0097380

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

11-AMRC-0168

JUN 27 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 100-H-3, 1716-H GARAGE FUEL TANK SITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2010-103 and supporting "Remaining Sites Verification Package for the 100-H-3, 1716-H Garage Fuel Tank Site," Revision 0. If you have questions, please contact me or your staff may contact Joanne Chance, of my staff, at (509) 376-0811.

Sincerely,

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

AMRC:JCC

Attachment

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

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

RECEIVED
JUN 30 2011
EDMC

Date Submitted: 1/27/11 Originator: M. L. Proctor Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-HR-1 Waste Site Code: 100-H-3 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2010-103

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 100-H-3, 1716-H Garage Fuel Tank Site waste site is located within the 100-HR-1 Operable Unit. The 100-H-3 waste site was the location of underground storage tanks (USTs) associated with the 1761-H maintenance garage building in the 100-H Area, west of the 107-H Retention Basin (116-H-7) and north of the 1717-H Combined Shops. The site has been remediated and presently exists as an open excavation. Remediation, verification sampling, and comparison of residual contaminant concentrations against cleanup levels have been performed in accordance with remedial action objectives and goals established by the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. The 100-H-3 waste site was included in the Remaining Sites ROD (EPA 1999) as a candidate site for further evaluation. The selected action involved: (1) evaluating the site using available process information, (2) remediating the site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification to Interim Closed Out.

Basis for reclassification:
Evaluation of verification sampling data for the 100-H-3 waste site demonstrates that this site meets the remedial action objectives specified in the Remaining Sites ROD. This site will support future unrestricted land uses that can be represented (or bounded) by a rural-residential scenario. Sampling results and RESRAD modeling results showed that this site will support unrestricted future use of shallow-zone soil (i.e., surface to 4.6 m [15 ft]) and is protective of groundwater and the Columbia River. Site contamination did not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required. In accordance with this evaluation, the verification sampling results support a reclassification of this site to Interim Closed Out. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-H-3, 1716-H Garage Fuel Tank Site* (attached).

Regulator Comments:
Approval of this WSRF documents regulator agreement that the 100-H-3 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)	M S French Signature	5/29/11 Date
N. Menard Ecology Project Manager (printed)	Nina M. Menard Signature	6/1/11 Date
N/A EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-H-3, 1716-H GARAGE FUEL TANK SITE

Attachment to Waste Site Reclassification Form 2010-103

January 2011

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-H-3, 1716-H GARAGE FUEL TANK SITE

EXECUTIVE SUMMARY

The 100-H-3, 1716-H Garage Fuel Tank Site waste site is located within the 100-HR-1 Operable Unit on the Hanford Site in southeastern Washington State. The Waste Information Data System (WIDS) suggests that the 100-H-3 waste site was the location of underground storage tanks (USTs) associated with the 1716-H maintenance garage building in the 100-H Area, west of the 107-H Retention Basin (116-H-7) and north of the 1717-H Combined Shops. According to WIDS, the site previously contained one or more USTs. The entire maintenance garage structure has been demolished. The automotive service area included gasoline pumps with associated underground tanks and possibly an oil pit.

No tanks were found at this site when confirmatory sampling was performed. Confirmatory investigation and sampling of the 100-H-3 waste site revealed that potential USTs had been previously removed. However, debris was backfilled at the former tank location, and sampling revealed that five analytes exceeded direct exposure remedial action goals (RAGs) for soil. Based on these results, the 100-H-3 waste site was recommended for remediation (WCH 2008).

Remedial action at the 100-H-3, 1716-H Garage Fuel Tank Site began on December 21, 2009 and continued through December 30, 2009, to a depth of approximately 3.5 m (11.5 ft). Verification sampling for the 100-H-3 waste site was performed on September 21, 2010 and March 29, 2011 to collect data to determine if the site met remedial action goals. The contaminants of potential concern for verification sampling included inductively coupled plasma (ICP) metals, mercury, polychlorinated biphenyls (PCBs), pesticides, semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons and total petroleum hydrocarbons (TPH) (WCH 2010b).

Results of verification sample analysis show that the waste removal action achieved compliance with the remedial action objectives for the 100-H-3 waste site. A summary of the verification sampling analytical results evaluated against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 100-H-3 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2007).

Table ES-1. Summary of Remedial Action Goals for the 100-H-3, 1716-H Garage Fuel Tank Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain 15-mrem/yr dose rate above background over 1,000 years.	Radionuclides were not COPCs for the 100-H-3 waste site.	NA

Table ES-1. Summary of Remedial Action Goals for the 100-H-3, 1716-H Garage Fuel Tank Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for all sampling areas (2.5×10^{-2}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	Excess cancer risk values for individual nonradionuclide COPCs are $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess carcinogenic risk for all sampling areas (3.5×10^{-7}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 100-H-3 waste site.	NA
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [a].		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 21.2 pCi/L [c].		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Lead, mercury, dieldrin, benzo(a)anthracene, benzo(b)fluoranthene amd benzo(k)fluoranthene are present at concentrations above soil RAGs for groundwater and/or Columbia River protection. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009), it is predicted that these constituents will not reach groundwater (and thus the Columbia River) within 1,000 years [d].	Yes

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

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

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

[d] RESRAD modeling predicts that residual concentrations of lead, mercury, dieldrin, benzo(a)anthracene, benzo(b)fluoranthene and benzo(k)fluoranthene will not migrate more than 3 m (10 ft) vertically in 1,000 years (based on evaluation of the constituent with the lowest distribution coefficient (Kd) value, dieldrin with a Kd value of 25.6 mL/g). The vadose zone underlying the soil below the site at the deepest test pit location is approximately 10.22 m (33.5 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

COPC = contaminant of potential concern
DOE = U.S. Department of Energy
MCL = maximum contaminant level
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
RAG = remedial action goal
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity

Soil cleanup levels were established in the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern, contaminants of potential concern, and other constituents (Appendix A). Those constituents exceeding the ecological screening level in the *Washington Administrative Code* Chapter 173-340, Table 749-3 were arsenic, boron, lead, mercury, and vanadium. U.S. Environmental Protection Agency ecological soil screening levels were exceeded for lead, manganese, vanadium, zinc, and dieldrin. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because the maximum detected levels of manganese, vanadium, and zinc are below Hanford Site background levels (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-H-3, 1716-H GARAGE FUEL TANK SITE

STATEMENT OF PROTECTIVENESS

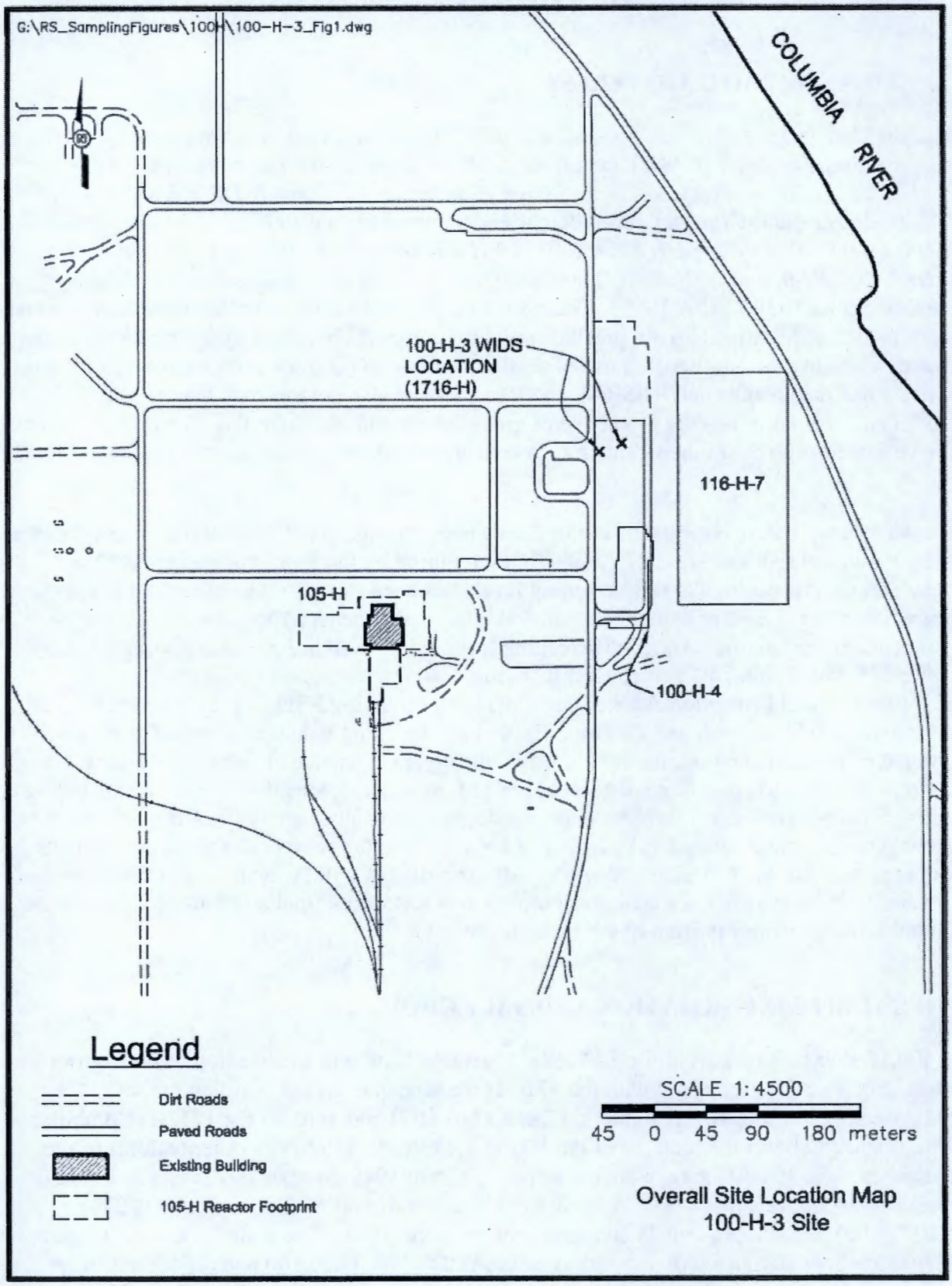
This report demonstrates that the 100-H-3, 1716-H Garage Fuel Tank Site waste site meets the remedial action objectives (RAOs) and remedial action goals (RAGs) as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009) and the *Interim Action Record 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 the 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 data results and RESRAD modeling results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The site does not have a deep zone or residual contaminant concentrations that would require any institutional controls.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern, contaminants of potential concern, and other constituents (Appendix A). Those constituents exceeding the ecological screening level in the *Washington Administrative Code* Chapter 173-340, Table 749-3 were arsenic, boron, lead, mercury, and vanadium. U.S. Environmental Protection Agency ecological soil screening levels were exceeded for lead, manganese, vanadium, zinc, and dieldrin. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because the maximum detected levels of manganese, vanadium, and zinc are below Hanford Site background levels (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-H-3 waste site, part of the 100-HR-1 Operable Unit, was the location of underground storage tanks (USTs) associated with the 1716-H maintenance garage building in the 100-H Area, west of the 107-H Retention Basin (116-H-7) and north of the 1717-H Combined Shops. Figure 1 shows the location of the 100-H-3 waste site relative to other features of the 100-H Area. The 1716-H garage building operated from 1949 through 1965 as an automotive service station and repair facility. According to Waste Information Data System (WIDS) (WCH 2010b), the site previously contained one or more USTs. The entire maintenance garage structure has been demolished. According to the WIDS (WCH 2010b) and the Stewardship Information System (SIS) (WCH 2010b), the automotive service area included gasoline pumps

Figure 1. Overall Site Location Map of the 100-H-3, 1716-H Garage Fuel Tank Site.



with associated underground tanks and probably an oil pit. There were no tanks found at this site when confirmatory sampling or waste site remediation were performed.

Geophysical Investigation

Two geophysical surveys were performed for the 100-H-3 waste site to provide comprehensive coverage of the 1716-H garage building footprint and surrounding vicinity. Ground-penetrating radar and EM-61 electromagnetic induction surveys were performed to establish the presence of any underground fuel tank(s) that may have been associated with the 1716-H garage building. Data collected from the surveys are interpreted as shown in Figure 2. The footprint of the former 1716-H garage building is also shown in Figure 2. The geophysical data did not indicate the presence of USTs at this site.

The first geophysical survey was performed in August 2004. This survey displayed significant buried rubble at the waste site, presumably from the demolished 1716-H garage building. According to Bergstrom and Mitchell (2004), two anomalous areas were identified in the geophysical investigation that had significant amounts of metal associated with them. Both of these areas had characteristics more typical of reinforced concrete than of USTs. Based on the coordinates and distances provided in Drawings P-4273 and P-3485 (GE 1948, 1949), the larger concrete anomaly (positioned between Washington State Plane coordinates N194 and N198) is presumed to be the concrete slab that housed the pump island and gas pumps. This concrete anomaly was located at the coordinates given in WIDS for the 100-H-3 waste site.

The second survey was performed on January 6, 2006, as an extension of the original geophysical investigation (Bergstrom and Mitchell 2006). A large anomalous area was identified during the geophysical investigation that had significant amounts of metal associated with it. The anomalous area was located along a water pipeline, underneath a roadway, suggesting that the anomaly is a concrete-encased pipe and not a UST. None of the other anomalous features identified by the geophysical survey were indicative of a UST.

REMEDIATION ACTION SUMMARY

The 100-H-3 waste site was remediated between December 21 and 30, 2009. Approximately 894 bank cubic meters (1,170 bank cubic yards) of soil and debris were removed from the site and disposed at the Environmental Restoration Disposal Facility. Remediation included removal of the pump island as well as the fuel supply lines. The area associated with the 100-H-3 remediation is shown in Figure 3.

At the expected location of the tanks, the excavation continued until the approximate depth of 3.5 m (11.5 ft) was reached. The adjacent french drain and debris at the former tank location were also removed. Figure 4 is a photograph of the location after remediation of the site. The fuel piping on the west side of the waste site was excavated to an approximate depth of 1.5 m (4.5 ft). Two unrelated utilities are visible in Figure 5: a 100-H-35, 100-H service water pipeline that parallels the road and a 100-H-28:5, 1607-H2 sanitary sewer pipeline inside the concrete encasement that crosses under the road. No soil staining or anomalous hazardous debris was noted during excavation and loadout of material associated with the 100-H-3 waste site. Figure 5 is a photograph of the pump island area after remediation.

Figure 2. Geophysical Investigation Results for the 100-H-3, 1716-H Garage Fuel Tank Site.

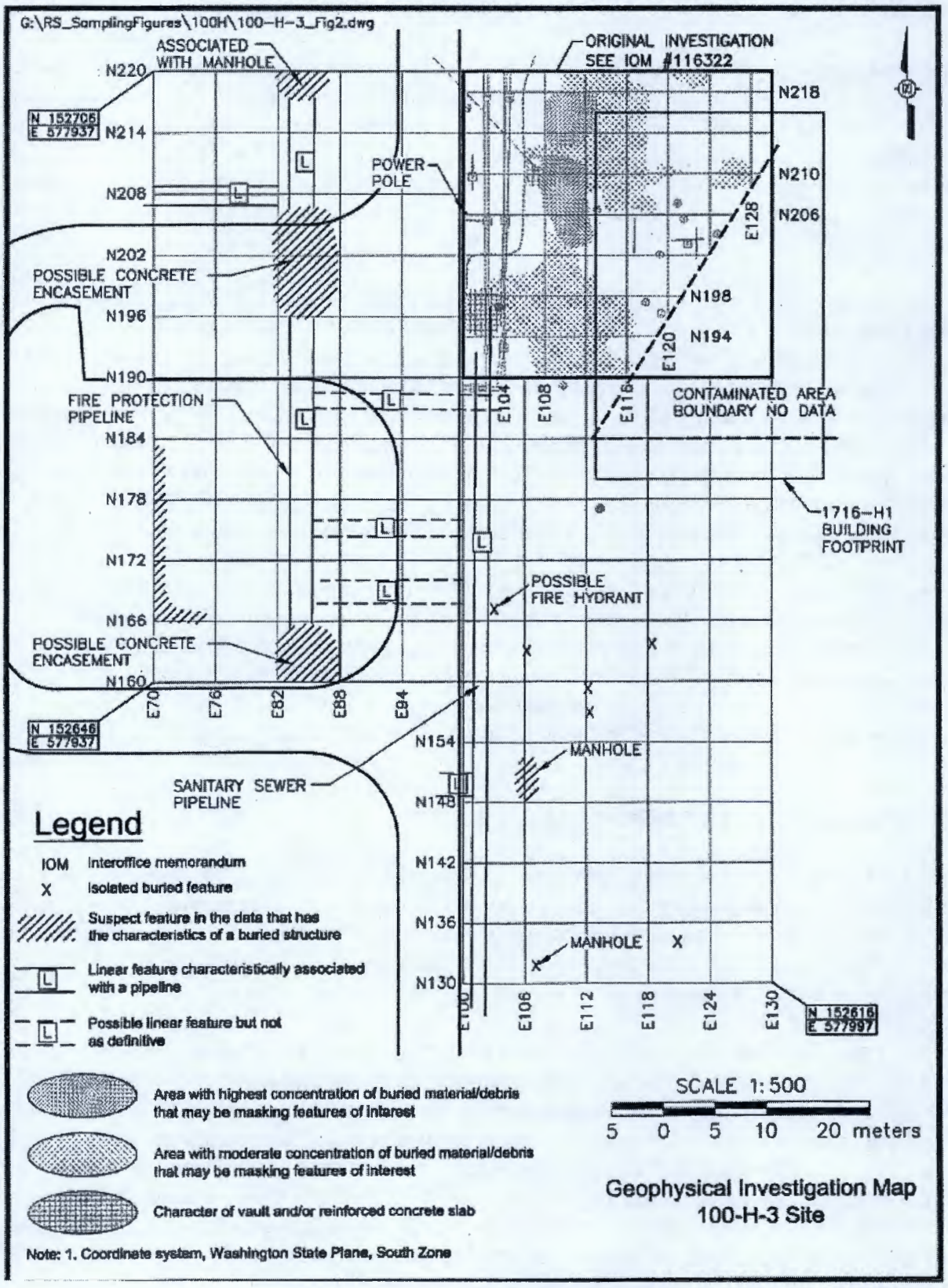


Figure 3. 100-H-3 Post-Excavation Boundary.

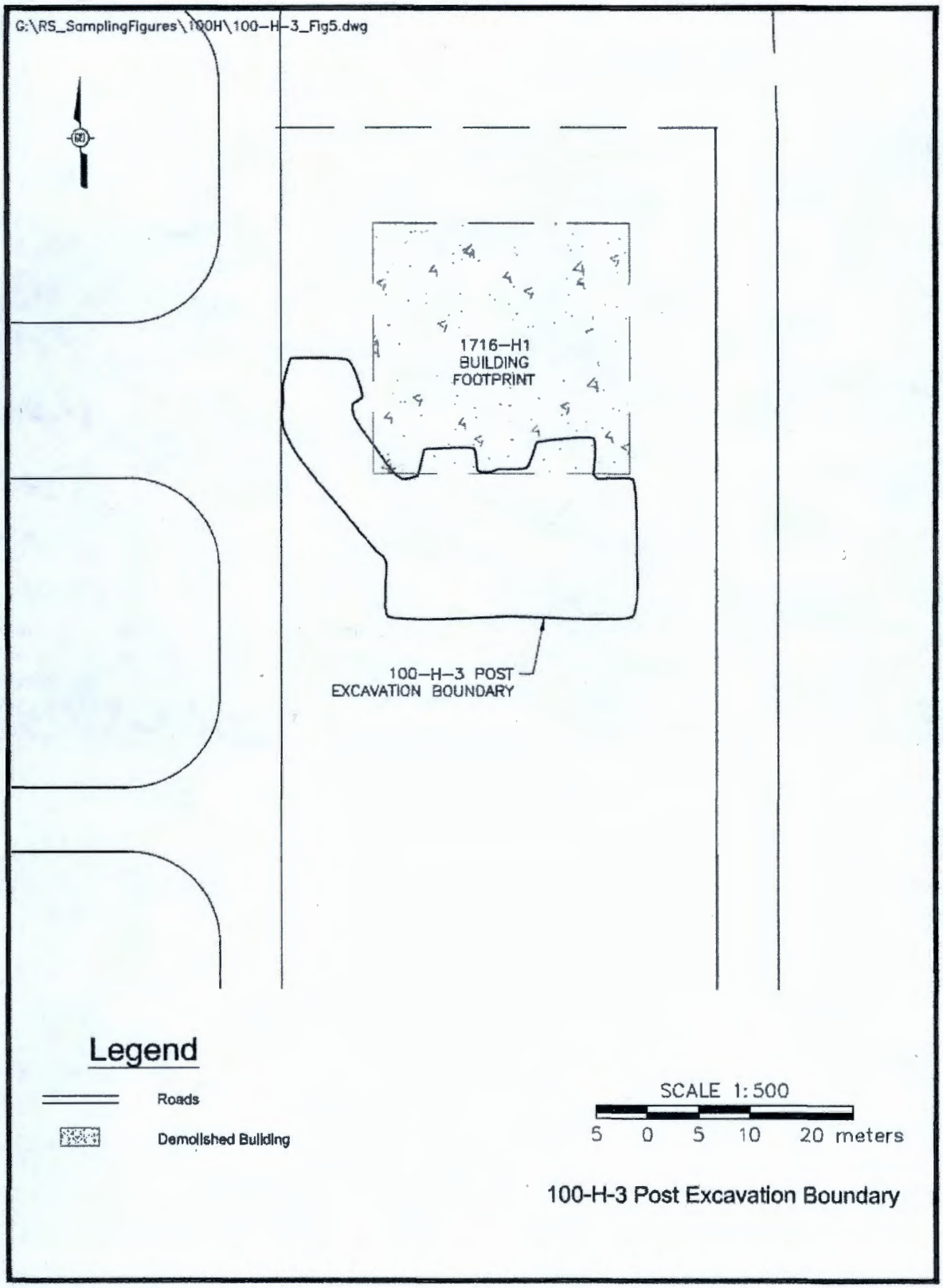


Figure 4. 100-H-3 Underground Storage Tank Location, Post-Remediation.

Figure 5. 100-H-3 Pump Island Area, Post-Remediation.

VERIFICATION SAMPLING ACTIVITIES

Verification sampling for the 100-H-3 waste site was performed on September 21, 2010 (WCH 2010a), and March 29, 2011 to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the RDR/RAWP (DOE-RL 2009) and the Remaining Sites ROD (EPA 1999). The verification sample results are provided within the 95% upper confidence limit (UCL) calculation in Appendix B and indicate that the remedial action achieved compliance with the RAOs for the 100-H-3 waste site. The following subsections provide additional discussion of the information used to develop the verification sampling design. A more detailed discussion of the verification sample design can be found in the verification work instruction (WCH 2010b).

Contaminants of Potential Concern

The contaminants of potential concern (COPCs) for the 100-H-3 waste site provided in the RDR/RAWP are semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), arsenic, barium, cadmium, total chromium, lead, selenium, silver, and polychlorinated biphenyls (PCBs). Field screening for VOCs was

performed during remediation, and no organics were detected; therefore, VOCs were eliminated as a site COPC. Although pesticides were not a COPC for confirmatory sampling, analysis for pesticides was performed, and several were detected above groundwater and river protection RAGs. Therefore, pesticides were included in the list of COPCs for verification sampling. Mercury levels were also evaluated for the site. Although not considered COPCs, antimony, beryllium, boron, cobalt, copper, manganese, molybdenum, nickel, vanadium, and zinc were evaluated by performing analyses for the constituents of the expanded inductively coupled plasma (ICP) metals list. The semivolatile organic analysis was replaced with polycyclic aromatic hydrocarbons (PAH) analysis, per Washington State Department of Ecology request made during verification work instruction review process. Radionuclides were not COPCs for this site, as the nature of the debris did not suggest a history of radiological contact, and field screening during remediation did not identify radiological contamination. Table 1 identifies the analyses performed for the 100-H-3 verification sampling.

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 footprint of the entire excavation was the only decision unit for verification sampling (Figure 6).

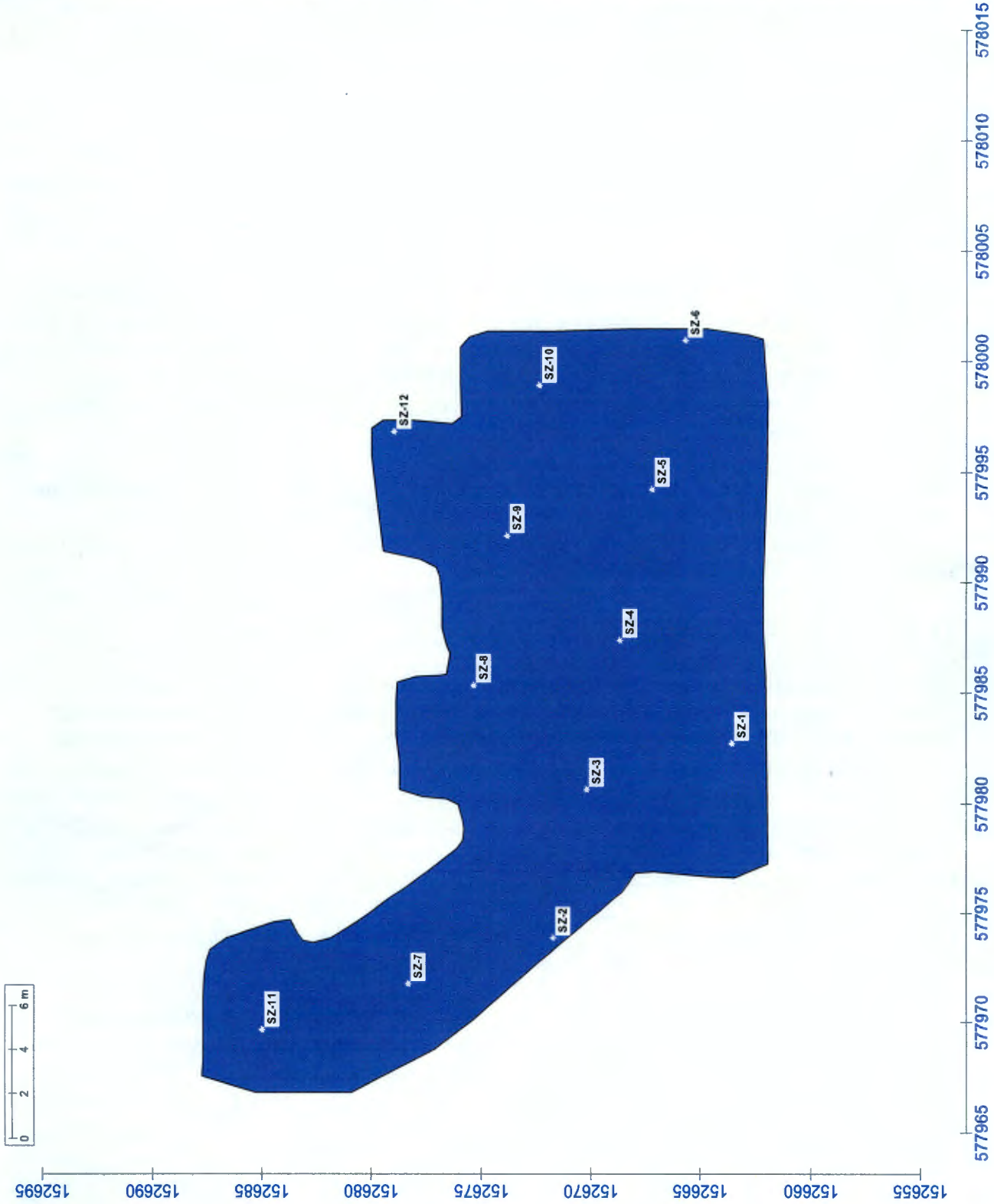
Table 1. Laboratory Analytical Methods.

Analytical Method	COPCs
ICP metals [a] – EPA Method 6010	Arsenic, barium, cadmium, total chromium, lead, selenium, silver
Mercury – EPA Method 7471	Mercury
PCB – EPA Method 8082	PCBs
Pesticides – Method 8081	Pesticides
PAH – EPA Method 8310	PAH
TPH – EPA Method 8015/418.1	TPH

[a] Although not considered COPCs, antimony, beryllium, boron, cobalt, copper, manganese, molybdenum, nickel, vanadium, and zinc were evaluated by performing analyses for the constituents of the expanded ICP metals list.

COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma
PCB = polychlorinated biphenyl
PAH = polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons

Figure 6. Shallow Zone Sample Locations for the 100-H-3, 1716-H Garage Fuel Tank Site.



The decision rule for demonstrating compliance with the cleanup criteria requires comparison of the true population mean, as estimated by the 95% 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 footprint of the 100-H-3 waste site using random-start systematic grids in an effort to determine the potential presence of residual contamination.

The footprint of the 100-H-3 waste site was delineated in Visual Sample Plan[1] (VSP) software and used as the basis for the location of a random-start systematic grid for verification soil sampling. Twelve soil sample locations were identified in the 100-H-3 waste site. Additional details concerning the use of VSP to develop the statistical sampling design and derive the number of verification samples to collect are discussed in the verification work instruction (WCH 2010b).

Field quality control samples consisted of one equipment blank sample and one field duplicate sample. All samples were submitted for full protocol laboratory analysis. A summary of verification samples collected for the 100-H-3 waste site is provided in Table 2, and a map of the sample locations is provided in Figure 6.

Verification Sample Results

Verification samples were analyzed using U.S. Environmental Protection Agency (EPA)-approved analytical methods. The 95% UCLs on the true population means for residual COPCs were calculated for the excavation footprint as specified by the RDR/RAWP (DOE-RL 2009) with calculations provided in Appendix A. When a COPC was detected in fewer than 50% of the verification samples collected, the maximum detected value was used for comparison against the RAGs; therefore no statistical evaluation was done for that COPC. If no detections for a given COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COPC. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2009) under *Washington Administrative Code* (WAC) 173-340-740(3) for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium; therefore, these constituents are not considered site COPCs.

Comparisons of the statistical and maximum results for COPCs against the site RAGs are summarized in Table 3. Contaminants that were not detected by laboratory analysis are excluded from these tables. 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 B).

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

Table 2. 100-H-3 Verification Sampling Summary Table.

Sample Location	HEIS Sample Number	WSP Coordinates		Sample Analysis
		Northing (m)	Easting (m)	
SZ-1	J1C1M3	152663.6	577982.7	ICP metals [a], mercury, TPH, PCBs, PAH, pesticides
SZ-2	J1C1M4	152671.7	577973.8	
SZ-3	J1C1M5	152670.2	577980.6	
SZ-4	J1C1M6	152668.7	577987.4	
SZ-5	J1C1M7	152667.2	577994.2	
SZ-6	J1C1M8	152665.7	578001.0	
SZ-7	J1C1M9	152678.3	577971.7	
SZ-8	J1C1N0	152675.3	577985.3	
SZ-9	J1C1N1	152673.8	577992.1	
SZ-10	J1C1N2	152672.3	577998.9	
SZ-11	J1C1N3	152685.0	577969.6	
SZ-12	J1C1N4	152679.0	577996.8	
Duplicate [b]	J1C1N5	152668.7	577987.4	
Equipment blank	J1C1N6	NA	NA	ICP metals [a], mercury, PAH

[a] The expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.
[b] The duplicate soil sample was of sample J191D8, which was chosen at the discretion of the project analytical lead.

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

Table 3. Comparison of Statistical Values to Action Levels for the 100-H-3 Shallow Zone Verification Samples. (2 Pages)

COPC	Statistical Result [b] (mg/kg)	Remedial Action Goals [a]			Does the Maximum Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Levels Protective of Groundwater	Soil Levels Protective of the River		
Metals (mg/kg)						
Arsenic	12.9	20 [c]	20 [c]	20 [c]	No	--
Barium	88.6 (<BG)	5,600	200	400	No	--
Beryllium	0.333 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	3.24	7,200	320	--	No	--
Cadmium	0.231 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium, total	17.3 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	6.47 (<BG)	24	15.7 [c]	--	No	--
Copper	15.1 (<BG)	2,960	59.2	22.0 [c]	No	--
Lead	67.8	353	10.2 [c]	10.2 [c]	Yes	Yes [f]
Manganese	306 (<BG)	3,760	512 [c]	512 [c]	No	--

Table 3. Comparison of Statistical Values to Action Levels for the 100-H-3 Shallow Zone Verification Samples. (2 Pages)

COPC	Statistical Result [b] (mg/kg)	Remedial Action Goals [a]			Does the Maximum Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Levels Protective of Groundwater	Soil Levels Protective of the River		
Mercury	0.413	24	0.33 [c]	0.33 [c]	Yes	Yes [f]
Molybdenum [e]	0.445	400	8	--	No	--
Nickel	14.9 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	49.1 (<BG)	560	85.1 [c]	--	No	--
Zinc	48.8 (<BG)	24,000	480	67.8 [c]	No	--
Total Petroleum Hydrocarbons (TPH) (mg/kg)						
TPH – motor oil	55.7	200	200	200	No	--
TPH – diesel range	164	200	200	200	No	--
Polychlorinated Biphenyls (PCBs) (mg/kg)						
Aroclor-1254	0.00796	0.5	0.017 [g]	0.017 [g]	No	--
Aroclor-1260	0.0144	0.5	0.017 [g]	0.017 [g]	No	--
Organics (mg/kg)						
Anthracene	0.017	24,000	240	1,920	No	--
Benzo(a)anthracene	0.023	1.37	0.015 [g]	0.015 [g]	Yes	Yes [f]
Benzo(a)pyrene	0.011	0.137	0.015 [g]	0.015 [g]	No	--
Benzo(b) fluoranthene	0.088	1.37	0.015 [g]	0.015 [g]	Yes	Yes [f]
Benzo(ghi) Perylene [h]	0.027	2,400	48	192	No	--
Benzo(k) fluoranthene	0.034	1.37	0.015 [g]	0.015 [g]	Yes	Yes [f]
beta-BHC	0.00253	0.556	0.00484	0.00554	No	--
Chrysene	0.057	13.7	0.12	0.1 [g]	No	--
Dieldrin	0.00492	0.0625	0.0033 [g]	0.0033 [g]	Yes	Yes [f]
Fluoranthene	0.19	3,200	64	18.0	No	--
Fluorene	0.012	3,200	64	260	No	--
Ideno(1,2,3-cd)pyrene	0.041	1.37	0.33 [g]	0.33 [g]	No	--
Phenanthrene [h]	0.12	24,000	240	1,920	No	--
Pyrene	0.062	2,400	48	192	No	--

[a] Lookup values and RAGs obtained from the *100 Area Remedial Design Report/ Remedial Action Work Plan* (RDR/RAWP) (DOE-RL 2009) unless otherwise noted.

[b] 95% upper confidence level or maximum value, depending on data censorship, as described in Appendix B.

[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP.

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3]) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

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

[f] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009), the residual concentrations of lead, mercury, dieldrin, benzo(a)anthracene, benzo(b)fluoranthene and benzo(k)fluoranthene are not expected to migrate more than 3 m (10 ft) vertically in 1,000 years (based on evaluation of the constituent with the lowest distribution coefficient (K_d) value, dieldrin with a K_d value of 25.6 mL/g). The vadose zone underlying the soil below the site at the deepest test pit location is approximately 10.22 m (33.5 ft) thick. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

[g] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) and the RDR/ RAWP (DOE-RL 2009).

[h] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:
Contaminant: benzo(g,h,i)perylene; surrogate: pyrene
Contaminant: phenathrene; surrogate: anthracene.

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

VERIFICATION SAMPLE DATA EVALUATION

This section demonstrates that remedial actions at the 100-H-3 waste site have achieved the applicable RAOs by meeting the RAGs and determining that groundwater and the river are protected.

Evaluation of the verification sampling results in Table 3 show that all results are below rural-residential scenario direct exposure, groundwater protection, and Columbia River protection soil RAGs at the 100-H-3 waste site, with the exception of lead, mercury, dieldrin, benzo(a)anthracene, benzo(b)fluoranthene and benzo(k)fluoranthene, which exceeded soil RAGs for groundwater and river protection cleanup levels. The thickness of the vadose zone beneath the bottom of the waste site excavation is approximately 10.22 m (33.5 ft) thick. Data were not collected on the vertical extent of these contaminants, but given the lowest soil-partitioning coefficient for these constituents (K_d) (25.6 mL/g for dieldrin); they are not predicted to migrate more than 3 m (10 ft) vertically in 1,000 years, as discussed in Appendix C of the RDR/RAWP (DOE-RL 2009). Therefore, residual soil concentrations of these constituents are predicted to be protective of groundwater and the Columbia River. All other COPCs were either not detected or were quantified below the RAGs.

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. The WAC 173-340 three-part test consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection can exceed two times the cleanup criteria, and (3) the percentage of samples exceeding the cleanup criteria must be less than 10% of the data set. The application of the three-part test for the 100-H-3 waste site is included in the statistical calculations (Appendix B). The results of this evaluation indicate that all residual COPC concentrations pass the three-part test in comparison against applicable RAGs, with the exception of lead, mercury, dieldrin, benzo(a)anthracene, benzo(b)fluoranthene and benzo(k)fluoranthene in comparison against the soil RAGs for groundwater and river protection. As described previously, RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009) predicts that these constituents will not reach groundwater (and, therefore, the river) within 1,000 years.

Assessment of the risk requirements for the 100-H-3 waste site is determined by calculation of the direct contact hazard quotient and carcinogenic (excess cancer) risk values for nonradionuclides. These calculations are located in Appendix B. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. These risk values were conservatively calculated using the 95% UCL or maximum values (Appendix B) from the samples collected at the 100-H-3 waste site. Risk values are not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. The calculations indicate that all individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the 100-H-3 waste site is 2.5×10^{-2}. All individual cumulative carcinogenic risk values are less than 1×10^{-6}. The cumulative carcinogenic risk value is 3.5×10^{-7}. Therefore, nonradionuclide risk requirements are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approaches and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications. The DQA for the 100-H-3 waste site establishes that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The evaluation verified that the sample design and resulting data set are acceptable for decision-making purposes. The detailed DQA is presented in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 100-H-3 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999). Verification sampling results support an evaluation that residual contaminant concentrations at the 100-H-3 waste site do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow-zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Therefore, the 100-H-3 waste site does not pose a risk to human health or the environment, and no institutional controls are required.
A reclassification to Interim Closed Out is supported for the 100-H-3, 1716-H Garage Fuel Tank Site waste site.

REFERENCES

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APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Maximum Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-H-3 Waste Site [a].

Hazardous Substance		2001 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Maximum Result
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
	Background	Metals (mg/kg)							
Arsenic III	6.5 [d]	--	--	7	18	--	43	46	12.9
Arsenic V	6.5 [d]	10	60	132					
Boron	--	0.5	--	--	--	--	--	--	3.24
Lead	10.2	50	500	118	120	1,700	11	56	67.8
Manganese	512	1,100 [e]	--	1,500	220	450	4,300	4,000	306 (<BG)
Mercury	0.33	0.3	0.1	5.5	--	--	--	--	0.413
Vanadium	85.1	2	--	--	--	--	7.8	280	49.1 (<BG)
Zinc	67.8	86 [e]	200	360	160	120	46	79	48.8 (<BG)
Dieldrin	--	--	--	0.07	--	--	0.022	0.0049	0.00492

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

[b] Available on the internet at (www.epa.gov/ecotox/ecossl).

[c] Wildlife.

[d] The Hanford Site background for arsenic is 6.5 mg/kg. An arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP, DOE/RL-96-17, Rev. 6.

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

-- = not available
BG = background
EPA = Environmental Protection Agency
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*

APPENDIX B

CALCULATIONS

APPENDIX B

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 file will be stored in a U.S. Department of Energy, Richland Operations Office repository. This calculation has been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculations," Washington Closure Hanford, Richland, Washington. The following calculations are provided in this appendix:

100-H-3, 1716-H Garage Fuel Tank Site Cleanup Verification 95% UCL Calculation, 0100H-CA-V0148, Rev. 1, Washington Closure Hanford, Richland, Washington.

100-H-3, 1716-H Garage Fuel Tank Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100H-CA-V0152, Rev. 1, Washington Closure Hanford, Richland, Washington.

100-H-3, 1716-H Garage Fuel Tank Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100H-CA-V0153, Rev. 0, Washington Closure Hanford, Richland, Washington.

CALCULATION COVER SHEET

Project Title:	100-H Field Remediation	**Job No.**	14655
Area	100-H		
Discipline	Environmental	***Calc. No.**	0100H-CA-V0148
Subject	100-H-3 Waste Site Cleanup Verification 95% UCL Calculations		
Computer Program	Excel	**Program No.**	Excel 2003

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

Committed Calculation **X** **Preliminary** **O** **Superseded** **O** **Voided** **O**

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 12 Attm. 1 = 11 Total =24	Irina Berezovskiy I. B. Berezovskiy	T. E. Queen T. E. Queen	J. D. Skoglie	D. F. Obenauer D. F. Obenauer	1/25/11

SUMMARY OF REVISIONS	

* Obtain calc no. from DIS

DE01437.03 (12/09/2004)

Washington Closure Hanford **CALCULATION SHEET**

Originator I. B. Berezovskiy	**Date** 01/11/11	**Calc. No.** 0100H-CA-V0148	**Rev. No.** 0
Project 100-H Field Remediation	**Job No.** 14655	**Checked** T. E. Queen	**Date** 01/11/11
Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 1 of 12

Summary

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

Table of Contents:
Sheets 1 to 4 - Calculation Sheet Summary
Sheet 5 to 8- Calculation Sheet Verification Data - Excavation
Sheet 9 to 11 - Ecology Software (MTCAStat) Results
Sheet 12 - Duplicate Analysis
Attachment 1 - 100-H-3, Verification Sampling Results (11 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.
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9) Ecology, 2005, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
10) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code.*

Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2009b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).

Calculation Description:
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 100-H-3 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 100-H-3 waste site underwent statistical sampling and is considered one decision unit for verification sampling.

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

Washington Closure Hanford **CALCULATION SHEET**

Originator	I. B. Berezovskiy	Date 01/11/11	Calc. No. 0100H-CA-V0148	Rev. No.	0
Project	100-H Field Remediation	Job No. 14655	Checked T. E. Queen	Date	01/11/11
Subject	100-H-3 Waste Site Cleanup Verification 95% UCL Calculations			Sheet No.	2 of 12

Summary (continued)

Methodology, continued:

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

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

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

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

The RPD is calculated when both the primary value and either the duplicate or split value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed in Table 2-1 of the SAP (DOE-RL 2009a) for certain constituents. All other constituents will have their own pre-determined TDL's based on the laboratory and method used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

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

For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. If the RPD is greater than 30%, further investigation regarding the usability of the data is performed. To assist in the identification of anomalous sample pairs, when an analyte is detected in the primary or duplicate/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 result exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable RSVP.

Washington Closure Hanford **CALCULATION SHEET**

Originator I. B. Berezovskiy	**Date** 01/13/11	**Calc. No.** 0100H-CA-V0148	**Rev. No.** 0
Project 100-H Field Remediation	**Job No.** 14655	**Checked** T. E. Queen	**Date** 01/13/11
Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 3 of 12

Summary (continued)

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

Results Summary - Excavation *

Analyte	95% UCL Result	Maximum Result	Units
Arsenic	12.9	--	mg/kg
Barium	88.6	--	mg/kg
Beryllium	0.333	--	mg/kg
Boron	3.24	--	mg/kg
Cadmium	0.231	--	mg/kg
Chromium	17.3	--	mg/kg
Cobalt	6.47	--	mg/kg
Copper	15.1	--	mg/kg
Lead	67.8	--	mg/kg
Manganese	306	--	mg/kg
Molybdenum	0.445	--	mg/kg
Nickel	14.9	--	mg/kg
Vanadium	49.1	--	mg/kg
Zinc	48.8	--	mg/kg
TPH - motor oil	55.7	--	mg/kg
Mercury	--	0.413	mg/kg
TPH - diesel range	--	164	mg/kg
Aroclor-1254	--	0.00796	mg/kg
Aroclor-1260	--	0.0144	mg/kg
Benzo(a)anthracene	--	0.0696	mg/kg
Benzo(a)pyrene	--	0.0708	mg/kg
Benzo(b)fluoranthene	--	0.0608	mg/kg
Benzo(ghi)perylene	--	0.0567	mg/kg
Benzo(k)fluoranthene	--	0.0630	mg/kg
beta-BHC	--	0.00253	mg/kg
Chrysene	--	0.0851	mg/kg
Dieldrin	--	0.00492	mg/kg
Fluoranthene	--	0.138	mg/kg
Phenanthrene	--	0.0813	mg/kg
Pyrene	--	0.143	mg/kg

3 Part Test Evaluation:

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

*The 95% UCL result or maximum value, depending on data censorship,

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

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

Washington Closure Hanford **CALCULATION SHEET**

Originator I. B. Berezovskiy	**Date** 01/11/11	**Calc. No.** 0100H-CA-V0148	**Rev. No.** 0
Project 100-H Field Remediation	**Job No.** 14655	**Checked** T. E. Queen	**Date** 01/11/11
Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 4 of 12

Summary (continued)

Results:

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

Relative Percent Difference Results and QA/QC Analysis*

Analyte	Excavation
	Duplicate Analysis
Aluminum	2.5%
Barium	3.2%
Calcium	6.7%
Chromium	4.6%
Copper	1.5%
Iron	2.6%
Magnesium	0.5%
Manganese	2.2%
Silicon	1.5%
Vanadium	2.6%
Zinc	0.7%
TPH - diesel range	2.4%
TPH - motor oil	2.4%

*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 I. B. Berezovskiy
Project 100-H Field Remediation
Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/24/11
Job No. 14655

Calc. No. 0100H-CA-V0148
Checked T. E. Queen

Rev. No. 0
Date 01/24/11
Sheet No. 5 of 12

1 **100-H-3 Statistical Calculations**

2 **Verification Data - Excavation**

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	SZ-4	J1C1M6	9/21/10	5.79		1.02	82.9		0.512	0.336		0.205	1.56	B	2.05	0.163	B	0.256	19.3		1.02	6.16		3.07	13.4		2.05
6	Duplicate of J1C1M6	J1C1N5	9/21/10	5.49		0.783	85.6		0.392	0.336		0.157	1.60		1.57	0.155	B	0.196	20.2		0.783	6.14		2.35	13.6		1.57
7	SZ-1	J1C1M3	9/21/10	25.0		0.742	93.2		0.371	0.338		0.148	4.07		1.48	0.169	B	0.186	12.9		0.742	6.86		2.23	14.5		1.48
8	SZ-2	J1C1M4	9/21/10	5.18		0.861	83.5		0.431	0.342		0.172	1.60	B	1.72	0.168	B	0.215	20.2		0.861	6.25		2.58	13.8		1.72
9	SZ-3	J1C1M5	9/21/10	5.47		0.958	88.4		0.479	0.360		0.192	1.62	B	1.92	0.169	B	0.239	20.9		0.958	6.45		2.87	14.3		1.92
10	SZ-5	J1C1M7	9/21/10	6.27		0.889	86.7		0.445	0.349		0.178	1.55	B	1.78	0.180	B	0.222	19.9		0.889	6.49		2.67	14.8		1.78
11	SZ-6	J1C1M8	9/21/10	19.8		0.735	58.8		0.367	0.283		0.147	1.27	B	1.47	0.130	B	0.184	12.7		0.735	5.91		2.20	14.1		1.47
12	SZ-7	J1C1M9	9/21/10	5.58		0.694	99.9		0.347	0.287		0.139	7.14		1.39	0.525		0.173	11.4		0.694	6.28		2.08	16.2		1.39
13	SZ-8	J1C1N0	9/21/10	8.27		0.774	73.6		0.387	0.289		0.155	1.50	B	1.55	0.131	B	0.193	15.6		0.774	5.71		2.32	16.3		1.55
14	SZ-9	J1C1N1	9/21/10	3.33		0.669	55.2		0.335	0.167		0.134	0.708	B	1.34	0.0947	B	0.167	13.3		0.669	4.92		2.01	13.2		1.34
15	SZ-10	J1C1N2	9/21/10	6.52		0.818	62.1		0.409	0.275		0.164	1.61	B	1.64	0.122	B	0.204	13.1		0.818	6.21		2.45	14.2		1.64
16	SZ-11	J1C1N3	9/21/10	17.4		0.840	76.1		0.420	0.318		0.168	1.65	B	1.68	0.148	B	0.210	13.9		0.840	6.40		2.52	14.7		1.68
17	SZ-12	J1C1N4	9/21/10	6.99		1.01	91.5		0.507	0.351		0.203	4.16		2.03	0.144	B	0.253	13.6		1.01	6.92		3.04	15.0		2.03

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
21	SZ-4	J1C1M6 /J1C1N5	9/21/10	5.64	84.3	0.336	1.58	0.159	19.8	6.15	13.5
22	SZ-1	J1C1M3	9/21/10	25.0	93.2	0.338	4.07	0.169	12.9	6.86	14.5
23	SZ-2	J1C1M4	9/21/10	5.18	83.5	0.342	1.60	0.168	20.2	6.25	13.8
24	SZ-3	J1C1M5	9/21/10	5.47	88.4	0.360	1.62	0.169	20.9	6.45	14.3
25	SZ-5	J1C1M7	9/21/10	6.27	86.7	0.349	1.55	0.180	19.9	6.49	14.8
26	SZ-6	J1C1M8	9/21/10	19.8	58.8	0.283	1.27	0.130	12.7	5.91	14.1
27	SZ-7	J1C1M9	9/21/10	5.58	99.9	0.287	7.14	0.525	11.4	6.28	16.2
28	SZ-8	J1C1N0	9/21/10	8.27	73.6	0.289	1.50	0.131	15.6	5.71	16.3
29	SZ-9	J1C1N1	9/21/10	3.33	55.2	0.167	0.708	0.0947	13.3	4.92	13.2
30	SZ-10	J1C1N2	9/21/10	6.52	62.1	0.275	1.61	0.122	13.1	6.21	14.2
31	SZ-11	J1C1N3	9/21/10	17.4	76.1	0.318	1.65	0.148	13.9	6.40	14.7
32	SZ-12	J1C1N4	9/21/10	6.99	91.5	0.351	4.16	0.144	13.6	6.92	15.0

33 **Statistical Computations**

34		Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
35	95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), 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.
36	N	12	12	12	12	12	12	12	12
37	% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%
38	Mean	9.62	79.4	0.308	2.37	0.178	15.6	6.21	14.6
39	Standard deviation	7.00	14.4	0.0536	1.84	0.112	3.53	0.532	0.951
40	95% UCL on mean	12.9	88.6	0.333	3.24	0.231	17.3	6.47	15.1
41	Maximum value	25.0	99.9	0.360	7.14	0.525	20.9	6.92	16.3
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection
43	**WAC 173-340 3-PART TEST**								
44	95% UCL > Cleanup Limit?	NO	NA	NA	NO	NA	NO	NA	NA
45	> 10% above Cleanup Limit?	NO	NA	NA	NO	NA	YES	NA	NA
46	Any sample > 2X Cleanup Limit?	NO	NA	NA	NO	NA	NO	NA	NA
47	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	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 (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

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Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/24/11
Job No. 14655

Calc. No. 0100H-CA-V0148
Checked T. E. Queen

Rev. No. 0
Date 01/24/11
Sheet No. 6 of 12

1 **100-H-3 Statistical Calculations**

2 **Verification Data - Excavation**

3	Sample	Sample	Sample	Lead			Manganese			Molybdenum			Nickel			Vanadium			Zinc			TPH - motor oil		
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
5	SZ-4	J1C1M6	9/21/10	10.3		1.02	279		1.02	0.409	B	1.02	16.7		2.56	41.6		1.02	54.7		3.07	171	J	10.6
6	Duplicate of J1C1M6	J1C1N5	9/21/10	9.12		0.783	273		0.783	0.344	B	0.783	16.2		1.96	42.7		0.783	54.3		2.35	180	J	10.3
7	SZ-1	J1C1M3	9/21/10	76.8		0.742	325		0.742	0.404	B	0.742	11.8		1.86	52.3		0.742	43.3		2.23	6.26	J	10.5
8	SZ-2	J1C1M4	9/21/10	6.50		0.861	304		0.861	0.420	B	0.861	16.3		2.15	43.2		0.861	54.1		2.58	10.9	UJ	10.9
9	SZ-3	J1C1M5	9/21/10	7.29		0.958	304		0.958	0.366	B	0.958	17.7		2.39	42.4		0.958	46.3		2.87	10.2	UJ	10.2
10	SZ-5	J1C1M7	9/21/10	12.9		0.889	310		0.889	0.431	B	0.889	15.9		2.22	45.3		0.889	50.5		2.67	31.2	J	10.6
11	SZ-6	J1C1M8	9/21/10	68.8		0.735	283		0.735	0.367	B	0.735	12.5		1.84	46.5		0.735	42.7		2.20	16.5	J	10.5
12	SZ-7	J1C1M9	9/21/10	27.4		0.694	249		0.694	0.639	B	0.694	10.5		1.73	49.2		0.694	50.2		2.08	83.9	J	10.9
13	SZ-8	J1C1N0	9/21/10	25.9		0.774	271		0.774	0.354	B	0.774	12.9		1.93	43.7		0.774	42.6		2.32	19.1	J	10.5
14	SZ-9	J1C1N1	9/21/10	4.18		0.669	208		0.669	0.317	B	0.669	9.67		1.67	48.9		0.669	32.9		2.01	5.29	J	9.81
15	SZ-10	J1C1N2	9/21/10	13.2		0.818	276		0.818	0.422	B	0.818	12.8		2.04	51.7		0.818	38.0		2.45	5.82	J	10.6
16	SZ-11	J1C1N3	9/21/10	64.8		0.840	321		0.840	0.350	B	0.840	11.5		2.10	48.1		0.840	40.3		2.52	5.53	J	10.5
17	SZ-12	J1C1N4	9/21/10	16.2		1.01	324		1.01	0.425	B	1.01	12.3		2.53	51.2		1.01	44.0		3.04	21.1	J	10.5

18 **Statistical Computation Input Data**

19	Sample	Sample	Sample	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc	TPH - motor oil
20	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
21	SZ-4	J1C1M6 /J1C1N5	9/21/10	9.71	276	0.377	16.5	42.2	54.5	176
22	SZ-1	J1C1M3	9/21/10	76.8	325	0.404	11.8	52.3	43.3	6.26
23	SZ-2	J1C1M4	9/21/10	6.50	304	0.420	16.3	43.2	54.1	10.9
24	SZ-3	J1C1M5	9/21/10	7.29	304	0.366	17.7	42.4	46.3	10.2
25	SZ-5	J1C1M7	9/21/10	12.9	310	0.431	15.9	45.3	50.5	31.2
26	SZ-6	J1C1M8	9/21/10	68.8	283	0.367	12.5	46.5	42.7	16.5
27	SZ-7	J1C1M9	9/21/10	27.4	249	0.639	10.5	49.2	50.2	83.9
28	SZ-8	J1C1N0	9/21/10	25.9	271	0.354	12.9	43.7	42.6	19.1
29	SZ-9	J1C1N1	9/21/10	4.18	208	0.317	9.67	48.9	32.9	5.29
30	SZ-10	J1C1N2	9/21/10	13.2	276	0.422	12.8	51.7	38.0	5.82
31	SZ-11	J1C1N3	9/21/10	64.8	321	0.350	11.5	48.1	40.3	5.53
32	SZ-12	J1C1N4	9/21/10	16.2	324	0.425	12.3	51.2	44.0	21.1

33 **Statistical Computations**

34		Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc	TPH - motor oil
35	95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
36	N	12	12	12	12	12	12	12
37	% < Detection limit	0%	0%	0%	0%	0%	0%	17%
38	Mean	27.8	288	0.406	13.4	47.1	45.0	32.6
39	Standard deviation	26.6	34.7	0.0817	2.59	3.70	6.50	50.0
40	95% UCL on mean	67.8	306	0.445	14.9	49.1	48.8	55.7
41	Maximum value	76.8	325	0.639	17.7	52.3	54.7	180
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	10.2 GW & River Protection	512 GW & River Protection	8 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200 DE, GW, River Protection
43	**WAC 173-340 3-PART TEST**							
44	95% UCL > Cleanup Limit?	YES	NA	NO	NA	NA	NA	NO
45	> 10% above Cleanup Limit?	YES	NA	NO	NA	NA	NA	NO
46	Any sample > 2X Cleanup Limit?	YES	NA	NO	NA	NA	NA	NO
47	**WAC 173-340 Compliance?**	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	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.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

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Rev. No. 0
Date 01/12/11
Sheet No. 7 of 12

1 **100-H-3 Waste Site**
2 **Verification Data - Excavation**

3	Sample Area	Sample Number	Sample Date	Mercury			TPH - Diesel Range			Aroclor-1254			Aroclor-1260			Benzo(a)anthracene SVOA			Benzo(a)pyrene SVOA			Benzo(b)fluoranthene SVOA			Benzo(ghi)perylene SVOA		
4				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	SZ-4	J1C1M6	9/21/10	0.413		0.0290	151	J	3.55	0.0142	JU	0.0142	0.0142	JU	0.0142	0.350	U	0.350	0.350	U	0.350	0.350	U	0.350	0.350	U	0.350
6	Duplicate of J1C1M6	J1C1N5	9/21/10	0.274		0.0282	164	J	3.44	0.0142	JU	0.0142	0.0142	JU	0.0142	0.347	U	0.347	0.347	U	0.347	0.347	U	0.347	0.347	U	0.347
7	SZ-1	J1C1M3	9/21/10	0.0275	U	0.0275	3.49	UJ	3.49	0.0140	JU	0.0140	0.0140	JU	0.0140	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
8	SZ-2	J1C1M4	9/21/10	0.0301	U	0.0301	3.62	UJ	3.62	0.0146	JU	0.0146	0.0146	JU	0.0146	0.360	U	0.360	0.360	U	0.360	0.360	U	0.360	0.360	U	0.360
9	SZ-3	J1C1M5	9/21/10	0.0232	B	0.0271	3.41	UJ	3.41	0.0137	JU	0.0137	0.0137	JU	0.0137	0.345	U	0.345	0.345	U	0.345	0.345	U	0.345	0.345	U	0.345
10	SZ-5	J1C1M7	9/21/10	0.0282	U	0.0282	3.54	UJ	3.54	0.0142	JU	0.0142	0.0142	JU	0.0142	0.347	U	0.347	0.347	U	0.347	0.347	U	0.347	0.347	U	0.347
11	SZ-6	J1C1M8	9/21/10	0.0251	U	0.0251	3.50	UJ	3.50	0.0140	JU	0.0140	0.0140	JU	0.0140	0.349	U	0.349	0.349	U	0.349	0.349	U	0.349	0.349	U	0.349
12	SZ-7	J1C1M9	9/21/10	0.0282	U	0.0282	3.64	UJ	3.64	0.00756	J	0.0144	0.0132	J	0.0144	0.0696	J	0.361	0.0708	J	0.361	0.0608	J	0.361	0.0567	J	0.361
13	SZ-8	J1C1N0	9/21/10	0.243		0.0279	3.51	UJ	3.51	0.00732	J	0.0139	0.0144	J	0.0139	0.341	U	0.341	0.341	U	0.341	0.341	U	0.341	0.341	U	0.341
14	SZ-9	J1C1N1	9/21/10	0.0273	U	0.0273	3.27	UJ	3.27	0.0136	JU	0.0136	0.0136	JU	0.0136	0.334	U	0.334	0.334	U	0.334	0.334	U	0.334	0.334	U	0.334
15	SZ-10	J1C1N2	9/21/10	0.0273	U	0.0273	3.52	UJ	3.52	0.00796	J	0.0136	0.00592	J	0.0136	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
16	SZ-11	J1C1N3	9/21/10	0.0272	U	0.0272	3.51	UJ	3.51	0.0140	JU	0.0140	0.0140	JU	0.0140	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338
17	SZ-12	J1C1N4	9/21/10	0.0138	B	0.0256	3.49	UJ	3.49	0.00416	J	0.0139	0.0081	J	0.0139	0.348	U	0.348	0.348	U	0.348	0.348	U	0.348	0.348	U	0.348

18 **3-Part Test Evaluations**

19		Mercury	TPH - Diesel Range	Aroclor-1254	Aroclor-1260	Benzo(a)anthracene SVOA	Benzo(a)pyrene SVOA	Benzo(b)fluoranthene SVOA	Benzo(ghi)perylene SVOA
20	% < Detection limit	67%	92%	67%	67%	92%	92%	92%	92%
21	Maximum value	0.413	164	0.00796	0.0144	0.0696	0.0708	0.0608	0.0567
22	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	0.33 GW & River Protection	200 DE, GW & River Protection	0.017 GW & River Protection	0.017 GW & River Protection	0.015 GW & River Protection	0.015 GW & River Protection	0.015 GW & River Protection	48 GW Protection
23	**3-PART TEST**								
24	Maximum > Cleanup Limit?	YES	NO	NO	NO	YES	YES	YES	NO
25	> 10% above Cleanup Limit?	NO	NO	NO	NO	NO	NO	NO	NO
26	Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	YES	YES	YES	NO
27	**3-Part Test Compliance?**	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

28

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator I. B. Berezovskiy
Project 100-H Field Remediation
Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/13/11
Job No. 14655

Calc. No. 0100H-CA-V0148
Checked T. E. Queen

Rev. No. 0
Date 01/13/11
Sheet No. 8 of 12

1	Sample	Sample	Sample	Benzo(k)fluoranthene SVOA			beta-BHC			Chrysene SVOA			Dieldrin			Fluoranthene SVOA			Phenanthrene SVOA			Pyrene SVOA		
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
3	SZ-4	J1C1M6	9/21/10	0.350	U	0.350	0.00142	UD	0.00142	0.350	U	0.350	0.00142	UD	0.00142	0.350	U	0.350	0.350	U	0.350	0.350	U	0.350
4	Duplicate of J1C1M6	J1C1N5	9/21/10	0.347	U	0.347	0.00142	UD	0.00142	0.347	U	0.347	0.00142	UD	0.00142	0.347	U	0.347	0.347	U	0.347	0.347	U	0.347
5	SZ-1	J1C1M3	9/21/10	0.332	U	0.332	0.00141	UD	0.00141	0.332	U	0.332	0.00141	UD	0.00141	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
6	SZ-2	J1C1M4	9/21/10	0.360	U	0.360	0.00146	UD	0.00146	0.360	U	0.360	0.00146	UD	0.00146	0.360	U	0.360	0.360	U	0.360	0.360	U	0.360
7	SZ-3	J1C1M5	9/21/10	0.345	U	0.345	0.00137	UD	0.00137	0.345	U	0.345	0.00137	UD	0.00137	0.345	U	0.345	0.345	U	0.345	0.345	U	0.345
8	SZ-5	J1C1M7	9/21/10	0.347	U	0.347	0.00142	UD	0.00142	0.347	U	0.347	0.00178	JD	0.00142	0.0723	J	0.347	0.347	U	0.347	0.0714	J	0.347
9	SZ-6	J1C1M8	9/21/10	0.349	U	0.349	0.00140	UD	0.00140	0.349	U	0.349	0.00140	UD	0.00140	0.349	U	0.349	0.349	U	0.349	0.349	U	0.349
10	SZ-7	J1C1M9	9/21/10	0.0630	J	0.361	0.00253	JD	0.00145	0.0851	J	0.361	0.00145	UD	0.00145	0.138	J	0.361	0.0813	J	0.361	0.143	J	0.361
11	SZ-8	J1C1N0	9/21/10	0.341	U	0.341	0.00139	UD	0.00139	0.341	U	0.341	0.00139	UD	0.00139	0.341	U	0.341	0.341	U	0.341	0.341	U	0.341
12	SZ-9	J1C1N1	9/21/10	0.334	U	0.334	0.00137	UD	0.00137	0.334	U	0.334	0.00492	JD	0.00137	0.334	U	0.334	0.334	U	0.334	0.334	U	0.334
13	SZ-10	J1C1N2	9/21/10	0.331	U	0.331	0.00136	UD	0.00136	0.331	U	0.331	0.00136	UD	0.00136	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
14	SZ-11	J1C1N3	9/21/10	0.338	U	0.338	0.00140	UD	0.00140	0.338	U	0.338	0.00140	UD	0.00140	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338
15	SZ-12	J1C1N4	9/21/10	0.348	U	0.348	0.00140	UD	0.00140	0.348	U	0.348	0.00140	UD	0.00140	0.348	U	0.348	0.348	U	0.348	0.348	U	0.348

16 **3-Part Test Evaluations**

17		Benzo(k)fluoranthene SVOA	beta-BHC	Chrysene SVOA	Dieldrin	Fluoranthene SVOA	Phenanthrene SVOA	Pyrene SVOA
18	% < Detection limit	92%	92%	92%	83%	83%	92%	83%
19	Maximum value	0.0630	0.00253	0.0851	0.00492	0.138	0.0813	0.143
20	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	0.015 GW & River Protection	0.00486 GW Protection	0.1 River Protection	0.0033 GW & River Protection	18.0 River Protection	240 GW Protection	48 GW Protection
21	**3-PART TEST**							
22	Maximum > Cleanup Limit?	YES	NO	NO	YES	NO	NO	NO
23	> 10% above Cleanup Limit?	NO	NO	NO	NO	NO	NO	NO
24	Any sample > 2X Cleanup Limit?	YES	NO	NO	NO	NO	NO	NO
25	**3-Part Test Compliance?**	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	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.

CALCULATION SHEET

Washington Closure Hanford

Originator I. B. Berezovskiy
Project 100-H Field Remediation
Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/11/11
Job No. 14655

Calc. No. 0100H-CA-V0148
Checked T. E. Queen

Rev. No. 0
Date 01/11/11
Sheet No. 9 of 12

Ecology Software (MTCAStat) Results, 100-H-3 Excavation

Arsenic 95% UCL Calculation

DATA	ID
5.64	J1C1M6/ J1C1N5
25.0	J1C1M3
5.18	J1C1M4
5.47	J1C1M5
6.27	J1C1M7
19.8	J1C1M8
5.58	J1C1M9
8.27	J1C1N0
3.33	J1C1N1
6.52	J1C1N2
17.4	J1C1N3
6.99	J1C1N4

Number of samples		Uncensored values	
Uncensored	12	Mean	9.62
Censored		Lognormal mean	9.58
Detection limit or PQL		Std. devn.	7.00
Method detection limit		Median	6.40
TOTAL	12	Min.	3.33
		Max.	25.0

Lognormal distribution? r-squared is: 0.865
Normal distribution? r-squared is: 0.747
Recommendations:
Reject BOTH lognormal and normal distributions.
UCL (based on Z-statistic) is 12.9

Barium 95% UCL Calculation

DATA	ID
84.3	J1C1M6/ J1C1N5
93.2	J1C1M3
83.5	J1C1M4
88.4	J1C1M5
86.7	J1C1M7
58.8	J1C1M8
99.9	J1C1M9
73.6	J1C1N0
55.2	J1C1N1
62.1	J1C1N2
76.1	J1C1N3
91.5	J1C1N4

Number of samples		Uncensored values	
Uncensored	12	Mean	79.4
Censored		Lognormal mean	79.6
Detection limit or PQL		Std. devn.	14.4
Method detection limit		Median	83.9
TOTAL	12	Min.	55.2
		Max.	99.9

Lognormal distribution? r-squared is: 0.917
Normal distribution? r-squared is: 0.945
Recommendations:
Use lognormal distribution.
UCL (Land's method) is 88.6

Beryllium 95% UCL Calculation

DATA	ID
0.336	J1C1M6/ J1C1N5
0.338	J1C1M3
0.342	J1C1M4
0.360	J1C1M5
0.349	J1C1M7
0.283	J1C1M8
0.287	J1C1M9
0.289	J1C1N0
0.167	J1C1N1
0.275	J1C1N2
0.318	J1C1N3
0.351	J1C1N4

Number of samples		Uncensored values	
Uncensored	12	Mean	0.308
Censored		Lognormal mean	0.309
Detection limit or PQL		Std. devn.	0.0536
Method detection limit		Median	0.327
TOTAL	12	Min.	0.167
		Max.	0.360

Lognormal distribution? r-squared is: 0.709
Normal distribution? r-squared is: 0.799
Recommendations:
Reject BOTH lognormal and normal distributions.
UCL (based on Z-statistic) is 0.333

Boron 95% UCL Calculation

DATA	ID
1.58	J1C1M6/ J1C1N5
4.07	J1C1M3
1.60	J1C1M4
1.62	J1C1M5
1.55	J1C1M7
1.27	J1C1M8
7.14	J1C1M9
1.50	J1C1N0
0.708	J1C1N1
1.61	J1C1N2
1.65	J1C1N3
4.16	J1C1N4

Number of samples		Uncensored values	
Uncensored	12	Mean	2.37
Censored		Lognormal mean	2.35
Detection limit or PQL		Std. devn.	1.84
Method detection limit		Median	1.61
TOTAL	12	Min.	0.708
		Max.	7.14

Lognormal distribution? r-squared is: 0.826
Normal distribution? r-squared is: 0.684
Recommendations:
Reject BOTH lognormal and normal distributions.
UCL (based on Z-statistic) is 3.24

Cadmium 95% UCL Calculation

DATA	ID
0.159	J1C1M6/ J1C1N5
0.169	J1C1M3
0.168	J1C1M4
0.169	J1C1M5
0.180	J1C1M7
0.130	J1C1M8
0.525	J1C1M9
0.131	J1C1N0
0.0947	J1C1N1
0.122	J1C1N2
0.148	J1C1N3
0.144	J1C1N4

Number of samples		Uncensored values	
Uncensored	12	Mean	0.178
Censored		Lognormal mean	0.175
Detection limit or PQL		Std. devn.	0.112
Method detection limit		Median	0.154
TOTAL	12	Min.	0.0947
		Max.	0.525

Lognormal distribution? r-squared is: 0.710
Normal distribution? r-squared is: 0.504
Recommendations:
Reject BOTH lognormal and normal distributions.
UCL (based on Z-statistic) is 0.231

Chromium 95% UCL Calculation

DATA	ID
19.8	J1C1M6/ J1C1N5
12.9	J1C1M3
20.2	J1C1M4
20.9	J1C1M5
19.9	J1C1M7
12.7	J1C1M8
11.4	J1C1M9
15.6	J1C1N0
13.3	J1C1N1
13.1	J1C1N2
13.9	J1C1N3
13.6	J1C1N4

Number of samples		Uncensored values	
Uncensored	12	Mean	15.6
Censored		Lognormal mean	15.6
Detection limit or PQL		Std. devn.	3.53
Method detection limit		Median	13.8
TOTAL	12	Min.	11.4
		Max.	20.9

Lognormal distribution? r-squared is: 0.868
Normal distribution? r-squared is: 0.843
Recommendations:
Reject BOTH lognormal and normal distributions.
UCL (based on Z-statistic) is 17.3

CALCULATION SHEET

Washington Closure Hanford

Originator I. B. Berezovskiy
Project 100-H Field Remediation
Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/11/11
Job No. 14655

Calc. No. 0100H-CA-V0148
Checked T. E. Queen

Rev. No. 0
Date 01/11/11
Sheet No. 10 of 12

Ecology Software (MTCAStat) Results, 100-H-3 Excavation

	DATA	ID	Cobalt 95% UCL Calculation			
1	DATA	ID				
2	6.15	J1C1M6/ J1C1N5				
3	6.86	J1C1M3				
4	6.25	J1C1M4	Number of samples		Uncensored values	
5	6.45	J1C1M5	Uncensored	12	Mean	6.21
6	6.49	J1C1M7	Censored		Lognormal mean	6.22
7	5.91	J1C1M8	Detection limit or PQL		Std. devn.	0.532
8	6.28	J1C1M9	Method detection limit			6.27
9	5.71	J1C1N0	TOTAL	12	Min.	4.92
10	4.92	J1C1N1			Max.	6.92
11	6.21	J1C1N2				
12	6.40	J1C1N3				
13	6.92	J1C1N4				
14						
15			Lognormal distribution?		Normal distribution?	
16			r-squared is: 0.857		r-squared is: 0.891	
17			Recommendations:			
18			Reject BOTH lognormal and normal distributions.			
19			UCL (based on Z-statistic) is		6.47	
20						

	DATA	ID	Copper 95% UCL Calculation			
1	DATA	ID				
2	13.5	J1C1M6/ J1C1N5				
3	14.5	J1C1M3				
4	13.8	J1C1M4	Number of samples		Uncensored values	
5	14.3	J1C1M5	Uncensored	12	Mean	14.6
6	14.8	J1C1M7	Censored		Lognormal mean	14.6
7	14.1	J1C1M8	Detection limit or PQL		Std. devn.	0.951
8	16.2	J1C1M9	Method detection limit		Median	14.4
9	16.3	J1C1N0	TOTAL	12	Min.	13.2
10	13.2	J1C1N1			Max.	16.3
11	14.2	J1C1N2				
12	14.7	J1C1N3				
13	15.0	J1C1N4				
14						
15			Lognormal distribution?		Normal distribution?	
16			r-squared is: 0.947		r-squared is: 0.934	
17			Recommendations:			
18			Use lognormal distribution.			
19			UCL (Land's method) is		15.1	
20						

	DATA	ID	Lead 95% UCL Calculation			
1	DATA	ID				
2	9.71	J1C1M6/ J1C1N5				
3	76.8	J1C1M3				
4	6.50	J1C1M4	Number of samples		Uncensored values	
5	7.29	J1C1M5	Uncensored	12	Mean	27.8
6	12.9	J1C1M7	Censored		Lognormal mean	29.2
7	68.8	J1C1M8	Detection limit or PQL		Std. devn.	26.6
8	27.4	J1C1M9	Method detection limit		Median	14.7
9	25.9	J1C1N0	TOTAL	12	Min.	4.18
10	4.18	J1C1N1			Max.	76.8
11	13.2	J1C1N2				
12	64.8	J1C1N3				
13	16.2	J1C1N4				
14						
15			Lognormal distribution?		Normal distribution?	
16			r-squared is: 0.953		r-squared is: 0.797	
17			Recommendations:			
18			Use lognormal distribution.			
19			UCL (Land's method) is		67.8	
20						

	DATA	ID	Manganese 95% UCL Calculation			
21	DATA	ID				
22	276	J1C1M6/ J1C1N5				
23	325	J1C1M3				
24	304	J1C1M4	Number of samples		Uncensored values	
25	304	J1C1M5	Uncensored	12	Mean	288
26	310	J1C1M7	Censored		Lognormal mean	288
27	283	J1C1M8	Detection limit or PQL		Std. devn.	34.7
28	249	J1C1M9	Method detection limit		Median	294
29	271	J1C1N0	TOTAL	12	Min.	208
30	208	J1C1N1			Max.	325
31	276	J1C1N2				
32	321	J1C1N3				
33	324	J1C1N4				
34						
35			Lognormal distribution?		Normal distribution?	
36			r-squared is: 0.863		r-squared is: 0.901	
37			Recommendations:			
38			Use normal distribution.			
39			UCL (based on t-statistic) is		306	
40						
41						

	DATA	ID	Molybdenum 95% UCL Calculation			
21	DATA	ID				
22	0.377	J1C1M6/ J1C1N5				
23	0.404	J1C1M3				
24	0.420	J1C1M4	Number of samples		Uncensored values	
25	0.366	J1C1M5	Uncensored	12	Mean	0.406
26	0.431	J1C1M7	Censored		Lognormal mean	0.406
27	0.367	J1C1M8	Detection limit or PQL		Std. devn.	0.0817
28	0.639	J1C1M9	Method detection limit		Median	0.390
29	0.354	J1C1N0	TOTAL	12	Min.	0.317
30	0.317	J1C1N1			Max.	0.639
31	0.422	J1C1N2				
32	0.350	J1C1N3				
33	0.425	J1C1N4				
34						
35			Lognormal distribution?		Normal distribution?	
36			r-squared is: 0.810		r-squared is: 0.719	
37			Recommendations:			
38			Reject BOTH lognormal and normal distributions.			
39			UCL (based on Z-statistic) is		0.445	
40						
41						

	DATA	ID	Nickel 95% UCL Calculation			
21	DATA	ID				
22	16.5	J1C1M6/ J1C1N5				
23	11.8	J1C1M3				
24	16.3	J1C1M4	Number of samples		Uncensored values	
25	17.7	J1C1M5	Uncensored	12	Mean	13.4
26	15.9	J1C1M7	Censored		Lognormal mean	13.4
27	12.5	J1C1M8	Detection limit or PQL		Std. devn.	2.59
28	10.5	J1C1M9	Method detection limit		Median	12.7
29	12.9	J1C1N0	TOTAL	12	Min.	9.67
30	9.67	J1C1N1			Max.	17.7
31	12.8	J1C1N2				
32	11.5	J1C1N3				
33	12.3	J1C1N4				
34						
35			Lognormal distribution?		Normal distribution?	
36			r-squared is: 0.946		r-squared is: 0.929	
37			Recommendations:			
38			Use lognormal distribution.			
39			UCL (Land's method) is		14.9	
40						
41						

CALCULATION SHEET

Washington Closure Hanford

Originator I. B. Berezovskiy
Project 100-H Field Remediation
Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 01/11/11
Job No. 14655

Calc. No. 0100H-CA-V0148
Checked T. E. Queen

Rev. No. 0
Date 01/11/11
Sheet No. 11 of 12

Ecology Software (MTCAStat) Results, 100-H-3 Excavation

Vanadium 95% UCL Calculation

DATA	ID
42.2	J1C1M6/ J1C1N5
52.3	J1C1M3
43.2	J1C1M4
42.4	J1C1M5
45.3	J1C1M7
46.5	J1C1M8
49.2	J1C1M9
43.7	J1C1N0
48.9	J1C1N1
51.7	J1C1N2
48.1	J1C1N3
51.2	J1C1N4

Number of samples		Uncensored values	
Uncensored	12	Mean	47.1
Censored		Lognormal mean	47.1
Detection limit or PQL		Std. devn.	3.70
Method detection limit			47.3
TOTAL	12	Min.	42.2
		Max.	52.3

Lognormal distribution? r-squared is: 0.946
Normal distribution? r-squared is: 0.947
Recommendations:
Use lognormal distribution.
UCL (Land's method) is 49.1

Zinc 95% UCL Calculation

DATA	ID
54.5	J1C1M6/ J1C1N5
43.3	J1C1M3
54.1	J1C1M4
46.3	J1C1M5
50.5	J1C1M7
42.7	J1C1M8
50.2	J1C1M9
42.6	J1C1N0
32.9	J1C1N1
38.0	J1C1N2
40.3	J1C1N3
44.0	J1C1N4

Number of samples		Uncensored values	
Uncensored	12	Mean	45.0
Censored		Lognormal mean	45.0
Detection limit or PQL		Std. devn.	6.50
Method detection limit		Median	43.7
TOTAL	12	Min.	32.9
		Max.	54.5

Lognormal distribution? r-squared is: 0.958
Normal distribution? r-squared is: 0.967
Recommendations:
Use lognormal distribution.
UCL (Land's method) is 48.8

TPH - motor oil 95% UCL Calculation

DATA	ID
176	J1C1M6/ J1C1N5
6.26	J1C1M3
5.45	J1C1M4
5.10	J1C1M5
31.2	J1C1M7
16.5	J1C1M8
83.9	J1C1M9
19.1	J1C1N0
5.29	J1C1N1
5.82	J1C1N2
5.53	J1C1N3
21.1	J1C1N4

Number of samples		Uncensored values	
Uncensored	12	Mean	31.7
Censored		Lognormal mean	29.7
Detection limit or PQL		Std. devn.	50.5
Method detection limit		Median	11.4
TOTAL	12	Min.	5.10
		Max.	176

Lognormal distribution? r-squared is: 0.846
Normal distribution? r-squared is: 0.579
Recommendations:
Reject BOTH lognormal and normal distributions.
UCL (based on Z-statistic) is 55.7

CALCULATION SHEET

Washington Closure Hanford

Originator J. B. Berezovskiy **Date** 01/12/11 **Calc. No.** 0100H-CA-V0148 **Rev. No.** 0
Project 100-H Area Confirmatory Sampling **Job No.** 14655 **Checked** T. E. Queen **Date** 01/12/11
Subject 100-H-3 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 12 of 12

100-H-3 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Aluminum			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	mg/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	9500		20.5	5.79		1.02	82.9		0.51	0.336		0.205	1.56	B	2.05	0.163	B	0.256	6630	J	20.5	19.3		1.02	6.16		3.07
Duplicate of J1C1M6	J1C1N5	9/21/10	9740		15.7	5.49		0.783	85.6		0.39	0.336		0.157	1.60		1.57	0.155	B	0.196	6200	J	15.7	20.2		0.783	6.14		2.35

Analysis:

	TDL	5	10	2	0.2	2	0.2	100	1	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)			Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	2.5%		3.2%				6.7%	4.6%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

100-H-3 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	13.4		2.05	19400		20.5	10.3		1.02	5670		5.12	279		1.02	0.413		0.0290	0.409	B	1.02	16.7		2.56	1380		102
Duplicate of J1C1M6	J1C1N5	9/21/10	13.6		1.57	18900		15.7	9.12		0.783	5700		3.92	273		0.783	0.274		0.0282	0.344	B	0.783	16.2		1.96	1370		78.3

Analysis:

	TDL	1	5	5	75	5	0.2	2	4	400
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)		No-Stop (acceptable)	No-Stop (acceptable)
	RPD	1.5%	2.6%		0.5%	2.2%				
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

100-H-3 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc			TPH - diesel range			TPH - motor oil		
			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-4	J1C1M6	9/21/10	263	J	6.14	225		51.2	41.6		1.02	54.7		3.07	151	J	3.55	171	J	10.6
Duplicate of J1C1M6	J1C1N5	9/21/10	267	J	4.70	234		39.2	42.7		0.783	54.3		2.35	164	J	3.44	180	J	10.3

Analysis:

	TDL	2	50	2.5	1	5	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	1.5%		2.6%	0.7%	2.4%	2.4%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable

Note: Gray cells indicate not applicable.
B = estimated result. Result is less than the RL but greater than the MDL.
J = estimated result.
HEIS = Hanford Environmental Information System
PQL = practical quantitation limit.
Q = qualifier.
RPD = relative percent difference.
TDL = target detection limit

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	9500		20.5	1.02	UJ	1.02	5.79		1.02	82.9		0.512	0.336		0.205
Duplicate of J1C1M6	J1C1N5	9/21/10	9740		15.7	0.783	UJ	0.783	5.49		0.783	85.6		0.392	0.336		0.157
SZ-1	J1C1M3	9/21/10	9580		14.8	0.742	UJ	0.740	25.0		0.742	93.2		0.371	0.338		0.148
SZ-2	J1C1M4	9/21/10	9950		17.2	0.861	UJ	0.861	5.18		0.861	83.5		0.431	0.342		0.172
SZ-3	J1C1M5	9/21/10	10300		19.2	0.958	UJ	0.958	5.47		0.958	88.4		0.479	0.360		0.192
SZ-5	J1C1M7	9/21/10	10100		17.8	0.889	UJ	0.889	6.27		0.889	86.7		0.445	0.349		0.178
SZ-6	J1C1M8	9/21/10	8630		14.7	0.735	UJ	0.735	19.8		0.735	58.8		0.367	0.283		0.147
SZ-7	J1C1M9	9/21/10	6930		13.9	0.694	UJ	0.694	5.58		0.694	99.9		0.347	0.287		0.139
SZ-8	J1C1N0	9/21/10	8360		15.5	0.774	UJ	0.774	8.27		0.774	73.6		0.387	0.289		0.155
SZ-9	J1C1N1	9/21/10	6050		13.4	0.669	UJ	0.669	3.33		0.669	55.2		0.335	0.167		0.134
SZ-10	J1C1N2	9/21/10	7840		16.4	0.818	UJ	0.818	6.52		0.818	62.1		0.409	0.275		0.164
SZ-11	J1C1N3	9/21/10	9140		16.8	0.840	UJ	0.840	17.4		0.840	76.1		0.420	0.318		0.168
SZ-12	J1C1N4	9/21/10	10100		20.3	1.01	UJ	1.01	6.99		1.01	91.5		0.507	0.351		0.203
Equipment Blank	J1C1N6	9/21/10	192		16.7	0.835	UJ	0.835	0.835	U	0.835	1.69		0.417	0.167	U	0.167

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	1.56	B	2.05	0.163	B	0.256	6630	J	20.5	19.3		1.02	6.16		3.07
Duplicate of J1C1M6	J1C1N5	9/21/10	1.60		1.57	0.155	B	0.196	6200	J	15.7	20.2		0.783	6.14		2.35
SZ-1	J1C1M3	9/21/10	4.07		1.48	0.169	B	0.186	6640	J	14.8	12.9		0.742	6.86		2.23
SZ-2	J1C1M4	9/21/10	1.60	B	1.72	0.168	B	0.215	7140	J	17.2	20.2		0.861	6.25		2.58
SZ-3	J1C1M5	9/21/10	1.62	B	1.92	0.169	B	0.239	7440	J	19.2	20.9		0.958	6.45		2.87
SZ-5	J1C1M7	9/21/10	1.55	B	1.78	0.180	B	0.222	8020	J	17.8	19.9		0.889	6.49		2.67
SZ-6	J1C1M8	9/21/10	1.27	B	1.47	0.130	B	0.184	5430	J	14.7	12.7		0.735	5.91		2.20
SZ-7	J1C1M9	9/21/10	7.14		1.39	0.525		0.173	5690	J	13.9	11.4		0.694	6.28		2.08
SZ-8	J1C1N0	9/21/10	1.50	B	1.55	0.131	B	0.193	5060	J	15.5	15.6		0.774	5.71		2.32
SZ-9	J1C1N1	9/21/10	0.708	B	1.34	0.0947	B	0.167	5020	J	13.4	13.3		0.669	4.92		2.01
SZ-10	J1C1N2	9/21/10	1.61	B	1.64	0.122	B	0.204	5350	J	16.4	13.1		0.818	6.21		2.45
SZ-11	J1C1N3	9/21/10	1.65	B	1.68	0.148	B	0.210	5260	J	16.8	13.9		0.840	6.40		2.52
SZ-12	J1C1N4	9/21/10	4.16		2.03	0.144	B	0.253	5630	J	20.3	13.6		1.01	6.92		3.04
Equipment Blank	J1C1N6	9/21/10	1.67	U	1.67	0.209	U	0.209	34.6	UJ	16.7	0.835	U	0.835	2.50	U	2.50

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

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

B = blank contamination (inorganic constituents)

HEIS = Hanford Environmental Information System

J = estimate

L – dilution indicating physical and chemical interference are present

M = Sample duplicate precision not met

PQL = practical quantitation limit

Q = qualifier

R = rejected

SVOA = semivolatile organic analysis

U = undetected

Attachment	1	Sheet No.	1 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	13.4		2.05	19400		20.5	10.3		1.02	5670		5.12	279		1.02
Duplicate of J1C1M6	J1C1N5	9/21/10	13.6		1.57	18900		15.7	9.12		0.783	5700		3.92	273		0.783
SZ-1	J1C1M3	9/21/10	14.5		1.48	21100		14.8	76.8		0.742	4650		3.71	325		0.742
SZ-2	J1C1M4	9/21/10	13.8		1.72	19300		17.2	6.5		0.861	6140		4.31	304		0.861
SZ-3	J1C1M5	9/21/10	14.3		1.92	19300		19.2	7.29		0.958	6490		4.79	304		0.958
SZ-5	J1C1M7	9/21/10	14.8		1.78	19900		17.8	12.9		0.889	6190		4.45	310		0.889
SZ-6	J1C1M8	9/21/10	14.1		1.47	18700		14.7	68.8		0.735	4420		3.67	283		0.735
SZ-7	J1C1M9	9/21/10	16.2		1.39	18100		13.9	27.4		0.694	3480		3.47	249		0.694
SZ-8	J1C1N0	9/21/10	16.3		1.55	18400		15.5	25.9		0.774	4630		3.87	271		0.774
SZ-9	J1C1N1	9/21/10	13.2		1.34	15800		13.4	4.18		0.669	4220		3.35	208		0.669
SZ-10	J1C1N2	9/21/10	14.2		1.64	19300		16.4	13.2		0.818	4470		4.09	276		0.818
SZ-11	J1C1N3	9/21/10	14.7		1.68	20000		16.8	64.8		0.840	4590		4.20	321		0.840
SZ-12	J1C1N4	9/21/10	15.0		2.03	21100		20.3	16.2		1.01	4630		5.07	324		1.01
Equipment Blank	J1C1N6	9/21/10	1.67	U	1.67	248		16.7	0.398	B	0.835	20.3		4.17	4.36		0.835

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	0.413		0.0290	0.409	B	1.02	16.7		2.56	1380		102	0.307	U	0.307
Duplicate of J1C1M6	J1C1N5	9/21/10	0.274		0.0282	0.344	B	0.783	16.2		1.96	1370		78.3	0.235	U	0.235
SZ-1	J1C1M3	9/21/10	0.0275	U	0.0275	0.404	B	0.742	11.8		1.86	1550		74.2	0.223	U	0.223
SZ-2	J1C1M4	9/21/10	0.0301	U	0.0301	0.420	B	0.861	16.3		2.15	1920		86.1	0.258	U	0.258
SZ-3	J1C1M5	9/21/10	0.0232	B	0.0271	0.366	B	0.958	17.7		2.39	1540		95.8	0.287	U	0.287
SZ-5	J1C1M7	9/21/10	0.0282	U	0.0282	0.431	B	0.889	15.9		2.22	1440		88.9	0.267	U	0.267
SZ-6	J1C1M8	9/21/10	0.0251	U	0.0251	0.367	B	0.735	12.5		1.84	1230		73.5	0.220	U	0.220
SZ-7	J1C1M9	9/21/10	0.0282	U	0.0282	0.639	B	0.694	10.5		1.73	1140		69.4	0.208	U	0.208
SZ-8	J1C1N0	9/21/10	0.243		0.0279	0.354	B	0.774	12.9		1.93	1170		77.4	0.232	U	0.232
SZ-9	J1C1N1	9/21/10	0.0273	U	0.0273	0.317	B	0.669	9.67		1.67	1090		66.9	0.201	U	0.201
SZ-10	J1C1N2	9/21/10	0.0273	U	0.0273	0.422	B	0.818	12.8		2.04	1080		81.8	0.245	U	0.245
SZ-11	J1C1N3	9/21/10	0.0272	U	0.0272	0.350	B	0.840	11.5		2.10	1410		84.0	0.252	U	0.252
SZ-12	J1C1N4	9/21/10	0.0138	B	0.0256	0.425	B	1.01	12.3		2.53	1810		101	0.304	U	0.304
Equipment Blank	J1C1N6	9/21/10	0.0231	U	0.0231	0.835	U	0.835	2.09	U	2.09	42.2	B	83.5	0.296		0.250

Attachment	1	Sheet No.	2 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Metals)

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-4	J1C1M6	9/21/10	263	J	6.14	1.02	U	1.02	225		51.2	41.6		1.02	54.7		3.07
Duplicate of J1C1M6	J1C1N5	9/21/10	267	J	4.70	0.783	U	0.783	234		39.2	42.7		0.783	54.3		2.35
SZ-1	J1C1M3	9/21/10	182	J	4.45	0.742	U	0.742	245		37.1	52.3		0.742	43.3		2.23
SZ-2	J1C1M4	9/21/10	247	J	5.17	0.861	U	0.861	317		43.1	43.2		0.861	54.1		2.58
SZ-3	J1C1M5	9/21/10	221	J	5.75	0.958	U	0.958	254		47.9	42.4		0.958	46.3		2.87
SZ-5	J1C1M7	9/21/10	208	J	5.34	0.889	U	0.889	253		44.5	45.3		0.889	50.5		2.67
SZ-6	J1C1M8	9/21/10	197	J	4.41	0.735	U	0.735	257		36.7	46.5		0.735	42.7		2.20
SZ-7	J1C1M9	9/21/10	156	J	4.16	0.694	U	0.694	282		34.7	49.2		0.694	50.2		2.08
SZ-8	J1C1N0	9/21/10	182	J	4.64	0.774	U	0.774	285		38.7	43.7		0.774	42.6		2.32
SZ-9	J1C1N1	9/21/10	165	J	4.02	0.669	U	0.669	172		33.5	48.9		0.669	32.9		2.01
SZ-10	J1C1N2	9/21/10	194	J	4.91	0.818	U	0.818	232		40.9	51.7		0.818	38.0		2.45
SZ-11	J1C1N3	9/21/10	252	J	5.04	0.840	U	0.840	228		42.0	48.1		0.840	40.3		2.52
SZ-12	J1C1N4	9/21/10	249	J	6.08	1.01	U	1.01	258		50.7	51.2		1.01	44.0		3.04
Equipment Blank	J1C1N6	9/21/10	195	J	5.01	0.835	U	0.835	41.7	U	41.7	0.298	B	0.835	1.09	B	2.50

Attachment	1	Sheet No.	3 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Metals)

Sample Location	HEIS Number	Sample Date	TPH - Diesel Range			TPH - motor oil (high boiling)		
			mg/kg	Q	PQL	mg/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	151	J	3.55	171	J	10.6
Duplicate of J1C1M6	J1C1N5	9/21/10	164	J	3.44	180	J	10.3
SZ-1	J1C1M3	9/21/10	3.49	UJ	3.49	6.26	J	10.5
SZ-2	J1C1M4	9/21/10	3.62	UJ	3.62	10.9	UJ	10.9
SZ-3	J1C1M5	9/21/10	3.41	UJ	3.41	10.2	UJ	10.2
SZ-5	J1C1M7	9/21/10	3.54	UJ	3.54	31.2	J	10.6
SZ-6	J1C1M8	9/21/10	3.50	UJ	3.50	16.5	J	10.5
SZ-7	J1C1M9	9/21/10	3.64	UJ	3.64	83.9	J	10.9
SZ-8	J1C1N0	9/21/10	3.51	UJ	3.51	19.1	J	10.5
SZ-9	J1C1N1	9/21/10	3.27	UJ	3.27	5.29	J	9.81
SZ-10	J1C1N2	9/21/10	3.52	UJ	3.52	5.82	J	10.6
SZ-11	J1C1N3	9/21/10	3.51	UJ	3.51	5.53	J	10.5
SZ-12	J1C1N4	9/21/10	3.49	UJ	3.49	21.1	J	10.5
Equipment Blank	J1C1N6	9/21/10						

Attachment	1	Sheet No.	4 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Organics)

Constituent	Class	SZ-4, J1C1M6 - Sampled on 9/21/10			Dupplicate of J1C1M6, J1C1N5 - Sampled on 9/21/10			SZ-1, J1C1M3 - Sampled on 9/21/10			SZ-2, J1C1M4 - Sampled on 9/21/10			SZ-3, J1C1M5 - Sampled on 9/21/10			SZ-5, J1C1M7 - Sampled on 9/21/10			SZ-6, J1C1M8 - Sampled on 9/21/09		
		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
Aroclor-1016	PCB	14.2	UJ	14.2	14.2	UJ	14.2	14.0	UJ	14.0	14.6	UJ	14.6	13.7	UJ	13.7	14.2	UJ	14.2	14.0	UJ	14.0
Aroclor-1221	PCB	14.2	UJ	14.2	14.2	UJ	14.2	14.0	UJ	14.0	14.6	UJ	14.6	13.7	UJ	13.7	14.2	UJ	14.2	14.0	UJ	14.0
Aroclor-1232	PCB	14.2	UJ	14.2	14.2	UJ	14.2	14.0	UJ	14.0	14.6	UJ	14.6	13.7	UJ	13.7	14.2	UJ	14.2	14.0	UJ	14.0
Aroclor-1242	PCB	14.2	UJ	14.2	14.2	UJ	14.2	14.0	UJ	14.0	14.6	UJ	14.6	13.7	UJ	13.7	14.2	UJ	14.2	14.0	UJ	14.0
Aroclor-1248	PCB	14.2	UJ	14.2	14.2	UJ	14.2	14.0	UJ	14.0	14.6	UJ	14.6	13.7	UJ	13.7	14.2	UJ	14.2	14.0	UJ	14.0
Aroclor-1254	PCB	14.2	UJ	14.2	14.2	UJ	14.2	14.0	UJ	14.0	14.6	UJ	14.6	13.7	UJ	13.7	14.2	UJ	14.2	14.0	UJ	14.0
Aroclor-1260	PCB	14.2	UJ	14.2	14.2	UJ	14.2	14.0	UJ	14.0	14.6	UJ	14.6	13.7	UJ	13.7	14.2	UJ	14.2	14.0	UJ	14.0

Constituent	Class	SZ-7, J1C1M9 - Sampled on 9/21/10			SZ-8, J1C1N0 - Sampled on 9/21/10			SZ-9, J1C1N1 - Sampled on 9/21/10			SZ-10, J1C1N2 - Sampled on 9/21/10			SZ-11, J1C1N3 - Sampled on 9/21/10			SZ-12, J1C1N4 - Sampled on 9/21/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	14.4	UJ	14.4	13.9	UJ	13.9	13.6	UJ	13.6	13.6	UJ	13.6	14.0	UJ	14.0	13.9	UJ	13.9
Aroclor-1221	PCB	14.4	UJ	14.4	13.9	UJ	13.9	13.6	UJ	13.6	13.6	UJ	13.6	14.0	UJ	14.0	13.9	UJ	13.9
Aroclor-1232	PCB	14.4	UJ	14.4	13.9	UJ	13.9	13.6	UJ	13.6	13.6	UJ	13.6	14.0	UJ	14.0	13.9	UJ	13.9
Aroclor-1242	PCB	14.4	UJ	14.4	13.9	UJ	13.9	13.6	UJ	13.6	13.6	UJ	13.6	14.0	UJ	14.0	13.9	UJ	13.9
Aroclor-1248	PCB	14.4	UJ	14.4	13.9	UJ	13.9	13.6	UJ	13.6	13.6	UJ	13.6	14.0	UJ	14.0	13.9	UJ	13.9
Aroclor-1254	PCB	7.56	J	14.4	7.32	J	13.9	13.6	UJ	13.6	7.96	J	13.6	14.0	UJ	14.0	4.16	J	13.9
Aroclor-1260	PCB	13.2	J	14.4	14.4	J	13.9	13.6	UJ	13.6	5.92	J	13.6	14.0	UJ	14.0	8.10	J	13.9

Attachment	1	Sheet No.	5 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Organics)

Constituent	Class	SZ-4, J1C1M6 - Sampled on 9/21/10			Dupplicate of J1C1M6, J1C1N5 - Sampled on			SZ-1, J1C1M3 - Sampled on 9/21/10			SZ-2, J1C1M4 - Sampled on 9/21/10			SZ-3, J1C1M5 - Sampled on 9/21/10			SZ-5, J1C1M7 - Sampled on 9/21/10			SZ-6, J1C1M8 - Sampled on 9/21/09		
		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
Aldrin	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Alpha-BHC	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
alpha-Chlordane	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Beta-BHC	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Delta-BHC	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Dichlorodiphenyldichloroethane	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Dichlorodiphenyldichloroethylene	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Dichlorodiphenyltrichloroethane	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Dieldrin	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.78	JD	1.78	1.40	UD	1.40
Endosulfan I	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Endosulfan II	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Endosulfan sulfate	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Endrin	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Endrin aldehyde	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Endrin ketone	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Gamma-BHC (Lindane)	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
gamma-Chlordane	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Heptachlor	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Heptachlor epoxide	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Methoxychlor	PEST	1.42	UD	1.42	1.42	UD	1.42	1.41	UD	1.41	1.46	UD	1.46	1.37	UD	1.37	1.42	UDJ	1.42	1.40	UD	1.40
Toxaphene	PEST	21.3	UDJ	21.3	21.3	UDJ	21.3	21.1	UDJ	21.1	21.9	UDJ	21.9	20.6	UDJ	20.6	21.3	UDJ	21.3	21.0	UDJ	21.0

Constituent	Class	SZ-7, J1C1M9 - Sampled on 9/21/10			SZ-8, J1C1N0 - Sampled on 9/21/10			SZ-9, J1C1N1 - Sampled on 9/21/10			SZ-10, J1C1N2 - Sampled on 9/21/10			SZ-11, J1C1N3 - Sampled on 9/21/10			SZ-12, J1C1N4 - Sampled on 9/21/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aldrin	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Alpha-BHC	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
alpha-Chlordane	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Beta-BHC	PEST	2.53	JD	2.53	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Delta-BHC	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Dichlorodiphenyldichloroethane	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Dichlorodiphenyldichloroethylene	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Dichlorodiphenyltrichloroethane	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Dieldrin	PEST	1.45	UD	1.45	1.39	UD	1.39	4.92	JD	4.92	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Endosulfan I	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Endosulfan II	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Endosulfan sulfate	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Endrin	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Endrin aldehyde	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Endrin ketone	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Gamma-BHC (Lindane)	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
gamma-Chlordane	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Heptachlor	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Heptachlor epoxide	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Methoxychlor	PEST	1.45	UD	1.45	1.39	UD	1.39	1.37	UD	1.37	1.36	UD	1.36	1.40	UD	1.40	1.40	UD	1.40
Toxaphene	PEST	21.7	UDJ	21.7	20.9	UDJ	20.9	20.5	UDJ	20.5	20.4	UDJ	20.4	21.0	UDJ	21.0	21.0	UDJ	21.0

Attachment	1	Sheet No.	6 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Organics)

Constituent	Class	SZ-4, J1C1M6 - Sampled on 9/21/10			Dupplicate of J1C1M6, J1C1N5 - Sampled on			SZ-1, J1C1M3 - Sampled on 9/21/10			SZ-2, J1C1M4 - Sampled on 9/21/10			SZ-3, J1C1M5 - Sampled on 9/21/10			SZ-5, J1C1M7 - Sampled on 9/21/10			SZ-6, J1C1M8 - Sampled on 9/21/09		
		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
1,2,4-Trichlorobenzene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
1,2-Dichlorobenzene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
1,3-Dichlorobenzene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
1,4-Dichlorobenzene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
2,4,5-Trichlorophenol	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
2,4,6-Trichlorophenol	SVOA	350	UJ	350	347	UJ	347	332	UJ	332	360	UJ	360	345	UJ	345	347	UJ	347	349	UJ	349
2,4-Dichlorophenol	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
2,4-Dimethylphenol	SVOA	350	UJ	350	347	UJ	347	332	UJ	332	360	UJ	360	345	UJ	345	347	UJ	347	349	UJ	349
2,4-Dinitrophenol	SVOA	1750	UJ	1750	1730	UJ	1730	1660	UJ	1660	1800	UJ	1800	1730	UJ	1730	1740	UJ	1740	1740	UJ	1740
2,4-Dinitrotoluene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
2,6-Dinitrotoluene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
2-Chloronaphthalene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
2-Chlorophenol	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
2-Methylnaphthalene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
2-Methylphenol (cresol, o-)	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
2-Nitroaniline	SVOA	1750	U	1750	1730	U	1730	1660	U	1660	1800	U	1800	1730	U	1730	1740	U	1740	1740	U	1740
2-Nitrophenol	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
3,3'-Dichlorobenzidine	SVOA	700	U	700	693	U	693	663	U	663	721	U	721	691	U	691	695	U	695	697	U	697
3+4 Methylphenol (cresol, m+p)	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
3-Nitroaniline	SVOA	1750	U	1750	1730	U	1730	1660	U	1660	1800	U	1800	1730	U	1730	1740	U	1740	1740	U	1740
4,6-Dinitro-2-methylphenol	SVOA	350	UJ	350	347	UJ	347	332	UJ	332	360	UJ	360	345	UJ	345	347	UJ	347	349	UJ	349
4-Bromophenylphenyl ether	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
4-Chloro-3-methylphenol	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
4-Chloroaniline	SVOA	350	UJ	350	347	UJ	347	332	UJ	332	360	UJ	360	345	UJ	345	347	UJ	347	349	UJ	349
4-Chlorophenylphenyl ether	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
4-Nitroaniline	SVOA	1750	U	1750	1730	U	1730	1660	U	1660	1800	U	1800	1730	U	1730	1740	U	1740	1740	U	1740
4-Nitrophenol	SVOA	1750	UJ	1750	1730	UJ	1730	1660	UJ	1660	1800	UJ	1800	1730	UJ	1730	1740	UJ	1740	1740	UJ	1740
Acenaphthene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Acenaphthylene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Anthracene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Benzo(a)anthracene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349

Attachment	1	Sheet No.	7 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Organics)

Constituent	Class	SZ-4, J1C1M6 - Sampled on 9/21/10			Dupplicate of J1C1M6, J1C1N5 - Sampled on			SZ-1, J1C1M3 - Sampled on 9/21/10			SZ-2, J1C1M4 - Sampled on 9/21/10			SZ-3, J1C1M5 - Sampled on 9/21/10			SZ-5, J1C1M7 - Sampled on 9/21/10			SZ-6, J1C1M8 - Sampled on 9/21/09		
		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
Benzo(b)fluoranthene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Benzo(ghi)perylene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Benzo(k)fluoranthene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Bis(2-chloro-1-methylethyl)ether	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Bis(2-Chloroethoxy)methane	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Bis(2-chloroethyl) ether	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Bis(2-ethylhexyl) phthalate	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Butylbenzylphthalate	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Carbazole	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Chrysene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Dibenz[a,h]anthracene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Dibenzofuran	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Diethyl phthalate	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Dimethyl phthalate	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Di-n-butylphthalate	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Di-n-octylphthalate	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Fluoranthene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	72.3	J	72.3	349	U	349
Fluorene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Hexachlorobenzene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Hexachlorobutadiene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Hexachlorocyclopentadiene	SVOA	350	UJ	350	347	UJ	347	332	UJ	332	360	UJ	360	345	UJ	345	347	UJ	347	349	UJ	349
Hexachloroethane	SVOA	350	UJ	350	347	UJ	347	332	UJ	332	360	UJ	360	345	UJ	345	347	UJ	347	349	UJ	349
Indeno(1,2,3-cd)pyrene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Isophorone	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Naphthalene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Nitrobenzene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
N-Nitroso-di-n-dipropylamine	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
N-Nitrosodiphenylamine	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Pentachlorophenol	SVOA	1750	UJ	1750	1730	UJ	1730	1660	UJ	1660	1800	UJ	1800	1730	UJ	1730	1740	UJ	1740	1740	UJ	1740
Phenanthrene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Phenol	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	347	U	347	349	U	349
Pyrene	SVOA	350	U	350	347	U	347	332	U	332	360	U	360	345	U	345	71.4	J	347	349	U	349

Attachment	1	Sheet No.	8 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Organics)

Constituent	Class	SZ-7, J1C1M9 - Sampled on 9/21/10			SZ-8, J1C1N0 - Sampled on 9/21/10			SZ-9, J1C1N1 - Sampled on 9/21/10			SZ-10, J1C1N2 - Sampled on 9/21/10			SZ-11, J1C1N3 - Sampled on 9/21/10			SZ-12, J1C1N4 - Sampled on 9/21/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
1,2-Dichlorobenzene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
1,3-Dichlorobenzene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
1,4-Dichlorobenzene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
2,4,5-Trichlorophenol	SVOA	361	U	361	341	UJ	341	334	U	334	331	U	331	338	U	338	348	U	348
2,4,6-Trichlorophenol	SVOA	361	UJ	361	341	UJ	341	334	UJ	334	331	UJ	331	338	UJ	338	348	UJ	348
2,4-Dichlorophenol	SVOA	361	U	361	341	UJ	341	334	U	334	331	U	331	338	U	338	348	U	348
2,4-Dimethylphenol	SVOA	361	UJ	361	341	UJ	341	334	UJ	334	331	UJ	331	338	UJ	338	348	UJ	348
2,4-Dinitrophenol	SVOA	1810	UJ	1810	1710	UJ	1710	1670	UJ	1670	1660	UJ	1660	1690	UJ	1690	1740	UJ	1740
2,4-Dinitrotoluene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
2,6-Dinitrotoluene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
2-Chloronaphthalene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
2-Chlorophenol	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
2-Methylnaphthalene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
2-Methylphenol (cresol, o-)	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
2-Nitroaniline	SVOA	1810	U	1810	1710	U	1710	1670	U	1670	1660	U	1660	1690	U	1690	1740	U	1740
2-Nitrophenol	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
3,3'-Dichlorobenzidine	SVOA	723	U	723	682	U	682	668	U	668	663	U	663	676	U	676	695	U	695
3+4 Methylphenol (cresol, m+p)	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
3-Nitroaniline	SVOA	1810	U	1810	1710	U	1710	1670	U	1670	1660	U	1660	1690	U	1690	1740	U	1740
4,6-Dinitro-2-methylphenol	SVOA	361	UJ	361	341	UJ	341	334	UJ	334	331	UJ	331	338	UJ	338	348	UJ	348
4-Bromophenylphenyl ether	SVOA	361	U	361	341	UJ	341	334	U	334	331	U	331	338	U	338	348	U	348
4-Chloro-3-methylphenol	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
4-Chloroaniline	SVOA	361	UJ	361	341	UJ	341	334	UJ	334	331	UJ	331	338	UJ	338	348	UJ	348
4-Chlorophenylphenyl ether	SVOA	361	U	361	341	UJ	341	334	U	334	331	U	331	338	U	338	348	U	348
4-Nitroaniline	SVOA	1810	U	1810	1710	U	1710	1670	U	1670	1660	U	1660	1690	U	1690	1740	U	1740
4-Nitrophenol	SVOA	1810	UJ	1810	1710	UJ	1710	1670	UJ	1670	1660	UJ	1660	1690	UJ	1690	1740	UJ	1740
Acenaphthene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Acenaphthylene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Anthracene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Benzo(a)anthracene	SVOA	69.6	J	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Benzo(a)pyrene	SVOA	70.8	J	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348

Attachment	1	Sheet No.	9 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Organics)

Constituent	Class	SZ-7, J1C1M9 - Sampled on 9/21/10			SZ-8, J1C1N0 - Sampled on 9/21/10			SZ-9, J1C1N1 - Sampled on 9/21/10			SZ-10, J1C1N2 - Sampled on 9/21/10			SZ-11, J1C1N3 - Sampled on 9/21/10			SZ-12, J1C1N4 - Sampled on 9/21/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Benzo(b)fluoranthene	SVOA	60.8	J	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Benzo(ghi)perylene	SVOA	56.7	J	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Benzo(k)fluoranthene	SVOA	63	J	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Bis(2-chloro-1-methylethyl)ether	SVOA	361	U	361	341	UJ	341	334	U	334	331	U	331	338	U	338	348	U	348
Bis(2-Chloroethoxy)methane	SVOA	361	U	361	341	UJ	341	334	U	334	331	U	331	338	U	338	348	U	348
Bis(2-chloroethyl) ether	SVOA	361	U	361	341	UJ	341	334	U	334	331	U	331	338	U	338	348	U	348
Bis(2-ethylhexyl) phthalate	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Butylbenzylphthalate	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Carbazole	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Chrysene	SVOA	85.1	J	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Dibenz[a,h]anthracene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Dibenzofuran	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Diethyl phthalate	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Dimethyl phthalate	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Di-n-butylphthalate	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Di-n-octylphthalate	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Fluoranthene	SVOA	138	J	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Fluorene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Hexachlorobenzene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Hexachlorobutadiene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Hexachlorocyclopentadiene	SVOA	361	UJ	361	341	UJ	341	334	UJ	334	331	UJ	331	338	UJ	338	348	UJ	348
Hexachloroethane	SVOA	361	UJ	361	341	UJ	341	334	UJ	334	331	UJ	331	338	UJ	338	348	UJ	348
Indeno(1,2,3-cd)pyrene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Isophorone	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Naphthalene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Nitrobenzene	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
N-Nitroso-di-n-dipropylamine	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
N-Nitrosodiphenylamine	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Pentachlorophenol	SVOA	1810	UJ	1810	1710	UJ	1710	1670	UJ	1670	1660	UJ	1660	1690	UJ	1690	1740	UJ	1740
Phenanthrene	SVOA	81.3	J	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Phenol	SVOA	361	U	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348
Pyrene	SVOA	143	J	361	341	U	341	334	U	334	331	U	331	338	U	338	348	U	348

Attachment	1	Sheet No.	10 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Attachment 1. 100-H-3 Waste Site Verification Sampling Results (Organic Detects)

Sample Location	HEIS Number	Sample Date	Aroclor-1254			Aroclor-1260			Benzo(a)anthracene SVOA			Benzo(a)pyrene SVOA			Benzo(b)fluoranthene		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	14.2	JU	14.2	14.2	JU	14.2	350	U	350	350	U	350	350	U	350
Duplicate of	J1C1N5	9/21/10	14.2	JU	14.2	14.2	JU	14.2	347	U	347	347	U	347	347	U	347
SZ-1	J1C1M3	9/21/10	14.0	JU	14.0	14.0	JU	14.0	332	U	332	332	U	332	332	U	332
SZ-2	J1C1M4	9/21/10	14.6	JU	14.6	14.6	JU	14.6	360	U	360	360	U	360	360	U	360
SZ-3	J1C1M5	9/21/10	13.7	JU	13.7	13.7	JU	13.7	345	U	345	345	U	345	345	U	345
SZ-5	J1C1M7	9/21/10	14.2	JU	14.2	14.2	JU	14.2	347	U	347	347	U	347	347	U	347
SZ-6	J1C1M8	9/21/10	14.0	JU	14.0	14.0	JU	14.0	349	U	349	349	U	349	349	U	349
SZ-7	J1C1M9	9/21/10	7.56	J	14.4	13.2	J	14.4	69.6	J	361	70.8	J	361	60.8	J	361
SZ-8	J1C1N0	9/21/10	7.32	J	13.9	14.4	J	13.9	341	U	341	341	U	341	341	U	341
SZ-9	J1C1N1	9/21/10	13.6	JU	13.6	13.6	JU	13.6	334	U	334	334	U	334	334	U	334
SZ-10	J1C1N2	9/21/10	7.96	J	13.6	5.92	J	13.6	331	U	331	331	U	331	331	U	331
SZ-11	J1C1N3	9/21/10	14.0	JU	14.0	14.0	JU	14.0	338	U	338	338	U	338	338	U	338
SZ-12	J1C1N4	9/21/10	4.16	J	13.9	8.10	J	13.9	348	U	348	348	U	348	348	U	348

Sample Location	HEIS Number	Sample Date	Benzo(ghi)perylene SVOA			Benzo(k)fluoranthene			beta-BHC			Chrysene SVOA			Dieldrin		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	350	U	350	350	U	350	1.42	UD	1.42	350	U	350	1.42	UD	1.42
Duplicate of	J1C1N5	9/21/10	347	U	347	347	U	347	1.42	UD	1.42	347	U	347	1.42	UD	1.42
SZ-1	J1C1M3	9/21/10	332	U	332	332	U	332	1.41	UD	1.41	332	U	332	1.41	UD	1.41
SZ-2	J1C1M4	9/21/10	360	U	360	360	U	360	1.46	UD	1.46	360	U	360	1.46	UD	1.46
SZ-3	J1C1M5	9/21/10	345	U	345	345	U	345	1.37	UD	1.37	345	U	345	1.37	UD	1.37
SZ-5	J1C1M7	9/21/10	347	U	347	347	U	347	1.42	UD	1.42	347	U	347	1.78	JD	1.42
SZ-6	J1C1M8	9/21/10	349	U	349	349	U	349	1.40	UD	1.40	349	U	349	1.40	UD	1.40
SZ-7	J1C1M9	9/21/10	56.7	J	361	63.0	J	361	2.53	JD	1.45	85.1	J	361	1.45	UD	1.45
SZ-8	J1C1N0	9/21/10	341	U	341	341	U	341	1.39	UD	1.39	341	U	341	1.39	UD	1.39
SZ-9	J1C1N1	9/21/10	334	U	334	334	U	334	1.37	UD	1.37	334	U	334	4.92	JD	1.37
SZ-10	J1C1N2	9/21/10	331	U	331	331	U	331	1.36	UD	1.36	331	U	331	1.36	UD	1.36
SZ-11	J1C1N3	9/21/10	338	U	338	338	U	338	1.40	UD	1.40	338	U	338	1.40	UD	1.40
SZ-12	J1C1N4	9/21/10	348	U	348	348	U	348	1.40	UD	1.40	348	U	348	1.40	UD	1.40

Sample Location	HEIS Number	Sample Date	Fluoranthene SVOA			Phenanthrene SVOA			Pyrene SVOA		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
SZ-4	J1C1M6	9/21/10	350	U	350	350	U	350	350	U	350
Duplicate of	J1C1N5	9/21/10	347	U	347	347	U	347	347	U	347
SZ-1	J1C1M3	9/21/10	332	U	332	332	U	332	332	U	332
SZ-2	J1C1M4	9/21/10	360	U	360	360	U	360	360	U	360
SZ-3	J1C1M5	9/21/10	345	U	345	345	U	345	345	U	345
SZ-5	J1C1M7	9/21/10	72.3	J	347	347	U	347	71.4	J	347
SZ-6	J1C1M8	9/21/10	349	U	349	349	U	349	349	U	349
SZ-7	J1C1M9	9/21/10	138	J	361	81.3	J	361	143	J	361
SZ-8	J1C1N0	9/21/10	341	U	341	341	U	341	341	U	341
SZ-9	J1C1N1	9/21/10	334	U	334	334	U	334	334	U	334
SZ-10	J1C1N2	9/21/10	331	U	331	331	U	331	331	U	331
SZ-11	J1C1N3	9/21/10	338	U	338	338	U	338	338	U	338
SZ-12	J1C1N4	9/21/10	348	U	348	348	U	348	348	U	348

Attachment	1	Sheet No.	11 of 11
Originator	I. B. Berezovskiy	Date	1/11/11
Checked	T. E. Queen	Date	1/11/11
Calc. No.	0100H-CA-V0148	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-HR-1

Discipline: Environmental Calculation No: 0100H-CA-V0152

Subject: 100-H-3 Direct Contact Hazard Quotient and Carcinogenic Risk Calculation

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 4 Total = 5	I. B Berezovskiy	T. E. Queen	J. D. Skoglie	D. F. Obenauer	1/25/11

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	I.B. Berezovskiy	Date:	1/12/2011	Calc. No.:	0100H-CA-V0152	Rev.:	0
Project:	100-HR-1 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	1/12/2011
Subject:	100-H-3 Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 4	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 100-H-3 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009a); the following criteria must be met:

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

GIVEN/REFERENCES:

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

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

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

4) WCH, 2011, *Remaining Sites Verification Package for the 100-H-3, 1716-H Garage Fuel Tank Site,* Attachment to Waste Site Reclassification Form 2010-103, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

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

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

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	I.B. Berezovskiy	Date:	1/24/2011	Calc. No.:	0100H-CA-V0152	Rev.:	0
Project:	100-HR-1 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	1/24/2011
Subject:	100-H-3 Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 4	

METHODOLOGY:

The 100-H-3 waste site is comprised of a single decision unit for verification sampling. The direct contact hazard quotient and carcinogenic risk calculations for the 100-H-3 waste site were conservatively calculated for the entire waste site using the twelve verification soil samples and one duplicate soil sample results (WCH 2011). Of the contaminants of potential concern (COPCs) for this site, mercury is the only metal analyte that requires HQ and risk calculations because it was detected above background value. In addition, boron, molybdenum, PCBs, pesticides and the listed SVOCs require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead was detected above background; however, lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake. Additionally, arsenic was detected above background; however, the arsenic standard is not toxicity based. Total petroleum hydrocarbons (TPH) were detected and do not have a background value; however, the nature of TPH toxicity differs from the intent of direct contact hazard quotient determination. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron is 3.24 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 4.5×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 2.5×10^{-2}. 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 0.0851 mg/kg, divided by 13.7 mg/kg, and multiplied as indicated, is 6.2×10^{-9}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 7.5×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	I.B. Berezovskiy	Date:	1/24/2011	Calc. No.:	0100H-CA-V0152	Rev.:	0
Project:	100-HR-1 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	1/24/2011
Subject:	100-H-3 Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 4	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-H-3 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					
Arsenic[c]	12.9	20	--	--	--
Boron	3.24	7,200	4.5E-04	--	--
Lead[d]	67.8	353	--	--	--
Mercury	0.413	24	1.7E-02	--	--
Molybdenum	0.445	400	1.1E-03	--	--
Semivolatiles					
Benzo(a)anthracene	0.0696	--	--	1.37	5.1E-08
Benzo(a)pyrene	0.0708	--	--	0.137	5.2E-07
Benzo(b)fluoranthene	0.0608	--	--	1.37	4.4E-08
Benzo(ghi)perylene[e]	0.0567	2,400	2.4E-05	--	--
Benzo(k)fluoranthene	0.0630	--	--	13.7	4.6E-09
Chrysene	0.0851	--	--	13.7	6.2E-09
Fluoranthene	0.138	3,200	4.3E-05	--	--
Phenanthrene[e]	0.0813	24,000	3.4E-06	--	--
Pyrene	0.143	2,400	6.0E-05	--	--
Pesticides					
BHC, beta (Hexachlorocyclohexane)	0.00253	--	--	0.556	4.6E-09
Dieldrin	0.00492	4	1.2E-03	0.0625	7.9E-08
Polychlorinated Biphenyls					
Aroclor-1254	0.00796	1.6	5.0E-03	0.5	1.6E-08
Aroclor-1260	0.0144	--	--	0.5	2.9E-08
Total Petroleum Hydrocarbons					
Diesel range and motor oil[f]	220	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**2.5E-02**		
Cumulative Excess Cancer Risk:					**7.5E-07**

Notes:

[a] = From WCH (2011).

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

c = The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP

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

[e] = Toxicity data for these chemicals are not available. The cleanup levels are based on use of surrogate chemicals.
benzo(g,h,i)perylene surrogate: pyrene
phenanthrene surrogate: anthracene

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

-- = not applicable

RAG = remedial action goal

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	I.B. Berezovskiy	Date:	1/11/2011	Calc. No.:	0100H-CA-V0152	Rev.:	0
Project:	100-HR-1 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	1/11/2011
Subject:	100-H-3 Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 4	

CONCLUSION:

The calculations in Tables 1 demonstrate that the 100-H-3 waste site meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk, as identified in the RDR/RAWP (DOE-RL 2009a) and SAP (DOE-RL 2009b). The hazard quotients and carcinogenic (excess cancer) risk are for use in the RSVP for this site.

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-HR-1

Discipline: Environmental *Calculation No: 0100H-CA-V0153

Subject: 100-H-3 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	I. B. Berezovskiy	T. E. Queen	J. D. Skoglie	D. F. Obenauer	1/25/11

SUMMARY OF REVISION

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	I. B. Berezovskiy	Date:	1/13/10	Calc. No.:	0100H-CA-V0153	Rev.:	0
Project:	100-H Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	1/13/10
Subject:	100-H-3 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 100-H-3 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) DOE-RL, 2009b, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

4) WAC 173-340-740(3)(a)(ii)(A), "Groundwater Protection."

5) WCH, 2011, *Remaining Sites Verification Package for the 100-H-3, 1716-H Garage Fuel Tank Site,* Attachment to Waste Site Reclassification Form 2010-103, 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:	I. B. Berezovskiy	Date:	1/13/10	Calc. No.:	0100H-CA-V0153	Rev.:	0
Project:	100-H Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	1/13/10
Subject:	100-H-3 Waste Site Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 2 of 3	

METHODOLOGY:

The 100-H-3 waste site is comprised of a single decision unit for verification sampling. Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at the 100-H-3 waste site were conservatively calculated for the entire waste site using the maximum value for each analyte (WCH 2011). Of the contaminants of potential concern (COPCs) for this site, boron and beta-Hexachlorocyclohexane (BHC, beta) are included because they do not have a Hanford Site-specific or Washington State background value available and their respective distribution coefficients are less than that necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (DOE-RL 2009). Based on this model and a vadose zone of approximately 10.22 m (33.5 ft) thickness, a K_d of 7.2 or greater is required to show no predicted migration to groundwater in 1,000 years using the generic site model. Additionally, arsenic was detected above background; however, the arsenic standard is not toxicity based, therefore a groundwater HQ is not calculated. All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than 7.2. 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 is 3.24 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg, is 1.0×10^{-2}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met. 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.) Boron was the only analyte; therefore, the sum of the HQ values is 1.0×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

2) To calculate the excess cancer risk for individual carcinogens, the maximum value is divided by the carcinogenic RAG value, then multiplied by 10^{-6}. For example, the maximum value for BHC, beta is 0.00253 mg/kg divided by 0.00486 mg/kg, multiplied as indicated is 5.2×10^{-7}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criteria is met. Because BHC, beta is the only constituent subject to evaluation for carcinogenic risk, the excess cancer risk value is 5.2×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criteria is 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:	I. B. Berezovskiy	Date:	1/13/10	Calc. No.:	0100H-CA-V0153	Rev.:	0
Project:	100-H Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	1/13/10
Subject:	100-H-3 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 100-H-3 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					
Arsenic [c]	12.9	20	--	--	--
Boron	3.24	320	1.0E-02	--	--
BHC, beta	0.00253	--	--	0.00486	5.2E-07
Totals					
Cumulative Hazard Quotient:			**1.0E-02**		
Cumulative Excess Cancer Risk:					**5.2E-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.
[c] = The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009a). The arsenic standard is not toxicity based, therefore, will not have a hazard quotient calculated.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 100-H-3 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 C

DATA QUALITY ASSESSMENT

APPENDIX C

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

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

A review of the sample design (WCH 2010b), the field logbooks (WCH 2010a, 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. To ensure quality data, the SAP data assurance requirements and the data validation procedure for chemical analysis (BHI 2000) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 100-H-3 waste site were provided by the laboratory in two sample delivery groups (SDGs): SDG K2410 and SDG JP0148. SDG K2410 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

SDG K2410

This SDG comprises thirteen verification soil samples (J1C1M3-J1C1M9, J1C1N0-J1C1N6) from the 100-H-3 waste site. A field duplicate pair (J1C1M6/J1C1N5) is included in this SDG. These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, and total petroleum hydrocarbons (TPH). In addition, one equipment blank (J1C1N6) was collected and analyzed for ICP metals and mercury. SDG K2410 was submitted for third-party validation. Minor deficiencies are as follows:

In the TPH analysis, all of the motor oil data in SDG K2410 were qualified by third-party validation as estimated with "J" flags, due to lack of a matrix spike (MS), matrix spike duplicate (MSD), and laboratory control sample (LCS) analysis. Estimated, or "J"-flagged, data are acceptable for decision-making purposes.

In the TPH analysis, the LCS recovery for diesel range organics is below the quality control (QC) limit at 40%. The diesel range organics results were considered estimated and flagged "J" by third party validation. The data are useable for decision-making purposes.

In the pesticides analysis, all of the toxaphene data in SDG K2410 were qualified by third-party validation as estimated with "J" flags, due to lack of an MS, MSD, and LCS analysis. Estimated, or "J"-flagged, data are acceptable for decision-making purposes.

In the pesticides analysis, the surrogate recoveries for sample J1C1M7 are below the QC criteria. Third-party validation qualified all pesticides results for sample J1C1M7 as estimated and flagged "J." Estimated, or "J"-flagged, data are acceptable for decision-making purposes.

In the PCB analysis, the surrogate recoveries for samples J1C1M7 and J1C1M8 are below the QC criteria. Third-party validation qualified all PCB results for samples J1C1M7 and J1C1M8 as estimated and flagged "J." Estimated, or "J"-flagged, data are acceptable for decision-making purposes.

In the PCB analysis, the relative percent differences (RPDs) are above the QC limit of 30% at 42% and 46%. The PCB results for SDG K2410 were considered estimated and flagged "J" by third party validation. The data are useable for decision-making purposes.

In the PCB analysis, the MSD for aroclor-1260 was above the QC limit at 159%. The detected aroclor-1260 sample results (J1C1M7, J1C1M9, J1C1N0, J1C1N2, and J1C1N4) were considered estimated and flagged "J" by third party validation. The data are useable for decision-making purposes.

In the SVOC analysis, a surrogate recovery in sample J1C1N0 was below the QC criteria. The 2,4-dichlorophenol, 2,4,6-trichlorophenol, 2,4,5-trichlorophenol, pentachlorophenol, bis(2-chloroethyl)ether, bis(2-chloroisopropyl)ether, bis(2-chloroethoxy)methane, 4-chlorophenyl phenyl ether, and 4-bromophenyl phenyl ether results in sample J1C1N0 were qualified as estimated and flagged "J" by third-party validation. The data are useable for decision-making purposes.

In the SVOC analysis, the MS and MSD results for hexachlorocyclopentadiene are below the QC criteria at 45% and 38%, respectively. The MSD results for 2,4,6-trichlorophenol (38%), 4-nitrophenol (23%), hexachloroethane (48%), and pentachlorophenol (43%) are all below the QC criteria. The LCS recoveries for 2,4,6-trichlorophenol (40%), 2,4-dimethylphenol (49%), 2,4-dinitrophenol (8%), 4,6-dinitro-2-methylphenol (12%), 4-chloroanaline (44%), 4-nitrophenol (35%), hexachlorocyclopentadiene (37%), hexachloroethane (48%), and pentachlorophenol (19%) are below the QC criteria. Third-party validation considered the results for these SVOCs estimated and flagged "J." The data are useable for decision-making purposes.

In the SVOC analysis, the RPDs for 2,4,6-trichlorophenol and 4-nitrophenol are above the QC limit of 30% at 35% and 74%, respectively. The 2,4,6-trichlorophenol and 4-nitrophenol results for SDG K2410 were considered estimated and flagged "J" by third party validation. The data are useable for decision-making purposes.

In the ICP metals analysis, the calcium result for sample J1C1N6 (the equipment blank) is of similar magnitude as the method blank result. The result for calcium in sample J1C1N6 is qualified as undetected and flagged "UJ" by third-party validation due to method blank contamination. The data is useable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for five analytes (aluminum, calcium, iron, antimony, and silicon). For aluminum and iron, 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, calcium, and silicon did not have mismatched spike and native concentrations in the original MS. The original MS recoveries for antimony, calcium, and silicon were 45%, 25%, and 196%, respectively. All antimony, calcium, and silicon data for SDG K2410 were considered estimated and flagged "J" by third-party validation due to the MS recoveries outside the QC limits. Estimated data are useable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon is below the QC limit at 58%. The silicon results were considered estimated and flagged "J" by third party validation. The data are useable for decision-making purposes.

In the ICP metals analysis, the RPD for calcium is above the QC limit of 30% at 40%. The calcium results were considered estimated and flagged "J" by third party validation. The data are useable for decision-making purposes.

SDG JP0148

This SDG comprises thirteen verification soil samples (J1H093-J1H099, J1H0C0-J1H0C7) and one equipment blank (J1H0C8) from the 100-H-3 waste site. A field duplicate pair (J1H096/J1H0C7) is included in this SDG. These samples were analyzed for polycyclic aromatic hydrocarbons (PAH). No minor deficiencies were noted:

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance/quality control (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 2010a, WCH 2011), are the primary and duplicate samples (J1C1M6/J1C1N5) and (J1H096/J1H0C7). The main and QA/QC sample results are presented in Appendix B.

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate

precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern (COPC). RPDs are not calculated for analytes that are not detected in both the main and duplicate sample at more than 5 times the target detection limit. RPDs of analytes detected at low concentrations (less than 5 times the detection limit) are not considered to be indicative of the analytical system performance. The upper confidence level (UCL) calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation.

The RPD calculated for pyrene from the PAH analysis (111.5%) is above the acceptance criteria of 30%. A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than 5 times the target detection limit (TDL), including undetected analytes. In these cases, a control limit of ± 2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. The benzo(a)anthracene, benzon(b)fluornathene, chrysene, fluoranthene, and phenanthrene data from the PAH analysis required this check, and the results for these analytes may be considered estimated. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are useable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above, are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 100-H-3 waste site verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 100-H-3 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 (ENRE) project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System (HEIS) database. The verification sample analytical data are also summarized in Appendix B.

REFERENCES

BHI, 2000, *Data Validation Procedure for Chemical Analysis*, BHI-01435, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

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

EPA, 2006, *Guidance on Systematic Planning using the Data Quality Objectives Process*, EPA QA/G-4, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2010a, *100-H Field Remediation and Sampling*, Logbook EL-1627-04 pp. 70-71, Washington Closure Hanford, Richland, Washington.

WCH, 2010b, *Work Instruction for Verification Sampling of the 100-H-3, 1716-H Garage Fuel Tank Site,* Work Instruction No. 0100H-WI-G0052, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2011, *100-H Field Remediation and Sampling*, Logbook EL-1627-05 pp. 4-6, Washington Closure Hanford, Richland, Washington.