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

14-AMRP-0098

JAN 31 2014

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

Dear Mr. Faulk:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 600-294, WHITE BLUFFS SERVICE STATION #2 WASTE SITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2013-132, and supporting, "Remaining Sites Verification Package for the 600-294, White Bluffs Service Station #2 Waste Site," Rev. 0. If you have questions, please contact me or your staff may contact Ellwood Glossbrenner, of my staff, at (509) 376-5828.

Sincerely,

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

AMRC:ETG

Attachment

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

cc w/o attach:
S. L. Feaster, WCH
T. Q. Howell, WCH
D. L. Plung, WCH
C. P. Strand, WCH

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-2 **Control No.:** 2013-132

Waste Site Code(s)/Subsite Code(s):

600-294, White Bluffs Service Station #2

Reclassification Category: Interim ☒ Final ☐

Reclassification Status: Closed Out ☒ No Action ☐ Rejected ☐

RCRA Postclosure ☐ Consolidated ☐ None ☐

Approvals Needed: DOE ☒ Ecology ☐ EPA ☒

Description of Current Waste Site Condition:

The 600-294, White Bluffs Service Station #2 waste site was identified as a candidate site for confirmatory sampling in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (100 Area ESD) (EPA 2009).

Confirmatory sampling at 600-294 waste site was performed on October 20, 2010. Confirmatory sampling results indicated the presence of several contaminants above cleanup levels, including asbestos, semivolatile organic compounds, and total petroleum hydrocarbons. Based on the confirmatory sampling results, this waste site was subsequently recommended for remove, treat, and dispose.

Remediation of the 600-294 waste site was performed from March 28 to July 16, 2013. The remediation resulted in approximately 162 bank cubic meters (212 bank cubic yards) of material being removed and disposed at the Environmental Restoration Disposal Facility (ERDF).

Cleanup verification sampling was performed September 4 and October 30, 2013, to determine if the waste site meets remedial action objectives (RAOs) and remedial action goals (RAGs) established by the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6 and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (Remaining Sites ROD) (EPA 1999) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP), DOE/RL-97-17, Rev. 6, U.S. Department of Energy, Richland, Washington (DOE-RL 2009b). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at ERDF at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for Reclassification:

Cleanup verification sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-294 waste site to Interim Closed Out. The current site conditions achieve the RAOs and RAGs established by the Remaining Sites ROD (EPA 1999). The results of verification sampling do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The analytical results and rationale presented in the attached remaining sites verification package also demonstrate that residual contaminant concentrations meet direct exposure cleanup criteria and are protective of groundwater and the Columbia River. Contamination above direct exposure levels was not observed in the shallow zone soils and is concluded to not exist in deep zone soils (i.e., below 4.6 m [15 ft] deep). Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone soils are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 600-294, White Bluffs Service Station #2 Waste Site* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-2 **Control No.:** 2013-132

Waste Site Code(s)/Subsite Code(s):

600-294, White Bluffs Service Station #2

Regulator Comments:

Waste Site Controls:

Engineered Controls: ☐ Yes ☒ No Institutional Controls: ☐ Yes ☒ No O&M Requirements: ☐ Yes ☒ No

If any of the Waste Site Controls are checked Yes, specify control requirements, including reference to the Record of Decision, TSD Closure Letter, or other relevant documents:

J. P. Neath	J P Neath	1/14/14
DOE Federal Project Director (printed)	Signature	Date
N/A		
Ecology Project Manager (printed)	Signature	Date
C. J. Guzzetti		1/16/14
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-294, WHITE BLUFFS SERVICE STATION #2 WASTE SITE

Attachment to Waste Site Reclassification Form 2013-132

January 2014

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-294, WHITE BLUFFS SERVICE STATION #2 WASTE SITE

EXECUTIVE SUMMARY

The 600-294, White Bluffs Service Station #2 waste site is located in the 100-IU-2 Operable Unit of the Hanford Site in the White Bluffs area west of the railroad tracks and north of Federal Avenue. The 600-294 waste site was included in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision* (EPA 2009) as a candidate site for confirmatory sampling.

Confirmatory sampling was performed at the 600-294 waste site on October 20, 2010. Confirmatory sampling results indicated the presence of several contaminants above cleanup levels, including asbestos, semivolatile organic compounds, and total petroleum hydrocarbons. This waste site was subsequently recommended for remove, treat, and dispose based on the confirmatory sampling results (WCH 2011).

Remedial action at the 600-294 waste site began on March 28, 2013, and was completed on July 16, 2013. Remediation at the 600-294 waste site extended to a maximum depth of 3 m (10 ft) below ground surface. The excavation resulted in the removal of 162 bank cubic meters (212 bank cubic yards) of miscellaneous debris, including two 1.2-m (4-ft)-diameter sections of corrugated piping and underlying soil. All material removed from the site was disposed at the Environmental Restoration Disposal Facility.

Verification sampling for the 600-294 waste site was conducted on September 4 and October 30, 2013. The verification sampling results indicate that residual contaminant concentrations meet the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 600-294 waste site. A summary of the cleanup evaluation for the soil results compared to the applicable cleanup criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

In accordance with this evaluation, the verification sampling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River.

Table ES-1. Summary of Remedial Action Goals for the 600-294 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15-mrem/yr above background over 1,000 years.	Radionuclides were not COPCs for the 600-294 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct-exposure criteria.	Yes [a]
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 (3.1×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	All individual carcinogen risk values are $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk (1.2×10^{-7}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 600-294 waste site.	NA
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [b].		
	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 [c].		
	Meet total uranium standard of 21.2 pCi/L [d].		

Table ES-1. Summary of Remedial Action Goals for the 600-294 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Residual concentrations of total chromium, lead, and total petroleum hydrocarbons are present above soil RAGs for groundwater and/or Columbia River protection. However, RESRAD modeling predicts that these constituents will not migrate to groundwater and/or the Columbia River within 1,000 years. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River [e].	Yes

[a] TPHs were detected above the soil direct exposure RAG listed in the 100 Area RDR/RAWP (DOE-RL 2009b) in three samples. However, there is no WAC 173-340-740 (1996) Method B value for direct exposure for TPH as these represent a broad compound class analysis typically used for soil screening. Potential direct exposure risks are better evaluated by analysis of specific individual constituents. In the case of the 600-294 site, analysis was performed for volatile organic compounds (including benzene, toluene, ethylbenzene, and xylenes), semivolatile organic compounds (including naphthalenes), and other polycyclic aromatic hydrocarbons. These analyses encompass the major individual compound risk drivers associated with petroleum hydrocarbon compounds. These constituents were all either undetected or detected well below direct exposure soil RAG values at the 600-294 site. Therefore, exceedance of the TPH soil RAG of 200 mg/kg does not represent a direct exposure risk and TPH with a soil K_d of 50 mL/g is predicted to migrate less than 1 m (3 ft) vertically in 1,000 years and is not a threat to groundwater or the river.

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

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

[d] Based on the isotopic distribution of uranium in the 100 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).

[e] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentrations of total chromium, lead and total petroleum hydrocarbons are not expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years (based on the contaminant with the lowest distribution coefficient [lead at 30 mL/g]). The vadose zone soil underlying the waste site excavation is approximately 5 m (16.4 ft) thick. Therefore, residual contamination in the 600-294 excavation is not predicted to migrate to groundwater and, hence, the Columbia River within 1,000 years.

COPC = contaminant of potential concern
DOE = U.S. Department of Energy
K_d = distribution coefficient
MCL = maximum contaminant level
NA = not applicable
RAG = remedial action goal
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Residual contamination above direct exposure levels was not observed in the shallow zone soils and is concluded not to exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based, in part, on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern, contaminants of potential concern, and other constituents. Those constituents exceeding the ecological screening levels in the *Washington Administrative Code*

(WAC) 173-340, "Model Toxics Control Act – Cleanup," were boron, lead, and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, lead, manganese, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of antimony, manganese, and vanadium are below Hanford Site background levels, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-294, WHITE BLUFFS SERVICE STATION #2 WASTE SITE

STATEMENT OF PROTECTIVENESS

The 600-294, White Bluffs Service Station #2 waste site verification sampling data, site evaluations, and supporting documentation demonstrate that the waste site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The excavation extended to a maximum depth of 3 m (10 ft) below ground surface (bgs). The results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]) and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. The results also demonstrate that residual contaminant concentrations are sufficiently protective of groundwater and the Columbia River. Contamination above direct exposure levels from the 600-294 waste site was not observed in the shallow zone soils and is concluded to not exist in the deep zone soils. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

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 (COPC), and other constituents. Those constituents exceeding the ecological screening levels in the *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were boron, lead, and vanadium. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, lead, manganese, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of antimony, manganese, and vanadium are below Hanford Site background levels, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site.

GENERAL SITE INFORMATION AND BACKGROUND

The 600-294 waste site, part of the 100-IU-2 Operable Unit, is the location of a service station with the potential for underground storage tanks (USTs), associated piping, and contaminated underlying soils. The 600-294 waste site is located in the White Bluffs Area west of the railroad tracks (west of Route 2N), north of Federal Avenue, and near the southeast corner of the equipment lot (Figure 1).

The center of the site is at Washington State Plane coordinates N 147599, E 577492. According to the Waste Information Data System report, the 600-294 waste site may have included USTs, associated piping, and contamination in the underlying soil. The service station was used for dispensing automotive fuel. The service station was demolished and buried in place in 1975. It was believed the service station was a wood-framed structure with shiplap siding and a concrete floor covering 148.6 m^2 (1,600 ft^2). The service station contained two gasoline pumps and two buried tanks with a total capacity of 15,142 L (4,000 gal), one diesel fuel pump, and a 3,800-L (1,000-gal) buried tank.

History

The White Bluffs township contained construction support facilities that were used during the 1940s for the Hanford Works Project. In the early 1970s, a Hanford Site safety and housekeeping evaluation focused on farm remnants and deteriorating production facilities. As part of this program, the pre-Manhattan project gas station facilities at White Bluffs were demolished and buried in place in 1975. Any USTs at the gas station site potentially remained in place (WHC 1991). The *White Bluffs, 100-IU-2 Operable Unit Technical Baseline Report* (BHI 1995) also stated that the service station was demolished in 1975, but no documentation was found related to removal of underground fuel storage tanks or septic systems.

CONFIRMATORY SAMPLING

Confirmatory sampling was conducted at the 600-294 waste site on October 20, 2010. Characterization sampling involved excavation of two test pits, one test trench (Figure 2), and collection of two focused samples and two asbestos samples.

Prior to excavation of test pit 1, suspected asbestos-containing materials were observed on the ground surface. A sample (J1CDR9) of transite-like material and a sample of gasket material (J1CDT0) were collected for asbestos analysis. During excavation of test pit 1, two 5-cm (2-in.)-diameter stainless steel pipelines were uncovered approximately 1 m (3 ft) bgs. The pipelines were found to be empty; therefore, a sample (J1C2C7) of soil underlying the pipelines was collected for analysis at approximately 1.2 m (4 ft) bgs.

No debris, stains, or pipelines were uncovered during the excavation of test pit 2. Excavation was extended to 4 m (13 ft) bgs, although native soil was observed at 1.8 m (6 ft) bgs.

Figure 1. The 600-294 Waste Site Location Map.

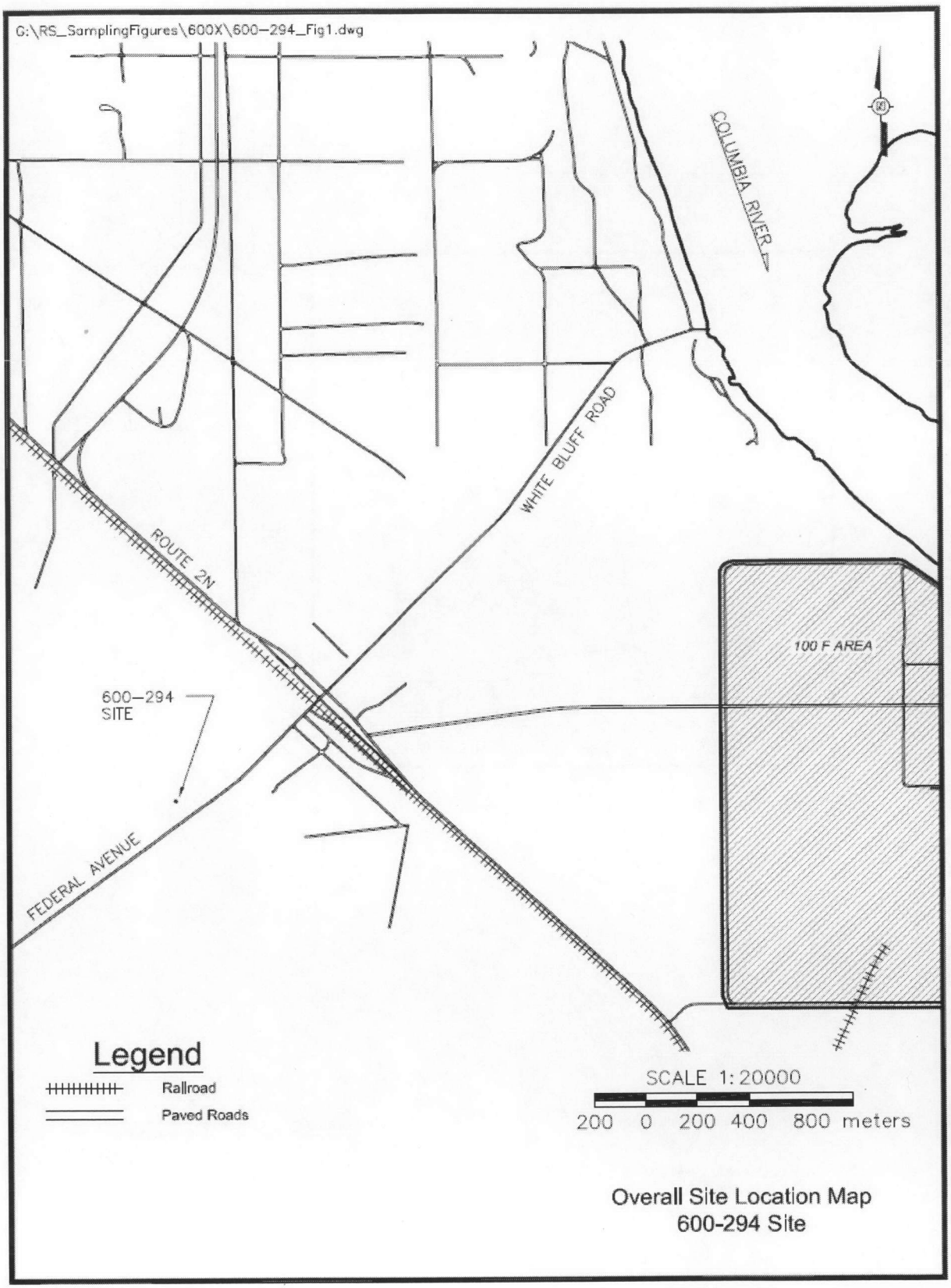
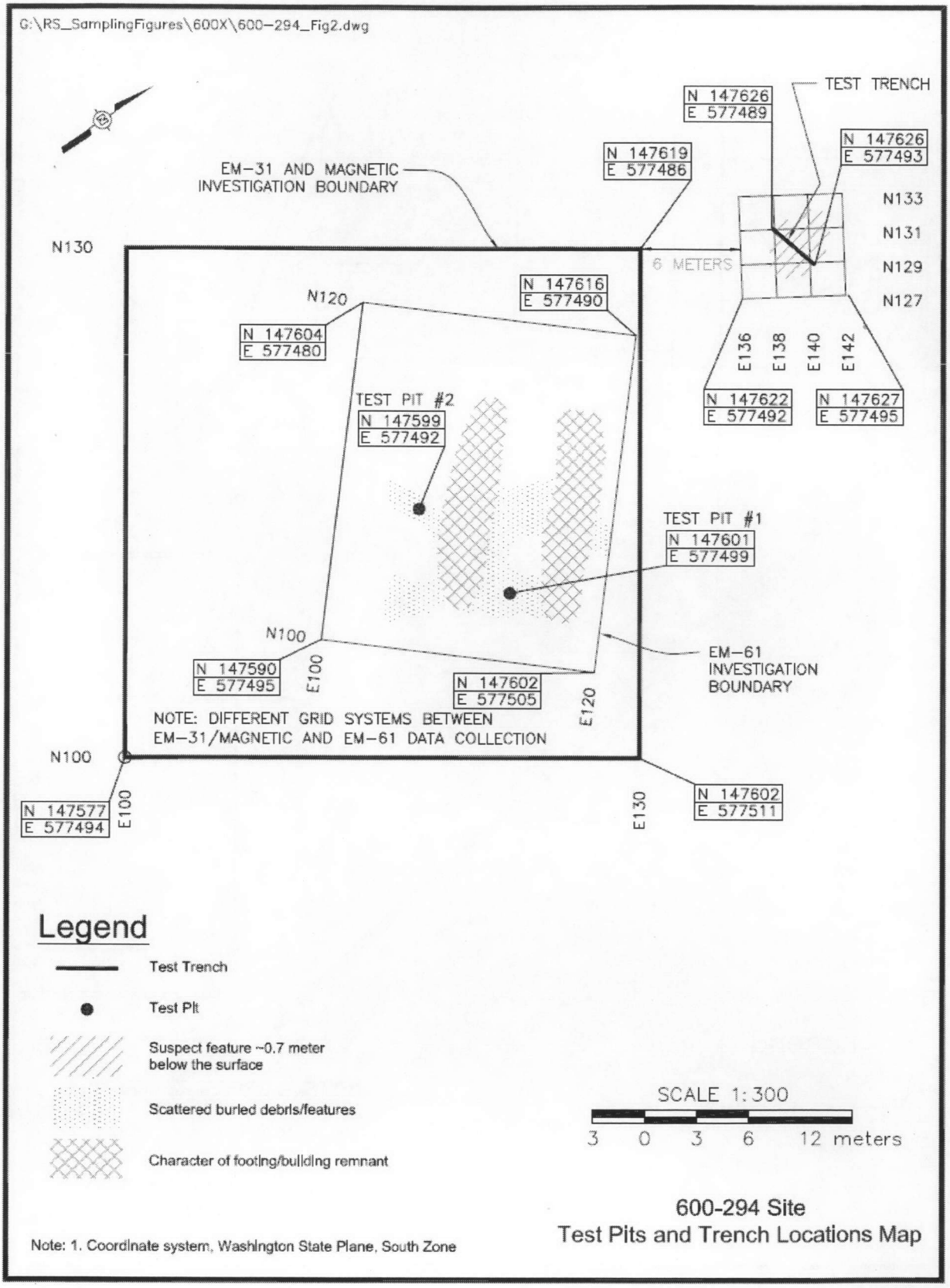


Figure 2. The 600-294 Waste Site Confirmatory Sampling Locations.



During the excavation of the test trench, a 6.1-m (20-ft) piece of 1.2-m (4-ft)-diameter corrugated pipe was uncovered 1 m (3 ft) bgs, trending in a north-south direction. In addition, a 7.6-cm (3-in.)-diameter steel pipeline was observed protruding from the east side of the corrugated pipe. It was determined that the 1.2-m (4-ft)-diameter corrugated pipe was a potential drain, because the pipe was perforated on the bottom to allow liquid discharged from the 7.6-cm (3-in.) line to leach through and into a bed of rock surrounding the corrugated pipe. Both the corrugated pipe and the 7.6-cm (3-in.) pipe were found to be empty of sediments. The rock was stained orange-yellow directly under the middle of the drain from the 7.6-cm (3-in.) pipe. The center of the corrugated pipe at this location was rusted through. Further excavation down to 3 m (10 ft) bgs uncovered a concrete slab with very brilliant yellow staining on top. A focused sample (J1C2C5) and a duplicate (J1C2C6) of this yellow stained sediment was collected for analysis. The results of confirmatory sampling are provided in Appendix A and indicated the presence of several contaminants above cleanup levels, including asbestos, semivolatile organic compounds (SVOCs), and total petroleum hydrocarbons (TPH).

Based on the results of confirmatory sampling, the 600-294 waste site was recommended for remove, treat, and dispose (WCH 2011) in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009).

REMEDIAL ACTION SUMMARY

Remedial Action

Remediation of the 600-294 south area was performed from March 28 through April 1, 2013. Approximately 63 bank cubic meters (BCM) (82 bank cubic yards [BCY]) of excavated materials were removed for direct disposal at the Environmental Restoration Disposal Facility (ERDF). The final depth of the south area excavation was approximately 1.8 m (6 ft) bgs.

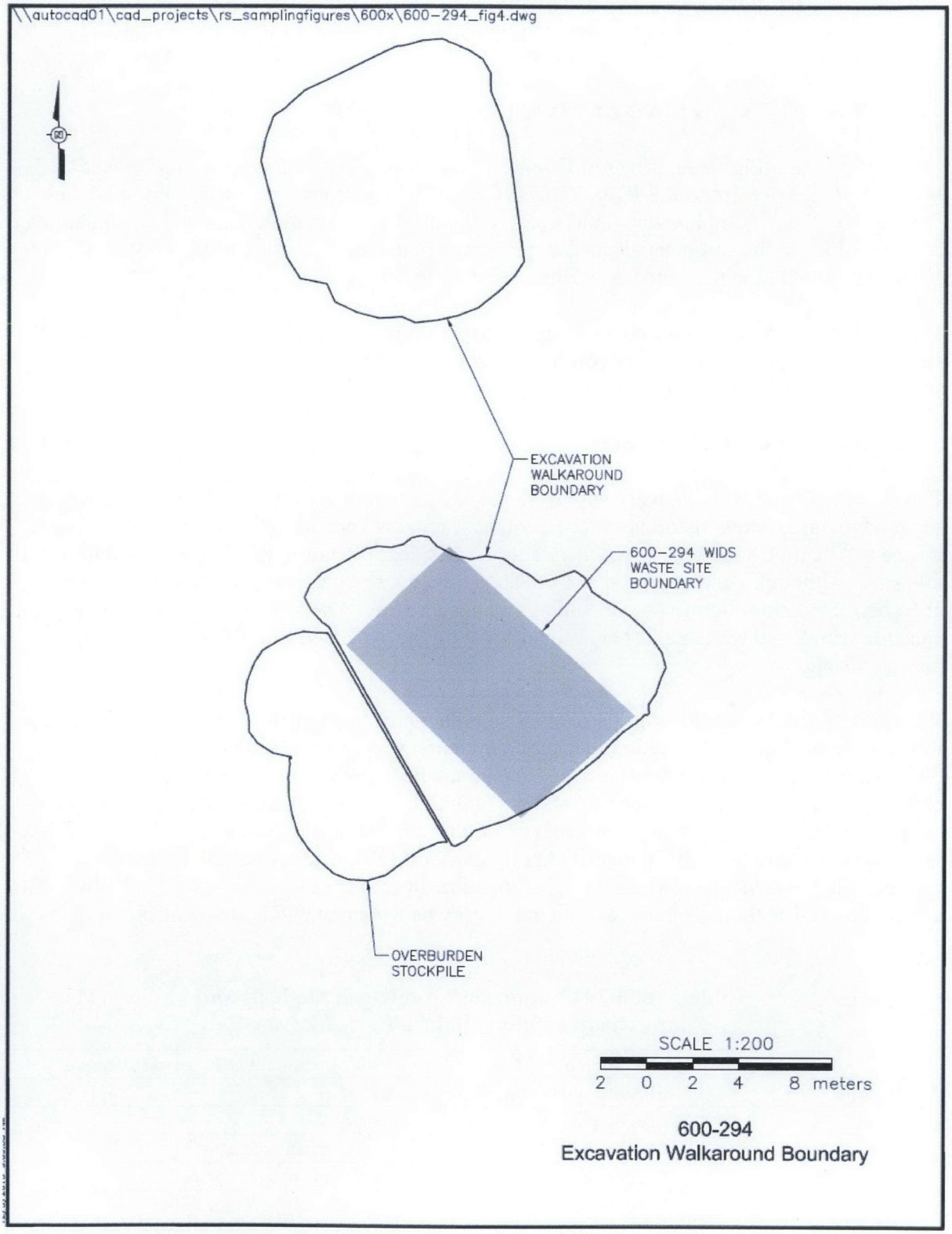
Remediation of the northern area of waste site 600-294 was performed from June 19 through July 16, 2013. Approximately 99 BCM (129 BCY) of excavated materials, including two 1.2-m (4-ft)-diameter sections of corrugated piping, were removed and loaded for direct disposal at ERDF. The final depth of the northern excavated area was 3 m (10 ft) bgs. Yellow soil staining was observed during excavation of the northern area. An in-process sample (J1RNY4) was collected from the yellow stained soils and analyzed for quick turn metals and hexavalent chromium. In-process data results showed that metals and hexavalent chromium concentrations were below the remedial action goals (RAGs) (Appendix A). An estimated total volume of 162 BCM (211 BCY) of contaminated soil and materials was excavated from the 600-294 waste site and disposed of at ERDF. Post-remediation photographs of the 600-294 waste site north and south excavations are included in Figures 3 and 4, respectively.

Figure 3. Post-Remediation Photograph of the 600-294 North Excavation (Looking South).

Figure 4. Post-Remediation Photograph of the 600-294 South Excavation (Looking West).

During the 600-294 waste site remedial activities, no UST was found. Overburden materials from the surface of the south excavation area were stockpiled to the west of the south excavation. The 600-294 waste site excavation walkaround boundaries are shown in Figure 5.

Figure 5. Post-Excavation Walkaround Boundary of the 600-294 Excavation.



No overburden materials were salvaged from the north excavation area. Radiological field screening was performed with handheld instruments during and immediately following remediation. No radiation was detected within either of the 600-294 excavation area.

VERIFICATION SAMPLING ACTIVITIES

Verification sampling as described in *Work Instruction for Verification Sampling of the 600-294, White Bluffs Service Station#2 Waste Site* (WCH 2013c) was conducted on September 4 and October 30, 2013. Sampling was conducted to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999).

The following subsections provide additional discussion of the information used to develop the verification sampling design. The results of verification sampling are also summarized to support interim closure of the site.

Contaminants of Potential Concern

The COPCs for the 600-294 waste site were based on the results of the available confirmatory sampling data, existing historical information, and process knowledge. The COPCs identified for the verification sampling included TPHs, SVOCs, lead, mercury, hexavalent chromium, and asbestos. Although not considered as COPCs, antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc were requested for analysis with the expanded list of inductively coupled plasma metals.

Radiological field screening was performed with handheld instruments during and immediately following remediation. No radiological contamination was detected within the 600-294 excavation area. No volatile organic compounds (VOCs) were detected within the 600-294 excavation area during confirmatory sampling; therefore, volatile organic analysis was not performed and VOCs were eliminated as COPCs for verification sampling. However, after verification sampling results indicated slightly elevated TPH results, analysis for benzene, toluene, ethylbenzene, and xylene was performed at three sample locations (WCH 2013b). The COPCs for verification sampling and the laboratory analytical methods are identified in Table 1.

Table 1. 600-294 Laboratory Analytical Methods and Contaminants of Potential Concern. (2 Pages)

Analysis	Analytical Method	Contaminant of Potential Concern
ICP metals [a]	EPA Method 6010	Lead
Mercury	EPA Method 7471	Mercury
Hexavalent chromium	EPA Method 7196	Hexavalent chromium
SVOA	EPA Method 8270	Semivolatile organic compounds
TPH	NWTPH-Dx	Total petroleum hydrocarbons
Bulk asbestos	NIOSH Method 7400	Asbestos

Table 1. 600-294 Laboratory Analytical Methods and Contaminants of Potential Concern. (2 Pages)

Analysis	Analytical Method	Contaminant of Potential Concern
VOA [b]	BTEX 5035 and 8260	VOCs – BTEX only

[a] Analysis was performed for the expanded list of ICP metals to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.
[b] Per regulator concurrence, analysis was performed on sampling locations EXC-3, EXC-8, and EXC-11, where TPH verification sampling results were detected above 200 mg/kg (WCH 2013b).

BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma
NIOSH = National Institute for Occupational Safety and Health
NWTPH-Dx = Northwest total petroleum hydrocarbon-diesel range organics
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbons
VOA = volatile organic analysis
VOC = volatile organic compound

Verification Sample Design

This section describes the basis for selection of an appropriate sample design to determine if residual contaminant concentrations exceed soil cleanup levels for the protection of human health and the environment, as identified in the Remaining Sites ROD (EPA 1999).

The excavation area was the single decision unit identified for the 600-294 waste site. A total of 12 statistical verification soil grab samples were collected from the waste site excavation area. Two composite-focused soil samples were collected from the overburden stockpile area. The overburden stockpile was divided into two approximately equal halves for verification sampling purposes. One composite sample composed of 25 aliquots of soil was collected from across the surface of each half of the overburden stockpile. A summary of the verification samples collected and laboratory analyses performed is provided in Table 2, and sample locations are shown in Figure 6.

All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). Additional information related to verification sampling can be found in the field sampling logbook (WCH 2013a).

Verification Sample Results

Verification samples were analyzed using EPA-approved analytical methods. The 95% upper confidence limit (UCL) on the true population mean for statistical sampling of COPCs was calculated as specified by the 100 Area RDR/RAWP (DOE-RL 2009b), with calculations provided in Appendix B. When a nonradionuclide COPC was detected in fewer than 50% of the statistical verification samples, the maximum detected value was used for comparison to the RAGs. If no detections for a given COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COPC. Evaluation of the verification data from the focused samples was performed by direct comparison of the maximum sample results against cleanup criteria. Asbestos was not detected in any of the verification samples.

Table 2. 600-294 Sample Summary.

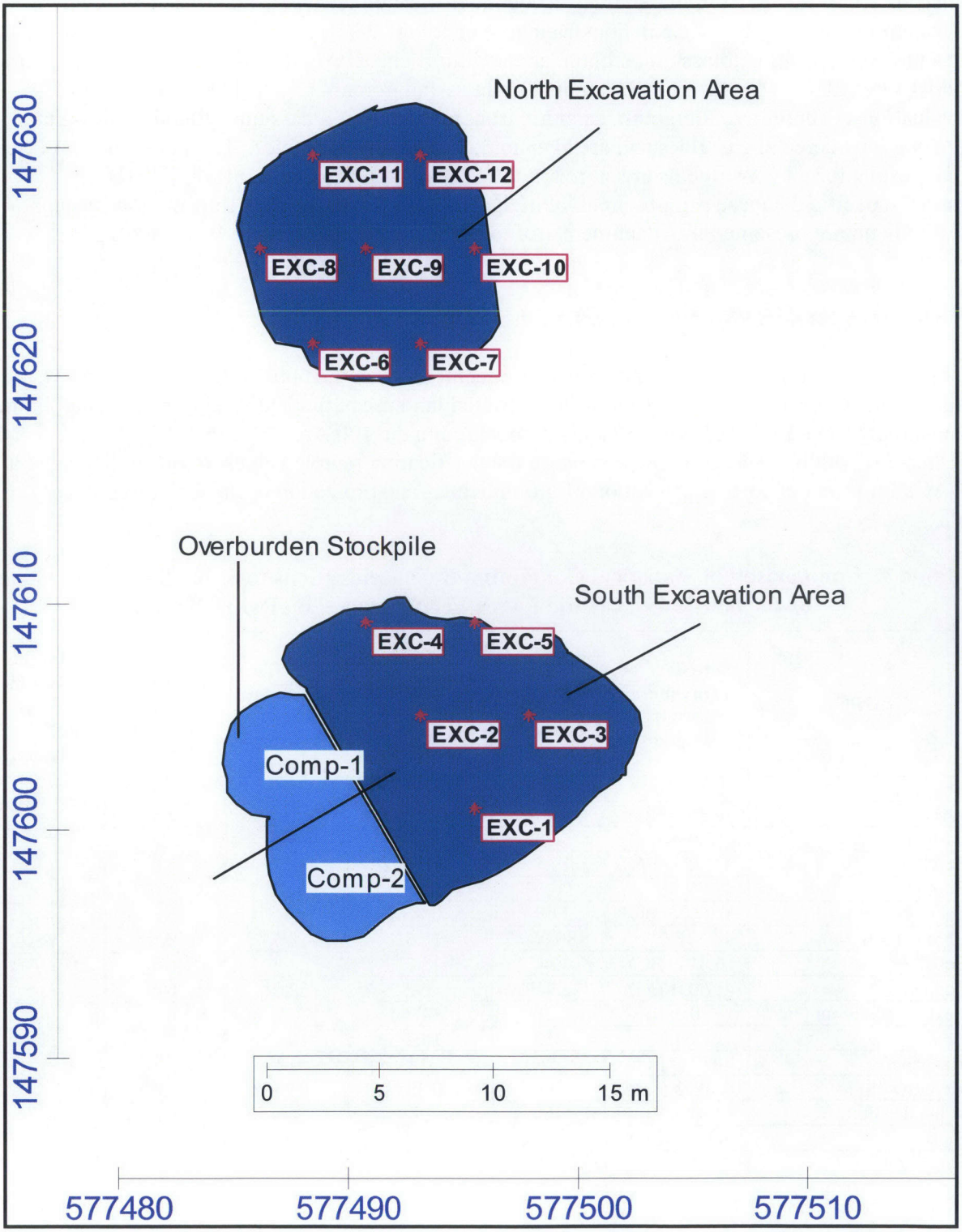
Sample Location	HEIS Sample Number	WSP Coordinates (m) (Center for Composite Samples)		Sample Analysis
		Northing	Easting	
EXC-1	J1RWL7/ J1RWN4	147601.0	577495.5	ICP metals [a], mercury, hexavalent chromium, SVOA, TPH, and asbestos
EXC-2	J1RWL8/ J1RWN5	147605.1	577493.2	
EXC-3 [b]	J1RWL9/ J1RWN6, J1T4N1	147605.1	577497.9	
EXC-4	J1RWM0/ J1RWN7	147609.2	577490.8	
EXC-5	J1RWM1/ J1RWN8	147609.2	577495.5	
EXC-6	J1RWM2/ J1RWN9	147621.5	577488.4	
EXC-7	J1RWM3/ J1RWP0	147621.5	577493.2	
EXC-8 [b]	J1RWM4/ J1RWP1, J1T4N2	147625.6	577486.1	
EXC-9	J1RWM5/ J1RWP2	147625.6	577490.8	
EXC-10	J1RWM6/ J1RWP3	147625.6	577495.5	
EXC-11 [b]	J1RWM7/ J1RWP4, J1T4N3	147629.7	577488.4	
EXC-12	J1RWM8/ J1RWP5	147629.7	577493.2	
Duplicate of J1RWL7/J1RWN4	J1RWM9/ J1RWP6	147601.0	577495.5	
Comp-1	J1RWN0/ J1RWP7	147607	577484	ICP metals [a], mercury, hexavalent chromium, SVOA, TPH, and asbestos
Comp-2	J1RWN1/ J1RWP8	147607	577486	
Duplicate J1RWN0/J1RWP7	J1RWN2/ J1RWP9	147607	577484	
Equipment blank	J1RWN3	NA	NA	ICP metals [a], mercury and SVOA
Trip blank	J1T4N4	NA	NA	BTEX

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

[b] Per regulator concurrence, VOA-BTEX analysis was performed on sampling locations EXC-3, EXC-8, and EXC-11, where TPH verification sampling results were detected above 200 mg/kg (WCH 2013b).

BTEX = benzene, toluene, ethylbenzene, and xylenes
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbons
VOA = volatile organic analysis
WSP = Washington State Plane

Figure 6. Verification Sample Locations for the 600-294 Waste Site Excavation Area.



Comparisons of the sample analytical results for each COPC against RAGs for the 600-294 waste site are summarized in Tables 3 and 4. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2013) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. The laboratory-reported data results for all constituents are stored in the Washington Closure Hanford (WCH) project-specific database prior to archival in the Hanford Environmental Information System (HEIS) and are presented in Attachment 1 of the 95% UCL calculations (Appendix B).

VERIFICATION SAMPLE DATA EVALUATION

This section demonstrates that contaminant concentrations at the 600-294 waste site achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the Remaining Sites ROD (EPA 1999) and documented in the 100 Area RDR/RAWP (DOE-RL 2009b). Tables 3 and 4 compare the verification sample values to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River.

Table 3. Comparison of Statistical Contaminant Concentrations to Remedial Action Goals for the 600-294 Excavation Area Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Statistical Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [c]	2.17 (<BG)	32	5 [d]	5 [d]	No	--
Arsenic	2.55 (<BG)	20 [d]	20 [d]	20 [d]	No	--
Barium	63.0 (<BG)	5,600	200	400	No	--
Beryllium	0.578 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Boron [f]	2.58	7,200	320	-- [g]	No	--
Cadmium [c]	0.271 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium (total)	18.7	80,000	18.5 [d]	18.5 [d]	Yes	Yes [h]
Cobalt	6.41 (<BG)	24	15.7 [d]	-- [g]	No	--
Copper	17.4 (<BG)	2,960	59.2	22.0 [d]	No	--
Hexavalent chromium	0.230	2.1	4.8	2	No	--
Lead	64.3	353	10.2 [d]	10.2 [d]	Yes	Yes [h]
Manganese	287 (<BG)	3,760	512 [d]	512 [d]	No	--
Mercury	0.00953 (<BG)	24	0.33 [d]	0.33 [d]	No	--
Molybdenum	0.538	400	8	-- [g]	No	--
Nickel	11.4 (<BG)	1,600	19.1 [d]	27.4	No	--
Vanadium	52.6 (<BG)	560	85.1 [d]	-- [g]	No	--
Zinc	44.7 (<BG)	24,000	480	67.8 [d]	No	--

Table 3. Comparison of Statistical Contaminant Concentrations to Remedial Action Goals for the 600-294 Excavation Area Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a]			Do the Statistical Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
2-methylnaphthalene	0.0153	320	3.2	--	No	--
Benzo(ghi)perylene [i]	0.0150	2,400	48	192	No	--
Naphthalene	0.0123	1,600	16.0	988	No	--
Phenanthrene [i]	0.0120	24,000	240	1,920	No	--
Phenol	0.104	24,000	480	4,200	No	--
TPH-motor oil	199	200	200	200	No	--
TPH-diesel range	22.5	200	200	200	No	--
(Total) TPH	222	200	200	200	Yes	Yes [j]

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

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

[c] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

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

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

[g] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2013) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[h] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentrations of total chromium and lead are not expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years (based on the contaminant with the lowest distribution coefficient, lead, with a value of 30 mL/g). The vadose zone underlying the soil below the site is approximately 5 m (16.4 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

[i] 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

[j] TPHs were detected above the soil direct exposure RAG listed in the 100 Area RDR/RAWP (DOE-RL 2009b) in three samples. However, there is no WAC 173-340-740 (1996) Method B value for direct exposure for TPH as these represent a broad compound class analysis typically used for soil screening. Potential direct exposure risks are better evaluated by analysis of specific individual constituents. In the case of the 600-294 site, analysis was performed for volatile organic compounds (including benzene, toluene, ethylbenzene, and xylenes), and semivolatile organic compounds (including naphthalenes and polycyclic aromatic hydrocarbons). These analyses encompass the major individual compound risk drivers associated with petroleum hydrocarbon compounds. These constituents were all either undetected or detected well below direct exposure soil RAG values at the 600-294 site. Therefore, exceedance of the TPH soil RAG of 200 mg/kg does not represent a direct exposure risk and TPH with a soil K_d of 50 mL/g is predicted to migrate less than 1 m (3 ft) vertically in 1,000 years and is not a threat to groundwater or the river.

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
K_d = distribution coefficient
RAG = remedial action goal
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Table 4. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-294 Overburden Area Verification Focused Samples.

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a]			Do the Statistical Results Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.57 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	69.0 (<BG)	5,600	200	400	No	--
Beryllium	0.580 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Boron [d]	3.59	7,200	320	-- [e]	No	--
Cadmium [f]	0.244 (<BG)	13.9 [c]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	12.2 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	6.43 (<BG)	24	15.7 [b]	-- [e]	No	--
Copper	14.6 (<BG)	2,960	59.2	22.0 [b]	No	--
Hexavalent Chromium	0.169	2.1	4.8	2	No	--
Lead	9.56 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	291 (<BG)	3,760	512 [b]	512 [b]	No	--
Molybdenum [f]	0.525	400	8	-- [e]	No	--
Nickel	11.4 (<BG)	1,600	19.1 [b]	27.4	No	--
Vanadium	52.9 (<BG)	560	85.1 [b]	-- [e]	No	--
Zinc	54.3 (<BG)	24,000	480	67.8 [b]	No	--
2-methylnaphthalene	0.0263	320	3.2	-- [e]	No	--
Benzo(ghi)perylene [g]	0.0277	2,400	48	192	No	--
Indeno(1,2,3,-cd)pyrene	0.0174	1.37	0.33 [h]	0.33 [h]	No	--
Naphthalene	0.0203	1,600	16.0	988	No	--
TPH-motor oil	46.9	200	200	200	No	--
TPH-diesel range	3.47	200	200	200	No	--
(Total) TPH	50	200	200	200	No	--

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

[b] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

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

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

[e] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2013) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [1996], [Method B for surface waters]).

[f] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

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

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

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

Direct Comparison to RAGs

Evaluation of the results listed in Tables 3 and 4 from the verification sampling at the 600-294 waste site indicates that no contaminants exceed direct exposure RAGs. Concentrations of total chromium, lead, and TPHs exceeded both groundwater protection and Columbia River protection cleanup levels. However, RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b) indicates that residual concentrations of these contaminants are not predicted to migrate more than 1.8 m (5.9 ft) vertically within 1,000 years based on the contaminant with the lowest distribution coefficient (K_d value) of the contaminants that exceeded the RAGs: lead with a K_d value of 30 mL/g. The vadose zone underlying the excavation is approximately 5 m (16.4 ft) thick. Therefore, residual concentrations of these contaminants are not predicted to migrate through the soil column to groundwater (and thus the Columbia River) within 1,000 years.

Total Petroleum Hydrocarbon Soil RAG Exceedance

Total petroleum hydrocarbons were detected above soil RAGs in 3 out of 12 statistical samples collected from the 600-294 excavation area. A soil RAG value of 200 mg/kg for direct exposure, protection of groundwater, and protection of the Columbia River is listed in the 100 Area RDR/RAWP (DOE-RL 2009b). However, this soil RAG value is obtained from WAC 173-340-740 (1996), Method A, and is identified as being a cleanup level for protection of groundwater only. There are no WAC 173-340-740 (1996) Method B TPH values for direct exposure or Method B TPH values for protection of groundwater or surface water. Total petroleum hydrocarbons represent a broad compound class analysis typically used for soil screening in lieu of more specific analytical methods. Potential direct exposure risks are better evaluated by analysis of specific individual constituents. In the case of the 600-294 waste site, per regulatory concurrence (WCH 2013b), analysis was performed for volatile organic compounds, including benzene, toluene, ethylbenzene, and xylenes (BTEX), for three sample locations (EXC-3, EXC-8, and EXC-11). Semivolatile organic analysis (including naphthalenes and other polycyclic aromatic hydrocarbons) was performed for all of the verification samples. These analyses encompass the major individual compound risk drivers associated with petroleum hydrocarbon compounds. These constituents were all either undetected or detected well below direct exposure soil RAG values at the 600-294 waste site. Therefore, exceedance of the TPH soil RAG of 200 mg/kg does not represent a direct exposure risk and TPH with a soil K_d of 50 mL/g is predicted to migrate less than 1 m (3 ft) vertically in 1,000 years and is not a threat to groundwater or the river.

Three-Part Test for Nonradionuclides

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

The application of the WAC 173-340 three-part test for the 600-294 waste site statistical data sets are included in the 95% UCL calculation (Appendix B). The results of this evaluation indicate that all residual COPC concentrations pass the three-part test in comparison to the applicable RAGs with the exception of total chromium, lead, and TPH-motor oil. However, as previously discussed, RESRAD modeling predicts that lead, the COPC with the lowest K_d value of 30 mL/g, is not predicted to migrate to groundwater and, hence, the Columbia River within 1,000 years. Therefore, the 95% UCL values for total chromium, lead, and TPH-motor oil are predicted to be protective of groundwater and the river and the requirements of the three-part test are met.

Direct Contact Noncarcinogenic Hazard Quotient Remedial Action Goal

Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. Hazard quotient and excess carcinogenic risk calculations for direct contact were conservatively performed for the 600-294 waste site using the highest of the focused composite and statistical values from all samples. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients are below 1.0, and all individual excess carcinogenic risk values are below 1×10^{-6}. The direct contact cumulative hazard quotient for the 600-294 waste site is 3.1×10^{-3}, and the cumulative excess carcinogenic risk value is 1.2×10^{-7}, satisfying the criteria of less than 1.0 and less than 1×10^{-5}, respectively. Therefore, the nonradionuclide risk requirements are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach (WCH 2013c), the field logbook (WCH 2013a), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 600-294 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in the WCH project-specific database for data evaluation prior to archival in the HEIS and are summarized in an attachment to the UCL calculation in Appendix B. The detailed DQA is presented in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 600-294 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). Remedial action was performed between March 28 and July 16, 2013, removing contaminated soil and debris from the site. Verification sampling was performed September 4, 2013, with additional BTEX sampling on

October 30. The analytical results indicate that the residual concentrations of COPCs meet the RAGs and associated remedial action objectives for direct exposure, groundwater protection, and river protection.

In accordance with this evaluation, verification sampling results and modeling indicate that the residual concentrations of COPCs at this site meet the RAGs and corresponding remedial action objectives for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the verification sampling and modeling results support a reclassification of the 600-294 waste site to Interim Closed Out. The results also demonstrate that residual contaminant concentrations are sufficiently protective of groundwater and the Columbia River. Contamination above direct exposure levels from the 600-294 waste site was not observed in the shallow zone soils and is concluded to not exist in the deep zone soils. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

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APPENDIX A

CONFIRMATORY AND IN-PROCESS SAMPLING RESULTS

Table A-1. 600-294 Confirmatory Sample Results - Metals and TPH (3 pages).

Sample location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Yellow stained soil (10 ft bgs)	J1C2C5	10/20/2010	12300		1.6	0.38	U	0.38	1.0		0.66	129		0.08	0.11	B	0.035	4.2		1.0
Duplicate of J1C2C5	J1C2C6	10/20/2010	10400		1.6	0.38	U	0.38	1.3		0.66	108		0.076	0.091	B	0.033	1.5	B	0.98
Soil beneath pipes (4 ft bgs)	J1C2C7	10/20/2010	6900		1.4	0.35	U	0.35	1.6		0.61	66.6		0.071	0.15	B	0.031	1.3	B	0.91
Equipment blank	J1C2C4	10/20/2010	191	N	1.3	0.39	B	0.33	0.60	B	0.57	5.0	M	0.066	0.046	B	0.028	0.85	U	0.85

Sample location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Yellow stained soil (10 ft bgs)	J1C2C5	10/20/2010	0.084	B	0.041	8320	J	14.9	12.0		0.061	3.7		0.11	7.6		0.23	0.225		0.145
Duplicate of J1C2C5	J1C2C6	10/20/2010	0.051	B	0.041	7270	J	14.2	11.5		0.058	3.6		0.10	7.1		0.22	1.41		0.137
Soil beneath pipes (4 ft bgs)	J1C2C7	10/20/2010	0.087	B	0.038	3240	J	13.1	8.6		0.054	5.4		0.093	12.6		0.20	0.322		0.148
Equipment blank	J1C2C4	10/20/2010	0.035	U	0.035	65.9	CJ	12.2	0.11	B	0.05	0.23	B	0.086	0.34	BM	0.19			

Sample location	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Yellow stained soil (10 ft bgs)	J1C2C5	10/20/2010	12400		4.0	3.6		0.27	3830		3.9	205		0.11	0.052		0.0058	0.70	B	0.27
Duplicate of J1C2C5	J1C2C6	10/20/2010	11400		3.8	3.6		0.27	3460		3.7	187		0.10	0.046		0.0060	0.54	B	0.26
Soil beneath pipes (4 ft bgs)	J1C2C7	10/20/2010	14800		3.5	3.7		0.25	3810		3.4	250		0.093	0.0055	U	0.0055	0.24	U	0.24
Equipment blank	J1C2C4	10/20/2010	2260	M	3.3	1.2	M	0.23	25.7		3.2	121	MN	0.086	0.0049	U	0.0049	0.30	B	0.22

Sample location	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Yellow stained soil (10 ft bgs)	J1C2C5	10/20/2010	6.6		0.13	2800		43.3	0.86	U	0.86	490	J	2.1	0.17	U	0.17	3610		62.4
Duplicate of J1C2C5	J1C2C6	10/20/2010	6.2		0.12	2230		41.2	0.86	U	0.86	482	J	2.1	0.16	U	0.16	3040		59.3
Soil beneath pipes (4 ft bgs)	J1C2C7	10/20/2010	10.2		0.11	1190		38.1	0.80	U	0.80	122	J	2.1	0.15	U	0.15	162		54.8
Equipment blank	J1C2C4	10/20/2010	0.24	BM	0.11	50.0	B	35.4	0.74	U	0.74	72.4	JN	2.1	0.14	U	0.14	50.9	U	50.9

Sample location	HEIS Number	Sample Date	Vanadium			Zinc			Asbestos	TPH - diesel range			TPH - diesel range -		
			mg/kg	Q	PQL	mg/kg	Q	PQL	% Total Asbestos	ug/kg	Q	PQL	ug/kg	Q	PQL
Yellow stained soil (10 ft bgs)	J1C2C5	10/20/2010	32.6		0.099	24.1		0.42		4200000	D	7600	5900000	D	11000
Duplicate of J1C2C5	J1C2C6	10/20/2010	30.4		0.094	22.8		0.40		4000000	D	7400	6100000	D	11000
Soil beneath pipes (4 ft bgs)	J1C2C7	10/20/2010	27.1		0.087	46.2		0.37		3700	J	700	6700		1000
Equipment blank	J1C2C4	10/20/2010	1.4	BM	0.081	1.4		0.34							
Transite	J1CDR9	10/20/2010							32.13						
Gasket	J1CDT0	10/20/2010							66.67						

Table A-1. 600-294 Confirmatory Sample Results -Organics (3 pages).

CONSTITUENT		J1C2C5, Yellow stained soil (10 ft bgs)			J1C2C6, Duplicate of J1C2C5			J1C2C7, Soil beneath pipes (4 ft bgs)			J1C2C4, Equipment blank		
		10/20/2010			10/20/2010			10/20/2010			10/20/2010		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	31	U	31	31	U	31	29	U	29	28	U	28
1,2-Dichlorobenzene	SVOA	25	U	25	24	U	24	23	U	23	22	U	22
1,3-Dichlorobenzene	SVOA	13	U	13	13	U	13	12	U	12	12	U	12
1,4-Dichlorobenzene	SVOA	15	U	15	15	U	15	14	U	14	14	U	14
2,4,5-Trichlorophenol	SVOA	11	U	11	11	U	11	10	U	10	10	U	10
2,4,6-Trichlorophenol	SVOA	11	U	11	11	U	11	10	U	10	10	U	10
2,4-Dichlorophenol	SVOA	11	U	11	11	U	11	10	U	10	10	U	10
2,4-Dimethylphenol	SVOA	74	U	74	72	U	72	68	U	68	66	U	66
2,4-Dinitrophenol	SVOA	370	U	370	360	U	360	340	U	340	330	U	330
2,4-Dinitrotoluene	SVOA	74	U	74	72	U	72	68	U	68	66	U	66
2,6-Dinitrotoluene	SVOA	31	U	31	31	U	31	29	U	29	28	U	28
2-Chloronaphthalene	SVOA	11	U	11	11	U	11	10	U	10	10	U	10
2-Chlorophenol	SVOA	24	U	24	23	U	23	21	U	21	21	U	21
2-Methylnaphthalene	SVOA	21	U	21	21	U	21	19	U	19	19	U	19
2-Methylphenol (cresol, o-)	SVOA	15	U	15	14	U	14	13	U	13	13	U	13
2-Nitroaniline	SVOA	56	U	56	55	U	55	51	U	51	50	U	50
2-Nitrophenol	SVOA	11	U	11	11	U	11	10	U	10	10	U	10
3+4 Methylphenol (cresol, m+p)	SVOA	37	U	37	36	U	36	34	U	34	33	U	33
3,3'-Dichlorobenzidine	SVOA	100	U	100	98	U	98	92	U	92	90	U	90
3-Nitroaniline	SVOA	82	U	82	80	U	80	75	U	75	73	U	73
4,6-Dinitro-2-methylphenol	SVOA	370	U	370	360	U	360	340	U	340	330	U	330
4-Bromophenylphenyl ether	SVOA	21	U	21	21	U	21	19	U	19	19	U	19
4-Chloro-3-methylphenol	SVOA	74	U	74	72	U	72	68	U	68	66	U	66
4-Chloroaniline	SVOA	92	U	92	90	U	90	84	U	84	82	U	82
4-Chlorophenylphenyl ether	SVOA	24	U	24	23	U	23	21	U	21	21	U	21
4-Nitroaniline	SVOA	81	U	81	79	U	79	74	U	74	73	U	73
4-Nitrophenol	SVOA	110	U	110	110	U	110	99	U	99	97	U	97
Acenaphthene	SVOA	12	U	12	11	U	11	11	U	11	10	U	10
Acenaphthylene	SVOA	19	U	19	19	U	19	17	U	17	17	U	17
Anthracene	SVOA	21	J	19	19	U	19	17	U	17	17	U	17
Benzo(a)anthracene	SVOA	22	U	22	22	U	22	20	U	20	20	U	20
Benzo(a)pyrene	SVOA	22	U	22	22	U	22	20	U	20	20	U	20
Benzo(b)fluoranthene	SVOA	29	U	29	29	U	29	27	U	27	26	U	26
Benzo(ghi)perylene	SVOA	18	U	18	18	U	18	16	U	16	16	U	16
Benzo(k)fluoranthene	SVOA	45	U	45	44	U	44	41	U	41	40	U	40
Bis(2-chloro-1-methylethyl)ether	SVOA	26	U	26	25	U	25	24	U	24	23	U	23
Bis(2-Chloroethoxy)methane	SVOA	26	U	26	25	U	25	24	U	24	23	U	23
Bis(2-chloroethyl) ether	SVOA	19	U	19	18	U	18	17	U	17	17	U	17
Bis(2-ethylhexyl) phthalate	SVOA	4100		52	3000		50	47	U	47	46	U	46
Butylbenzylphthalate	SVOA	48	U	48	47	U	47	44	U	44	43	U	43
Carbazole	SVOA	40	U	40	39	U	39	37	U	37	36	U	36
Chrysene	SVOA	30	U	30	30	U	30	28	U	28	27	U	27
Di-n-butylphthalate	SVOA	53	J	21	46	J	21	30	U	19	29	U	19
Di-n-octylphthalate	SVOA	16	U	22	16	U	22	15	U	20	14	U	20
Dibenz[a,h]anthracene	SVOA	21	U	29	21	U	28	19	U	27	19	U	26
Dibenzofuran	SVOA	22	U	26	22	U	25	20	U	24	20	U	23
Diethyl phthalate	SVOA	29	U	33	28	U	32	57	J	30	26	U	29
Dimethyl phthalate	SVOA	26	U	16	25	U	16	24	U	15	23	U	14
Fluoranthene	SVOA	40	U	40	44	J	39	37	U	37	36	U	36
Fluorene	SVOA	20	U	20	20	U	20	18	U	18	18	U	18
Hexachlorobenzene	SVOA	33	U	33	32	U	32	30	U	30	29	U	29
Hexachlorobutadiene	SVOA	11	U	11	11	U	11	10	U	10	10	U	10
Hexachlorocyclopentadiene	SVOA	56	U	56	55	U	55	51	U	51	50	U	50
Hexachloroethane	SVOA	24	U	24	23	U	23	22	U	22	21	U	21
Indeno(1,2,3-cd)pyrene	SVOA	25	U	25	24	U	24	23	U	23	22	U	22
Isophorone	SVOA	19	U	19	19	U	19	17	U	17	17	U	17
N-Nitroso-di-n-dipropylamine	SVOA	35	U	35	34	U	34	32	U	32	31	U	31
N-Nitrosodiphenylamine	SVOA	24	U	25	23	U	24	21	U	23	21	U	22
Naphthalene	SVOA	35	U	35	34	U	34	32	U	32	31	U	31
Nitrobenzene	SVOA	25	U	24	24	U	23	23	U	21	22	U	21
Pentachlorophenol	SVOA	370	U	370	360	U	360	340	U	340	330	U	330
Phenanthrene	SVOA	71	J	19	82	J	19	17	U	17	17	U	17
Phenol	SVOA	2500	JD	200	3200	JD	200	18	U	18	18	U	18
Pyrene	SVOA	74	J	14	13	U	13	12	U	12	12	U	12

Table A-1. 600-294 Confirmatory Sample Results -Organics (3 pages).

CONSTITUENT		J1C2C5, Yellow stained soil (10 ft bgs)			J1C2C6, Duplicate of J1C2C5			J1C2C7, Soil beneath pipes (4 ft bgs)			J1C2C4, Equipment blank		
		10/20/2010			10/20/2010			10/20/2010			10/20/2010		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	3.1	U	3.1	2.9	U	2.9	2.8	U	2.8			
Aroclor-1221	PCB	9.0	U	9.0	8.4	U	8.4	8.0	U	8.0			
Aroclor-1232	PCB	2.3	U	2.3	2.1	U	2.1	2.0	U	2.0			
Aroclor-1242	PCB	5.3	U	5.3	4.9	U	4.9	4.6	U	4.6			
Aroclor-1248	PCB	5.3	U	5.3	4.9	U	4.9	4.6	U	4.6			
Aroclor-1254	PCB	2.9	U	2.9	2.7	U	2.7	2.6	U	2.6			
Aroclor-1260	PCB	2.9	U	2.9	2.7	U	2.7	2.6	U	2.6			

Table A-2. 600-294 In-process Sampling Results - Metals, TCLP Metals and Hexavalent Chromium.

Sample Location	HEIS Number	Sample Date	Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-294	J1RNY4	7/10/13	0.354	U	10.1	80.3		2.01	0.0857	U	0.101

Sample Location	HEIS Number	Sample Date	Cadmium			Chromium			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-294	J1RNY4	7/10/13	0.0378	U	2.01	17.5		10.1	0.563		0.155

Sample Location	HEIS Number	Sample Date	Lead			Selenium			Silver		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-294	J1RNY4	7/10/13	2.43	U	10.1	0.0678	U	10.1	-0.161	U	10.1

Sample Location	HEIS Number	Sample Date	Arsenic -TCLP			Barium-TCLP			Cadmium-TCLP		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
600-294	J1RNY4	7/10/13	0.00566	U	0.28	0.259	U	0.28	0.000629	U	0.028

Sample Location	HEIS Number	Sample Date	Chromium-TCLP			Lead-TCLP			Selenium-TCLP		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
600-294	J1RNY4	7/10/13	0.00264	U	0.056	0.000395	U	0.28	0.00531	U	0.28

Sample Location	HEIS Number	Sample Date	Silver-TCLP		
			mg/L	Q	PQL
600-294	J1RNY4	7/10/13	-0.00048	U	0.056

APPENDIX B

CALCULATIONS

APPENDIX B

CALCULATIONS

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

600-294 Waste Site Cleanup Verification 95% UCL Calculations, 0600X-CA-V0154, Rev. 0, Washington Closure Hanford, Richland, Washington.

600-294 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0600X-CA-V0155, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-IU-2/6 Field Remediation **Job No. 14655**

Area: 600 Area

Discipline: Environmental *Calculation No: 0600X-CA-V0154

Subject: 600-294 Waste Site Cleanup Verification 95% UCL Calculation

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 9 Attm. 1 = 9 Total = 19	J. D. Skoglie	I. B. Berezovskiy	C. H. Dobie	D. F. Obenauer	12/17/13

SUMMARY OF REVISION

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

Washington Closure Hanford

CALCULATION SHEET

Originator J. D. Skoglie	**Date** 11/21/13	**Calc. No.** 0600X-CA-V0154	**Rev. No.** 0
Project 100-IU-2/6 Remediation	**Job No.** 14655	**Checked** I. B. Berezovskiy	**Date** 11/21/13
Subject 600-294 Waste Site Cleanup Verification 95% UCL Calculation			**Sheet No.** 1 of 9

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 3 - Calculation Sheet Summary
Sheets 4 to 5 - Calculation Sheet Verification Data - 600-294 Excavation
Sheets 6 to 7 - Ecology Software (MTCAStat) Results
Sheets 8 and 9 - Calculation Sheet Duplicate Analysis
Attachment 1 - 600-294, Waste Site Verification Sampling Results (9 sheets)

Given/References:

1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2009b), DOE-RL (2001), and Ecology (1996).
3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes* , DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
6) Ecology, 1992, *Statistical Guidance for Ecology Site Managers* , Publication #92-54, Washington Department of Ecology, Olympia, Washington.
7) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets),* Publication #92-54, Washington Department of Ecology, Olympia, Washington.
8) Ecology, 1996, *Model Toxic Control Act Cleanup Levels and Risk Calculations (CLARC II),* Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
9) Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
10) EPA, 1989, Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual, Part A; Interim Final, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D.C.
11) EPA, 2013, "EPA Concurrence for 600-294 Additional Sampling," CCN 173590 to H. M. Carman from C. J. Guzzetti, Washington Closure Hanford, Richland, Washington, October 30.
12) 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 and focused data from verification samples (Attachment 1) from the 600-294 waste site. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2009b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:

The 600-294 waste site underwent statistical verification sampling at one decision unit (excavation) and two composite samples within the overburden stockpile area. A duplicate sample was taken at both locations. Analytical results for all sampling locations are summarized in the tables provided on sheet 3. Three TPH (motor oil) samples failed direct exposure RAGs, however, information only samples (sheet 8 of Attachment 1) and an agreement with EPA (EPA 2013) allow this site to show protection to human health and the environment. 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 J. D. Skoglie		**Date** 11/21/13	**Calc. No.** 0600X-CA-V0154	**Rev. No.**	0
Project 100-IU-2/6 Remediation		**Job No.** 14655	**Checked** I. B. Berezovskiy	**Date**	11/21/13
Subject 600-294 Waste Site Cleanup Verification 95% UCL Calculation				**Sheet No.**	2 of 9

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

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

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

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

The RPD is calculated when both the primary value and 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 J. D. Skoglie Date 11/21/13 Calc. No. 0600X-CA-V0154 Rev. No. 0
Project 100-IU-2/6 Remediation Job No. 14655 Checked I. B. Berezovskiy Date 11/21/13
Subject 600-294 Waste Site Cleanup Verification 95% UCL Calculation Sheet No. 3 of 9

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL and maximum calculations for the 600-294 excavation, overburden stockpile samples, the WAC 173-340-740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the RSVP for this site.

600-294 Statistical and Composite Sampling Results Summary [a]

Analyte	600-294 Excavation		Overburden Stockpile	Units
	95% UCL	Maximum	Maximum	
Antimony	--	2.17	--	mg/kg
Arsenic	2.55	--	2.57	mg/kg
Barium	63.0	--	69.0	mg/kg
Beryllium	0.578	--	0.580	mg/kg
Boron	2.58	--	3.59	mg/kg
Cadmium	0.271	--	0.244	mg/kg
Chromium	18.7	--	12.2	mg/kg
Cobalt	6.41	--	6.43	mg/kg
Copper	17.4	--	14.6	mg/kg
Hexavalent chromium	--	0.230	0.169	mg/kg
Lead	64.3	--	9.56	mg/kg
Manganese	287	--	291	mg/kg
Mercury	--	0.00953	--	mg/kg
Molybdenum	0.538	--	0.525	mg/kg
Nickel	11.4	--	11.4	mg/kg
Vanadium	52.6	--	52.9	mg/kg
Zinc	44.7	--	54.3	mg/kg
2-methylnaphthalene	--	0.0153	0.0263	mg/kg
Benzo(ghi)perylene	--	0.0150	0.0277	mg/kg
Indeno(1,2,3-cd)pyrene	--	--	0.0174	mg/kg
Naphthalene	--	0.0123	0.0203	mg/kg
Phenanthrene	--	0.0120	--	mg/kg
Phenol	--	0.104	--	mg/kg
TPH - Motor Oil (high boiling)	199	--	46.9	mg/kg
TPH - Diesel Range	22.5	--	3.47	mg/kg

3-Part Test Evaluation:	**600-294**
95% UCL or maximum [a] > Cleanup Limit?	YES
> 10% above Cleanup Limit?	YES
Any sample > 2x Cleanup Limit?	YES

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

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

Analyte	600-294 Duplicate Analysis	
	EXC	OB
Aluminum	0.4%	0.0%
Barium	4.4%	0.3%
Calcium	2.9%	2.1%
Chromium	16.2%	0.0%
Copper	0.7%	2.1%
Iron	1.1%	1.0%
Magnesium	1.5%	2.0%
Manganese	1.1%	5.4%
Silicon	13.0%	8.7%
Vanadium	2.5%	5.8%
Zinc	5.3%	14.9%
TPH - Motor Oil	--	***32.5%***

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

-- = not applicable
B = the analyte was detected in both the associated QC blank and in the sample.
D = dilution
DE = direct exposure
EXC = excavation
GW = groundwater
J = estimate
MTCA = *Model Toxics Control Act*
N = spike sample recovery outside control limits
OB = overburden
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
TPH = total petroleum hydrocarbons
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-294 Waste Site Cleanup Verification 95% UCL Calculation

Date 11/21/13
Job No. 14655

Calc. No. 0600X-CA-V0154
Checked I. B. Berezovskiy

Rev. No. 0
Date 11/21/13
Sheet No. 4 of 9

600-294 Statistical Calculations

Verification Data - 600-294 Waste Site Excavation

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Manganese mg/kg	Q	PQL
EXC-1	J1RWL7	9/4/13	2.07	B	0.502	62.9		0.100	0.533		0.100	2.53	B	1.00	0.192	B	0.100	11.9		0.150	5.98	D	0.752	14.7		0.301	6.56	D	1.66	273		0.201
Duplicate of J1RWL7	J1RWM9	9/4/13	2.11	B	0.467	60.2		0.0934	0.537		0.0934	2.19	B	0.934	0.237	B	0.0934	14.0		0.140	5.94	D	0.700	14.6		0.280	5.75	D	1.54	270		0.187
EXC-2	J1RWL8	9/4/13	2.60	B	0.471	78.0		0.0942	0.617		0.0942	4.45	B	0.942	0.201	B	0.0942	12.3		0.141	6.30	D	0.707	14.8		0.283	6.37	D	1.55	306		0.188
EXC-3	J1RWL9	9/4/13	2.36	B	0.484	55.0		0.0968	0.532		0.0968	2.40	B	0.968	0.312	B	0.0968	16.0		0.145	6.02	D	0.726	29.0		0.290	21.2	D	1.60	268		0.194
EXC-4	J1RWM0	9/4/13	3.00		0.458	62.9		0.0916	0.584		0.0916	2.07	B	0.916	0.205	B	0.0916	17.9		0.137	6.94	D	0.687	15.8		0.275	8.20	D	1.51	307		0.183
EXC-5	J1RWM1	9/4/13	2.89		0.481	60.8		0.0961	0.547		0.0961	2.31	B	0.961	0.356	B	0.0961	11.9		0.144	6.48	D	0.721	16.8		0.288	25.7	D	1.59	293		0.192
EXC-6	J1RWM2	9/4/13	2.31	B	0.491	59.6		0.0983	0.578		0.0983	1.61	B	0.983	0.261	B	0.0983	11.4		0.147	6.27	D	0.737	12.8		0.295	3.98	BD	1.62	284		0.197
EXC-7	J1RWM3	9/4/13	2.17	B	0.427	57.9		0.0853	0.585		0.0853	2.13	B	0.853	0.259	B	0.0853	13.4		0.128	6.44	D	0.640	13.9		0.256	5.72	D	1.41	277		0.171
EXC-8	J1RWM4	9/4/13	2.27	B	0.487	58.5		0.0973	0.557		0.0973	1.63	B	0.973	0.256	B	0.0973	37.1		0.146	5.66	D	0.730	12.2		0.292	3.83	BD	1.61	257		0.195
EXC-9	J1RWM5	9/4/13	2.24	B	0.471	49.1		0.0942	0.531		0.0942	1.86	B	0.942	0.219	B	0.0942	10.5		0.141	5.15	D	0.706	11.6		0.283	3.05	BD	1.55	220		0.188
EXC-10	J1RWM6	9/4/13	2.07	B	0.436	58.2		0.0873	0.561		0.0873	1.74	B	0.873	0.213	B	0.0873	13.2		0.131	6.26	D	0.655	14.0		0.262	261	D	1.44	277		0.175
EXC-11	J1RWM7	9/4/13	2.26	B	0.492	58.1		0.0984	0.566		0.0984	2.25	B	0.984	0.147	B	0.0984	14.8		0.148	6.00	D	0.738	13.2		0.295	4.33	BD	1.62	270		0.197
EXC-12	J1RWM8	9/4/13	2.43	B	0.459	58.1		0.0917	0.583		0.0917	1.83	B	0.917	0.211	B	0.0917	11.3		0.138	6.42	D	0.688	13.6		0.275	4.77	D	1.51	280		0.183

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Lead mg/kg	Manganese mg/kg
EXC-1	J1RWL7/ J1RWM9	9/4/13	2.09	61.6	0.535	2.36	0.215	13.0	5.96	14.7	6.16	272
EXC-2	J1RWL8	9/4/13	2.60	78.0	0.617	4.45	0.201	12.3	6.30	14.8	6.37	306
EXC-3	J1RWL9	9/4/13	2.36	55.0	0.532	2.40	0.312	16.0	6.02	29.0	21.2	268
EXC-4	J1RWM0	9/4/13	3.00	62.9	0.584	2.07	0.205	17.9	6.94	15.8	8.20	307
EXC-5	J1RWM1	9/4/13	2.89	60.8	0.547	2.31	0.356	11.9	6.48	16.8	25.7	293
EXC-6	J1RWM2	9/4/13	2.31	59.6	0.578	1.61	0.261	11.4	6.27	12.8	3.98	284
EXC-7	J1RWM3	9/4/13	2.17	57.9	0.585	2.13	0.259	13.4	6.44	13.9	5.72	277
EXC-8	J1RWM4	9/4/13	2.27	58.5	0.557	1.63	0.256	37.1	5.66	12.2	3.83	257
EXC-9	J1RWM5	9/4/13	2.24	49.1	0.531	1.86	0.219	10.5	5.15	11.6	3.05	220
EXC-10	J1RWM6	9/4/13	2.07	58.2	0.561	1.74	0.213	13.2	6.26	14.0	261	277
EXC-11	J1RWM7	9/4/13	2.26	58.1	0.566	2.25	0.147	14.8	6.00	13.2	4.33	270
EXC-12	J1RWM8	9/4/13	2.43	58.1	0.583	1.83	0.211	11.3	6.42	13.6	4.77	280

Statistical Computations

	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese
95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mean	2.39	59.8	0.565	2.22	0.238	15.2	6.16	15.2	29.5	276
Standard deviation	0.30	6.72	0.0261	0.757	0.0554	7.21	0.453	4.58	73.3	23.1
95% UCL on mean	2.55	63.0	0.578	2.58	0.271	18.7	6.41	17.4	64.3	287
Maximum value	3.00	78.0	0.617	4.45	0.356	37.1	6.94	29.0	261	307
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	10.2 GW & River Protection	512 GW & River Protection
WAC 173-340 3-PART TEST										
95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	YES	NA	NO	YES	NA
> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NO	NA	NO	YES	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	YES	NA	NO	YES	NA
WAC 173-340 Compliance?	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-294 Waste Site Cleanup Verification 95% UCL Calculation

Date 11/21/13
Job No. 14655

Calc. No. 0600X-CA-V0154
Checked I. B. Berezovskiy

Rev. No. 0
Date 11/21/13
Sheet No. 5 of 9

1 **600-294 Statistical Calculations**

2 **Verification Data - 600-294 Waste Site Excavation**

3	Sample	Sample	Sample	Molybdenum			Nickel			Vanadium			Zinc			TPH - diesel range			TPH - motor oil (high boiling)		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	EXC-1	J1RWL7	9/4/13	0.532	B	0.201	10.9		0.150	48.0	D	0.502	49.9	D	2.01	4950	J	2170	33100	B	2170
6	Duplicate of J1RWL7	J1RWM9	9/4/13	0.516	B	0.187	11.0		0.140	49.2	D	0.467	52.6	D	1.87	2170	U	2170	18600	UB	2170
7	EXC-2	J1RWL8	9/4/13	0.531	B	0.188	10.8		0.141	51.5	D	0.471	45.0	D	1.88	2380	J	2180	25200	B	2180
8	EXC-3	J1RWL9	9/4/13	0.520	B	0.194	12.1		0.145	48.3	D	0.484	44.6	D	1.94	16600	DJ	10800	395000	BD	10800
9	EXC-4	J1RWM0	9/4/13	0.530	B	0.183	12.9		0.137	61.4	D	0.458	42.0	D	1.83	2760	J	2160	14900	UB	2160
10	EXC-5	J1RWM1	9/4/13	0.470	B	0.192	10.8		0.144	46.4	D	0.481	45.5	D	1.92	7030		2170	83000	B	2170
11	EXC-6	J1RWM2	9/4/13	0.506	B	0.197	10.7		0.147	51.8	D	0.491	39.0	D	1.97	2170	U	2170	27600	B	2170
12	EXC-7	J1RWM3	9/4/13	0.541	B	0.171	10.9		0.128	52.3	D	0.427	40.2	D	1.71	10600		2180	155000	B	2180
13	EXC-8	J1RWM4	9/4/13	0.545	B	0.195	9.42		0.146	48.7	D	0.487	41.1	D	1.95	13500	DJ	11200	280000	BD	11200
14	EXC-9	J1RWM5	9/4/13	0.564	B	0.188	9.18		0.141	45.5	D	0.471	34.9	D	1.88	8880	DJ	4320	164000	BD	4320
15	EXC-10	J1RWM6	9/4/13	0.536	B	0.175	11.0		0.131	52.7	D	0.436	43.9	D	1.75	2170	U	2170	39100	B	2170
16	EXC-11	J1RWM7	9/4/13	0.519	B	0.197	11.5		0.148	47.5	D	0.492	42.5	D	1.97	17900	DJ	10800	363000	BD	10800
17	EXC-12	J1RWM8	9/4/13	0.514	B	0.183	10.1		0.138	52.4	D	0.459	40.2	D	1.83	2170	U	2170	34000	B	2170

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19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Molybdenum	Nickel	Vanadium	Zinc	TPH - diesel range	TPH - motor oil (high boiling)
21	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg
22	EXC-1	J1RWL7/ J1RWM9	9/4/13	0.524	11.0	48.6	51.3	3018	17093
23	EXC-2	J1RWL8	9/4/13	0.531	10.8	51.5	45.0	2380	25200
24	EXC-3	J1RWL9	9/4/13	0.520	12.1	48.3	44.6	16600	395000
25	EXC-4	J1RWM0	9/4/13	0.530	12.9	61.4	42.0	2760	1080
26	EXC-5	J1RWM1	9/4/13	0.470	10.8	46.4	45.5	7030	83000
27	EXC-6	J1RWM2	9/4/13	0.506	10.7	51.8	39.0	1085	27600
28	EXC-7	J1RWM3	9/4/13	0.541	10.9	52.3	40.2	10600	155000
29	EXC-8	J1RWM4	9/4/13	0.545	9.42	48.7	41.1	13500	280000
30	EXC-9	J1RWM5	9/4/13	0.564	9.18	45.5	34.9	8880	164000
31	EXC-10	J1RWM6	9/4/13	0.536	11.0	52.7	43.9	1085	39100
32	EXC-11	J1RWM7	9/4/13	0.519	11.5	47.5	42.5	17900	363000
33	EXC-12	J1RWM8	9/4/13	0.514	10.1	52.4	40.2	1085	34000

34 **Statistical Computations**

35		Molybdenum	Nickel	Vanadium	Zinc	TPH - diesel range	TPH - motor oil (high boiling)
36	95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.
37	N	12	12	12	12	12	12
38	% < Detection limit	0%	0%	0%	0%	25%	8%
39	Mean	0.525	10.9	50.6	42.5	7160	132006
40	Standard deviation	0.0232	1.03	4.22	4.06	6249	141187
41	95% UCL on mean	0.538	11.4	52.6	44.7	22467	199052
42	Maximum value	0.564	12.9	61.4	52.6	17900	395000
43	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise**	8 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200000 ug/kg DE, GW, & River Protection	200000 ug/kg DE, GW, & River Protection
44	**WAC 173-340 3-PART TEST**						
45	95% UCL > Cleanup Limit?	NO	NA	NA	NA	NO	NO
46	> 10% above Cleanup Limit?	NO	NA	NA	NA	NO	YES
47	Any sample > 2X Cleanup Limit?	NO	NA	NA	NA	NO	NO
48	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (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.	A detailed assessment will be performed. The data set does NOT meet the 3-part test criteria when compared to the direct exposure RAG.

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CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-294 Waste Site Cleanup Verification 95% UCL Calculation

Date 11/21/13
Job No. 14655

Calc. No. 0600X-CA-V0154
Checked I. B. Berezovskiy

Rev. No. 0
Date 11/21/13
Sheet No. 6 of 9

Ecology Software (MTCAStat) Results, 600-294 Waste Site

Arsenic 95% UCL Calculation

DATA	ID
	J1RWL7/
2.09	J1RWM9
2.60	J1RWL8
2.36	J1RWL9
3.00	J1RWM0
2.89	J1RWM1
2.31	J1RWM2
2.17	J1RWM3
2.27	J1RWM4
2.24	J1RWM5
2.07	J1RWM6
2.26	J1RWM7
2.43	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	2.39
Censored		Lognormal mean	2.39
Detection limit or PQL		Std. devn.	0.297
Method detection limit		Median	2.29
TOTAL	12	Min.	2.07
		Max.	3.00

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

UCL (Land's method) is 2.55

Barium 95% UCL Calculation

DATA	ID
	J1RWL7/
61.6	J1RWM9
78.0	J1RWL8
55.0	J1RWL9
62.9	J1RWM0
60.8	J1RWM1
59.6	J1RWM2
57.9	J1RWM3
58.5	J1RWM4
49.1	J1RWM5
58.2	J1RWM6
58.1	J1RWM7
58.1	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	59.8
Censored		Lognormal mean	59.8
Detection limit or PQL		Std. devn.	6.72
Method detection limit		Median	58.4
TOTAL	12	Min.	49.1
		Max.	78.0

Lognormal distribution? r-squared is: 0.798
Normal distribution? r-squared is: 0.757
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 63.0

Beryllium 95% UCL Calculation

DATA	ID
	J1RWL7/
0.535	J1RWM9
0.617	J1RWL8
0.532	J1RWL9
0.584	J1RWM0
0.547	J1RWM1
0.578	J1RWM2
0.585	J1RWM3
0.557	J1RWM4
0.531	J1RWM5
0.561	J1RWM6
0.566	J1RWM7
0.583	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.565
Censored		Lognormal mean	0.565
Detection limit or PQL		Std. devn.	0.0261
Method detection limit		Median	0.564
TOTAL	12	Min.	0.531
		Max.	0.617

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

UCL (Land's method) is 0.578

Boron 95% UCL Calculation

DATA	ID
	J1RWL7/
2.36	J1RWM9
4.45	J1RWL8
2.40	J1RWL9
2.07	J1RWM0
2.31	J1RWM1
1.61	J1RWM2
2.13	J1RWM3
1.63	J1RWM4
1.86	J1RWM5
1.74	J1RWM6
2.25	J1RWM7
1.83	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	2.22
Censored		Lognormal mean	2.22
Detection limit or PQL		Std. devn.	0.757
Method detection limit		Median	2.10
TOTAL	12	Min.	1.61
		Max.	4.45

Lognormal distribution? r-squared is: 0.795
Normal distribution? r-squared is: 0.654
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2.58

Cadmium 95% UCL Calculation

DATA	ID
	J1RWL7/
0.215	J1RWM9
0.201	J1RWL8
0.312	J1RWL9
0.205	J1RWM0
0.356	J1RWM1
0.261	J1RWM2
0.259	J1RWM3
0.256	J1RWM4
0.219	J1RWM5
0.213	J1RWM6
0.147	J1RWM7
0.211	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.238
Censored		Lognormal mean	0.238
Detection limit or PQL		Std. devn.	0.0554
Method detection limit		Median	0.217
TOTAL	12	Min.	0.147
		Max.	0.356

Lognormal distribution? r-squared is: 0.926
Normal distribution? r-squared is: 0.907
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.271

Chromium 95% UCL Calculation

DATA	ID
	J1RWL7/
13.0	J1RWM9
12.3	J1RWL8
16.0	J1RWL9
17.9	J1RWM0
11.9	J1RWM1
11.4	J1RWM2
13.4	J1RWM3
37.1	J1RWM4
10.5	J1RWM5
13.2	J1RWM6
14.8	J1RWM7
11.3	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	15.2
Censored		Lognormal mean	15.1
Detection limit or PQL		Std. devn.	7.21
Method detection limit		Median	13.1
TOTAL	12	Min.	10.5
		Max.	37.1

Lognormal distribution? r-squared is: 0.723
Normal distribution? r-squared is: 0.564
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 18.7

Cobalt 95% UCL Calculation

DATA	ID
	J1RWL7/
5.96	J1RWM9
6.30	J1RWL8
6.02	J1RWL9
6.94	J1RWM0
6.48	J1RWM1
6.27	J1RWM2
6.44	J1RWM3
5.66	J1RWM4
5.15	J1RWM5
6.26	J1RWM6
6.00	J1RWM7
6.42	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	6.16
Censored		Lognormal mean	6.16
Detection limit or PQL		Std. devn.	0.453
Method detection limit		Median	6.27
TOTAL	12	Min.	5.15
		Max.	6.94

Lognormal distribution? r-squared is: 0.905
Normal distribution? r-squared is: 0.924
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.41

Copper 95% UCL Calculation

DATA	ID
	J1RWL7/
14.7	J1RWM9
14.8	J1RWL8
29.0	J1RWL9
15.8	J1RWM0
16.8	J1RWM1
12.8	J1RWM2
13.9	J1RWM3
12.2	J1RWM4
11.6	J1RWM5
14.0	J1RWM6
13.2	J1RWM7
13.6	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	15.2
Censored		Lognormal mean	15.2
Detection limit or PQL		Std. devn.	4.58
Method detection limit		Median	14.0
TOTAL	12	Min.	11.6
		Max.	29.0

Lognormal distribution? r-squared is: 0.728
Normal distribution? r-squared is: 0.604
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 17.4

Lead 95% UCL Calculation

DATA	ID
	J1RWL7/
6.16	J1RWM9
6.37	J1RWL8
21.2	J1RWL9
8.20	J1RWM0
25.7	J1RWM1
3.98	J1RWM2
5.72	J1RWM3
3.83	J1RWM4
3.05	J1RWM5
261	J1RWM6
4.33	J1RWM7
4.77	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	29.5
Censored		Lognormal mean	19.4
Detection limit or PQL		Std. devn.	73.3
Method detection limit		Median	5.94
TOTAL	12	Min.	3.05
		Max.	261

Lognormal distribution? r-squared is: 0.735
Normal distribution? r-squared is: 0.367
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 64.3

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-294 Waste Site Cleanup Verification 95% UCL Calculation

Date 11/21/13
Job No. 14655

Calc. No. 0600X-CA-V0154
Checked I. B. Berezovskiy

Rev. No. 0
Date 11/21/13
Sheet No. 7 of 9

Ecology Software (MTCAStat) Results, 600-294 Waste Site

Manganese 95% UCL Calculation

DATA	ID
	J1RWL7/
272	J1RWM9
306	J1RWL8
268	J1RWL9
307	J1RWM0
293	J1RWM1
284	J1RWM2
277	J1RWM3
257	J1RWM4
220	J1RWM5
277	J1RWM6
270	J1RWM7
280	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	276
Censored		Lognormal mean	276
Detection limit or PQL		Std. devn.	23.1
Method detection limit		Median	277
TOTAL	12	Min.	220
		Max.	307

Lognormal distribution? r-squared is: 0.859
Normal distribution? r-squared is: 0.891
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 287

Molybdenum 95% UCL Calculation

DATA	ID
	J1RWL7/
0.524	J1RWM9
0.531	J1RWL8
0.520	J1RWL9
0.530	J1RWM0
0.470	J1RWM1
0.506	J1RWM2
0.541	J1RWM3
0.545	J1RWM4
0.564	J1RWM5
0.536	J1RWM6
0.519	J1RWM7
0.514	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	0.525
Censored		Lognormal mean	0.525
Detection limit or PQL		Std. devn.	0.0232
Method detection limit		Median	0.527
TOTAL	12	Min.	0.470
		Max.	0.564

Lognormal distribution? r-squared is: 0.903
Normal distribution? r-squared is: 0.917
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.538

Nickel 95% UCL Calculation

DATA	ID
	J1RWL7/
11.0	J1RWM9
10.8	J1RWL8
12.1	J1RWL9
12.9	J1RWM0
10.8	J1RWM1
10.7	J1RWM2
10.9	J1RWM3
9.42	J1RWM4
9.18	J1RWM5
11.0	J1RWM6
11.5	J1RWM7
10.1	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	10.9
Censored		Lognormal mean	10.9
Detection limit or PQL		Std. devn.	1.03
Method detection limit		Median	10.9
TOTAL	12	Min.	9.18
		Max.	12.9

Lognormal distribution? r-squared is: 0.942
Normal distribution? r-squared is: 0.940
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.4

Vanadium 95% UCL Calculation

DATA	ID
	J1RWL7/
48.6	J1RWM9
51.5	J1RWL8
48.3	J1RWL9
61.4	J1RWM0
46.4	J1RWM1
51.8	J1RWM2
52.3	J1RWM3
48.7	J1RWM4
45.5	J1RWM5
52.7	J1RWM6
47.5	J1RWM7
52.4	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	50.6
Censored		Lognormal mean	50.6
Detection limit or PQL		Std. devn.	4.22
Method detection limit		Median	50.1
TOTAL	12	Min.	45.5
		Max.	61.4

Lognormal distribution? r-squared is: 0.873
Normal distribution? r-squared is: 0.842
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 52.6

Zinc 95% UCL Calculation

DATA	ID
	J1RWL7/
51.3	J1RWM9
45.0	J1RWL8
44.6	J1RWL9
42.0	J1RWM0
45.5	J1RWM1
39.0	J1RWM2
40.2	J1RWM3
41.1	J1RWM4
34.9	J1RWM5
43.9	J1RWM6
42.5	J1RWM7
40.2	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	42.5
Censored		Lognormal mean	42.5
Detection limit or PQL		Std. devn.	4.06
Method detection limit		Median	42.3
TOTAL	12	Min.	34.9
		Max.	52.6

Lognormal distribution? r-squared is: 0.948
Normal distribution? r-squared is: 0.943
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 44.7

TPH - Diesel Range 95% UCL Calculation

DATA	ID
	J1RWL7/
3018	J1RWM9
2380	J1RWL8
16600	J1RWL9
2760	J1RWM0
7030	J1RWM1
1085	J1RWM2
10600	J1RWM3
13500	J1RWM4
8880	J1RWM5
1085	J1RWM6
17900	J1RWM7
1085	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	7160
Censored		Lognormal mean	8140
Detection limit or PQL		Std. devn.	6249
Method detection limit		Median	5024
TOTAL	12	Min.	1085
		Max.	17900

Lognormal distribution? r-squared is: 0.914
Normal distribution? r-squared is: 0.887
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 22467

TPH - Motor Oil (High Boiling) 95% UCL Calculation

DATA	ID
	J1RWL7/
17093	J1RWM9
25200	J1RWL8
395000	J1RWL9
1080	J1RWM0
83000	J1RWM1
27600	J1RWM2
155000	J1RWM3
280000	J1RWM4
164000	J1RWM5
39100	J1RWM6
363000	J1RWM7
34000	J1RWM8

Number of samples		Uncensored values	
Uncensored	12	Mean	132006
Censored		Lognormal mean	234574
Detection limit or PQL		Std. devn.	141187
Method detection limit		Median	61050
TOTAL	12	Min.	1080
		Max.	395000

Lognormal distribution? r-squared is: 0.893
Normal distribution? r-squared is: 0.838
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 199052

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-294 Waste Site Cleanup Verification 95% UCL Calculation

Date 11/21/13
Job No. 14655

Calc. No. 0600X-CA-V0154
Checked I. B. Berezovskiy

Rev. No. 0
Date 11/21/13
Sheet No. 8 of 9

Duplicate Analysis - 600-294

Sampling Area	Sample 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
EXC-1	J1RWL7	9/4/13	5700		6.82	2.07	B	0.502	62.9		0.100	0.533		0.100	2.53	B	1.00	0.192	B	0.100	4400		8.03	11.9		0.150	5.98	D	0.752
Duplicate of J1RWL7	J1RWM9	9/4/13	5720		6.35	2.11	B	0.467	60.2		0.0934	0.537		0.0934	2.19	B	0.934	0.237	B	0.0934	4530		7.47	14.0		0.140	5.94	D	0.700

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)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	0.4%		4.4%				2.9%	16.2%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Duplicate Analysis - 600-294

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese			Molybdenum			Nickel			Potassium			Silicon		
			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
EXC-1	J1RWL7	9/4/13	14.7		0.301	18500		8.03	6.56	D	1.66	3980		8.53	273		0.201	0.532	B	0.201	10.9		0.150	1090		6.42	327	*JN	1.50
Duplicate of J1RWL7	J1RWM9	9/4/13	14.6		0.280	18700		7.47	5.75	D	1.54	4040		7.94	270		0.187	0.516	B	0.187	11.0		0.140	1050		5.98	287	*JN	1.40

Analysis:

	TDL	1	5	5	75	5	2	4	400	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	0.7%	1.1%		1.5%	1.1%				13.0%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 600-294

Sampling Area	HEIS Number	Sample Date	Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1RWL7	9/4/13	106		7.02	48.0	D	0.502	49.9	D	2.01
Duplicate of J1RWL7	J1RWM9	9/4/13	109		6.54	49.2	D	0.467	52.6	D	1.87

Analysis:

	TDL	50	2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD		2.5%	5.3%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-294 Waste Site Cleanup Verification 95% UCL Calculation

Date 11/21/13
Job No. 14655

Calc. No. 0600X-CA-V0154
Checked I. B. Berezovskiy

Rev. No. 0
Date 11/21/13
Sheet No. 9 of 9

Duplicate Analysis - 600-294

Sampling Area	Sample 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
COMP-1	J1RWN0	9/4/13	5910		6.22	2.57	B	0.457	69.0		0.0915	0.553		0.0915	3.49	B	0.915	0.195	B	0.0915	4770		7.32	12.2		0.137	5.89	D	0.686
Duplicate of J1RWN0	J1RWN2	9/4/13	5910		6.31	2.45	B	0.464	68.8		0.0928	0.580		0.0928	3.59	B	0.928	0.179	B	0.0928	4870		7.43	12.2		0.139	6.20	D	0.696

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)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	0.0%		0.3%				2.1%	0.0%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Duplicate Analysis - 600-294

Sampling Area	HEIS Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Magnesium			Manganese			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
COMP-1	J1RWN0	9/4/13	14.2		0.274	0.169	B	0.158	19300		7.32	9.56	D	1.51	3990		7.77	269		0.183	0.476	B	0.183	11.0		0.137	1140		5.85
Duplicate of J1RWN0	J1RWN2	9/4/13	14.5		0.279	0.169	B	0.158	19500		7.43	9.47	D	1.53	4070		7.89	284		0.186	0.525	B	0.186	11.4		0.139	1130		5.94

Analysis:

	TDL	1	0.5	5	5	75	5	2	4	400
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	2.1%		1.0%		2.0%	5.4%			
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Duplicate Analysis - 600-294

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc			TPH - diesel range			TPH - motor oil (high boiling)			2-Methylnaphthalene			Benzo(ghi)perylene			Naphthalene		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
COMP-1	J1RWN0	9/4/13	320	*JN	1.37	124		6.40	49.9	D	0.457	42.9	D	1.83	3020	J	2170	46900	B	2170	26.3	J	10.0	16.3	J	10.0	20.3	J	10.0
Duplicate of J1RWN0	J1RWN2	9/4/13	349	*JN	1.39	129		6.50	52.9	D	0.464	49.8	D	1.86	3060	J	2170	33800	B	2170	20.4	J	10.0	27.7	J	10.0	16.7	J	10.0

Analysis:

	TDL	2	50	2.5	1	5000	5000	660	660	660
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	8.7%		5.8%	14.9%		32.5%			
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable

Attachment 1. 600-294 Waste Site Verification Sample Results (Metals and TPH).

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
EXC-1	J1RWL7	9/4/13	5700		6.82	2.17	BD	1.66	2.07	B	0.502	62.9		0.100	0.533		0.100
Duplicate of J1RWL7	J1RWM9	9/4/13	5720		6.35	1.54	UD	1.54	2.11	B	0.467	60.2		0.0934	0.537		0.0934
EXC-2	J1RWL8	9/4/13	6080		6.41	1.55	UD	1.55	2.60	B	0.471	78.0		0.0942	0.617		0.0942
EXC-3	J1RWL9	9/4/13	5420		6.58	1.60	UD	1.60	2.36	B	0.484	55.0		0.0968	0.532		0.0968
EXC-4	J1RWM0	9/4/13	6350		6.23	1.51	UD	1.51	3.00		0.458	62.9		0.0916	0.584		0.0916
EXC-5	J1RWM1	9/4/13	5940		6.54	1.59	UD	1.59	2.89		0.481	60.8		0.0961	0.547		0.0961
EXC-6	J1RWM2	9/4/13	5710		6.68	1.62	UD	1.62	2.31	B	0.491	59.6		0.0983	0.578		0.0983
EXC-7	J1RWM3	9/4/13	5930		5.80	1.41	UD	1.41	2.17	B	0.427	57.9		0.0853	0.585		0.0853
EXC-8	J1RWM4	9/4/13	5600		6.62	1.61	UD	1.61	2.27	B	0.487	58.5		0.0973	0.557		0.0973
EXC-9	J1RWM5	9/4/13	4960		6.40	1.55	UD	1.55	2.24	B	0.471	49.1		0.0942	0.531		0.0942
EXC-10	J1RWM6	9/4/13	5860		5.94	1.44	UD	1.44	2.07	B	0.436	58.2		0.0873	0.561		0.0873
EXC-11	J1RWM7	9/4/13	6180		6.69	1.62	UD	1.62	2.26	B	0.492	58.1		0.0984	0.566		0.0984
EXC-12	J1RWM8	9/4/13	5680		6.24	1.51	UD	1.51	2.43	B	0.459	58.1		0.0917	0.583		0.0917
COMP-1	J1RWN0	9/4/13	5910		6.22	1.51	UD	1.51	2.57	B	0.457	69.0		0.0915	0.553		0.0915
Duplicate of J1RWN0	J1RWN2	9/4/13	5910		6.31	1.53	UD	1.53	2.45	B	0.464	68.8		0.0928	0.580		0.0928
COMP-2	J1RWN1	9/4/13	5780		6.64	1.61	UD	1.61	2.24	B	0.488	63.0		0.0976	0.577		0.0976
Equipment Blank	J1RWN3	9/4/13	93.0		6.43	0.312	U	0.312	0.523	B	0.473	1.72		0.0945	0.0945	U	0.0945

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
EXC-1	J1RWL7	9/4/13	2.53	B	1.00	0.192	B	0.100	4400		8.03	11.9		0.150	5.98	D	0.752
Duplicate of J1RWL7	J1RWM9	9/4/13	2.19	B	0.934	0.237	B	0.0934	4530		7.47	14.0		0.140	5.94	D	0.700
EXC-2	J1RWL8	9/4/13	4.45	B	0.942	0.201	B	0.0942	5910		7.54	12.3		0.141	6.30	D	0.707
EXC-3	J1RWL9	9/4/13	2.40	B	0.968	0.312	B	0.0968	4120		7.74	16.0		0.145	6.02	D	0.726
EXC-4	J1RWM0	9/4/13	2.07	B	0.916	0.205	B	0.0916	5900		7.33	17.9		0.137	6.94	D	0.687
EXC-5	J1RWM1	9/4/13	2.31	B	0.961	0.356	B	0.0961	4660		7.69	11.9		0.144	6.48	D	0.721
EXC-6	J1RWM2	9/4/13	1.61	B	0.983	0.261	B	0.0983	4980		7.86	11.4		0.147	6.27	D	0.737
EXC-7	J1RWM3	9/4/13	2.13	B	0.853	0.259	B	0.0853	5150		6.83	13.4		0.128	6.44	D	0.640
EXC-8	J1RWM4	9/4/13	1.63	B	0.973	0.256	B	0.0973	4220		7.79	37.1		0.146	5.66	D	0.730
EXC-9	J1RWM5	9/4/13	1.86	B	0.942	0.219	B	0.0942	4340		7.53	10.5		0.141	5.15	D	0.706
EXC-10	J1RWM6	9/4/13	1.74	B	0.873	0.213	B	0.0873	4900		6.98	13.2		0.131	6.26	D	0.655
EXC-11	J1RWM7	9/4/13	2.25	B	0.984	0.147	B	0.0984	4380		7.87	14.8		0.148	6.00	D	0.738
EXC-12	J1RWM8	9/4/13	1.83	B	0.917	0.211	B	0.0917	5390		7.34	11.3		0.138	6.42	D	0.688
COMP-1	J1RWN0	9/4/13	3.49	B	0.915	0.195	B	0.0915	4770		7.32	12.2		0.137	5.89	D	0.686
Duplicate of J1RWN0	J1RWN2	9/4/13	3.59	B	0.928	0.179	B	0.0928	4870		7.43	12.2		0.139	6.20	D	0.696
COMP-2	J1RWN1	9/4/13	2.99	B	0.976	0.244	B	0.0976	5010		7.81	11.6		0.146	6.43	D	0.732
Equipment Blank	J1RWN3	9/4/13	0.945	U	0.945	0.0945	U	0.0945	32.5		7.56	0.142	U	0.142	0.749		0.142

Note: Gray cells indicate not applicable.

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

* = duplicate analysis not within control limits

B = estimated result; result is less than the RL but greater than the MDL.

COMP = composite

D = reported from a dilution

EXC = excavation

HEIS = Hanford Environmental Information System

J = estimate

N = recovery is outside control limits.

PQL = practical quantitation limit

Q = qualifier

SVOA = semivolatile organic analysis

TPH = total petroleum hydrocarbon

U = undetected

Attachment	1	Sheet No.	1 of 9
Originator	J. D. Skoglie	Date	11/21/13
Checked	I. B. Berezovskiy	Date	11/21/13
Calc. No.	0600X-CA-V0154	Rev. No.	0

Attachment 1. 600-294 Waste Site Verification Sample Results (Metals and TPH).

Sample Location	HEIS Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1RWL7	9/4/13	14.7		0.301	0.160	U	0.160	18500		8.03	6.56	D	1.66	3980		8.53
Duplicate of J1RWL7	J1RWM9	9/4/13	14.6		0.280	0.159	U	0.159	18700		7.47	5.75	D	1.54	4040		7.94
EXC-2	J1RWL8	9/4/13	14.8		0.283	0.159	U	0.159	19100		7.54	6.37	D	1.55	4290		8.01
EXC-3	J1RWL9	9/4/13	29.0		0.290	0.159	U	0.159	17900		7.74	21.2	D	1.60	3760		8.23
EXC-4	J1RWM0	9/4/13	15.8		0.275	0.158	U	0.158	22900		7.33	8.20	D	1.51	4470		7.79
EXC-5	J1RWM1	9/4/13	16.8		0.288	0.155	U	0.155	18400		7.69	25.7	D	1.59	4140		8.17
EXC-6	J1RWM2	9/4/13	12.8		0.295	0.159	U	0.159	18500		7.86	3.98	BD	1.62	3930		8.35
EXC-7	J1RWM3	9/4/13	13.9		0.256	0.230	B	0.161	19200		6.83	5.72	D	1.41	4050		7.25
EXC-8	J1RWM4	9/4/13	12.2		0.292	0.165	U	0.165	17100		7.79	3.83	BD	1.61	3490		8.27
EXC-9	J1RWM5	9/4/13	11.6		0.283	0.169	B	0.158	16500		7.53	3.05	BD	1.55	3580		8.01
EXC-10	J1RWM6	9/4/13	14.0		0.262	0.157	U	0.157	19900		6.98	261	D	1.44	4000		7.42
EXC-11	J1RWM7	9/4/13	13.2		0.295	0.160	U	0.160	18800		7.87	4.33	BD	1.62	3860		8.36
EXC-12	J1RWM8	9/4/13	13.6		0.275	0.158	U	0.158	19200		7.34	4.77	D	1.51	3890		7.80
COMP-1	J1RWN0	9/4/13	14.2		0.274	0.169	B	0.158	19300		7.32	9.56	D	1.51	3990		7.77
Duplicate of J1RWN0	J1RWN2	9/4/13	14.5		0.279	0.169	B	0.158	19500		7.43	9.47	D	1.53	4070		7.89
COMP-2	J1RWN1	9/4/13	14.6		0.293	0.160	U	0.160	19200		7.81	8.41	D	1.61	3950		8.30
Equipment Blank	J1RWN3	9/4/13	0.284	U	0.284				474		7.56	0.458	B	0.312	11.6	B	8.03

Sample Location	HEIS Number	Sample Date	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
EXC-1	J1RWL7	9/4/13	273		0.201	0.00396	U	0.00396	0.532	B	0.201	10.9		0.150	1090		6.42
Duplicate of J1RWL7	J1RWM9	9/4/13	270		0.187	0.00380	U	0.00380	0.516	B	0.187	11.0		0.140	1050		5.98
EXC-2	J1RWL8	9/4/13	306		0.188	0.00393	B	0.00366	0.531	B	0.188	10.8		0.141	1210		6.03
EXC-3	J1RWL9	9/4/13	268		0.194	0.00402	U	0.00402	0.520	B	0.194	12.1		0.145	1120		6.20
EXC-4	J1RWM0	9/4/13	307		0.183	0.00402	U	0.00402	0.530	B	0.183	12.9		0.137	1160		5.86
EXC-5	J1RWM1	9/4/13	293		0.192	0.00379	U	0.00379	0.470	B	0.192	10.8		0.144	973		6.15
EXC-6	J1RWM2	9/4/13	284		0.197	0.00406	U	0.00406	0.506	B	0.197	10.7		0.147	1090		6.29
EXC-7	J1RWM3	9/4/13	277		0.171	0.00931	B	0.00402	0.541	B	0.171	10.9		0.128	1100		5.46
EXC-8	J1RWM4	9/4/13	257		0.195	0.00361	U	0.00361	0.545	B	0.195	9.42		0.146	1040		6.23
EXC-9	J1RWM5	9/4/13	220		0.188	0.00349	U	0.00349	0.564	B	0.188	9.18		0.141	846		6.03
EXC-10	J1RWM6	9/4/13	277		0.175	0.00953	B	0.00351	0.536	B	0.175	11.0		0.131	1120		5.59
EXC-11	J1RWM7	9/4/13	270		0.197	0.00370	U	0.00370	0.519	B	0.197	11.5		0.148	1160		6.30
EXC-12	J1RWM8	9/4/13	280		0.183	0.00403	U	0.00403	0.514	B	0.183	10.1		0.138	1100		5.87
COMP-1	J1RWN0	9/4/13	269		0.183	0.00395	U	0.00395	0.476	B	0.183	11.0		0.137	1140		5.85
Duplicate of J1RWN0	J1RWN2	9/4/13	284		0.186	0.00376	U	0.00376	0.525	B	0.186	11.4		0.139	1130		5.94
COMP-2	J1RWN1	9/4/13	291		0.195	0.00385	U	0.00385	0.522	B	0.195	10.5		0.146	1140		6.25
Equipment Blank	J1RWN3	9/4/13	7.52		0.189	0.00379	U	0.00379	0.189	U	0.189	0.184	B	0.142	34.7		6.05

Attachment	1	Sheet No.	2 of 9
Originator	J. D. Skoglie	Date	11/21/13
Checked	I. B. Berezovskiy	Date	11/21/13
Calc. No.	0600X-CA-V0154	Rev. No.	0

Attachment 1. 600-294 Waste Site Verification Sample Results (Metals and TPH).

Sample Location	HEIS Number	Sample Date	Selenium			Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1RWL7	9/4/13	0.315	UD	0.315	327	*JN	1.50	0.100	U	0.100	106		7.02	48.0	D	0.502
Duplicate of J1RWL7	J1RWM9	9/4/13	0.311	UD	0.311	287	*JN	1.40	0.0934	U	0.0934	109		6.54	49.2	D	0.467
EXC-2	J1RWL8	9/4/13	0.308	UD	0.308	317	*JN	1.41	0.0942	U	0.0942	181		6.60	51.5	D	0.471
EXC-3	J1RWL9	9/4/13	0.308	UD	0.308	298	*JN	1.45	0.0968	U	0.0968	123		6.78	48.3	D	0.484
EXC-4	J1RWM0	9/4/13	0.324	UD	0.324	236	*JN	1.37	0.0916	U	0.0916	137		6.41	61.4	D	0.458
EXC-5	J1RWM1	9/4/13	0.302	UD	0.302	320	*JN	1.44	0.0961	U	0.0961	127		6.73	46.4	D	0.481
EXC-6	J1RWM2	9/4/13	0.311	UD	0.311	325	*JN	1.47	0.0983	U	0.0983	106		6.88	51.8	D	0.491
EXC-7	J1RWM3	9/4/13	0.328	UD	0.328	234	*JN	1.28	0.0853	U	0.0853	152		5.97	52.3	D	0.427
EXC-8	J1RWM4	9/4/13	0.315	UD	0.315	324	*JN	1.46	0.0973	U	0.0973	197		6.81	48.7	D	0.487
EXC-9	J1RWM5	9/4/13	0.307	UD	0.307	341	*JN	1.41	0.0942	U	0.0942	165		6.59	45.5	D	0.471
EXC-10	J1RWM6	9/4/13	0.317	UD	0.317	286	*JN	1.31	0.0873	U	0.0873	118		6.11	52.7	D	0.436
EXC-11	J1RWM7	9/4/13	0.319	UD	0.319	374	*JN	1.48	0.0984	U	0.0984	189		6.89	47.5	D	0.492
EXC-12	J1RWM8	9/4/13	0.291	UD	0.291	350	*JN	1.38	0.0917	U	0.0917	110		6.42	52.4	D	0.459
COMP-1	J1RWN0	9/4/13	0.317	UD	0.317	320	*JN	1.37	0.0915	U	0.0915	124		6.40	49.9	D	0.457
Duplicate of J1RWN0	J1RWN2	9/4/13	0.323	UD	0.323	349	*JN	1.39	0.0928	U	0.0928	129		6.50	52.9	D	0.464
COMP-2	J1RWN1	9/4/13	0.311	UD	0.311	326	*JN	1.46	0.0976	U	0.0976	125		6.83	51.5	D	0.488
Equipment Blank	J1RWN3	9/4/13	0.301	UD	0.301	90.7	*JN	1.42	0.0945	U	0.0945	6.62	U	6.62	0.318	B	0.0945

Sample Location	HEIS Number	Sample Date	Zinc			TPH - diesel range			TPH - motor oil (high boiling)		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC-1	J1RWL7	9/4/13	49.9	D	2.01	4950	J	2170	33100	B	2170
Duplicate of J1RWL7	J1RWM9	9/4/13	52.6	D	1.87	2170	U	2170	18600	UB	2170
EXC-2	J1RWL8	9/4/13	45.0	D	1.88	2380	J	2180	25200	B	2180
EXC-3	J1RWL9	9/4/13	44.6	D	1.94	16600	DJ	10800	395000	BD	10800
EXC-4	J1RWM0	9/4/13	42.0	D	1.83	2760	J	2160	14900	UB	2160
EXC-5	J1RWM1	9/4/13	45.5	D	1.92	7030		2170	83000	B	2170
EXC-6	J1RWM2	9/4/13	39.0	D	1.97	2170	U	2170	27600	B	2170
EXC-7	J1RWM3	9/4/13	40.2	D	1.71	10600		2180	155000	B	2180
EXC-8	J1RWM4	9/4/13	41.1	D	1.95	13500	DJ	11200	280000	BD	11200
EXC-9	J1RWM5	9/4/13	34.9	D	1.88	8880	DJ	4320	164000	BD	4320
EXC-10	J1RWM6	9/4/13	43.9	D	1.75	2170	U	2170	39100	B	2170
EXC-11	J1RWM7	9/4/13	42.5	D	1.97	17900	DJ	10800	363000	BD	10800
EXC-12	J1RWM8	9/4/13	40.2	D	1.83	2170	U	2170	34000	B	2170
COMP-1	J1RWN0	9/4/13	42.9	D	1.83	3020	J	2170	46900	B	2170
Duplicate of J1RWN0	J1RWN2	9/4/13	49.8	D	1.86	3060	J	2170	33800	B	2170
COMP-2	J1RWN1	9/4/13	54.3	D	1.95	3470	J	2170	24000	B	2170
Equipment Blank	J1RWN3	9/4/13	3.50		0.378						

Attachment	1	Sheet No.	3 of 9
Originator	J. D. Skoglie	Date	11/21/13
Checked	I. B. Berezovskiy	Date	11/21/13
Calc. No.	0600X-CA-V0154	Rev. No.	0

Attachment 1. 600-294 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-1 - J1RWL7			Duplicate of J1RWL7 - J1RWM9			EXC-2 - J1RWL8			EXC-3 - J1RWL9			EXC-4 - J1RWM0		
		9/4/13			9/4/13			9/4/13			9/4/13			9/4/13		
		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	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
1,2-Dichlorobenzene	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
1,3-Dichlorobenzene	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
1,4-Dichlorobenzene	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
2,4,5-Trichlorophenol	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
2,4,6-Trichlorophenol	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
2,4-Dichlorophenol	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
2,4-Dimethylphenol	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
2,4-Dinitrophenol	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	99.8	UJ	99.8	100	UJ	100
2,4-Dinitrotoluene	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
2,6-Dinitrotoluene	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
2-Chloronaphthalene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
2-Chlorophenol	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
2-Methylnaphthalene	SVOA	15.3	J	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
2-Methylphenol (cresol, o-)	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
2-Nitroaniline	SVOA	110	U	110	110	U	110	110	U	110	110	U	110	110	U	110
2-Nitrophenol	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
3,3'-Dichlorobenzidine	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
3+4 Methylphenol (cresol, m+p)	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
3-Nitroaniline	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
4,6-Dinitro-2-methylpheno	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	99.8	UJ	99.8	100	UJ	100
4-Bromophenylphenyl ether	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
4-Chloro-3-methylpheno	SVOA	133	U	133	134	U	134	133	U	133	133	U	133	133	U	133
4-Chloroaniline	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	99.8	UJ	99.8	100	UJ	100
4-Chlorophenylphenyl ether	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
4-Nitroaniline	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
4-Nitrophenol	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	99.8	UJ	99.8	100	UJ	100
Acenaphthene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Acenaphthylene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Anthracene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Benzo(a)anthracene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Benzo(a)pyrene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Benzo(b)fluoranthene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Benzo(ghi)perylene	SVOA	15.0	J	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Benzo(k)fluoranthene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Bis(2-Chloroethoxy)methane	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Bis(2-chloroethyl) ether	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	99.8	UJ	99.8	100	UJ	100
Bis(2-chloroisopropyl) ether	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	99.8	UJ	99.8	100	UJ	100
Bis(2-ethylhexyl) phthalate	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Butylbenzylphthalate	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Carbazole	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Chrysene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Dibenz[a,h]anthracene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Dibenzofuran	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Diethylphthalate	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Dimethyl phthalate	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Di-n-butylphthalate	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Di-n-octylphthalate	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Diphenylamine	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Fluoranthene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Fluorene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Hexachlorobenzene	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Hexachlorobutadiene	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Hexachlorocyclopentadiene	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	99.8	UJ	99.8	100	UJ	100
Hexachloroethane	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Indeno(1,2,3-cd)pyrene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Isophorone	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Naphthalene	SVOA	12.3	J	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Nitrobenzene	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
N-Nitroso-di-n-dipropylamine	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Pentachlorophenol	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Phenanthrene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0
Phenol	SVOA	100	U	100	100	U	100	100	U	100	99.8	U	99.8	100	U	100
Pyrene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	9.98	U	9.98	10.0	U	10.0

Attachment	1	Sheet No.	4 of 9
Originator	J. D. Skoglic	Date	11/21/13
Checked	I. B. Berezovskiy	Date	11/21/13
Calc. No.	0600X-CA-V0154	Rev. No.	0

Attachment 1. 600-294 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-5 - J1RWM1			EXC-6 - J1RWM2			EXC-7 - J1RWM3			EXC-8 - J1RWM4			EXC-9 - J1RWM5		
		9/4/13			9/4/13			9/4/13			9/4/13			9/4/13		
		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	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
1,2-Dichlorobenzene	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
1,3-Dichlorobenzene	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
1,4-Dichlorobenzene	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
2,4,5-Trichlorophenol	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
2,4,6-Trichlorophenol	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
2,4-Dichlorophenol	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
2,4-Dimethylphenol	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
2,4-Dinitrophenol	SVOA	100	UJ	100	101	UJ	101	101	UJ	101	104	UJ	104	100	UJ	100
2,4-Dinitrotoluene	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
2,6-Dinitrotoluene	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
2-Chloronaphthalene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
2-Chlorophenol	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
2-Methylnaphthalene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
2-Methylphenol (cresol, o-)	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
2-Nitroaniline	SVOA	110	U	110	111	U	111	111	U	111	114	U	114	110	U	110
2-Nitrophenol	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
3,3'-Dichlorobenzidine	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
3+4 Methylphenol (cresol, m+p)	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
3-Nitroaniline	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
4,6-Dinitro-2-methylpheno	SVOA	100	UJ	100	101	UJ	101	101	UJ	101	104	UJ	104	100	UJ	100
4-Bromophenylphenyl ether	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
4-Chloro-3-methylpheno	SVOA	134	U	134	134	U	134	134	U	134	139	U	139	134	U	134
4-Chloroaniline	SVOA	100	UJ	100	101	UJ	101	101	UJ	101	104	UJ	104	100	UJ	100
4-Chlorophenylphenyl ether	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
4-Nitroaniline	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
4-Nitrophenol	SVOA	100	UJ	100	101	UJ	101	101	UJ	101	104	UJ	104	100	UJ	100
Acenaphthene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Acenaphthylene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Anthracene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Benzo(a)anthracene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Benzo(a)pyrene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Benzo(b)fluoranthene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Benzo(ghi)perylene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Benzo(k)fluoranthene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Bis(2-Chloroethoxy)methane	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Bis(2-chloroethyl) ether	SVOA	100	UJ	100	101	UJ	101	101	UJ	101	104	UJ	104	100	UJ	100
Bis(2-chloroisopropyl) ether	SVOA	100	UJ	100	101	UJ	101	101	UJ	101	104	UJ	104	100	UJ	100
Bis(2-ethylhexyl) phthalate	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Butylbenzylphthalate	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Carbazole	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Chrysene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Dibenz[a,h]anthracene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Dibenzofuran	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Diethylphthalate	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Dimethyl phthalate	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Di-n-butylphthalate	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Di-n-octylphthalate	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Diphenylamine	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Fluoranthene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Fluorene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Hexachlorobenzene	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Hexachlorobutadiene	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Hexachlorocyclopentadiene	SVOA	100	UJ	100	101	UJ	101	101	UJ	101	104	UJ	104	100	UJ	100
Hexachloroethane	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Indeno(1,2,3-cd)pyrene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Isophorone	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Naphthalene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Nitrobenzene	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
N-Nitroso-di-n-dipropylamine	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Pentachlorophenol	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Phenanthrene	SVOA	12.0	J	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0
Phenol	SVOA	100	U	100	101	U	101	101	U	101	104	U	104	100	U	100
Pyrene	SVOA	10.0	U	10.0	10.1	U	10.1	10.1	U	10.1	10.4	U	10.4	10.0	U	10.0

Attachment	1	Sheet No.	5 of 9
Originator	J. D. Skoglie	Date	11/21/13
Checked	I. B. Berezovskiy	Date	11/21/13
Calc. No.	0600X-CA-V0154	Rev. No.	0

Attachment 1. 600-294 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-10 - J1RWM6			EXC-11 - J1RWM7			EXC-12 - J1RWM8			COMP-1 - J1RWN0			Duplicate of J1RWN0 - J1RWN2		
		9/4/13			9/4/13			9/4/13			9/4/13			9/4/13		
		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	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
1,2-Dichlorobenzene	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
1,3-Dichlorobenzene	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
1,4-Dichlorobenzene	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
2,4,5-Trichlorophenol	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
2,4,6-Trichlorophenol	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
2,4-Dichlorophenol	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
2,4-Dimethylphenol	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
2,4-Dinitrophenol	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100
2,4-Dinitrotoluene	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
2,6-Dinitrotoluene	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
2-Chloronaphthalene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
2-Chlorophenol	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
2-Methylnaphthalene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	26.3	J	10.0	20.4	J	10.0
2-Methylphenol (cresol, o-)	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
2-Nitroaniline	SVOA	110	U	110	110	U	110	110	U	110	110	U	110	110	U	110
2-Nitrophenol	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
3,3'-Dichlorobenzidine	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
3+4 Methylphenol (cresol, m+p)	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
3-Nitroaniline	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
4,6-Dinitro-2-methylpheno	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100
4-Bromophenylphenyl ether	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
4-Chloro-3-methylpheno	SVOA	133	U	133	134	U	134	134	U	134	133	U	133	134	U	134
4-Chloroaniline	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100
4-Chlorophenylphenyl ether	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
4-Nitroaniline	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
4-Nitrophenol	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100
Acenaphthene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Acenaphthylene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Anthracene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Benzo(a)anthracene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Benzo(a)pyrene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Benzo(b)fluoranthene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Benzo(ghi)perylene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	16.3	J	10.0	27.7	J	10.0
Benzo(k)fluoranthene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Bis(2-Chloroethoxy)methane	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Bis(2-chloroethyl) ether	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100
Bis(2-chloroisopropyl) ether	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100
Bis(2-ethylhexyl) phthalate	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Butylbenzylphthalate	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Carbazole	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Chrysene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Dibenz[a,h]anthracene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Dibenzofuran	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Diethylphthalate	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Dimethyl phthalate	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Di-n-butylphthalate	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Di-n-octylphthalate	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Diphenylamine	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Fluoranthene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Fluorene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Hexachlorobenzene	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Hexachlorobutadiene	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Hexachlorocyclopentadiene	SVOA	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100	100	UJ	100
Hexachloroethane	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Indeno(1,2,3-cd)pyrene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	17.4	J	10.0
Isophorone	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Naphthalene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	20.3	J	10.0	16.7	J	10.0
Nitrobenzene	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
N-Nitroso-di-n-dipropylamine	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Pentachlorophenol	SVOA	100	U	100	100	U	100	100	U	100	100	U	100	100	U	100
Phenanthrene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0
Phenol	SVOA	104	J	100	100	U	100	100	U	100	100	U	100	100	U	100
Pyrene	SVOA	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0	10.0	U	10.0

Attachment	1	Sheet No.	6 of 9
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Calc. No.	0600X-CA-V0154	Rev. No.	0

Attachment 1. 600-294 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	COMP-2 - J1RWN1			Equipment Blank - J1RWN3		
		9/4/13			9/4/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	100	U	100	99.7	U	99.7
1,2-Dichlorobenzene	SVOA	100	U	100	99.7	U	99.7
1,3-Dichlorobenzene	SVOA	100	U	100	99.7	U	99.7
1,4-Dichlorobenzene	SVOA	100	U	100	99.7	U	99.7
2,4,5-Trichlorophenol	SVOA	100	U	100	99.7	U	99.7
2,4,6-Trichlorophenol	SVOA	100	U	100	99.7	U	99.7
2,4-Dichlorophenol	SVOA	100	U	100	99.7	U	99.7
2,4-Dimethylphenol	SVOA	100	U	100	99.7	U	99.7
2,4-Dinitrophenol	SVOA	100	UJ	100	99.7	UJ	99.7
2,4-Dinitrotoluene	SVOA	100	U	100	99.7	U	99.7
2,6-Dinitrotoluene	SVOA	100	U	100	99.7	U	99.7
2-Chloronaphthalene	SVOA	10.0	U	10.0	9.97	U	9.97
2-Chlorophenol	SVOA	100	U	100	99.7	U	99.7
2-Methylnaphthalene	SVOA	11.4	J	10.0	9.97	U	9.97
2-Methylphenol (cresol, o-)	SVOA	100	U	100	99.7	U	99.7
2-Nitroaniline	SVOA	110	U	110	110	U	110
2-Nitrophenol	SVOA	100	U	100	99.7	U	99.7
3,3'-Dichlorobenzidine	SVOA	100	U	100	99.7	U	99.7
3+4 Methylphenol (cresol, m+p)	SVOA	100	U	100	99.7	U	99.7
3-Nitroaniline	SVOA	100	U	100	99.7	U	99.7
4,6-Dinitro-2-methylpheno	SVOA	100	UJ	100	99.7	UJ	99.7
4-Bromophenylphenyl ether	SVOA	100	U	100	99.7	U	99.7
4-Chloro-3-methylpheno	SVOA	134	U	134	133	U	133
4-Chloroaniline	SVOA	100	UJ	100	99.7	UJ	99.7
4-Chlorophenylphenyl ether	SVOA	100	U	100	99.7	U	99.7
4-Nitroaniline	SVOA	100	U	100	99.7	U	99.7
4-Nitrophenol	SVOA	100	UJ	100	99.7	UJ	99.7
Acenaphthene	SVOA	10.0	U	10.0	9.97	U	9.97
Acenaphthylene	SVOA	10.0	U	10.0	9.97	U	9.97
Anthracene	SVOA	10.0	U	10.0	9.97	U	9.97
Benzo(a)anthracene	SVOA	10.0	U	10.0	9.97	U	9.97
Benzo(a)pyrene	SVOA	10.0	U	10.0	9.97	U	9.97
Benzo(b)fluoranthene	SVOA	10.0	U	10.0	9.97	U	9.97
Benzo(ghi)perylene	SVOA	10.0	U	10.0	9.97	U	9.97
Benzo(k)fluoranthene	SVOA	10.0	U	10.0	9.97	U	9.97
Bis(2-Chloroethoxy)methane	SVOA	100	U	100	99.7	U	99.7
Bis(2-chloroethyl) ether	SVOA	100	UJ	100	99.7	UJ	99.7
Bis(2-chloroisopropyl) ether	SVOA	100	UJ	100	99.7	UJ	99.7
Bis(2-ethylhexyl) phthalate	SVOA	100	U	100	218	J	99.7
Butylbenzylphthalate	SVOA	100	U	100	99.7	U	99.7
Carbazole	SVOA	10.0	U	10.0	9.97	U	9.97
Chrysene	SVOA	10.0	U	10.0	9.97	U	9.97
Dibenz[a,h]anthracene	SVOA	10.0	U	10.0	9.97	U	9.97
Dibenzofuran	SVOA	100	U	100	99.7	U	99.7
Diethylphthalate	SVOA	100	U	100	99.7	U	99.7
Dimethyl phthalate	SVOA	100	U	100	99.7	U	99.7
Di-n-butylphthalate	SVOA	100	U	100	99.7	U	99.7
Di-n-octylphthalate	SVOA	100	U	100	99.7	U	99.7
Diphenylamine	SVOA	100	U	100	99.7	U	99.7
Fluoranthene	SVOA	10.0	U	10.0	9.97	U	9.97
Fluorene	SVOA	10.0	U	10.0	9.97	U	9.97
Hexachlorobenzene	SVOA	100	U	100	99.7	U	99.7
Hexachlorobutadiene	SVOA	100	U	100	99.7	U	99.7
Hexachlorocyclopentadiene	SVOA	100	UJ	100	99.7	UJ	99.7
Hexachloroethane	SVOA	100	U	100	99.7	U	99.7
Indeno(1,2,3-cd)pyrene	SVOA	10.0	J	10.0	9.97	U	9.97
Isophorone	SVOA	100	U	100	99.7	U	99.7
Naphthalene	SVOA	10.0	U	10.0	9.97	U	9.97
Nitrobenzene	SVOA	100	U	100	99.7	U	99.7
N-Nitroso-di-n-dipropylamine	SVOA	100	U	100	99.7	U	99.7
Pentachlorophenol	SVOA	100	U	100	99.7	U	99.7
Phenanthrene	SVOA	10.0	U	10.0	9.97	U	9.97
Phenol	SVOA	100	U	100	99.7	U	99.7
Pyrene	SVOA	10.0	U	10.0	9.97	U	9.97

Attachment	1	Sheet No.	7 of 9
Originator	J. D. Skoglie	Date	11/21/13
Checked	I. B. Berezovskiy	Date	11/21/13
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Attachment 1. 600-294 Waste Site BTEX Sample Data for Information Only

Sample Location	HEIS Number	Sample Date	Benzene			Ethylbenzene			Toluene			Xylenes (total)		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC-3	J1T4N1	10/30/13	0.272	U	0.272	0.272	U	0.272	0.272	U	0.272	0.272	U	0.272
EXC-8	J1T4N2	10/30/13	0.300	U	0.300	0.300	U	0.300	0.300	U	0.300	0.300	U	0.300
EXC-11	J1T4N3	10/30/13	0.289	U	0.289	0.289	U	0.289	0.289	U	0.289	0.289	U	0.289
Trip Blank	J1T4N4	10/30/13	0.341	U	0.341	0.341	U	0.341	0.341	U	0.341	0.341	U	0.341

Attachment	1	Sheet No.	8 of 9
Originator	J. D. Skoglie	Date	11/21/13
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Attachment 1. 600-294 Waste Site Verification Sample Results (Asbestos)[a].

Sample Location	HEIS Number	Sample Date	Chrysotile	Amosite	Crocidolite	Tremolite	Actinolite	Anthophyllite
			%	%	%	%	%	%
EXC-1	J1RWN4	9/4/13	ND	ND	ND	ND	ND	ND
Duplicate of J1RWN4	J1RWP6	9/4/13	ND	ND	ND	ND	ND	ND
EXC-2	J1RWN5	9/4/13	ND	ND	ND	ND	ND	ND
EXC-3	J1RWN6	9/4/13	ND	ND	ND	ND	ND	ND
EXC-4	J1RWN7	9/4/13	ND	ND	ND	ND	ND	ND
EXC-5	J1RWN8	9/4/13	ND	ND	ND	ND	ND	ND
EXC-6	J1RWN9	9/4/13	ND	ND	ND	ND	ND	ND
EXC-7	J1RWP0	9/4/13	ND	ND	ND	ND	ND	ND
EXC-8	J1RWP1	9/4/13	ND	ND	ND	ND	ND	ND
EXC-9	J1RWP2	9/4/13	ND	ND	ND	ND	ND	ND
EXC-10	J1RWP3	9/4/13	ND	ND	ND	ND	ND	ND
EXC-11	J1RWP4	9/4/13	ND	ND	ND	ND	ND	ND
EXC-12	J1RWP5	9/4/13	ND	ND	ND	ND	ND	ND
COMP-1	J1RWP7	9/4/13	ND	ND	ND	ND	ND	ND
Duplicate of J1RWP7	J1RWP9	9/4/13	ND	ND	ND	ND	ND	ND
COMP-2	J1RWP8	9/4/13	ND	ND	ND	ND	ND	ND

[a] The required detection limit asbestos is 1%.

Attachment	1	Sheet No.	9 of 9
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Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-IU-2/6 Field Remediation **Job No. 14655**

Area: 600 Area

Discipline: Environmental Calculation No: 0600X-CA-V0155

Subject: 600-294 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 4 Total = 5	J. D. Skoglie	I. B. Berezovskiy	C. H. Dobie	D. F. Obenauer	12/17/13

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	11/21/2013	Calc. No.:	0600X-CA-V0155	Rev.:	0
Project:	100-IU-2 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	11/21/2013
Subject:	600-294 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 4	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 600-294 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, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

3) EPA, 2013, "EPA Concurrence for 600-294 Additional Sampling," CCN 173590 to H. M. Carman from C. J. Guzzetti, Washington Closure Hanford, Richland, Washington, October 30.

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

5) WCH, 2013, *Remaining Sites Verification Package for the 600-294, White Bluffs Service Station #2 Waste Site, A*ttachment to Waste Site Reclassification Form 2013-132, 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:	J. D. Skoglie	Date:	11/21/2013	Calc. No.:	0600X-CA-V0155	Rev.:	0
Project:	100-IU-2 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	11/21/2013
Subject:	600-294 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 4	

METHODOLOGY:

The 600-294 waste site underwent statistical verification sampling at one decision unit (excavation) and two composite samples within the overburden stockpile area. A duplicate sample was taken at both locations. Three TPH (motor oil) samples failed direct exposure RAGs, however, information only samples (WCH 2013) and an agreement with EPA (EPA 2013) allows this site to show protection to human health and the environment. The direct contact hazard quotient and carcinogenic risk calculations for the 600-294 waste site were conservatively calculated for the entire waste site using the greater of the statistical and composite verification soil sample results (WCH 2013). Of the contaminants of potential concern (COPCs) for this site, boron, hexavalent chromium, molybdenum, and the detected semivolatile organic compounds (SVOCs) require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Although total petroleum hydrocarbons (diesel range + motor oil) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. 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. 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 3.59 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 5.0×10^{-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 3.1×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for hexavalent chromium is 0.230 mg/kg, divided by 2.1 mg/kg, and multiplied as indicated, is 1.1×10^{-7}. 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 1.2×10^{-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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	11/21/2013	Calc. No.:	0600X-CA-V0155	Rev.:	0
Project:	100-IU-2 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	11/21/2013
Subject:	600-294 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 4	

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 hazard quotient and excess cancer risk calculations.

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 600-294 Waste Site.

Contaminants of Potential Concern	Statistical or Maximum Value [a] (mg/kg)	Noncarcinogen RAG [b] (mg/kg)	Hazard Quotient	Carcinogen RAG [b] (mg/kg)	Carcinogen Risk
Metals					
Boron	3.59	7,200	5.0E-04	--	--
Chromium, total	18.7	80,000	2.3E-04	--	--
Chromium, hexavalent [c]	0.230	240	9.6E-04	2.1	1.1E-07
Lead [d]	64.3	353	--	--	--
Molybdenum	0.538	400	1.3E-03	--	--
Semivolatiles					
Benzo(ghi)perylene	0.0277	2,400	1.2E-05	--	--
Indeno(1,2,3-cd) pyrene	0.0174	--	--	1.37	1.3E-08
Methylnapthalene; 2-	0.0263	320	8.2E-05	--	--
Naphthalene	0.0203	1,600	1.3E-05	--	--
Phenanthrene [e]	0.0120	24,000	5.0E-07	--	--
Phenol	0.104	24,000	4.3E-06	--	--
Total Petroleum Hydrocarbons					
Diesel range + motor oil [f]	222 [g]	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**3.1E-03**		
Cumulative Excess Cancer Risk:					**1.2E-07**

[a] = From WCH (2013).
[b] = Value obtained from the RDR/RAWP (DOE-RL 2009b) or *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.
[c] = Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3), 1996.
[d] = Value for the noncarcinogenic RAG calculated using Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, EPA/540/R 93/081, Publication No. 9285.7, U.S. Environmental Protection Agency, Washington, D.C.
[e] = Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: Contaminant: phenanthrene; surrogate: anthracene
[f] = The risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation.
[g] = Additional information only sampling and an agreement with EPA and DOE (EPA 2013) allows the TPH maximum to exceed the direct exposure RAG of 200 mg/kg. This is discussed further in the associated RSVP (WCH 2013).
-- = not applicable RAG = remedial action goal

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	11/21/2013	Calc. No.:	0600X-CA-V0155	Rev.:	0
Project:	100-IU-2 Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	11/21/2013
Subject:	600-294 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 4	

CONCLUSION:

The calculations in Table 1 demonstrate that the 600-294 waste site meets the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk, respectively, as identified in the RDR/RAWP (DOE-RL 2009b) and SAP (DOE-RL 2009a). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

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 2013c) and sampling agreement (WCH 2013b). This DQA was performed in accordance with site-specific data quality objectives found in the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009).

A review of the sample design (WCH 2013c), sample agreement (WCH 2013b), the field logbook (WCH 2013a), 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 100 Area SAP (DOE-RL 2001) data assurance requirements and the data validation procedures 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 600-294 waste site were provided by the laboratories in three sample delivery groups (SDGs): SDG MA06983, XP0009, and XP0026. SDG XP0009 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 600-294 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

MA06983

This SDG comprises 14 statistical soil grab samples (J1RWN4 through J1RWN9, J1RWP0 through J1RWP6, J1RWP9) and 2 composite samples (J1RWP7, J1RWP8) collected from the 600-294 excavation on October 30, 2013. This SDG includes two field duplicate pairs (J1RWN4/J1RWP6, J1RWP7/J1RWP9). These samples were analyzed for asbestos. No major or minor deficiencies were noted in the asbestos analysis.

SDG XP0009

This SDG comprises 14 statistical soil grab samples (J1RWL7 through J1RWL9, J1RWM0 through J1RWM9, J1RWN2), 2 composite samples (J1RWN0, J1RWN1), and an equipment blank (J1RWN3) collected from the 600-294 excavation on September 4, 2013. This SDG includes two field duplicate pairs (J1RWL7/J1RWM9, J1RWN0/J1RWN2). These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium,

semivolatile organic compounds (SVOC), and total petroleum hydrocarbons (TPH). No major deficiencies were noted. Minor deficiencies are as follows.

In the SVOC analysis, the common laboratory contaminant bis(2-ethylhexyl)phthalate was detected in the equipment blank (J1RWN3) above the detection limit but below the reporting limit. There is no impact on the evaluation of the 600-294 waste site. The data are usable for decision-making purposes.

In the SVOC analysis, the laboratory control standard recoveries for 2,4-dinitrophenol (41%), 4-nitrophenol (36.7%), and hexachlorocyclopentadiene (35.4%) are outside the quality control (QC) limits. Third-party validation qualified all results for these analytes as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the matrix spike (MS) recovery for 2,4-dinitrophenol (28.3%), 4-nitrophenol (35.8%), and hexachlorocyclopentadiene (34.4%) are outside the QC limits. Third-party validation qualified all results for these analytes as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the matrix spike duplicate recoveries for 2,4-dinitrophenol (22.9%), 2-methyl-4,6-dinitrophenol (49%), 4-chloroanaline 49.9%), 4-nitrophenol (28.1%), hexachlorocyclopentadiene (35.7%), bis(2-chloroethyl)ether (49.2%), and bis(2chloroisopropyl)ether (48.5%) are outside the QC limits. Third-party validation qualified all results for these analytes as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the TPH analysis, motor oil range organics were detected in the method blank at low concentrations. Similar concentrations of motor oil were detected in samples J1RWM0 and J1RWM9. Third-party validation qualified the motor oil results for samples J1RWM0 and J1RWM9 as undetected with "U" flags. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery for silicon (0%) is outside the QC range. Additionally, the relative percent difference (RPD) calculated for silicon (34%) in the laboratory duplicate is outside the QC range. Third-party validation qualified all silicon results as estimated with "J" flags. Silicon is not a regulated compound for the 600-294 waste site. There is no impact to the evaluation of the waste site. The data are usable for decision-making purposes.

SDG XP0026

This SDG comprises four soil grab samples (J1T4N1 through J1T4N4) collected from the 600-294 excavation on October 30, 2013. These samples were analyzed for the volatile organic compounds benzene, toluene, ethylbenzene, and xylene (BTEX). These samples were not part of the original sample design but were added after evaluation of the initial data and in conference with the U.S. Environmental Protection Agency (WCH 2013b). No major deficiencies were noted. Minor deficiencies are as follows.

In the BTEX analysis, all surrogate recoveries in sample J1T4N2 and one surrogate recovery in sample J1T4N3 in the range of 129% to 137% are outside the QC range. This suggests a possible high bias in the associated data. The associated data was reported as undetected so there is no impact from a high bias. The data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples listed in the field logbook (WCH 2013a) for the 600-294 waste site include two sets of duplicate samples (J1RWL7/J1RWM9, J1RWN0, J1RWN2). The 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. Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the target detection limit (TDL). Relative percent differences of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation.

The RPD calculated for the second field duplicate pair (J1RWN0, J1RWN2) is above the acceptance criteria (30%) at 32.5%. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix and do not necessarily indicate a problem with the sample handling or analysis.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. None of the data required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 600-294 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 600-294 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 Washington Closure Hanford project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix B.

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