2.72	263	0.258	8.49	54.5	41.7	1.72
30	SPA-9	J19CJ0	11/9/09	0.18	2.92	271	0.277	8.57	51.7	42.9	2.42
31	SPA-10	J19CJ1	11/9/09	0.16	1.88	238	0.259	8.22	51.9	37.6	1.71
32	SPA-11	J19CJ2	11/9/09	0.07	2.85	263	0.260	9.60	52.9	40.6	1.71
33	SPA-12	J19CJ3	11/9/09	0.13	4.22	278	0.277	10.4	48.0	43.5	3.87

34 **Statistical Computations**

35		Hexavalent Chromium	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc	Benzo(a)anthracene
36	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), lognormal and normal distribution rejected, use z-statistic.
37	N	12	12	12	12	12	12	12	12
38	% < Detection limit	0%	0%	0%	0%	0%	0%	0%	50%
39	Mean	0.13	2.97	266	0.267	9.39	49.7	40.4	2.57
40	Standard deviation	0.04	0.582	21.3	0.0280	1.21	5.40	3.04	2.51
41	95% UCL on mean	0.16	3.24	277	0.280	10.1	52.3	42.2	3.77
42	Maximum value	0.18	4.22	309	0.331	12.0	54.5	44.5	10.2
43	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	2 River Protection	10.2 GW & River Protection	512 GW & River Protection	8 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	15 ug/kg GW & River Protection
44	**WAC 173-340 3-PART TEST**								
45	95% UCL > Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NO
46	> 10% above Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NO
47	Any sample > 2X Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NO
48	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
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Rev. No. 4
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116-D-5 Statistical Calculations

Verification Data - Staging Pile Area

Sample Area	Sample Number	Sample Date	Benzo(b)fluoranthene ug/kg	Q	PQL	Chrysene ug/kg	Q	PQL	Fluoranthene ug/kg	Q	PQL	Nitrogen in Nitrate and Nitrite (Method 353.2)[a] mg/kg	Q	PQL	Sulfate mg/kg	Q	PQL
SPA-1	J19CH2	11/9/09	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	0.99		0.21	4.3		2.3
Duplicate of J19CH2	J19CJ4	11/9/09	3.38	J	3.44	1.46	J	3.44	10.4		3.44	2.47		0.20	5.0		2.4
SPA-2	J19CH3	11/9/09	1.28	J	3.41	1.19	J	3.41	3.41	U	3.41	5.52		0.21	40.3		2.5
SPA-3	J19CH4	11/9/09	3.42	U	3.42	1.03	J	3.42	3.42	U	3.42	1.34		0.20	25.9		2.7
SPA-4	J19CH5	11/9/09	1.52	J	3.43	1.01	J	3.43	2.74	J	3.43	1.54		0.22	20.2		2.5
SPA-5	J19CH6	11/9/09	9.76		3.47	18.2		3.47	18.2		3.47	1.16		0.20	3.2		2.6
SPA-6	J19CH7	11/9/09	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	0.96		0.22	3.9		2.7
SPA-7	J19CH8	11/9/09	1.00	J	3.44	3.44	U	3.44	3.44	U	3.44	1.37		0.19	5.3		2.4
SPA-8	J19CH9	11/9/09	3.44	U	3.44	3.44	U	3.44	1.78	J	3.44	1.09		0.19	5.2		2.4
SPA-9	J19CJ0	11/9/09	5.87		3.54	1.87	J	3.54	9.01		3.54	1.34		0.22	12.2		2.7
SPA-10	J19CJ1	11/9/09	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	0.23		0.19	2.7		2.5
SPA-11	J19CJ2	11/9/09	3.42	U	3.42	3.42	U	3.42	1.52	J	3.42	0.49		0.22	4.5		2.7
SPA-12	J19CJ3	11/9/09	7.74		3.45	2.99	J	3.45	12.7		3.45	2.90		0.20	71.4		2.4

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Benzo(b)fluoranthene ug/kg	Chrysene ug/kg	Fluoranthene ug/kg	Nitrogen in Nitrate and Nitrite (Method 353.2)[a] mg/kg	Sulfate mg/kg
SPA-1	J19CH2/ J19CJ4	11/9/09	2.55	1.59	6.06	1.73	4.7
SPA-2	J19CH3	11/9/09	1.28	1.19	1.71	5.52	40.3
SPA-3	J19CH4	11/9/09	1.71	1.03	1.71	1.34	25.9
SPA-4	J19CH5	11/9/09	1.52	1.01	2.74	1.54	20.2
SPA-5	J19CH6	11/9/09	9.76	18.2	18.2	1.16	3.2
SPA-6	J19CH7	11/9/09	1.72	1.72	1.72	0.96	3.9
SPA-7	J19CH8	11/9/09	1.00	1.72	1.72	1.37	5.3
SPA-8	J19CH9	11/9/09	1.72	1.72	1.78	1.09	5.2
SPA-9	J19CJ0	11/9/09	5.87	1.87	9.01	1.34	12.2
SPA-10	J19CJ1	11/9/09	1.71	1.71	1.71	0.23	2.7
SPA-11	J19CJ2	11/9/09	1.71	1.71	1.52	0.49	4.5
SPA-12	J19CJ3	11/9/09	7.74	2.99	12.7	2.90	71.4

Statistical Computations

	Benzo(b)fluoranthene	Chrysene	Fluoranthene	Nitrogen in Nitrate and Nitrite (Method 353.2)[a]	Sulfate
95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12
% < Detection limit	42%	42%	42%	0%	0%
Mean	3.19	3.04	5.05	1.64	16.6
Standard deviation	2.92	4.80	5.50	1.39	20.8
95% UCL on mean	4.58	5.32	7.66	3.15	26.5
Maximum value	9.76	18.2	18.2	5.52	71.4
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	15 ug/kg GW & River Protection	100 ug/kg River Protection	18000 ug/kg River Protection	1000 GW Protection	25000 GW Protection
WAC 173-340 3-PART TEST					
95% UCL > Cleanup Limit?	NO	NO	NO	NO	NA
> 10% above Cleanup Limit?	NO	NO	NO	NO	NA
Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NA
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.	Because all values are below background (237 mg/kg) the WAC 173-340 3-part test is not required.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-D Area Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 3
Date 04/15/11
Sheet No. 23 of 53

1 **116-D-5 Waste Site**
2 **Verification Data -Staging Pile Area**

3	Sample	Sample	Sample	Antimony			Silver			Benzo(a)pyrene			Benzo(ghi)perylene			Benzo(k)fluoranthene			Dibenz[a,h]anthracene			Phenanthrene			Pyrene		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	SPA-1	J19CH2	11/9/09	0.412	U	0.410	0.137	U	0.137	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	1.39	J	1.39	3.44	U	3.44	3.44	U	3.44
6	Duplicate of J19CH2	J19CJ4	11/9/09	0.515	U	0.520	0.172	U	0.172	1.56	J	3.44	3.44	U	3.44	1.17	J	3.44	3.44	U	3.44	1.86	J	3.44	3.56		3.44
7	SPA-2	J19CH3	11/9/09	0.589	U	0.590	0.196	U	0.196	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41	3.41	U	3.41
8	SPA-3	J19CH4	11/9/09	0.416	U	0.420	0.139	U	0.139	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42
9	SPA-4	J19CH5	11/9/09	0.474	U	0.470	0.158	U	0.158	3.43	U	3.43	3.43	U	3.43	3.43	U	3.43	3.43	U	3.43	3.43	U	3.43	3.43	U	3.43
10	SPA-5	J19CH6	11/9/09	0.479	U	0.480	0.16	U	0.160	4.48		3.47	2.75	J	3.47	3.91		3.47	3.47	U	3.47	3.11	J	3.47	8.96		3.47
11	SPA-6	J19CH7	11/9/09	0.239	B	0.450	0.149	U	0.149	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44
12	SPA-7	J19CH8	11/9/09	0.498	U	0.500	0.228		0.170	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44
13	SPA-8	J19CH9	11/9/09	0.205	B	0.410	0.135	U	0.135	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44	3.44	U	3.44
14	SPA-9	J19CJ0	11/9/09	0.567	U	0.570	0.189	U	0.189	2.13	J	3.54	1.09	J	3.54	1.53	J	3.54	3.54	U	3.54	1.11	J	3.54	1.87	J	3.54
15	SPA-10	J19CJ1	11/9/09	0.409	U	0.410	0.136	U	0.136	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42
16	SPA-11	J19CJ2	11/9/09	0.530	U	0.530	0.177	U	0.177	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42	3.42	U	3.42
17	SPA-12	J19CJ3	11/9/09	0.476	U	0.480	0.159	U	0.159	2.92	J	3.45	1.57	J	3.45	1.84	J	3.45	3.45	U	3.45	2.43	J	3.45	5.68		3.45

18 **3-Part Test Evaluations**

19		Antimony	Silver	Benzo(a)pyrene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Dibenz[a,h]anthracene	Phenanthrene	Pyrene
20	% < Detection limit	83%	92%	67%	75%	67%	92%	67%	67%
21	Maximum value	0.239	0.228	4.48	2.75	3.91	1.39	3.11	8.96
22	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	5 GW & River Protection	0.73 River Protection	15 ug/kg GW & River Protection	48000 ug/kg GW Protection	15 ug/kg GW & River Protection	30 ug/kg GW & River Protection	240000 ug/kg GW Protection	48000 ug/kg GW Protection
23	**3-PART TEST**								
24	Maximum > Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO	NO
25	> 10% above Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO	NO
26	Any sample > 2X Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO	NO
27	**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.	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 J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

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1 **116-D-5 Waste Site**
2 **Verification Data -Staging Pile Area**

3	Sample	Sample	Sample	beta-BHC			4,4'-DDE			Endrin Aldehyde			Endrin Ketone			Methoxychlor			Chloride			Fluoride		
4	Area	Number	Date	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	SPA-1	J19CH2	11/9/09	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	2.3	U	2.3	2.3	U	2.3
6	Duplicate of J19CH2	J19CJ4	11/9/09	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	2.4	U	2.4	2.4	U	2.4
7	SPA-2	J19CH3	11/9/09	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	74.8		2.5	2.5	U	2.5
8	SPA-3	J19CH4	11/9/09	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	3.3		2.7	2.7	U	2.7
9	SPA-4	J19CH5	11/9/09	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	5.1		2.5	2.5	U	2.5
10	SPA-5	J19CH6	11/9/09	1.37	UD	1.37	1.37	UD	1.37	1.37	UD	1.37	1.37	UD	1.37	1.37	UD	1.37	2.6	U	2.6	2.6	U	2.6
11	SPA-6	J19CH7	11/9/09	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	2.7	U	2.7	2.7	U	2.7
12	SPA-7	J19CH8	11/9/09	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	2.4	U	2.4	2.4	U	2.4
13	SPA-8	J19CH9	11/9/09	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36	2.4		2.4	2.4	U	2.4
14	SPA-9	J19CJ0	11/9/09	1.40	UD	1.40	1.40	UD	1.40	1.40	UD	1.40	1.40	UD	1.40	1.40	UD	1.40	2.7	U	2.7	2.7	U	2.7
15	SPA-10	J19CJ1	11/9/09	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	2.5	U	2.5	2.5	U	2.5
16	SPA-11	J19CJ2	11/9/09	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	1.35	UD	1.35	2.7	U	2.7	0.3	B	2.7
17	SPA-12	J19CJ3	11/9/09	1.51	D	1.51	6.57	JD	6.57	1.38	JD	1.38	17.2	JD	17.2	19.6	JD	19.6	6.4		2.4	2.4	U	2.4

18 **3-Part Test Evaluations**

19		beta-BHC	4,4'-DDE	Endrin Aldehyde	Endrin Ketone	Methoxychlor	Chloride	Fluoride
20	% < Detection limit	92%	92%	92%	92%	92%	58%	92%
21	Maximum value	1.51	6.57	1.38	17.2	19.6	74.8	0.3
22	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	4.86 ug/kg GW Protection	3.3 ug/kg River Protection	39 ug/kg River Protection	39 ug/kg River Protection	1670 ug/kg River Protection	25000 GW Protection	96 GW Protection
23	**3-PART TEST**							
24	Maximum > Cleanup Limit?	NO	YES	NO	NO	NO	NA	NA
25	> 10% above Cleanup Limit?	NO	NO	NO	NO	NO	NA	NA
26	Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO	NA	NA
27	**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.	Because all values are below background (100 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (2.81 mg/kg) the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

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116-D-5 Statistical Calculations

Verification Data - Overburden

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g	Q	MDA	Europium-152 pCi/g	Q	MDA	Nickel-63 pCi/g	Q	MDA	Uranium-233/234 pCi/g	Q	MDA	Uranium-238 pCi/g	Q	MDA
OB-1	J19CB4	11/3/2009	0.018	U	0.018	0.046	U	0.046	3.42		2.61	0.509		0.260	0.475		0.260
OB-2	J19CB5	11/3/2009	0.017	U	0.017	0.047	U	0.047	1.15	U	2.39	0.477		0.244	0.636		0.244
OB-3	J19CB6	11/3/2009	0.021	U	0.021	0.058	U	0.058	2.33	U	2.41	0.507		0.259	0.778		0.259
OB-4	J19CB7	11/3/2009	0.158		0.036	0.081		0.078	2.21	U	2.36	0.555		0.118	0.478		0.118
OB-5	J19CB8	11/3/2009	0.098		0.025	0.087		0.065	2.39		2.36	0.478		0.158	0.627		0.126
OB-6	J19CB9	11/3/2009	0.073		0.025	0.062	U	0.062	2.19	U	2.43	0.644		0.170	0.689		0.170
OB-7	J19CC0	11/3/2009	0.081		0.023	0.065		0.044	2.55		2.44	0.651		0.147	0.517		0.147
OB-8	J19CC1	11/3/2009	0.137		0.015	0.100		0.045	2.13	U	2.48	0.514		0.179	0.677		0.179
OB-9	J19CC2	11/3/2009	0.058		0.032	0.083	U	0.083	0.710	U	2.40	0.618		0.296	0.618		0.296
OB-10	J19CC3	11/3/2009	0.190		0.028	0.141		0.063	2.78		2.44	0.686		0.291	0.762		0.291
OB-11	J19CC4	11/3/2009	0.028	U	0.028	0.105		0.060	1.82	U	2.48	0.607		0.332	0.520		0.332
OB-12	J19CC5	11/3/2009	0.021	U	0.023	0.065	U	0.065	1.73	U	2.64	0.273	U	0.299	0.898		0.299

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g	Europium-152 pCi/g	Nickel-63 pCi/g	Uranium-233/234 pCi/g	Uranium-238 pCi/g
OB-1	J19CB4	11/3/2009	0.009	0.023	3.42	0.509	0.475
OB-2	J19CB5	11/3/2009	0.009	0.024	1.15	0.477	0.636
OB-3	J19CB6	11/3/2009	0.011	0.029	2.33	0.507	0.778
OB-4	J19CB7	11/3/2009	0.158	0.081	2.21	0.555	0.478
OB-5	J19CB8	11/3/2009	0.098	0.087	2.39	0.478	0.627
OB-6	J19CB9	11/3/2009	0.073	0.031	2.19	0.644	0.689
OB-7	J19CC0	11/3/2009	0.081	0.065	2.55	0.651	0.517
OB-8	J19CC1	11/3/2009	0.137	0.100	2.13	0.514	0.677
OB-9	J19CC2	11/3/2009	0.058	0.042	0.710	0.618	0.618
OB-10	J19CC3	11/3/2009	0.190	0.141	2.78	0.686	0.762
OB-11	J19CC4	11/3/2009	0.014	0.105	1.82	0.607	0.520
OB-12	J19CC5	11/3/2009	0.021	0.033	1.73	0.273	0.898

Statistical Computations

	Cesium-137	Europium-152	Nickel-63	Uranium-233/234	Uranium-238
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.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
N	12	12	12	12	12
% < Detection limit	42%	50%	67%	8%	0%
Mean	0.072	0.063	2.12	0.543	0.640
Standard deviation	0.0634	0.0391	0.714	0.112	0.131
Z-statistic	1.64	1.64	1.64	1.64	1.64
95% UCL on mean	0.102	0.082	2.46	0.596	0.702
Maximum value	0.190	0.141	3.42	0.686	0.898

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

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1 **116-D-5 Statistical Calculations**

1 **Verification Data - Overburden**

2	Sample	Sample	Sample	Arsenic			Barium			Beryllium			Boron			Cadmium			Chromium			Cobalt			Copper		
3	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
3.5	OB-1	J19CB4	11/3/2009	1.76		0.702	62.5		0.351	0.157		0.140	0.570	B	1.40	0.0586	B	0.140	5.04		0.140	7.11		1.40	14.1		0.702
4.2	OB-2	J19CB5	11/3/2009	1.77		0.904	49.0		0.452	0.149	B	0.181	0.641	B	1.81	0.0593	B	0.181	6.36		0.181	7.89		1.81	14.3		0.904
4.9	OB-3	J19CB6	11/3/2009	2.15		0.871	53.7		0.435	0.167	B	0.174	0.861	B	1.74	0.0467	B	0.174	6.70		0.174	7.27		1.74	14.5		0.871
5.6	OB-4	J19CB7	11/3/2009	1.89		0.735	51.6		0.368	0.167		0.147	0.732	B	1.47	0.0539	B	0.147	7.16		0.147	6.78		1.47	13.7		0.735
6.3	OB-5	J19CB8	11/3/2009	2.25		0.989	58.6		0.494	0.189	B	0.198	0.930	B	1.98	0.0539	B	0.198	7.88		0.198	7.55		1.98	14.7		0.989
7	OB-6	J19CB9	11/3/2009	1.85		0.654	51.4		0.327	0.160		0.131	0.905	B	1.31	0.0474	B	0.131	5.92		0.131	6.95		1.31	14.2		0.654
7.7	OB-7	J19CC0	11/3/2009	1.83		0.745	62.3		0.373	0.178		0.149	0.789	B	1.49	0.0640	B	0.149	5.75		0.149	7.56		1.49	15.3		0.745
8.4	OB-8	J19CC1	11/3/2009	2.36		0.827	55.8		0.414	0.161	B	0.165	0.851	B	1.65	0.0591	B	0.165	5.92		0.165	7.86		1.65	14.1		0.827
9.1	OB-9	J19CC2	11/3/2009	1.73		0.715	56.3		0.357	0.165		0.143	0.610	B	1.43	0.0551	B	0.143	5.59		0.143	6.97		1.43	14.2		0.715
9.8	OB-10	J19CC3	11/3/2009	2.29		0.800	56.8		0.400	0.184		0.160	0.880	B	1.60	0.0678	B	0.160	7.94		0.160	7.04		1.60	15.6		0.800
11	OB-11	J19CC4	11/3/2009	1.82		0.758	50.2		0.379	0.167		0.152	0.402	B	1.52	0.0457	B	0.152	4.22		0.152	7.49		1.52	15.4		0.758
11	OB-12	J19CC5	11/3/2009	2.42		0.889	62.1		0.445	0.195		0.178	0.961	B	1.78	0.0766	B	0.178	7.13		0.178	7.72		1.78	16.0		0.889

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13 **Statistical Computation Input Data**

13	Sample	Sample	Sample	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
14	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
15	OB-1	J19CB4	11/3/2009	1.76	62.5	0.157	0.570	0.0586	5.04	7.11	14.1
15	OB-2	J19CB5	11/3/2009	1.77	49.0	0.149	0.641	0.0593	6.36	7.89	14.3
16	OB-3	J19CB6	11/3/2009	2.15	53.7	0.167	0.861	0.0467	6.70	7.27	14.5
17	OB-4	J19CB7	11/3/2009	1.89	51.6	0.167	0.732	0.0539	7.16	6.78	13.7
18	OB-5	J19CB8	11/3/2009	2.25	58.6	0.189	0.930	0.0539	7.88	7.55	14.7
18	OB-6	J19CB9	11/3/2009	1.85	51.4	0.160	0.905	0.0474	5.92	6.95	14.2
19	OB-7	J19CC0	11/3/2009	1.83	62.3	0.178	0.789	0.0640	5.75	7.56	15.3
20	OB-8	J19CC1	11/3/2009	2.36	55.8	0.161	0.851	0.0591	5.92	7.86	14.1
20	OB-9	J19CC2	11/3/2009	1.73	56.3	0.165	0.610	0.0551	5.59	6.97	14.2
21	OB-10	J19CC3	11/3/2009	2.29	56.8	0.184	0.880	0.0678	7.94	7.04	15.6
22	OB-11	J19CC4	11/3/2009	1.82	50.2	0.167	0.402	0.0457	4.22	7.49	15.4
22	OB-12	J19CC5	11/3/2009	2.42	62.1	0.195	0.961	0.0766	7.13	7.72	16.0

23 **Statistical Computations**

24		Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
25	95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat 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.	Large data set (n ≥10), use MTCAStat lognormal distribution.
25	N	12	12	12	12	12	12	12	12
26	% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%
27	Mean	2.01	55.9	0.170	0.761	0.0573	6.30	7.35	14.7
27	Standard deviation	0.262	4.81	0.0138	0.172	0.00909	1.12	0.379	0.72
28	95% UCL on mean	2.13	58.5	0.177	0.850	0.0625	6.99	7.55	15.1
29	Maximum value	2.42	62.5	0.195	0.961	0.0766	7.94	7.89	16.0
29	**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
30	**WAC 173-340 3-PART TEST**								
31	95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
32	> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
32	Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
33	**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 J. D. Skoglie
Project 100-D Field Remediation
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116-D-5 Statistical Calculations

Verification Data - Overburden

Sample Area	Sample Number	Sample Date	Lead mg/kg	Lead Q	Lead PQL	Manganese mg/kg	Manganese Q	Manganese PQL	Molybdenum mg/kg	Molybdenum Q	Molybdenum PQL	Nickel mg/kg	Nickel Q	Nickel PQL	Vanadium mg/kg	Vanadium Q	Vanadium PQL	Zinc mg/kg	Zinc Q	Zinc PQL	Benzo(a)anthracene ug/kg	Benzo(a)anthracene Q	Benzo(a)anthracene PQL	Benzo(a)pyrene ug/kg	Benzo(a)pyrene Q	Benzo(a)pyrene PQL
OB-1	J19CB4	11/3/2009	2.23		0.351	321		3.51	0.309	B	1.40	7.56		2.81	56.5		1.76	41.8		7.02	3.21	J	3.42	2.91	J	3.42
OB-2	J19CB5	11/3/2009	2.48		0.452	287		4.52	0.353	B	1.81	8.26		3.62	64.0		2.26	46.1		9.04	1.60	J	3.44	1.44	J	3.44
OB-3	J19CB6	11/3/2009	2.49		0.435	264		4.35	0.285	B	1.74	8.27		3.48	53.6		2.18	42.1		8.71	1.83	J	3.43	1.75	J	3.43
OB-4	J19CB7	11/3/2009	2.56		0.368	253		3.68	0.265	B	1.47	8.26		2.94	52.6		1.84	39.4		7.35	77.8		3.44	61.3		3.44
OB-5	J19CB8	11/3/2009	2.91		0.494	298		4.94	0.281	B	1.98	9.30		3.95	53.6		2.47	43.2		9.89	4.80		3.43	2.69	J	3.43
OB-6	J19CB9	11/3/2009	2.43		0.327	255		3.27	0.271	B	1.31	8.47		2.62	51.5		1.63	41.3		6.54	3.36	J	3.45	2.88	J	3.45
OB-7	J19CC0	11/3/2009	2.62		0.373	280		3.73	0.298	B	1.49	7.66		2.98	55.8		1.86	43.9		7.45	13.0		3.43	9.75		3.43
OB-8	J19CC1	11/3/2009	2.55		0.414	278		4.14	0.297	B	1.65	7.45		3.31	55.8		2.07	43.9		8.27	51.7		3.43	40.8		3.43
OB-9	J19CC2	11/3/2009	2.23		0.357	253		3.57	0.277	B	1.43	7.13		2.86	54.6		1.79	41.8		7.15	5.75		3.44	3.84		3.44
OB-10	J19CC3	11/3/2009	2.69		0.400	262		4.00	0.273	B	1.60	10.4		3.20	51.0		2.00	42.4		8.00	25.8		3.42	18.7		3.42
OB-11	J19CC4	11/3/2009	2.06		0.379	263		3.79	0.315	B	1.52	6.22		3.03	55.7		1.90	42.5		7.58	11.3		3.44	9.81		3.44
OB-12	J19CC5	11/3/2009	2.60		0.445	275		4.45	0.285	B	1.78	9.03		3.56	53.3		2.22	45.0		8.89	3.45	U	3.45	3.45	U	3.45

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Lead mg/kg	Manganese mg/kg	Molybdenum mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	Benzo(a)anthracene ug/kg	Benzo(a)pyrene ug/kg
OB-1	J19CB4	11/3/2009	2.23	321	0.309	7.56	56.5	41.8	3.21	2.91
OB-2	J19CB5	11/3/2009	2.48	287	0.353	8.26	64.0	46.1	1.60	1.44
OB-3	J19CB6	11/3/2009	2.49	264	0.285	8.27	53.6	42.1	1.83	1.75
OB-4	J19CB7	11/3/2009	2.56	253	0.265	8.26	52.6	39.4	77.8	61.3
OB-5	J19CB8	11/3/2009	2.91	298	0.281	9.30	53.6	43.2	4.80	2.69
OB-6	J19CB9	11/3/2009	2.43	255	0.271	8.47	51.5	41.3	3.36	2.88
OB-7	J19CC0	11/3/2009	2.62	280	0.298	7.66	55.8	43.9	13.0	9.75
OB-8	J19CC1	11/3/2009	2.55	278	0.297	7.45	55.8	43.9	51.7	40.8
OB-9	J19CC2	11/3/2009	2.23	253	0.277	7.13	54.6	41.8	5.75	3.84
OB-10	J19CC3	11/3/2009	2.69	262	0.273	10.4	51.0	42.4	25.8	18.7
OB-11	J19CC4	11/3/2009	2.06	263	0.315	6.22	55.7	42.5	11.3	9.81
OB-12	J19CC5	11/3/2009	2.60	275	0.285	9.03	53.3	45.0	1.73	1.73

Statistical Computations

	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc	Benzo(a)anthracene	Benzo(a)pyrene
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), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%	8%	8%
Mean	2.49	274	0.292	8.17	54.8	42.8	16.8	13.1
Standard deviation	0.23	20.5	0.0244	1.09	3.38	1.78	24.1	18.9
95% UCL on mean	2.62	285	0.304	8.79	56.4	43.7	72.6	49.5
Maximum value	2.91	321	0.353	10.4	64.0	46.1	77.8	61.3
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise	10.2 GW & River Protection	512 GW & River Protection	8 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	15 ug/kg GW & River Protection	15 ug/kg GW & River Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NA	NO	NA	NA	NA	YES	YES
> 10% above Cleanup Limit?	NA	NA	NO	NA	NA	NA	YES	YES
Any sample > 2X Cleanup Limit?	NA	NA	NO	NA	NA	NA	YES	YES
WAC 173-340 Compliance?	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to direct exposure RAG.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 3
Date 04/15/11
Sheet No. 28 of 53

1 **116-D-5 Statistical Calculations**
2 **Verification Data - Overburden**

3	Sample	Sample	Sample	Benzo(b)fluoranthene			Benzo(ghi)perylene			Benzo(k)fluoranthene			Chrysene			Fluoranthene			Indeno(1,2,3-cd)pyrene			Phenathrene			Pyrene		
4	Area	Number	Date	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	OB-1	J19CB4	11/3/2009	5.35		3.42	3.42	U	3.42	1.62	J	3.42	2.67	J	3.42	8.00		3.42	3.42	U	3.42	1.97	J	3.42	2.82	J	3.42
6	OB-2	J19CB5	11/3/2009	2.95	J	3.44	3.44	U	3.44	0.91	J	3.44	0.93	J	3.44	5.51		3.44	3.44	U	3.44	3.44	U	3.44	1.94	J	3.44
7	OB-3	J19CB6	11/3/2009	3.20	J	3.43	3.43	U	3.43	1.10	J	3.43	3.43	U	3.43	6.75		3.43	3.43	U	3.43	0.93	J	3.43	0.91	J	3.43
8	OB-4	J19CB7	11/3/2009	96.4		3.44	35.9		3.44	26.5		3.44	52.4		3.44	254		3.44	31.1		3.44	55.6		3.44	161		3.44
9	OB-5	J19CB8	11/3/2009	5.64		3.43	4.04		3.43	1.89	J	3.43	3.94		3.43	7.25		3.43	1.11	J	3.43	4.64		3.43	6.98		3.43
10	OB-6	J19CB9	11/3/2009	5.05		3.45	1.26	J	3.45	1.72	J	3.45	3.25	J	3.45	8.35		3.45	3.45	U	3.45	1.95	J	3.45	2.98	J	3.45
11	OB-7	J19CC0	11/3/2009	13.4		3.43	6.29		3.43	5.12		3.43	9.58		3.43	19.5		3.43	5.54		3.43	5.98		3.43	13.3		3.43
12	OB-8	J19CC1	11/3/2009	41.8		3.43	24.4		3.43	18.8		3.43	37.7		3.43	77.7		3.43	24.0		3.43	7.85		3.43	67.5		3.43
13	OB-9	J19CC2	11/3/2009	7.38		3.44	4.07		3.44	2.33	J	3.44	5.21		3.44	7.02		3.44	3.44	U	3.44	1.39	J	3.44	2.21	J	3.44
14	OB-10	J19CC3	11/3/2009	37.2		3.42	14.3		3.42	10.2		3.42	19.2		3.42	64.2		3.42	13.8		3.42	12.2		3.42	48.2		3.42
15	OB-11	J19CC4	11/3/2009	15.5		3.44	7.51		3.44	5.03		3.44	7.37		3.44	28.7		3.44	6.44		6.44	11.2		3.44	13.1		3.44
16	OB-12	J19CC5	11/3/2009	3.45	U	3.45	3.45	U	3.45	3.45	U	3.45	3.45	U	3.45	2.77	J	3.45	3.45	U	3.45	3.45	U	3.45	0.91	J	3.45

17
18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Phenathrene	Pyrene
20	Area	Number	Date	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
21	OB-1	J19CB4	11/3/2009	5.35	1.71	1.62	2.7	8.0	1.7	2.0	2.8
22	OB-2	J19CB5	11/3/2009	2.95	1.72	0.91	0.9	5.5	1.7	1.7	1.9
23	OB-3	J19CB6	11/3/2009	3.20	1.72	1.10	1.7	6.8	1.7	0.9	0.9
24	OB-4	J19CB7	11/3/2009	96.4	35.9	26.5	52.4	254	31.1	55.6	161
25	OB-5	J19CB8	11/3/2009	5.64	4.04	1.89	3.9	7.3	1.1	4.6	7.0
26	OB-6	J19CB9	11/3/2009	5.05	1.26	1.72	3.3	8.4	1.7	2.0	3.0
27	OB-7	J19CC0	11/3/2009	13.4	6.29	5.12	9.6	19.5	5.5	6.0	13.3
28	OB-8	J19CC1	11/3/2009	41.8	24.4	18.8	37.7	77.7	24.0	7.9	67.5
29	OB-9	J19CC2	11/3/2009	7.38	4.07	2.33	5.2	7.0	1.7	1.4	2.2
30	OB-10	J19CC3	11/3/2009	37.2	14.3	10.2	19.2	64.2	13.8	12.2	48.2
31	OB-11	J19CC4	11/3/2009	15.5	7.51	5.03	7.4	28.7	6.4	11.2	13.1
32	OB-12	J19CC5	11/3/2009	1.73	1.73	1.73	1.7	2.8	1.7	1.7	0.9

33 **Statistical Computations**

34		Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Fluoranthene	Indeno(1,2,3-cd)pyrene	Phenathrene	Pyrene
35	95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
36	N	12	12	12	12	12	12	12	12
37	% < Detection limit	8%	33%	8%	17%	0%	50%	17%	0%
38	Mean	19.6	8.72	6.41	12	40.8	7.7	8.9	26.8
39	Standard deviation	27.6	10.9	8.19	16.5	71.5	10.1	15.2	47.3
40	95% UCL on mean	68.0	26.4	18.3	46.7	74.8	12.5	27.1	296
41	Maximum value	96.4	35.9	26.5	52.4	254	31.1	55.6	161
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	15 ug/kg GW & River Protection	48000 ug/kg GW Protection	15 ug/kg GW & River Protection	100 ug/kg River Protection	18000 ug/kg River Protection	330 ug/kg GW & River Protection	240000 ug/kg GW Protection	48000 ug/kg GW Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	YES	NO	YES	NO	NO	NO	NO	NO
45	> 10% above Cleanup Limit?	YES	NO	YES	NO	NO	NO	NO	NO
46	Any sample > 2X Cleanup Limit?	YES	NO	NO	NO	NO	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 direct exposure RAG.	The data set meets the 3-part test criteria when compared to direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/28/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 4
Date 04/28/11
Sheet No. 29 of 53

116-D-5 Statistical Calculations

Verification Data - Overburden

Sample Area	Sample Number	Sample Date	Chloride mg/kg	Q	PQL	Nitrogen in Nitrate and Nitrite (Method 353.2)[a] mg/kg	Q	PQL	Sulfate mg/kg	Q	PQL
OB-1	J19CB4	11/3/2009	12.1		2.4	2.06		0.21	24.3		2.4
OB-2	J19CB5	11/3/2009	2.6	U	2.6	0.43		0.21	4.8		2.6
OB-3	J19CB6	11/3/2009	2.6	U	2.6	0.67		0.21	12.4		2.6
OB-4	J19CB7	11/3/2009	46.8		2.6	5.10		0.21	24.7		2.6
OB-5	J19CB8	11/3/2009	13.1		2.6	4.29		0.21	27.6		2.6
OB-6	J19CB9	11/3/2009	4.2		2.5	1.33		0.21	15.8		2.5
OB-7	J19CC0	11/3/2009	46.1		2.4	4.04		0.21	19.0		2.4
OB-8	J19CC1	11/3/2009	18.3		2.4	3.61		0.21	26.2		2.4
OB-9	J19CC2	11/3/2009	3.0		2.5	0.60		0.21	7.4		2.5
OB-10	J19CC3	11/3/2009	8.2		2.6	4.09		0.20	25.6		2.6
OB-11	J19CC4	11/3/2009	2.6	U	2.6	0.72		0.21	6.3		2.6
OB-12	J19CC5	11/3/2009	4.4		2.4	1.13		0.21	20.9		2.4

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Chloride mg/kg	Nitrogen in Nitrate and Nitrite (Method 353.2)[a] mg/kg	Sulfate mg/kg
OB-1	J19CB4	11/3/2009	12.1	2.06	24.3
OB-2	J19CB5	11/3/2009	1.3	0.43	4.8
OB-3	J19CB6	11/3/2009	1.3	0.67	12.4
OB-4	J19CB7	11/3/2009	46.8	5.10	24.7
OB-5	J19CB8	11/3/2009	13.1	4.29	27.6
OB-6	J19CB9	11/3/2009	4.2	1.33	15.8
OB-7	J19CC0	11/3/2009	46.1	4.04	19.0
OB-8	J19CC1	11/3/2009	18.3	3.61	26.2
OB-9	J19CC2	11/3/2009	3.0	0.60	7.4
OB-10	J19CC3	11/3/2009	8.2	4.09	25.6
OB-11	J19CC4	11/3/2009	1.3	0.72	6.3
OB-12	J19CC5	11/3/2009	4.4	1.13	20.9

Statistical Computations

	Chloride	Nitrogen in Nitrate and Nitrite (Method 353.2)[a]	Sulfate
95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat normal distribution.
N	12	12	12
% < Detection limit	25%	0%	0%
Mean	13.3	2.34	17.9
Standard deviation	16.4	1.75	8.4
95% UCL on mean	59.0	5.34	22.3
Maximum value	46.8	5.10	27.6
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise	25000 GW Protection	1000 GW Protection	25000 GW Protection
WAC 173-340 3-PART TEST			
95% UCL > Cleanup Limit?	NA	NO	NA
> 10% above Cleanup Limit?	NA	NO	NA
Any sample > 2X Cleanup Limit?	NA	NO	NA
WAC 173-340 Compliance?	Because all values are below background (100 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 (237 mg/kg) the WAC 173-340 3-part test is not required.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-D Area Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 3
Date 04/15/11
Sheet No. 30 of 53

1 **116-D-5 Waste Site**
2 **Verification Data - Overburden**

3				Hexavalent chromium			Mercury			Bis(2-ethylhexyl)phthalate			Anthracene			Dibenz[a,h]anthracene			Heptachlor epoxide		
4	Sample Area	Sample Number	Sample Date	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	OB-1	J19CB4	11/3/2009	0.21	U	0.21	0.0265	U	0.0265	338	U	338	3.42	U	3.42	3.42	U	3.42	1.35	UD	1.35
7	OB-2	J19CB5	11/3/2009	0.18	B	0.21	0.0250	U	0.0250	340	U	340	3.44	U	3.44	3.44	U	3.44	1.36	UD	1.36
8	OB-3	J19CB6	11/3/2009	0.12	B	0.21	0.0290	U	0.0290	339	U	339	3.43	U	3.43	3.43	U	3.43	1.35	UD	1.35
9	OB-4	J19CB7	11/3/2009	0.21	U	0.21	0.0281	U	0.0281	340	U	340	12.2		3.44	6.73		3.44	1.36	UD	1.36
10	OB-5	J19CB8	11/3/2009	0.12	B	0.21	0.0250	U	0.0250	854		339	3.43	U	3.43	3.43	U	3.43	1.36	UD	1.36
11	OB-6	J19CB9	11/3/2009	0.21	U	0.21	0.0281	U	0.0281	341	U	341	3.45	U	3.45	3.45	U	3.45	1.36	UD	1.36
12	OB-7	J19CC0	11/3/2009	0.21	U	0.21	0.0237	U	0.0237	339	U	339	3.43	U	3.43	1.06	J	3.43	1.36	UD	1.36
13	OB-8	J19CC1	11/3/2009	0.10	B	0.21	0.0231	U	0.0231	339	U	339	3.43	U	3.43	5.18		3.43	1.35	UD	1.35
14	OB-9	J19CC2	11/3/2009	0.11	B	0.21	0.0100	B	0.0281	340	U	340	3.44	U	3.44	3.44	U	3.44	1.44	JD	1.44
15	OB-10	J19CC3	11/3/2009	0.20	U	0.20	0.0273	U	0.0273	519		338	0.905	J	3.42	2.48	J	3.42	1.35	UD	1.35
16	OB-11	J19CC4	11/3/2009	0.21	U	0.21	0.0276		0.0231	249	J	340	0.979	J	3.44	1.13	J	3.44	1.36	UD	1.36
17	OB-12	J19CC5	11/3/2009	0.21	U	0.21	0.0290	U	0.0290	340	U	340	3.45	U	3.45	3.45	U	3.45	1.51	JD	1.51

18 **3-Part Test Evaluations**

19		Hexavalent chromium	Mercury	Bis(2-ethylhexyl)phthalate	Anthracene	Dibenz[a,h]anthracene	Heptachlor epoxide
20	% < Detection limit	42%	83%	75%	75%	58%	83%
21	Maximum value	0.18	0.0276	854	12.2	6.73	1.51
22	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	2 River Protection	0.33 GW & River Protection	360 ug/kg River Protection	240000 ug/kg GW Protection	30 ug/kg GW & River Protection	2 ug/kg GW & River Protection
23	**3-PART TEST**						
24	Maximum > Cleanup Limit?	NO	NA	YES	NO	NO	NO
25	> 10% above Cleanup Limit?	NO	NA	YES	NO	NO	NO
26	Any sample > 2X Cleanup Limit?	NO	NA	YES	NO	NO	NO
27	**3-Part Test Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

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Arsenic 95% UCL Calculation

DATA	ID
3.06	J19CC8/ J19CD8
2.14	J19CC6
4.63	J19CC7
2.37	J19CC9
1.99	J19CD0
2.82	J19CD1
1.72	J19CD2
1.61	J19CD3
2.49	J19CD4
1.96	J19CD5
2.26	J19CD6
2.11	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	2.43
Censored		Lognormal mean	2.43
Detection limit or PQL		Std. devn.	0.81
Method detection limit		Median	2.20
TOTAL	12	Min.	1.61
		Max.	4.63

Lognormal distribution? r-squared is: 0.906
Normal distribution? r-squared is: 0.785
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.86

Barium 95% UCL Calculation

DATA	ID
63.3	J19CC8/ J19CD8
44.4	J19CC6
69.5	J19CC7
66.6	J19CC9
57.9	J19CD0
60.6	J19CD1
57.2	J19CD2
57.6	J19CD3
56.4	J19CD4
53.5	J19CD5
62.7	J19CD6
64.6	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	59.5
Censored		Lognormal mean	59.6
Detection limit or PQL		Std. devn.	6.7
Method detection limit		Median	59.3
TOTAL	12	Min.	44.4
		Max.	69.5

Lognormal distribution? r-squared is: 0.904
Normal distribution? r-squared is: 0.940
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 63.5

Beryllium 95% UCL Calculation

DATA	ID
0.175	J19CC8/ J19CD8
0.147	J19CC6
0.332	J19CC7
0.213	J19CC9
0.171	J19CD0
0.156	J19CD1
0.169	J19CD2
0.156	J19CD3
0.195	J19CD4
0.155	J19CD5
0.188	J19CD6
0.186	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	0.187
Censored		Lognormal mean	0.187
Detection limit or PQL		Std. devn.	0.050
Method detection limit		Median	0.173
TOTAL	12	Min.	0.147
		Max.	0.332

Lognormal distribution? r-squared is: 0.772
Normal distribution? r-squared is: 0.664
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.210

Boron 95% UCL Calculation

DATA	ID
1.03	J19CC8/ J19CD8
0.400	J19CC6
0.897	J19CC7
1.17	J19CC9
0.705	J19CD0
0.764	J19CD1
0.701	J19CD2
0.445	J19CD3
0.692	J19CD4
0.675	J19CD5
1.98	J19CD6
1.10	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	0.880
Censored		Lognormal mean	0.884
Detection limit or PQL		Std. devn.	0.420
Method detection limit		Median	0.735
TOTAL	12	Min.	0.400
		Max.	1.98

Lognormal distribution? r-squared is: 0.945
Normal distribution? r-squared is: 0.826
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1.16

Cadmium 95% UCL Calculation

DATA	ID
0.0739	J19CC8/ J19CD8
0.0474	J19CC6
0.0658	J19CC7
0.0702	J19CC9
0.0878	J19CD0
0.0562	J19CD1
0.0423	J19CD2
0.0370	J19CD3
0.0528	J19CD4
0.0589	J19CD5
0.0686	J19CD6
0.0506	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	0.0593
Censored		Lognormal mean	0.0595
Detection limit or PQL		Std. devn.	0.0145
Method detection limit		Median	0.0576
TOTAL	12	Min.	0.0370
		Max.	0.0878

Lognormal distribution? r-squared is: 0.990
Normal distribution? r-squared is: 0.983
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.0685

Chromium 95% UCL Calculation

DATA	ID
12.0	J19CC8/ J19CD8
6.66	J19CC6
20.3	J19CC7
8.01	J19CC9
9.63	J19CD0
10.2	J19CD1
5.53	J19CD2
6.32	J19CD3
9.87	J19CD4
6.11	J19CD5
7.66	J19CD6
7.03	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	9.11
Censored		Lognormal mean	9.08
Detection limit or PQL		Std. devn.	4.03
Method detection limit		Median	7.84
TOTAL	12	Min.	5.53
		Max.	20.3

Lognormal distribution? r-squared is: 0.897
Normal distribution? r-squared is: 0.747
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 11.0

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Cobalt 95% UCL Calculation

DATA	ID
6.02	J19CC8/ J19CD8
9.01	J19CC6
10.2	J19CC7
8.60	J19CC9
8.11	J19CD0
5.92	J19CD1
8.97	J19CD2
9.14	J19CD3
8.34	J19CD4
8.71	J19CD5
7.64	J19CD6
8.49	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	8.26
Censored		Lognormal mean	8.28
Detection limit or PQL		Std. devn.	1.24
Method detection limit		Median	8.55
TOTAL	12	Min.	5.92
		Max.	10.2

Lognormal distribution? r-squared is: 0.843
Normal distribution? r-squared is: 0.885
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 8.85

Copper 95% UCL Calculation

DATA	ID
13.7	J19CC8/ J19CD8
15.5	J19CC6
23.7	J19CC7
15.5	J19CC9
14.7	J19CD0
12.1	J19CD1
14.4	J19CD2
14.1	J19CD3
16.4	J19CD4
15.4	J19CD5
14.9	J19CD6
14.5	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	15.4
Censored		Lognormal mean	15.4
Detection limit or PQL		Std. devn.	2.83
Method detection limit		Median	14.8
TOTAL	12	Min.	12.1
		Max.	23.7

Lognormal distribution? r-squared is: 0.746
Normal distribution? r-squared is: 0.662
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 16.8

Hexavalent Chromium 95% UCL Calculation

DATA	ID
0.18	J19CC8/ J19CD8
0.19	J19CC6
0.15	J19CC7
0.12	J19CC9
0.17	J19CD0
0.18	J19CD1
0.19	J19CD2
0.20	J19CD3
0.18	J19CD4
0.11	J19CD5
0.17	J19CD6
0.20	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	0.17
Censored		Lognormal mean	0.17
Detection limit or PQL		Std. devn.	0.029
Method detection limit		Median	0.18
TOTAL	12	Min.	0.11
		Max.	0.20

Lognormal distribution? r-squared is: 0.818
Normal distribution? r-squared is: 0.866
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.18

Lead 95% UCL Calculation

DATA	ID
2.96	J19CC8/ J19CD8
1.99	J19CC6
7.44	J19CC7
2.76	J19CC9
2.37	J19CD0
2.33	J19CD1
1.60	J19CD2
1.38	J19CD3
2.97	J19CD4
3.44	J19CD5
3.22	J19CD6
2.74	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	2.93
Censored		Lognormal mean	2.93
Detection limit or PQL		Std. devn.	1.55
Method detection limit		Median	2.75
TOTAL	12	Min.	1.38
		Max.	7.44

Lognormal distribution? r-squared is: 0.893
Normal distribution? r-squared is: 0.693
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 3.67

Manganese 95% UCL Calculation

DATA	ID
259	J19CC8/ J19CD8
332	J19CC6
398	J19CC7
327	J19CC9
282	J19CD0
250	J19CD1
307	J19CD2
302	J19CD3
313	J19CD4
306	J19CD5
285	J19CD6
297	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	305
Censored		Lognormal mean	305
Detection limit or PQL		Std. devn.	38
Method detection limit		Median	304
TOTAL	12	Min.	250
		Max.	398

Lognormal distribution? r-squared is: 0.932
Normal distribution? r-squared is: 0.898
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 326

Molybdenum 95% UCL Calculation

DATA	ID
0.242	J19CC8/ J19CD8
0.366	J19CC6
0.362	J19CC7
0.281	J19CC9
0.275	J19CD0
0.215	J19CD1
0.292	J19CD2
0.298	J19CD3
0.287	J19CD4
0.309	J19CD5
0.268	J19CD6
0.299	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	0.291
Censored		Lognormal mean	0.291
Detection limit or PQL		Std. devn.	0.043
Method detection limit		Median	0.290
TOTAL	12	Min.	0.215
		Max.	0.366

Lognormal distribution? r-squared is: 0.940
Normal distribution? r-squared is: 0.936
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.316

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Nickel 95% UCL Calculation

DATA	ID
11.0	J19CC8/ J19CD8
9.32	J19CC6
20.8	J19CC7
9.18	J19CC9
9.07	J19CD0
10.7	J19CD1
7.80	J19CD2
8.25	J19CD3
10.6	J19CD4
8.91	J19CD5
9.16	J19CD6
9.26	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	10.3
Censored		Lognormal mean	10.3
Detection limit or PQL		Std. devn.	3.43
Method detection limit		Median	9.22
TOTAL	12	Min.	7.80
		Max.	20.8

Lognormal distribution? r-squared is: 0.674
Normal distribution? r-squared is: 0.554
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 12.0

Vanadium 95% UCL Calculation

DATA	ID
39.1	J19CC8/ J19CD8
76.8	J19CC6
49.3	J19CC7
56.9	J19CC9
55.2	J19CD0
40.7	J19CD1
65.4	J19CD2
68.4	J19CD3
54.4	J19CD4
61.5	J19CD5
52.9	J19CD6
62.1	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	56.9
Censored		Lognormal mean	57.0
Detection limit or PQL		Std. devn.	10.9
Method detection limit		Median	56.1
TOTAL	12	Min.	39.1
		Max.	76.8

Lognormal distribution? r-squared is: 0.963
Normal distribution? r-squared is: 0.979
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 63.7

Zinc 95% UCL Calculation

DATA	ID
36.6	J19CC8/ J19CD8
51.7	J19CC6
62.1	J19CC7
47.1	J19CC9
48.1	J19CD0
35.8	J19CD1
48.6	J19CD2
50.1	J19CD3
48.4	J19CD4
49.2	J19CD5
46.3	J19CD6
48.3	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	47.7
Censored		Lognormal mean	47.7
Detection limit or PQL		Std. devn.	6.7
Method detection limit		Median	48.4
TOTAL	12	Min.	35.8
		Max.	62.1

Lognormal distribution? r-squared is: 0.823
Normal distribution? r-squared is: 0.832
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 50.9

Fluoranthene 95% UCL Calculation

DATA	ID
15.9	J19CC8/ J19CD8
1.69	J19CC6
1.80	J19CC7
1.69	J19CC9
30.5	J19CD0
1.68	J19CD1
1.67	J19CD2
1.72	J19CD3
6.54	J19CD4
2.06	J19CD5
8.52	J19CD6
2.22	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	6.33
Censored		Lognormal mean	5.92
Detection limit or PQL		Std. devn.	8.76
Method detection limit		Median	1.93
TOTAL	12	Min.	1.67
		Max.	30.5

Lognormal distribution? r-squared is: 0.755
Normal distribution? r-squared is: 0.608
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 10.5

Fluoride 95% UCL Calculation

DATA	ID
0.5	J19CC8/ J19CD8
1.3	J19CC6
1.3	J19CC7
0.4	J19CC9
1.3	J19CD0
0.5	J19CD1
0.3	J19CD2
1.2	J19CD3
1.3	J19CD4
1.2	J19CD5
1.3	J19CD6
0.3	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	0.9
Censored		Lognormal mean	0.9
Detection limit or PQL		Std. devn.	0.5
Method detection limit		Median	1.2
TOTAL	12	Min.	0.3
		Max.	1.3

Lognormal distribution? r-squared is: 0.786
Normal distribution? r-squared is: 0.779
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 1.1

Nitrogen in Nitrite and Nitrate 95% UCL Calculation

DATA	ID
3.05	J19CC8/ J19CD8
0.64	J19CC6
1.28	J19CC7
0.26	J19CC9
2.48	J19CD0
0.53	J19CD1
0.92	J19CD2
0.23	J19CD3
3.52	J19CD4
0.91	J19CD5
3.16	J19CD6
0.66	J19CD7

Number of samples		Uncensored values	
Uncensored	12	Mean	1.47
Censored		Lognormal mean	1.59
Detection limit or PQL		Std. devn.	1.22
Method detection limit		Median	0.92
TOTAL	12	Min.	0.23
		Max.	3.52

Lognormal distribution? r-squared is: 0.945
Normal distribution? r-squared is: 0.855
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3.53

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	DATA	ID	Sulfate 95% UCL Calculation			
1						
2	9.05	J19CC8/ J19CD8				
3	3.70	J19CC6				
4	10.9	J19CC7	Number of samples		Uncensored values	
5	5.30	J19CC9	Uncensored	12	Mean	9.81
6	23.3	J19CD0	Censored		Lognormal mean	10.2
7	11.0	J19CD1	Detection limit or PQL		Std. devn.	7.46
8	3.60	J19CD2	Method detection limit		Median	8.48
9	1.90	J19CD3	TOTAL	12	Min.	1.90
10	25.2	J19CD4			Max.	25.2
11	7.90	J19CD5				
12	11.2	J19CD6				
13	4.70	J19CD7				
14						
15						
16						
17			Lognormal distribution?		Normal distribution?	
18			r-squared is: 0.967		r-squared is: 0.839	
19			Recommendations:			
20			Use lognormal distribution.			
21						
22			UCL (Land's method) is		18.3	
23						

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Arsenic 95% UCL Calculation

DATA	ID
2.20	J1F1J3/ J1F1J8
4.51	J19CD9
2.20	J19CF0
2.16	J19CF1
1.60	J1F1J4
3.20	J1F1J5
3.48	J19CF5
2.50	J1F1J6
2.25	J19CF7
2.50	J1F1J7
1.94	J19CF9
2.84	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	2.62
Censored		Lognormal mean	2.62
Detection limit or PQL		Std. devn.	0.79
Method detection limit		Median	2.38
TOTAL	12	Min.	1.60
		Max.	4.51

Lognormal distribution? r-squared is: 0.950
Normal distribution? r-squared is: 0.880
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3.08

Barium 95% UCL Calculation

DATA	ID
54.1	J1F1J3/ J1F1J8
88.0	J19CD9
53.7	J19CF0
56.8	J19CF1
70.5	J1F1J4
72.2	J1F1J5
66.3	J19CF5
69.4	J1F1J6
81.1	J19CF7
68.2	J1F1J7
55.9	J19CF9
54.6	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	65.9
Censored		Lognormal mean	66.0
Detection limit or PQL		Std. devn.	11.3
Method detection limit		Median	67.3
TOTAL	12	Min.	53.7
		Max.	88.0

Lognormal distribution? r-squared is: 0.920
Normal distribution? r-squared is: 0.911
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 72.3

Beryllium 95% UCL Calculation

DATA	ID
0.110	J1F1J3/ J1F1J8
0.396	J19CD9
0.180	J19CF0
0.209	J19CF1
0.054	J1F1J4
0.120	J1F1J5
0.256	J19CF5
0.130	J1F1J6
0.238	J19CF7
0.110	J1F1J7
0.169	J19CF9
0.185	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.180
Censored		Lognormal mean	0.183
Detection limit or PQL		Std. devn.	0.090
Method detection limit		Median	0.175
TOTAL	12	Min.	0.054
		Max.	0.396

Lognormal distribution? r-squared is: 0.955
Normal distribution? r-squared is: 0.904
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.255

Boron 95% UCL Calculation

DATA	ID
0.693	J1F1J3/ J1F1J8
1.02	J19CD9
0.637	J19CF0
0.509	J19CF1
0.495	J1F1J4
1.10	J1F1J5
1.26	J19CF5
0.470	J1F1J6
0.765	J19CF7
0.990	J1F1J7
0.568	J19CF9
0.649	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.763
Censored		Lognormal mean	0.766
Detection limit or PQL		Std. devn.	0.265
Method detection limit		Median	0.671
TOTAL	12	Min.	0.470
		Max.	1.26

Lognormal distribution? r-squared is: 0.948
Normal distribution? r-squared is: 0.915
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.934

Cadmium 95% UCL Calculation

DATA	ID
0.0735	J1F1J3/ J1F1J8
0.109	J19CD9
0.0529	J19CF0
0.0711	J19CF1
0.0600	J1F1J4
0.100	J1F1J5
0.0755	J19CF5
0.0820	J1F1J6
0.0936	J19CF7
0.0960	J1F1J7
0.0523	J19CF9
0.0473	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.0761
Censored		Lognormal mean	0.0764
Detection limit or PQL		Std. devn.	0.0205
Method detection limit		Median	0.0745
TOTAL	12	Min.	0.0473
		Max.	0.109

Lognormal distribution? r-squared is: 0.961
Normal distribution? r-squared is: 0.965
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.0897

Chromium 95% UCL Calculation

DATA	ID
14.1	J1F1J3/ J1F1J8
25.9	J19CD9
8.67	J19CF0
13.1	J19CF1
15.3	J1F1J4
16.2	J1F1J5
12.5	J19CF5
16.6	J1F1J6
24.1	J19CF7
16.7	J1F1J7
5.63	J19CF9
8.33	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	14.8
Censored		Lognormal mean	15.0
Detection limit or PQL		Std. devn.	5.96
Method detection limit		Median	14.7
TOTAL	12	Min.	5.63
		Max.	25.9

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

UCL (Land's method) is 19.7

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Cobalt 95% UCL Calculation

DATA	ID
7.95	J1F1J3/ J1F1J8
10.8	J19CD9
8.37	J19CF0
8.46	J19CF1
9.50	J1F1J4
8.40	J1F1J5
8.20	J19CF5
7.50	J1F1J6
8.29	J19CF7
8.50	J1F1J7
8.63	J19CF9
8.27	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	8.57
Censored		Lognormal mean	8.57
Detection limit or PQL		Std. devn.	0.84
Method detection limit		Median	8.39
TOTAL	12	Min.	7.50
		Max.	10.8

Lognormal distribution? r-squared is: 0.800
Normal distribution? r-squared is: 0.762
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 8.97

Copper 95% UCL Calculation

DATA	ID
16.3	J1F1J3/ J1F1J8
26.8	J19CD9
14.5	J19CF0
15.4	J19CF1
16.6	J1F1J4
15.3	J1F1J5
16.3	J19CF5
15.2	J1F1J6
15.9	J19CF7
16.3	J1F1J7
13.6	J19CF9
14.6	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	16.4
Censored		Lognormal mean	16.4
Detection limit or PQL		Std. devn.	3.40
Method detection limit		Median	15.7
TOTAL	12	Min.	13.6
		Max.	26.8

Lognormal distribution? r-squared is: 0.631
Normal distribution? r-squared is: 0.549
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 18.0

Hexavalent chromium 95% UCL Calculation

DATA	ID
0.21	J1F1J3/ J1F1J8
0.19	J19CD9
0.20	J19CF0
0.16	J19CF1
0.45	J1F1J4
0.24	J1F1J5
0.20	J19CF5
0.70	J1F1J6
0.14	J19CF7
0.30	J1F1J7
0.20	J19CF9
0.18	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.26
Censored		Lognormal mean	0.26
Detection limit or PQL		Std. devn.	0.16
Method detection limit		Median	0.20
TOTAL	12	Min.	0.14
		Max.	0.70

Lognormal distribution? r-squared is: 0.823
Normal distribution? r-squared is: 0.672
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.34

Lead 95% UCL Calculation

DATA	ID
3.00	J1F1J3/ J1F1J8
9.15	J19CD9
2.64	J19CF0
3.78	J19CF1
2.60	J1F1J4
3.90	J1F1J5
4.21	J19CF5
7.60	J1F1J6
4.57	J19CF7
4.60	J1F1J7
1.93	J19CF9
2.44	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	4.20
Censored		Lognormal mean	4.21
Detection limit or PQL		Std. devn.	2.16
Method detection limit		Median	3.84
TOTAL	12	Min.	1.93
		Max.	9.15

Lognormal distribution? r-squared is: 0.949
Normal distribution? r-squared is: 0.835
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 5.63

Manganese 95% UCL Calculation

DATA	ID
283	J1F1J3/ J1F1J8
456	J19CD9
301	J19CF0
317	J19CF1
307	J1F1J4
294	J1F1J5
323	J19CF5
273	J1F1J6
292	J19CF7
320	J1F1J7
277	J19CF9
286	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	311
Censored		Lognormal mean	311
Detection limit or PQL		Std. devn.	48.7
Method detection limit		Median	298
TOTAL	12	Min.	273
		Max.	456

Lognormal distribution? r-squared is: 0.697
Normal distribution? r-squared is: 0.627
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 334

Mercury 95% UCL Calculation

DATA	ID
0.0180	J1F1J3/ J1F1J8
0.0535	J19CD9
0.0137	J19CF0
0.0303	J19CF1
0.0072	J1F1J4
0.0220	J1F1J5
0.0125	J19CF5
0.500	J1F1J6
0.0170	J19CF7
0.0190	J1F1J7
0.0140	J19CF9
0.0144	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.0601
Censored		Lognormal mean	0.0419
Detection limit or PQL		Std. devn.	0.1390
Method detection limit		Median	0.0175
TOTAL	12	Min.	0.0072
		Max.	0.500

Lognormal distribution? r-squared is: 0.711
Normal distribution? r-squared is: 0.361
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.126

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Molybdenum 95% UCL Calculation

DATA	ID
0.185	J1F1J3/ J1F1J8
0.386	J19CD9
0.361	J19CF0
0.338	J19CF1
0.130	J1F1J4
0.125	J1F1J5
0.329	J19CF5
0.125	J1F1J6
0.325	J19CF7
0.130	J1F1J7
0.367	J19CF9
0.344	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	0.262
Censored		Lognormal mean	0.267
Detection limit or PQL		Std. devn.	0.111
Method detection limit		Median	0.327
TOTAL	12	Min.	0.125
		Max.	0.386

Lognormal distribution? r-squared is: 0.787
Normal distribution? r-squared is: 0.812
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.315

Nickel 95% UCL Calculation

DATA	ID
11.0	J1F1J3/ J1F1J8
23.1	J19CD9
8.86	J19CF0
10.7	J19CF1
8.20	J1F1J4
11.3	J1F1J5
11.6	J19CF5
9.50	J1F1J6
10.3	J19CF7
11.4	J1F1J7
6.47	J19CF9
8.73	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	10.9
Censored		Lognormal mean	10.9
Detection limit or PQL		Std. devn.	4.13
Method detection limit		Median	10.5
TOTAL	12	Min.	6.47
		Max.	23.1

Lognormal distribution? r-squared is: 0.816
Normal distribution? r-squared is: 0.657
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 12.9

Vanadium 95% UCL Calculation

DATA	ID
48.9	J1F1J3/ J1F1J8
45.1	J19CD9
59.1	J19CF0
55.5	J19CF1
68.0	J1F1J4
50.7	J1F1J5
50.7	J19CF5
49.1	J1F1J6
55.3	J19CF7
52.0	J1F1J7
64.1	J19CF9
60.0	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	54.9
Censored		Lognormal mean	54.9
Detection limit or PQL		Std. devn.	6.81
Method detection limit		Median	53.7
TOTAL	12	Min.	45.1
		Max.	68.0

Lognormal distribution? r-squared is: 0.970
Normal distribution? r-squared is: 0.956
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 58.6

Zinc 95% UCL Calculation

DATA	ID
38.3	J1F1J3/ J1F1J8
65.8	J19CD9
46.0	J19CF0
45.2	J19CF1
44.5	J1F1J4
40.9	J1F1J5
47.8	J19CF5
39.8	J1F1J6
47.9	J19CF7
42.7	J1F1J7
50.0	J19CF9
48.4	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	46.4
Censored		Lognormal mean	46.5
Detection limit or PQL		Std. devn.	7.11
Method detection limit		Median	45.6
TOTAL	12	Min.	38.3
		Max.	65.8

Lognormal distribution? r-squared is: 0.865
Normal distribution? r-squared is: 0.799
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 49.8

Benzo(a)anthracene 95% UCL Calculation

DATA	ID
1.73	J1F1J3/ J1F1J8
1.75	J19CD9
4.26	J19CF0
1.88	J19CF1
1.65	J1F1J4
360	J1F1J5
1.67	J19CF5
41.0	J1F1J6
1.71	J19CF7
38.0	J1F1J7
7.10	J19CF9
1.87	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	38.6
Censored		Lognormal mean	26.7
Detection limit or PQL		Std. devn.	102
Method detection limit		Median	1.88
TOTAL	12	Min.	1.65
		Max.	360

Lognormal distribution? r-squared is: 0.737
Normal distribution? r-squared is: 0.386
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 87.1

Benzo(a)pyrene 95% UCL Calculation

DATA	ID
3.43	J1F1J3/ J1F1J8
1.75	J19CD9
3.28	J19CF0
1.37	J19CF1
3.30	J1F1J4
230	J1F1J5
1.67	J19CF5
39.0	J1F1J6
1.71	J19CF7
21.0	J1F1J7
6.76	J19CF9
1.53	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	26.2
Censored		Lognormal mean	18.9
Detection limit or PQL		Std. devn.	65.2
Method detection limit		Median	3.29
TOTAL	12	Min.	1.37
		Max.	230

Lognormal distribution? r-squared is: 0.806
Normal distribution? r-squared is: 0.409
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 57.2

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Benzo(b)fluoranthene 95% UCL Calculation

DATA	ID
2.28	J1F1J3/ J1F1J8
1.75	J19CD9
5.90	J19CF0
4.11	J19CF1
2.15	J1F1J4
360	J1F1J5
1.67	J19CF5
38.0	J1F1J6
1.71	J19CF7
38.0	J1F1J7
11.2	J19CF9
2.55	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	39.1
Censored		Lognormal mean	28.1
Detection limit or PQL		Std. devn.	102
Method detection limit		Median	3.33
TOTAL	12	Min.	1.67
		Max.	360

Lognormal distribution? r-squared is: 0.816
Normal distribution? r-squared is: 0.387
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 87.5

Benzo(k)fluoranthene 95% UCL Calculation

DATA	ID
2.13	J1F1J3/ J1F1J8
1.75	J19CD9
2.29	J19CF0
1.37	J19CF1
2.00	J1F1J4
200	J1F1J5
1.67	J19CF5
23.0	J1F1J6
1.71	J19CF7
23.0	J1F1J7
3.89	J19CF9
1.02	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	22.0
Censored		Lognormal mean	14.8
Detection limit or PQL		Std. devn.	56.6
Method detection limit		Median	2.06
TOTAL	12	Min.	1.02
		Max.	200

Lognormal distribution? r-squared is: 0.754
Normal distribution? r-squared is: 0.388
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 48.9

Chrysene 95% UCL Calculation

DATA	ID
2.58	J1F1J3/ J1F1J8
1.75	J19CD9
2.46	J19CF0
1.37	J19CF1
2.50	J1F1J4
330	J1F1J5
1.67	J19CF5
40.0	J1F1J6
1.71	J19CF7
39.0	J1F1J7
2.20	J19CF9
1.70	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	35.6
Censored		Lognormal mean	23.7
Detection limit or PQL		Std. devn.	93.8
Method detection limit		Median	2.33
TOTAL	12	Min.	1.37
		Max.	330

Lognormal distribution? r-squared is: 0.690
Normal distribution? r-squared is: 0.389
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 80.1

Fluoranthene 95% UCL Calculation

DATA	ID
7.00	J1F1J3/ J1F1J8
1.75	J19CD9
11.0	J19CF0
3.94	J19CF1
6.50	J1F1J4
340	J1F1J5
1.67	J19CF5
7.00	J1F1J6
1.71	J19CF7
49.0	J1F1J7
21.3	J19CF9
4.92	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	38.0
Censored		Lognormal mean	27.8
Detection limit or PQL		Std. devn.	96.0
Method detection limit		Median	6.75
TOTAL	12	Min.	1.67
		Max.	340

Lognormal distribution? r-squared is: 0.874
Normal distribution? r-squared is: 0.391
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 83.6

Chloride 95% UCL Calculation

DATA	ID
1.05	J1F1J3/ J1F1J8
5.90	J19CD9
3.10	J19CF0
4.50	J19CF1
1.00	J1F1J4
29.1	J1F1J5
1.25	J19CF5
5.90	J1F1J6
1.25	J19CF7
2.10	J1F1J7
1.20	J19CF9
7.60	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	5.33
Censored		Lognormal mean	5.08
Detection limit or PQL		Std. devn.	7.83
Method detection limit		Median	2.60
TOTAL	12	Min.	1.00
		Max.	29.1

Lognormal distribution? r-squared is: 0.893
Normal distribution? r-squared is: 0.551
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 9.05

Nitrogen in Nitrate and Nitrite (Method 353.2) 95% UCL Calculation

DATA	ID
0.31	J1F1J3/ J1F1J8
1.22	J19CD9
1.91	J19CF0
4.03	J19CF1
0.18	J1F1J4
0.64	J1F1J5
1.24	J19CF5
14.3	J1F1J6
6.60	J19CF7
0.54	J1F1J7
0.81	J19CF9
1.53	J19CH0

Number of samples		Uncensored values	
Uncensored	12	Mean	2.78
Censored		Lognormal mean	2.89
Detection limit or PQL		Std. devn.	4.07
Method detection limit		Median	1.23
TOTAL	12	Min.	0.18
		Max.	14.3

Lognormal distribution? r-squared is: 0.980
Normal distribution? r-squared is: 0.634
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.6

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	DATA	ID	Sulfate 95% UCL Calculation			
1						
2	4.15	J1F1J3/ J1F1J8				
3	85.1	J19CD9				
4	28.3	J19CF0	Number of samples		Uncensored values	
5	34.4	J19CF1	Uncensored	12	Mean	22.1
6	4.30	J1F1J4	Censored		Lognormal mean	23.3
7	29.3	J1F1J5	Detection limit or PQL		Std. devn.	22.7
8	4.80	J19CF5	Method detection limit		Median	16.9
9	27.1	J1F1J6	TOTAL	12	Min.	4.15
10	17.0	J19CF7			Max.	85.1
11	8.30	J1F1J7				
12	5.80	J19CF9				
13	16.7	J19CH0				
14						
15						
16						
17			Lognormal distribution?		Normal distribution?	
18			r-squared is: 0.932		r-squared is: 0.736	
19			Recommendations:			
20			Use lognormal distribution.			
21						
22			UCL (Land's method) is		55.0	
23						
24						

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Arsenic 95% UCL Calculation

DATA	ID
2.44	J19CH2/ J19CJ4
2.50	J19CH3
2.28	J19CH4
1.97	J19CH5
1.93	J19CH6
2.29	J19CH7
1.91	J19CH8
1.73	J19CH9
2.48	J19CJ0
1.19	J19CJ1
2.01	J19CJ2
2.79	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	2.13
Censored		Lognormal mean	2.13
Detection limit or PQL		Std. devn.	0.43
Method detection limit		Median	2.15
TOTAL	12	Min.	1.19
		Max.	2.79

Lognormal distribution? r-squared is: 0.877
Normal distribution? r-squared is: 0.943
Recommendations:
Use normal distribution

UCL (based on t-statistic) is 2.35

Barium 95% UCL Calculation

DATA	ID
54.4	J19CH2/ J19CJ4
60.0	J19CH3
51.3	J19CH4
55.7	J19CH5
67.8	J19CH6
69.9	J19CH7
49.5	J19CH8
55.5	J19CH9
61.0	J19CJ0
43.3	J19CJ1
60.4	J19CJ2
63.0	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	57.6
Censored		Lognormal mean	57.7
Detection limit or PQL		Std. devn.	7.6
Method detection limit		Median	57.9
TOTAL	12	Min.	43.3
		Max.	69.9

Lognormal distribution? r-squared is: 0.970
Normal distribution? r-squared is: 0.983
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 62.1

Beryllium 95% UCL Calculation

DATA	ID
0.162	J19CH2/ J19CJ4
0.197	J19CH3
0.151	J19CH4
0.154	J19CH5
0.151	J19CH6
0.214	J19CH7
0.178	J19CH8
0.175	J19CH9
0.184	J19CJ0
0.125	J19CJ1
0.179	J19CJ2
0.197	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.172
Censored		Lognormal mean	0.172
Detection limit or PQL		Std. devn.	0.025
Method detection limit		Median	0.177
TOTAL	12	Min.	0.125
		Max.	0.214

Lognormal distribution? r-squared is: 0.956
Normal distribution? r-squared is: 0.972
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.187

Boron 95% UCL Calculation

DATA	ID
0.681	J19CH2/ J19CJ4
1.59	J19CH3
0.657	J19CH4
0.609	J19CH5
0.811	J19CH6
0.963	J19CH7
0.777	J19CH8
0.823	J19CH9
1.04	J19CJ0
0.449	J19CJ1
1.04	J19CJ2
1.31	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.896
Censored		Lognormal mean	0.900
Detection limit or PQL		Std. devn.	0.318
Method detection limit		Median	0.817
TOTAL	12	Min.	0.449
		Max.	1.59

Lognormal distribution? r-squared is: 0.982
Normal distribution? r-squared is: 0.934
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1.12

Cadmium 95% UCL Calculation

DATA	ID
0.0596	J19CH2/ J19CJ4
0.0577	J19CH3
0.0459	J19CH4
0.0449	J19CH5
0.0564	J19CH6
0.0595	J19CH7
0.0431	J19CH8
0.0675	J19CH9
0.0945	J19CJ0
0.0343	J19CJ1
0.0579	J19CJ2
0.0658	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.0573
Censored		Lognormal mean	0.0574
Detection limit or PQL		Std. devn.	0.0153
Method detection limit		Median	0.0578
TOTAL	12	Min.	0.0343
		Max.	0.0945

Lognormal distribution? r-squared is: 0.936
Normal distribution? r-squared is: 0.887
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.0666

Chromium 95% UCL Calculation

DATA	ID
9.69	J19CH2/ J19CJ4
8.21	J19CH3
7.30	J19CH4
5.91	J19CH5
7.64	J19CH6
7.59	J19CH7
6.56	J19CH8
6.13	J19CH9
6.82	J19CJ0
4.32	J19CJ1
6.80	J19CJ2
8.44	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	7.12
Censored		Lognormal mean	7.14
Detection limit or PQL		Std. devn.	1.38
Method detection limit		Median	7.06
TOTAL	12	Min.	4.32
		Max.	9.69

Lognormal distribution? r-squared is: 0.931
Normal distribution? r-squared is: 0.969
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.00

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Cobalt 95% UCL Calculation

DATA	ID
5.33	J19CH2/ J19CJ4
7.15	J19CH3
5.86	J19CH4
7.01	J19CH5
6.65	J19CH6
7.37	J19CH7
7.66	J19CH8
7.48	J19CH9
7.81	J19CJ0
6.79	J19CJ1
7.09	J19CJ2
6.84	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	6.92
Censored		Lognormal mean	6.93
Detection limit or PQL		Std. devn.	0.72
Method detection limit		Median	7.05
TOTAL	12	Min.	5.33
		Max.	7.81

Lognormal distribution? r-squared is: 0.871
Normal distribution? r-squared is: 0.905
Recommendations:
Use normal distribution

UCL (based on t-statistic) is 7.29

Copper 95% UCL Calculation

DATA	ID
11.5	J19CH2/ J19CJ4
16.2	J19CH3
12.7	J19CH4
13.2	J19CH5
13.4	J19CH6
13.9	J19CH7
14.7	J19CH8
13.8	J19CH9
14.1	J19CJ0
12.2	J19CJ1
13.5	J19CJ2
14.1	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	13.6
Censored		Lognormal mean	13.6
Detection limit or PQL		Std. devn.	1.21
Method detection limit		Median	13.7
TOTAL	12	Min.	11.5
		Max.	16.2

Lognormal distribution? r-squared is: 0.958
Normal distribution? r-squared is: 0.950
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 12.3

Hexavalent Chromium 95% UCL Calculation

DATA	ID
0.17	J19CH2/ J19CJ4
0.12	J19CH3
0.17	J19CH4
0.10	J19CH5
0.14	J19CH6
0.14	J19CH7
0.06	J19CH8
0.10	J19CH9
0.18	J19CJ0
0.16	J19CJ1
0.07	J19CJ2
0.13	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.13
Censored		Lognormal mean	0.13
Detection limit or PQL		Std. devn.	0.04
Method detection limit		Median	0.14
TOTAL	12	Min.	0.06
		Max.	0.18

Lognormal distribution? r-squared is: 0.907
Normal distribution? r-squared is: 0.956
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.16

Lead 95% UCL Calculation

DATA	ID
2.87	J19CH2/ J19CJ4
3.47	J19CH3
2.76	J19CH4
2.70	J19CH5
2.72	J19CH6
3.64	J19CH7
2.86	J19CH8
2.72	J19CH9
2.92	J19CJ0
1.88	J19CJ1
2.85	J19CJ2
4.22	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	2.97
Censored		Lognormal mean	2.97
Detection limit or PQL		Std. devn.	0.58
Method detection limit		Median	2.86
TOTAL	12	Min.	1.88
		Max.	4.22

Lognormal distribution? r-squared is: 0.851
Normal distribution? r-squared is: 0.854
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 3.24

Manganese 95% UCL Calculation

DATA	ID
235	J19CH2/ J19CJ4
282	J19CH3
240	J19CH4
272	J19CH5
261	J19CH6
309	J19CH7
279	J19CH8
263	J19CH9
271	J19CJ0
238	J19CJ1
263	J19CJ2
278	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	266
Censored		Lognormal mean	266
Detection limit or PQL		Std. devn.	21.3
Method detection limit		Median	267
TOTAL	12	Min.	235
		Max.	309

Lognormal distribution? r-squared is: 0.938
Normal distribution? r-squared is: 0.936
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 277

Molybdenum 95% UCL Calculation

DATA	ID
0.214	J19CH2/ J19CJ4
0.331	J19CH3
0.251	J19CH4
0.266	J19CH5
0.261	J19CH6
0.254	J19CH7
0.295	J19CH8
0.258	J19CH9
0.277	J19CJ0
0.259	J19CJ1
0.260	J19CJ2
0.277	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.267
Censored		Lognormal mean	0.267
Detection limit or PQL		Std. devn.	0.028
Method detection limit		Median	0.261
TOTAL	12	Min.	0.214
		Max.	0.331

Lognormal distribution? r-squared is: 0.879
Normal distribution? r-squared is: 0.870
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.280

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Nickel 95% UCL Calculation

DATA	ID
9.61	J19CH2/ J19CJ4
10.4	J19CH3
10.1	J19CH4
7.65	J19CH5
12.0	J19CH6
9.02	J19CH7
8.67	J19CH8
8.49	J19CH9
8.57	J19CJ0
8.22	J19CJ1
9.60	J19CJ2
10.4	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	9.39
Censored		Lognormal mean	9.40
Detection limit or PQL		Std. devn.	1.21
Method detection limit		Median	9.31
TOTAL	12	Min.	7.65
		Max.	12.0

Lognormal distribution? r-squared is: 0.967
Normal distribution? r-squared is: 0.947
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.1

Vanadium 95% UCL Calculation

DATA	ID
37.4	J19CH2/ J19CJ4
51.1	J19CH3
41.0	J19CH4
51.7	J19CH5
48.2	J19CH6
53.9	J19CH7
54.4	J19CH8
54.5	J19CH9
51.7	J19CJ0
51.9	J19CJ1
52.9	J19CJ2
48.0	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	49.7
Censored		Lognormal mean	49.8
Detection limit or PQL		Std. devn.	5.4
Method detection limit		Median	51.7
TOTAL	12	Min.	37.4
		Max.	54.5

Lognormal distribution? r-squared is: 0.770
Normal distribution? r-squared is: 0.801
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 52.3

Zinc 95% UCL Calculation

DATA	ID
33.7	J19CH2/ J19CJ4
41.2	J19CH3
38.6	J19CH4
40.7	J19CH5
38.0	J19CH6
44.5	J19CH7
42.4	J19CH8
41.7	J19CH9
42.9	J19CJ0
37.6	J19CJ1
40.6	J19CJ2
43.5	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	40.4
Censored		Lognormal mean	40.5
Detection limit or PQL		Std. devn.	3.0
Method detection limit		Median	41.0
TOTAL	12	Min.	33.7
		Max.	44.5

Lognormal distribution? r-squared is: 0.914
Normal distribution? r-squared is: 0.936
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 42.2

Benzo(a)anthracene 95% UCL Calculation

DATA	ID
2.01	J19CH2/ J19CJ4
1.07	J19CH3
1.71	J19CH4
1.01	J19CH5
10.2	J19CH6
1.72	J19CH7
1.72	J19CH8
1.72	J19CH9
2.42	J19CJ0
1.71	J19CJ1
1.71	J19CJ2
3.87	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	2.57
Censored		Lognormal mean	2.46
Detection limit or PQL		Std. devn.	2.51
Method detection limit		Median	1.72
TOTAL	12	Min.	1.01
		Max.	10.2

Lognormal distribution? r-squared is: 0.764
Normal distribution? r-squared is: 0.520
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 3.77

Benzo(b)fluoranthene 95% UCL Calculation

DATA	ID
2.55	J19CH2/ J19CJ4
1.28	J19CH3
1.71	J19CH4
1.52	J19CH5
9.76	J19CH6
1.72	J19CH7
1.00	J19CH8
1.72	J19CH9
5.87	J19CJ0
1.71	J19CJ1
1.71	J19CJ2
7.74	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	3.19
Censored		Lognormal mean	3.13
Detection limit or PQL		Std. devn.	2.92
Method detection limit		Median	1.72
TOTAL	12	Min.	1.00
		Max.	9.76

Lognormal distribution? r-squared is: 0.821
Normal distribution? r-squared is: 0.700
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 4.58

Chrysene 95% UCL Calculation

DATA	ID
1.59	J19CH2/ J19CJ4
1.19	J19CH3
1.03	J19CH4
1.01	J19CH5
18.2	J19CH6
1.72	J19CH7
1.72	J19CH8
1.72	J19CH9
1.87	J19CJ0
1.71	J19CJ1
1.71	J19CJ2
2.99	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	3.04
Censored		Lognormal mean	2.60
Detection limit or PQL		Std. devn.	4.80
Method detection limit		Median	1.72
TOTAL	12	Min.	1.01
		Max.	18.2

Lognormal distribution? r-squared is: 0.633
Normal distribution? r-squared is: 0.381
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 5.32

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Fluoranthene 95% UCL Calculation

DATA	ID
6.06	J19CH2/ J19CJ4
1.71	J19CH3
1.71	J19CH4
2.74	J19CH5
18.2	J19CH6
1.72	J19CH7
1.72	J19CH8
1.78	J19CH9
9.01	J19CJ0
1.71	J19CJ1
1.52	J19CJ2
12.7	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	5.05
Censored		Lognormal mean	4.95
Detection limit or PQL		Std. devn.	5.50
Method detection limit		Median	1.75
TOTAL	12	Min.	1.52
		Max.	18.2

Lognormal distribution? r-squared is: 0.778
Normal distribution? r-squared is: 0.701
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 7.66

Nitrogen in Nitrite and Nitrate 95% UCL Calculation

DATA	ID
1.73	J19CH2/ J19CJ4
5.52	J19CH3
1.34	J19CH4
1.54	J19CH5
1.16	J19CH6
0.96	J19CH7
1.37	J19CH8
1.09	J19CH9
1.34	J19CJ0
0.23	J19CJ1
0.49	J19CJ2
2.90	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	1.64
Censored		Lognormal mean	1.71
Detection limit or PQL		Std. devn.	1.39
Method detection limit		Median	1.34
TOTAL	12	Min.	0.23
		Max.	5.52

Lognormal distribution? r-squared is: 0.909
Normal distribution? r-squared is: 0.716
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3.15

Sulfate 95% UCL Calculation

DATA	ID
4.7	J19CH2/ J19CJ4
40.3	J19CH3
25.9	J19CH4
20.2	J19CH5
3.2	J19CH6
3.9	J19CH7
5.3	J19CH8
5.2	J19CH9
12.2	J19CJ0
2.7	J19CJ1
4.5	J19CJ2
71.4	J19CJ3

Number of samples		Uncensored values	
Uncensored	12	Mean	16.6
Censored		Lognormal mean	16.7
Detection limit or PQL		Std. devn.	20.8
Method detection limit		Median	5.25
TOTAL	12	Min.	2.70
		Max.	71.4

Lognormal distribution? r-squared is: 0.898
Normal distribution? r-squared is: 0.703
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 26.5

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Arsenic 95% UCL Calculation

DATA	ID
1.76	J19CB4
1.77	J19CB5
2.15	J19CB6
1.89	J19CB7
2.25	J19CB8
1.85	J19CB9
1.83	J19CC0
2.36	J19CC1
1.73	J19CC2
2.29	J19CC3
1.82	J19CC4
2.42	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	2.01
Censored		Lognormal mean	2.01
Detection limit or PQL		Std. devn.	0.26
Method detection limit		Median	1.87
TOTAL	12	Min.	1.73
		Max.	2.42

Lognormal distribution? r-squared is: 0.876
Normal distribution? r-squared is: 0.869
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2.13

Barium 95% UCL Calculation

DATA	ID
62.5	J19CB4
49.0	J19CB5
53.7	J19CB6
51.6	J19CB7
58.6	J19CB8
51.4	J19CB9
62.3	J19CC0
55.8	J19CC1
56.3	J19CC2
56.8	J19CC3
50.2	J19CC4
62.1	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	55.9
Censored		Lognormal mean	55.9
Detection limit or PQL		Std. devn.	4.8
Method detection limit		Median	56.1
TOTAL	12	Min.	49.0
		Max.	62.5

Lognormal distribution? r-squared is: 0.950
Normal distribution? r-squared is: 0.946
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 58.5

Beryllium 95% UCL Calculation

DATA	ID
0.157	J19CB4
0.149	J19CB5
0.167	J19CB6
0.167	J19CB7
0.189	J19CB8
0.160	J19CB9
0.178	J19CC0
0.161	J19CC1
0.165	J19CC2
0.184	J19CC3
0.167	J19CC4
0.195	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	0.170
Censored		Lognormal mean	0.170
Detection limit or PQL		Std. devn.	0.014
Method detection limit		Median	0.167
TOTAL	12	Min.	0.149
		Max.	0.195

Lognormal distribution? r-squared is: 0.954
Normal distribution? r-squared is: 0.945
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.177

Boron 95% UCL Calculation

DATA	ID
0.570	J19CB4
0.641	J19CB5
0.861	J19CB6
0.732	J19CB7
0.930	J19CB8
0.905	J19CB9
0.789	J19CC0
0.851	J19CC1
0.610	J19CC2
0.880	J19CC3
0.402	J19CC4
0.961	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	0.761
Censored		Lognormal mean	0.765
Detection limit or PQL		Std. devn.	0.172
Method detection limit		Median	0.820
TOTAL	12	Min.	0.402
		Max.	0.961

Lognormal distribution? r-squared is: 0.867
Normal distribution? r-squared is: 0.923
Recommendations:
Use normal distribution

UCL (based on t-statistic) is 0.850

Cadmium 95% UCL Calculation

DATA	ID
0.0586	J19CB4
0.0593	J19CB5
0.0467	J19CB6
0.0539	J19CB7
0.0539	J19CB8
0.0474	J19CB9
0.0640	J19CC0
0.0591	J19CC1
0.0551	J19CC2
0.0678	J19CC3
0.0457	J19CC4
0.0766	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	0.0573
Censored		Lognormal mean	0.0574
Detection limit or PQL		Std. devn.	0.00909
Method detection limit		Median	0.0569
TOTAL	12	Min.	0.0457
		Max.	0.0766

Lognormal distribution? r-squared is: 0.962
Normal distribution? r-squared is: 0.944
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.0625

Chromium 95% UCL Calculation

DATA	ID
5.04	J19CB4
6.36	J19CB5
6.70	J19CB6
7.16	J19CB7
7.88	J19CB8
5.92	J19CB9
5.75	J19CC0
5.92	J19CC1
5.59	J19CC2
7.94	J19CC3
4.22	J19CC4
7.13	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	6.30
Censored		Lognormal mean	6.31
Detection limit or PQL		Std. devn.	1.12
Method detection limit		Median	6.14
TOTAL	12	Min.	4.22
		Max.	7.94

Lognormal distribution? r-squared is: 0.958
Normal distribution? r-squared is: 0.974
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.99

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DATA	ID
7.11	J19CB4
7.89	J19CB5
7.27	J19CB6
6.78	J19CB7
7.55	J19CB8
6.95	J19CB9
7.56	J19CC0
7.86	J19CC1
6.97	J19CC2
7.04	J19CC3
7.49	J19CC4
7.72	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	7.35
Censored		Lognormal mean	7.35
Detection limit or PQL		Std. devn.	0.38
Method detection limit		Median	7.38
TOTAL	12	Min.	6.78
		Max.	7.89

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

UCL (Land's method) is 7.55

Copper 95% UCL Calculation

DATA	ID
14.1	J19CB4
14.3	J19CB5
14.5	J19CB6
13.7	J19CB7
14.7	J19CB8
14.2	J19CB9
15.3	J19CC0
14.1	J19CC1
14.2	J19CC2
15.6	J19CC3
15.4	J19CC4
16.0	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	14.7
Censored		Lognormal mean	14.7
Detection limit or PQL		Std. devn.	0.72
Method detection limit		Median	14.4
TOTAL	12	Min.	13.7
		Max.	16.0

Lognormal distribution? r-squared is: 0.924
Normal distribution? r-squared is: 0.918
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 15.1

Lead 95% UCL Calculation

DATA	ID
2.23	J19CB4
2.48	J19CB5
2.49	J19CB6
2.56	J19CB7
2.91	J19CB8
2.43	J19CB9
2.62	J19CC0
2.55	J19CC1
2.23	J19CC2
2.69	J19CC3
2.06	J19CC4
2.60	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	2.49
Censored		Lognormal mean	2.49
Detection limit or PQL		Std. devn.	0.23
Method detection limit		Median	2.52
TOTAL	12	Min.	2.06
		Max.	2.91

Lognormal distribution? r-squared is: 0.946
Normal distribution? r-squared is: 0.955
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.62

Manganese 95% UCL Calculation

DATA	ID
321	J19CB4
287	J19CB5
264	J19CB6
253	J19CB7
298	J19CB8
255	J19CB9
280	J19CC0
278	J19CC1
253	J19CC2
262	J19CC3
263	J19CC4
275	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	274
Censored		Lognormal mean	274
Detection limit or PQL		Std. devn.	20
Method detection limit		Median	270
TOTAL	12	Min.	253
		Max.	321

Lognormal distribution? r-squared is: 0.914
Normal distribution? r-squared is: 0.896
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 285

Molybdenum 95% UCL Calculation

DATA	ID
0.309	J19CB4
0.353	J19CB5
0.285	J19CB6
0.265	J19CB7
0.281	J19CB8
0.271	J19CB9
0.298	J19CC0
0.297	J19CC1
0.277	J19CC2
0.273	J19CC3
0.315	J19CC4
0.285	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	0.292
Censored		Lognormal mean	0.292
Detection limit or PQL		Std. devn.	0.024
Method detection limit		Median	0.285
TOTAL	12	Min.	0.265
		Max.	0.353

Lognormal distribution? r-squared is: 0.898
Normal distribution? r-squared is: 0.870
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.304

Nickel 95% UCL Calculation

DATA	ID
7.56	J19CB4
8.26	J19CB5
8.27	J19CB6
8.26	J19CB7
9.30	J19CB8
8.47	J19CB9
7.66	J19CC0
7.45	J19CC1
7.13	J19CC2
10.4	J19CC3
6.22	J19CC4
9.03	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	8.17
Censored		Lognormal mean	8.17
Detection limit or PQL		Std. devn.	1.09
Method detection limit		Median	8.26
TOTAL	12	Min.	6.22
		Max.	10.4

Lognormal distribution? r-squared is: 0.968
Normal distribution? r-squared is: 0.964
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.79

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Vanadium 95% UCL Calculation

DATA	ID
56.5	J19CB4
64.0	J19CB5
53.6	J19CB6
52.6	J19CB7
53.6	J19CB8
51.5	J19CB9
55.8	J19CC0
55.8	J19CC1
54.6	J19CC2
51.0	J19CC3
55.7	J19CC4
53.3	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	54.8
Censored		Lognormal mean	54.8
Detection limit or PQL		Std. devn.	3.4
Method detection limit		Median	54.1
TOTAL	12	Min.	51.0
		Max.	64.0

Lognormal distribution? r-squared is: 0.826
Normal distribution? r-squared is: 0.798
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 56.4

Zinc 95% UCL Calculation

DATA	ID
41.8	J19CB4
46.1	J19CB5
42.1	J19CB6
39.4	J19CB7
43.2	J19CB8
41.3	J19CB9
43.9	J19CC0
43.9	J19CC1
41.8	J19CC2
42.4	J19CC3
42.5	J19CC4
45.0	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	42.8
Censored		Lognormal mean	42.8
Detection limit or PQL		Std. devn.	1.8
Method detection limit		Median	42.5
TOTAL	12	Min.	39.4
		Max.	46.1

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

UCL (Land's method) is 43.7

Benzo(a)anthracene 95% UCL Calculation

DATA	ID
3.21	J19CB4
1.60	J19CB5
1.83	J19CB6
77.8	J19CB7
4.80	J19CB8
3.36	J19CB9
13.0	J19CC0
51.7	J19CC1
5.75	J19CC2
25.8	J19CC3
11.3	J19CC4
1.73	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	16.8
Censored		Lognormal mean	17.6
Detection limit or PQL		Std. devn.	24.1
Method detection limit		Median	5.28
TOTAL	12	Min.	1.60
		Max.	77.8

Lognormal distribution? r-squared is: 0.937
Normal distribution? r-squared is: 0.681
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 72.6

Benzo(a)pyrene 95% UCL Calculation

DATA	ID
2.91	J19CB4
1.44	J19CB5
1.75	J19CB6
61.3	J19CB7
2.69	J19CB8
2.88	J19CB9
9.75	J19CC0
40.8	J19CC1
3.84	J19CC2
18.7	J19CC3
9.81	J19CC4
1.73	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	13.1
Censored		Lognormal mean	13.2
Detection limit or PQL		Std. devn.	18.9
Method detection limit		Median	3.38
TOTAL	12	Min.	1.44
		Max.	61.3

Lognormal distribution? r-squared is: 0.906
Normal distribution? r-squared is: 0.665
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 49.5

Benzo(b)fluoranthene 95% UCL Calculation

DATA	ID
5.35	J19CB4
2.95	J19CB5
3.20	J19CB6
96.4	J19CB7
5.64	J19CB8
5.05	J19CB9
13.4	J19CC0
41.8	J19CC1
7.38	J19CC2
37.2	J19CC3
15.5	J19CC4
1.73	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	19.6
Censored		Lognormal mean	20.0
Detection limit or PQL		Std. devn.	27.6
Method detection limit		Median	6.51
TOTAL	12	Min.	1.73
		Max.	96.4

Lognormal distribution? r-squared is: 0.953
Normal distribution? r-squared is: 0.658
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 68.0

Benzo(ghi)perylene 95% UCL Calculation

DATA	ID
1.71	J19CB4
1.72	J19CB5
1.72	J19CB6
35.9	J19CB7
4.04	J19CB8
1.26	J19CB9
6.29	J19CC0
24.4	J19CC1
4.07	J19CC2
14.3	J19CC3
7.51	J19CC4
1.73	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	8.72
Censored		Lognormal mean	8.91
Detection limit or PQL		Std. devn.	10.9
Method detection limit		Median	4.06
TOTAL	12	Min.	1.26
		Max.	35.9

Lognormal distribution? r-squared is: 0.911
Normal distribution? r-squared is: 0.714
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 26.4

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Benzo(k)fluoranthene 95% UCL Calculation

DATA	ID
1.62	J19CB4
0.91	J19CB5
1.10	J19CB6
26.5	J19CB7
1.89	J19CB8
1.72	J19CB9
5.12	J19CC0
18.8	J19CC1
2.33	J19CC2
10.2	J19CC3
5.03	J19CC4
1.73	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	6.41
Censored		Lognormal mean	6.40
Detection limit or PQL		Std. devn.	8.19
Method detection limit		Median	2.11
TOTAL	12	Min.	0.91
		Max.	26.5

Lognormal distribution? r-squared is: 0.910
Normal distribution? r-squared is: 0.697
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 18.3

Chrysene 95% UCL Calculation

DATA	ID
2.67	J19CB4
0.93	J19CB5
1.72	J19CB6
52.4	J19CB7
3.94	J19CB8
3.25	J19CB9
9.58	J19CC0
37.7	J19CC1
5.21	J19CC2
19.2	J19CC3
7.37	J19CC4
1.73	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	16.5
Censored		Lognormal mean	12
Detection limit or PQL		Std. devn.	0.50
Method detection limit		Median	12
TOTAL	12	Min.	12
		Max.	13

Lognormal distribution? r-squared is: 0.965
Normal distribution? r-squared is: 0.697
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 46.7

Fluoranthene 95% UCL Calculation

DATA	ID
8.0	J19CB4
5.5	J19CB5
6.8	J19CB6
254	J19CB7
7.3	J19CB8
8.4	J19CB9
19.5	J19CC0
77.7	J19CC1
7.0	J19CC2
64.2	J19CC3
28.7	J19CC4
2.8	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	40.8
Censored		Lognormal mean	38.6
Detection limit or PQL		Std. devn.	71.5
Method detection limit		Median	8.18
TOTAL	12	Min.	2.77
		Max.	254

Lognormal distribution? r-squared is: 0.898
Normal distribution? r-squared is: 0.549
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 74.8

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

DATA	ID
1.7	J19CB4
1.7	J19CB5
1.7	J19CB6
31.1	J19CB7
1.1	J19CB8
1.7	J19CB9
5.5	J19CC0
24.0	J19CC1
1.7	J19CC2
13.8	J19CC3
6.4	J19CC4
1.7	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	7.69
Censored		Lognormal mean	7.67
Detection limit or PQL		Std. devn.	10.1
Method detection limit		Median	1.73
TOTAL	12	Min.	1.11
		Max.	31.1

Lognormal distribution? r-squared is: 0.824
Normal distribution? r-squared is: 0.690
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 12.5

Phenanthrene 95% UCL Calculation

DATA	ID
2.0	J19CB4
1.7	J19CB5
0.9	J19CB6
55.6	J19CB7
4.6	J19CB8
2.0	J19CB9
6.0	J19CC0
7.9	J19CC1
1.4	J19CC2
12.2	J19CC3
11.2	J19CC4
1.7	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	8.93
Censored		Lognormal mean	8.37
Detection limit or PQL		Std. devn.	15.2
Method detection limit		Median	3.31
TOTAL	12	Min.	0.93
		Max.	55.6

Lognormal distribution? r-squared is: 0.914
Normal distribution? r-squared is: 0.515
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 27.1

Pyrene 95% UCL Calculation

DATA	ID
2.82	J19CB4
1.94	J19CB5
0.91	J19CB6
161	J19CB7
6.98	J19CB8
2.98	J19CB9
13.3	J19CC0
67.5	J19CC1
2.21	J19CC2
48.2	J19CC3
13.1	J19CC4
0.91	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	26.8
Censored		Lognormal mean	31.3
Detection limit or PQL		Std. devn.	47.3
Method detection limit		Median	4.98
TOTAL	12	Min.	0.91
		Max.	161

Lognormal distribution? r-squared is: 0.941
Normal distribution? r-squared is: 0.601
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 296

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Chloride 95% UCL Calculation

DATA	ID
12.1	J19CB4
1.3	J19CB5
1.3	J19CB6
46.8	J19CB7
13.1	J19CB8
4.2	J19CB9
46.1	J19CC0
18.3	J19CC1
3.0	J19CC2
8.2	J19CC3
1.3	J19CC4
4.4	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	13.3
Censored		Lognormal mean	15.2
Detection limit or PQL		Std. devn.	16.4
Method detection limit		Median	6.30
TOTAL	12	Min.	1.30
		Max.	46.8

Lognormal distribution? r-squared is: 0.944
Normal distribution? r-squared is: 0.732
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 59.0

Nitrogen in Nitrite and Nitrate 95% UCL Calculation

DATA	ID
2.06	J19CB4
0.43	J19CB5
0.67	J19CB6
5.10	J19CB7
4.29	J19CB8
1.33	J19CB9
4.04	J19CC0
3.61	J19CC1
0.60	J19CC2
4.09	J19CC3
0.72	J19CC4
1.13	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	2.34
Censored		Lognormal mean	2.53
Detection limit or PQL		Std. devn.	1.75
Method detection limit		Median	1.70
TOTAL	12	Min.	0.43
		Max.	5.10

Lognormal distribution? r-squared is: 0.912
Normal distribution? r-squared is: 0.879
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 5.34

Sulfate 95% UCL Calculation

DATA	ID
24.3	J19CB4
4.8	J19CB5
12.4	J19CB6
24.7	J19CB7
27.6	J19CB8
15.8	J19CB9
19.0	J19CC0
26.2	J19CC1
7.4	J19CC2
25.6	J19CC3
6.3	J19CC4
20.9	J19CC5

Number of samples		Uncensored values	
Uncensored	12	Mean	17.9
Censored		Lognormal mean	18.8
Detection limit or PQL		Std. devn.	8.37
Method detection limit		Median	20.0
TOTAL	12	Min.	4.80
		Max.	27.6

Lognormal distribution? r-squared is: 0.854
Normal distribution? r-squared is: 0.912
Recommendations:
Use normal distribution

UCL (based on t-statistic) is 22.3

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Originator J. D. Skoglie **Date** 04/15/11 **Calc. No.** 0100D-CA-V0352 **Rev. No.** 3
Project 100-D Field Remediation **Job No.** 14655 **Checked** T. E. Queen **Date** 04/15/11
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Duplicate Analysis - 116-D-5 Shallow Zone

Sampling Area	Sample Number	Sample Date	Cesium-137			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranim-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
SZ-3	J19CC8	11/10/09	0.083		0.043	15.7		0.423	0.714		0.076	0.866		0.170	0.841		0.059	0.866		0.170	0.559		0.171	0.514		0.171
Duplicate of J19CC8	J19CD8	11/10/09	0.062		0.032	14.8		0.289	0.568		0.049	0.839		0.116	0.84		0.034	0.839		0.116	0.487		0.177	0.579		0.177

Analysis:

	TDL		0.1			0.5			0.1			0.2			1			1			1			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)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	RPD					5.9%			22.8%																	
	Difference > 2 TDL?		No - acceptable			Not applicable			Not applicable			No - acceptable			No - acceptable			No - acceptable			No - acceptable			No - acceptable		

Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-3	J19CC8	11/10/09	6210		3.44	2.93		0.688	62.3		0.344	0.178		0.138	1.12	B	1.38	0.0728	B	0.138	7520		68.8	11.1	J	0.138
Duplicate of J19CC8	J19CD8	11/10/09	6570		3.53	3.19		0.706	64.3		0.353	0.172		0.141	0.949	B	1.41	0.0750	B	0.141	8460		70.6	12.8	J	0.141

Analysis:

	TDL		5			1			0.5			0.2			2			0.2			100			0.2		
Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (continue)			Yes (continue)		
	Both >5xTDL?		Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)									Yes (calc RPD)			Yes (calc RPD)		
	RPD		5.6%						3.2%												11.8%			14.2%		
	Difference > 2 TDL?		Not applicable			No - acceptable			Not applicable			No - acceptable			No - acceptable			No - acceptable			Not applicable			Not applicable		

Sampling Area	Sample Number	Sample Date	Cobalt			Copper			Hexavalent Chromium			Iron			Lead			Magnesium			Manganese			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	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-3	J19CC8	11/10/09	6.22		1.38	15.2		0.688	0.17	B	0.21	16900		13.8	3.10		0.344	3990	J	51.6	263		3.44	0.265	B	1.38
Duplicate of J19CC8	J19CD8	11/10/09	5.82		1.41	12.2		0.706	0.18	B	0.20	15600		14.1	2.81		0.353	4170	J	52.9	255		3.53	0.218	B	1.41

Analysis:

	TDL		2			1			0.5			5			0.5			75			5			2		
Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)		
	Both >5xTDL?		No-Stop (acceptable)			Yes (calc RPD)						Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)			Yes (calc RPD)					
	RPD					21.9%						8.0%			9.8%			4.4%			3.1%					
	Difference > 2 TDL?		No - acceptable			Not applicable			No - acceptable			Not applicable			Not applicable			Not applicable			Not applicable			No - acceptable		

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Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/15/11
Job No. 14655

Calc. No. 0100D-CA-V0352
Checked T. E. Queen

Rev. No. 3
Date 04/15/11
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Duplicate Analysis - 116-D-5 Shallow Zone

Sampling Area	HEIS Number	Sample Date	Nickel			Potassium			Silicon			Sodium			Vanadium			Zinc			Benzo(a)anthracene (8310)			Benzo(a)pyrene (8310)		
			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
SZ-3	J19CC8	11/10/09	10.8		2.75	1080		275	406	J	1.38	200		34.4	42.4	J	1.72	38.2		6.88	10.1		3.43	8.56		3.43
Duplicate of J19CC8	J19CD8	11/10/09	11.2		2.82	1160		282	531	J	1.41	193		35.3	35.8	J	1.76	35.0		7.06	3.39	J	3.39	2.54		3.39

Analysis:

	TDL	4	400	2	50	2.5	1	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)		
	RPD			26.7%		16.9%	8.7%		
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

Sampling Area	Sample Number	Sample Date	Benzo(b)fluoranthene (8310)			Benzo(k)fluoranthene (8310)			Chrysene (8310)			Fluoranthene (8310)			Indeno(1,2,3-cd)pyrene (8310)			Phenanthrene (8310)			Pyrene (8310)			Chloride		
			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	mg/kg	Q	PQL
SZ-3	J19CC8	11/10/09	13.9	U	3.43	4.62		3.43	3.42	J	3.43	24.1		3.43	5.82	B	3.43	6.16		3.43	10.3		3.43	12		2.4
Duplicate of J19CC8	J19CD8	11/10/09	7.11	B	3.39	1.52	J	3.39	3.05	J	3.39	7.62		3.39	3.39	U	3.39	1.19	J	3.39	2.71	J	3.39	2.6	U	2.6

Analysis:

	TDL	15	15	100	50	30	50	50	2
Duplicate Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	Both >5xTDL?	No-Stop (acceptable)			No-Stop (acceptable)				
	RPD								
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Yes - assess further

Sampling Area	HEIS Number	Sample Date	Fluoride			Nitrogen in nitrite and nitrate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-3	J19CC8	11/10/09	0.4	B	2.4	3.34		0.20	11.1	B	2.4
Duplicate of J19CC8	J19CD8	11/10/09	0.5	B	2.6	2.76		0.21	7.0	B	2.6

Analysis:

	TDL	5	0.75	5
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?		No-Stop (acceptable)	No-Stop (acceptable)
	RPD			
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-D Field Remediation
Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations

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1 **Duplicate Analysis - 116-D-5 Deep Zone**

2	Sampling	Sample	Sample	Cesium-137			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranium-238		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	DZ-4 [a]	J1F1J3	3/16/11	0.238		0.0552																0.182		0.169	0.199		0.187
5	DZ-4	J19CF2	11/10/2009	0.434		0.035	12.3		0.245	0.459		0.060	0.766		0.130	0.712		0.040	0.766		0.130	0.572		0.175	0.617		0.175
6	Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	0.192		0.0276																0.174		0.151	0.204		0.154
7	Duplicate of J19CF2	J19CH1	11/10/2009	0.495		0.018	12.3		0.116	0.479		0.029	0.709		0.063	0.693		0.02	0.709		0.063	0.524		0.174	0.547		0.174

8 **Analysis:**

9		TDL	0.05	0.5	0.1	0.2	1	1	1	1
10	Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
11		Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
12		RPD		0.0%						
13		Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

14

15	Sampling	HEIS	Sample	Aluminum			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium			Cobalt		
16	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
17	DZ-4 [a]	J1F1J3	3/16/11	5930	X	1.40	2.10		0.600	51.1	X	0.069	0.10	B	0.030	0.071	B	0.037	5520	X	12.8	13.3	X	0.053	7.1	X	0.091
18	DZ-4	J19CF2	11/10/2009	6110		3.58	2.31		0.717	63.5		0.358	0.211		0.143	0.0851	B	0.143	6950		71.7	10.5		0.143	7.74		1.43
19	Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	7080	X	1.60	2.30		0.670	57.0	X	0.077	0.12	B	0.033	0.076	B	0.042	6670	X	14.3	14.9	X	0.059	8.8	X	0.10
20	Duplicate of J19CF2	J19CH1	11/10/2009	6620		3.68	2.77		0.736	69.6		0.368	0.227		0.147	0.0716	B	0.147	7220		73.6	11.7		0.147	7.73		1.47

21 **Analysis:**

22		TDL	5	10	2	0.5	0.2	100	0.5	2
23	Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
24		Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
25		RPD	17.7%		10.9%			18.9%	11.3%	
26		Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

27

28	Sampling	Sample	Sample	Copper			Hexavalent chromium			Iron			Lead			Magnesium			Manganese			Mercury			Nickel		
29	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
30	DZ-4 [a]	J1F1J3	3/16/11	14.7	X	0.20	0.220		0.150	18900	X	3.4	3.00		0.290	4290	X	3.40	272	X	0.091	0.013	B	0.0056	9.0	X	0.11
31	DZ-4	J19CF2	11/10/2009	15.1		0.717	0.190	B	0.210	22300		14.3	3.36		0.358	4250	J	53.8	291		3.58	0.0605		0.0290	8.34		2.87
32	Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	17.9	X	0.22	0.191		0.145	20900	X	3.9	3.00		0.280	5400	X	3.8	294	X	0.10	0.023		0.0052	13.0	X	0.12
33	Duplicate of J19CF2	J19CH1	11/10/2009	15.5		0.736	0.170	B	0.210	22200		14.7	3.34		0.368	4260	J	55.2	280		3.68	0.0595		0.0258	9.45		2.94

34 **Analysis:**

35		TDL	1	0.5	5	5	75	5	0.2	4
36	Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
37		Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
38		RPD	19.6%		10.1%		22.9%	7.8%		
39		Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

40

41	Sampling	HEIS	Sample	Potassium			Silicon			Sodium			Vanadium			Zinc			Bis(2-ethylhexyl)phthalate			Sulfate		
42	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	mg/kg	Q	PQL
43	DZ-4 [a]	J1F1J3	3/16/11	672		37.2	178	MN	5.10	256		53.5	47.8	X	0.085	36.8	X	0.36	110	JB	48	3.9	B	1.8
44	DZ-4	J19CF2	11/10/2009	926		287	381		1.43	236		35.8	60.4		1.79	49.4		7.17	681	UD	681	21.9		2.6
45	Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	813		41.6	172		5.70	388		59.9	49.9	X	0.095	39.7	X	0.40	110	JB	48	4.4	B	1.8
46	Duplicate of J19CF2	J19CH1	11/10/2009	1120		294	477		1.47	270		36.8	49.6		1.84	46.9		7.36	340	U	340	30.1		2.5

47 **Analysis:**

48		TDL	400	2	50	2.5	1	660	5
49	Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
50		Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
51		RPD		3.4%	41.0%	4.3%	7.6%		
52		Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable

53 [a] Department of Ecology requested additional remediation and re-samples taken at these locations. Original samples are for information only except for K-40, Ra-226, Th-228 GEA, & Th-232 GEA, these analytes were not re-sampled.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie **Date** 04/15/11 **Calc. No.** 0100D-CA-V0352 **Rev. No.** 3

Project 100-D Field Remediation **Job No.** 14655 **Checked** T. E. Queen **Date** 04/15/11

Subject 116-D-5 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 52 of 53

Duplicate Analysis - 116-D-5 Staging Pile Area

Sampling Area	Sample Number	Sample Date	Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranium-238			Aluminum		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
SPA-1	J19CH2	11/9/09	14.9		0.248	0.508		0.045	0.812		0.085	0.669		0.026	0.812		0.085	0.468		0.115	0.362		0.115	5270		3.43
Duplicate of J19CH2	J19CJ4	11/9/09	14.1		0.142	0.506		0.024	0.688		0.057	0.716		0.017	0.688		0.057	0.422		0.216	0.338		0.216	5490		4.30

Analysis:

	TDL	0.5	0.1	0.2	1	1	1	1	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)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	5.5%	0.4%						4.1%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable

Sampling Area	HEIS Number	Sample Date	Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-1	J19CH2	11/9/09	2.62		0.343	51.7		0.343	0.160		0.137	0.571	B	1.37	0.0564	B	0.137	6280		68.6	10.7		0.137	5.13		1.37
Duplicate of J19CH2	J19CJ4	11/9/09	2.25		0.430	57.0		0.430	0.164	B	0.172	0.791	B	1.72	0.0627	B	0.172	6090		85.9	8.67		0.172	5.53		1.72

Analysis:

	TDL	1	0.5	0.2	2	0.2	100	0.2	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)				Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		9.8%				3.1%	21.0%	
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Sampling Area	Sample Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Magnesium			Manganese			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-1	J19CH2	11/9/09	11.3		0.686	0.17		0.21	14600		13.7	2.87		0.343	4010		51.5	235		3.43	0.208	B	1.37	9.99		2.75
Duplicate of J19CH2	J19CJ4	11/9/09	11.7		0.859	0.17		0.21	15700		17.2	2.86		0.430	3690		64.4	234		4.30	0.219	B	1.72	9.23		3.44

Analysis:

	TDL	1	0.5	5	0.5	75	5	2	4
Duplicate Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)		Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)
	RPD	3.5%		7.3%	0.3%	8.3%	0.4%		
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable

CALCULATION SHEET

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Sheet No. 53 of 53

1 **Duplicate Analysis - 116-D-5 Staging Pile Area**

2	Sampling Area	HEIS Number	Sample Date	Potassium			Silicon			Sodium			Vanadium			Zinc			Dibenz[a,h]anthracene (8310)			Nitrogen in Nitrite and Nitrate			Sulfate		
3				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	SPA-1	J19CH2	11/9/09	936		275	457		1.37	177		34.3	34.0		1.72	32.1		6.86	1.39	J	1.39	0.99		0.21	4.3		2.3
5	Duplicate of J19CH2	J19CJ4	11/9/09	1000		344	514		1.72	205		43.0	40.7		2.15	35.2		8.59	3.44	U	3.44	2.47		0.20	5.0		2.4

6 **Analysis:**

7		TDL	400	2	50	2.5	1	30	0.75	5
8	Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**
9		Both >5xTDL?	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**		No-Stop (acceptable)	No-Stop (acceptable)
10		RPD		11.7%		17.9%	9.2%			
11		Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

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Attachment 1. 116-D-5 Waste Site Radionuclides Verification Sample Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
SZ-3	J19CC8	11/10/09	0.311	U	0.311	-1.74	UJ	5.59	0.083		0.043	0.045	U	0.045	0.113	U	0.113	0.138	U	0.138	0.146	U	0.146
Duplicate of J19CC8	J19CD8	11/10/09	0.047	U	0.047	-4.24	UJ	5.53	0.062		0.032	0.025	U	0.025	0.073	U	0.073	0.099	U	0.099	0.097	U	0.097
SZ-1	J19CC6	11/10/09	0.080	U	0.08	-1.70	UJ	5.29	0.014	U	0.014	0.015	U	0.015	0.045	U	0.045	0.049	U	0.049	0.058	U	0.058
SZ-2	J19CC7	11/10/09	0.045	U	0.045	-3.36	UJ	6.77	0.033	U	0.033	0.036	U	0.036	0.094	U	0.094	0.126	U	0.126	0.110	U	0.110
SZ-4	J19CC9	11/10/09	0.087	U	0.087	-2.37	UJ	5.46	0.025	U	0.025	0.029	U	0.029	0.064	U	0.064	0.093	U	0.093	0.064	U	0.064
SZ-5	J19CD0	11/10/09	0.044	U	0.044	-0.887	UJ	6.59	1.62		0.033	0.090	U	0.090	1.04		0.071	0.132	U	0.132	0.113	U	0.113
SZ-6	J19CD1	11/10/09	0.038	U	0.038	-3.23	UJ	5.47	0.022	U	0.022	0.023	U	0.023	0.047	U	0.047	0.086	U	0.086	0.063	U	0.063
SZ-7	J19CD2	11/10/09	0.248	U	0.248	-3.97	UJ	5.25	0.027	U	0.027	0.030	U	0.030	0.078	U	0.078	0.109	U	0.109	0.097	U	0.097
SZ-8	J19CD3	11/10/09	0.129	U	0.129	-3.72	UJ	5.21	0.020	U	0.020	0.019	U	0.019	0.051	U	0.051	0.062	U	0.062	0.070	U	0.070
SZ-9	J19CD4	11/10/09	0.079	U	0.079	-2.97	UJ	6.10	0.029		0.017	0.017	U	0.017	0.050	U	0.050	0.058	U	0.058	0.068	U	0.068
SZ-10	J19CD5	11/10/09	0.083	U	0.083	-2.22	UJ	5.65	0.027	U	0.027	0.028	U	0.028	0.067	U	0.067	0.088	U	0.088	0.071	U	0.071
SZ-11	J19CD6	11/10/09	0.148	U	0.148	-1.78	UJ	5.93	0.034		0.027	0.020	U	0.020	0.061	U	0.061	0.074	U	0.074	0.076	U	0.076
SZ-12	J19CD7	11/10/09	0.034	U	0.034	-4.10	UJ	6.28	0.027	U	0.027	0.026	U	0.026	0.066	U	0.066	0.084	U	0.084	0.091	U	0.091
DZ-4 [a]	J1F1J3	3/16/11	0.0175	U	0.242	-0.0261	U	0.468	0.238		0.0552	0.0185	U	0.0641	0.271	U	0.158	0.117	U	0.200	-0.0134	U	0.0997
DZ-4	J19CF2	11/10/09	0.047	U	0.047	-0.128	UJ	6.22	0.434		0.035	0.077		0.029	1.50		0.070	0.108	U	0.108	0.087	U	0.087
Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	-0.0621	U	0.122	-0.172	U	0.468	0.192		0.0276	-0.0056	U	0.0293	0.258	U	0.103	0.0346	U	0.101	0.0032	U	0.0954
Duplicate of J19CF2	J19CH1	11/10/09	0.124	U	0.124	-0.494	UJ	5.99	0.495		0.018	0.077		0.014	1.65		0.035	0.184	U	0.184	0.063	U	0.063
DZ-1	J19CD9	11/10/09	0.146	U	0.146	1.66	UJ	5.76	1.78		0.055	0.044	U	0.044	0.909		0.108	0.152	U	0.152	0.125	U	0.125
DZ-2	J19CF0	11/10/09	0.146	U	0.146	0	UJ	6.57	0.171		0.025	0.021	U	0.021	0.110		0.059	0.072	U	0.072	0.077	U	0.077
DZ-3	J19CF1	11/10/09	0.039	U	0.039	0.980	UJ	5.28	0.236		0.035	0.031	U	0.031	0.329		0.075	0.105	U	0.105	0.068	U	0.068
DZ-5 [a]	J1F1J4	3/16/11	-0.0004	U	0.205	-0.113	U	0.47	1.72		0.0482	0.0005	U	0.0516	0.0536	U	0.123	0.0298	U	0.157	0.0503	U	0.0932
DZ-5	J19CF3	11/10/09	0.074	U	0.074	1.31	UJ	6.05	12.4		0.068	0.096		0.039	4.29		0.144	0.538	U	0.538	0.142	U	0.142
DZ-6 [a]	J1F1J5	3/16/11	0.0206	U	0.161	-0.108	U	0.468	1.33		0.0703	0.0502	U	0.0855	0.353	U	0.228	0.0937	U	0.254	0.0446	U	0.141
DZ-6	J19CF4	11/10/09	0.584	U	0.584	1.14	UJ	6.49	3.37		0.095	0.416		0.059	7.98		0.174	0.679	U	0.679	0.251	U	0.251
DZ-7	J19CF5	11/10/09	0.103	U	0.103	0.931	UJ	5.65	0.019	U	0.019	0.021	U	0.021	0.061	U	0.061	0.066	U	0.066	0.107	U	0.107
DZ-8 [a]	J1F1J6	3/16/11	0.0550	U	0.150	-0.0887	U	0.468	0.886		0.0317	0.0351	U	0.0379	0.788		0.103	0.102	U	0.115	0.0495	U	0.113
DZ-8	J19CF6	11/10/09	0.138	U	0.138	-0.632	UJ	6.14	0.588		0.049	0.120		0.039	1.62		0.100	0.150	U	0.150	0.123	U	0.123
DZ-9	J19CF7	11/10/09	0.183	U	0.183	0.954	UJ	5.79	0.935		0.035	0.026	U	0.026	0.379		0.068	0.087	U	0.087	0.099	U	0.099
DZ-10 [a]	J1F1J7	3/16/11	-0.0508	U	0.171	-0.123	U	0.468	1.1		0.0278	0.0126	U	0.0313	0.455		0.0714	-0.0084	U	0.0935	-0.0087	U	0.0789
DZ-10	J19CF8	11/10/09	0.077	U	0.077	2.64	UJ	6.40	16.4		0.075	0.096	U	0.096	3.56		0.195	0.182	U	0.182	0.186	U	0.186
DZ-11	J19CF9	11/10/09	0.012	U	0.012	0.578	UJ	6.23	0.007	U	0.007	0.007	U	0.007	0.019	U	0.019	0.026	U	0.026	0.027	U	0.027
DZ-12	J19CH0	11/10/09	0.011	U	0.011	2.42	UJ	5.87	0.027		0.006	0.007	U	0.007	0.015	U	0.015	0.024	U	0.024	0.034	U	0.034

[a] Department of Ecology requested additional remediation and re-samples taken at these locations. Original samples are for information only unless that analyte was not re-sampled.

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

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

B = blank contamination (inorganic constituents)

C = analyte detected in sample and QC blank and sample concentration was ≤5 times blank

D = reported from a dilution

HEIS = Hanford Environmental Information System

J = estimate

L = dilution indicating physical and chemical interference are present

M = sample duplicate precision not met

MDA = minimum detection allowed

PQL = practical quantitation limit

Q = qualifier

R = rejected

U = undetected

X = physical and chemical interferences are present

Attachment	1	Sheet No.	1 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	1

Attachment 1. 116-D-5 Waste Site Radionuclides Verification Sample Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Nickel-63			Plutonium-238			Plutonium-239/240			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
SZ-3	J19CC8	11/10/09	-0.098	U	3.23	0.006	U	0.070	0.006	U	0.024	15.7		0.423	0.714		0.076	0.866		0.170	0.841		0.059
Duplicate of J19CC8	J19CD8	11/10/09	1.61	U	3.23	-0.019	U	0.301	0	U	0.142	14.8		0.289	0.568		0.049	0.839		0.116	0.84		0.034
SZ-1	J19CC6	11/10/09	1.50	U	3.09	0.058	U	0.116	0.016	U	0.048	9.92		0.155	0.374		0.023	0.555		0.064	0.547		0.023
SZ-2	J19CC7	11/10/09	1.09	U	3.42	0	U	0.070	0	U	0.038	15.5		0.332	0.599		0.060	1.06		0.152	1.12		0.041
SZ-4	J19CC9	11/10/09	1.08	U	3.09	0.007	U	0.053	0	U	0.035	9.32		0.250	0.387		0.043	0.715		0.106	0.678		0.031
SZ-5	J19CD0	11/10/09	7.49		3.49	-0.003	U	0.036	0.045		0.043	11.7		0.217	0.453		0.055	0.699		0.109	0.68		0.039
SZ-6	J19CD1	11/10/09	-0.105	U	3.48	-0.009	U	0.093	-0.005	U	0.052	15.4		0.235	0.487		0.044	0.784		0.113	0.649		0.026
SZ-7	J19CD2	11/10/09	-0.084	U	2.76	-0.026	U	0.086	0.007	U	0.031	9.74		0.282	0.408		0.049	0.636		0.108	0.547		0.037
SZ-8	J19CD3	11/10/09	-0.591	U	3.25	0.033	U	0.076	-0.007	U	0.040	9.40		0.207	0.379		0.040	0.567		0.077	0.529		0.028
SZ-9	J19CD4	11/10/09	1.96	U	3.42	-0.030	U	0.168	-0.015	U	0.116	12.2		0.152	0.413		0.035	0.669		0.078	0.667		0.026
SZ-10	J19CD5	11/10/09	0.752	U	3.31	-0.017	U	0.166	0.017	U	0.133	9.62		0.246	0.376		0.040	0.612		0.110	0.574		0.031
SZ-11	J19CD6	11/10/09	1.42	U	3.02	0	U	0.159	0	U	0.110	11.6		0.212	0.446		0.032	0.685		0.097	0.648		0.030
SZ-12	J19CD7	11/10/09	0.495	U	2.97	0.055	U	0.201	0	U	0.139	10.3		0.212	0.402		0.045	0.611		0.107	0.648		0.031
DZ-4 [a]	J1F1J3	3/16/11	5.72	U	13.3	-0.0041	U	0.171	0.0368	U	0.171												
DZ-4	J19CF2	11/10/09	4.98		3.29	-0.010	U	0.082	0.019	U	0.046	12.3		0.245	0.459		0.060	0.766		0.130	0.712		0.040
Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	2.32	U	11.8	-0.0025	U	0.188	0.0502	U	0.188												
Duplicate of J19CF2	J19CH1	11/10/09	4.20		3.17	-0.050	U	0.154	0	U	0.095	12.3		0.116	0.479		0.029	0.709		0.063	0.693		0.02
DZ-1	J19CD9	11/10/09	0.317	U	3.14	0	U	0.239	0.031	U	0.239	16.2		0.369	0.582		0.084	0.987		0.177	1.16		0.058
DZ-2	J19CF0	11/10/09	-0.458	U	3.18	0	U	0.088	0	U	0.052	10.9		0.227	0.410		0.045	0.663		0.097	0.609		0.031
DZ-3	J19CF1	11/10/09	0.806	U	3.50	-0.007	U	0.045	0	U	0.045	11.5		0.292	0.458		0.049	0.745		0.143	0.726		0.038
DZ-5 [a]	J1F1J4	3/16/11	5.44	U	11.9	-0.0018	U	0.137	-0.0018	U	0.137												
DZ-5	J19CF3	11/10/09	0.597	U	3.76	0.013	U	0.065	0.220		0.060	16.9		0.378	0.655		0.110	0.902		0.206	0.927		0.072
DZ-6 [a]	J1F1J5	3/16/11	4.61	U	13.3	-0.0049	U	0.146	0.0291	U	0.136												
DZ-6	J19CF4	11/10/09	38.6		3.21	0.017	U	0.075	0.131		0.041	12.7		0.36	0.415		0.140	0.728		0.292	0.726		0.096
DZ-7	J19CF5	11/10/09	-1.78	U	3.34	0.016	U	0.090	-0.011	U	0.051	13.2		0.200	0.510		0.040	0.917		0.078	0.884		0.032
DZ-8 [a]	J1F1J6	3/16/11	0.864	U	13.4	0	U	0.141	0	U	0.141												
DZ-8	J19CF6	11/10/09	2.28	U	3.04	0.013	U	0.113	0.021	U	0.047	14.3		0.325	0.478		0.087	0.780		0.192	0.774		0.053
DZ-9	J19CF7	11/10/09	0.044	U	3.06	0.016	U	0.082	0.016	U	0.044	12.9		0.267	0.518		0.052	0.818		0.110	0.756		0.040
DZ-10 [a]	J1F1J7	3/16/11	-0.826	U	11.9	0	U	0.202	0.0484	U	0.225												
DZ-10	J19CF8	11/10/09	3.35		3.14	0	U	0.174	0.114	U	0.174	21.1		0.461	0.744		0.117	1.33		0.208	1.33		0.079
DZ-11	J19CF9	11/10/09	0.337	U	3.34	-0.024	U	0.271	0	U	0.187	10.1		0.071	0.387		0.014	0.566		0.031	0.571		0.010
DZ-12	J19CH0	11/10/09	0.046	U	3.17	0	U	0.218	0	U	0.174	11.2		0.071	0.408		0.013	0.682		0.024	0.587		0.008

Attachment	1	Sheet No.	2 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	1

Attachment 1. 116-D-5 Waste Site Radionuclides Verification Sample Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Thorium-232 GEA			Strontium-90			Tritium			Uranium-233/234			Uranium-235			Uranium-235 GEA			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
SZ-3	J19CC8	11/10/09	0.866		0.170	-0.062	U	0.304				0.559		0.171	0.054	U	0.207	0.337	U	0.337	0.514		0.171
Duplicate	J19CD8	11/10/09	0.839		0.116	0.040	U	0.319				0.487		0.177	0.168	U	0.215	0.201	U	0.201	0.579		0.177
SZ-1	J19CC6	11/10/09	0.555		0.064	-0.017	U	0.290				0.661	J	0.187	0	U	0.227	0.116	U	0.116	0.734	J	0.187
SZ-2	J19CC7	11/10/09	1.06		0.152	0.138	U	0.292				0.674		0.166	0.053	U	0.201	0.184	U	0.184	0.434		0.166
SZ-4	J19CC9	11/10/09	0.715		0.106	-0.132	U	0.290				0.539		0.229	0.036	U	0.277	0.136	U	0.136	0.419		0.229
SZ-5	J19CD0	11/10/09	0.699		0.109	0.081	U	0.304				0.534		0.255	0.081	U	0.309	0.177	U	0.177	0.501		0.255
SZ-6	J19CD1	11/10/09	0.784		0.113	-0.090	U	0.291				0.477		0.152	0.072	U	0.184	0.136	U	0.136	0.338		0.152
SZ-7	J19CD2	11/10/09	0.636		0.108	-0.052	U	0.318				0.270		0.188	0	U	0.228	0.174	U	0.174	0.393		0.188
SZ-8	J19CD3	11/10/09	0.567		0.077	-0.029	U	0.353				0.794		0.156	0.025	U	0.188	0.128	U	0.128	0.570		0.156
SZ-9	J19CD4	11/10/09	0.669		0.078	0.032	U	0.306				0.650		0.166	0.052	U	0.201	0.123	U	0.123	0.953		0.166
SZ-10	J19CD5	11/10/09	0.612		0.110	-0.099	U	0.294				0.542		0.166	0.053	U	0.201	0.144	U	0.144	0.347		0.166
SZ-11	J19CD6	11/10/09	0.685		0.097	0.084	U	0.317				0.667		0.176	0.056	U	0.213	0.144	U	0.144	0.575		0.176
SZ-12	J19CD7	11/10/09	0.611		0.107	-0.027	U	0.299				0.664		0.175	0.083	U	0.212	0.138	U	0.138	0.779		0.175
DZ-4 [a]	J1F1J3	3/16/11				0.134	U	0.193	0.0031	U	0.0246	0.182		0.169	-0.0113	U	0.146				0.199		0.187
DZ-4	J19CF2	11/10/09	0.766		0.130	0.038	U	0.307	-4.32	UJ	8.10	0.572		0.175	0.028	U	0.212	0.188	U	0.188	0.617		0.175
Duplicate of J1F1J3 [a]	J1F1J8	3/16/11				0.159	U	0.199	0.0159	U	0.0249	0.174		0.151	-0.00183	U	0.117				0.204		0.154
Duplicate of J19CF2	J19CH1	11/10/09	0.709		0.063	-0.124	U	0.344	-3.63	UJ	8.02	0.524		0.174	0.055	U	0.211	0.086	U	0.086	0.547		0.174
DZ-1	J19CD9	11/10/09	0.987		0.177	0.093	U	0.239	-2.34	UJ	8.02	0.528		0.168	0.053	U	0.204	0.234	U	0.234	0.418		0.168
DZ-2	J19CF0	11/10/09	0.663		0.097	0.006	U	0.315	2.11	UJ	8.70	0.756		0.242	0.061	U	0.234	0.142	U	0.142	0.883		0.193
DZ-3	J19CF1	11/10/09	0.745		0.143	0.130	U	0.316	-1.95	UJ	7.09	0.603		0.178	0.140	U	0.215	0.166	U	0.166	0.719		0.178
DZ-5 [a]	J1F1J4	3/16/11				0.280		0.205	0.0017	U	0.0177	0.186	U	0.195	-0.00590	U	0.141				0.252		0.172
DZ-5	J19CF3	11/10/09	0.902		0.206	0.231		0.211	-3.88	UJ	8.28	0.562		0.172	0.054	U	0.208	0.309	U	0.309	0.562		0.172
DZ-6 [a]	J1F1J5	3/16/11				0.0783	U	0.189	0.0086	U	0.0289	0.145		0.0880	0.0200	U	0.0790				0.186		0.095
DZ-6	J19CF4	11/10/09	0.728		0.292	0.087	U	0.383	-0.276	UJ	8.52	0.395		0.159	0	U	0.192	0.400	U	0.400	0.416		0.159
DZ-7	J19CF5	11/10/09	0.917		0.078	0.092	U	0.326	4.02	UJ	7.54	0.545		0.139	0.044	U	0.168	0.153	U	0.153	0.454		0.139
DZ-8 [a]	J1F1J6	3/16/11				0.154	U	0.229	0.0007	U	0.0319	0.156		0.0838	-0.00112	U	0.0838				0.177		0.0934
DZ-8	J19CF6	11/10/09	0.780		0.192	0.126	U	0.211	-0.673	UJ	6.84	0.515		0.303	0.048	U	0.367	0.216	U	0.216	0.515		0.303
DZ-9	J19CF7	11/10/09	0.818		0.110	0.044	U	0.322	-3.79	UJ	7.81	0.669		0.213	0	U	0.258	0.179	U	0.179	0.752		0.213
DZ-10 [a]	J1F1J7	3/16/11				0.0200	U	0.224	0.0222	U	0.0348	0.328		0.123	-0.00167	U	0.107				0.219		0.111
DZ-10	J19CF8	11/10/09	1.33		0.208	0.365		0.205	3.57	UJ	8.50	0.562		0.166	0.052	U	0.200	0.340	U	0.340	0.346		0.166
DZ-11	J19CF9	11/10/09	0.566		0.031	0.061	U	0.330	2.79	UJ	8.21	0.376		0.169	0	U	0.205	0.061	U	0.061	0.508		0.169
DZ-12	J19CH0	11/10/09	0.682		0.024	0.003	U	0.324	2.01	UJ	7.77	0.627		0.229	0.108	U	0.277	0.061	U	0.061	0.657		0.229

Attachment	1	Sheet No.	3 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	1

Attachment 1. 116-D-5 Waste Site Radionuclides Verification Sample Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Uranium-238 GEA		
			pCi/g	Q	MDA
SZ-3	J19CC8	11/10/09	5.04	U	5.04
Duplicate of J19CC8	J19CD8	11/10/09	3.05	U	3.05
SZ-1	J19CC6	11/10/09	1.85	U	1.85
SZ-2	J19CC7	11/10/09	4.05	U	4.05
SZ-4	J19CC9	11/10/09	3.05	U	3.05
SZ-5	J19CD0	11/10/09	3.03	U	3.03
SZ-6	J19CD1	11/10/09	2.84	U	2.84
SZ-7	J19CD2	11/10/09	3.67	U	3.67
SZ-8	J19CD3	11/10/09	2.40	U	2.40
SZ-9	J19CD4	11/10/09	1.86	U	1.86
SZ-10	J19CD5	11/10/09	3.43	U	3.43
SZ-11	J19CD6	11/10/09	2.53	U	2.53
SZ-12	J19CD7	11/10/09	3.25	U	3.25
DZ-4 [a]	J1F1J3	3/16/11			
DZ-4	J19CF2	11/10/09	3.63	U	3.63
Duplicate of J1F1J3 [a]	J1F1J8	3/16/11			
Duplicate of J19CF2	J19CH1	11/10/09	1.81	U	1.81
DZ-1	J19CD9	11/10/09	5.59	U	5.59
DZ-2	J19CF0	11/10/09	2.43	U	2.43
DZ-3	J19CF1	11/10/09	3.83	U	3.83
DZ-5 [a]	J1F1J4	3/16/11			
DZ-5	J19CF3	11/10/09	5.58	U	5.58
DZ-6 [a]	J1F1J5	3/16/11			
DZ-6	J19CF4	11/10/09	8.64	U	8.64
DZ-7	J19CF5	11/10/09	2.32	U	2.32
DZ-8 [a]	J1F1J6	3/16/11			
DZ-8	J19CF6	11/10/09	6.22	U	6.22
DZ-9	J19CF7	11/10/09	3.15	U	3.15
DZ-10 [a]	J1F1J7	3/16/11			
DZ-10	J19CF8	11/10/09	7.05	U	7.05
DZ-11	J19CF9	11/10/09	0.842	U	0.842
DZ-12	J19CH0	11/10/09	2.89	U	2.89

Attachment	1	Sheet No.	4 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	1

Attachment 1. 116-D-5 Waste Site Radionuclides Verification Sample Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
SPA-1	J19CH2	11/9/09	0.034	U	0.034	-2.42	U	5.86	0.020	U	0.020	0.024	U	0.024	0.048	U	0.048	0.078	U	0.078	0.058	U	0.058
Duplicate of J19CH2	J19CJ4	11/9/09	0.084	U	0.084	-4.70	U	6.79	0.012	U	0.012	0.012	U	0.012	0.033	U	0.033	0.042	U	0.042	0.046	U	0.046
SPA-2	J19CH3	11/9/09	0.261	U	0.261	-2.01	U	5.82	0.033	U	0.033	0.03	U	0.03	0.086	U	0.086	0.110	U	0.110	0.100	U	0.100
SPA-3	J19CH4	11/9/09	0.097	U	0.097	-2.43	U	5.88	0.019	U	0.019	0.017	U	0.017	0.055	U	0.055	0.061	U	0.061	0.087	U	0.087
SPA-4	J19CH5	11/9/09	0.041	U	0.041	-4.40	U	6.64	0.023	U	0.023	0.026	U	0.026	0.062	U	0.062	0.083	U	0.083	0.064	U	0.064
SPA-5	J19CH6	11/9/09	0.035	U	0.035	-2.67	U	5.90	0.022	U	0.022	0.022	U	0.022	0.052	U	0.052	0.076	U	0.076	0.060	U	0.060
SPA-6	J19CH7	11/9/09	0.238	U	0.238	-2.75	U	5.73	0.033	U	0.033	0.030	U	0.030	0.092	U	0.092	0.109	U	0.109	0.107	U	0.107
SPA-7	J19CH8	11/9/09	0.089	U	0.089	-2.83	U	5.66	0.016	U	0.016	0.016	U	0.016	0.052	U	0.052	0.053	U	0.053	0.068	U	0.068
SPA-8	J19CH9	11/9/09	0.088	U	0.088	-2.48	U	6.14	0.026	U	0.026	0.027	U	0.027	0.066	U	0.066	0.097	U	0.097	0.067	U	0.067
SPA-9	J19CJ0	11/9/09	0.136	U	0.136	-3.90	U	6.64	0.021	U	0.021	0.020	U	0.020	0.054	U	0.054	0.064	U	0.064	0.071	U	0.071
SPA-10	J19CJ1	11/9/09	0.031	U	0.031	-2.70	U	5.74	0.024	U	0.024	0.025	U	0.025	0.061	U	0.061	0.086	U	0.086	0.059	U	0.059
SPA-11	J19CJ2	11/9/09	0.039	U	0.039	-2.02	U	5.84	0.022	U	0.022	0.024	U	0.024	0.057	U	0.057	0.079	U	0.079	0.063	U	0.063
SPA-12	J19CJ3	11/9/09	0.035	U	0.035	-2.86	U	6.33	0.031	U	0.031	0.022	U	0.022	0.055	U	0.055	0.076	U	0.076			
OB-1	J19CB4	11/3/09	0.029	U	0.029	0.177	U	2.92	0.018	U	0.018	0.020	U	0.020	0.046	U	0.046	0.066	U	0.066	0.079	U	0.079
OB-2	J19CB5	11/3/09	0.090	U	0.090	0.771	U	3.04	0.017	U	0.017	0.017	U	0.017	0.047	U	0.047	0.062	U	0.062	0.066	U	0.066
OB-3	J19CB6	11/3/09	0.039	U	0.039	-0.952	U	2.93	0.021	U	0.021	0.024	U	0.024	0.058	U	0.058	0.075	U	0.075	0.061	U	0.061
OB-4	J19CB7	11/3/09	0.100	U	0.100	-0.784	U	3.22	0.158		0.036	0.033	U	0.033	0.081		0.078	0.117	U	0.117	0.088	U	0.088
OB-5	J19CB8	11/3/09	0.036	U	0.036	-0.639	U	3.32	0.098		0.025	0.028	U	0.028	0.087		0.065	0.087	U	0.087	0.061	U	0.061
OB-6	J19CB9	11/3/09	0.147	U	0.147	-1.51	U	2.93	0.073		0.025	0.023	U	0.023	0.062	U	0.062	0.076	U	0.076	0.079	U	0.079
OB-7	J19CC0	11/3/09	0.030	U	0.030	0.093	U	3.06	0.081		0.023	0.020	U	0.020	0.065		0.044	0.072	U	0.072	0.091	U	0.091
OB-8	J19CC1	11/3/09	0.087	U	0.087	0.278	U	3.04	0.137		0.015	0.017	U	0.017	0.100		0.045	0.061	U	0.061	0.069	U	0.069
OB-9	J19CC2	11/3/09	0.094	U	0.094	0.430	U	3.03	0.058		0.032	0.032	U	0.032	0.083	U	0.083	0.112	U	0.112	0.085	U	0.085
OB-10	J19CC3	11/3/09	0.043	U	0.043	0.705	U	3.02	0.190		0.028	0.027	U	0.027	0.141		0.063	0.080	U	0.080	0.066	U	0.066
OB-11	J19CC4	11/3/09	0.035	U	0.035	-1.67	U	3.11	0.028	U	0.028	0.026	U	0.026	0.105		0.060	0.089	U	0.089	0.097	U	0.097
OB-12	J19CC5	11/3/09	0.163	U	0.163	-0.677	U	3.18	0.021	U	0.023	0.024	U	0.024	0.065	U	0.065	0.082	U	0.082	0.085	U	0.085

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Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
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Attachment 1. 116-D-5 Waste Site Radionuclides Verification Sample Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Nickel-63			Plutonium-238			Plutonium-239/240			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
SPA-1	J19CH2	11/9/09	0.769	U	2.58	-0.062	U	0.381	0.031	U	0.237	14.9		0.248	0.508		0.045	0.812		0.085	0.669		0.026
Duplicate of J19CH2	J19CJ4	11/9/09	1.25	U	2.49	0	U	0.255	-0.033	U	0.255	14.1		0.142	0.506		0.024	0.688		0.057	0.716		0.017
SPA-2	J19CH3	11/9/09	0.88	U	2.44	0.053	U	0.290	0	U	0.201	12.4		0.355	0.510		0.066	0.765		0.132	0.671		0.038
SPA-3	J19CH4	11/9/09	1.45	U	2.37	0	U	0.238	0	U	0.190	13.5		0.185	0.547		0.033	0.698		0.075	0.715		0.030
SPA-4	J19CH5	11/9/09	1.46	U	2.45	0	U	0.184	0	U	0.183	11.7		0.228	0.482		0.041	0.621		0.104	0.667		0.033
SPA-5	J19CH6	11/9/09	1.45	U	2.71	0	U	0.190	0	U	0.190	12.9		0.204	0.464		0.041	0.687		0.087	0.624		0.027
SPA-6	J19CH7	11/9/09	1.09	U	2.68	0.061	U	0.235	0	U	0.235	11.9		0.367	0.534		0.070	0.799		0.143	0.774		0.048
SPA-7	J19CH8	11/9/09	0.441	U	2.56	0.106	U	0.292	0	U	0.202	11.3		0.138	0.443		0.035	0.673		0.069	0.680		0.027
SPA-8	J19CH9	11/9/09	0.785	U	2.64	-0.035	U	0.337	0.035	U	0.269	10.7		0.225	0.476		0.052	0.699		0.121	0.694		0.034
SPA-9	J19CJ0	11/9/09	1.57	U	2.71	0	U	0.349	-0.046	U	0.349	11.0		0.207	0.420		0.039	0.758		0.078	0.647		0.028
SPA-10	J19CJ1	11/9/09	1.10	U	2.71	0.037	U	0.285	0	U	0.285	9.86		0.233	0.383		0.044	0.597		0.085	0.570		0.030
SPA-11	J19CJ2	11/9/09	0.777	U	2.48	0.045	U	0.341	0.044	U	0.340	10.8		0.201	0.450		0.045	0.666		0.099	0.681		0.031
SPA-12	J19CJ3	11/9/09	1.45	U	2.57	0.037	U	0.280	0.037	U	0.280	12.9		0.198	0.474		0.042	0.679		0.094	0.698		0.028
OB-1	J19CB4	11/3/09	3.42		2.61	0.025	U	0.080	0.016	U	0.047	10.6		0.201	0.385		0.036	0.620		0.095	0.527		0.023
OB-2	J19CB5	11/3/09	1.15	U	2.39	0.023	U	0.077	-0.005	U	0.056	10.5		0.123	0.402		0.038	0.604		0.080	0.568		0.027
OB-3	J19CB6	11/3/09	2.33	U	2.41	0.014	U	0.083	0	U	0.073	10.7		0.186	0.439		0.041	0.640		0.099	0.633		0.031
OB-4	J19CB7	11/3/09	2.21	U	2.36	0.004	U	0.087	0.017	U	0.032	10.5		0.230	0.450		0.063	0.760		0.138	0.661		0.050
OB-5	J19CB8	11/3/09	2.39		2.36	-0.024	U	0.074	0.012	U	0.044	10.0		0.254	0.464		0.048	0.726		0.098	0.625		0.034
OB-6	J19CB9	11/3/09	2.19	U	2.43	-0.018	U	0.067	0.007	U	0.028	10.6		0.216	0.441		0.044	0.663		0.088	0.605		0.030
OB-7	J19CC0	11/3/09	2.55		2.44	0.042	U	0.260	-0.021	U	0.161	11.3		0.216	0.458		0.036	0.680		0.094	0.586		0.024
OB-8	J19CC1	11/3/09	2.13	U	2.48	0	U	0.195	0	U	0.156	10.7		0.124	0.392		0.04	0.638		0.066	0.578		0.028
OB-9	J19CC2	11/3/09	0.710	U	2.40	-0.055	U	0.246	0.037	U	0.140	9.68		0.265	0.387		0.059	0.628		0.116	0.612		0.055
OB-10	J19CC3	11/3/09	2.78		2.44	0.072	U	0.222	0	U	0.138	12.5		0.193	0.441		0.047	0.757		0.125	0.688		0.032
OB-11	J19CC4	11/3/09	1.82	U	2.48	0.033	U	0.256	-0.033	U	0.256	9.20		0.209	0.322		0.051	0.548		0.110	0.527		0.035
OB-12	J19CC5	11/3/09	1.73	U	2.64	0	U	0.289	-0.038	U	0.289	11.4		0.275	0.441		0.045	0.689		0.092	0.665		0.033

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Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
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Attachment 1. 116-D-5 Waste Site Radionuclides Verification Sample Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Thorium-232 GEA			Strontium-90			Tritium			Uranium-233/234			Uranium-235			Uranium-235 GEA			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
SPA-1	J19CH2	11/9/09	0.812		0.085	-0.029	U	0.280				0.468		0.115	0.073	U	0.140	0.142	U	0.142	0.362		0.115
Duplicate of J19CH2	J19CJ4	11/9/09	0.688		0.057	0.050	U	0.254				0.422		0.216	0.034	U	0.261	0.098	U	0.098	0.338		0.216
SPA-2	J19CH3	11/9/09	0.765		0.132	-0.067	U	0.269				0.343		0.181	0.079	U	0.151	0.201	U	0.201	0.637		0.125
SPA-3	J19CH4	11/9/09	0.698		0.075	0.025	U	0.312				0.496		0.157	0.034	U	0.131	0.140	U	0.140	0.368		0.108
SPA-4	J19CH5	11/9/09	0.621		0.104	-0.020	U	0.332				0.531		0.081	0.026	U	0.098	0.155	U	0.155	0.553		0.081
SPA-5	J19CH6	11/9/09	0.687		0.087	0.057	U	0.324				0.479		0.110	0.072	U	0.092	0.130	U	0.130	0.599		0.076
SPA-6	J19CH7	11/9/09	0.799		0.143	0.031	U	0.261				0.414		0.113	0.043	U	0.110	0.218	U	0.218	0.568		0.090
SPA-7	J19CH8	11/9/09	0.673		0.069	0.077	U	0.283				0.625		0.100	0.047	U	0.121	0.130	U	0.130	0.534		0.100
SPA-8	J19CH9	11/9/09	0.699		0.121	0.002	U	0.128				0.729		0.112	0.014	U	0.109	0.142	U	0.142	0.517		0.09
SPA-9	J19CJ0	11/9/09	0.758		0.078	-0.028	U	0.233				0.742		0.284	0.045	U	0.344	0.133	U	0.133	0.742		0.284
SPA-10	J19CJ1	11/9/09	0.597		0.085	0.069	U	0.350				0.586		0.224	0.036	U	0.272	0.133	U	0.133	0.674		0.224
SPA-11	J19CJ2	11/9/09	0.666		0.099	-0.097	U	0.255				0.464		0.177	0.112	U	0.215	0.154	U	0.154	0.440		0.177
SPA-12	J19CJ3	11/9/09	0.679		0.094	0.018	U	0.227				0.392		0.187	0.059	U	0.227	0.133	U	0.133	0.343		0.187
OB-1	J19CB4	11/3/09	0.620		0.095	-0.002	U	0.260				0.509		0.260	0.041	U	0.314	0.101	U	0.101	0.475		0.260
OB-2	J19CB5	11/3/09	0.604		0.080	0.051	U	0.287				0.477		0.244	0	U	0.295	0.129	U	0.129	0.636		0.244
OB-3	J19CB6	11/3/09	0.640		0.099	0.035	U	0.298				0.507		0.259	0	U	0.313	0.138	U	0.138	0.778		0.259
OB-4	J19CB7	11/3/09	0.760		0.138	-0.031	U	0.248				0.555		0.118	0.037	U	0.143	0.164	U	0.164	0.478		0.118
OB-5	J19CB8	11/3/09	0.726		0.098	0.080	U	0.309				0.478		0.158	0.060	U	0.153	0.154	U	0.154	0.627		0.126
OB-6	J19CB9	11/3/09	0.663		0.088	0.040	U	0.375				0.644		0.170	0.054	U	0.206	0.146	U	0.146	0.689		0.170
OB-7	J19CC0	11/3/09	0.680		0.094	0.022	U	0.302				0.651		0.147	0.070	U	0.177	0.115	U	0.115	0.517		0.147
OB-8	J19CC1	11/3/09	0.638		0.066	-0.006	U	0.283				0.514		0.179	0.085	U	0.216	0.141	U	0.141	0.677		0.179
OB-9	J19CC2	11/3/09	0.628		0.116	-0.018	U	0.314				0.618		0.296	0.047	U	0.358	0.165	U	0.165	0.618		0.296
OB-10	J19CC3	11/3/09	0.757		0.125	0.013	U	0.301				0.686		0.291	0	U	0.353	0.148	U	0.148	0.762		0.291
OB-11	J19CC4	11/3/09	0.548		0.110	-0.066	U	0.311				0.607		0.332	0.052	U	0.401	0.150	U	0.150	0.520		0.332
OB-12	J19CC5	11/3/09	0.689		0.092	-0.027	U	0.293				0.273	U	0.299	0.047	U	0.362	0.159	U	0.159	0.898		0.299

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Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	1

Attachment 1. 116-D-5 Waste Site Radionuclides Verification Sample Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Uranium-238 GEA		
			pCi/g	Q	MDA
SPA-1	J19CH2	11/9/09	2.82	U	2.82
Duplicate of J19CH2	J19CJ4	11/9/09	2.13	U	2.13
SPA-2	J19CH3	11/9/09	4.30	U	4.30
SPA-3	J19CH4	11/9/09	2.20	U	2.20
SPA-4	J19CH5	11/9/09	2.98	U	2.98
SPA-5	J19CH6	11/9/09	2.58	U	2.58
SPA-6	J19CH7	11/9/09	4.26	U	4.26
SPA-7	J19CH8	11/9/09	2.91	U	2.91
SPA-8	J19CH9	11/9/09	3.18	U	3.18
SPA-9	J19CJ0	11/9/09	2.45	U	2.45
SPA-10	J19CJ1	11/9/09	2.94	U	2.94
SPA-11	J19CJ2	11/9/09	2.86	U	2.86
SPA-12	J19CJ3	11/9/09			
OB-1	J19CB4	11/3/09	2.44	U	2.44
OB-2	J19CB5	11/3/09	1.96	U	1.96
OB-3	J19CB6	11/3/09	4.04	U	4.04
OB-4	J19CB7	11/3/09	3.89	U	3.89
OB-5	J19CB8	11/3/09	3.30	U	3.30
OB-6	J19CB9	11/3/09	2.72	U	2.72
OB-7	J19CC0	11/3/09	2.41	U	2.41
OB-8	J19CC1	11/3/09	2.08	U	2.08
OB-9	J19CC2	11/3/09	3.42	U	3.42
OB-10	J19CC3	11/3/09	2.95	U	2.95
OB-11	J19CC4	11/3/09	3.45	U	3.45
OB-12	J19CC5	11/3/09	2.81	U	2.81

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Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	1

Attachment 1. 116-D-5 Waste Site Metals Verification Sampling Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-3	J19CC8	11/10/2009	6210		3.44	0.413	UJ	0.413	2.93		0.688	62.3		0.344	0.178		0.138	1.12	B	1.38	0.0728	B	0.138
Duplicate of J19CC8	J19CD8	11/10/2009	6570		3.53	0.423	UJ	0.423	3.19		0.706	64.3		0.353	0.172		0.141	0.949	B	1.41	0.0750	B	0.141
SZ-1	J19CC6	11/10/2009	4820		3.76	0.451	UJ	0.451	2.14		0.751	44.4		0.376	0.147	B	0.150	0.400	B	1.50	0.0474	B	0.150
SZ-2	J19CC7	11/10/2009	10300		4.42	0.530	UJ	0.530	4.63		0.884	69.5		0.442	0.332		0.177	0.897	B	1.77	0.0658	B	0.177
SZ-4	J19CC9	11/10/2009	6280		4.43	0.531	UJ	0.531	2.37		0.885	66.6		0.443	0.213		0.177	1.17	B	1.77	0.0702	B	0.177
SZ-5	J19CD0	11/10/2009	5600		3.23	0.388	UJ	0.388	1.99		0.646	57.9		0.323	0.171		0.129	0.705	B	1.29	0.0878	B	0.129
SZ-6	J19CD1	11/10/2009	6260		3.63	0.436	UJ	0.436	2.82		0.727	60.6		0.363	0.156		0.145	0.764	B	1.45	0.0562	B	0.145
SZ-7	J19CD2	11/10/2009	5080		3.77	0.452	UJ	0.452	1.72		0.753	57.2		0.377	0.169		0.151	0.701	B	1.51	0.0423	B	0.151
SZ-8	J19CD3	11/10/2009	5110		3.46	0.416	UJ	0.416	1.61		0.693	57.6		0.346	0.156		0.139	0.445	B	1.39	0.0370	B	0.139
SZ-9	J19CD4	11/10/2009	6400		4.16	0.500	UJ	0.500	2.49		0.833	56.4		0.416	0.195		0.167	0.692	B	1.67	0.0528	B	0.167
SZ-10	J19CD5	11/10/2009	5090		4.02	0.482	UJ	0.482	1.96		0.804	53.5		0.402	0.155	B	0.161	0.675	B	1.61	0.0589	B	0.161
SZ-11	J19CD6	11/10/2009	6230		3.55	0.426	UJ	0.426	2.26		0.710	62.7		0.355	0.188		0.142	1.98		1.42	0.0686	B	0.142
SZ-12	J19CD7	11/10/2009	5970		3.56	0.427	UJ	0.427	2.11		0.712	64.6		0.356	0.186		0.142	1.10	B	1.42	0.0506	B	0.142
DZ-4 [a]	J1F1J3	3/16/11	5930	X	1.4	0.34	U	0.34	2.1		0.60	51.1	X	0.069	0.10	B	0.030	0.89	B	0.89	0.071	B	0.037
DZ-4	J19CF2	11/10/2009	6110		3.58	0.449	J	0.430	2.31		0.717	63.5		0.358	0.211		0.143	0.821	B	1.43	0.0851	B	0.143
Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	7080	X	1.6	0.39	U	0.39	2.3		0.67	57.0	X	0.077	0.12	B	0.033	0.99	U	0.99	0.076	B	0.042
Duplicate of J19CF2	J19CH1	11/10/2009	6620		3.68	0.442	UJ	0.442	2.77		0.736	69.6		0.368	0.227		0.147	0.994	B	1.47	0.0716	B	0.147
DZ-1	J19CD9	11/10/2009	11900		3.73	0.438	BJ	0.448	4.51		0.747	88.0		0.373	0.396		0.149	1.02	B	1.49	0.109	B	0.149
DZ-2	J19CF0	11/10/2009	5510		3.44	0.393	BJ	0.413	2.2		0.688	53.7		0.344	0.180		0.138	0.637	B	1.38	0.0529	B	0.138
DZ-3	J19CF1	11/10/2009	6130		3.91	0.328	BJ	0.470	2.16		0.783	56.8		0.391	0.209		0.157	0.509	B	1.57	0.0711	B	0.157
DZ-5 [a]	J1F1J4	3/16/11	5870	X	1.6	0.38	U	0.38	1.6		0.67	70.5	X	0.077	0.054	B	0.033	0.99	U	0.99	0.060	B	0.041
DZ-5	J19CF3	11/10/2009	7740		3.84	0.293	BJ	0.461	2.96		0.768	71.6		0.384	0.249		0.154	0.409	B	1.54	0.615		0.154
DZ-6 [a]	J1F1J5	3/16/11	6760	X	1.5	0.37	U	0.37	3.2		0.64	72.2	X	0.074	0.12	B	0.032	1.1	B	0.95	0.10	B	0.040
DZ-6	J19CF4	11/10/2009	7420		3.69	0.296	BJ	0.443	3.28		0.738	82.2		0.369	0.247		0.148	0.824	B	1.48	0.352		0.148
DZ-7	J19CF5	11/10/2009	7730		4.14	0.251	BJ	0.497	3.48		0.828	66.3		0.414	0.256		0.166	1.26	B	1.66	0.0755	B	0.166
DZ-8 [a]	J1F1J6	3/16/11	6960	X	1.5	0.37	U	0.37	2.5		0.64	69.4	X	0.073	0.13	B	0.032	0.94	U	0.94	0.082	B	0.039
DZ-8	J19CF6	11/10/2009	9090		4.79	0.575	UJ	0.575	3.66		0.958	80.3		0.479	0.296		0.192	1.68	B	1.92	0.0995	B	0.192
DZ-9	J19CF7	11/10/2009	6850		3.82	0.458	UJ	0.458	2.25		0.764	81.1		0.382	0.238		0.153	1.53	U	1.53	0.0936	B	0.153
DZ-10 [a]	J1F1J7	3/16/11	6820	X	1.6	0.38	U	0.38	2.5		0.67	68.2	X	0.077	0.11	B	0.033	0.99	B	0.99	0.096	B	0.041
DZ-10	J19CF8	11/10/2009	14600		4.89	0.378	BJ	0.587	6.12		0.978	117		0.489	0.486		0.196	0.902	B	1.96	0.327		0.196
DZ-11	J19CF9	11/10/2009	4540		4.20	0.252	BJ	0.504	1.94		0.840	55.9		0.420	0.169		0.168	0.568	B	1.68	0.0523	B	0.168
DZ-12	J19CH0	11/10/2009	5460		4.19	0.502	UJ	0.502	2.84		0.837	54.6		0.419	0.185		0.167	0.649	B	1.67	0.0473	B	0.167

[a] Department of Ecology requested additional remediation and re-samples taken at these locations. Original samples are for information only.

Attachment	1	Sheet No.	9 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Metals Verification Sampling Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-3	J19CC8	11/10/2009	7520		68.8	11.1	J	0.138	6.22		1.38	15.2		0.688	0.17	B	0.21	16900		13.8	3.10		0.344
Duplicate of J19CC8	J19CD8	11/10/2009	8460		70.6	12.8	J	0.141	5.82		1.41	12.2		0.706	0.18	B	0.20	15600		14.1	2.81		0.353
SZ-1	J19CC6	11/10/2009	6080		75.1	6.66	J	0.150	9.01		1.50	15.5		0.751	0.19	B	0.20	26500		15.0	1.99		0.376
SZ-2	J19CC7	11/10/2009	11000		88.4	20.3	J	0.177	10.2		1.77	23.7		0.884	0.15	B	0.22	24800		17.7	7.44		0.442
SZ-4	J19CC9	11/10/2009	7780		88.5	8.01	J	0.177	8.60		1.77	15.5		0.885	0.12	B	0.21	22600		17.7	2.76		0.443
SZ-5	J19CD0	11/10/2009	5980		64.6	9.63	J	0.129	8.11		1.29	14.7		0.646	0.17	B	0.21	21000		12.9	2.37		0.323
SZ-6	J19CD1	11/10/2009	7140		72.7	10.2	J	0.145	5.92		1.45	12.1		0.727	0.18	B	0.20	16300		14.5	2.33		0.363
SZ-7	J19CD2	11/10/2009	6070		75.3	5.53	J	0.151	8.97		1.51	14.4		0.753	0.19	B	0.20	24500		15.1	1.60		0.377
SZ-8	J19CD3	11/10/2009	5620		69.3	6.32	J	0.139	9.14		1.39	14.1		0.693	0.20	B	0.21	23800		13.9	1.38		0.346
SZ-9	J19CD4	11/10/2009	6740		83.3	9.87	J	0.167	8.34		1.67	16.4		0.833	0.18	B	0.21	21600		16.7	2.97		0.416
SZ-10	J19CD5	11/10/2009	6590		80.4	6.11	J	0.161	8.71		1.61	15.4		0.804	0.11	B	0.21	22300		16.1	3.44		0.402
SZ-11	J19CD6	11/10/2009	5910		71.0	7.66	J	0.142	7.64		1.42	14.9		0.710	0.17	B	0.20	20400		14.2	3.22		0.355
SZ-12	J19CD7	11/10/2009	5310		71.2	7.03	J	0.142	8.49		1.42	14.5		0.712	0.20	B	0.20	22200		14.2	2.74		0.356
DZ-4 [a]	J1F1J3	3/16/11	5520	X	12.8	13.3	X	0.053	7.1	X	0.091	14.7	X	0.20	0.220		0.150	18900	X	3.4	3.0		0.29
DZ-4	J19CF2	11/10/2009	6950		71.7	10.5		0.143	7.74		1.43	15.1		0.717	0.19	B	0.21	22300		14.3	3.36		0.358
Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	6670	X	14.3	14.9	X	0.059	8.8	X	0.10	17.9	X	0.22	0.191		0.145	20900	X	3.9	3.0		0.28
Duplicate of J19CF2	J19CH1	11/10/2009	7220		73.6	11.7		0.147	7.73		1.47	15.5		0.736	0.17	B	0.21	22200		14.7	3.34		0.368
DZ-1	J19CD9	11/10/2009	12500		74.7	25.9		0.149	10.8		1.49	26.8		0.747	0.19	B	0.21	26400		14.9	9.15		0.373
DZ-2	J19CF0	11/10/2009	7550		68.8	8.67		0.138	8.37		1.38	14.5		0.688	0.20	B	0.21	22900		13.8	2.64		0.344
DZ-3	J19CF1	11/10/2009	7170		78.3	13.1		0.157	8.46		1.57	15.4		0.783	0.16	B	0.21	21800		15.7	3.78		0.391
DZ-5 [a]	J1F1J4	3/16/11	5310	X	14.2	15.3	X	0.058	9.5	X	0.10	16.6	X	0.22	0.454		0.150	24300	X	3.8	2.6		1.3
DZ-5	J19CF3	11/10/2009	9130		76.8	35.8		0.154	6.86		1.54	16.1		0.768	0.15	B	0.21	18300		15.4	4.05		0.384
DZ-6 [a]	J1F1J5	3/16/11	7580	X	13.6	16.2	X	0.056	8.4	X	0.097	15.3	X	0.21	0.241		0.149	20500	X	3.7	3.9		0.28
DZ-6	J19CF4	11/10/2009	7830		73.8	38.2		0.148	7.54		1.48	15.6		0.738	0.16	B	0.21	22100		14.8	4.88		0.369
DZ-7	J19CF5	11/10/2009	9730		82.8	12.5		0.166	8.20		1.66	16.3		0.828	0.20	B	0.21	22800		16.6	4.21		0.414
DZ-8 [a]	J1F1J6	3/16/11	5640	X	13.6	16.6	X	0.056	7.5	X	0.096	15.2	X	0.21	0.700		0.154	20100	X	3.7	7.6		0.28
DZ-8	J19CF6	11/10/2009	8320		95.8	16.0		0.192	7.56		1.92	15.8		0.958	0.20	B	0.21	20100		19.2	5.19		0.479
DZ-9	J19CF7	11/10/2009	6210		76.4	24.1		0.153	8.29		1.53	15.9		0.764	0.14	B	0.21	23000		15.3	4.57		0.382
DZ-10 [a]	J1F1J7	3/16/11	7800	X	14.2	16.7	X	0.058	8.5	X	0.10	16.3	X	0.22	0.302		0.155	21000	X	3.8	4.6		0.26
DZ-10	J19CF8	11/10/2009	14400		97.8	41.0		0.196	12.4		1.96	31.8		0.978	0.17	B	0.22	32000		19.6	11.5		0.489
DZ-11	J19CF9	11/10/2009	6330		84.0	5.63		0.168	8.63		1.68	13.6		0.840	0.20	B	0.20	25700		16.8	1.93		0.420
DZ-12	J19CH0	11/10/2009	7340		83.7	8.33		0.167	8.27		1.67	14.6		0.837	0.18	B	0.20	25700		16.7	2.44		0.419

Attachment	1	Sheet No.	10 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Metals Verification Sampling Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-3	J19CC8	11/10/2009	3990	J	51.6	263		3.44	0.0265	U	0.0265	0.265	B	1.38	10.8		2.75	1080		275	0.688	U	0.688
Duplicate of J19CC8	J19CD8	11/10/2009	4170	J	52.9	255		3.53	0.0277	U	0.0277	0.218	B	1.41	11.2		2.82	1160		282	0.706	U	0.706
SZ-1	J19CC6	11/10/2009	4440	J	56.4	332		3.76	0.0279	U	0.0279	0.366	B	1.50	9.32		3.01	694		301	0.751	U	0.751
SZ-2	J19CC7	11/10/2009	6860	J	66.3	398		4.42	0.0145	B	0.0303	0.362	B	1.77	20.8		3.54	1700		354	0.884	U	0.884
SZ-4	J19CC9	11/10/2009	4220	J	66.4	327		4.43	0.0298	U	0.0298	0.281	B	1.77	9.18		3.54	1010		354	0.885	U	0.885
SZ-5	J19CD0	11/10/2009	4050	J	48.5	282		3.23	0.0651		0.0251	0.275	B	1.29	9.07		2.58	874		258	0.646	U	0.646
SZ-6	J19CD1	11/10/2009	3960	J	54.5	250		3.63	0.0277	U	0.0277	0.215	B	1.45	10.7		2.91	955		291	0.727	U	0.727
SZ-7	J19CD2	11/10/2009	4130	J	56.5	307		3.77	0.0288	U	0.0288	0.292	B	1.51	7.80		3.01	784		301	0.753	U	0.753
SZ-8	J19CD3	11/10/2009	3850	J	52.0	302		3.46	0.0280	U	0.0280	0.298	B	1.39	8.25		2.77	674		277	0.693	U	0.693
SZ-9	J19CD4	11/10/2009	4310	J	62.5	313		4.16	0.0258	U	0.0258	0.287	B	1.67	10.6		3.33	1120		333	0.833	U	0.833
SZ-10	J19CD5	11/10/2009	3770	J	60.3	306		4.02	0.0232	U	0.0232	0.309	B	1.61	8.91		3.22	1040		322	0.804	U	0.804
SZ-11	J19CD6	11/10/2009	3910	J	53.2	285		3.55	0.0236	U	0.0236	0.268	B	1.42	9.16		2.84	1340		284	0.710	U	0.710
SZ-12	J19CD7	11/10/2009	3660	J	53.4	297		3.56	0.0263	U	0.0263	0.299	B	1.42	9.26		2.85	1000		285	0.712	U	0.712
DZ-4 [a]	J1F1J3	3/16/11	4290	X	3.4	272	X	0.091	0.013	B	0.0056	0.24	B	0.24	9.0	X	0.11	672		37.2	0.78	U	0.78
DZ-4	J19CF2	11/10/2009	4250	J	53.8	291		3.58	0.0605		0.0290	0.363	B	1.43	8.34		2.87	926		287	0.717	U	0.717
Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	5400	X	3.8	294	X	0.10	0.023		0.0052	0.26	U	0.26	13.0	X	0.12	813		41.6	0.87	U	0.87
Duplicate of J19CF2	J19CH1	11/10/2009	4260	J	55.2	280		3.68	0.0595		0.0258	0.378	B	1.47	9.45		2.94	1120		294	0.736	U	0.736
DZ-1	J19CD9	11/10/2009	8530	J	56.0	456		3.73	0.0535		0.0308	0.386	B	1.49	23.1		2.99	1800		299	0.747	U	0.747
DZ-2	J19CF0	11/10/2009	4520	J	51.6	301		3.44	0.0273	U	0.0273	0.361	B	1.38	8.86		2.75	890		275	0.688	U	0.688
DZ-3	J19CF1	11/10/2009	4870	J	58.7	317		3.91	0.0303		0.0262	0.338	B	1.57	10.7		3.13	854		313	0.783	U	0.783
DZ-5 [a]	J1F1J4	3/16/11	4590	X	3.7	307	X	0.10	0.0072	B	0.0059	0.26	U	0.26	8.2	X	0.12	493		41.3	0.87	U	0.87
DZ-5	J19CF3	11/10/2009	5860	J	57.6	302		3.84	0.0711		0.0281	0.294	B	1.54	12.4		3.07	934		307	0.768	U	0.768
DZ-6 [a]	J1F1J5	3/16/11	4850	X	3.6	294	X	0.097	0.022		0.0060	0.25	U	0.25	11.3	X	0.12	986		39.7	0.83	U	0.83
DZ-6	J19CF4	11/10/2009	5550	J	55.4	300		3.69	0.7230		0.0242	0.353	B	1.48	12.3		2.95	947		295	0.738	U	0.738
DZ-7	J19CF5	11/10/2009	4930	J	62.1	323		4.14	0.0250	U	0.0250	0.329	B	1.66	11.6		3.31	1710		331	0.828	U	0.828
DZ-8 [a]	J1F1J6	3/16/11	4950	X	3.6	273	X	0.096	0.50		0.0053	0.25	U	0.25	9.5	X	0.12	839		39.5	0.83	U	0.83
DZ-8	J19CF6	11/10/2009	5160	J	71.9	316		4.79	0.4810		0.0296	0.300	B	1.92	12.5		3.83	1780		383	0.958	U	0.958
DZ-9	J19CF7	11/10/2009	5310	J	57.3	292		3.82	0.0170	B	0.0292	0.325	B	1.53	10.3		3.05	719		305	0.764	U	0.764
DZ-10 [a]	J1F1J7	3/16/11	4910	X	3.7	320	X	0.10	0.019		0.0058	0.26	U	0.26	11.4	X	0.12	1040		41.3	0.87	U	0.87
DZ-10	J19CF8	11/10/2009	10400	J	73.4	518		4.89	0.0451		0.0299	0.381	B	1.96	29.8		3.91	2300		391	0.978	U	0.978
DZ-11	J19CF9	11/10/2009	3870	J	63.0	277		4.20	0.0279	U	0.0279	0.367	B	1.68	6.47		3.36	760		336	0.840	U	0.840
DZ-12	J19CH0	11/10/2009	4370	J	62.8	286		4.19	0.0287	U	0.0287	0.344	B	1.67	8.73		3.35	932		335	0.837	U	0.837

Attachment	1	Sheet No.	11 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Metals Verification Sampling Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-3	J19CC8	11/10/2009	406	J	1.38	0.138	U	0.138	200		34.4	42.4	J	1.72	38.2		6.88
Duplicate of J19CC8	J19CD8	11/10/2009	531	J	1.41	0.141	U	0.141	193		35.3	35.8	J	1.76	35.0		7.06
SZ-1	J19CC6	11/10/2009	277	J	1.50	0.150	U	0.150	268		37.6	76.8	J	1.88	51.7		7.51
SZ-2	J19CC7	11/10/2009	520	J	1.77	0.177	U	0.177	296		44.2	49.3	J	2.21	62.1		8.84
SZ-4	J19CC9	11/10/2009	440	J	1.77	0.177	U	0.177	252		44.3	56.9	J	2.21	47.1		8.85
SZ-5	J19CD0	11/10/2009	346	J	1.29	0.129	U	0.129	263		32.3	55.2	J	1.62	48.1		6.46
SZ-6	J19CD1	11/10/2009	499	J	1.45	0.145	U	0.145	233		36.3	40.7	J	1.82	35.8		7.27
SZ-7	J19CD2	11/10/2009	420	J	1.51	1.30		0.151	299		37.7	65.4	J	1.88	48.6		7.53
SZ-8	J19CD3	11/10/2009	308	J	1.39	0.139	U	0.139	278		34.6	68.4	J	1.73	50.1		6.93
SZ-9	J19CD4	11/10/2009	479	J	1.67	0.167	U	0.167	300		41.6	54.4	J	2.08	48.4		8.33
SZ-10	J19CD5	11/10/2009	394	J	1.61	0.161	U	0.161	265		40.2	61.5	J	2.01	49.2		8.04
SZ-11	J19CD6	11/10/2009	512	J	1.42	0.142	U	0.142	236		35.5	52.9	J	1.77	46.3		7.10
SZ-12	J19CD7	11/10/2009	415	J	1.42	0.142	U	0.142	246		35.6	62.1	J	1.78	48.3		7.12
DZ-4 [a]	J1F1J3	3/16/11	178	MN	5.1	0.15	U	0.15	256		53.5	47.8	X	0.085	36.8	X	0.36
DZ-4	J19CF2	11/10/2009	381		1.43	0.143	U	0.143	236		35.8	60.4		1.79	49.4		7.17
Duplicate of J1F1J3 [a]	J1F1J8	3/16/11	172		5.7	0.16	U	0.16	388		59.9	49.9	X	0.095	39.7	X	0.40
Duplicate of J19CF2	J19CH1	11/10/2009	477		1.47	0.147	U	0.147	270		36.8	49.6		1.84	46.9		7.36
DZ-1	J19CD9	11/10/2009	439		1.49	0.149	U	0.149	266		37.3	45.1		1.87	65.8		7.47
DZ-2	J19CF0	11/10/2009	343		1.38	0.138	U	0.138	279		34.4	59.1		1.72	46.0		6.88
DZ-3	J19CF1	11/10/2009	402		1.57	0.157	U	0.157	240		39.1	55.5		1.96	45.2		7.83
DZ-5 [a]	J1F1J4	3/16/11	126		5.7	0.16	U	0.16	355		59.5	68.0	X	0.095	44.5	X	0.40
DZ-5	J19CF3	11/10/2009	431		1.54	0.154	U	0.154	247		38.4	39.0		1.92	60.1		7.68
DZ-6 [a]	J1F1J5	3/16/11	242		5.5	0.15	U	0.15	294		57.1	50.7	X	0.091	40.9	X	0.39
DZ-6	J19CF4	11/10/2009	424		1.48	0.148	U	0.148	355		36.9	54.5		1.85	67.6		7.38
DZ-7	J19CF5	11/10/2009	491		1.66	0.166	U	0.166	249		41.4	50.7		2.07	47.8		8.28
DZ-8 [a]	J1F1J6	3/16/11	165		5.4	0.15	U	0.15	252		56.8	49.1	X	0.09	39.8	X	0.38
DZ-8	J19CF6	11/10/2009	750		1.92	0.192	U	0.192	280		47.9	41.2		2.40	47.7		9.58
DZ-9	J19CF7	11/10/2009	354		1.53	0.153	U	0.153	257		38.2	55.3		1.91	47.9		7.64
DZ-10 [a]	J1F1J7	3/16/11	250		5.7	0.16	U	0.16	287		59.5	52.0	X	0.095	42.7	X	0.40
DZ-10	J19CF8	11/10/2009	636		1.96	0.196	U	0.196	214		48.9	44.1		2.45	84.3		9.78
DZ-11	J19CF9	11/10/2009	441		1.68	0.168	U	0.168	253		42	64.1		2.10	50.0		8.40
DZ-12	J19CH0	11/10/2009	416		1.67	0.167	U	0.167	283		41.9	60.0		2.09	48.4		8.37

Attachment	1	Sheet No.	12 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Metals Verification Sampling Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-1	J19CH2	11/9/2009	5270		3.43	0.412	U	0.410	2.62		0.343	51.7		0.343	0.16		0.137	0.571	B	1.37	0.0564	B	0.137
Duplicate of J19CH2	J19CJ4	11/9/2009	5490		4.3	0.515	U	0.520	2.25		0.430	57.0		0.430	0.164	B	0.172	0.791	B	1.72	0.0627	B	0.172
SPA-2	J19CH3	11/9/2009	5870		4.91	0.589	U	0.590	2.50		0.491	60.0		0.491	0.197		0.196	1.59	B	1.96	0.0577	B	0.196
SPA-3	J19CH4	11/9/2009	4870		3.46	0.416	U	0.420	2.28		0.346	51.3		0.346	0.151		0.139	0.657	B	1.39	0.0459	B	0.139
SPA-4	J19CH5	11/9/2009	4800		3.95	0.474	U	0.470	1.97		0.395	55.7		0.395	0.154	B	0.158	0.609	B	1.58	0.0449	B	0.158
SPA-5	J19CH6	11/9/2009	4880		3.99	0.479	U	0.480	1.93		0.399	67.8		0.399	0.151	B	0.160	0.811	B	1.60	0.0564	B	0.160
SPA-6	J19CH7	11/9/2009	6450		3.73	0.239	B	0.450	2.29		0.373	69.9		0.373	0.214		0.149	0.963	B	1.49	0.0595	B	0.149
SPA-7	J19CH8	11/9/2009	5230		4.15	0.498	U	0.500	1.91		0.415	49.5		0.415	0.178		0.166	0.777	B	1.66	0.0431	B	0.166
SPA-8	J19CH9	11/9/2009	5000		3.39	0.205	B	0.410	1.73		0.339	55.5		0.339	0.175		0.135	0.823	B	1.35	0.135	U	0.135
SPA-9	J19CJ0	11/9/2009	5330		4.73	0.567	U	0.570	2.48		0.473	61.0		0.473	0.184	B	0.189	1.04	B	1.89	0.189	U	0.189
SPA-10	J19CJ1	11/9/2009	3700		3.41	0.409	U	0.410	1.19		0.341	43.3		0.341	0.125	B	0.136	0.449	B	1.36	0.0343	B	0.136
SPA-11	J19CJ2	11/9/2009	5520		4.42	0.530	U	0.530	2.01		0.442	60.4		0.442	0.179		0.177	1.04	B	1.77	0.0579	B	0.177
SPA-12	J19CJ3	11/9/2009	6120		3.97	0.476	U	0.480	2.79		0.397	63.0		0.397	0.197		0.159	1.31	B	1.59	0.0658	B	0.159
OB-1	J19CB4	11/3/2009	4570		3.51	0.421	U	0.421	1.76		0.702	62.5		0.351	0.157		0.140	0.57	B	1.40	0.0586	B	0.140
OB-2	J19CB5	11/3/2009	4450		4.52	0.542	U	0.542	1.77		0.904	49.0		0.452	0.149	B	0.181	0.641	B	1.81	0.0593	B	0.181
OB-3	J19CB6	11/3/2009	4880		4.35	0.522	U	0.522	2.15		0.871	53.7		0.435	0.167	B	0.174	0.861	B	1.74	0.0467	B	0.174
OB-4	J19CB7	11/3/2009	4940		3.68	0.441	U	0.441	1.89		0.735	51.6		0.368	0.167		0.147	0.732	B	1.47	0.0539	B	0.147
OB-5	J19CB8	11/3/2009	5720		4.94	0.593	U	0.593	2.25		0.989	58.6		0.494	0.189	B	0.198	0.930	B	1.98	0.0539	B	0.198
OB-6	J19CB9	11/3/2009	4720		3.27	0.392	U	0.392	1.85		0.654	51.4		0.327	0.16		0.131	0.905	B	1.31	0.0474	B	0.131
OB-7	J19CC0	11/3/2009	4940		3.73	0.447	U	0.447	1.83		0.745	62.3		0.373	0.178		0.149	0.789	B	1.49	0.0640	B	0.149
OB-8	J19CC1	11/3/2009	4650		4.14	0.496	U	0.496	2.36		0.827	55.8		0.414	0.161	B	0.165	0.851	B	1.65	0.0591	B	0.165
OB-9	J19CC2	11/3/2009	4570		3.57	0.429	U	0.429	1.73		0.715	56.3		0.357	0.165		0.143	0.610	B	1.43	0.0551	B	0.143
OB-10	J19CC3	11/3/2009	5290		4.00	0.480	U	0.480	2.29		0.800	56.8		0.400	0.184		0.160	0.880	B	1.60	0.0678	B	0.160
OB-11	J19CC4	11/3/2009	4140		3.79	0.455	U	0.455	1.82		0.758	50.2		0.379	0.167		0.152	0.402	B	1.52	0.0457	B	0.152
OB-12	J19CC5	11/3/2009	5350		4.45	0.534	U	0.534	2.42		0.889	62.1		0.445	0.195		0.178	0.961	B	1.78	0.0766	B	0.178
EB	J19CB3	11/3/2009	148		4.82	0.579	U	0.579	0.964	U	0.964	1.73		0.482	0.193	U	0.193	1.93	U	1.93	0.193	U	0.193

Attachment	1	Sheet No.	13 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Metals Verification Sampling Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-1	J19CH2	11/9/2009	6280		68.6	10.7		0.137	5.13		1.37	11.3		0.686	0.17		0.21	14600		13.7	2.87		0.343
Duplicate of J19CH2	J19CJ4	11/9/2009	6090		85.9	8.67		0.172	5.53		1.72	11.7		0.859	0.17		0.21	15700		17.2	2.86		0.430
SPA-2	J19CH3	11/9/2009	6590		98.1	8.21		0.196	7.15		1.96	16.2		0.981	0.12		0.20	20000		19.6	3.47		0.491
SPA-3	J19CH4	11/9/2009	6380		69.3	7.30		0.139	5.86		1.39	12.7		0.693	0.17		0.21	16900		13.9	2.76		0.346
SPA-4	J19CH5	11/9/2009	5900		79.1	5.91		0.158	7.01		1.58	13.2		0.791	0.10		0.21	19500		15.8	2.70		0.395
SPA-5	J19CH6	11/9/2009	5950		79.9	7.64		0.160	6.65		1.60	13.4		0.799	0.14		0.21	18100		16.0	2.72		0.399
SPA-6	J19CH7	11/9/2009	4970		74.7	7.59		0.149	7.37		1.49	13.9		0.747	0.14		0.21	20900		14.9	3.64		0.373
SPA-7	J19CH8	11/9/2009	6790		83.0	6.56		0.166	7.66		1.66	14.7		0.830	0.06		0.21	20900		16.6	2.86		0.415
SPA-8	J19CH9	11/9/2009	5550		67.7	6.13		0.135	7.48		1.35	13.8		0.677	0.10		0.21	19500		13.5	2.72		0.339
SPA-9	J19CJ0	11/9/2009	6750		94.5	6.82		0.189	7.81		1.89	14.1		0.945	0.18		0.21	20200		18.9	2.92		0.473
SPA-10	J19CJ1	11/9/2009	4510		68.2	4.32		0.136	6.79		1.36	12.2		0.682	0.16		0.20	18300		13.6	1.88		0.341
SPA-11	J19CJ2	11/9/2009	7170		88.4	6.80		0.177	7.09		1.77	13.5		0.884	0.07		0.20	19200		17.7	2.85		0.442
SPA-12	J19CJ3	11/9/2009	7960		79.4	8.44		0.159	6.84		1.59	14.1		0.794	0.13		0.21	18900		15.9	4.22		0.397
OB-1	J19CB4	11/3/2009	6380		70.2	5.04		0.140	7.11		1.40	14.1		0.702	0.21	U	0.21	20300		14.0	2.23		0.351
OB-2	J19CB5	11/3/2009	6530		90.4	6.36		0.181	7.89		1.81	14.3		0.904	0.18	B	0.21	22300		18.1	2.48		0.452
OB-3	J19CB6	11/3/2009	6540		87.1	6.70		0.174	7.27		1.74	14.5		0.871	0.12	B	0.21	20600		17.4	2.49		0.435
OB-4	J19CB7	11/3/2009	5490		73.5	7.16		0.147	6.78		1.47	13.7		0.735	0.21	U	0.21	18700		14.7	2.56		0.368
OB-5	J19CB8	11/3/2009	6310		98.9	7.88		0.198	7.55		1.98	14.7		0.989	0.12	B	0.21	21300		19.8	2.91		0.494
OB-6	J19CB9	11/3/2009	6450		65.4	5.92		0.131	6.95		1.31	14.2		0.654	0.21	U	0.21	18400		13.1	2.43		0.327
OB-7	J19CC0	11/3/2009	5510		74.5	5.75		0.149	7.56		1.49	15.3		0.745	0.21	U	0.21	20100		14.9	2.62		0.373
OB-8	J19CC1	11/3/2009	6020		82.7	5.92		0.165	7.86		1.65	14.1		0.827	0.10	B	0.21	20200		16.5	2.55		0.414
OB-9	J19CC2	11/3/2009	5630		71.5	5.59		0.143	6.97		1.43	14.2		0.715	0.11	B	0.21	19700		14.3	2.23		0.357
OB-10	J19CC3	11/3/2009	6390		80.0	7.94		0.160	7.04		1.60	15.6		0.800	0.20	U	0.20	19100		16.0	2.69		0.400
OB-11	J19CC4	11/3/2009	5510		75.8	4.22		0.152	7.49		1.52	15.4		0.758	0.21	U	0.21	20400		15.2	2.06		0.379
OB-12	J19CC5	11/3/2009	8480		88.9	7.13		0.178	7.72		1.78	16.0		0.889	0.21	U	0.21	20200		17.8	2.60		0.445
EB	J19CB3	11/3/2009	44.5	B	96.4	0.197		0.193	1.93	U	1.93	0.964	U	0.964				179		19.3	0.482	U	0.482

Attachment	1	Sheet No.	14 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Metals Verification Sampling Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-1	J19CH2	11/9/2009	4010		51.5	235		3.43	0.0273	U	0.0273	0.208	B	1.37	9.99		2.75	936		275	0.686	U	0.686
Duplicate of J19CH2	J19CJ4	11/9/2009	3690		64.4	234		4.3	0.0290	U	0.0290	0.219	B	1.72	9.23		3.44	1000		344	0.859	U	0.859
SPA-2	J19CH3	11/9/2009	4340		73.6	282		4.91	0.0265	U	0.0265	0.331	B	1.96	10.4		3.92	1430		392	0.981	U	0.981
SPA-3	J19CH4	11/9/2009	3860		52.0	240		3.46	0.0250	U	0.0250	0.251	B	1.39	10.1		2.77	913		277	0.693	U	0.693
SPA-4	J19CH5	11/9/2009	3620		59.3	272		3.95	0.0243	U	0.0243	0.266	B	1.58	7.65		3.16	841		316	0.791	U	0.791
SPA-5	J19CH6	11/9/2009	4060		59.9	261		3.99	0.0257	U	0.0257	0.261	B	1.60	12.0		3.19	909		319	0.799	U	0.799
SPA-6	J19CH7	11/9/2009	3910		56.0	309		3.73	0.0257	U	0.0257	0.254	B	1.49	9.02		2.99	1370		299	0.747	U	0.747
SPA-7	J19CH8	11/9/2009	4040		62.3	279		4.15	0.0300	U	0.0300	0.295	B	1.66	8.67		3.32	967		332	0.830	U	0.830
SPA-8	J19CH9	11/9/2009	3880		50.8	263		3.39	0.0273	U	0.0273	0.258	B	1.35	8.49		2.71	952		271	0.677	U	0.677
SPA-9	J19CJ0	11/9/2009	3670		70.9	271		4.73	0.0225	U	0.0225	0.277	B	1.89	8.57		3.78	1010		378	0.945	U	0.945
SPA-10	J19CJ1	11/9/2009	3510		51.2	238		3.41	0.0265	U	0.0265	0.259	B	1.36	8.22		2.73	607		273	0.682	U	0.682
SPA-11	J19CJ2	11/9/2009	3730		66.3	263		4.42	0.0257	U	0.0257	0.260	B	1.77	9.60		3.53	1050		353	0.884	U	0.884
SPA-12	J19CJ3	11/9/2009	4210		59.5	278		3.97	0.0265	U	0.0265	0.277	B	1.59	10.4		3.18	1160		318	0.794	U	0.794
OB-1	J19CB4	11/3/2009	3970		52.7	321		3.51	0.0265	U	0.0265	0.309	B	1.40	7.56		2.81	750		281	0.702	U	0.702
OB-2	J19CB5	11/3/2009	3880		67.8	287		4.52	0.0250	U	0.0250	0.353	B	1.81	8.26		3.62	770		362	0.904	U	0.904
OB-3	J19CB6	11/3/2009	3860		65.3	264		4.35	0.0290	U	0.0290	0.285	B	1.74	8.27		3.48	849		348	0.871	U	0.871
OB-4	J19CB7	11/3/2009	3490		55.1	253		3.68	0.0281	U	0.0281	0.265	B	1.47	8.26		2.94	800		294	0.735	U	0.735
OB-5	J19CB8	11/3/2009	4280		74.2	298		4.94	0.0250	U	0.0250	0.281	B	1.98	9.30		3.95	979		395	0.989	U	0.989
OB-6	J19CB9	11/3/2009	3670		49.0	255		3.27	0.0281	U	0.0281	0.271	B	1.31	8.47		2.62	794		262	0.654	U	0.654
OB-7	J19CC0	11/3/2009	3660		55.9	280		3.73	0.0237	U	0.0237	0.298	B	1.49	7.66		2.98	879		298	0.745	U	0.745
OB-8	J19CC1	11/3/2009	3520		62.1	278		4.14	0.0231	U	0.0231	0.297	B	1.65	7.45		3.31	813		331	0.827	U	0.827
OB-9	J19CC2	11/3/2009	3440		53.6	253		3.57	0.0100	B	0.0281	0.277	B	1.43	7.13		2.86	764		286	0.715	U	0.715
OB-10	J19CC3	11/3/2009	3870		60.0	262		4.00	0.0273	U	0.0273	0.273	B	1.60	10.4		3.20	867		320	0.800	U	0.800
OB-11	J19CC4	11/3/2009	3370		56.9	263		3.79	0.0276		0.0231	0.315	B	1.52	6.22		3.03	686		303	0.758	U	0.758
OB-12	J19CC5	11/3/2009	3910		66.7	275		4.45	0.0290	U	0.0290	0.285	B	1.78	9.03		3.56	957		356	0.889	U	0.889
EB	J19CB3	11/3/2009	25.3	B	72.3	3.23	B	4.82	0.0281	U	0.0281	1.93	U	1.93	3.86	U	3.86	35.3	B	386	0.964	U	0.964

Attachment	1	Sheet No.	15 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Metals Verification Sampling Results (8 Pages)

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-1	J19CH2	11/9/2009	457		1.37	0.137	U	0.137	177		34.3	34		1.72	32.1		6.86
Duplicate of J19CH2	J19CJ4	11/9/2009	514		1.72	0.172	U	0.172	205		43.0	40.7		2.15	35.2		8.59
SPA-2	J19CH3	11/9/2009	815		1.96	0.196	U	0.196	194		49.1	51.1		2.45	41.2		9.81
SPA-3	J19CH4	11/9/2009	461		1.39	0.139	U	0.139	180		34.6	41.0		1.73	38.6		6.93
SPA-4	J19CH5	11/9/2009	548		1.58	0.158	U	0.158	186		39.5	51.7		1.98	40.7		7.91
SPA-5	J19CH6	11/9/2009	660		1.60	0.16	U	0.160	185		39.9	48.2		2.00	38.0		7.99
SPA-6	J19CH7	11/9/2009	615		1.49	0.149	U	0.149	200		37.3	53.9		1.87	44.5		7.47
SPA-7	J19CH8	11/9/2009	607		1.66	0.228		0.170	214		41.5	54.4		2.08	42.4		8.30
SPA-8	J19CH9	11/9/2009	539		1.35	0.135	U	0.135	206		33.9	54.5		1.69	41.7		6.77
SPA-9	J19CJ0	11/9/2009	736		1.89	0.189	U	0.189	217		47.3	51.7		2.36	42.9		9.45
SPA-10	J19CJ1	11/9/2009	342		1.36	0.136	U	0.136	177		34.1	51.9		1.71	37.6		6.82
SPA-11	J19CJ2	11/9/2009	729		1.77	0.177	U	0.177	225		44.2	52.9		2.21	40.6		8.84
SPA-12	J19CJ3	11/9/2009	688		1.59	0.159	U	0.159	227		39.7	48.0		1.98	43.5		7.94
OB-1	J19CB4	11/3/2009	451		1.40	0.140	U	0.140	254		35.1	56.5		1.76	41.8		7.02
OB-2	J19CB5	11/3/2009	453		1.81	0.181	U	0.181	213		45.2	64.0		2.26	46.1		9.04
OB-3	J19CB6	11/3/2009	485		1.74	0.174	U	0.174	229		43.5	53.6		2.18	42.1		8.71
OB-4	J19CB7	11/3/2009	418		1.47	0.147	U	0.147	214		36.8	52.6		1.84	39.4		7.35
OB-5	J19CB8	11/3/2009	643		1.98	0.198	U	0.198	238		49.4	53.6		2.47	43.2		9.89
OB-6	J19CB9	11/3/2009	345		1.31	0.131	U	0.131	219		32.7	51.5		1.63	41.3		6.54
OB-7	J19CC0	11/3/2009	461		1.49	0.149	U	0.149	214		37.3	55.8		1.86	43.9		7.45
OB-8	J19CC1	11/3/2009	426		1.65	0.165	U	0.165	204		41.4	55.8		2.07	43.9		8.27
OB-9	J19CC2	11/3/2009	363		1.43	0.143	U	0.143	227		35.7	54.6		1.79	41.8		7.15
OB-10	J19CC3	11/3/2009	515		1.60	0.16	U	0.160	244		40.0	51.0		2.00	42.4		8.00
OB-11	J19CC4	11/3/2009	420		1.52	0.152	U	0.152	232		37.9	55.7		1.90	42.5		7.58
OB-12	J19CC5	11/3/2009	536		1.78	0.178	U	0.178	243		44.5	53.3		2.22	45.0		8.89
EB	J19CB3	11/3/2009	177		1.93	0.193	U	0.193	48.2	U	48.2	2.41	U	2.41	0.973	B	9.64

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Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CC8 SZ-3 11/10/2009			J19CD8 Duplicate of J19CC8 11/10/2009			J19CC6 SZ-1 11/10/2009			J19CC7 SZ-2 11/10/2009			J19CC9 SZ-4 11/10/2009			J19CD0 SZ-5 11/10/2009			J19CD1 SZ-6 11/10/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
1,2-Dichlorobenzene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
1,3-Dichlorobenzene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
1,4-Dichlorobenzene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
2,4,5-Trichlorophenol	341	UJ	341	335	UJ	335	337	UJ	337	356	UJ	356	339	UJ	339	341	UJ	341	336	UJ	336
2,4,6-Trichlorophenol	341	UJ	341	335	UJ	335	337	UJ	337	356	UJ	356	339	UJ	339	341	UJ	341	336	UJ	336
2,4-Dichlorophenol	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
2,4-Dimethylphenol	341	UJ	341	335	UJ	335	337	UJ	337	356	UJ	356	339	UJ	339	341	UJ	341	336	UJ	336
2,4-Dinitrophenol	1700	UJ	1700	1680	UJ	1680	1690	UJ	1690	1780	UJ	1780	1690	UJ	1690	1710	UJ	1710	1680	UJ	1680
2,4-Dinitrotoluene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
2,6-Dinitrotoluene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
2-Chloronaphthalene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
2-Chlorophenol	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
2-Methylnaphthalene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
2-Methylphenol (cresol, o-)	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
2-Nitroaniline	1700	U	1700	1680	U	1680	1690	U	1690	1780	U	1780	1690	U	1690	1710	U	1710	1680	U	1680
2-Nitrophenol	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
3+4 Methylphenol (cresol, m+p)	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
3,3'-Dichlorobenzidine	681	U	681	671	U	671	674	U	674	712	U	712	678	U	678	682	U	682	671	U	671
3-Nitroaniline	1700	U	1700	1680	U	1680	1690	U	1690	1780	U	1780	1690	U	1690	1710	U	1710	1680	U	1680
4,6-Dinitro-2-methylphenol	341	UJ	341	335	UJ	335	337	UJ	337	356	UJ	356	339	UJ	339	341	UJ	341	336	UJ	336
4-Bromophenylphenyl ether	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
4-Chloro-3-methylphenol	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
4-Chloroaniline	341	UJ	341	335	UJ	335	337	UJ	337	356	UJ	356	339	UJ	339	341	UJ	341	336	UJ	336
4-Chlorophenylphenyl ether	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
4-Nitroaniline	1700	U	1700	1680	U	1680	1690	U	1690	1780	U	1780	1690	U	1690	1710	U	1710	1680	U	1680
4-Nitrophenol	1700	UJ	1700	1680	UJ	1680	1690	UJ	1690	1780	UJ	1780	1690	UJ	1690	1710	UJ	1710	1680	UJ	1680
Acenaphthene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Acenaphthylene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Anthracene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Benzo(a)anthracene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Benzo(a)pyrene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Benzo(b)fluoranthene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Benzo(ghi)perylene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Benzo(k)fluoranthene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Bis(2-chloro-1-methylethyl)ether	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Bis(2-Chloroethoxy)methane	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Bis(2-chloroethyl) ether	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Bis(2-ethylhexyl) phthalate	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Butylbenzylphthalate	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336

[a] Department of Ecology requested additional remediation and re-samples taken at these locations. Original samples are for information only.

Attachment	1	Sheet No.	17 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CD2 SZ-7 11/10/2009			J19CD3 SZ-8 11/10/2009			J19CD4 SZ-9 11/10/2009			J19CD5 SZ-10 11/10/2009			J19CD6 SZ-11 11/10/2009			J19CD7 SZ-12 11/10/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
1,2-Dichlorobenzene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
1,3-Dichlorobenzene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
1,4-Dichlorobenzene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
2,4,5-Trichlorophenol	338	UJ	338	338	UJ	338	341	UJ	341	340	UJ	340	337	UJ	337	338	UJ	338
2,4,6-Trichlorophenol	338	UJ	338	338	UJ	338	341	UJ	341	340	UJ	340	337	UJ	337	338	UJ	338
2,4-Dichlorophenol	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
2,4-Dimethylphenol	338	UJ	338	338	UJ	338	341	UJ	341	340	UJ	340	337	UJ	337	338	UJ	338
2,4-Dinitrophenol	1690	UJ	1690	1690	UJ	1690	1700	UJ	1700	1700	UJ	1700	1690	UJ	1690	1690	UJ	1690
2,4-Dinitrotoluene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
2,6-Dinitrotoluene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
2-Chloronaphthalene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
2-Chlorophenol	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
2-Methylnaphthalene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
2-Methylphenol (cresol, o-)	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
2-Nitroaniline	1690	U	1690	1690	U	1690	1700	U	1700	1700	U	1700	1690	U	1690	1690	U	1690
2-Nitrophenol	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
3+4 Methylphenol (cresol, m+p)	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
3,3'-Dichlorobenzidine	676	U	676	677	U	677	681	U	681	679	U	679	674	U	674	676	U	676
3-Nitroaniline	1690	U	1690	1690	U	1690	1700	U	1700	1700	U	1700	1690	U	1690	1690	U	1690
4,6-Dinitro-2-methylphenol	338	UJ	338	338	UJ	338	341	UJ	341	340	UJ	340	337	UJ	337	338	UJ	338
4-Bromophenylphenyl ether	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
4-Chloro-3-methylphenol	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
4-Chloroaniline	338	UJ	338	338	UJ	338	341	UJ	341	340	UJ	340	337	UJ	337	338	UJ	338
4-Chlorophenylphenyl ether	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
4-Nitroaniline	1690	U	1690	1690	U	1690	1700	U	1700	1700	U	1700	1690	U	1690	1690	U	1690
4-Nitrophenol	1690	UJ	1690	1690	UJ	1690	1700	UJ	1700	1700	UJ	1700	1690	UJ	1690	1690	UJ	1690
Acenaphthene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Acenaphthylene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Anthracene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Benzo(a)anthracene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Benzo(a)pyrene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Benzo(b)fluoranthene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Benzo(ghi)perylene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Benzo(k)fluoranthene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Bis(2-chloro-1-methylethyl)ether	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Bis(2-Chloroethoxy)methane	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Bis(2-chloroethyl) ether	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Bis(2-ethylhexyl) phthalate	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Butylbenzylphthalate	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338

Attachment	1	Sheet No.	18 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CC8 SZ-3 11/10/2009			J19CD8 Duplicate of J19CC8 11/10/2009			J19CC6 SZ-1 11/10/2009			J19CC7 SZ-2 11/10/2009			J19CC9 SZ-4 11/10/2009			J19CD0 SZ-5 11/10/2009			J19CD1 SZ-6 11/10/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Carbazole	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Chrysene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Di-n-butylphthalate	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Di-n-octylphthalate	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Dibenz[a,h]anthracene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Dibenzofuran	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Diethyl phthalate	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Dimethyl phthalate	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Fluoranthene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Fluorene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Hexachlorobenzene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Hexachlorobutadiene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Hexachlorocyclopentadiene	341	UJ	341	335	UJ	335	337	UJ	337	356	UJ	356	339	UJ	339	341	UJ	341	336	UJ	336
Hexachloroethane	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Indeno(1,2,3-cd)pyrene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Isophorone	341	UJ	341	335	UJ	335	337	UJ	337	356	UJ	356	339	UJ	339	341	UJ	341	336	UJ	336
N-Nitroso-di-n-dipropylamine	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
N-Nitrosodiphenylamine	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Naphthalene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Nitrobenzene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Pentachlorophenol	1700	UJ	1700	1680	UJ	1680	1690	UJ	1690	1780	UJ	1780	1690	UJ	1690	1710	UJ	1710	1680	UJ	1680
Phenanthrene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Phenol	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336
Pyrene	341	U	341	335	U	335	337	U	337	356	U	356	339	U	339	341	U	341	336	U	336

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Constituent	J19CD2 SZ-7 11/10/2009			J19CD3 SZ-8 11/10/2009			J19CD4 SZ-9 11/10/2009			J19CD5 SZ-10 11/10/2009			J19CD6 SZ-11 11/10/2009			J19CD7 SZ-12 11/10/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Carbazole	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Chrysene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Di-n-butylphthalate	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Di-n-octylphthalate	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Dibenz[a,h]anthracene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Dibenzofuran	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Diethyl phthalate	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Dimethyl phthalate	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Fluoranthene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Fluorene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Hexachlorobenzene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Hexachlorobutadiene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Hexachlorocyclopentadiene	338	UJ	338	338	UJ	338	341	UJ	341	340	UJ	340	337	UJ	337	338	UJ	338
Hexachloroethane	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Indeno(1,2,3-cd)pyrene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Isophorone	338	UJ	338	338	UJ	338	341	UJ	341	340	UJ	340	337	UJ	337	338	UJ	338
N-Nitroso-di-n-dipropylamine	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
N-Nitrosodiphenylamine	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Naphthalene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Nitrobenzene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Pentachlorophenol	1690	UJ	1690	1690	UJ	1690	1700	UJ	1700	1700	UJ	1700	1690	UJ	1690	1690	UJ	1690
Phenanthrene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Phenol	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338
Pyrene	338	U	338	338	U	338	341	U	341	340	U	340	337	U	337	338	U	338

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Constituent	Re-sample DZ-4 - J1F1J3 [a] 3/16/11			J19CF2 DZ-4 11/10/2009			Re-sample Duplicate of J1F1J3 - J1F1J8 [a] 3/16/11			J19CH1 Duplicate of J19CF2 11/10/2009			J19CD9 DZ-1 11/10/2009			J19CF0 DZ-2 11/10/2009			J19CF1 DZ-3 11/10/2009		
	ug/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	29	U	29	681	UJD	681	29	U	29	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
1,2-Dichlorobenzene	23	U	23	681	UJD	681	23	U	23	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
1,3-Dichlorobenzene	12	U	12	681	UD	681	13	U	13	340	U	340	350	U	350	341	U	341	346	U	346
1,4-Dichlorobenzene	14	U	14	681	UJD	681	14	U	14	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
2,4,5-Trichlorophenol	10	U	10	681	UJD	681	10	U	10	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
2,4,6-Trichlorophenol	10	U	10	681	UJD	681	10	U	10	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
2,4-Dichlorophenol	10	U	10	681	UJD	681	10	U	10	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
2,4-Dimethylphenol	69	U	69	681	UJD	681	69	U	69	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
2,4-Dinitrophenol	350	U	350	3410	UJD	3410	350	U	350	1700	UJ	1700	1750	UJ	1750	1700	UJ	1700	1730	UJ	1730
2,4-Dinitrotoluene	69	U	69	681	UD	681	69	U	69	340	U	340	350	U	350	341	U	341	346	U	346
2,6-Dinitrotoluene	29	U	29	681	UD	681	29	U	29	340	U	340	350	U	350	341	U	341	346	U	346
2-Chloronaphthalene	10	U	10	681	UD	681	10	U	10	340	U	340	350	U	350	341	U	341	346	U	346
2-Chlorophenol	22	U	22	681	UJD	681	22	U	22	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
2-Methylnaphthalene	20	U	20	681	UJD	681	20	U	20	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
2-Methylphenol (cresol, o-)	14	U	14	681	UJD	681	14	U	14	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
2-Nitroaniline	52	U	52	3410	UD	3410	52	U	52	1700	U	1700	1750	U	1750	1700	U	1700	1730	U	1730
2-Nitrophenol	10	U	10	681	UJD	681	10	U	10	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
3+4 Methylphenol (cresol, m+p)	34	U	34	681	UD	681	35	U	35	340	U	340	350	U	350	341	U	341	346	U	346
3,3'-Dichlorobenzidine	94	U	94	1360	UJD	1360	94	U	94	680	UJ	680	700	UJ	700	682	UJ	682	692	UJ	692
3-Nitroaniline	76	U	76	3410	UD	3410	77	U	77	1700	U	1700	1750	U	1750	1700	U	1700	1730	U	1730
4,6-Dinitro-2-methylphenol	340	U	340	681	UJD	681	350	U	350	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
4-Bromophenylphenyl ether	20	U	20	681	UD	681	20	U	20	340	U	340	350	U	350	341	U	341	346	U	346
4-Chloro-3-methylphenol	69	U	69	681	UJD	681	69	U	69	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
4-Chloroaniline	85	U	85	681	UJD	681	86	U	86	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
4-Chlorophenylphenyl ether	22	U	22	681	UD	681	22	U	22	340	U	340	350	UJ	350	341	U	341	346	U	346
4-Nitroaniline	75	U	75	3410	UD	3410	76	U	76	1700	U	1700	1750	U	1750	1700	U	1700	1730	U	1730
4-Nitrophenol	100	U	100	3410	UD	3410	100	U	100	1700	U	1700	1750	UJ	1750	1700	U	1700	1730	U	1730
Acenaphthene	11	U	11	681	UJD	681	11	U	11	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Acenaphthylene	18	U	18	681	UD	681	18	U	18	340	U	340	350	U	350	341	U	341	346	U	346
Anthracene	18	U	18	356	JD	681	18	U	18	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Benzo(a)anthracene	21	U	21	1680	D	681	21	U	21	340	U	340	350	U	350	341	U	341	102	J	346
Benzo(a)pyrene	21	U	21	2070	D	681	21	U	21	340	U	340	350	U	350	341	U	341	80.9	J	346
Benzo(b)fluoranthene	27	U	27	2310	D	681	27	U	27	340	U	340	350	U	350	341	U	341	95	J	346
Benzo(ghi)perylene	17	U	17	1960	D	681	17	U	17	340	U	340	350	U	350	341	U	341	346	U	346
Benzo(k)fluoranthene	42	U	42	2020	D	681	42	U	42	340	U	340	350	U	350	341	U	341	96.5	J	346
Bis(2-chloro-1-methylethyl)ether	24	U	24	681	UD	681	24	U	24	340	U	340	350	U	350	341	U	341	346	U	346
Bis(2-Chloroethoxy)methane	24	U	24	681	UJD	681	24	U	24	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Bis(2-chloroethyl) ether	17	U	17	681	UJD	681	17	U	17	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Bis(2-ethylhexyl) phthalate	110	JB	48	681	UD	681	110	JB	48	340	U	340	350	U	350	341	U	341	346	U	346
Butylbenzylphthalate	45	U	45	681	UJD	681	45	U	45	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346

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Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	Re-sample DZ-5 - J1F1J4 [a] 3/16/11			J19CF3 DZ-5 11/10/2009			Re-sample DZ-6 - J1F1J5 [a] 3/16/11			J19CF4 DZ-6 11/10/2009			J19CF5 DZ-7 11/10/2009			Re-sample DZ-8 - J1F1J6 [a] 3/16/11			J19CF6 DZ-8 11/10/2009		
	ug/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	29	U	29	339	UJ	339	30	U	30	1730	UJD	1730	339	UJ	339	31	U	31	348	UJ	348
1,2-Dichlorobenzene	23	U	23	339	UJ	339	23	U	23	1730	UJD	1730	339	UJ	339	24	U	24	348	UJ	348
1,3-Dichlorobenzene	13	U	13	339	U	339	13	U	13	1730	UD	1730	339	U	339	13	U	13	348	U	348
1,4-Dichlorobenzene	14	U	14	339	UJ	339	14	U	14	1730	UJD	1730	339	UJ	339	15	U	15	348	UJ	348
2,4,5-Trichlorophenol	11	U	11	339	UJ	339	11	U	11	1730	UJD	1730	339	UJ	339	11	U	11	348	UJ	348
2,4,6-Trichlorophenol	11	U	11	339	UJ	339	11	U	11	1730	UJD	1730	339	UJ	339	11	U	11	348	UJ	348
2,4-Dichlorophenol	11	U	11	339	UJ	339	11	U	11	1730	UJD	1730	339	UJ	339	11	U	11	348	UJ	348
2,4-Dimethylphenol	69	U	69	339	UJ	339	70	U	70	1730	UJD	1730	339	UJ	339	72	U	72	348	UJ	348
2,4-Dinitrophenol	350	U	350	1700	UJ	1700	350	U	350	8650	UJD	8650	1690	UJ	1690	360	U	360	1740	UJ	1740
2,4-Dinitrotoluene	69	U	69	339	U	339	70	U	70	1730	UD	1730	339	U	339	72	U	72	348	U	348
2,6-Dinitrotoluene	29	U	29	339	U	339	30	U	30	1730	UD	1730	339	U	339	31	U	31	348	U	348
2-Chloronaphthalene	11	U	11	339	U	339	11	U	11	1730	UD	1730	339	U	339	11	U	11	348	U	348
2-Chlorophenol	22	U	22	339	UJ	339	22	U	22	1730	UJD	1730	339	UJ	339	23	U	23	348	UJ	348
2-Methylnaphthalene	20	U	20	339	UJ	339	20	U	20	1730	UJD	1730	339	UJ	339	21	U	21	348	UJ	348
2-Methylphenol (cresol, o-)	14	U	14	339	UJ	339	14	U	14	1730	UJD	1730	339	UJ	339	14	U	14	348	UJ	348
2-Nitroaniline	53	U	53	1700	U	1700	53	U	53	8650	UD	8650	1690	U	1690	55	U	55	1740	U	1740
2-Nitrophenol	11	U	11	339	UJ	339	11	U	11	1730	UJD	1730	339	UJ	339	11	U	11	348	UJ	348
3+4 Methylphenol (cresol, m+p)	35	U	35	339	U	339	35	U	35	1730	UD	1730	339	U	339	36	U	36	348	U	348
3,3'-Dichlorobenzidine	95	U	95	679	UJ	679	96	U	96	3460	UJD	3460	678	UJ	678	98	U	98	696	UJ	696
3-Nitroaniline	77	U	77	1700	U	1700	78	U	78	8650	UD	8650	1690	U	1690	80	U	80	1740	U	1740
4,6-Dinitro-2-methylphenol	350	U	350	339	UJ	339	350	U	350	1730	UJD	1730	339	UJ	339	360	U	360	348	UJ	348
4-Bromophenylphenyl ether	20	U	20	339	U	339	20	U	20	1730	UD	1730	339	U	339	21	U	21	348	U	348
4-Chloro-3-methylphenol	69	U	69	339	UJ	339	70	U	70	1730	UJD	1730	339	UJ	339	72	U	72	348	UJ	348
4-Chloroaniline	86	U	86	339	UJ	339	87	U	87	1730	UJD	1730	339	UJ	339	90	U	90	348	UJ	348
4-Chlorophenylphenyl ether	22	U	22	339	U	339	22	U	22	1730	UD	1730	339	U	339	23	U	23	348	U	348
4-Nitroaniline	76	U	76	1700	U	1700	77	U	77	8650	UD	8650	1690	U	1690	79	U	79	1740	U	1740
4-Nitrophenol	100	U	100	1700	U	1700	100	U	100	8650	UD	8650	1690	U	1690	110	U	110	1740	U	1740
Acenaphthene	11	U	11	339	UJ	339	11	U	11	1730	UJD	1730	339	UJ	339	11	U	11	348	UJ	348
Acenaphthylene	18	U	18	339	U	339	18	U	18	1730	UD	1730	339	U	339	19	U	19	348	U	348
Anthracene	18	U	18	339	UJ	339	18	U	18	1730	UJD	1730	339	UJ	339	19	U	19	348	UJ	348
Benzo(a)anthracene	21	U	21	339	U	339	70	J	21	4350	D	1730	339	U	339	22	U	22	129	J	348
Benzo(a)pyrene	21	U	21	339	U	339	98	J	21	8410	D	1730	339	U	339	22	U	22	147	J	348
Benzo(b)fluoranthene	28	U	28	339	U	339	130	JX	28	8030	D	1730	339	U	339	29	U	29	148	J	348
Benzo(ghi)perylene	17	U	17	339	U	339	35	J	17	7870	D	1730	339	U	339	17	U	17	90.3	J	348
Benzo(k)fluoranthene	42	U	42	339	U	339	43	UX	43	7570	D	1730	339	U	339	44	U	44	160	J	348
Bis(2-chloro-1-methylethyl)ether	24	U	24	339	U	339	24	U	24	1730	UD	1730	339	U	339	25	U	25	348	U	348
Bis(2-Chloroethoxy)methane	24	U	24	339	UJ	339	24	U	24	1730	UJD	1730	339	UJ	339	25	U	25	348	UJ	348
Bis(2-chloroethyl) ether	17	U	17	339	UJ	339	18	U	18	1730	UJD	1730	339	UJ	339	18	U	18	348	UJ	348
Bis(2-ethylhexyl) phthalate	120	JB	48	339	U	339	120	JB	49	1730	UD	1730	339	U	339	120	JB	50	348	U	348
Butylbenzylphthalate	45	U	45	339	UJ	339	46	U	46	1730	UJD	1730	339	UJ	339	47	U	47	348	UJ	348

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Checked	T. E. Queen	Date	04/15/11
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Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CF7 DZ-9 11/10/2009			Re-sample DZ-10 - J1F1J7 [a] 3/16/11			J19CF8 DZ-10 11/10/2009			J19CF9 DZ-11 11/10/2009			J19CH0 DZ-12 11/10/2009		
	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	343	UJ	343	31	U	31	362	UJ	362	338	UJ	338	337	UJ	337
1,2-Dichlorobenzene	343	UJ	343	25	U	25	362	UJ	362	338	UJ	338	337	UJ	337
1,3-Dichlorobenzene	343	U	343	13	U	13	362	U	362	338	U	338	337	U	337
1,4-Dichlorobenzene	343	UJ	343	15	U	15	362	UJ	362	338	UJ	338	337	UJ	337
2,4,5-Trichlorophenol	343	UJ	343	11	U	11	362	UJ	362	338	UJ	338	337	UJ	337
2,4,6-Trichlorophenol	343	UJ	343	11	U	11	362	UJ	362	338	UJ	338	337	UJ	337
2,4-Dichlorophenol	343	UJ	343	11	U	11	362	UJ	362	338	UJ	338	337	UJ	337
2,4-Dimethylphenol	343	UJ	343	74	U	74	362	UJ	362	338	UJ	338	337	UJ	337
2,4-Dinitrophenol	1710	UJ	1710	370	U	370	1810	UJ	1810	1690	UJ	1690	1680	UJ	1680
2,4-Dinitrotoluene	343	U	343	74	U	74	362	U	362	338	U	338	337	U	337
2,6-Dinitrotoluene	343	U	343	31	U	31	362	U	362	338	U	338	337	U	337
2-Chloronaphthalene	343	U	343	11	U	11	362	U	362	338	U	338	337	U	337
2-Chlorophenol	343	UJ	343	23	U	23	362	UJ	362	338	UJ	338	337	UJ	337
2-Methylnaphthalene	343	UJ	343	21	U	21	362	UJ	362	338	UJ	338	337	UJ	337
2-Methylphenol (cresol, o-)	343	UJ	343	15	U	15	362	UJ	362	338	UJ	338	337	UJ	337
2-Nitroaniline	1710	U	1710	56	U	56	1810	U	1810	1690	U	1690	1680	U	1680
2-Nitrophenol	343	UJ	343	11	U	11	362	UJ	362	338	UJ	338	337	UJ	337
3+4 Methylphenol (cresol, m+p)	343	U	343	37	U	37	362	U	362	338	U	338	337	U	337
3,3'-Dichlorobenzidine	685	UJ	685	100	U	100	723	UJ	723	676	UJ	676	674	UJ	674
3-Nitroaniline	1710	U	1710	82	U	82	1810	U	1810	1690	U	1690	1680	U	1680
4,6-Dinitro-2-methylphenol	343	UJ	343	370	U	370	362	UJ	362	338	UJ	338	337	UJ	337
4-Bromophenylphenyl ether	343	U	343	21	U	21	362	U	362	338	U	338	337	U	337
4-Chloro-3-methylphenol	343	UJ	343	74	U	74	362	UJ	362	338	UJ	338	337	UJ	337
4-Chloroaniline	343	UJ	343	92	U	92	362	UJ	362	338	UJ	338	337	UJ	337
4-Chlorophenylphenyl ether	343	U	343	23	U	23	362	U	362	338	U	338	337	U	337
4-Nitroaniline	1710	U	1710	81	U	81	1810	U	1810	1690	U	1690	1680	U	1680
4-Nitrophenol	1710	U	1710	110	U	110	1810	U	1810	1690	U	1690	1680	U	1680
Acenaphthene	343	UJ	343	12	U	12	362	UJ	362	338	UJ	338	337	UJ	337
Acenaphthylene	343	U	343	19	U	19	362	U	362	338	U	338	337	U	337
Anthracene	343	UJ	343	19	U	19	362	UJ	362	338	UJ	338	337	UJ	337
Benzo(a)anthracene	343	U	343	23	J	22	362	U	362	338	U	338	337	U	337
Benzo(a)pyrene	343	U	343	72	J	22	362	U	362	338	U	338	337	U	337
Benzo(b)fluoranthene	343	U	343	34	JX	29	362	U	362	338	U	338	337	U	337
Benzo(ghi)perylene	343	U	343	18	U	18	362	U	362	338	U	338	337	U	337
Benzo(k)fluoranthene	343	U	343	45	UX	45	362	U	362	338	U	338	337	U	337
Bis(2-chloro-1-methylethyl)ether	343	U	343	26	U	26	362	U	362	338	U	338	337	U	337
Bis(2-Chloroethoxy)methane	343	UJ	343	26	U	26	362	UJ	362	338	UJ	338	337	UJ	337
Bis(2-chloroethyl) ether	343	UJ	343	19	U	19	362	UJ	362	338	UJ	338	337	UJ	337
Bis(2-ethylhexyl) phthalate	343	U	343	120	JB	51	362	U	362	338	U	338	337	U	337
Butylbenzylphthalate	343	UJ	343	48	U	48	362	UJ	362	338	UJ	338	337	UJ	337

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Constituent	Re-sample DZ-4 - J1F1J3 [a] 3/16/11			J19CF2 DZ-4 11/10/2009			Re-sample Duplicate of J1F1J3 - J1F1J8 [a] 3/16/11			J19CH1 Duplicate of J19CF2 11/10/2009			J19CD9 DZ-1 11/10/2009			J19CF0 DZ-2 11/10/2009			J19CF1 DZ-3 11/10/2009		
	ug/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Carbazole	37	U	37	207	JD	681	38	U	38	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Chrysene	28	U	28	1910	D	681	28	U	28	340	U	340	350	U	350	341	U	341	118	J	346
Di-n-butylphthalate	30	U	30	681	UD	681	30	U	30	340	U	340	350	U	350	341	U	341	346	U	346
Di-n-octylphthalate	15	U	15	681	UD	681	15	U	15	340	U	340	350	U	350	341	U	341	346	U	346
Dibenz[a,h]anthracene	20	U	20	451	JD	681	20	U	20	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Dibenzofuran	21	U	21	681	UJD	681	21	U	21	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Diethyl phthalate	27	U	27	681	UD	681	27	U	27	340	U	340	350	U	350	341	U	341	346	U	346
Dimethyl phthalate	24	U	24	681	UD	681	24	U	24	340	U	340	350	U	350	341	U	341	346	U	346
Fluoranthene	37	U	37	2680	JD	681	38	U	38	340	UJ	340	350	UJ	350	341	UJ	341	187	J	346
Fluorene	19	U	19	681	UJD	681	19	U	19	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Hexachlorobenzene	30	U	30	681	UD	681	30	U	30	340	U	340	350	U	350	341	U	341	346	U	346
Hexachlorobutadiene	10	U	10	681	UJD	681	10	U	10	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Hexachlorocyclopentadiene	52	U	52	681	UJD	681	52	U	52	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Hexachloroethane	22	U	22	681	UD	681	22	U	22	340	U	340	350	U	350	341	U	341	346	U	346
Indeno(1,2,3-cd)pyrene	23	U	23	1600	D	681	23	U	23	340	U	340	350	U	350	341	U	341	346	U	346
Isophorone	18	U	18	681	UJD	681	18	U	18	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
N-Nitroso-di-n-dipropylamine	32	U	32	681	UJD	681	32	U	32	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
N-Nitrosodiphenylamine	22	U	22	681	UD	681	22	U	22	340	U	340	350	U	350	341	U	341	346	U	346
Naphthalene	32	U	32	681	UJD	681	32	U	32	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Nitrobenzene	23	U	23	681	UJD	681	23	U	23	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Pentachlorophenol	340	U	340	3410	UJD	3410	350	U	350	1700	UJ	1700	1750	UJ	1750	1700	UJ	1700	1730	UJ	1730
Phenanthrene	18	U	18	998	JD	681	18	U	18	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Phenol	19	U	19	681	UJD	681	19	U	19	340	UJ	340	350	UJ	350	341	UJ	341	346	UJ	346
Pyrene	13	U	13	3780	D	681	13	U	13	340	U	340	350	U	350	341	U	341	190	J	346

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Constituent	Re-sample DZ-5 - J1F1J4 [a] 3/16/11			J19CF3 DZ-5 11/10/2009			Re-sample DZ-6 - J1F1J5 [a] 3/16/11			J19CF4 DZ-6 11/10/2009			J19CF5 DZ-7 11/10/2009			Re-sample DZ-8 - J1F1J6 [a] 3/16/11			J19CF6 DZ-8 11/10/2009		
	ug/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL
Carbazole	38	U	38	339	UJ	339	38	U	38	1730	UJD	1730	339	UJ	339	39	U	39	348	UJ	348
Chrysene	28	U	28	339	U	339	78	J	29	4660	D	1730	339	U	339	30	U	30	151	J	348
Di-n-butylphthalate	31	U	31	339	U	339	31	U	31	1730	UD	1730	339	U	339	32	U	32	348	U	348
Di-n-octylphthalate	15	U	15	339	U	339	15	U	15	1730	UD	1730	339	U	339	16	U	16	348	U	348
Dibenz[a,h]anthracene	20	U	20	339	UJ	339	20	U	20	1980	JD	1730	339	UJ	339	21	U	21	348	UJ	348
Dibenzofuran	21	U	21	339	UJ	339	21	U	21	1730	UJD	1730	339	UJ	339	22	U	22	348	UJ	348
Diethyl phthalate	27	U	27	339	U	339	28	U	28	1730	UD	1730	339	U	339	28	U	28	348	U	348
Dimethyl phthalate	24	U	24	339	U	339	24	U	24	1730	UD	1730	339	U	339	25	U	25	348	U	348
Fluoranthene	38	U	38	339	UJ	339	100	J	38	3120	JD	1730	339	UJ	339	39	U	39	195	J	348
Fluorene	19	U	19	339	UJ	339	19	U	19	1730	UJD	1730	339	UJ	339	20	U	20	348	UJ	348
Hexachlorobenzene	31	U	31	339	U	339	31	U	31	1730	UD	1730	339	U	339	32	U	32	348	U	348
Hexachlorobutadiene	11	U	11	339	UJ	339	11	U	11	1730	UJD	1730	339	UJ	339	11	U	11	348	UJ	348
Hexachlorocyclopentadiene	53	U	53	339	UJ	339	53	U	53	1730	UJD	1730	339	UJ	339	55	U	55	348	UJ	348
Hexachloroethane	22	U	22	339	U	339	23	U	23	1730	UD	1730	339	U	339	23	U	23	348	U	348
Indeno(1,2,3-cd)pyrene	23	U	23	339	U	339	85	J	23	6720	D	1730	339	U	339	24	U	24	90	J	348
Isophorone	18	U	18	339	UJ	339	18	U	18	1730	UJD	1730	339	UJ	339	19	U	19	348	UJ	348
N-Nitroso-di-n-dipropylamine	33	U	33	339	UJ	339	33	U	33	1730	UJD	1730	339	UJ	339	34	U	34	348	UJ	348
N-Nitrosodiphenylamine	22	U	22	339	U	339	22	U	22	1730	UD	1730	339	U	339	23	U	23	348	U	348
Naphthalene	33	U	33	339	UJ	339	33	U	33	1730	UJD	1730	339	UJ	339	34	U	34	348	UJ	348
Nitrobenzene	23	U	23	339	UJ	339	23	U	23	1730	UJD	1730	339	UJ	339	24	U	24	348	UJ	348
Pentachlorophenol	350	U	350	1700	UJ	1700	350	U	350	8650	UJD	8650	1690	UJ	1690	360	U	360	1740	UJ	1740
Phenanthrene	18	U	18	339	UJ	339	19	J	18	1730	UJD	1730	339	UJ	339	19	U	19	68.1	J	348
Phenol	19	U	19	339	UJ	339	19	U	19	1730	UJD	1730	339	UJ	339	20	U	20	348	UJ	348
Pyrene	13	U	13	339	U	339	110	J	13	11100	D	1730	339	U	339	13	U	13	163	J	348

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Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CF7 DZ-9 11/10/2009			Re-sample DZ-10 - J1F1J7 [a] 3/16/11			J19CF8 DZ-10 11/10/2009			J19CF9 DZ-11 11/10/2009			J19CH0 DZ-12 11/10/2009		
	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Carbazole	343	UJ	343	40	U	40	362	UJ	362	338	UJ	338	337	UJ	337
Chrysene	343	U	343	30	U	30	362	U	362	338	U	338	337	U	337
Di-n-butylphthalate	343	U	343	32	U	32	362	U	362	338	U	338	337	U	337
Di-n-octylphthalate	343	U	343	16	U	16	362	U	362	338	U	338	337	U	337
Dibenz[a,h]anthracene	343	UJ	343	72	J	21	362	UJ	362	338	UJ	338	337	UJ	337
Dibenzofuran	343	UJ	343	22	U	22	362	UJ	362	338	UJ	338	337	UJ	337
Diethyl phthalate	343	U	343	29	U	29	362	U	362	338	U	338	337	U	337
Dimethyl phthalate	343	U	343	26	U	26	362	U	362	338	U	338	337	U	337
Fluoranthene	343	UJ	343	40	U	40	362	UJ	362	338	UJ	338	337	UJ	337
Fluorene	343	UJ	343	20	U	20	362	UJ	362	338	UJ	338	337	UJ	337
Hexachlorobenzene	343	U	343	32	U	32	362	U	362	338	U	338	337	U	337
Hexachlorobutadiene	343	UJ	343	11	U	11	362	UJ	362	338	UJ	338	337	UJ	337
Hexachlorocyclopentadiene	343	UJ	343	56	U	56	362	UJ	362	338	UJ	338	337	UJ	337
Hexachloroethane	343	U	343	24	U	24	362	U	362	338	U	338	337	U	337
Indeno(1,2,3-cd)pyrene	343	U	343	68	J	25	362	U	362	338	U	338	337	U	337
Isophorone	343	UJ	343	19	U	19	362	UJ	362	338	UJ	338	337	UJ	337
N-Nitroso-di-n-dipropylamine	343	UJ	343	35	U	35	362	UJ	362	338	UJ	338	337	UJ	337
N-Nitrosodiphenylamine	343	U	343	23	U	23	362	U	362	338	U	338	337	U	337
Naphthalene	343	UJ	343	35	U	35	362	UJ	362	338	UJ	338	337	UJ	337
Nitrobenzene	343	UJ	343	25	U	25	362	UJ	362	338	UJ	338	337	UJ	337
Pentachlorophenol	1710	UJ	1710	370	U	370	1810	UJ	1810	1690	UJ	1690	1680	UJ	1680
Phenanthrene	343	UJ	343	19	U	19	362	UJ	362	338	UJ	338	337	UJ	337
Phenol	343	UJ	343	20	U	20	362	UJ	362	338	UJ	338	337	UJ	337
Pyrene	343	U	343	27	J	14	362	U	362	338	U	338	337	U	337

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Constituent	J19CH2 SPA-1 11/09/2009			J19CJ4 Duplicate of J19CH2 11/09/2009			J19CH3 SPA-2 11/09/2009			J19CH4 SPA-3 11/09/2009			J19CH5 SPA-4 11/09/2009			J19CH6 SPA-5 11/09/2009			J19CH7 SPA-6 11/09/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
1,2-Dichlorobenzene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
1,3-Dichlorobenzene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
1,4-Dichlorobenzene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2,4,5-Trichlorophenol	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2,4,6-Trichlorophenol	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2,4-Dichlorophenol	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2,4-Dimethylphenol	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2,4-Dinitrophenol	1700	U	1700	1700	U	1700	1680	U	1680	1690	U	1690	1700	U	1700	1710	U	1710	1700	U	1700
2,4-Dinitrotoluene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2,6-Dinitrotoluene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2-Chloronaphthalene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2-Chlorophenol	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2-Methylnaphthalene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
2-Nitroaniline	1700	U	1700	1700	U	1700	1680	U	1680	1690	U	1690	1700	U	1700	1710	U	1710	1700	U	1700
2-Nitrophenol	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
3+4 Methylphenol (cresol, m+p)	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
3,3'-Dichlorobenzidine	680	U	680	680	U	680	673	U	673	677	U	677	678	U	678	685	U	685	680	U	680
3-Nitroaniline	1700	U	1700	1700	U	1700	1680	U	1680	1690	U	1690	1700	U	1700	1710	U	1710	1700	U	1700
4,6-Dinitro-2-methylphenol	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
4-Bromophenylphenyl ether	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
4-Chloro-3-methylphenol	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
4-Chloroaniline	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
4-Chlorophenylphenyl ether	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
4-Nitroaniline	1700	U	1700	1700	U	1700	1680	U	1680	1690	U	1690	1700	U	1700	1710	U	1710	1700	U	1700
4-Nitrophenol	1700	U	1700	1700	U	1700	1680	U	1680	1690	U	1690	1700	U	1700	1710	U	1710	1700	U	1700
Acenaphthene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Acenaphthylene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Anthracene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Benzo(a)anthracene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Benzo(a)pyrene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Benzo(b)fluoranthene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Benzo(ghi)perylene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Benzo(k)fluoranthene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Bis(2-chloro-1-methylethyl)ether	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Bis(2-Chloroethoxy)methane	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Bis(2-chloroethyl) ether	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Bis(2-ethylhexyl) phthalate	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Butylbenzylphthalate	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340

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Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CH8 SPA-7 11/09/2009			J19CH9 SPA-8 11/09/2009			J19CJ0 SPA-9 11/09/2009			J19CJ1 SPA-10 11/09/2009			J19CJ2 SPA-11 11/09/2009			J19CJ3 SPA-12 11/09/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
1,2-Dichlorobenzene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
1,3-Dichlorobenzene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
1,4-Dichlorobenzene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2,4,5-Trichlorophenol	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2,4,6-Trichlorophenol	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2,4-Dichlorophenol	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2,4-Dimethylphenol	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2,4-Dinitrophenol	1700	U	1700	1700	U	1700	1750	U	1750	1690	U	1690	1690	U	1690	1700	U	1700
2,4-Dinitrotoluene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2,6-Dinitrotoluene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2-Chloronaphthalene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2-Chlorophenol	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2-Methylnaphthalene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
2-Nitroaniline	1700	U	1700	1700	U	1700	1750	U	1750	1690	U	1690	1690	U	1690	1700	U	1700
2-Nitrophenol	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
3+4 Methylphenol (cresol, m+p)	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
3,3'-Dichlorobenzidine	680	U	680	679	U	679	699	U	699	676	U	676	676	U	676	681	U	681
3-Nitroaniline	1700	U	1700	1700	U	1700	1750	U	1750	1690	U	1690	1690	U	1690	1700	U	1700
4,6-Dinitro-2-methylphenol	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
4-Bromophenylphenyl ether	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
4-Chloro-3-methylphenol	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
4-Chloroaniline	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
4-Chlorophenylphenyl ether	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
4-Nitroaniline	1700	U	1700	1700	U	1700	1750	U	1750	1690	U	1690	1690	U	1690	1700	U	1700
4-Nitrophenol	1700	U	1700	1700	U	1700	1750	U	1750	1690	U	1690	1690	U	1690	1700	U	1700
Acenaphthene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Acenaphthylene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Anthracene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Benzo(a)anthracene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Benzo(a)pyrene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Benzo(b)fluoranthene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Benzo(ghi)perylene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Benzo(k)fluoranthene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Bis(2-chloro-1-methylethyl)ether	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Bis(2-Chloroethoxy)methane	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Bis(2-chloroethyl) ether	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Bis(2-ethylhexyl) phthalate	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Butylbenzylphthalate	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341

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Checked	T. E. Queen	Date	04/15/11
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Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CH2 SPA-1 11/09/2009			J19CJ4 Duplicate of J19CH2 11/09/2009			J19CH3 SPA-2 11/09/2009			J19CH4 SPA-3 11/09/2009			J19CH5 SPA-4 11/09/2009			J19CH6 SPA-5 11/09/2009			J19CH7 SPA-6 11/09/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Carbazole	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Chrysene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Di-n-butylphthalate	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Di-n-octylphthalate	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Dibenz[a,h]anthracene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Dibenzofuran	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Diethyl phthalate	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Dimethyl phthalate	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Fluoranthene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Fluorene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Hexachlorobenzene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Hexachlorobutadiene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Hexachlorocyclopentadiene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Hexachloroethane	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Isophorone	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
N-Nitrosodiphenylamine	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Naphthalene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Nitrobenzene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Pentachlorophenol	1700	U	1700	1700	U	1700	1680	U	1680	1690	U	1690	1700	U	1700	1710	U	1710	1700	U	1700
Phenanthrene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Phenol	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340
Pyrene	340	U	340	340	U	340	337	U	337	338	U	338	339	U	339	343	U	343	340	U	340

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Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CH8 SPA-7 11/09/2009			J19CH9 SPA-8 11/09/2009			J19CJ0 SPA-9 11/09/2009			J19CJ1 SPA-10 11/09/2009			J19CJ2 SPA-11 11/09/2009			J19CJ3 SPA-12 11/09/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Carbazole	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Chrysene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Di-n-butylphthalate	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Di-n-octylphthalate	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Dibenz[a,h]anthracene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Dibenzofuran	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Diethyl phthalate	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Dimethyl phthalate	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Fluoranthene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Fluorene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Hexachlorobenzene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Hexachlorobutadiene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Hexachlorocyclopentadiene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Hexachloroethane	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Isophorone	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
N-Nitrosodiphenylamine	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Naphthalene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Nitrobenzene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Pentachlorophenol	1700	U	1700	1700	U	1700	1750	U	1750	1690	U	1690	1690	U	1690	1700	U	1700
Phenanthrene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Phenol	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341
Pyrene	340	U	340	340	U	340	349	U	349	338	U	338	338	U	338	341	U	341

Attachment	1	Sheet No.	30 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CB4 OB-1 11/03/2009			J19CB5 OB-2 11/03/2009			J19CB6 OB-3 11/03/2009			J19CB7 OB-4 11/03/2009			J19CB8 OB-5 11/03/2009			J19CB9 OB-6 11/03/2009			J19CC0 OB-7 11/03/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
1,2-Dichlorobenzene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
1,3-Dichlorobenzene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
1,4-Dichlorobenzene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2,4,5-Trichlorophenol	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2,4,6-Trichlorophenol	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2,4-Dichlorophenol	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2,4-Dimethylphenol	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2,4-Dinitrophenol	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700	1700	U	1700	1700	U	1700
2,4-Dinitrotoluene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2,6-Dinitrotoluene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2-Chloronaphthalene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2-Chlorophenol	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2-Methylnaphthalene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2-Methylphenol (cresol, o-)	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
2-Nitroaniline	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700	1700	U	1700	1700	U	1700
2-Nitrophenol	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
3+4 Methylphenol (cresol, m+p)	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
3,3'-Dichlorobenzidine	677	U	677	680	U	680	678	U	678	679	U	679	679	U	679	682	U	682	679	U	679
3-Nitroaniline	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700	1700	U	1700	1700	U	1700
4,6-Dinitro-2-methylphenol	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
4-Bromophenylphenyl ether	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
4-Chloro-3-methylphenol	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
4-Chloroaniline	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
4-Chlorophenylphenyl ether	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
4-Nitroaniline	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700	1700	U	1700	1700	U	1700
4-Nitrophenol	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700	1700	U	1700	1700	U	1700
Acenaphthene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Acenaphthylene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Anthracene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Benzo(a)anthracene	338	U	338	340	U	340	339	U	339	120	J	340	339	U	339	341	U	341	339	U	339
Benzo(a)pyrene	338	U	338	340	U	340	339	U	339	62.2	J	340	339	U	339	341	U	341	339	U	339
Benzo(b)fluoranthene	338	U	338	340	U	340	339	U	339	84	J	340	339	U	339	341	U	341	339	U	339
Benzo(ghi)perylene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Benzo(k)fluoranthene	338	U	338	340	U	340	339	U	339	90.6	J	340	339	U	339	341	U	341	339	U	339
Bis(2-chloro-1-methylethyl)ether	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Bis(2-Chloroethoxy)methane	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Bis(2-chloroethyl) ether	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Bis(2-ethylhexyl) phthalate	338	U	338	340	U	340	339	U	339	340	U	340	854		339	341	U	341	339	U	339
Butylbenzylphthalate	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339

Attachment	1	Sheet No.	31 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CC1 OB-8 11/03/2009			J19CC2 OB-9 11/03/2009			J19CC3 OB-10 11/03/2009			J19CC4 OB-11 11/03/2009			J19CC5 OB-12 11/03/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
1,2-Dichlorobenzene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
1,3-Dichlorobenzene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
1,4-Dichlorobenzene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2,4,5-Trichlorophenol	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2,4,6-Trichlorophenol	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2,4-Dichlorophenol	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2,4-Dimethylphenol	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2,4-Dinitrophenol	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700
2,4-Dinitrotoluene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2,6-Dinitrotoluene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2-Chloronaphthalene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2-Chlorophenol	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2-Methylnaphthalene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2-Methylphenol (cresol, o-)	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
2-Nitroaniline	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700
2-Nitrophenol	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
3+4 Methylphenol (cresol, m+p)	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
3,3'-Dichlorobenzidine	677	U	677	679	U	679	676	U	676	680	U	680	681	U	681
3-Nitroaniline	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700
4,6-Dinitro-2-methylphenol	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
4-Bromophenylphenyl ether	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
4-Chloro-3-methylphenol	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
4-Chloroaniline	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
4-Chlorophenylphenyl ether	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
4-Nitroaniline	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700
4-Nitrophenol	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700
Acenaphthene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Acenaphthylene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Anthracene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Benzo(a)anthracene	339	U	339	340	U	340	338	U	338	82.3	J	340	340	U	340
Benzo(a)pyrene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Benzo(b)fluoranthene	339	U	339	340	U	340	338	U	338	61.7	J	340	340	U	340
Benzo(ghi)perylene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Benzo(k)fluoranthene	339	U	339	340	U	340	338	U	338	61.1	J	340	340	U	340
Bis(2-chloro-1-methylethyl)ether	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Bis(2-Chloroethoxy)methane	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Bis(2-chloroethyl) ether	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Bis(2-ethylhexyl) phthalate	339	U	339	340	U	340	519		338	249	J	340	340	U	340
Butylbenzylphthalate	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340

Attachment	1	Sheet No.	32 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CB4 OB-1 11/03/2009			J19CB5 OB-2 11/03/2009			J19CB6 OB-3 11/03/2009			J19CB7 OB-4 11/03/2009			J19CB8 OB-5 11/03/2009			J19CB9 OB-6 11/03/2009			J19CC0 OB-7 11/03/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Carbazole	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Chrysene	338	U	338	340	U	340	339	U	339	133	J	340	339	U	339	341	U	341	339	U	339
Di-n-butylphthalate	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Di-n-octylphthalate	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Dibenz[a,h]anthracene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Dibenzofuran	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Diethyl phthalate	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Dimethyl phthalate	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Fluoranthene	338	U	338	340	U	340	339	U	339	301	J	340	339	U	339	341	U	341	339	U	339
Fluorene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Hexachlorobenzene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Hexachlorobutadiene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Hexachlorocyclopentadiene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Hexachloroethane	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Indeno(1,2,3-cd)pyrene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Isophorone	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
N-Nitroso-di-n-dipropylamine	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
N-Nitrosodiphenylamine	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Naphthalene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Nitrobenzene	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Pentachlorophenol	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700	1700	U	1700	1700	U	1700
Phenanthrene	338	U	338	340	U	340	339	U	339	130	J	340	339	U	339	341	U	341	339	U	339
Phenol	338	U	338	340	U	340	339	U	339	340	U	340	339	U	339	341	U	341	339	U	339
Pyrene	338	U	338	340	U	340	339	U	339	242	J	340	339	U	339	341	U	341	339	U	339

Attachment	1	Sheet No.	33 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Semi-Volatile Organic Analysis Verification Sampling Results. (16 Pages)

Constituent	J19CC1 OB-8 11/03/2009			J19CC2 OB-9 11/03/2009			J19CC3 OB-10 11/03/2009			J19CC4 OB-11 11/03/2009			J19CC5 OB-12 11/03/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Carbazole	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Chrysene	339	U	339	340	U	340	338	U	338	94.4	J	340	340	U	340
Di-n-butylphthalate	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Di-n-octylphthalate	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Dibenz[a,h]anthracene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Dibenzofuran	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Diethyl phthalate	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Dimethyl phthalate	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Fluoranthene	339	U	339	340	U	340	338	U	338	183	J	340	340	U	340
Fluorene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Hexachlorobenzene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Hexachlorobutadiene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Hexachlorocyclopentadiene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Hexachloroethane	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Indeno(1,2,3-cd)pyrene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Isophorone	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
N-Nitroso-di-n-dipropylamine	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
N-Nitrosodiphenylamine	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Naphthalene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Nitrobenzene	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Pentachlorophenol	1690	U	1690	1700	U	1700	1690	U	1690	1700	U	1700	1700	U	1700
Phenanthrene	339	U	339	340	U	340	338	U	338	68	J	340	340	U	340
Phenol	339	U	339	340	U	340	338	U	338	340	U	340	340	U	340
Pyrene	339	U	339	340	U	340	338	U	338	158	J	340	340	U	340

Attachment	1	Sheet No.	34 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site PAH Verification Sampling Results. (5 Pages)

Constituent	J19CC8 SZ-3 11/10/2009			J19CD8 Duplicate of J19CC8 11/10/2009			J19CC6 SZ-1 11/10/2009			J19CC7 SZ-2 11/10/2009			J19CC9 SZ-4 11/10/2009			J19CD0 SZ-5 11/10/2009			J19CD1 SZ-6 11/10/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Acenaphthene	34.3	U	34.3	33.9	U	33.9	33.8	U	33.8	36	U	36.0	33.7	U	33.7	33.4	U	33.4	33.6	U	33.6
Acenaphthylene	34.3	U	34.3	33.9	U	33.9	33.8	U	33.8	36	U	36.0	33.7	U	33.7	33.4	U	33.4	33.6	U	33.6
Anthracene	3.43	U	3.43	3.39	U	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	3.34	U	3.34	3.36	U	3.36
Benzo(a)anthracene	10.1		3.43	3.39	J	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	11.8		3.34	3.36	U	3.36
Benzo(a)pyrene	8.56		3.43	2.54	J	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	8.34		3.34	3.36	U	3.36
Benzo(b)fluoranthene	13.9		3.43	7.11		3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	15.2		3.34	3.36	U	3.36
Benzo(ghi)perylene	3.43	U	3.43	3.39	U	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	3.34	U	3.34	3.36	U	3.36
Benzo(k)fluoranthene	4.62		3.43	1.52	J	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	5.01		3.34	3.36	U	3.36
Chrysene	3.42	J	3.43	3.05	J	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	12.8		3.34	3.36	U	3.36
Dibenz[a,h]anthracene	3.43	U	3.43	3.39	U	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	3.34	U	3.34	3.36	U	3.36
Fluoranthene	24.1		3.43	7.62		3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	30.5		3.34	3.36	U	3.36
Fluorene	3.43	U	3.43	3.39	U	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	3.34	U	3.34	3.36	U	3.36
Indeno(1,2,3-cd)pyrene	5.82		3.43	3.39	U	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	6.34		3.34	3.36	U	3.36
Naphthalene	34.3	U	34.3	33.9	U	33.9	33.8	U	33.8	36	U	36.0	33.7	U	33.7	33.4	U	33.4	33.6	U	33.6
Phenanthrene	6.16		3.43	1.19	J	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	4.51		3.34	3.36	U	3.36
Pyrene	10.3		3.43	2.71	J	3.39	3.38	U	3.38	3.6	U	3.60	3.37	U	3.37	13.9		3.34	3.36	U	3.36

Constituent	J19CD2 SZ-7 11/10/2009			J19CD3 SZ-8 11/10/2009			J19CD4 SZ-9 11/10/2009			J19CD5 SZ-10 11/10/2009			J19CD6 SZ-11 11/10/2009			J19CD7 SZ-12 11/10/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Acenaphthene	33.3	U	33.3	34.3	U	34.3	34.5	U	34.5	34.4	U	34.4	34.1	U	34.1	34.2	U	34.2
Acenaphthylene	33.3	U	33.3	34.3	U	34.3	34.5	U	34.5	34.4	U	34.4	34.1	U	34.1	34.2	U	34.2
Anthracene	3.33	U	3.33	3.43	U	3.43	3.45	U	3.45	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42
Benzo(a)anthracene	3.33	U	3.33	3.43	U	3.43	2.75	J	3.45	3.44	U	3.44	1.53	J	3.41	3.42	U	3.42
Benzo(a)pyrene	3.33	U	3.33	3.43	U	3.43	3.45	U	3.45	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42
Benzo(b)fluoranthene	3.33	U	3.33	3.43	U	3.43	4.13		3.45	3.44	U	3.44	3.41	U	3.41	1.37	J	3.42
Benzo(ghi)perylene	3.33	U	3.33	3.43	U	3.43	3.45	U	3.45	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42
Benzo(k)fluoranthene	3.33	U	3.33	3.43	U	3.43	1.38	J	3.45	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42
Chrysene	3.33	U	3.33	3.43	U	3.43	1.89	J	3.45	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42
Dibenz[a,h]anthracene	3.33	U	3.33	3.43	U	3.43	3.45	U	3.45	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42
Fluoranthene	3.33	U	3.33	3.43	U	3.43	6.54		3.45	2.06	J	3.44	8.52		3.41	2.22	J	3.42
Fluorene	3.33	U	3.33	3.43	U	3.43	3.45	U	3.45	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42
Indeno(1,2,3-cd)pyrene	3.33	U	3.33	3.43	U	3.43	2.75	J	3.45	3.44	U	3.44	2.73	J	3.41	3.42	U	3.42
Naphthalene	33.3	U	33.3	34.3	U	34.3	34.5	U	34.5	34.4	U	34.4	34.1	U	34.1	34.2	U	34.2
Phenanthrene	3.33	U	3.33	3.43	U	3.43	3.45	U	3.45	3.44	U	3.44	2.55	J	3.41	3.42	U	3.42
Pyrene	3.33	U	3.33	3.43	U	3.43	3.45	U	3.45	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42

[a] Department of Ecology requested additional remediation and re-samples taken at these locations. Original samples are for information only.

Attachment	1	Sheet No.	35 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site PAH Verification Sampling Results. (5 Pages)

Constituent	Re-sample DZ-4 - J1F1J3 [a] 3/16/11			J19CF2 DZ-4 11/10/2009			Re-sample Duplicate of J1F1J3 - J1F1J8 [a] 3/16/11			J19CH1 Duplicate of J19CF2 11/10/2009			J19CD9 DZ-1 11/10/2009			J19CF0 DZ-2 11/10/2009			J19CF1 DZ-3 11/10/2009		
	ug/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Acenaphthene	11	U	11	33.9	U	33.9	11	U	11	33.0	U	33.0	34.9	U	34.9	32.8	U	32.8	34.3	U	34.3
Acenaphthylene	9.8	U	9.8	33.9	U	33.9	9.6	U	9.6	33.0	U	33.0	34.9	U	34.9	32.8	U	32.8	34.3	U	34.3
Anthracene	3.3	U	3.3	24.0		3.39	3.2	U	3.2	11.0		3.30	3.49	U	3.49	3.28	U	3.28	3.43	U	3.43
Benzo(a)anthracene	3.5	U	3.5	186		3.39	3.4	U	3.4	118		3.30	3.49	U	3.49	4.26		3.28	1.88	J	3.43
Benzo(a)pyrene	6.9	U	6.9	134		3.39	6.8	U	6.8	85.1		3.30	3.49	U	3.49	3.28	J	3.28	1.37	J	3.43
Benzo(b)fluoranthene	4.6	U	4.6	284		3.39	4.5	U	4.5	175		3.30	3.49	U	3.49	5.90		3.28	4.11		3.43
Benzo(ghi)perylene	7.8	U	7.8	93.3		3.39	7.6	U	7.6	67.0		3.30	3.49	U	3.49	3.28	J	3.28	3.43	U	3.43
Benzo(k)fluoranthene	4.3	U	4.3	71.8		3.39	4.2	U	4.2	49.2		3.30	3.49	U	3.49	2.29	J	3.28	1.37	J	3.43
Chrysene	5.2	U	5.2	163		3.39	5.1	U	5.1	76.8		3.30	3.49	U	3.49	2.46	J	3.28	1.37	J	3.43
Dibenz[a,h]anthracene	12	U	12	20.3		3.39	12	U	12	11.7		3.30	3.49	U	3.49	3.28	U	3.28	3.43	U	3.43
Fluoranthene	14	U	14	564		3.39	14	U	14	328		3.30	3.49	U	3.49	11.0		3.28	3.94		3.43
Fluorene	5.7	U	5.7	3.72		3.39	5.6	U	5.6	1.48	J	3.30	3.49	U	3.49	3.28	U	3.28	3.43	U	3.43
Indeno(1,2,3-cd)pyrene	13	U	13	81.6		3.39	13	U	13	57.1		3.30	3.49	U	3.49	3.28	U	3.28	3.43	U	3.43
Naphthalene	13	U	13	33.9	U	33.9	13	U	13	33.0	U	33.0	34.9	U	34.9	32.8	U	32.8	34.3	U	34.3
Phenanthrene	13	U	13	117		3.39	13	U	13	49.7		3.30	3.49	U	3.49	3.77		3.28	1.03	J	3.43
Pyrene	13	U	13	386		3.39	13	U	13	240		3.30	3.49	U	3.49	4.26		3.28	3.43	U	3.43

Constituent	Re-sample DZ-5 - J1F1J4 [a] 3/16/11			J19CF3 DZ-5 11/10/2009			Re-sample DZ-6 - J1F1J5 [a] 3/16/11			J19CF4 DZ-6 11/10/2009			J19CF5 DZ-7 11/10/2009			Re-sample DZ-8 - J1F1J6 [a] 3/16/11			J19CF6 DZ-8 11/10/2009		
	ug/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL
Acenaphthene	10	U	10	34	U	34.0	10	U	10	138	UD	138	33.4	U	33.4	11	U	11	34.9	U	34.9
Acenaphthylene	9.2	U	9.2	34	U	34.0	9.4	U	9.4	138	UD	138	33.4	U	33.4	9.6	U	9.6	34.9	U	34.9
Anthracene	3.1	U	3.1	3.4	U	3.40	3.2	U	3.2	14.3	D	13.8	3.34	U	3.34	3.3	U	3.3	2.09	J	3.49
Benzo(a)anthracene	3.3	U	3.3	3.39	J	3.40	360		3.3	1040	D	13.8	3.34	U	3.34	41		3.4	79.2		3.49
Benzo(a)pyrene	6.6	U	6.6	2.71	J	3.40	230		6.7	1090	D	13.8	3.34	U	3.34	39		6.9	52.8		3.49
Benzo(b)fluoranthene	4.3	U	4.3	7.29		3.40	360		4.4	1900	D	13.8	3.34	U	3.34	38		4.5	122		3.49
Benzo(ghi)perylene	7.4	U	7.4	3.4	U	3.40	190		7.5	784	D	13.8	3.34	U	3.34	7.7	U	7.7	46.7		3.49
Benzo(k)fluoranthene	4.0	U	4.0	2.71	J	3.40	200		4.1	586	D	13.8	3.34	U	3.34	23		4.2	35.4		3.49
Chrysene	5.0	U	5.0	2.2	J	3.40	330		5.1	917	D	13.8	3.34	U	3.34	40	J	5.2	62.3		3.49
Dibenz[a,h]anthracene	11	U	11	3.4	U	3.40	36	X	12	160	D	13.8	3.34	U	3.34	12	U	12	9.59		3.49
Fluoranthene	13	U	13	9.15		3.40	340		14	2010	D	13.8	3.34	U	3.34	14	U	14	197		3.49
Fluorene	5.4	U	5.4	3.4	U	3.40	5.5	U	5.5	7.77	JD	13.8	3.34	U	3.34	5.7	U	5.7	3.49	U	3.49
Indeno(1,2,3-cd)pyrene	12	U	12	3.4	U	3.40	220		13	723	D	13.8	3.34	U	3.34	22	J	13	47.4		3.49
Naphthalene	12	U	12	34	U	34.0	13	U	13	138	UD	138	33.4	U	33.4	13	U	13	34.9	U	34.9
Phenanthrene	12	U	12	3.4	U	3.40	43		13	98.8	D	13.8	3.34	U	3.34	13	U	13	23.4		3.49
Pyrene	12	U	12	1.86	J	3.40	600		13	2110	D	13.8	3.34	U	3.34	21	J	13	138		3.49

Attachment	1	Sheet No.	36 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site PAH Verification Sampling Results. (5 Pages)

Constituent	J19CF7 DZ-9 11/10/2009			Re-sample DZ-10 - J1F1J7 [a] 3/16/11			J19CF8 DZ-10 11/10/2009			J19CF9 DZ-11 11/10/2009			J19CH0 DZ-12 11/10/2009		
	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Acenaphthene	34.1	U	34.1	11	U	11	36.6	U	36.6	33.9	U	33.9	34	U	34
Acenaphthylene	34.1	U	34.1	9.9	U	9.9	36.6	U	36.6	33.9	U	33.9	34	U	34
Anthracene	3.41	U	3.41	3.4	U	3.4	3.66	U	3.66	3.39	U	3.39	3.4	U	3.4
Benzo(a)anthracene	3.41	U	3.41	38		3.5	1.83	J	3.66	7.1		3.39	1.87	J	3.4
Benzo(a)pyrene	3.41	U	3.41	21		7.1	1.64	J	3.66	6.76		3.39	1.53	J	3.4
Benzo(b)fluoranthene	3.41	U	3.41	38	X	4.6	5.11		3.66	11.2		3.39	2.55	J	3.4
Benzo(ghi)perylene	3.41	U	3.41	7.9	U	7.9	3.66	U	3.66	6.76		3.39	3.4	U	3.4
Benzo(k)fluoranthene	3.41	U	3.41	23		4.3	3.65	J	3.66	3.89		3.39	1.02	J	3.4
Chrysene	3.41	U	3.41	39	J	5.3	3.66	U	3.66	2.2	J	3.39	3.4	U	3.4
Dibenz[a,h]anthracene	3.41	U	3.41	12	U	12	3.66	U	3.66	3.39	U	3.39	3.4	U	3.4
Fluoranthene	3.41	U	3.41	49		14	5.48		3.66	21.3		3.39	4.92		3.4
Fluorene	3.41	U	3.41	5.8	U	5.8	3.66	U	3.66	3.39	U	3.39	3.4	U	3.4
Indeno(1,2,3-cd)pyrene	3.41	U	3.41	20	J	13	3.66	U	3.66	6.43		3.39	3.4	U	3.4
Naphthalene	34.1	U	34.1	13	U	13	36.6	U	36.6	33.9	U	33.9	34	U	34
Phenanthrene	3.41	U	3.41	13	U	13	3.66	U	3.66	3.89		3.39	1.53	J	3.4
Pyrene	3.41	U	3.41	56		13	3.66	U	3.66	9.81		3.39	3.4	U	3.4

Attachment	1	Sheet No.	37 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site PAH Verification Sampling Results. (5 Pages)

Constituent	J19CH2 SPA-1 11/09/2009			J19CJ4 Duplicate of J19CH2 11/09/2009			J19CH3 SPA-2 11/09/2009			J19CH4 SPA-3 11/09/2009			J19CH5 SPA-4 11/09/2009			J19CH6 SPA-5 11/09/2009			J19CH7 SPA-6 11/09/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Acenaphthene	34.4	U	34.4	34.4	U	34.4	34.1	U	34.1	34.2	U	34.2	34.3	U	34.3	34.7	U	34.7	34.4	U	34.4
Acenaphthylene	34.4	U	34.4	34.4	U	34.4	34.1	U	34.1	34.2	U	34.2	34.3	U	34.3	34.7	U	34.7	34.4	U	34.4
Anthracene	3.44	U	3.44	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42	3.43	U	3.43	3.47	U	3.47	3.44	U	3.44
Benzo(a)anthracene	3.44	U	3.44	2.3	J	3.44	1.07	J	3.41	3.42	U	3.42	1.01	J	3.43	10.2		3.47	3.44	U	3.44
Benzo(a)pyrene	3.44	U	3.44	1.56	J	3.44	3.41	U	3.41	3.42	U	3.42	3.43	U	3.43	4.48		3.47	3.44	U	3.44
Benzo(b)fluoranthene	3.44	U	3.44	3.38	J	3.44	1.28	J	3.41	3.42	U	3.42	1.52	J	3.43	9.76		3.47	3.44	U	3.44
Benzo(ghi)perylene	3.44	U	3.44	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42	3.43	U	3.43	2.75	J	3.47	3.44	U	3.44
Benzo(k)fluoranthene	3.44	U	3.44	1.17	J	3.44	3.41	U	3.41	3.42	U	3.42	3.43	U	3.43	3.91		3.47	3.44	U	3.44
Chrysene	3.44	U	3.44	1.46	J	3.44	1.19	J	3.41	1.03	J	3.42	1.01	J	3.43	18.2		3.47	3.44	U	3.44
Dibenz[a,h]anthracene	1.39	J	1.39	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42	3.43	U	3.43	3.47	U	3.47	3.44	U	3.44
Fluoranthene	3.44	U	3.44	10.4		3.44	3.41	U	3.41	3.42	U	3.42	2.74	J	3.43	18.2		3.47	3.44	U	3.44
Fluorene	3.44	U	3.44	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42	3.43	U	3.43	3.47	U	3.47	3.44	U	3.44
Indeno(1,2,3-cd)pyrene	3.44	U	3.44	3.44	U	3.44	3.41	U	3.41	3.42	U	3.42	3.43	U	3.43	3.47	U	3.47	3.44	U	3.44
Naphthalene	34.4	U	34.4	34.4	U	34.4	34.1	U	34.1	34.2	U	34.2	34.3	U	34.3	34.7	U	34.7	34.4	U	34.4
Phenanthrene	3.44	U	3.44	1.86	J	3.44	3.41	U	3.41	3.42	U	3.42	3.43	U	3.43	3.11	J	3.47	3.44	U	3.44
Pyrene	3.44	U	3.44	3.56		3.44	3.41	U	3.41	3.42	U	3.42	3.43	U	3.43	8.96		3.47	3.44	U	3.44

Constituent	J19CH8 SPA-7 11/09/2009			J19CH9 SPA-8 11/09/2009			J19CJ0 SPA-9 11/09/2009			J19CJ1 SPA-10 11/09/2009			J19CJ2 SPA-11 11/09/2009			J19CJ3 SPA-12 11/09/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Acenaphthene	34.4	U	34.4	34.4	U	34.4	35.4	U	35.4	34.2	U	34.2	34.2	U	34.2	34.5	U	34.5
Acenaphthylene	34.4	U	34.4	34.4	U	34.4	35.4	U	35.4	34.2	U	34.2	34.2	U	34.2	34.5	U	34.5
Anthracene	3.44	U	3.44	3.44	U	3.44	3.54	U	3.54	3.42	U	3.42	3.42	U	3.42	3.45	U	3.45
Benzo(a)anthracene	3.44	U	3.44	3.44	U	3.44	2.42	J	3.54	3.42	U	3.42	3.42	U	3.42	3.87		3.45
Benzo(a)pyrene	3.44	U	3.44	3.44	U	3.44	2.13	J	3.54	3.42	U	3.42	3.42	U	3.42	2.92	J	3.45
Benzo(b)fluoranthene	0.995	J	3.44	3.44	U	3.44	5.87		3.54	3.42	U	3.42	3.42	U	3.42	7.74		3.45
Benzo(ghi)perylene	3.44	U	3.44	3.44	U	3.44	1.09	J	3.54	3.42	U	3.42	3.42	U	3.42	1.57	J	3.45
Benzo(k)fluoranthene	3.44	U	3.44	3.44	U	3.44	1.53	J	3.54	3.42	U	3.42	3.42	U	3.42	1.84	J	3.45
Chrysene	3.44	U	3.44	3.44	U	3.44	1.87	J	3.54	3.42	U	3.42	3.42	U	3.42	2.99	J	3.45
Dibenz[a,h]anthracene	3.44	U	3.44	3.44	U	3.44	3.54	U	3.54	3.42	U	3.42	3.42	U	3.42	3.45	U	3.45
Fluoranthene	3.44	U	3.44	1.78	J	3.44	9.01		3.54	3.42	U	3.42	1.52	J	3.42	12.7		3.45
Fluorene	3.44	U	3.44	3.44	U	3.44	3.54	U	3.54	3.42	U	3.42	3.42	U	3.42	3.45	U	3.45
Indeno(1,2,3-cd)pyrene	3.44	U	3.44	3.44	U	3.44	3.54	U	3.54	3.42	U	3.42	3.42	U	3.42	3.45	U	3.45
Naphthalene	34.4	U	34.4	34.4	U	34.4	35.4	U	35.4	34.2	U	34.2	34.2	U	34.2	34.5	U	34.5
Phenanthrene	3.44	U	3.44	3.44	U	3.44	1.11	J	3.54	3.42	U	3.42	3.42	U	3.42	2.43	J	3.45
Pyrene	3.44	U	3.44	3.44	U	3.44	1.87	J	3.54	3.42	U	3.42	3.42	U	3.42	5.68		3.45

Attachment	I	Sheet No.	38 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site PAH Verification Sampling Results. (5 Pages)

Constituent	J19CB4 OB-1 11/03/2009			J19CB5 OB-2 11/03/2009			J19CB6 OB-3 11/03/2009			J19CB7 OB-4 11/03/2009			J19CB8 OB-5 11/03/2009			J19CB9 OB-6 11/03/2009			J19CC0 OB-7 11/03/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Acenaphthene	34.2	U	34.2	34.4	U	34.4	34.3	U	34.3	34.4	U	34.4	34.3	U	34.3	34.5	U	34.5	34.3	U	34.3
Acenaphthylene	34.2	U	34.2	34.4	U	34.4	34.3	U	34.3	34.4	U	34.4	34.3	U	34.3	34.5	U	34.5	34.3	U	34.3
Anthracene	3.42	U	3.42	3.44	U	3.44	3.43	U	3.43	12.2		3.44	3.43	U	3.43	3.45	U	3.45	3.43	U	3.43
Benzo(a)anthracene	3.21	J	3.42	1.6	J	3.44	1.83	J	3.43	77.8		3.44	4.8		3.43	3.36	J	3.45	13		3.43
Benzo(a)pyrene	2.91	J	3.42	1.44	J	3.44	1.75	J	3.43	61.3		3.44	2.69	J	3.43	2.88	J	3.45	9.75		3.43
Benzo(b)fluoranthene	5.35		3.42	2.95	J	3.44	3.2	J	3.43	96.4		3.44	5.64		3.43	5.05		3.45	13.4		3.43
Benzo(ghi)perylene	3.42	U	3.42	3.44	U	3.44	3.43	U	3.43	35.9		3.44	4.04		3.43	1.26	J	3.45	6.29		3.43
Benzo(k)fluoranthene	1.62	J	3.42	0.91	J	3.44	1.1	J	3.43	26.5		3.44	1.89	J	3.43	1.72	J	3.45	5.12		3.43
Chrysene	2.67	J	3.42	0.927	J	3.44	3.43	U	3.43	52.4		3.44	3.94		3.43	3.25	J	3.45	9.58		3.43
Dibenz[a,h]anthracene	3.42	U	3.42	3.44	U	3.44	3.43	U	3.43	6.73		3.44	3.43	U	3.43	3.45	U	3.45	1.06	J	3.43
Fluoranthene	8.00		3.42	5.51		3.44	6.75		3.43	254		3.44	7.25		3.43	8.35		3.45	19.5		3.43
Fluorene	3.42	U	3.42	3.44	U	3.44	3.43	U	3.43	3.44	U	3.44	3.43	U	3.43	3.45	U	3.45	3.43	U	3.43
Indeno(1,2,3-cd)pyrene	3.42	U	3.42	3.44	U	3.44	3.43	U	3.43	31.1		3.44	1.11	J	3.43	3.45	U	3.45	5.54		3.43
Naphthalene	34.2	U	34.2	34.4	U	34.4	34.3	U	34.3	34.4	U	34.4	34.3	U	34.3	34.5	U	34.5	34.3	U	34.3
Phenanthrene	1.97	J	3.42	3.44	U	3.44	0.925	J	3.43	55.6		3.44	4.64		3.43	1.95	J	3.45	5.98		3.43
Pyrene	2.82	J	3.42	1.94	J	3.44	0.907	J	3.43	161		3.44	6.98		3.43	2.98	J	3.45	13.3		3.43

Constituent	J19CC1 OB-8 11/03/2009			J19CC2 OB-9 11/03/2009			J19CC3 OB-10 11/03/2009			J19CC4 OB-11 11/03/2009			J19CC5 OB-12 11/03/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Acenaphthene	34.3	U	34.3	34.4	U	34.4	34.2	U	34.2	34.4	U	34.4	34.5	U	34.5
Acenaphthylene	34.3	U	34.3	34.4	U	34.4	34.2	U	34.2	34.4	U	34.4	34.5	U	34.5
Anthracene	3.43	U	3.43	3.44	U	3.44	0.905	J	3.42	0.979	J	3.44	3.45	U	3.45
Benzo(a)anthracene	51.7		3.43	5.75		3.44	25.8		3.42	11.3		3.44	3.45	U	3.45
Benzo(a)pyrene	40.8		3.43	3.84		3.44	18.7		3.42	9.81		3.44	3.45	U	3.45
Benzo(b)fluoranthene	41.8		3.43	7.38		3.44	37.2		3.42	15.5		3.44	3.45	U	3.45
Benzo(ghi)perylene	24.4		3.43	4.07		3.44	14.3		3.42	7.51		3.44	3.45	U	3.45
Benzo(k)fluoranthene	18.8		3.43	2.33	J	3.44	10.2		3.42	5.03		3.44	3.45	U	3.45
Chrysene	37.7		3.43	5.21		3.44	19.2		3.42	7.37		3.44	3.45	U	3.45
Dibenz[a,h]anthracene	5.18		3.43	3.44	U	3.44	2.48	J	3.42	1.13	J	3.44	3.45	U	3.45
Fluoranthene	77.7		3.43	7.02		3.44	64.2		3.42	28.7		3.44	2.77	J	3.45
Fluorene	3.43	U	3.43	3.44	U	3.44	3.42	U	3.42	3.44	U	3.44	3.45	U	3.45
Indeno(1,2,3-cd)pyrene	24		3.43	3.44	U	3.44	13.8		3.42	6.44		6.44	3.45	U	3.45
Naphthalene	34.3	U	34.3	34.4	U	34.4	34.2	U	34.2	34.4	U	34.4	34.5	U	34.5
Phenanthrene	7.85		3.43	1.39	J	3.44	12.2		3.42	11.2		3.44	3.45	U	3.45
Pyrene	67.5		3.43	2.21	J	3.44	48.2		3.42	13.1		3.44	0.911	J	3.45

Attachment	1	Sheet No.	39 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	1

Attachment 1. 116-D-5 Waste Site Pesticides Verification Sampling Results. (5 Pages)

Constituent	J19CC8 SZ-3 11/10/2009			J19CD8 Duplicate of J19CC8 11/10/09			J19CC6 SZ-1 11/10/2009			J19CC7 SZ-2 11/10/2009			J19CC9 SZ-4 11/10/2009			J19CD0 SZ-5 11/10/2009			J19CD1 SZ-6 11/10/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Aldrin	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Alpha-BHC	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
alpha-Chlordane	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
beta-BHC	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Delta-BHC	1.36	UJD	1.36	1.34	UJD	1.34	1.35	UJD	1.35	1.42	UJD	1.42	1.36	UJD	1.36	1.36	UJD	1.36	1.34	UJD	1.34
4,4'-DDD	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
4,4'-DDE	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
4,4'-DDT	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Dieldrin	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Endosulfan I	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Endosulfan II	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Endosulfan sulfate	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Endrin	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Endrin aldehyde	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Endrin ketone	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Gamma-BHC (Lindane)	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
gamma-Chlordane	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Heptachlor	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Heptachlor epoxide	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Methoxychlor	1.36	UD	1.36	1.34	UD	1.34	1.35	UD	1.35	1.42	UD	1.42	1.36	UD	1.36	1.36	UD	1.36	1.34	UD	1.34
Toxaphene	13.6	UJD	13.6	13.4	UJD	13.4	13.5	UJD	13.5	14.2	UJD	14.2	13.6	UJD	13.6	13.6	UJD	13.6	13.4	UJD	13.4

Constituent	J19CD2 SZ-7 11/10/2009			J19CD3 SZ-8 11/10/2009			J19CD4 SZ-9 11/10/2009			J19CD5 SZ-10 11/10/2009			J19CD6 SZ-11 11/10/2009			J19CD7 SZ-12 11/10/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Aldrin	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Alpha-BHC	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
alpha-Chlordane	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
beta-BHC	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Delta-BHC	1.35	UJD	1.35	1.35	UJD	1.35	1.36	UJD	1.36	1.36	UJD	1.36	1.35	UJD	1.35	1.35	UJD	1.35
4,4'-DDD	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
4,4'-DDE	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
4,4'-DDT	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Dieldrin	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Endosulfan I	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Endosulfan II	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Endosulfan sulfate	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Endrin	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Endrin aldehyde	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Endrin ketone	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Gamma-BHC (Lindane)	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
gamma-Chlordane	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Heptachlor	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Heptachlor epoxide	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Methoxychlor	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35
Toxaphene	13.5	UJD	13.5	13.5	UJD	13.5	13.6	UJD	13.6	13.6	UJD	13.6	13.5	UJD	13.5	13.5	UJD	13.5

[a] Department of Ecology requested additional remediation and re-samples taken at these locations. Original samples are for information only.

Attachment	1	Sheet No.	40 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Pesticides Verification Sampling Results. (5 Pages)

Constituent	Re-sample DZ-4 - J1F1J3 * 3/16/11			J19CF2 DZ-4 11/10/2009			Re-sample Duplicate of J1F1J3 - J1F1J8 * 3/16/11			J19CH1 Duplicate of J19CF2 11/10/2009			J19CD9 DZ-1 11/10/2009			J19CF0 DZ-2 11/10/2009			J19CF1 DZ-3 11/10/2009		
	ug/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Aldrin	0.27	U	0.27	1.36	UD	1.36	0.27	U	0.27	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Alpha-BHC	0.23	U	0.23	1.36	UD	1.36	0.23	U	0.23	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
alpha-Chlordane	0.35	U	0.35	1.36	UD	1.36	0.34	U	0.34	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
beta-BHC	0.72	U	0.72	1.36	UD	1.36	0.71	U	0.71	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Delta-BHC	0.43	U	0.43	1.36	UD	1.36	0.43	U	0.43	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
4,4'-DDD	0.59	U	0.59	1.36	UD	1.36	0.58	U	0.58	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
4,4'-DDE	0.26	U	0.26	1.36	UD	1.36	0.25	U	0.25	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
4,4'-DDT	0.64	U	0.64	1.36	UD	1.36	0.63	U	0.63	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Dieldrin	0.23	U	0.23	1.36	UD	1.36	0.22	U	0.22	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Endosulfan I	0.19	U	0.19	1.36	UD	1.36	0.19	U	0.19	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Endosulfan II	0.31	U	0.31	1.36	UD	1.36	0.30	U	0.30	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Endosulfan sulfate	0.30	U	0.30	1.36	UD	1.36	0.29	U	0.29	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Endrin	0.33	U	0.33	1.36	UD	1.36	0.32	U	0.32	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Endrin aldehyde	0.19	UN	0.19	1.36	UD	1.36	0.18	U	0.18	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Endrin ketone	0.53	U	0.53	1.36	UD	1.36	0.52	U	0.52	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Gamma-BHC (Lindane)	0.50	U	0.50	1.36	UD	1.36	0.49	U	0.49	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
gamma-Chlordane	0.29	U	0.29	1.36	UD	1.36	0.28	U	0.28	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Heptachlor	0.23	U	0.23	1.36	UD	1.36	0.23	U	0.23	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Heptachlor epoxide	0.46	U	0.46	1.36	UD	1.36	0.45	U	0.45	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Methoxychlor	0.49	U	0.49	1.36	UD	1.36	0.48	U	0.48	1.36	UD	1.36	1.4	UD	1.4	1.36	UD	1.36	1.38	UD	1.38
Toxaphene	17.0	U	17.0	13.6	UJD	13.6	17.0	U	17.0	13.6	UJD	13.6	14.0	UJD	14.0	13.6	UJD	13.6	13.8	UJD	13.8

Constituent	Re-sample DZ-5 - J1F1J4 * 3/16/11			J19CF3 DZ-5 11/10/2009			Re-sample DZ-6 - J1F1J5 * 3/16/11			J19CF4 DZ-6 11/10/2009			J19CF5 DZ-7 11/10/2009			Re-sample DZ-8 - J1F1J6 * 3/16/11			J19CF6 DZ-8 11/10/2009		
	ug/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL
Aldrin	0.26	U	0.26	1.36	UD	1.36	0.27	U	0.27	1.38	UD	1.38	1.36	UD	1.36	0.27	U	0.27	1.39	UD	1.39
Alpha-BHC	0.22	U	0.22	1.36	UD	1.36	0.23	U	0.23	1.38	UD	1.38	1.36	UD	1.36	0.23	U	0.23	1.39	UD	1.39
alpha-Chlordane	0.33	U	0.33	1.36	UD	1.36	0.34	U	0.34	1.38	UD	1.38	1.36	UD	1.36	0.35	U	0.35	1.39	UD	1.39
beta-BHC	0.68	U	0.68	1.36	UD	1.36	0.70	U	0.70	1.38	UD	1.38	1.36	UD	1.36	0.72	U	0.72	1.39	UD	1.39
Delta-BHC	0.41	U	0.41	1.36	UD	1.36	0.42	U	0.42	1.38	UD	1.38	1.36	UD	1.36	0.43	U	0.43	1.39	UD	1.39
4,4'-DDD	0.56	U	0.56	1.36	UD	1.36	0.58	U	0.58	3.15	JD	3.15	1.36	UD	1.36	0.59	U	0.59	1.39	UD	1.39
4,4'-DDE	0.25	U	0.25	1.36	UD	1.36	0.25	U	0.25	1.38	UD	1.38	1.36	UD	1.36	0.26	U	0.26	1.39	UD	1.39
4,4'-DDT	0.61	U	0.61	1.36	UD	1.36	1.0	J	0.62	1.38	UD	1.38	1.36	UD	1.36	0.64	U	0.64	1.39	UD	1.39
Dieldrin	0.22	U	0.22	1.36	UD	1.36	0.22	U	0.22	1.38	UD	1.38	1.36	UD	1.36	0.23	U	0.23	1.39	UD	1.39
Endosulfan I	0.18	U	0.18	1.36	UD	1.36	0.19	U	0.19	1.38	UD	1.38	1.36	UD	1.36	0.19	U	0.19	1.39	UD	1.39
Endosulfan II	0.30	U	0.30	1.36	UD	1.36	0.30	U	0.30	1.38	UD	1.38	1.36	UD	1.36	0.31	U	0.31	1.39	UD	1.39
Endosulfan sulfate	0.28	U	0.28	1.36	UD	1.36	0.29	U	0.29	1.38	UD	1.38	1.36	UD	1.36	0.30	U	0.30	1.39	UD	1.39
Endrin	0.32	U	0.32	1.36	UD	1.36	0.32	U	0.32	8.39	D	1.38	1.36	UD	1.36	0.33	U	0.33	1.39	UD	1.39
Endrin aldehyde	0.18	U	0.18	1.36	UD	1.36	0.18	U	0.18	1.38	UD	1.38	1.36	UD	1.36	0.18	U	0.18	1.39	UD	1.39
Endrin ketone	0.50	U	0.50	1.36	UD	1.36	0.52	U	0.52	1.38	UD	1.38	1.36	UD	1.36	0.53	U	0.53	1.39	UD	1.39
Gamma-BHC (Lindane)	0.48	U	0.48	1.36	UD	1.36	0.49	U	0.49	1.38	UD	1.38	1.36	UD	1.36	0.50	U	0.50	1.39	UD	1.39
gamma-Chlordane	0.27	U	0.27	1.36	UD	1.36	0.28	U	0.28	2.45	JD	1.38	1.36	UD	1.36	0.29	U	0.29	1.39	UD	1.39
Heptachlor	0.22	U	0.22	1.36	UD	1.36	0.23	U	0.23	1.38	UD	1.38	1.36	UD	1.36	0.23	U	0.23	1.39	UD	1.39
Heptachlor epoxide	0.44	U	0.44	1.36	UD	1.36	0.45	U	0.45	2.10	JD	1.38	1.36	UD	1.36	0.46	U	0.46	2.81	JD	1.39
Methoxychlor	0.46	U	0.46	1.36	UD	1.36	0.48	U	0.48	1.38	UD	1.38	1.36	UD	1.36	0.49	U	0.49	1.39	UD	1.39
Toxaphene	16.0	U	16.0	13.6	UJD	13.6	17.0	U	17.0	13.8	UJD	13.8	13.6	UJD	13.6	17.0	U	17.0	13.9	UJD	13.9

Attachment	1	Sheet No.	41 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Pesticides Verification Sampling Results. (5 Pages)

Constituent	J19CF7 DZ-9 11/10/2009			Re-sample DZ-10 - J1F1J7 * 3/16/11			J19CF8 DZ-10 11/10/2009			J19CF9 DZ-11 11/10/2009			J19CH0 DZ-12 11/10/2009		
	µg/kg	Q	PQL	ug/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Aldrin	1.37	UD	1.37	0.28	U	0.28	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Alpha-BHC	1.37	UD	1.37	0.24	U	0.24	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
alpha-Chlordane	1.37	UD	1.37	0.36	U	0.36	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
beta-BHC	1.37	UD	1.37	0.74	U	0.74	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Delta-BHC	1.37	UD	1.37	0.45	U	0.45	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
4,4'-DDD	1.37	UD	1.37	0.61	U	0.61	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
4,4'-DDE	1.37	UD	1.37	0.27	U	0.27	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
4,4'-DDT	1.37	UD	1.37	0.89	J	0.66	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Dieldrin	1.37	UD	1.37	0.23	U	0.23	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Endosulfan I	1.37	UD	1.37	0.20	U	0.20	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Endosulfan II	1.37	UD	1.37	0.32	U	0.32	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Endosulfan sulfate	1.37	UD	1.37	0.31	U	0.31	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Endrin	1.37	UD	1.37	0.34	U	0.34	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Endrin aldehyde	1.37	UD	1.37	0.19	U	0.19	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Endrin ketone	1.37	UD	1.37	0.55	U	0.55	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Gamma-BHC (Lindane)	1.37	UD	1.37	0.52	U	0.52	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
gamma-Chlordane	1.37	UD	1.37	0.30	U	0.30	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Heptachlor	1.37	UD	1.37	0.24	U	0.24	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Heptachlor epoxide	1.37	UD	1.37	0.48	U	0.48	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Methoxychlor	1.37	UD	1.37	0.50	U	0.50	1.45	UD	1.45	1.35	UD	1.35	1.35	UD	1.35
Toxaphene	13.7	UJD	13.7	18.0	U	18.0	14.5	UJD	14.5	13.5	UJD	13.5	13.5	UJD	13.5

Attachment	1	Sheet No.	42 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Pesticides Verification Sampling Results. (5 Pages)

Constituent	J19CH2 SPA-1 11/09/2009			J19CJ4 Duplicate of J19CH2 11/09/09			J19CH3 SPA-2 11/09/2009			J19CH4 SPA-3 11/09/2009			J19CH5 SPA-4 11/09/2009			J19CH6 SPA-5 11/09/2009			J19CH7 SPA-6 11/09/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Aldrin	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Alpha-BHC	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
alpha-Chlordane	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
beta-BHC	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Delta-BHC	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
4,4'-DDD	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
4,4'-DDE	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
4,4'-DDT	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Dieldrin	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Endosulfan I	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Endosulfan II	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Endosulfan sulfate	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Endrin	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Endrin aldehyde	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Endrin ketone	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Gamma-BHC (Lindane)	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
gamma-Chlordane	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Heptachlor	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Heptachlor epoxide	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Methoxychlor	1.36	UD	1.36	1.36	UD	1.36	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36	1.37	UD	1.37	1.36	UD	1.36
Toxaphene	13.6	UD	13.6	13.6	UD	13.6	13.5	UD	13.5	13.5	UD	13.5	13.6	UD	13.6	13.7	UD	13.7	13.6	UD	13.6

Constituent	J19CH8 SPA-7 11/09/2009			J19CH9 SPA-8 11/09/2009			J19CJ0 SPA-9 11/09/2009			J19CJ1 SPA-10 11/09/2009			J19CJ2 SPA-11 11/09/2009			J19CJ3 SPA-12 11/09/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Aldrin	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Alpha-BHC	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
alpha-Chlordane	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
beta-BHC	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.51	D	1.51
Delta-BHC	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
4,4'-DDD	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
4,4'-DDE	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	6.57	JD	6.57
4,4'-DDT	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Dieldrin	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Endosulfan I	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Endosulfan II	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Endosulfan sulfate	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Endrin	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Endrin aldehyde	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.38	JD	1.38
Endrin ketone	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	17.2	JD	17.2
Gamma-BHC (Lindane)	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
gamma-Chlordane	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Heptachlor	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Heptachlor epoxide	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	1.36	UD	1.36
Methoxychlor	1.36	UD	1.36	1.36	UD	1.36	1.4	UD	1.4	1.35	UD	1.35	1.35	UD	1.35	19.6	JD	19.6
Toxaphene	13.6	UD	13.6	13.6	UD	13.6	14.0	UD	14.0	13.5	UD	13.5	13.5	UD	13.5	13.6	UD	13.6

Attachment	1	Sheet No.	43 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Waste Site Pesticides Verification Sampling Results. (5 Pages)

Constituent	J19CB4 OB-1 11/03/2009			J19CB5 OB-2 11/03/2009			J19CB6 OB-3 11/03/2009			J19CB7 OB-4 11/03/2009			J19CB8 OB-5 11/03/2009			J19CB9 OB-6 11/03/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Aldrin	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Alpha-BHC	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
alpha-Chlordane	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
beta-BHC	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Delta-BHC	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
4,4'-DDD	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
4,4'-DDE	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
4,4'-DDT	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Dieldrin	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Endosulfan I	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Endosulfan II	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Endosulfan sulfate	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Endrin	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Endrin aldehyde	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Endrin ketone	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Gamma-BHC (Lindane)	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
gamma-Chlordane	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Heptachlor	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Heptachlor epoxide	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Methoxychlor	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36	1.36	UD	1.36
Toxaphene	13.5	UD	13.5	13.6	UD	13.6	13.5	UD	13.5	13.6	UD	13.6	13.6	UD	13.6	13.6	UD	13.6

Constituent	J19CC0 OB-7 11/03/2009			J19CC1 OB-8 11/03/2009			J19CC2 OB-9 11/03/2009			J19CC3 OB-10 11/03/2009			J19CC4 OB-11 11/03/2009			J19CC5 OB-12 11/03/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Aldrin	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Alpha-BHC	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
alpha-Chlordane	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
beta-BHC	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Delta-BHC	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
4,4'-DDD	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
4,4'-DDE	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
4,4'-DDT	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Dieldrin	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Endosulfan I	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Endosulfan II	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Endosulfan sulfate	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Endrin	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Endrin aldehyde	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Endrin ketone	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Gamma-BHC (Lindane)	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
gamma-Chlordane	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Heptachlor	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Heptachlor epoxide	1.36	UD	1.36	1.35	UD	1.35	1.44	JD	1.44	1.35	UD	1.35	1.36	UD	1.36	1.51	JD	1.51
Methoxychlor	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.35	UD	1.35	1.36	UD	1.36	1.36	UD	1.36
Toxaphene	13.6	UD	13.6	13.5	UD	13.5	13.6	UD	13.6	13.5	UD	13.5	13.6	UD	13.6	13.6	UD	13.6

Attachment	1	Sheet No.	44 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	0

Attachment 1. 116-D-5 Anions Verification Sample Results (4 Pages)

Sample Location	HEIS Number	Sample Date	Bromide			Chloride			Fluoride			Nitrate (Method 300.0)			Nitrite (Method 300.0)			Nitrogen in Nitrite and Nitrate (Method 353.2)[a]		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-3	J19CC8	11/10/09	2.4	U	2.4	12		2.4	0.4	B	2.4	17.1	J	2.4	2.4	UR	2.4	3.34		0.20
Duplicate of J19CC8	J19CD8	11/10/09	2.6	U	2.6	2.6	U	2.6	0.5	B	2.6	10.2	J	2.6	2.6	UR	2.6	2.76		0.21
SZ-1	J19CC6	11/10/09	2.6	U	2.6	2.6	U	2.6	2.6	U	2.6	4.1	J	2.6	2.6	UR	2.6	0.64		0.19
SZ-2	J19CC7	11/10/09	2.6	U	2.6	2.6	U	2.6	2.6	U	2.6	6.4	J	2.6	2.6	UR	2.6	1.28		0.23
SZ-4	J19CC9	11/10/09	2.4	U	2.4	2.4	U	2.4	0.4	B	2.4	0.8	BJ	2.4	2.4	UR	2.4	0.26		0.20
SZ-5	J19CD0	11/10/09	2.6	U	2.6	13.9		2.6	2.6	U	2.6	11	J	2.6	2.6	UR	2.6	2.48		0.21
SZ-6	J19CD1	11/10/09	2.7	U	2.7	4.6		2.7	0.5	B	2.7	4.2	J	2.7	2.7	UR	2.7	0.53		0.21
SZ-7	J19CD2	11/10/09	2.6	U	2.6	2.6	U	2.6	0.3	B	2.6	5.6	J	2.6	2.6	UR	2.6	0.92		0.21
SZ-8	J19CD3	11/10/09	2.4	U	2.4	2.4	U	2.4	2.4	U	2.4	2.4	UR	2.4	2.4	UR	2.4	0.23		0.21
SZ-9	J19CD4	11/10/09	2.6	U	2.6	12.8		2.6	2.6	U	2.6	16.2	J	2.6	2.6	UR	2.6	3.52		0.20
SZ-10	J19CD5	11/10/09	2.3	U	2.3	2.3	U	2.3	2.3	U	2.3	5.1	J	2.3	2.3	UR	2.3	0.91		0.20
SZ-11	J19CD6	11/10/09	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	91.1	J	2.5	2.5	UR	2.5	3.16	D	0.42
SZ-12	J19CD7	11/10/09	2.4	U	2.4	2.3	B	2.4	0.3	B	2.4	3.8	J	2.4	2.4	UR	2.4	0.66		0.20
DZ-4 [bc]	J1F1J3	3/16/11	0.41	U	0.41	2.1	U	2.1	0.88	U	0.88	2.4	B	1.5	1.2	U	1.2	0.39	U	0.39
DZ-4	J19CF2	11/10/09	2.6	U	2.6	8.5		2.6	2.6	U	2.6	16.8	J	2.6	2.6	UR	2.6	2.20	J	0.22
Duplicate of J1F1J3 [bc]	J1F1J8	3/16/11	0.41	U	0.41	2.1	U	2.1	0.87	U	0.87	2.6	B	1.5	1.2	U	1.2	0.42	B	0.38
Duplicate of J19CF2	J19CH1	11/10/09	2.5	U	2.5	11		2.5	2.5	U	2.5	20.9	J	2.5	2.5	UR	2.5	4.24		0.19
DZ-1	J19CD9	11/10/09	2.6	U	2.6	5.9		2.6	2.6	U	2.6	7.6	J	2.6	2.6	UR	2.6	1.22	J	0.22
DZ-2	J19CF0	11/10/09	2.4	U	2.4	3.1		2.4	2.4	U	2.4	9.3	J	2.4	2.4	UR	2.4	1.91	J	0.20
DZ-3	J19CF1	11/10/09	2.5	U	2.5	4.5		2.5	2.5	U	2.5	35	J	2.5	2.5	UR	2.5	4.03	J	0.20
DZ-5 [bc]	J1F1J4	3/16/11	0.39	U	0.39	2.0	U	2.0	0.83	U	0.83	1.8	B	1.4	1.1	U	1.1	0.35	U	0.35
DZ-5	J19CF3	11/10/09	2.4	U	2.4	19.8		2.4	2.4	U	2.4	53.3	J	2.4	2.4	UR	2.4	14.4	D	1.03
DZ-6 [bc]	J1F1J5	3/16/11	0.42	U	0.42	29.1		2.1	1.1	B	0.89	3.3	B	1.5	1.2	U	1.2	0.64	B	0.37
DZ-6	J19CF4	11/10/09	2.4	U	2.4	418	DJ	48.2	2.4	U	2.4	355	DJ	48.2	12.1	UDR	12.1	49.3	DJ	1.99
DZ-7	J19CF5	11/10/09	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	5.3	J	2.5	2.5	UR	2.5	1.24		0.20
DZ-8 [bc]	J1F1J6	3/16/11	0.43	U	0.43	5.9		2.2	0.90	U	0.90	50.0		1.5	1.2	U	1.2	14.3		0.37
DZ-8	J19CF6	11/10/09	2.6	U	2.6	27.9		2.6	0.3	B	2.6	124	DJ	12.9	2.6	UR	2.6	27.3	D	2.19
DZ-9	J19CF7	11/10/09	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	33.9	J	2.5	2.5	UR	2.5	6.60		0.22
DZ-10 [bc]	J1F1J7	3/16/11	0.42	U	0.42	2.1	B	2.1	1.1	B	0.89	2.9	B	1.5	1.2	U	1.2	0.54	B	0.38
DZ-10	J19CF8	11/10/09	2.5	U	2.5	61.9		2.5	2.5	U	2.5	301	DJ	12.7	2.5	UR	2.5	65.6	D	2.11
DZ-11	J19CF9	11/10/09	2.4	U	2.4	2.4	U	2.4	2.4	U	2.4	5.8	J	2.4	2.4	UR	2.4	0.81		0.19
DZ-12	J19CH0	11/10/09	2.5	U	2.5	7.6		2.5	2.5	U	2.5	9.1	J	2.5	2.5	UR	2.5	1.53		0.20

[a] Due to an excessive sample holding time exceedance, non-detected Method 300.0 nitrite data were rejected; and all detected Method 300.0 nitrate and nitrite data were considered estimated. It was anticipated that meeting the hold time requirement for IC anions (Method 300.0) would be challenging; therefore EPA Method 353.2 was requested. Data from EPA Method 353.2 was used to calculate the 95% UCL.

[b] Department of Ecology requested additional remediation and re-samples taken at these locations. Original samples are for information only.

[c] "Nitrate" and "nitrite" were converted from "nitrogen in nitrate" and "nitrogen in nitrite" respectively to be consistent with the original samples.

Attachment	1	Sheet No.	45 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	3

Attachment 1. 116-D-5 Anions Verification Sample Results (4 Pages)

Sample Location	HEIS Number	Sample Date	Phosphate			Sulfate			Percent moisture (wet sample)			pH Measurement		
			mg/kg	Q	PQL	mg/kg	Q	PQL	%	Q	PQL	pH unit	Q	PQL
SZ-3	J19CC8	11/10/09	2.4	UR	2.4	11.1		2.4						
Duplicate of J19CC8	J19CD8	11/10/09	2.6	UR	2.6	7.0		2.6						
SZ-1	J19CC6	11/10/09	2.6	UR	2.6	3.7		2.6						
SZ-2	J19CC7	11/10/09	2.6	UR	2.6	10.9		2.6						
SZ-4	J19CC9	11/10/09	2.4	UR	2.4	5.3		2.4						
SZ-5	J19CD0	11/10/09	2.6	UR	2.6	23.3		2.6						
SZ-6	J19CD1	11/10/09	2.7	UR	2.7	11.0		2.7						
SZ-7	J19CD2	11/10/09	2.6	UR	2.6	3.6		2.6						
SZ-8	J19CD3	11/10/09	2.4	UR	2.4	1.9	B	2.4						
SZ-9	J19CD4	11/10/09	2.6	UR	2.6	25.2		2.6						
SZ-10	J19CD5	11/10/09	2.3	UR	2.3	7.9		2.3						
SZ-11	J19CD6	11/10/09	9.8	J	2.5	11.2		2.5						
SZ-12	J19CD7	11/10/09	2.4	J	2.4	4.7		2.4						
DZ-4 [b]	J1F1J3	3/16/11	1.3	U	1.3	3.9	B	1.8	8.1		0	9.40		0.01
DZ-4	J19CF2	11/10/09	2.6	UR	2.6	21.9		2.6						
Duplicate of J1F1J3 [b]	J1F1J8	3/16/11	1.3	U	1.3	4.4	B	1.8	7.1		0	9.38		0.01
Duplicate of J19CF2	J19CH1	11/10/09	2.5	UR	2.5	30.1		2.5						
DZ-1	J19CD9	11/10/09	2.6	UR	2.6	85.1		2.6						
DZ-2	J19CF0	11/10/09	2.4	UR	2.4	28.3		2.4						
DZ-3	J19CF1	11/10/09	2.5	UR	2.5	34.4		2.5						
DZ-5 [b]	J1F1J4	3/16/11	2.1	BC	1.3	4.3	B	1.7	5.5		0	9.26		0.01
DZ-5	J19CF3	11/10/09	2.4	UR	2.4	221	D	12.0						
DZ-6 [b]	J1F1J5	3/16/11	1.3	U	1.3	29.3		1.9	8.5		0	9.20		0.01
DZ-6	J19CF4	11/10/09	2.4	UR	2.4	769	DJ	48.2						
DZ-7	J19CF5	11/10/09	5.6	J	2.5	4.8		2.5						
DZ-8 [b]	J1F1J6	3/16/11	1.4	U	1.4	27.1		1.9	8.9		0	9.06		0.01
DZ-8	J19CF6	11/10/09	2.6	UR	2.6	198	D	12.9						
DZ-9	J19CF7	11/10/09	2.5	UR	2.5	17.0		2.5						
DZ-10 [b]	J1F1J7	3/16/11	1.3	U	1.3	8.3		1.9	10.6		0	9.37		0.01
DZ-10	J19CF8	11/10/09	2.5	UR	2.5	239	D	12.7						
DZ-11	J19CF9	11/10/09	2.4	UR	2.4	5.8		2.4						
DZ-12	J19CH0	11/10/09	2.5	UR	2.5	16.7		2.5						

Attachment	1	Sheet No.	46 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	3

Attachment 1. 116-D-5 Anions Verification Sample Results (4 Pages)

Sample Location	HEIS Number	Sample Date	Bromide			Chloride			Fluoride			Nitrate (Method 300.0)			Nitrite (Method 300.0)			Nitrogen in Nitrite and Nitrate (Method 353.2)[a]		
			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-1	J19CH2	11/9/09	2.3	U	2.3	2.3	U	2.3	2.3	U	2.3	5.1		2.3	2.3	UR	2.3	0.99		0.21
Duplicate of J19CH2	J19CJ4	11/9/09	2.4	U	2.4	2.4	U	2.4	2.4	U	2.4	12.4		2.4	2.4	UR	2.4	2.47		0.20
SPA-2	J19CH3	11/9/09	2.5	U	2.5	74.8		2.5	2.5	U	2.5	28.7		2.5	2.5	UR	2.5	5.52		0.21
SPA-3	J19CH4	11/9/09	2.7	U	2.7	3.3		2.7	2.7	U	2.7	7.9		2.7	2.7	UR	2.7	1.34		0.20
SPA-4	J19CH5	11/9/09	2.5	U	2.5	5.1		2.5	2.5	U	2.5	8.5		2.5	2.5	UR	2.5	1.54		0.22
SPA-5	J19CH6	11/9/09	2.6	U	2.6	2.6	U	2.6	2.6	U	2.6	8.2		2.6	2.6	UR	2.6	1.16		0.20
SPA-6	J19CH7	11/9/09	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	4.3		2.7	2.7	UR	2.7	0.96		0.22
SPA-7	J19CH8	11/9/09	2.4	U	2.4	2.4	U	2.4	2.4	U	2.4	7.2		2.4	2.4	UR	2.4	1.37		0.19
SPA-8	J19CH9	11/9/09	2.4	U	2.4	2.4		2.4	2.4	U	2.4	5.3		2.4	2.4	UR	2.4	1.09		0.19
SPA-9	J19CJ0	11/9/09	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	5.9		2.7	2.7	UR	2.7	1.34		0.22
SPA-10	J19CJ1	11/9/09	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	0.9	B	2.5	2.5	UR	2.5	0.23		0.19
SPA-11	J19CJ2	11/9/09	2.7	U	2.7	2.7	U	2.7	0.3	B	2.7	2.5	B	2.7	2.7	UR	2.7	0.49		0.22
SPA-12	J19CJ3	11/9/09	2.4	U	2.4	6.4		2.4	2.4	U	2.4	14.3		2.4	2.4	UR	2.4	2.9		0.20
OB-1	J19CB4	11/3/09	2.4	U	2.4	12.1		2.4	2.4	U	2.4	15		2.4	2.4	UR	2.4	2.06		0.21
OB-2	J19CB5	11/3/09	2.6	U	2.6	2.6	U	2.6	2.6	U	2.6	1.9	B	2.6	2.6	UR	2.6	0.43		0.21
OB-3	J19CB6	11/3/09	2.6	U	2.6	2.6	U	2.6	2.6	U	2.6	3.6		2.6	2.6	UR	2.6	0.67		0.21
OB-4	J19CB7	11/3/09	2.6	U	2.6	46.8		2.6	2.6	U	2.6	37.7		2.6	2.6	UR	2.6	5.1		0.21
OB-5	J19CB8	11/3/09	2.6	U	2.6	13.1		2.6	2.6	U	2.6	32.9		2.6	2.6	UR	2.6	4.29		0.21
OB-6	J19CB9	11/3/09	2.5	U	2.5	4.2		2.5	2.5	U	2.5	7.2		2.5	2.5	UR	2.5	1.33		0.21
OB-7	J19CC0	11/3/09	2.4	U	2.4	46.1		2.4	2.4	U	2.4	31.5		2.4	2.4	UR	2.4	4.04		0.21
OB-8	J19CC1	11/3/09	2.4	U	2.4	18.3		2.4	2.4	U	2.4	26.6		2.4	2.4	UR	2.4	3.61		0.21
OB-9	J19CC2	11/3/09	2.5	U	2.5	3		2.5	2.5	U	2.5	4.5		2.5	2.5	UR	2.5	0.6		0.21
OB-10	J19CC3	11/3/09	2.6	U	2.6	8.2		2.6	2.6	U	2.6	32.6		2.6	2.6	UR	2.6	4.09		0.20
OB-11	J19CC4	11/3/09	2.6	U	2.6	2.6	U	2.6	2.6	U	2.6	4.2		2.6	2.6	UR	2.6	0.72		0.21
OB-12	J19CC5	11/3/09	2.4	U	2.4	4.4		2.4	2.4	U	2.4	7.2		2.4	2.4	UR	2.4	1.13		0.21

Attachment	1	Sheet No.	47 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	3

Attachment 1. 116-D-5 Anions Verification Sample Results (4 Pages)

Sample Location	HEIS Number	Sample Date	Phosphate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-1	J19CH2	11/9/09	2.3	UR	2.3	4.3		2.3
Duplicate of J19CH2	J19CJ4	11/9/09	2.4	UR	2.4	5.0		2.4
SPA-2	J19CH3	11/9/09	4.3	UR	2.5	40.3		2.5
SPA-3	J19CH4	11/9/09	2.7	UR	2.7	25.9		2.7
SPA-4	J19CH5	11/9/09	2.5	UR	2.5	20.2		2.5
SPA-5	J19CH6	11/9/09	2.6	UR	2.6	3.2		2.6
SPA-6	J19CH7	11/9/09	2.6	B	2.7	3.9		2.7
SPA-7	J19CH8	11/9/09	2.4	UR	2.4	5.3		2.4
SPA-8	J19CH9	11/9/09	2.4	UR	2.4	5.2		2.4
SPA-9	J19CJ0	11/9/09	2.7	UR	2.7	12.2		2.7
SPA-10	J19CJ1	11/9/09	2.5	UR	2.5	2.7		2.5
SPA-11	J19CJ2	11/9/09	2.7	UR	2.7	4.5		2.7
SPA-12	J19CJ3	11/9/09	2.4	UR	2.4	71.4		2.4
OB-1	J19CB4	11/3/09	2.4	UR	2.4	24.3		2.4
OB-2	J19CB5	11/3/09	2.6	UR	2.6	4.8		2.6
OB-3	J19CB6	11/3/09	2.6	UR	2.6	12.4		2.6
OB-4	J19CB7	11/3/09	2.6	UR	2.6	24.7		2.6
OB-5	J19CB8	11/3/09	2.6	UR	2.6	27.6		2.6
OB-6	J19CB9	11/3/09	2.5	UR	2.5	15.8		2.5
OB-7	J19CC0	11/3/09	2.4	UR	2.4	19.0		2.4
OB-8	J19CC1	11/3/09	2.4	UR	2.4	26.2		2.4
OB-9	J19CC2	11/3/09	2.5	UR	2.5	7.4		2.5
OB-10	J19CC3	11/3/09	2.6	UR	2.6	25.6		2.6
OB-11	J19CC4	11/3/09	2.6	UR	2.6	6.3		2.6
OB-12	J19CC5	11/3/09	2.4	UR	2.4	20.9		2.4

Attachment	1	Sheet No.	48 of 48
Originator	J. D. Skoglie	Date	04/15/11
Checked	T. E. Queen	Date	04/15/11
Calc. No.	0100D-CA-V0352	Rev. No.	3

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0354

Subject: 116-D-5 Waste Site 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 = 3 Total = 4	J. D. Skoglie	T. E. Queen	B. L. Vedder	D. F. Obenauer	Signed 3/1/10
1	Cover = 1 Sheets = 3 Total = 4	J. D. Skoglie	T. E. Queen	B. L. Vedder	D. F. Obenauer	Signed 3/29/10
2	Cover = 1 Sheets = 3 Total = 4	J. D. Skoglie	T. E. Queen	NA	D. F. Obenauer	4/19/11

SUMMARY OF REVISION

1	Page 2, line 24: updated the sum of HQ value. Page 3, line 23: higher pyrene value entered. Page 3, line 26: the constituent "endrin" was removed because it was found in the deep zone only.
2	Revision due to re-sample data Page 1, line 22 & 23: UCL calculation changed to 2011 and Rev. 3. Page 2, line 7: revised reference to WCH (2011). Page 2, line 9, deleted "nitrogen in nitrate" Page 2, line 24: updated the sum of the HQ value. Page 2, line 27 & 28: updated maximum value for chrysene and its carcinogenic risk total. Page 2, line 34: updated cumulative excess cancer risk. Page 3, Table 1: updated maximum and statistical values as well as cumulative totals.
WCH-DE-018 (05/08/2007)	*Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	04/19/11	Calc. No.:	0100D-CA-V0354	Rev.:	2
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	04/19/11
Subject:	116-D-5 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 116-D-5 waste site. 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, 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.

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

3) WCH, 2011, *116-D-5 Waste Site Cleanup Verification 95% UCL Calculation*, 0100D-CA-V0352, Rev. 3, 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 2009).

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 2009).

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:	J. D. Skoglie	Date:	04/19/11	Calc. No.:	0100D-CA-V0354	Rev.:	2
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	04/19/11
Subject:	116-D-5 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	2 of 3

METHODOLOGY:

The 116-D-5 waste site is comprised of four decision units for verification sampling consisting of the shallow zone, deep zone, staging pile area, and overburden. The direct contact hazard quotient and carcinogenic risk calculations for the 116-D-5 waste site were conservatively calculated for the entire waste site EXCEPT the deep zone using the greater of the statistical or maximum value for each analyte in all decision units from WCH (2011). The deep zone data will be discussed in the RSVP and in the protection of groundwater calculation. Of the contaminants of potential concern (COPCs) for this site, silver is included because it is quantitated at a concentration above Hanford Site background. Boron, hexavalent chromium, molybdenum, the detected semivolatiles, and the detected pesticides require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. 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 1.16 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 1.6×10^{-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 7.9×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for chrysene is 0.0467 mg/kg, divided by 13.7 mg/kg, and multiplied as indicated, is 3.4×10^{-9}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 9.0×10^{-7}. 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:	J. D. Skoglie	Date:	04/19/11	Calc. No.:	0100D-CA-V0354	Rev.:	2
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	04/19/11
Subject:	116-D-5 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	3 of 3

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 116-D-5 Waste Site.

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[c]	1.16	7,200	1.6E-04	--	--
Chromium, hexavalent[c]	0.18	240	7.5E-04	2.1	8.6E-08
Molybdenum[c]	0.316	400	7.9E-04	--	--
Silver	1.30	400	3.3E-03	--	--
Semivolatiles					
Anthracene	0.0122	24,000	5.1E-07	--	--
Benzo(a)anthracene	0.0726	--	--	1.37	5.3E-08
Benzo(a)pyrene	0.0495	--	--	0.137	3.6E-08
Benzo(b)fluoranthene	0.068	--	--	1.37	5.0E-08
Benzo(ghi)perylene	0.0264	2,400	1.1E-05	--	--
Benzo(k)fluoranthene	0.0183	--	--	1.37	1.3E-08
Bis(2-ethylhexyl)phthalate	0.854	1600	5.3E-04	71.4	6.2E-07
Chrysene	0.0467	--	--	13.7	3.4E-09
Dibenz(a,h)anthracene	0.00673	--	--	1.37	4.9E-09
Fluoranthene	0.0748	3,200	2.3E-05	--	--
Indeno(1,2,3-cd) pyrene	0.0125	--	--	1.37	9.1E-09
Phenanthrene	0.0271	24,000	1.1E-06	--	--
Pyrene	0.296	2,400	1.2E-04	--	--
Pesticides					
beta-1,2,3,4,5,6- Hexachlorocyclohexane	0.00151	--	--	0.556	2.7E-09
DDE, 4,4'-	0.00657	--	--	2.94	2.2E-09
Endrin aldehyde	0.00138	24	5.8E-05	--	--
Endrin ketone	0.0172	24	7.2E-04	--	--
Heptachlor epoxide	0.00151	1.04	1.5E-03	0.11	1.4E-08
Methoxychlor	0.0196	400	4.9E-05	--	--
Totals					
Cumulative Hazard Quotient:			**7.9E-03**		
Cumulative Excess Cancer Risk:					**9.0E-07**

Notes:

[a] = From WCH (2011).

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

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

-- = not applicable

RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 116-D-5 waste site meets the requirements for the direct contact hazard quotients and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2009).

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-V0355

Subject: 116-D-5 Waste Site 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	J. D. Skoglie	T. E. Queen	B. L. Vedder	D. F. Obenauer	Signed 3/1/10
1	Cover = 1 Sheets = 3 Total = 4	J. D. Skoglie	T. E. Queen	B. L. Vedder	D. F. Obenauer	Signed 3/29/10
2	Cover = 1 Sheets = 3 Total = 4	R. J. Nielson	T. E. Queen	B. L. Vedder	D. F. Obenauer	4/28/11

SUMMARY OF REVISION

1	Page 2, line 9: due to lab error deleted nitrogen in nitrite. Page 2, line 36: updated sum of HQ value. Page 3, line 22: converted units to mg/kg for fluorene. Page 3, line 25: due to lab error deleted nitrogen in nitrite. Page 3, line 29: updated cumulative hazard quotient.
2	Due to additional remediation and resampling of five locations in the deep zone of the excavation, changes were made to the GIVEN/REFERENCES, METHODOLOGY, and RESULTS sections of the calculation. All changes are noted by revision bars in the margin.

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	R. J. Nielson RN	Date:	4/25/2011	Calc. No.:	0100D-CA-V0355	Rev.:	2
Project:	100-D Field Remediation	Job No:	14655	Checked:	T. E. Queen TQ	Date:	4/25/2011
Subject:	116-D-5 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for the 116-D-5 waste site. 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) WAC 173-340-740(3)(a)(ii)(A), "Groundwater Protection."

5) WCH, 2011, *116-D-5 Waste Site Cleanup Verification 95% UCL Calculations*, 0100D-CA-V0352, Rev 4, 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:	R. J. Nielson	Date:	4/25/2011	Calc. No.:	0100D-CA-V0355	Rev.:	2
Project:	100-D Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	4/25/2011
Subject:	116-D-5 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 2 of 3	

METHODOLOGY:

The 116-D-5 waste site consisted of four decision units for verification sampling: the shallow zone, deep zone, staging pile area, and the overburden stockpile.

Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at the 116-D-5 waste site were conservatively calculated for the entire waste site using the greater of the statistical or maximum value for each analyte from WCH (2011). Of the contaminants of potential concern (COPCs) for this site, beta BHC, boron, , and hexavalent chromium are included because they do not have a Hanford Site-specific or Washington State background value available and their respective distribution coefficient is 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 7 m (23 ft) thickness, a K_d of 10 or greater is required to show no predicted migration to groundwater in 1,000 years using the generic site model. All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than 10. 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 (µg/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 µg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii)(A) (1996). For example, the maximum soil value for boron of 1.16 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg, is 3.6×10^{-3}. 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 7.4×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) Beta-BHC is the only carcinogenic constituent to meet the criteria for evaluation at the 116-D-5 waste site. The carcinogen risk is 3.1×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-6}$, this criterion is met. Because beta-BHC is the only carcinogenic constituent subject to this calculation, the cumulative excess cancer risk of $<1 \times 10^{-5}$ is also met.

4) 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:	R. J. Nielson	Date:	4/25/2011	Calc. No.:	0100D-CA-V0355	Rev.:	2
Project:	100-D Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	4/25/2011
Subject:	116-D-5 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 3 of 3	

RESULTS:

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

Table 1 shows the results of the calculations.

Table 1. Hazard Quotient and Excess Cancer Risk for Protection of Groundwater Results for the 116-D-5 Waste Site.

Contaminants of Potential Concern	Statistical or Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.16	320	3.6E-03	--	--
Chromium, hexavalent	0.34	4.8	7.1E-02	--	--
Pesticides					
BHC, beta	0.00151	--	--	0.00486	3.1E-07
Totals					
Cumulative Hazard Quotient:			**7.4E-02**		
Cumulative Excess Cancer Risk:					**3.1E-07**

Notes:
[a] = From WCH (2011).
[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and "100 times" model unless otherwise noted.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 116-D-5 waste site 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 D

DATA QUALITY ASSESSMENT

APPENDIX D

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

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

A review of the sample design (WCH 2009b), the field logbooks (WCH 2009a, WCH 2011), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. The sample design included a statistical sampling approach. In order to calculate the number of samples needed in the statistical sampling plan, the standard deviation for each contaminant of concern/contaminant of potential concern (COC/COPC) in the target population was assumed to be less than or equal to 40% of the corresponding decision threshold for each COC/COPC. Examination of the resulting data set shows the sample standard deviations are consistent with those assumptions.

To ensure quality data, the SAP (DOE-RL 2009) 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 116-D-5 waste site were provided by the laboratories in four sample delivery groups (SDGs): K1816, K1829, K1830, and JP0124. SDG K1830 was submitted for third-party validation. Major and minor deficiencies were identified in the analytical data set and are discussed below.

MAJOR DEFICIENCIES

Holding times greater than twice the established acceptable hold time for nitrite and phosphate became the basis for rejection ("R" flag) of the undetected ion chromatograph (IC) anion results for nitrite and phosphate in the four SDGs for 116-D-5. The samples for SDG K1816 were collected on November 3, 2009, and extracted and analyzed on November 19, 2009. The samples for SDG K1829 were collected on November 9, 2009, and extracted and analyzed on November 20, 2009. The samples for SDG K1830 were collected on November 10, 2009, and extracted and analyzed on November 30, 2009. The samples for SDG JP0124 were collected on March 16, 2011 and extracted and analyzed on March 22, 2011. It was anticipated that meeting the hold time requirement for IC anions would be challenging, and U.S. Environmental

Protection Agency (EPA) Analytical Method 353.2 was requested in the 116-D-5 sample design (WCH 2009a) to provide acceptable nitrate/nitrite data for decision-making purposes. The Method 353.2 data will be used for site evaluation of nitrate/nitrite. Phosphate is not a regulated chemical under *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act-Cleanup." The rejection of the undetected nitrite and phosphate data does not hinder the evaluation of the 116-D-5 waste site.

MINOR DEFICIENCIES

Minor deficiencies are discussed for the 116-D-5 data set 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 K1816

This SDG comprises 12 statistical soil samples (J19CB4 through J19CB9 and J19CC0 through J19CC5) from the overburden soil stockpile. These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, pesticides, semivolatile organic compounds (SVOC), polycyclic aromatic hydrocarbons (PAH), nitrate/nitrite, IC anions, strontium-90, carbon-14, and nickel-63 by liquid scintillation, isotopic plutonium, isotopic uranium, and by gamma spectroscopy. In addition, one equipment blank (J19CB3) was collected and analyzed for ICP metals and mercury. Minor deficiencies are as follows.

In the radionuclide analysis, all carbon-14 results may be considered estimated due to the lack of a matrix spike (MS) analysis. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the MS recoveries are outside the acceptance criteria for the following analytes: 1,2,4-trichlorobenzene (56%), 2-methylnaphthalene (59%), 2-methylphenol (56%), 2-nitroaniline (59%), 4-chloro-3-methylphenol (59%), 3 and/or 4-methylphenol (58%), acenaphthene (58%), acenaphthylene (56%), benzo[g,h,i] perylene (55%), bis(2-ethylhexyl) phthalate (20%), indeno[1,2,3-cd]pyrene (56%), and isophorone (48%). The matrix spike duplicate (MSD) recoveries were outside quality control (QC) limits for the benzo[g,h,i]perylene (58%), bis(2-ethylhexyl)phthalate (29%), and isophorone (55%). Laboratory control sample (LCS) recoveries were outside QC limits for 1,2,4-trichlorobenzene (55%), 2-methylnaphthalene (58%), and isophorone (48%). All results for analytes with MS, MSD, or LCS recoveries outside QC limits may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, the surrogate triphenylene recovery was outside the acceptance criteria in sample J19CC5. All PAH results in sample J19CC5 may be considered estimated. The data are usable for decision-making purposes.

In the pesticides analysis, the holding time requirement was exceeded by 14 days for samples J19CB4 through J19CB7. These samples were collected on November 3, 2009, extracted on December 1, 2009, and analyzed on December 3, 2009. Due to holding times being exceeded by

no greater than twice the limit, all pesticide results for these samples may be considered estimated. Estimated data are usable for decision-making purposes.

In the pesticides analysis, the MS and MSD results for delta-BHC (46% and 48%) were outside the QC limits. The beta-BHC MS result (135%) was also outside the QC limits. The delta-BHC and beta-BHC results may be considered estimated. Estimated data are usable for decision-making purposes.

All of the toxaphene data in SDG K1816 may be considered estimated due to lack of a MS, MSD, or LCS analysis for the analyte. Estimated data are acceptable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for six analytes (aluminum, calcium, iron, manganese, antimony, and silicon). For aluminum, chromium, iron, manganese, and silicon, 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 did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 55%. The antimony data may be considered estimated. Estimated data are usable for decision-making purposes.

In the IC anions analysis by EPA Method 300.0, the holding time requirement for nitrate, nitrite, and phosphate is two days. Due to holding times being exceeded by greater than twice the limit, all detected nitrate results may be considered estimated. Estimated data are usable for decision-making purposes.

SDG K1829

This SDG comprises thirteen statistical soil samples (J19CH2 through J19CH9 and J19CJ0 through J19CJ4) from the waste staging pile area footprint. A field duplicate pair (J19CH2/J19CJ4) is included in this SDG. These samples were analyzed for ICP metals, mercury, hexavalent chromium, pesticides, SVOC, PAH, nitrate/nitrite, IC anions, strontium-90, carbon-14, and nickel-63 by liquid scintillation, isotopic plutonium, isotopic uranium, and by gamma spectroscopy. Minor deficiencies are as follows.

In the radionuclide analysis, all carbon-14 results may be considered estimated due to the lack of a MS analysis. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the MS recoveries are outside the acceptance criteria for the following analytes: 2,4,6-trichlorophenol (37%), 2,4-dinitrophenol (16%), 4,6-dinitro-2-methylphenol (29%), and pentachlorophenol (43%). The MSD recoveries were outside QC limits for 2,4-dinitrophenol (20%), 4,6-dinitro-2-methylphenol (35%), and pentachlorophenol (45%). LCS recoveries were outside QC limits for 4,6-dinitro-2-methylphenol (43%), 2,4-dinitrophenol (34%), and fluoranthene (0%). All results for analytes with MS, MSD, or LCS recoveries

outside QC limits may be considered estimated. Estimated data are usable for decision-making purposes.

All of the toxaphene data in SDG K1829 may be considered estimated due to lack of MS, MSD, or LCS analysis for the analyte. Estimated data are acceptable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for four analytes (aluminum, iron, antimony, and silicon). For aluminum, iron, and silicon, 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 did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 54%. The antimony data may be considered estimated. Estimated data are usable for decision-making purposes.

In the IC anions analysis by EPA Method 300.0, the holding time requirement for nitrate, nitrite, and phosphate is 2 days. Due to holding times being exceeded by greater than twice the limit, all detected nitrate and phosphate results may be considered estimated. Estimated data are usable for decision-making purposes.

All of the nitrate/nitrite as nitrogen data in SDG K1829 may be considered estimated due to lack of MS and MSD analysis for the analyte. Estimated data are acceptable for decision-making purposes.

SDG K1830

This SDG comprises 13 statistical soil samples (J19CC6 through J19CC9 and J19CD0 through J19CD8) from the excavation shallow zone, and 13 statistical soil samples (J19CD9, J19CF0 through J19CF9, and J19CH0 through J19CH1) from the excavation deep zone. Two field duplicate pairs (J19CC8/J19CD8 and J19CF2/J19CH1) are included in this SDG. These samples were analyzed for ICP metals, mercury, hexavalent chromium, pesticides, SVOC, PAH, nitrate/nitrite, IC anions, strontium-90, carbon-14, and nickel-63 by liquid scintillation, isotopic plutonium, isotopic uranium, and by gamma spectroscopy. In addition, the excavation deep zone samples were analyzed for tritium. SDG K1830 was submitted for third-party validation. Minor deficiencies are as follows.

In the pesticides analysis, the MS and MSD results for delta-BHC (48% and 49%) were outside the QC limits for samples J19CC6 through J19CC9, and J19CD0 through J19CD8. The delta-BHC results for these samples were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

All of the toxaphene data in SDG K1830 was qualified by third-party validation as estimated with "J" flags, due to lack of a MS, MSD, or LCS analysis for the analyte. Estimated or "J"-flagged data are acceptable for decision-making purposes.

In the SVOC analysis, the MS recovery (31%) was outside QC limits for the 2,4-dinitrophenol results associated with samples J19CD9, J19CF0 through J19CF9, and J19CH0 through J19CH1. The MSD recoveries are outside the acceptance criteria for the following analytes associated with samples J19CD9, J19CF0 through J19CF9, and J19CH0 through J19CH1: 1,2,4-trichlorobenzene (46%), 2,4-dimethylphenol (40%), 2,4-dinitrophenol (13%), 2-nitrophenol (46%), 3,3-dichlorobenzidine (49%), 4,6-dinitro-2-methylphenol (29%), 4-chloroanaline (36%), 4-nitrophenol (46%), hexachlorocyclopentadiene (15%), isophorone (44%), naphthalene (45%), nitrobenzene (49%), and pentachlorophenol (35%). LCS recoveries associated with these samples were outside QC limits for hexachlorocyclopentadiene (25%) and butyl benzyl phthalate (0%). All results for analytes with MS, MSD, or LCS recoveries outside QC limits were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the MS recoveries were outside QC limits for the 2,4-dinitrophenol (31%), 2,4,6-trichlorophenol (41%), 2,4-dimethylphenol (47%), 4,6-dinitro-2-methylphenol (45%), 4-chloroanaline (39%), hexachlorocyclopentadiene (46%), isophorone (47%), and pentachlorophenol (38%) results associated with samples J19CC6 through J19CC9 and J19CD0 through J19CD8. The MSD recoveries are outside the acceptance criteria for the following analytes associated with samples J19CC6 through J19CC9 and J19CD0 through J19CD8: 2,4-dinitrophenol (48%) and 4-chloroanaline (36%). LCS recoveries associated with these samples were outside QC limits for 2,4-dinitrophenol (28%), 4,6-dinitro-2-methylphenol (44%) and pentachlorophenol (40%). All results for analytes with MS, MSD, or LCS recoveries outside QC limits were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the relative percent difference (RPD) for MS/MSD results associated with samples J19CD9, J19CF0 through J19CF9, and J19CH0 through J19CH1 were greater than 30% for the following analytes: phenol (38%), bis(2-chloroethyl)ether (33%), 2-chlorophenol (38%), 1,2-dichlorobenzene (36%), 1,4-dichlorobenzene (31%), 1,2,4-trichlorobenzene (63%), 2-methylphenol (33%), 2-methylnaphthalene (61%), n-nitroso-di-d-propylamine (38%), nitrobenzene (63%), isophorone (57%), 2-nitrophenol (69%), 4-nitrophenol (51%), bis(2-chloroethoxy)methane (60%), naphthalene (67%), 4-chloroanaline (56%), hexachlorobutadiene (62%), hexachlorocyclopentadiene (108%), acenaphthene (32%), 2,4,5-trichlorophenol (35%), 2,4,6-trichlorophenol (47%), 2,4-dichlorophenol (62%), 2,4-dimethylphenol (83%), 2,4-dinitrophenol (80%), 4,6-dinitro-2-methylphenol (65%), 4-chloro-3-methylphenol (58%), 4-chlorophenylphenylether (32%), dibenzofuran (33%), fluorine (32%), fluoranthene (44%), anthracene (32%), dibenz(a,h)anthracene (32%), carbazole (31%), pentachlorophenol (36%), and phenanthrene (33%). The results for these analytes in these samples were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the RPD for MS/MSD results associated with samples J19CC6 through J19CC9, and J19CD0 through J19CD8, were greater than 30% for the following analytes: 4-nitrophenol (35%), 2,4,5-trichlorophenol (36%), 2,4,6-trichlorophenol (58%), 2,4-dinitrophenol (44%), 4,6-dinitro-2-methylphenol (35%), and pentachlorophenol (56%). The results for these analytes in these samples were qualified as estimates and flagged "J" by

third-party validation. Estimated data are usable for decision-making purposes.

In the radionuclide analysis, all tritium and carbon-14 results were qualified as estimates and flagged "J" by third-party validation, due to the lack of a MS analysis. Estimated data are usable for decision-making purposes.

In the radionuclide analysis, the uranium-233/234 and uranium-238 results for sample J19CC6 were qualified as estimates and flagged "J" by third-party validation due to a tracer recovery outside of the QC limits (107%). Estimated data are usable for decision-making purposes.

In the ICP metals analysis, for samples J19CD9, J19CF0 through J19CF9, and J19CH0 through J19CH1, the MS recoveries were out of project acceptance criteria for seven analytes (aluminum, calcium, iron, manganese, magnesium, antimony, and silicon). For aluminum, chromium, iron, manganese, and silicon, 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 magnesium did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony and magnesium were 39% and 132%, respectively. The antimony and magnesium data for samples J19CD9, J19CF0 through J19CF9, and J19CH0-J19CH1 were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the ICP metals analysis for samples J19CC6 through J19CC9 and J19CD0 through J19CD8, the MS recoveries were out of project acceptance criteria for eight analytes (aluminum, chromium, iron, manganese, magnesium, antimony, silicon, and vanadium). 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, chromium, magnesium, silicon, and vanadium did not have mismatched spike and native concentrations in the original MS. The original MS recoveries for antimony, chromium, magnesium, silicon, and vanadium were 56%, 67%, 50%, 263%, and 57%, respectively. The antimony, chromium, magnesium, silicon, and vanadium data for samples J19CC6 through J19CC9 and J19CD0 through J19CD8 were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the IC anions analysis by EPA Method 300.0, the holding time requirement for nitrate, nitrite, and phosphate is 2 days. Due to holding times being exceeded by greater than twice the limit, all detected nitrate and phosphate results were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the IC anions analysis, all of the nitrate/nitrite data for samples J19CD9, J19CF0, J19CF1, J19CF2, and J19CF4, were qualified by third-party validation as estimated with "J" flags, due to lack of a MS or MSD analysis for the analyte. Estimated or "J"-flagged data are acceptable for decision-making purposes.

In the IC anions analysis, the chloride, sulfate, nitrate, and nitrite results for sample J19CF4 were

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

SDG JP0124

This SDG comprises 6 statistical soil samples (J1F1J3 through J1F1J8) from the excavation deep zone. These samples were taken to replace the sample results for J19CF2, J19CF3, J19CF4, J19CF6, J19CF8, and J19CH1 following additional remediation. A field duplicate pair (J1F1J3/J1F1J8) is included in this SDG. These samples were analyzed for ICP metals, mercury, hexavalent chromium, pesticides, SVOC, PAH, nitrate/nitrite, IC anions, strontium-90, carbon-14, and nickel-63 by liquid scintillation, isotopic plutonium, isotopic uranium, tritium, and by gamma spectroscopy. Minor deficiencies are as follows.

In the IC anions analysis by EPA Method 300.0, the holding time requirement for nitrate, nitrite, and orthophosphate is 2 days. Due to holding times being exceeded by greater than twice the limit, all detected nitrate and orthophosphate results may be considered estimated. Estimated data are usable for decision-making purposes.

In the IC anions analysis, the orthophosphate result for sample J1F1J4 may be considered estimated due to method blank contamination. The data are usable for decision-making purposes.

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

In the pesticide analysis, the MS and MSD for endrin aldehyde are below the QC criteria at 32% and 7%, respectively. In addition, the endrin aldehyde MS/MSD RPD is above the acceptance criteria, at 127%. The endrin aldehyde sample results may be considered estimated. Estimated data are usable for decision-making purposes.

All of the toxaphene data in SDG JP0124 may be considered estimated due to lack of MS, MSD, or LCS analysis for the analyte. Estimated 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 55% and 18%, respectively. All antimony and silicon data for SDG JP0124 may be considered estimated. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the silicon result may be considered estimated due to an LCS recovery below QC limits at 15%. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the RPD for silicon was above the QC limit at 81%. The silicon sample results may be considered estimated. The data are useable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field 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 logbooks (WCH 2009a, WCH 2011), are summarized in Table D-1. The main and QA/QC sample results are presented in Appendix C.

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

Sample Area	Main Sample	Duplicate Sample
Shallow zone excavation	J19CC8	J19CD8
Deep zone excavation	J1F1J3	J1F1J8
Staging pile area footprint	J19CH2	J19CJ4

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 concern. RPDs 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). RPDs 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 95% upper confidence limit calculation brief in Appendix C provides details on duplicate pair evaluation and RPD calculation.

The RPDs calculated for sodium (41.0%) in the deep zone excavation field duplicates samples are above the acceptance criteria (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 five times the TDL, including undetected analytes. In these cases, a control limit of ± 2 times the TDL is used (Appendix C) to indicate that a visual check of the data is required by the reviewer. No data 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 116-D-5 waste sites 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 116-D-5 waste site 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 C.

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