1222762

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

14-AMRP-0080

JAN 09 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 FORMS AND SUPPORTING DOCUMENTATION FOR THE 600-368, SEGMENT 4 STAINED SOIL #1; AND 600-369, SEGMENT 4 BARE GROUND AND CRUSTED SOIL AREAS WASTE SITES, REVISION 0

Attached for your use are the approved Waste Site Reclassification Forms Nos. 2013-083 and 2013-090 and supporting, "Remaining Sites Verification Package for the 600-368, Segment 4 Stained Soil #1; and 600-369, Segment 4 Bare Ground and Crusted Soil Areas Waste Sites," 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

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
J. P. Shearer, CHPRC
C. P. Strand, WCH

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WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-6 **Control No.:** 2013-083

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

600-368, Segment 4 Stained Soil #1

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 600-368, Segment 4 Stained Soil #1 waste site was located in the 100-IU-6 Operable Unit of the Hanford Site and consisted of a 15-m^2 (157-ft^2) area covered with green granules. The 600-368 waste site was located approximately 130 m (427 ft) west of the Leazer Spur and was added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999), as a candidate site for confirmatory sampling in the *Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011,* U.S. Department of Energy, Richland, Washington (DOE-RL 2012). This waste site was subsequently recommended for remove, treat, and dispose without confirmatory sampling and is being dispositioned as a "plug-in" site in accordance with 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).

Remediation of the 600-368 waste site occurred on March 28, 2013. The remediation resulted in approximately 54 bank cubic meters (71 bank cubic yards) of material being removed and disposed at the Environmental Restoration Disposal Facility (ERDF). Cleanup verification sampling was performed on May 16, 2013, to determine if the waste site meets remedial action objectives (RAOs) and remedial action goals (RAGs) established by the 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 2009). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the 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 600-368 waste site to Interim Closed Out. The current site conditions achieve the RAOs and RAGs established by the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009). 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 soil are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 600-368, Segment 4 Stained Soil #1; and 600-369, Segment 4 Bare Ground and Crusted Soil Areas Waste Sites* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-6 **Control No.:** 2013-083

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

600-368, Segment 4 Stained Soil #1

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		12/12/13
DOE Federal Project Director (printed)	Signature	Date
N/A		
Ecology Project Manager (printed)	Signature	Date
C. Guzzetti		12/18/13
EPA Project Manager (printed)	Signature	Date

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-6 **Control No.:** 2013-090

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

600-369; Segment 4 Bare Ground and Crusted Soil Areas

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 600-369; Segment 4 Bare Ground and Crusted Soil Areas waste site was divided into eight subsites: 600-369:1, 600-369:2, 600-369:3, 600-369:4, 600-369:5, 600-369:6, 600-369:7, and 600-369:8. All subsites consisted of areas devoid of vegetation located near the Leazer Spur in the 100-IU-6 Operable Unit of the Hanford Site. The 600-369 waste site was added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999), as a candidate site for confirmatory sampling in the *Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011,* U.S. Department of Energy, Richland, Washington (DOE-RL 2012). This waste site was subsequently recommended for remove, treat, and dispose without confirmatory sampling and is being dispositioned as a "plug-in" site in accordance with 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).

Remediation of the 600-369 waste site, including all eight subsites (600-369:1, 600-369:2, 600-369:3, 600-369:4, 600-369:5, 600-369:6, 600-369:7, and 600-369:8), was performed from March 28, 2013, through May 6, 2013. The remediation resulted in approximately 3,969 bank cubic meters (5,191 bank cubic yards) of material being removed and disposed at the Environmental Restoration Disposal Facility (ERDF). Cleanup verification sampling was performed on May 16, 28, and 29, 2013, to determine if the waste site meets remedial action objectives (RAOs) and remedial action goals (RAGs) established by the 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 2009). 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 (2 Pages):

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 600-369 waste site to Interim Closed Out. With the exception of lead and arsenic concentrations at the 600-369:4 subsite, the current site conditions achieve the RAOs and RAGs established by the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009). As agreed by the Tri-Parties in Tri-Party Agreement Change Notice TPA-CN-401, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2010), lead and arsenic contamination that resulted from pesticide use prior to the Manhattan Project are excluded as contaminants of concern and will be discussed in a future *Comprehensive Environmental Response, Compensation, and Liability Act* document. The results of verification sampling show that residual contaminant concentrations (with the exception of lead and arsenic) 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 (with the exception of arsenic) 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.

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-IU-6 **Control No.:** 2013-090

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

600-369; Segment 4 Bare Ground and Crusted Soil Areas

Basis for reclassification (2 Pages):

Contamination above direct exposure levels originating from Hanford Site or Manhattan Project activities 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 (ICs) to prevent uncontrolled drilling or excavation into the deep zone soil are not required. (Note: Although ICs are not required for contaminants associated with the 600-369 waste site, an IC will be established to address lead and arsenic contamination associated with pre-Hanford orchard use, consistent with TPA-CN-401 [DOE-RL 2010].) The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 600-368, Segment 4 Stained Soil #1; and 600-369, Segment 4 Bare Ground and Crusted Soil Areas Waste Sites* (attached).

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	12/12/13
DOE Federal Project Director (printed)	Signature	Date
N/A		
Ecology Project Manager (printed)	Signature	Date
C. Guzzetti		12/19/13
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-368, SEGMENT 4 STAINED SOIL #1; AND 600-369, SEGMENT 4 BARE GROUND AND CRUSTED SOIL AREAS WASTE SITES

Attachment to Waste Site Reclassification Forms 2013-083, and 2013-090

December 2013

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-368, SEGMENT 4 STAINED SOIL #1; AND 600-369, SEGMENT 4 BARE GROUND AND CRUSTED SOIL AREAS WASTE SITES

EXECUTIVE SUMMARY

The 600-368 and 600-369 waste sites are part of the 100-IU-6 Operable Unit. The 600-368 waste site consisted of a small area covered with green granules located approximately 130 m (427 ft) west of the Leazer Spur. The 600-369 waste site consisted of eight areas that were devoid of vegetation near the Leazer Spur. The 600-396 waste site was divided into eight subsites: 600-369:1, 600-369:2, 600-369:3, 600-369:4, 600-369:5, 600-369:6, 600-369:7, and 600-369:8. The 600-368 and 600-369 waste sites were added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999) as candidate sites for confirmatory sampling in the *Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011* (DOE-RL 2012). These waste sites were subsequently recommended for remove, treat, and dispose (RTD) without confirmatory sampling (WCH 2013a, WCH 2013b) based on the observed presence of stained soils, stressed vegetation, and barren ground at these sites and were dispositioned as "plug-in" sites in accordance with the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington* (100 Area ESD) (EPA 2009).

Remediation of the 600-368 waste site occurred on March 28, 2013, and resulted in approximately 54 bank cubic meters (71 bank cubic yards) of soil and debris being removed for disposal at the Environmental Restoration Disposal Facility (ERDF). All eight subsites of the 600-369 waste site were remediated between March 28, 2013, and May 6, 2013, and resulted in approximately 3,969 bank cubic meters (5,191 bank cubic yards) of soil and debris being removed for disposal at ERDF. No overburden soil was stockpiled to be used as backfill.

Following remediation, verification sampling was conducted for the 600-368, 600-369:1, 600-369:2, 600-369:4, 600-369:6, 600-369:7, and 600-369:8 site and subsites on May 16, 2013. Verification sampling for the 600-369:3 and 600-369:5 subsites was performed on May 28, 2013, and May 29, 2013, respectively. The results of verification sampling indicated that residual contaminant concentrations met the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 600-368 and 600-369 waste sites. Verification sampling results support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The results indicated that the waste removal action achieved compliance with the RAOs and RAGs for the 600-368 and 600-369 waste sites, with acknowledgment that residual lead and arsenic contamination (detected at the 600-369:4 subsite) due to pesticide use previous to the Manhattan Project is excluded from the contaminants of potential concern (COPCs) and will

instead be discussed in a future *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) document.

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 sites in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

Table ES-1. Summary of Remedial Action Goals for the 600-368 and 600-369 Waste Sites. (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 600-368 and 600-369 waste sites.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure RAGs with the exception of arsenic in the 600-369:4 subsite. As agreed by the Tri-Party project managers, arsenic associated with pesticide use in pre-Hanford historic orchards is not a COPC (TPA CN-401 [DOE-RL 2010]).	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for all sampling areas (2.2×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk values for individual nonradionuclide COPCs are all $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The cumulative excess cancer risk (1.0×10^{-6}), is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 600-368 and 600-369 waste sites.	NA
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [a].		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 21.2 pCi/L [c].		

Table ES-1. Summary of Remedial Action Goals for the 600-368 and 600-369 Waste Sites. (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.	Arsenic, lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are present at concentrations exceeding soil RAGs for groundwater and/or Columbia River protection. However, an evaluation based upon RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b) shows that with the exception of arsenic, residual concentrations of these constituents are predicted to be protective of groundwater and the river [d]. As agreed by the Tri-Party project managers, arsenic and lead (present at the 600-369:4 subsite) associated with pesticide use in pre-Hanford historic orchards are not COPCs (TPA-CN-401 [DOE-RL 2010]).	Yes

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

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

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

[d] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and benzo(k)fluoranthene are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years (based on the distribution coefficient of lead, 30 mL/g). The vadose zone underlying the soil below the site is approximately 7 m (23 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River. Arsenic and lead present at the 600-369:4 subsite due to pesticide use previous to the Manhattan Project are excluded as COPCs and will instead be discussed in a future CERCLA document (DOE-RL 2010).

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COPC = contaminant of potential concern
DOE = U.S. Department of Energy
MCL = maximum contaminant level
NA = not applicable
RAG = remedial action goal
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity

In accordance with this evaluation, the verification sampling results support a reclassification of these sites to interim closed out. The current site conditions achieve the RAOs and the corresponding RAGs established in the 100 Area RDR/RAWP (DOE-RL 2009b) and the 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. As agreed by the Tri-Parties in TPA-CN-401 (DOE-RL 2010), lead and arsenic contamination that resulted from pesticide use prior to the Manhattan Project are excluded as COPCs and will be discussed in a future CERCLA document.

The 600-368 and 600-369 waste sites contamination does not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the sites 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 sites contaminants of concern, COPCs, and other constituents. Those constituents exceeding the ecological screening level in *Washington Administrative Code* 173-340, "Model Toxics Control Act - Cleanup," were arsenic, boron, lead, and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, arsenic, lead, manganese, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of antimony, manganese, vanadium, and zinc 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. Arsenic and lead concentrations associated with historic pesticide use previous to the Manhattan Project were excluded from the COPCs and will instead be discussed in a future CERCLA document (DOE-RL 2010).

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-368, SEGMENT 4 STAINED SOIL #1; AND 600-369, SEGMENT 4 BARE GROUND AND CRUSTED SOIL AREAS WASTE SITES

STATEMENT OF PROTECTIVENESS

The 600-368, Segment 4 Stained Soil #1, and 600-369, Segment 4 Bare Ground and Crusted Soil Areas verification sampling data, site evaluations, and supporting documentation demonstrate that these waste sites meet 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). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]) and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Contamination above direct exposure levels from the 600-368 and 600-369 waste sites 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 sites are not required. As agreed by the Tri-Parties in TPA-CN-401 (DOE-RL 2010), lead and arsenic contamination that resulted from pesticide use prior to the Manhattan Project are excluded as contaminants of potential concern (COPCs) and will be discussed in a future *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) document.

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 sites contaminants of concern, COPCs, and other constituents. Those constituents exceeding the ecological screening level in *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act - Cleanup," were arsenic, boron, lead, and vanadium. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, arsenic, lead, manganese, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. Because the detected levels of antimony, manganese, vanadium, and zinc 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. Arsenic and lead concentrations associated with historic pesticide use previous to the Manhattan Project will be excluded from the COPCs and will instead be discussed in a future CERCLA document (DOE-RL 2010).

GENERAL SITE INFORMATION AND BACKGROUND

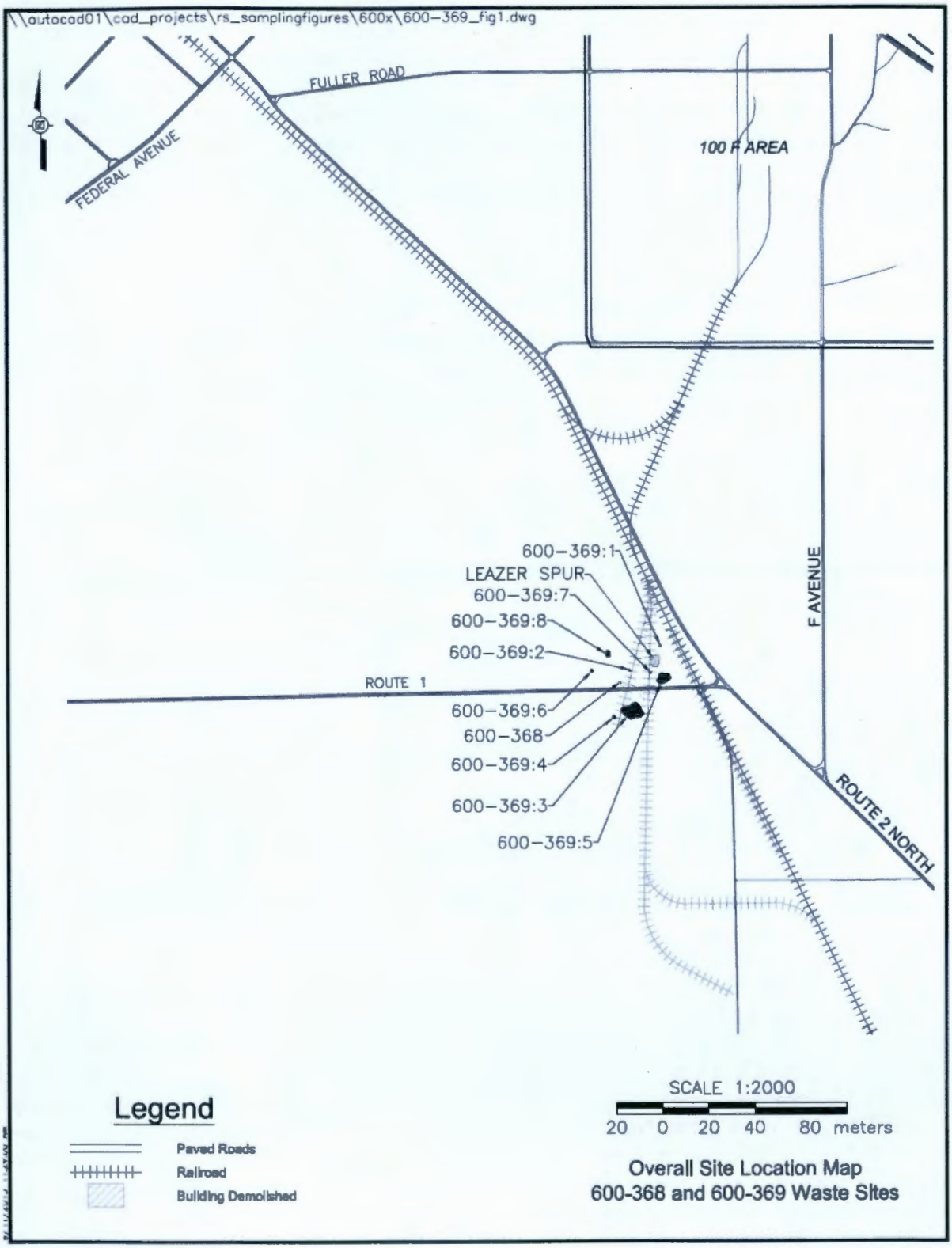
The 600-368 and 600-369 waste sites are located within the 100-IU-6 Operable Unit. The 600-368 waste site is reported in the 100-F/IU-2/IU-6 Area-Segment 4 Orphan Sites Evaluation (OSE) report (WCH 2011) as consisting of a 15-m^2 (157-ft^2) area covered with green granules. The 600-368 waste site location is 20 m (66 ft) north of Route 1 and 440 m (1,444 ft) west of Route 2 North (Figure 1). The center of the 600-368 waste site is located at Washington State Plane (WSP) coordinates N 145328.3, E 579763.9. The 600-369 waste site consists of eight subsites each consisting of areas devoid of vegetation. The 600-369 subsites are located on either side of Route 1 to the west of Route 2 North (Figure 1). The centers of the eight subsites are as follows:

- 600-369:1, N 145487.63, E 579937.30
- 600-369:2, N 145380.74, E 579803.50
- 600-369:3, N 145204.89, E 579812.38
- 600-369:4, N 145178.74, E 579736.30
- 600-369:5, N 145351.86, E 579952.40
- 600-369:6, N 145336.17, E 579633.55
- 600-369:7, N 145368.72, E 579895.23
- 600-369:8, N 145413.13, E 579698.99.

The 600-368 waste site has no process history. The site was discovered on February 26, 2009, while the 100-F/IU-2/IU-6 Area-Segment 4 OSE was being conducted (WCH 2011). It consists of an 15-m^2 (157-ft^2) area covered with green granules located approximately 130 m (427 ft) west of the Leazer Spur warehouse facilities that operated from 1943 to 1945.

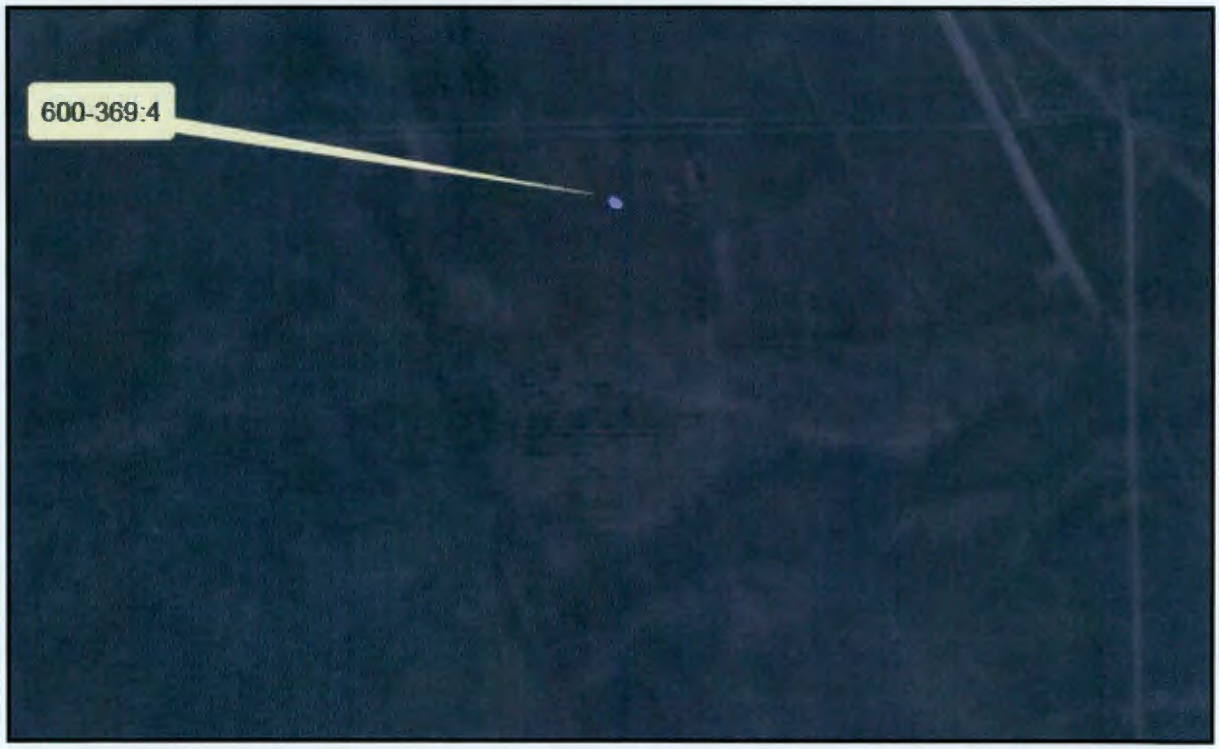
The 600-369 waste site is the former location of temporary construction buildings built in 1944 including various warehouses, a crane operators' loft, a riggers' loft, and an ice storage pit. The site was discovered while the 100-F/IU-2/IU-6 Area-Segment 4 OSE was being conducted (WCH 2011). The 600-369:1 subsite consists of a 6-m (20-ft)-diameter burn pit. The 600-369:2 subsite consists of a 3-m (10-ft)-diameter area devoid of vegetation. The 600-369:3 subsite consists of a large area with multiple spots of stressed vegetation and bare earth. The 600-369:4 subsite consists of a 14-m (46-ft)-diameter area with multiple spots of bare ground. The 600-369:5 subsite consists of a 50-m (164-ft)-diameter area with multiple spots of bare ground. The 600-369:6 subsite consists of an 11-m (36-ft)-diameter area of crusted soil with no vegetation visible. The 600-369:7 subsite consists of a 2-m (7-ft)-diameter area of red-crusted soil devoid of vegetation. The 600-369:8 subsite consists of a 10-m (33-ft)-diameter area of stressed vegetation and six drum lids.

Figure 1. The 600-368 and 600-369 Waste Site Location Map.



The location of the 600-369:4 subsite is within the pre-Hanford farmstead area that is visible in the 1943 baseline Geographical Information System imagery (Figure 2). Verification soil samples detected elevated concentrations of lead and arsenic in surface soil samples from the 600-369:4 subsite. Delistraty and Yokel (2003) report concentrations ranging from 2.9 to 270 mg/kg arsenic and 6.5 to 1,900 mg/kg lead in samples collected from historic orchard soils for the Hanford 100 Areas, with a mean concentration of 30 mg/kg arsenic and 220 mg/kg lead. Lead and arsenic are associated with historic orchards and the use of lead arsenate as an orchard pesticide; they are eliminated as COPCs for verification sampling as agreed to by the regulatory agencies and documented in Tri-Party Agreement Change Notice TPA-CN-401 (DOE-RL 2010).

Figure 2. 1943 Aerial Photograph of Orchard Tracts Showing the 600-369:4 Subsite Location.



During the growing season, orchards were sprayed with lead arsenate from the time the trees bloomed until they were harvested (BHI 1999). Orchard sprays were reported to have contained about 0.5 kg (1 lb) of arsenate or lead to 189 L (50 gal) of water for the first brood of coddling moths and 2.7 kg (6 lb) of lead arsenate paste or 1.4 kg (3 lb) of powder to 757 L (200 gal) of water for the second brood of codling moths. Following the second spraying, Winesaps required a spraying every 30 days and Rome Beauties, Spitz, Delicious, and Jonathan's required spraying every 20 days for the remainder of the season. Historic photographs (Figures 3 and 4) show two methods used for application of orchard pesticides. Additional discussion of the agricultural history, including practices for orchard crops, is provided in BHI (1999).

Figure 3. Hand Sprayer Used for Application of Pesticides (1932).

Figure 4. Mobile Orchard Spraying Equipment (1932).

Geophysical Survey

The objective of the geophysical survey was to determine if any utilities were located in the area of the 600-368 and 600-369 waste sites. The geophysical interpretation map for the waste site areas is included in Figure 5. No anomalies or utility lines were identified by the geophysical investigation.

In-Process Sampling

Waste characterization and in-process sampling was performed to determine the COPCs and waste disposal requirements for each waste site, and to guide remedial action efforts (Table 1). All waste characterization and in-process sampling data is included in Appendix A.

Table 1. 600-368 and 600-369 Waste Characterization and In-Process Soil Samples.

Location	HEIS Sample Number	Sample Date
600-368 WC	J1RD29	1/22/2013
600-368 WC	J1RD31	1/22/2013
600-368 IP	J1RK33	4/3/2013
600-369:1 WC	J1RD32	1/22/2013
600-369:5 WC	J1RFN9	2/21/2013
600-369:6 WC	J1RD33	1/22/2013
600-369:8 WC	J1RD34	1/22/2013
600-369:6 IP	J1RJT6	4/1/2013
600-369:1 IP	J1RJT7	4/1/2013
600-369:5 IP	J1RL15	4/24/2013

HEIS = Hanford Environmental Information System
IP = in-process
WC = waste characterization

REMEDIAL ACTION SUMMARY

The 600-368 and 600-369 waste sites were recommended for remediation without confirmatory sampling based on the observed presence of stained soils, stressed vegetation, and barren ground at these sites (WCH 2013a, 2013b).

Remedial Action

Remediation of the 600-368 waste site occurred on March 28, 2013, and resulted in approximately 54 bank cubic meters (71 bank cubic yards) of soil and debris being removed for disposal at the Environmental Restoration Disposal Facility (ERDF). A photograph taken during 600-368 waste site remediation is included in Figure 6.

Figure 5. Geophysical Interpretation Map for the 600-368 and 600-369 Waste Sites.

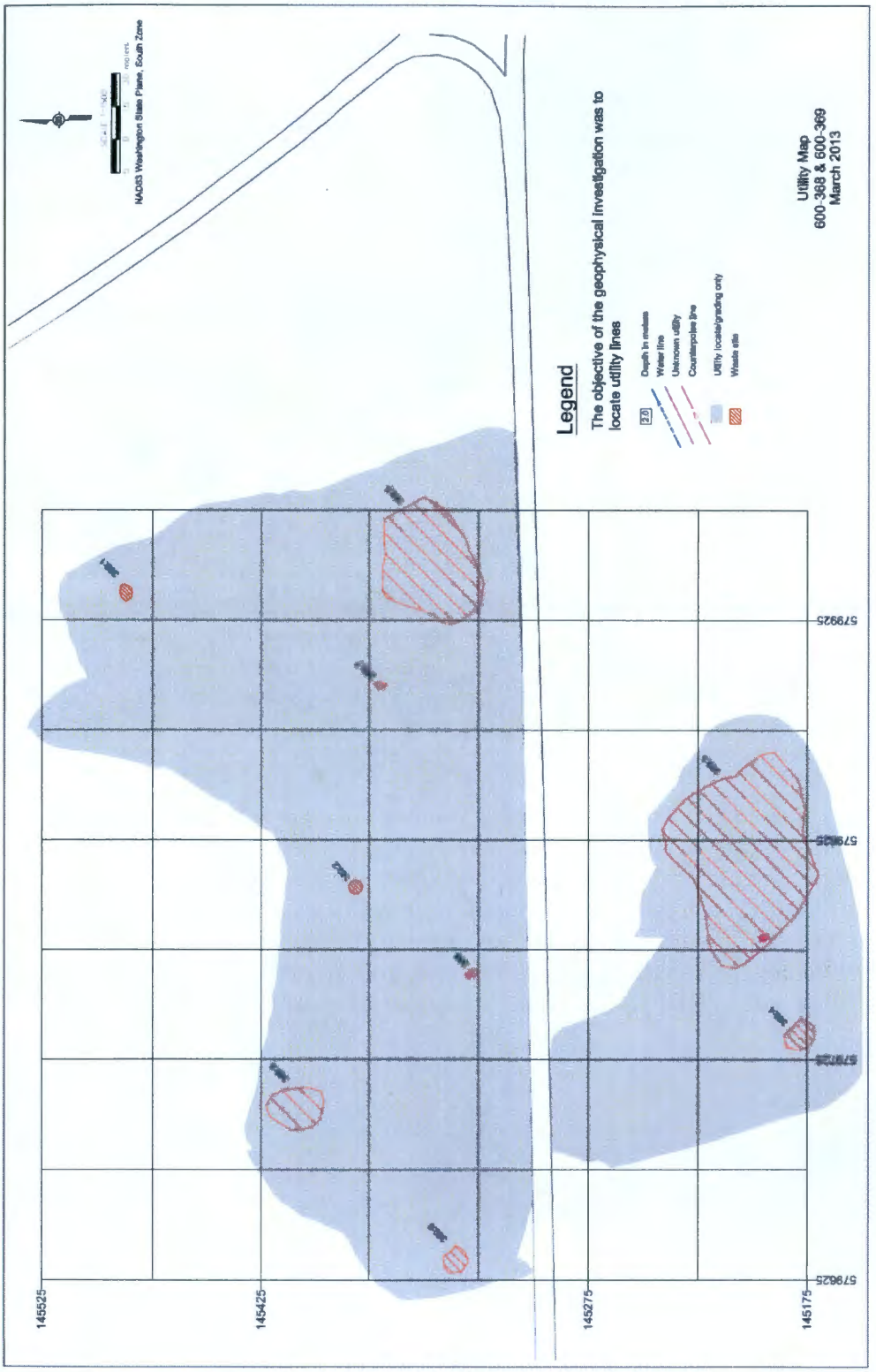
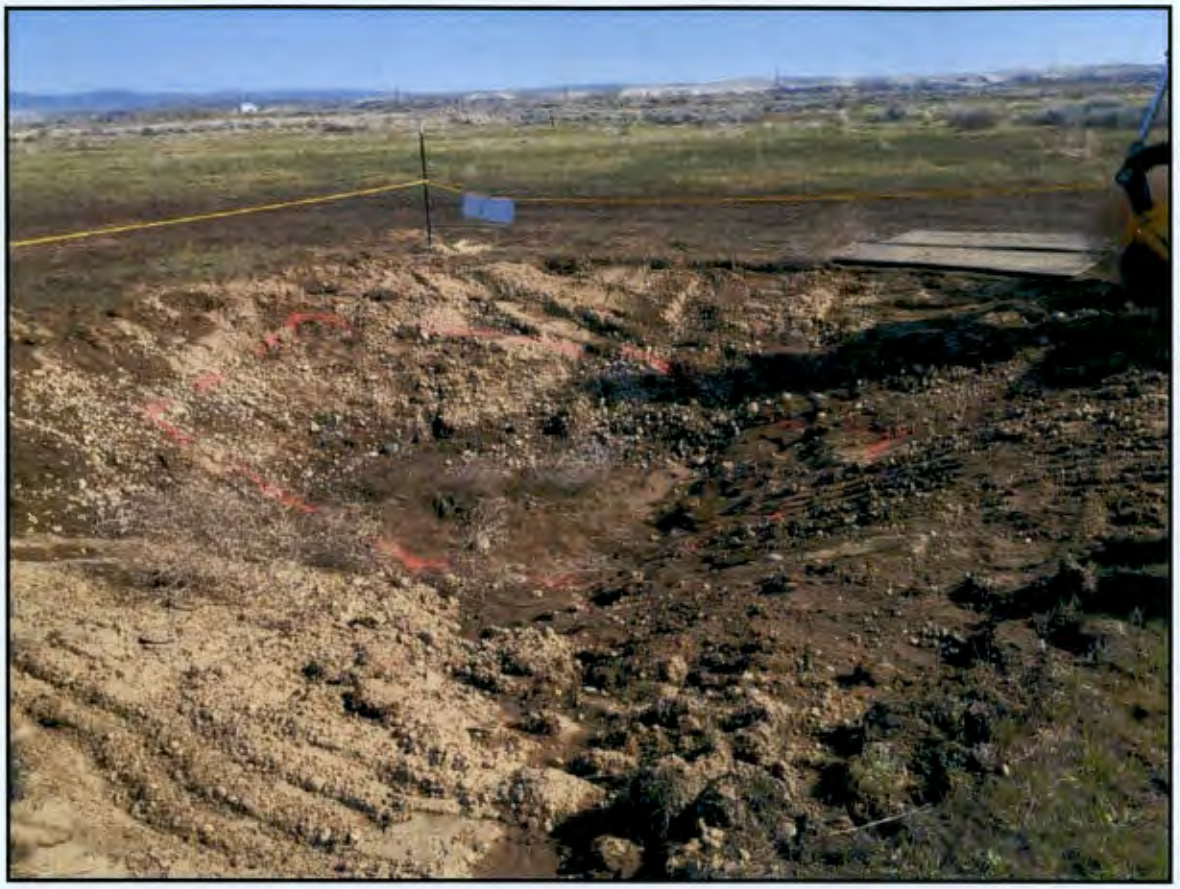


Figure 6. Photograph of the 600-368 Waste Site Remediation.



Remediation of the 600-369 waste site (which consists of eight subsites) was performed from March 28 through May 6, 2013. Approximately 3,969 bank cubic meters (5,191 bank cubic yards) of excavated materials from the 600-369 waste site were removed and direct loaded for disposal at ERDF. The approximate depth of the 600-368 and 600-369 excavations is 0.5 to 1 m (1.5 to 3.3 ft) below ground surface. Post-excavation photographs of each subsite excavation are provided in Figures 7 through 14. All material removed from the waste subsites was direct loaded for disposal at ERDF, and no soil staging pile areas or overburden areas were utilized.

Figure 7. The 600-369:1 Subsite Post-Excavation Photograph, Looking East (August 7, 2013).

Figure 8. The 600-369:2 Subsite Post-Excavation Photograph, Looking East (August 7, 2013).

Figure 9. The 600-369:3 Subsite Post-Excavation Photograph, Looking East (August 7, 2013).

Figure 10. The 600-369:4 Subsite Post-Excavation Photograph, Looking West (August 7, 2013).

Figure 11. The 600-369:5 Subsite Post-Excavation Photograph, Looking South (August 7, 2013).

Figure 12. The 600-369:6 Subsite Post-Excavation Photograph, Looking North (August 7, 2013).

Figure 13. The 600-369:7 Subsite Post-Excavation Photograph, Looking North (August 7, 2013).

Figure 14. The 600-369:8 Subsite Post-Excavation Photograph, Looking North (August 7, 2013).

The 600-369:4 subsite verification sampling results showed elevated concentrations of arsenic (27 mg/kg) and lead (22.3 mg/kg). Additional remediation was performed to remove an additional 30 to 46 cm (12 to 18 in.) of soil. Following additional remediation, x-ray fluorescence (XRF) measurements were taken to evaluate the excavation for approximate lead and arsenic concentrations. The XRF measurements indicated that arsenic levels ranged between 20 and 32 mg/kg, and lead levels ranged from 23 to 226 mg/kg. The XRF measurements taken of the area surrounding the 600-369:4 excavation exhibited similar arsenic and lead levels as those observed within the 600-369:4 excavation. The XRF measurements, as well as other evidence, such as close by tree stumps and other farmstead debris, indicated that the site is within a former orchard area (Figures 15 and 16).

Figure 15. Photograph of Tree Stumps/Debris Looking East Toward the 600-369:4 Subsite (August 2013).

Figure 16. Photograph of Wood Debris Looking Southeast Toward the 600-369:4 Subsite (August 2013).

In concurrence with EPA and the U.S. Department of Energy, Richland Operations Office, the 600-369:4 subsite was determined to be associated with the historical orchard lead-arsenate applications (WCH 2013d). In accordance with the Tri-Party Agreement Change Notice TPA-CN-401 (DOE-RL 2010), dated December 6, 2010, lead and arsenic are conditionally excluded as COPCs for sites demonstrated to have been located within orchard areas.

VERIFICATION SAMPLING ACTIVITIES

Verification sampling was performed at the 600-368 waste site on May 16, 2013. Verification sampling was conducted at the 600-369:1, 600-369:2, 600-369:4, 600-369:6, 600-369:7, and 600-369:8 subsites on May 16, 2013. Verification sampling was conducted at 600-369:3 and 600-369:5 subsites on May 28 and 29, 2013, respectively. 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 verification sample results are provided in Appendix B and indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and remedial action

goals (RAGs) for the 600-368 and 600-369 waste sites. The following subsections provide additional discussion of the information used to develop the verification sampling design. The maximum results of verification sampling are summarized to support interim closure of the site. A more detailed discussion of the verification sampling can be found in the *Work Instruction for Verification Sampling of the Combined 600 Area Waste Sites; 600-368, 600-369, 600-370, 600-371, 600-372, 600-373, 600-374, 600-375, 600-376, 600-377, 600-379* (WCH 2013f).

Contaminants of Potential Concern

The COPCs for the individual waste sites were based on site descriptions, the results of waste characterization sampling, and professional judgment. The technical basis for the COPC determination at each waste site is detailed in Table 2. Analytes that were detected near or above RAGs during waste characterization sampling (Appendix A) were included as COPCs for verification sampling. The COPCs for verification sampling and the laboratory analytical methods are identified in Table 3.

Verification Sample Design

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples that were collected. All sampling was performed in accordance with the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2009a). Verification soil sampling occurred based on the size of each waste site or waste site area in accordance with Table 4. The dimensions and sample numbers were determined based on previously approved waste site designs in the 100-IU-6 Operable Units.

Table 5 includes information from the verification sampling instructions (WCH 2013c, 2013f) that estimated the dimensions of each waste site and correlated the number of samples to be collected to the estimated waste site size based on Table 4. The actual dimensions and surface area of the sites after remediation along with the updated number of samples for the sample design (600-368 and 600-369) is also presented. Changes to the estimated sample design based on final site dimensions were approved by the U.S. Department of Energy and the lead regulatory agency. The 600-369:1 excavation area was larger than originally estimated; therefore, two composite samples were collected from the excavation area.

Table 2. Verification Sampling Contaminants of Potential Concern.

Site	Site Description	Suggested COPCs in RTD Memo	Waste Characterization Analysis	Constituents Above Direct Exposure	Constituents Above Groundwater and River Protection	Other COPCs to Consider	COPCs for Verification Sampling
600-368, Segment 4 Stained Soil #1							
	An 15 m^2 area covered with green granules	ICP metals, mercury	ICP metals, mercury, TCLP metals, IC anions, nitrate/nitrite, PAH	Lead, PAH (benzo(a) anthracene)	Barium, total chromium, zinc	Hexavalent chromium	ICP metals, hexavalent chromium, PAH, nitrate/nitrite
600-369, Segment 4 Bare Ground and Crusted Soil Areas							
600-369:1	Eight areas that are devoid of vegetation near the Leazer Spur	ICP metals, mercury, TPH, PAH, pesticides, PCBs	ICP metals, mercury, TPH, PAH	TPH	Barium, PAH - benzo(k) fluoranthene	Pesticides, PCBs	ICP metals, TPH, PAH, pesticides, PCBs
600-369:2							
600-369:3							
600-369:4							
600-369:5			Quick turn metals	None	None		
600-369:6			ICP metals, mercury, TPH, PAH	None	PAH - benzo(a) anthracene		
600-369:7							
600-369:8			ICP metals, mercury, TPH, PAH	TPH	None		

COPC = contaminant of potential concern
IC = ion chromatography
ICP = inductively coupled plasma
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
RTD = remove, treat, and dispose
TCLP = toxicity characteristic leaching procedure
TPH = total petroleum hydrocarbons

Table 3. 600-368 and 600-369 Laboratory Analytical Methods.

Analytical Method	Contaminant of Potential Concern
ICP metals [a] – EPA Method 6010	Metals [a]
Mercury – EPA Method 7471 [b]	Mercury
Hexavalent chromium – EPA Method 7196 [b]	Hexavalent chromium
Nitrate/nitrite – EPA Method 353.2 [b]	Nitrate/nitrite
PAH – EPA Method 8310	Polycyclic aromatic hydrocarbons
TPH – NWTPH-Dx [c]	Total petroleum hydrocarbons
Pesticides – EPA Method 8081 [c]	Pesticides
PCBs – EPA Method 8082 [c]	Polychlorinated biphenyls

[a] The expanded list of ICP metals included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc in the analytical results package.
[b] The 600-369 waste site was not analyzed for mercury, hexavalent chromium and nitrate/nitrite.
[c] The 600-368 waste site was not analyzed for TPH, pesticides and PCBs.

EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma
NWTPH-Dx= Northwest total petroleum hydrocarbons- diesel range organics
PAH= polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons

Table 4. Verification Sampling Design Based on Waste Site Surface Area (WCH 2013f).

Surface Area	Sample Design
<100 m^2	One composite sample
100 - 500 m^2	Two composite samples (halves)
500 - 1000 m^2	Four composite samples (quadrants)
>1,000 m^2	Statistical design using Visual Sample Plan (PNNL 2010)

Table 5. Waste Site Dimension Information.

Waste Site	Site Description	Northing [a]	Easting [a]	Estimated Remediation Dimensions L x W x D (m)	Estimated Surface Area (m^2)	Actual Remediation Dimensions L x W x D (m)	Actual Surface Area (m^2)	Actual Sample Design
600-368, Segment 4 Stained Soil #1								
600-368	A 15 m^2 area covered with green granules.	145328.32	579763.92	6 x 4 x 1	24	5 x 3 x 1	15	One composite
600-369, Segment 4 Bare Ground and Crusted Soil Areas								
600-369:1	Eight areas that are devoid of vegetation near the Leazer Spur	145487.63	579937.3	8 x 6 x 1	48	21 x 10 x 1	210	Two composites
600-369:2		145380.74	579803.5	6 x 6 x 1	36	9.3 x 7 x 1	65	One composite
600-369:3		145204.89	579812.38	70 x 65 x 1	4550	71.5 x 67 x 1	4,791	Statistical design
600-369:4		145178.74	579736.3	15 x 11 x 1	165	16 x 12 x 1	192	Two composites
600-369:5		145351.86	579952.4	60 x 45 x 1	2700	59 x 37.5 x 1	2,213	Statistical design
600-369:6		145336.17	579633.55	13 x 11 x 1	143	13 x 10.5 x 1	137	Two composites
600-369:7		145368.72	579895.23	6 x 4 x 1	24	6 x 4 x 1	24	One composite
600-369:8		145413.13	579698.99	28 x 20 x 1	560	32.5 x 20 x 1	650	Four composites

[a] The vertical and lateral extent of contamination at these sites is unknown; however, reasonable certainty exists to conclude that the contamination is restricted to the surface debris and the surface stained soil.

The original design for the 600-369:1 subsite indicated that this site was expected to have one composite sample collected based on the estimated remediation dimensions (Table 5). However, continued remediation of the area devoid of vegetation increased these dimensions (from one to two samples). Figures 17 through 27 show the waste site excavation footprints and the sampling locations. The WSP coordinates shown are the approximate center of the sample area for each composite sample. A summary of the verification samples collected and laboratory analyses performed is provided in Tables 6 and 7. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the 100 Area SAP (DOE-RL 2009a). Additional information related to verification sampling can be found in the field sampling logbook (WCH 2013e).

Figure 17. The 600-368 Waste Site Post-Excavation Boundary With Verification Sampling Locations.

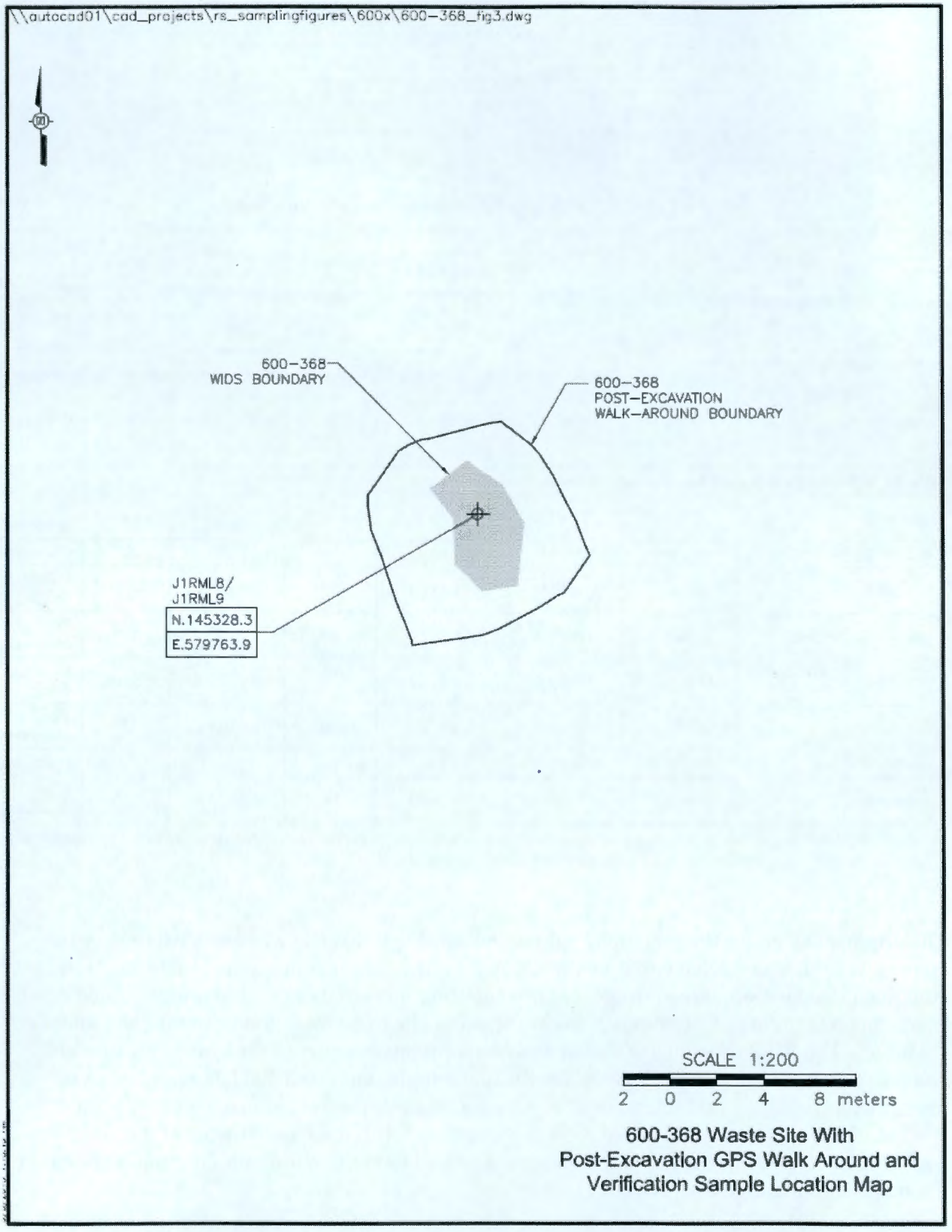


Figure 18. The 600-369:1 Subsite Post-Excavation Boundary With Verification Sampling Locations.

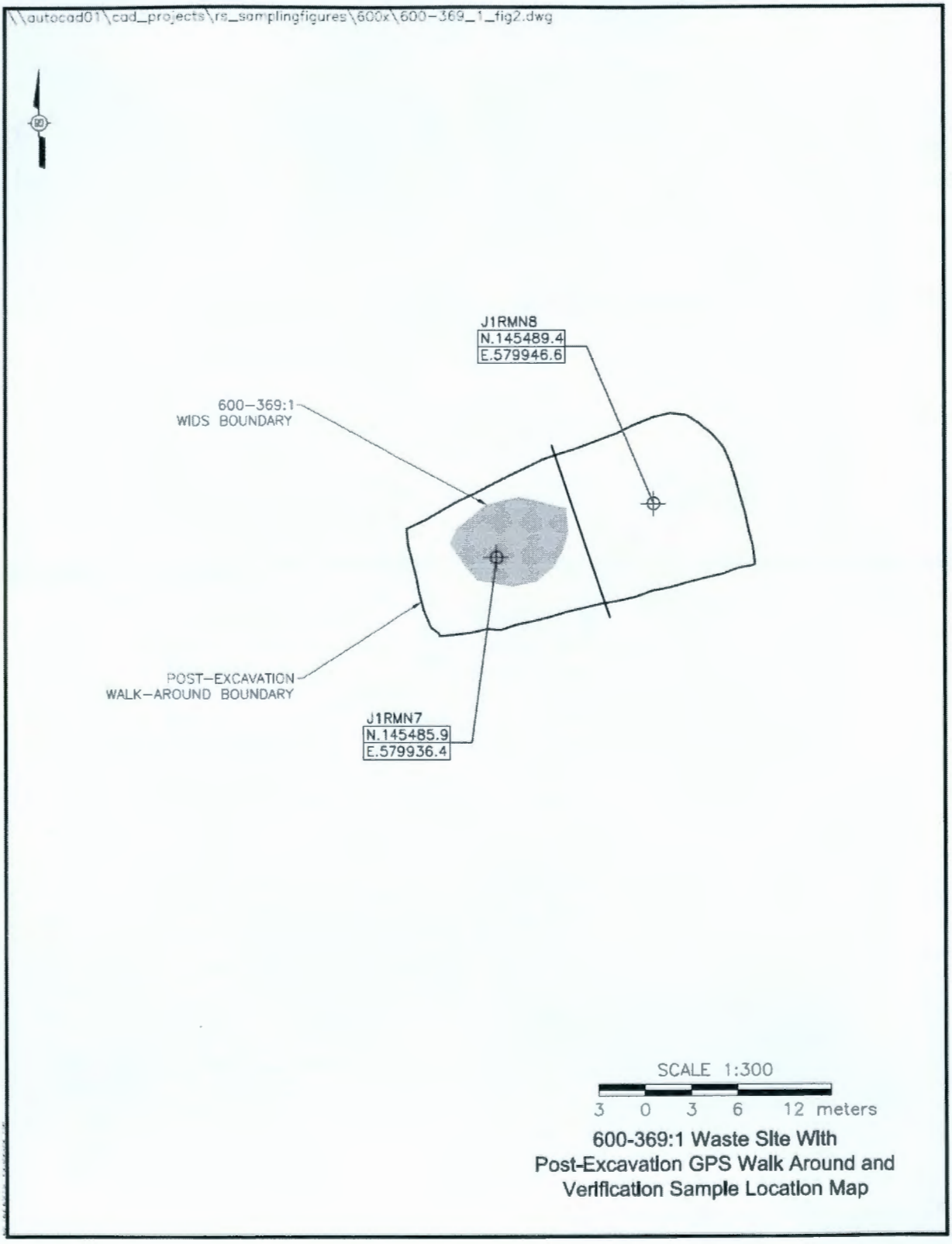


Figure 19. The 600-369:2 Subsite Post-Excavation Boundary With Verification Sampling Locations.

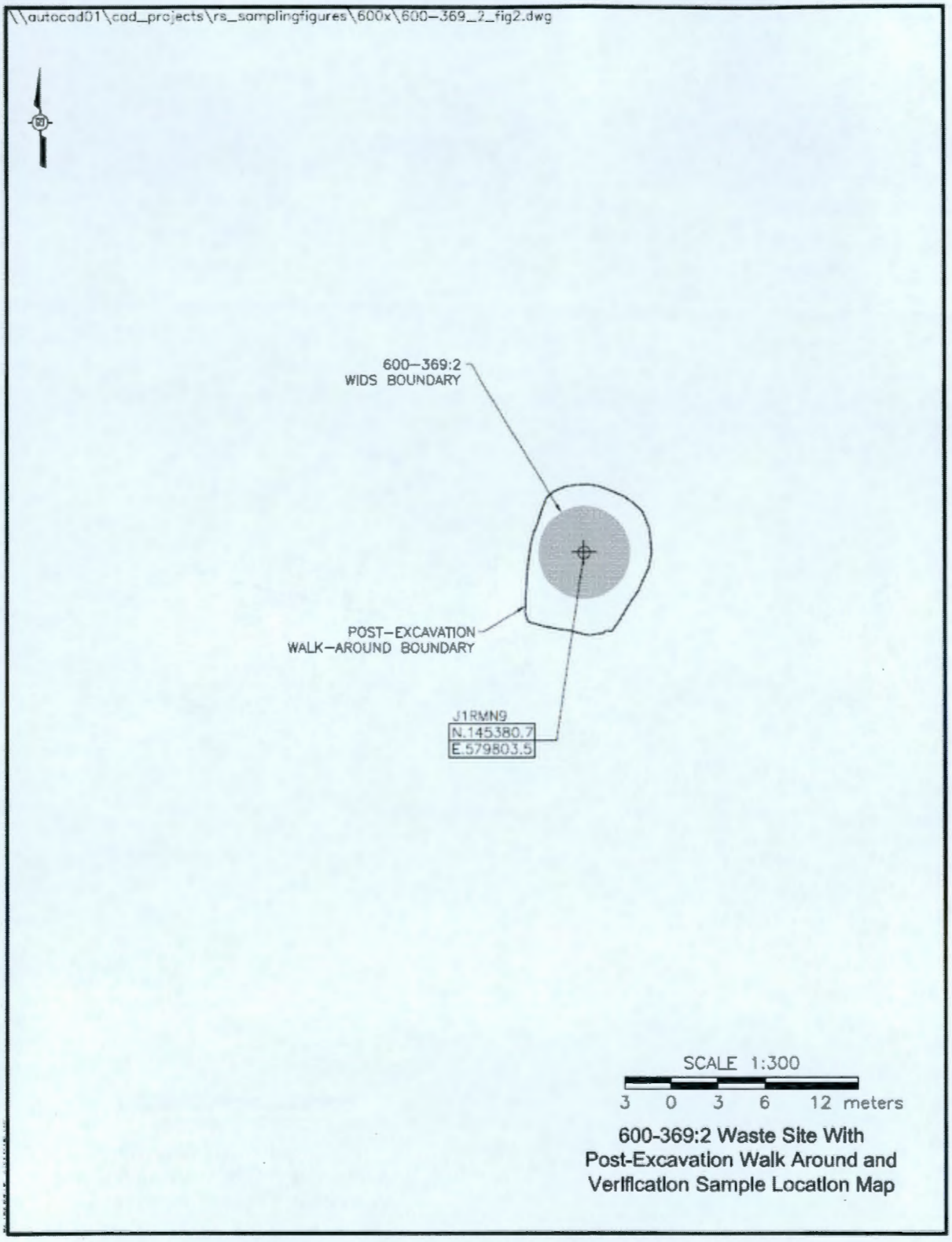


Figure 20. The 600-369:3 Subsite Post-Excavation Boundary.

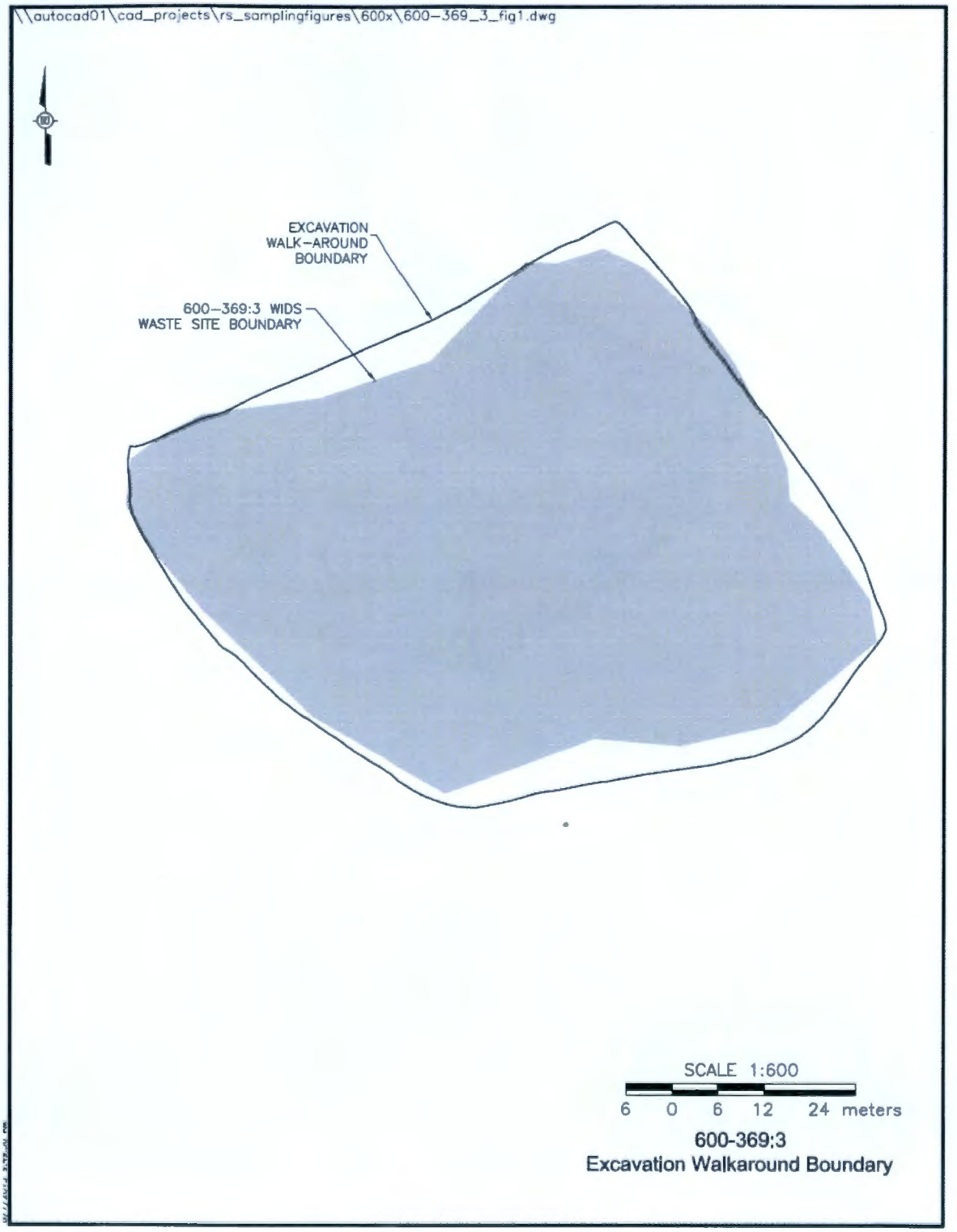


Figure 21. The 600-369:3 Subsite Verification Sampling Locations.

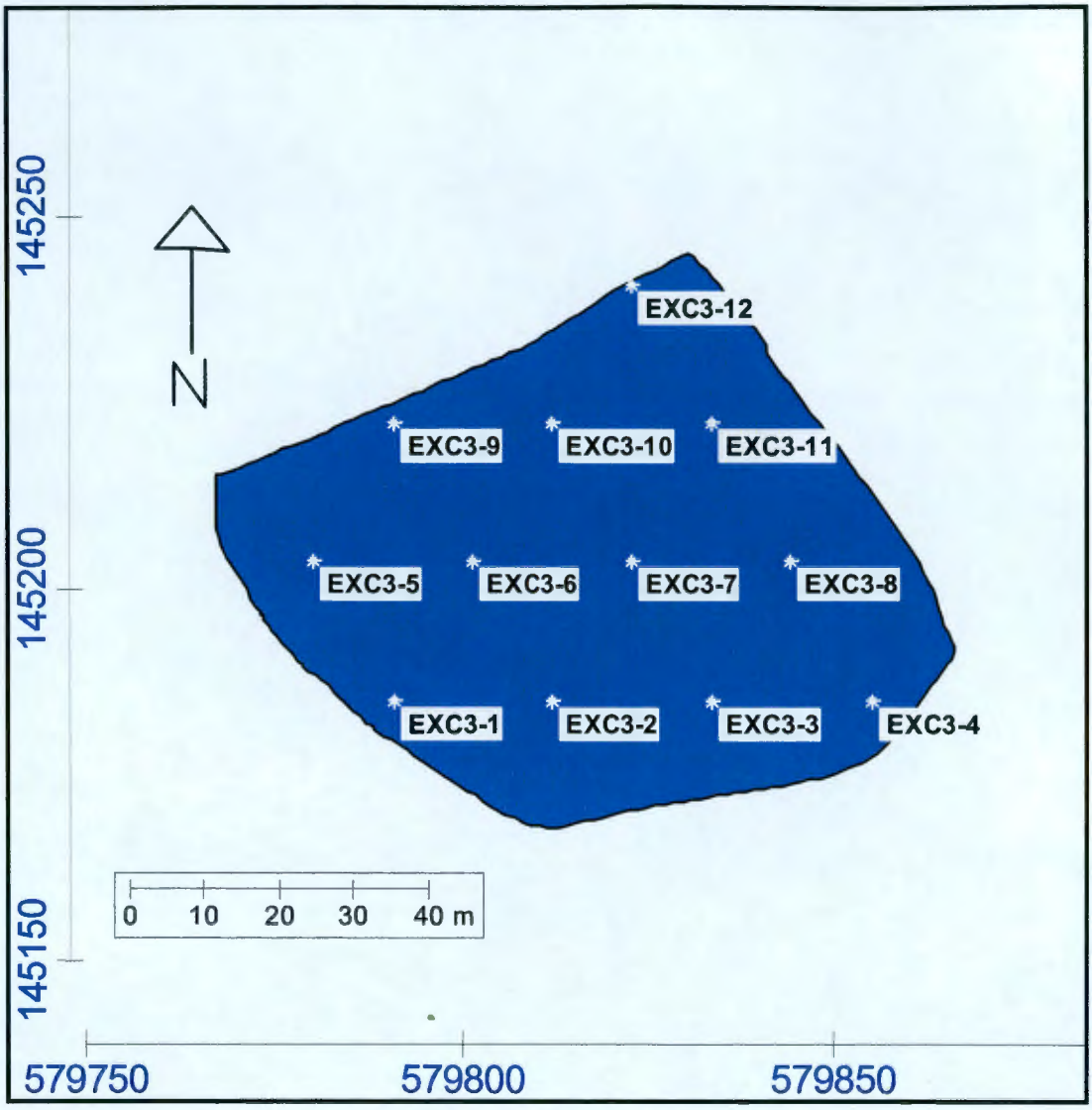


Figure 22. The 600-369:4 Subsite Post-Excavation Boundary With Verification Sampling Locations.

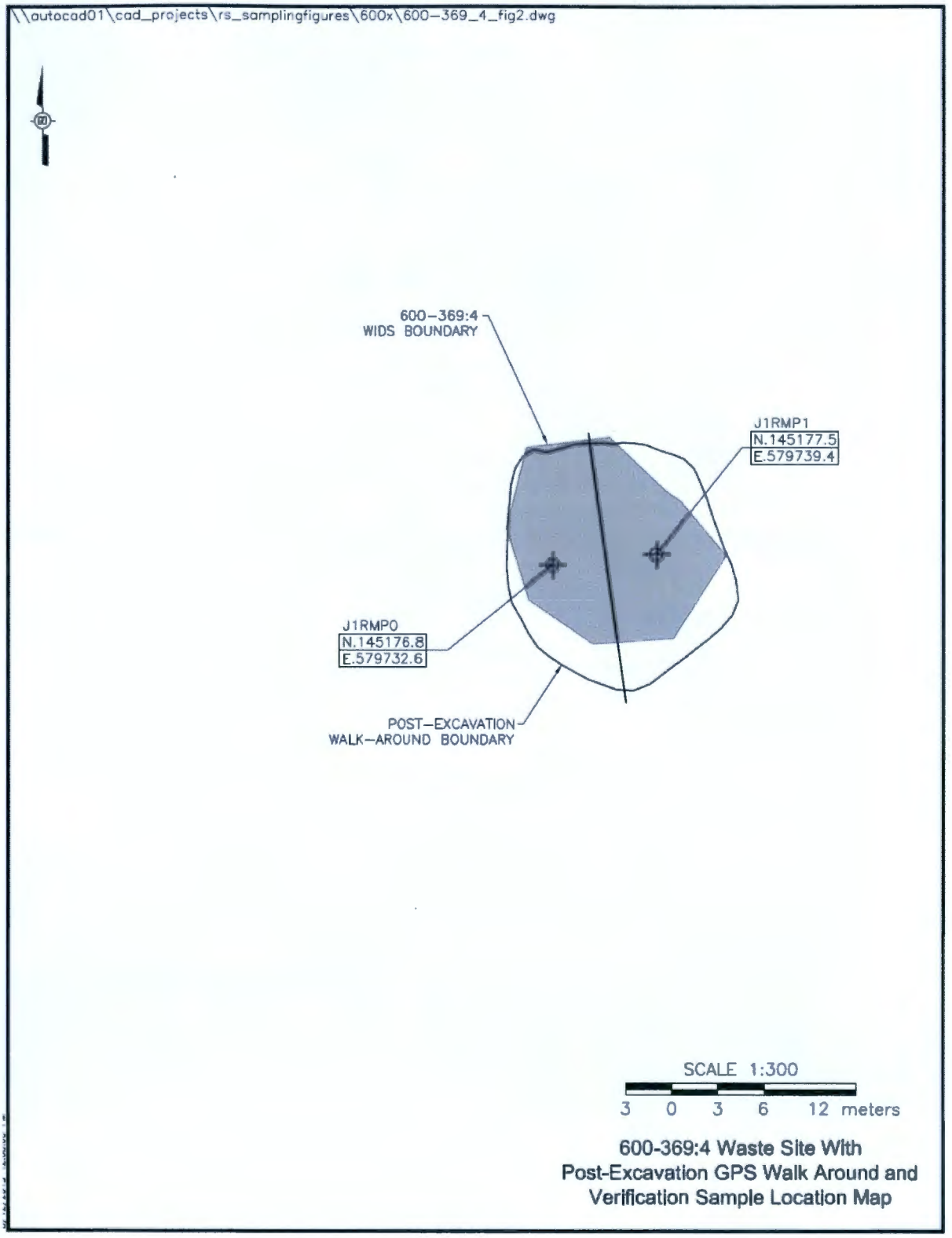


Figure 23. The 600-369:5 Subsite Post-Excavation Boundary.

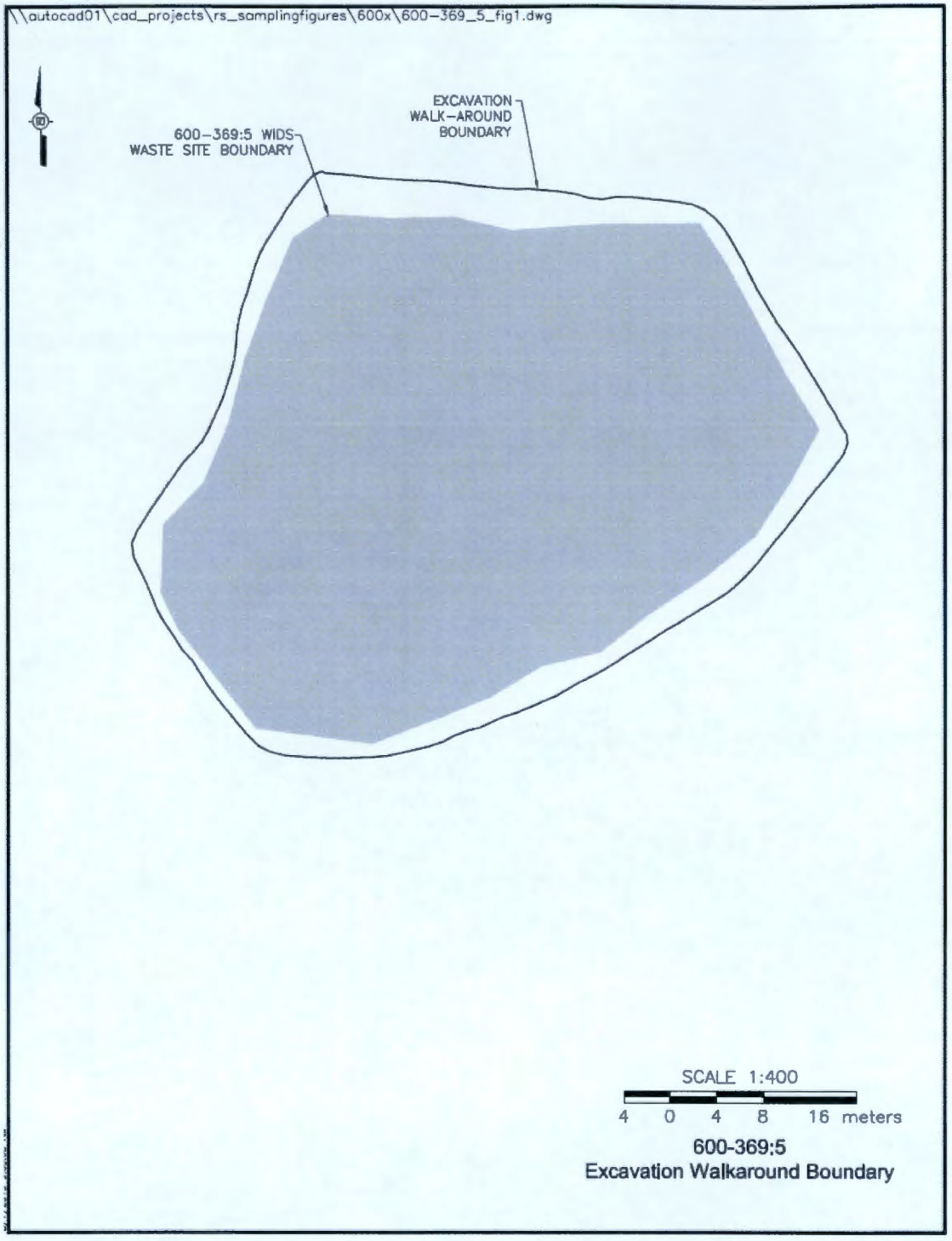


Figure 24. 600-369:5 Waste Site Verification Sample Locations.

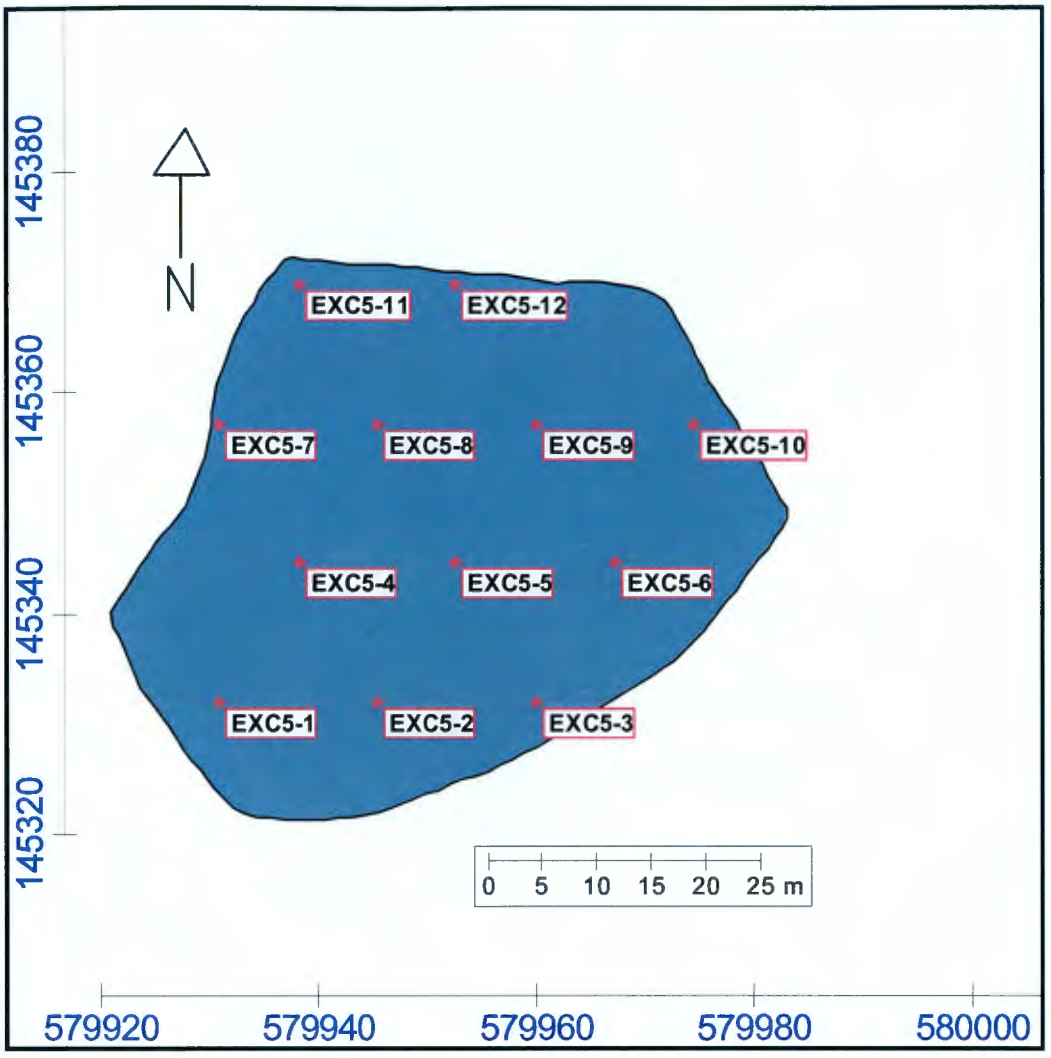


Figure 25. The 600-369:6 Subsite Post-Excavation Boundary With Verification Sampling Locations.

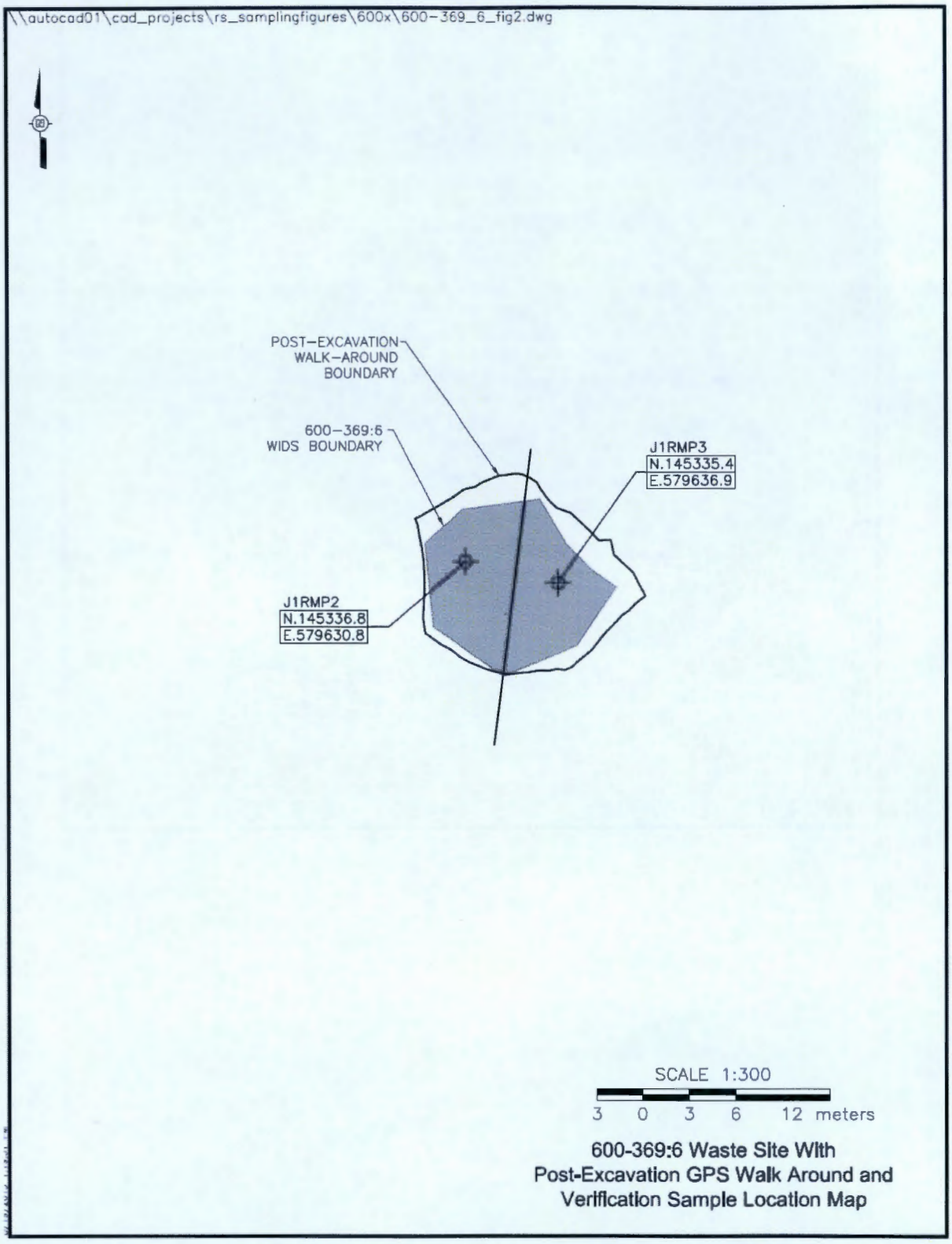


Figure 26. The 600-369:7 Subsite Post-Excavation Boundary With Verification Sampling Locations.

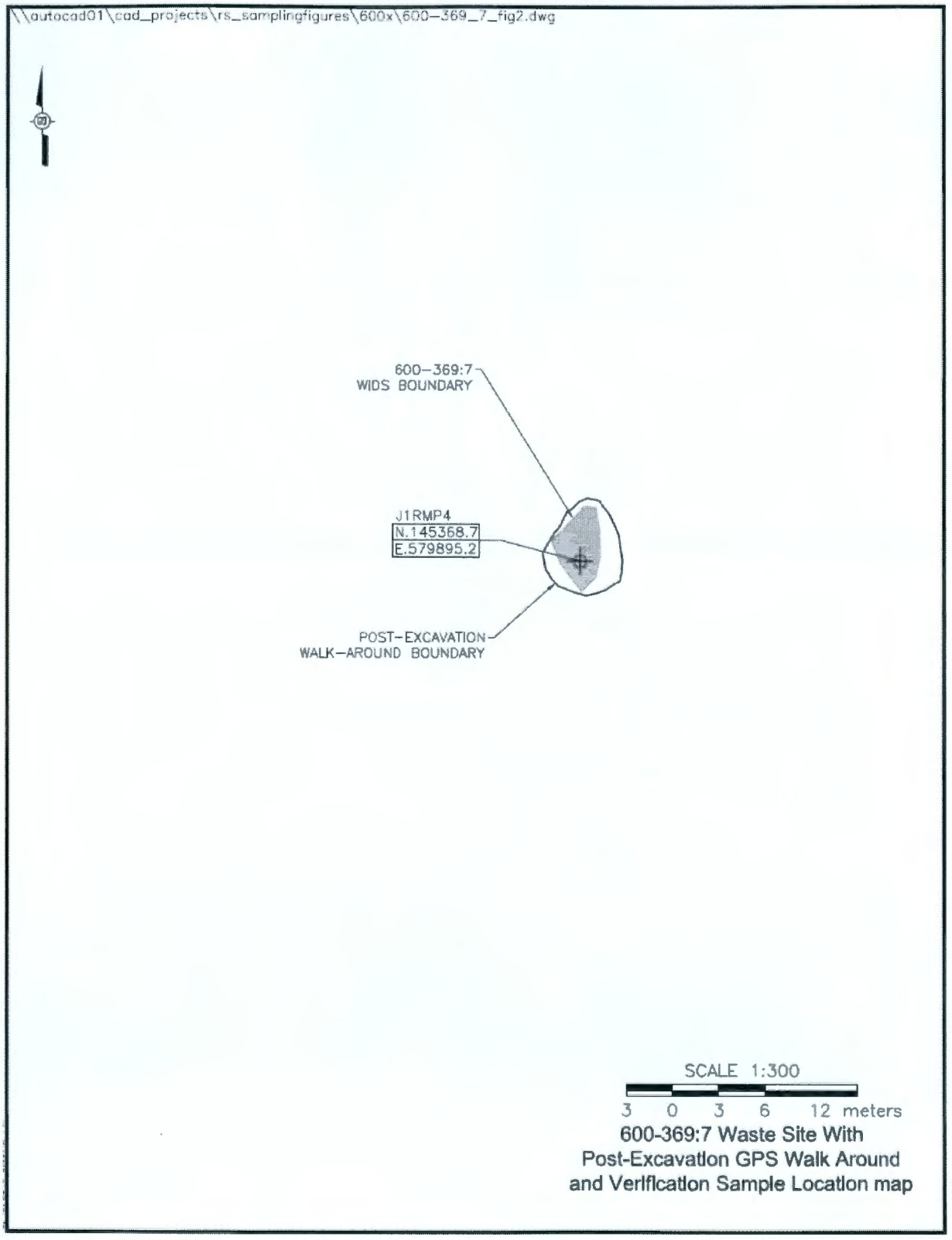


Figure 27. The 600-369:8 Subsite Post-Excavation Boundary With Verification Sampling Locations.

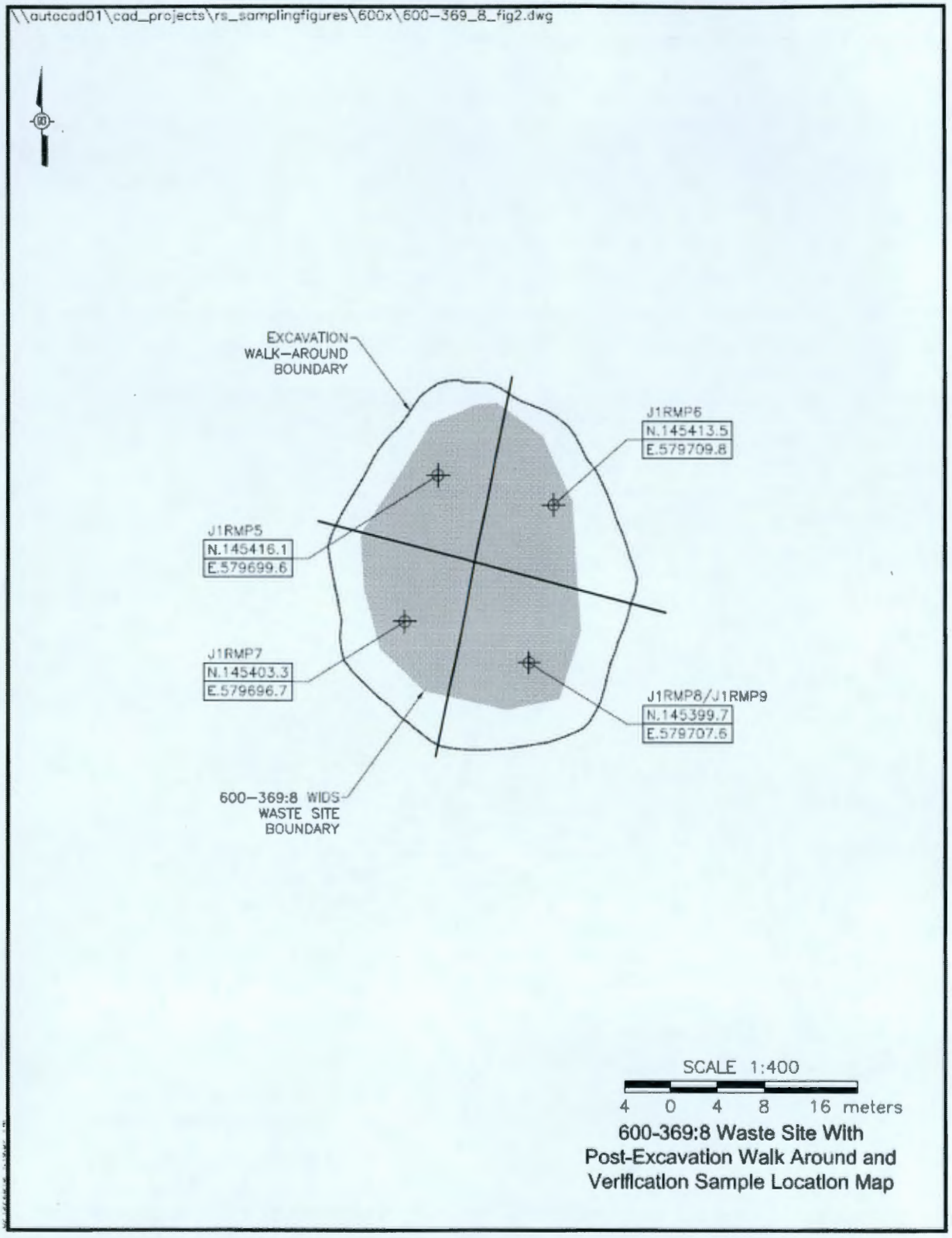


Table 6. Sample Summary Table for the 600-368 and 600-369:1, 600-369:2, 600-369:4, 600-369:6, 600-369:7, and 600-369:8 Subsites.

Sample Location	HEIS Number	Sample Analysis
600-368	J1RML8	ICP metals [a], mercury, PAH, nitrite/nitrate, hexavalent chromium
600-368, duplicate of J1RML8	J1RML9	
600-369:1, Area 1	J1RMN7	ICP metals [a], mercury, TPH, PAH
600-369:1, Area 2	J1RMN8	
600-369:2	J1RMN9	
600-369:4, Area A	J1RMP0	
600-369:4, Area B	J1RMP1	
600-369:6, Area A	J1RMP2	
600-369:6, Area B	J1RMP3	
600-369:7	J1RMP4	
600-369:8, Area A	J1RMP5	
600-369:8, Area B	J1RMP6	
600-369:8, Area C	J1RMP7	
600-369:8, Area D	J1RMP8	
600-369:8, duplicate of J1RMP8	J1RMP9	
Equipment blank (600-368)	J1RMM0	ICP metals [a], mercury

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

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
PAH = polycyclic aromatic hydrocarbons
TPH = total petroleum hydrocarbons

Table 7. 600-369:3 and 600-369:5 Sample Summary. (2 Pages)

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Northing	Easting	
EXC3-1	J1RN42	145185.1	579791.0	ICP metals [a], TPH, PAH, pesticides, PCBs
EXC3-2	J1RN43	145185.1	579812.4	
EXC3-3	J1RN44	145185.1	579833.9	
EXC3-4	J1RN45	145185.1	579855.4	
EXC3-5	J1RN46	145203.7	579780.2	
EXC3-6	J1RN47	145203.7	579801.7	
EXC3-7	J1RN48	145203.7	579823.2	
EXC3-8	J1RN49	145203.7	579844.6	
EXC3-9	J1RN50	145222.3	579791.0	
EXC3-10	J1RN51	145222.3	579812.4	
EXC3-11	J1RN52	145222.3	579833.9	
EXC3-12	J1RN53	145240.9	579823.2	
Duplicate of J1RN49	J1RN54	145203.7	579844.6	

Table 7. 600-369:3 and 600-369:5 Sample Summary. (2 Pages)

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Northing	Easting	
EXC5-1	J1RN56	145332.0	579930.8	ICP metals [a], TPH, PAH, pesticides, PCBs
EXC5-2	J1RN57	145332.0	579945.4	
EXC5-3	J1RN58	145332.0	579960.0	
EXC5-4	J1RN59	145344.7	579938.1	
EXC5-5	J1RN60	145344.7	579952.7	
EXC5-6	J1RN61	145344.7	579967.3	
EXC5-7	J1RN62	145357.3	579930.8	
EXC5-8	J1RN63	145357.3	579945.4	
EXC5-9	J1RN64	145357.3	579960.0	
EXC5-10	J1RN65	145357.3	579974.6	
EXC5-11	J1RN66	145369.9	579938.1	
EXC5-12	J1RN67	145369.9	579952.7	
Duplicate of J1RN67	J1RN68	145369.9	579952.7	
Equipment blank (600-369:3)	J1RN55	NA	NA	ICP metals [a]
Equipment blank (600-369:5)	J1RN69	NA	NA	

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

HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TBD = to be determined
TPH = total petroleum hydrocarbons

Verification Sample Results

All verification samples were analyzed using analytical methods approved by EPA (DOE-RL 2009b). Evaluation of the verification data from the 600-369:3 and 600-369:5 subsites against cleanup criteria was performed by direct comparison to the statistical sample results for each COPC. Evaluation of the verification data from the 600-368 waste site and the 600-369:1, 600-369:2, 600-369:4, 600-369:6, 600-369:7, and 600-369:8 subsites was performed by direct comparison of the maximum sample results for each COPC against cleanup criteria. If no detections for a given COPC were reported in the data set, then no maximum evaluation or statistical calculations were performed for that COPC.

The primary statistical calculation to evaluate compliance with cleanup standards is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. The 95% UCL values for each detected COPC are computed for 600-369:3 and 600-369:5 decision units as specified by the 100 Area RDR/RAWP (DOE-RL 2009b). The calculations are provided in Appendix B. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for a decision unit, the maximum detected value was used for comparison to RAGs.

If no detections for a given COPC were reported in the data set, then no statistical calculation or evaluation was performed for that COPC.

Comparisons of the results for site COPCs with the RAGs for each of the 600-368 and 600-369 decision units are listed in Tables 8 through 16. 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 2011) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (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) Restoration project-specific database prior to archival in the Hanford Environmental Information System, and are presented in Attachment 1 of the 95% UCL calculations (Appendix B).

Table 8. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-368 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.51	32	5 [b]	5 [b]	No	--
Arsenic	3.1 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	100 (<BG)	5,600 [c]	200	400	No	--
Beryllium	0.18 (<BG)	10.4 [d]	1.51 [b]	1.51 [b]	No	--
Boron [e]	1.2	7,200 [c]	320	-- [f]	No	--
Cadmium [g]	0.17 (<BG)	13.9 [d]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	9.6 (<BG)	80,000 [c]	18.5 [b]	18.5 [b]	No	--
Cobalt	9.9 (<BG)	24 [c]	15.7 [b]	-- [f]	No	--
Copper	12.9 (<BG)	2,960 [c]	59.2	22.0 [b]	No	--
Hexavalent chromium [e]	0.231	2.1	4.8	2	No	--
Lead	6.8 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	398 (<BG)	3,760 [c]	512 [b]	512 [b]	No	--
Nickel	10.2 (<BG)	1,600 [c]	19.1 [b]	27.4	No	--
Vanadium	53.7 (<BG)	560 [c]	85.1 [b]	-- [f]	No	--
Zinc	55.6 (<BG)	24,000 [c]	480	67.8 [b]	No	--

Table 8. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-368 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Nitrogen in nitrate and nitrite	4.1	128,000 [c]	1,000	2,000	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[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] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B (Ecology 1996).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3) (1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[g] Hanford Site-specific background 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).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity
WAC = *Washington Administrative Code*

Table 9. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:1 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.5 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	69.5 (<BG)	5,600 [c]	200	400	No	--
Beryllium	0.36 (<BG)	10.4 [d]	1.51 [b]	1.51 [b]	No	--
Boron [e]	2.1	7,200 [c]	320	-- [f]	No	--
Cadmium [g]	0.24 (<BG)	13.9 [d]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	6.9 (<BG)	80,000 [c]	18.5 [b]	18.5 [b]	No	--
Cobalt	6.5 (<BG)	24 [c]	15.7 [b]	-- [f]	No	--
Copper	12.0 (<BG)	2,960 [c]	59.2	22.0 [b]	No	--
Lead	4.0 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	338 (<BG)	3,760 [c]	512 [b]	512 [b]	No	--
Molybdenum [e]	0.27 (<BG)	400 [c]	8	-- [f]	No	--
Nickel	7.5 (<BG)	1,600 [c]	19.1 [b]	27.4	No	--
Vanadium	62.3 (<BG)	560 [c]	85.1 [b]	-- [f]	No	--
Zinc	43.3 (<BG)	24,000 [c]	480	67.8 [b]	No	--
TPH – diesel	24	200	200	200	No	--

Table 9. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:1 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
TPH – diesel EXT	82	200	200	200	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[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] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B (Ecology 1996).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3) (1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[g] Hanford Site-specific background 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).

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

Table 10. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:2 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.7 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	75.6 (<BG)	5,600 [c]	200	400	No	--
Beryllium	0.41 (<BG)	10.4 [d]	1.51 [b]	1.51 [b]	No	--
Boron [e]	1.1	7,200 [c]	320	-- [f]	No	--
Cadmium [g]	0.23 (<BG)	13.9 [d]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	8.9 (<BG)	80,000 [c]	18.5 [b]	18.5 [b]	No	--
Cobalt	7.0 (<BG)	24 [c]	15.7 [b]	-- [f]	No	--
Copper	13.9 (<BG)	2,960 [c]	59.2	22.0 [b]	No	--
Lead	3.8 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	367 (<BG)	3,760 [c]	512 [b]	512 [b]	No	--
Nickel	9.2 (<BG)	1,600 [c]	19.1 [c]	27.4	No	--
Vanadium	57.6 (<BG)	560 [c]	85.1 [c]	-- [f]	No	--
Zinc	44.7 (<BG)	24,000 [c]	480	67.8 [b]	No	--
TPH – diesel	2.9	200	200	200	No	--
TPH – diesel EXT	6.0	200	200	200	No	--

Table 10. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:2 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Benzo(b)fluoranthene	0.010	1.37	0.015 [h]	0.015 [h]	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[b] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] 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]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).
[g] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: Contaminant: acenaphthylene; surrogate: acenaphthene
[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid turnaround analyses. Prior notification and concurrence with the laboratory may be necessary to meet this RDL. Actual detection limits may differ from any RDL.

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

Table 11. Comparison of Contaminant Concentrations to Action Levels for the 600-369:3 Excavation Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.53 (<BG)	32	5	5	No	--
Arsenic	12.5	20 [c]	20 [c]	20 [c]	No	--
Barium	68.4 (<BG)	5,600 [d]	200	400	No	--
Beryllium	0.23 (<BG)	10.4 [e]	1.51 [c]	1.51 [c]	No	--
Boron [f]	1.4	7,200 [d]	320	-- [g]	No	--
Cadmium [h]	0.29 (<BG)	13.9 [e]	0.81 [c]	0.81 [c]	No	--
Chromium	9.8 (<BG)	80,000 [d]	18.5 [c]	18.5 [c]	No	--
Cobalt	6.8 (<BG)	24 [d]	15.7 [c]	-- [g]	No	--
Copper	14.7 (<BG)	2,960 [d]	59.2	22.0 [c]	No	--
Lead	52.4	353	10.2 [c]	10.2 [c]	Yes	Yes [i]
Manganese	3.6 (<BG)	3,760 [d]	512 [c]	-- [g]	No	--
Nickel	11.5 (<BG)	1,600 [d]	19.1 [c]	27.4	No	--
Vanadium	40.7 (<BG)	560 [d]	85.1 [c]	-- [g]	No	--
Zinc	42.7 (<BG)	24,000 [d]	480	67.8 [c]	No	--
TPH-diesel range	7.5	200	200	200	No	--

Table 11. Comparison of Contaminant Concentrations to Action Levels for the 600-369:3 Excavation Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
TPH-diesel range extended	31	200	200	200	No	--
Acenanphthene	0.018	4,800 [d]	96	129	No	--
Benzo(a)anthracene	0.070	1.37	0.015 [j]	0.015 [j]	Yes	Yes [i]
Benzo(a)pyrene	0.092	0.137	0.015 [j]	0.015 [j]	Yes	Yes [i]
Benzo(b)fluoranthene	0.12	1.37	0.015 [j]	0.015 [j]	Yes	Yes [i]
Benzo(ghi)perylene [k]	0.075	2,400 [d]	48	192	No	--
Benzo(k)fluoranthene	0.053	13.7	0.12 [j]	0.015 [j]	Yes	Yes [i]
Chrysene	0.10	13.7	0.12	0.1 [j]	No	--
Fluoranthene	0.17	3,200 [d]	64	18.0	No	--
Fluorene	0.0081	3,200 [d]	64	260	No	--
Indeno(1,2,3-cd)pyrene	0.074	1.37	0.33 [j]	0.33 [j]	No	--
Phenanthrene [k]	0.064	24,000 [d]	240	1,920	No	--
Pyrene	0.13	2,400 [d]	48	192	No	--

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

[b] Maximum or 95% UCL, depending on data censorship, as described in the *600-368 and 600-369 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix B).

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

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

[e] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B (Ecology 1996).

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

[g] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).

[h] 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).

[i] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and benzo(k)fluoranthene are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years (based on the distribution coefficient of lead, 30 mL/g). The vadose zone underlying the soil below the site is approximately 7 m (23 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

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

[k] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:
benzo(ghi)perylene; surrogate: pyrene
phenanthrene; surrogate: anthracene.

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

Table 12. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:4 Excavation Verification Sampling Data.

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	27.0	20 [b]	20 [b]	20 [b]	Yes [c]	Yes [c]
Barium	84.8 (<BG)	5,600 [d]	200	400	No	--
Beryllium	0.40 (<BG)	10.4 [e]	1.51 [b]	1.51 [b]	No	--
Boron [f]	1.4	7,200 [d]	320	-- [g]	No	--
Cadmium [h]	0.26 (<BG)	13.9 [e]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	9.9 (<BG)	80,000 [d]	18.5 [b]	18.5 [b]	No	--
Cobalt	7.0 (<BG)	24 [d]	15.7 [b]	-- [g]	No	--
Copper	14.1 (<BG)	2,960 [d]	59.2	22.0 [b]	No	--
Lead	59.6	353	10.2 [b]	10.2 [b]	Yes [c]	Yes [c]
Manganese	378 (<BG)	3,760 [d]	512 [b]	512 [b]	No	--
Nickel	9.8 (<BG)	1,600 [d]	19.1 [b]	27.4	No	--
Vanadium	57.4 (<BG)	560 [d]	85.1 [b]	-- [g]	No	--
Zinc	46.7 (<BG)	24,000 [d]	480	67.8 [b]	No	--
TPH-diesel range	6.0	200	200	200	No	--
TPH-diesel range extended	14	200	200	200	No	--
Benzo(a)anthracene	0.013	1.37	0.015 [i]	0.015 [i]	No	--
Benzo(a)pyrene	0.014	0.137	0.015 [i]	0.015 [i]	No	--
Benzo(b)fluoranthene	0.023	1.37	0.015 [i]	0.015 [i]	Yes	Yes [j]
Benzo(ghi)perylene [k]	0.015	2,400 [d]	48	192	No	--
Benzo(k)fluoranthene	0.0061	13.7	0.12 [i]	0.015 [i]	No	--
Chrysene	0.014	13.7	0.12	0.1 [i]	No	--
Fluoranthene	0.026	3,200 [d]	64	18.0	No	--
Pyrene	0.028	2,400 [d]	48	192	No	--

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

[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] Lead and arsenic associated with the use of pesticides previous to the Manhattan Project are excluded as COPCs for the 600-369:4 subsite as agreed to by the Tri-Party Agreement Project Managers in Tri-Party Agreement Change Notice TPA-CN-401 (DOE-RL 2010).

[d] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B (Ecology 1996).

[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 ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).

[h] 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).

[i] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid-turnaround analyses.

[j] Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of benzo(b)fluoranthene is not expected to migrate vertically in 1,000 years (based on the benzo(b)fluoranthene K_d value of 803 mL/g). When contaminant K_d values are greater than 80 mL/g, RESRAD modeling predicts that the contaminants will show no migration within the 100 Area vadose zone and no impact on groundwater or the Columbia River.

[k] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: benzo(ghi)perylene; surrogate: pyrene

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Table 13. Comparison of Contaminant Concentrations to Action Levels for the 600-369:5 Excavation Statistical Verification Samples.

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.4 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	81.9 (<BG)	5,600 [d]	200	400	No	--
Beryllium	0.16 (<BG)	10.4 [e]	1.51 [c]	1.51 [c]	No	--
Boron [f]	1.5	7,200 [d]	320	-- [g]	No	--
Cadmium [h]	0.25 (<BG)	13.9 [e]	0.81 [c]	0.81 [c]	No	--
Chromium	8.6 (<BG)	80,000 [d]	18.5 [c]	18.5 [c]	No	--
Cobalt	8.3 (<BG)	24 [d]	15.7 [c]	-- [g]	No	--
Copper	14.2 (<BG)	2,960 [d]	59.2	22.0 [c]	No	--
Lead	5.0 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	368 (<BG)	3,760 [d]	512 [c]	-- [g]	No	--
Molybdenum [f]	0.32 (<BG)	400 [d]	8	-- [g]	No	--
Nickel	9.3 (<BG)	1,600 [d]	19.1 [c]	27.4	No	--
Vanadium	62.1 (<BG)	560 [d]	85.1 [c]	-- [g]	No	--
Zinc	46.4 (<BG)	24,000 [d]	480	67.8 [c]	No	--
TPH-diesel range	10	200	200	200	No	--
TPH-diesel range extended	25	200	200	200	No	--
Benzo(b)fluoranthene	0.0076	1.37	0.015 [i]	0.015 [i]	No	--
Chrysene	0.0059	13.7	0.12	0.1 [i]	No	--

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

[b] Maximum or 95% UCL, depending on data censorship, as described in the *600-368 and 600-369 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix B).

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

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

[e] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B (Ecology 1996).

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

[g] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Washington State Department of Ecology Cleanup Levels and Risk Calculations database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], Ecology 1996 [Method B for surface waters]).

[h] 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).

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

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

Table 14. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:6 Excavation Verification Sampling Data.

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.8 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	76.2 (<BG)	5,600 [c]	200	400	No	--
Beryllium	0.39 (<BG)	10.4 [d]	1.51 [b]	1.51 [b]	No	--
Boron [e]	1.4	7,200 [c]	320	-- [f]	No	--
Cadmium [g]	0.24 (<BG)	13.9 [d]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	8.6 (<BG)	80,000 [c]	18.5 [b]	18.5 [b]	No	--
Cobalt	7.0 (<BG)	24 [c]	15.7 [b]	-- [f]	No	--
Copper	13.8 (<BG)	2,960 [c]	59.2	22.0 [b]	No	--
Lead	4.2 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	374 (<BG)	3,760 [c]	512 [b]	512 [b]	No	--
Nickel	8.8 (<BG)	1,600 [c]	19.1 [b]	27.4	No	--
Vanadium	59.8 (<BG)	560 [c]	85.1 [b]	-- [f]	No	--
Zinc	45.1 (<BG)	24,000 [c]	480	67.8 [b]	No	--
TPH-diesel range	40	200	200	200	No	--
TPH-diesel range extended	78	200	200	200	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[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] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B (Ecology 1996).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3) (1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[g] Hanford Site-specific background 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).

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

Table 15. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:7 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.3 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	67.1 (<BG)	5,600 [c]	200	400	No	--
Beryllium	0.37 (<BG)	10.4 [d]	1.51 [b]	1.51 [b]	No	--
Cadmium [e]	0.30 (<BG)	13.9 [d]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	8.0 (<BG)	80,000 [c]	18.5 [b]	18.5 [b]	No	--
Cobalt	7.3 (<BG)	24 [c]	15.7 [b]	-- [f]	No	--
Copper	15.4 (<BG)	2,960 [c]	59.2	22.0 [b]	No	--
Lead	5.5 (<BG)	353	10.2 [b]	10.2 [b]	No	--

Table 15. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:7 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Manganese	371 (<BG)	3,760 [c]	512 [b]	512 [b]	No	--
Nickel	8.1 (<BG)	1,600 [c]	19.1 [b]	27.4	No	--
Vanadium	56.7 (<BG)	560 [c]	85.1 [b]	-- [f]	No	--
Zinc	50.3 (<BG)	24,000 [c]	480	67.8 [b]	No	--
TPH-diesel range	3.3	200	200	200	No	--
TPH-diesel range extended	6.8	200	200	200	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[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] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B (Ecology 1996).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3) (1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] 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).
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).

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

Table 16. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:8 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals [a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.3 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	68.3 (<BG)	5,600 [c]	200	400	No	--
Beryllium	0.38 (<BG)	10.4 [d]	1.51 [b]	1.51 [b]	No	--
Boron [e]	0.97	7,200 [c]	320	-- [f]	No	--
Cadmium [g]	0.22 (<BG)	13.9 [d]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	8.6 (<BG)	80,000 [c]	18.5 [b]	18.5 [b]	No	--
Cobalt	6.6 (<BG)	24 [c]	15.7 [b]	-- [f]	No	--
Copper	12.7 (<BG)	2,960 [c]	59.2	22.0 [b]	No	--
Lead	3.5 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	339 (<BG)	3,760 [c]	512 [b]	512 [b]	No	--
Nickel	8.2 (<BG)	1,600 [c]	19.1 [b]	27.4	No	--
Vanadium	61.0 (<BG)	560 [c]	85.1 [b]	-- [f]	No	--
Zinc	43.8 (<BG)	24,000 [c]	480	67.8 [b]	No	--
TPH-diesel range	65	200	200	200	No	--

Table 16. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-369:8 Excavation Verification Sampling Data. (2 Pages)

COPC	Maximum Result	Remedial Action Goals[a]			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
TPH-diesel range extended	130	200	200	200	No	--

[a] RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b).
[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] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B (Ecology 1996).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3) (1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[e] No Hanford Site-specific or Washington State background value available.
[f] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
[g] Hanford Site-specific background 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).

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

VERIFICATION SAMPLE DATA EVALUATION

This section demonstrates that contaminant concentrations at the 600-368 and 600-369 waste sites 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).

Direct Comparison to RAGs

Evaluation of the verification sampling results in Tables 8 through 16 show that all direct exposure RAGs are met for the 600-368 and 600-369 waste sites, with the exception of arsenic at the 600-369:4 subsite.

Arsenic at the 600-369:4 subsite was measured at concentrations exceeding cleanup criteria for direct exposure and protection of groundwater and the Columbia River. Lead was measured at concentrations exceeding cleanup criteria for protection of groundwater and the Columbia River at the 600-369:4 subsite. However, since arsenic and lead contamination at the 600-369:4 subsite is associated with historic lead arsenate pesticide use at pre-Hanford orchard land, they are excluded as COPCs (DOE-RL 2010) and are not evaluated further.

Based on the RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), residual concentrations of lead (at the 600-369:3 subsite excavation), benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not predicted to migrate more than 2 m (6.6 ft) vertically within 1,000 years (based on the lowest distribution coefficient of the contaminants exceeding RAGs,

with a lead distribution coefficient value of 30 mL/g). The vadose zone underlying the excavation is approximately 7 m (23 ft) thick. Therefore, residual concentrations of lead (at the 600-369:3 subsite excavation), benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not predicted to migrate through the soil column to groundwater (and thus the Columbia River) within 1,000 years.

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 three-part test for the 600-369:3 and 600-369:5 remediation footprints is included in the statistical calculations (Appendix B). The results of this evaluation indicate that lead data sets have sample results that exceeded the cleanup limit by greater than two times in comparison against the soil RAGs for groundwater and river protection in the 600-369:3 decision unit. However, based on the RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), the residual concentration of lead is predicted to migrate less than 2 m (6.6 ft) vertically in 1,000 years (based on the distribution coefficient [K_d] of lead of 30 mL/g). The vadose zone underlying the excavation is approximately 7 m (23 ft) thick. Therefore, the residual concentrations of lead are predicted to be protective of groundwater and the Columbia River.

Direct Contact Noncarcinogenic Hazard Quotient Remedial Action Goal

Assessment of the risk requirements for the 600-368 and 600-369 waste sites was determined by calculation of the hazard quotient and excess carcinogenic risk. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. Hazard quotient and excess carcinogenic risk calculations for direct contact were conservatively performed for the 600-368 and 600-369 waste sites in Appendix B using the highest of the focused and statistical values from all decision units. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients are below 1.0, and all individual excess carcinogenic risk values are below 1×10^{-6}. The direct contact cumulative hazard quotient for the 600-368 and 600-369 waste sites is 2.2×10^{-3}, and the cumulative excess carcinogenic risk value is 1.0×10^{-6}, satisfying the criteria to be less than 1.0 and less than 1×10^{-5}, respectively. Therefore, the nonradionuclide risk requirements are met.

Hazard Quotient and Carcinogenic Risk Calculation for Groundwater

Evaluation of the verification sampling results, as presented in Tables 8 through 16, show that all COPCs were quantified below their respective soil RAGs with the exception of arsenic, lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene. Of these,

arsenic and lead were measured at concentrations exceeding cleanup criteria for direct exposure and protection of groundwater and the Columbia River at the 600-369:4 subsite. However, since arsenic and lead contamination at 600-369:4 subsite is associated with historic lead arsenate pesticide use at pre-Hanford orchard land, they are excluded as COPCs (DOE-RL 2010) and are not evaluated further. Based on RESRAD modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b), residual concentrations of lead detected at the 600-369:3 subsite (having a Kd value of 30 mL/g) are predicted to not migrate more than 2 m (6.6 ft) vertically in 1,000 years. The thickness of the vadose zone below the waste site excavation is approximately 7 m (23 ft) thick. Therefore, residual lead concentrations are predicted to be protective of groundwater and the Columbia River. All other COPCs were either not detected or were quantified below the RAGs.

DATA QUALITY ASSESSMENT

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

The DQA for the 600-368 and 600-369 waste sites 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 a WCH project-specific database prior to archival in the Hanford Environmental Information System and are summarized in an attachment to the relative percent difference calculation in Appendix B. The detailed DQA is presented in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 600-368 and 600-369 waste sites have been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). Verification sampling was performed, and the analytical results indicate that, with the exception of arsenic and lead at the 600-369:4, the residual concentrations of COPCs meet the RAOs for direct exposure, groundwater protection, and river protection. Arsenic at the 600-369:4 subsite was measured at concentrations exceeding cleanup criteria for direct exposure and protection of groundwater and the Columbia River. Lead was measured at concentrations exceeding cleanup criteria for protection of groundwater and the Columbia River at the 600-369:4 subsite. However, as agreed by the Tri-Parties in TPA-CN-401 (DOE-RL 2010), residual lead and arsenic contamination present at the 600-369:4 subsite that resulted from pesticide use prior to the Manhattan Project are excluded as COPCs and will be discussed in a future CERCLA document. Contamination above direct exposure levels originating from Hanford Site or Manhattan Project activities was not observed in the shallow zone and is concluded to not exist in the deep zone soils. Therefore, institutional controls to prevent uncontrolled drilling into the deep zone (below 4.6 m [15 ft]) are

not required. In accordance with this evaluation, the verification sampling results support a reclassification of the 600-368 and 600-369 waste sites to Interim Closed Out.

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APPENDIX A

WASTE CHARACTERIZATION AND IN-PROCESS SAMPLING RESULTS

Table A-1. 600-368 Waste Site Waste Characterization Data - Anions and Metals. (2 Pages)

Sample Location	HEIS Number	Sample Date	Bromide			Chloride			Fluoride			Nitrate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
underlying soil	J1RD29	1/22/13	1.0	U	1.0	1.0	U	1.0	1.0	U	1.0	7.5		1.0
green granules	J1RD31	1/22/13	0.90	U	0.90	1.5	B	0.90	0.9	U	0.9	12.2		0.90

Sample Location	HEIS Number	Sample Date	Nitrite			Nitrogen in			Phosphate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
underlying soil	J1RD29	1/22/13	1.0	U	1.0	1.93		0.10	2.6	B	2.0	71.6		1.0
green granules	J1RD31	1/22/13	0.90	U	0.90	2.97		0.090	1.9	U	1.9	121		1.9

Sample Location	HEIS Number	Sample Date	Sulfide			Percent Solids			pH Measurement			Aluminum		
			mg/kg	Q	PQL	%	Q	PQL	pH	Q	PQL	mg/kg	Q	PQL
underlying soil	J1RD29	1/22/13	2990		42.5	92.9		0.10	6.75		0.10	6690		13.9
green granules	J1RD31	1/22/13	8120		397				6.55		0.10	6320		52.6

Sample Location	HEIS Number	Sample Date	Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
underlying soil	J1RD29	1/22/13	1.67	U	1.67	3.47		2.78	400		1.39	0.283	B	0.56
green granules	J1RD31	1/22/13	2.63	U	2.63	3.07		2.63	352		1.32	0.279	J	0.53

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
underlying soil	J1RD29	1/22/13	3.37	B	5.57	0.400	B	0.56	7020		278	370		0.56
green granules	J1RD31	1/22/13	3.32	J	5.26	0.412	J	0.66	7580		52.6	373		2.63

Sample Location	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
underlying soil	J1RD29	1/22/13	11.3		5.57	11.0		2.78	19400		55.7	2110		1.39
green granules	J1RD31	1/22/13	10.9		7.89	10.9		5.26	18500		52.6	2090		2.63

Sample Location	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
underlying soil	J1RD29	1/22/13	5330		209	266		13.9	0.0106	B	0.026	5.57	U	5.57
green granules	J1RD31	1/22/13	5440		13.2	235		2.63	0.0142		0.027	2.63	U	2.63

Sample Location	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
underlying soil	J1RD29	1/22/13	7.08	B	11.1	1170		1110	0.835	U	0.835	174		5.57
green granules	J1RD31	1/22/13	7.39		6.58	1010		263	2.63	U	2.63	231		15.8

Sample Location	HEIS Number	Sample Date	Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
underlying soil	J1RD29	1/22/13	0.557	U	0.557	214		139	52.7		6.96	18000		27.8
green granules	J1RD31	1/22/13	2.63	U	2.63	244		132	51.2		2.63	17700		7.89

Sample Location	HEIS Number	Sample Date	Mercury (TCLP)			Arsenic (TCLP)			Barium (TCLP)			Cadmium		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
underlying soil	J1RD29	1/22/13	0.0002	U	2E-04	0.075	U	0.08	2.64		0.005	0.015	U	0.02
green granules	J1RD31	1/22/13	0.0002	U	2E-04	0.075	U	0.08	1.56		0.005	0.015	U	0.02

Sample Location	HEIS Number	Sample Date	Chromium			Lead (TCLP)			Selenium (TCLP)			Silver (TCLP)		
			mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL	mg/L	Q	PQL
underlying soil	J1RD29	1/22/13	0.125		0.025	1.35		0.05	0.10	U	0.10	0.030	U	0.030
green granules	J1RD31	1/22/13	0.11		0.025	1.71		0.05	0.10	U	0.10	0.030	U	0.030

Table A-1. 600-368 Waste Site Waste Characterization Data - Organics (2 Pages).

CONSTITUENT	CLASS	Underlying Soil 1/22/13			Green Granules 1/22/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	1790	U	1790	1640	U	1640
Acenaphthylene	PAH	1790	U	1790	1640	U	1640
Anthracene	PAH	1790	U	1790	1640	U	1640
Benzo(a)anthracene	PAH	1760	JD	1790	1850	D	1640
Benzo(a)pyrene	PAH	1790	U	1790	1640	U	1640
Benzo(b)fluoranthene	PAH	1790	U	1790	1640	U	1640
Benzo(ghi)perylene	PAH	1790	U	1790	1640	U	1640
Benzo(k)fluoranthene	PAH	1790	U	1790	1640	U	1640
Chrysene	PAH	1790	U	1790	1640	U	1640
Dibenz[a,h]anthracene	PAH	1790	U	1790	1640	U	1640
Fluoranthene	PAH	914	JD	1790	1640	U	1640
Fluorene	PAH	1790	U	1790	1640	U	1640
Indeno(1,2,3-cd)pyrene	PAH	1790	U	1790	1640	U	1640
Naphthalene	PAH	1790	U	1790	1640	U	1640
Phenanthrene	PAH	1790	U	1790	1640	U	1640
Pyrene	PAH	1790	U	1790	1640	U	1640

Table A-2. 600-369 Waste Site Characterization Data - Metals and TPH. (2 Pages)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-369:1	J1RD32	1/22/13	4880		59.4	7.13	U	7.13	11.9	U	11.9	239		5.94
600-369:5	J1RFN9	2/21/13							1.64	U	9.93	67.8		1.99
600-369:6	J1RD33	1/22/13	7210		14.3	1.72	U	1.72	2.29	B	2.86	68.8		1.43
600-369:8	J1RD34	1/22/13	6790		12.6	1.51	U	1.51	2.29	B	2.52	71.4		1.26

Sample Location	HEIS Number	Sample Date	Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-369:1	J1RD32	1/22/13	2.38	U	2.38	11.9	B	23.8	2.38	U	2.38	7500		1190
600-369:5	J1RFN9	2/21/13	0.215		0.0993				0.174	U	1.99			
600-369:6	J1RD33	1/22/13	0.266	B	0.573	5.73	U	5.73	0.573	U	0.573	3790		286
600-369:8	J1RD34	1/22/13	0.248	B	0.505	5.05	U	5.05	0.15	B	0.505	3810		252

Sample Location	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-369:1	J1RD32	1/22/13	6.39		2.38	23.8	U	23.8	11.8	B	11.9	16100		238
600-369:5	J1RFN9	2/21/13	6.13	U	9.93									
600-369:6	J1RD33	1/22/13	7.73		0.573	7.40		5.73	10.6		2.86	24600		57.3
600-369:8	J1RD34	1/22/13	7.68		0.505	7.33		5.05	11.2		2.52	23700		50.5

Sample Location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-369:1	J1RD32	1/22/13	8.07		5.94	2950		891	249		59.4	0.0575		0.0329
600-369:5	J1RFN9	2/21/13	7.28	U	9.93									
600-369:6	J1RD33	1/22/13	6.40		1.43	4210		215	327		14.3	0.0238	U	0.0238
600-369:8	J1RD34	1/22/13	7.47		1.26	4070		189	339		12.6	0.0261	U	0.0261

Sample Location	HEIS Number	Sample Date	Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-369:1	J1RD32	1/22/13	23.8	U	23.8	7.46	B	47.5	1290	B	4750	3.56	U	3.56
600-369:5	J1RFN9	2/21/13										-0.0576	U	9.93
600-369:6	J1RD33	1/22/13	5.73	U	5.73	7.43	B	11.5	1570		1150	0.859	U	0.859
600-369:8	J1RD34	1/22/13	5.05	U	5.05	7.23	B	10.1	1300		1010	0.757	U	0.757

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-369:1	J1RD32	1/22/13	1160		23.8	2.38	U	2.38	142	B	594	46.4		29.7
600-369:5	J1RFN9	2/21/13	-0.156	U	9.93									
600-369:6	J1RD33	1/22/13	533		5.73	0.573	U	0.573	217		143	68.1		7.16
600-369:8	J1RD34	1/22/13	538		5.05	0.505	U	0.505	209		126	69.3		6.31

Sample Location	HEIS Number	Sample Date	Zinc			TPH - Diesel			TPH - Motor Oil		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
600-369:1	J1RD32	1/22/13	40.8	B	119	553000		30600	1010000		91900
600-369:6	J1RD33	1/22/13	52.2		28.6						
600-369:8	J1RD34	1/22/13	52.7		25.2	50900		13900	213000		41700

Table A-2. 600-369 Waste Site Characterization Data - Organics (2 Pages).

CONSTITUENT	CLASS	600-369:1 J1RD32			600-369:6 J1RD33			600-369:8 J1RD34		
		1/22/13			1/22/13			1/22/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	310	U	310	127	JD	267	277	U	277
Acenaphthylene	PAH	280	JD	310	244	JD	267	277	U	277
Anthracene	PAH	310	U	310	267	U	267	277	U	277
Benzo(a)anthracene	PAH	310	U	310	70.2	JD	267	277	U	277
Benzo(a)pyrene	PAH	310	U	310	267	U	267	277	U	277
Benzo(b)fluoranthene	PAH	310	U	310	267	U	267	277	U	277
Benzo(ghi)perylene	PAH	310	U	310	267	U	267	277	U	277
Benzo(k)fluoranthene	PAH	79.3	JD	310	267	U	267	277	U	277
Chrysene	PAH	310	U	310	267	U	267	277	U	277
Dibenz[a,h]anthracene	PAH	310	U	310	267	U	267	277	U	277
Fluoranthene	PAH	1940	D	310	267	U	267	277	U	277
Fluorene	PAH	636	D	310	267	U	267	277	U	277
Indeno(1,2,3-cd)pyrene	PAH	310	U	310	267	U	267	277	U	277
Naphthalene	PAH	2020	D	310	267	U	267	277	U	277
Phenanthrene	PAH	426	D	310	267	U	267	277	U	277
Pyrene	PAH	235	JD	310	267	U	267	277	U	277

Table A-3. 600-368 Waste Site In-process Sampling Locations - Metals.

Sample Location	Sample Number	Sample Date	Aluminum			Antimony			Arsenic		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RK33	4/3/13	8710		1.6	0.40	U	0.40	3.0		0.69

Sample Location	Sample Number	Sample Date	Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RK33	4/3/13	246	M	0.079	0.32		0.034	1.2	B	1.0

Sample Location	Sample Number	Sample Date	Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RK33	4/3/13	0.25		0.043	3720	X	14.7	10.1		0.061

Sample Location	Sample Number	Sample Date	Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RK33	4/3/13	8.5	X	0.1	14.2		0.23	24000	X	4.0

Sample Location	Sample Number	Sample Date	Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RK33	4/3/13	12.9		0.28	4440		3.9	439		0.10

Sample Location	Sample Number	Sample Date	Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RK33	4/3/13	0.30	B	0.27	9.5	X	0.13	1730		42.8

Sample Location	Sample Number	Sample Date	Selenium			Silicon			Silver		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RK33	4/3/13	0.90	U	0.90	299		5.9	0.17	U	0.17

Sample Location	Sample Number	Sample Date	Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RK33	4/3/13	199		61.5	59.7		0.10	118		0.42

Sample Location	Sample Number	Sample Date	Mercury			Percent moisture (wet sample)		
			mg/kg	Q	PQL	%	Q	PQL
600-368	J1RK33	4/3/13	0.010	B	0.006	10.4		0

Table A-4. 600-369 Waste Site In-process Sampling Data - Organics.

LOCATION		600-369:6, J1RJT6			600-369:1, J1RJT7			600-369:5, J1RL15		
CONSTITUENT	CLASS	04/01/13 10:45 AM			04/01/13 10:55 AM			04/24/13 09:45 AM		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH							48	UD	48
Acenaphthylene	PAH							44	UD	44
Anthracene	PAH							15	UD	15
Benzo(a)anthracene	PAH							15	UD	15
Benzo(a)pyrene	PAH							31	UD	31
Benzo(b)fluoranthene	PAH							20	UD	20
Benzo(ghi)perylene	PAH							35	UD	35
Benzo(k)fluoranthene	PAH							19	UD	19
Chrysene	PAH							23	UD	23
Dibenz[a,h]anthracene	PAH							53	UD	53
Fluoranthene	PAH							63	UD	63
Fluorene	PAH							26	UD	26
Indeno(1,2,3-cd)pyrene	PAH							58	UD	58
Naphthalene	PAH							58	UD	58
Phenanthrene	PAH							58	UD	58
Pyrene	PAH							58	UD	58
Aroclor-1016	PCB	2.7	U	2.7	2.9	U	2.9			
Aroclor-1221	PCB	7.9	U	7.9	8.4	U	8.4			
Aroclor-1232	PCB	2.0	U	2.0	2.1	U	2.1			
Aroclor-1242	PCB	4.6	U	4.6	4.9	U	4.9			
Aroclor-1248	PCB	4.6	U	4.6	4.9	U	4.9			
Aroclor-1254	PCB	2.5	U	2.5	2.7	U	2.7			
Aroclor-1260	PCB	2.5	U	2.5	2.7	U	2.7			

Table A-4. 600-369 Waste Site In-process Sampling Data - Physical.

Location	Sample Number	Sample Date	Percent moisture (wet		
			%	Q	PQL
600-369:6	J1RJT6	4/1/13	0.88		0
600-369:5	J1RL15	4/24/13	0.62		0
600-369:1	J1RJT7	4/1/13	5.3		0

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:

600-368 and 600-369 Waste Sites Cleanup Verification, 95% UCL Calculation, 0600X-CA-V0144, Rev. 0, Washington Closure Hanford, Richland, Washington.

600-368 and 600-369 Waste Sites Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0600X-CA-V0145, 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-V0144

Subject: 600-368 and 600-369 Waste Sites 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	Onginator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 17 Attm. 1 = 14 Total = 32	J. D. Skoglie	N. K. Schiffern	I. B. Berezovskiy	D. F. Obenauer	12/3/13

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** 08/28/13 **Calc. No.** 0600X-CA-V0144 **Rev. No.** 0
Project 100-IU-2/6 Remediation **Job No.** 14655 **Checked** N. K. Schiffern **Date** 08/28/13
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations **Sheet No.** 1 of 17

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:

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) 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 composite data from verification samples (Attachment 1) from the 600-368 and 600-369 waste sites. 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 600-368 and 600-369 waste sites underwent statistical verification sampling for two decision units (600-369:3 (EXC3) and 600-369:5 (EXC5)) and composite samples at seven decision units (600-368, 600-369:1, 600-369:2, 600-369:4, 600-369:6, 600-369:7, and
600-369:8). Analytical results for all sampling locations are summarized in the tables provided on sheets 3, 4, and 5. Further information of the sample data quality is presented in the data quality assessment section of the associated RSVP.

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie **Date** 08/19/13 **Calc. No.** 0600X-CA-V0144 **Rev. No.** 0
Project 100-IU-2/6 Remediation **Job No.** 14655 **Checked** N. K. Schiffern **Date** 08/19/13
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations **Sheet No.** 2 of 17

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** 08/28/13 **Calc. No.** 0600X-CA-V0144 **Rev. No.** 0
Project 100-IU-2/6 Remediation **Job No.** 14655 **Checked** N. K. Schiffern **Date** 08/28/13
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations **Sheet No.** 3 of 17

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the 600-368, 600-369, 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.

600-368 and 600-369 Statistical Sampling Results Summary [a]

Analyte	600-369:3		600-369:5		Units
	95% UCL	Maximum	95% UCL	Maximum	
Antimony	--	0.53	--	--	mg/kg
Arsenic	12.5	--	3.4	--	mg/kg
Barium	68.4	--	81.9	--	mg/kg
Beryllium	0.23	--	0.16	--	mg/kg
Boron	1.4	--	--	1.5	mg/kg
Cadmium	0.29	--	0.25	--	mg/kg
Chromium	9.8	--	8.6	--	mg/kg
Cobalt	6.8	--	8.3	--	mg/kg
Copper	14.7	--	14.2	--	mg/kg
Lead	52.4	--	5.0	--	mg/kg
Manganese	306	--	368	--	mg/kg
Molybdenum	--	--	--	0.32	mg/kg
Nickel	11.5	--	9.3	--	mg/kg
Vanadium	40.7	--	62.1	--	mg/kg
Zinc	42.7	--	46.4	--	mg/kg
TPH - diesel range	7.5	--	10	--	mg/kg
TPH - diesel range extended	31	--	25	--	mg/kg
Acenaphthene	--	0.018	--	--	mg/kg
Benzo(a)anthracene	--	0.070	--	--	mg/kg
Benzo(a)pyrene	--	0.092	--	--	mg/kg
Benzo(b)fluoranthene	--	0.12	--	0.0076	mg/kg
Benzo(ghi)perylene	--	0.075	--	--	mg/kg
Benzo(k)fluoranthene	--	0.053	--	--	mg/kg
Chrysene	--	0.10	--	0.0059	mg/kg
Fluoranthene	--	0.17	--	--	mg/kg
Fluorene	--	0.0081	--	--	mg/kg
Indeno(1,2,3-cd)pyrene	--	0.074	--	--	mg/kg
Phenanthrene	--	0.064	--	--	mg/kg
Pyrene	--	0.13	--	--	mg/kg
3-Part Test Evaluation:	**600-369:3**		**600-369:5**		
95% UCL or maximum[a] >					
Cleanup Limit?	YES	YES	NO	NO	
> 10% above Cleanup Limit?	YES	YES	NO	NO	
Any sample > 2x Cleanup Limit?	YES	YES	NO	NO	

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

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

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie **Date** 08/19/13 **Calc. No.** 0600X-CA-V0144 **Rev. No.** 0
Project 100-IU-2/6 Remediation **Job No.** 14655 **Checked** N. K. Schiffern **Date** 08/19/13
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations **Sheet No.** 4 of 17

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the 600-368, 600-369, 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.

600-368 and 600-369 Maximum Sampling Results Summary[a]

Analyte	600-368	600-369:1	600-369:2	600-369:4	600-369:6	600-369:7	600-369:8	Units
Antimony	0.51	--	--	--	--	--	--	mg/kg
Arsenic	3.1	2.5	2.7	27.0	2.8	3.3	3.3	mg/kg
Barium	100	69.5	75.6	84.8	76.2	67.1	68.3	mg/kg
Beryllium	0.18	0.36	0.41	0.40	0.39	0.37	0.38	mg/kg
Boron	1.2	2.1	1.1	1.4	1.4	--	0.97	mg/kg
Cadmium	0.17	0.24	0.23	0.26	0.24	0.30	0.22	mg/kg
Chromium	9.6	6.9	8.9	9.9	8.6	8.0	8.6	mg/kg
Cobalt	9.9	6.5	7.0	7.0	7.0	7.3	6.6	mg/kg
Copper	12.9	12.0	13.9	14.1	13.8	15.4	12.7	mg/kg
Hexavalent chromium	0.231	--	--	--	--	--	--	mg/kg
Lead	6.8	4.0	3.8	59.6	4.2	5.5	3.5	mg/kg
Manganese	398	338	367	378	374	371	339	mg/kg
Molybdenum	--	0.27	--	--	--	--	--	mg/kg
Nickel	10.2	7.5	9.2	9.8	8.8	8.1	8.2	mg/kg
Vanadium	53.7	62.3	57.6	57.4	59.8	56.7	61.0	mg/kg
Zinc	55.6	43.3	44.7	46.7	45.1	50.3	43.8	mg/kg
Nitrogen in Nitrate and Nitrite	4.1	--	--	--	--	--	--	mg/kg
TPH - diesel range	--	24	2.9	6.0	40	3.3	65	mg/kg
TPH - diesel range extended	--	82	6.0	14	78	6.8	130	mg/kg
Benzo(a)anthracene	--	--	--	0.013	--	--	--	mg/kg
Benzo(a)pyrene	--	--	--	0.014	--	--	--	mg/kg
Benzo(b)fluoranthene	--	--	0.010	0.023	--	--	--	mg/kg
Benzo(ghi)perylene	--	--	--	0.015	--	--	--	mg/kg
Benzo(k)fluoranthene	--	--	--	0.0061	--	--	--	mg/kg
Chrysene	--	--	--	0.014	--	--	--	mg/kg
Fluoranthene	--	--	--	0.026	--	--	--	mg/kg
Pyrene	--	--	--	0.028	--	--	--	mg/kg

[a] Decision unit 600-369:4 is located within an orchard area. Therefore, arsenic and lead will be excluded from the Contaminants of Potential Concern (COPC) list and will be discussed in this sites RSVP.

-- = not applicable

Washington Closure Hanford **CALCULATION SHEET**

Originator J. D. Skoglie **Date** 08/19/13 **Calc. No.** 0600X-CA-V0144 **Rev. No.** 0
Project 100-IU-2/6 Remediation **Job No.** 14655 **Checked** N. K. Schiffern **Date** 08/19/13
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations **Sheet No.** 5 of 17

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the 600-368, 600-369, the WAC 173-340-740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the RSVP for this site.

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

Analyte	Duplicate Analysis			
	600-368	600-369:8 Area D	EXC3-8	EXC5-12
Aluminum	4.5%	1.0%	2.2%	3.6%
Barium	1.9%	2.5%	10.3%	6.4%
Calcium	3.0%	4.3%	0.9%	2.4%
Chromium	6.5%	15.0%	7.4%	1.3%
Copper	3.1%	0.8%	4.3%	1.6%
Iron	3.0%	3.4%	3.2%	0.8%
Magnesium	5.3%	0.2%	0.0%	1.1%
Manganese	0.8%	3.3%	1.6%	0.8%
Silicon	14.0%	12.5%	10.8%	***39.1%***
Vanadium	1.3%	5.9%	0.3%	0.2%
Zinc	2.6%	2.5%	1.3%	0.2%
TPH - Diesel EXT				9.8%

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

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations

Date 08/28/13
Job No. 14655
Calc. No. 0600X-CA-V0144
Checked N. K. Schiffern

Rev. No. 0
Date 08/28/13
Sheet No. 6 of 17

600-368 and 600-369 Statistical Calculations
Verification Data - 600-369:3 (EXC3)

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
EXC3-8	J1RN49	5/28/13	3.1		0.59	51.7		0.068	0.20		0.030	0.88	U	0.88	0.23		0.037	9.8		0.052	5.7		0.090	13.6		0.20
Duplicate of J1RN49	J1RN54	5/28/13	3.0		0.57	57.3		0.066	0.19		0.029	0.85	U	0.85	0.23		0.036	9.1		0.050	5.9		0.087	14.2		0.19
EXC3-1	J1RN42	5/28/13	9.0		0.65	68.9		0.074	0.25		0.032	1.3	B	0.96	0.27		0.040	10.0		0.057	7.5		0.20	13.9		0.21
EXC3-2	J1RN43	5/28/13	4.2		0.61	46.1		0.071	0.20		0.031	1.0	B	0.91	0.23		0.038	10.0		0.054	5.4		0.093	13.2		0.20
EXC3-3	J1RN44	5/28/13	3.0		0.60	51.5		0.069	0.20		0.030	0.89	U	0.89	0.21		0.037	10.0		0.052	5.0		0.090	11.4		0.20
EXC3-4	J1RN45	5/28/13	2.6		0.60	53.3		0.070	0.21		0.030	0.90	U	0.90	0.21		0.038	8.8		0.053	5.8		0.092	13.4		0.20
EXC3-5	J1RN46	5/28/13	21.0		0.57	80.9		0.065	0.27		0.028	1.4	B	0.84	0.30		0.035	9.2		0.050	7.8		0.086	16.6		0.19
EXC3-6	J1RN47	5/28/13	4.2		0.62	58.0		0.071	0.21		0.031	0.92	U	0.92	0.21		0.039	9.4		0.054	5.8		0.094	13.7		0.20
EXC3-7	J1RN48	5/28/13	2.7		0.65	43.6		0.074	0.15	B	0.032	0.96	U	0.96	0.22		0.040	8.0		0.057	4.9		0.098	11.1		0.21
EXC3-9	J1RN50	5/28/13	16.7		0.63	70.2		0.073	0.22		0.032	1.4	B	0.94	0.33		0.039	8.0		0.056	7.0		0.096	13.8		0.21
EXC3-10	J1RN51	5/28/13	5.6		0.57	58.6		0.065	0.22		0.028	2.4		0.84	0.24		0.035	10.0		0.050	6.1		0.086	13.1		0.19
EXC3-11	J1RN52	5/28/13	11.5		0.66	81.1		0.076	0.25		0.033	1.6	B	0.98	0.35		0.041	10.7		0.058	7.5		0.10	17.5		0.22
EXC3-12	J1RN53	5/28/13	4.6		0.61	65.2		0.070	0.20		0.031	1.3	B	0.91	0.35		0.038	8.9		0.054	6.2		0.092	12.1		0.20

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
EXC3-8	J1RN49/ J1RN54	5/28/13	3.1	54.5	0.20	0.43	0.23	9.5	5.8	13.9
EXC3-1	J1RN42	5/28/13	9.0	68.9	0.25	1.3	0.27	10.0	7.5	13.9
EXC3-2	J1RN43	5/28/13	4.2	46.1	0.20	1.0	0.23	10.0	5.4	13.2
EXC3-3	J1RN44	5/28/13	3.0	51.5	0.20	0.45	0.21	10.0	5.0	11.4
EXC3-4	J1RN45	5/28/13	2.6	53.3	0.21	0.45	0.21	8.8	5.8	13.4
EXC3-5	J1RN46	5/28/13	21.0	80.9	0.27	1.4	0.30	9.2	7.8	16.6
EXC3-6	J1RN47	5/28/13	4.2	58.0	0.21	0.46	0.21	9.4	5.8	13.7
EXC3-7	J1RN48	5/28/13	2.7	43.6	0.15	0.48	0.22	8.0	4.9	11.1
EXC3-9	J1RN50	5/28/13	16.7	70.2	0.22	1.4	0.33	8.0	7.0	13.8
EXC3-10	J1RN51	5/28/13	5.6	58.6	0.22	2.4	0.24	10.0	6.1	13.1
EXC3-11	J1RN52	5/28/13	11.5	81.1	0.25	1.6	0.35	10.7	7.5	17.5
EXC3-12	J1RN53	5/28/13	4.6	65.2	0.20	1.3	0.35	8.9	6.2	12.1

Statistical Computations

	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat normal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	42%	0%	0%	0%	0%
Mean	7.3	61.0	0.21	1.1	0.26	9.4	6.2	13.6
Standard deviation	6.1	12.4	0.031	0.62	0.056	0.84	0.99	1.9
95% UCL on mean	12.5	68.4	0.23	1.4	0.29	9.8	6.8	14.7
Maximum value	21.0	81.1	0.27	2.4	0.35	10.7	7.8	17.5
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW, & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NA
> 10% above Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NA
WAC 173-340 Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations

Date 08/28/13
Job No. 14655

Calc. No. 0600X-CA-V0144
Checked N. K. Schiffern

Rev. No. 0
Date 08/28/13
Sheet No. 7 of 17

600-368 and 600-369 Statistical Calculations
Verification Data - 600-369:3 (EXC3)

Sample Area	Sample Number	Sample Date	Lead			Manganese			Nickel			Vanadium			Zinc			TPH - Diesel Range			TPH - Diesel Range EXT		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC3-8	J1RN49	5/28/13	6.2		0.24	255	X	0.090	10.1	X	0.11	36.2		0.085	30.9	X	0.36	3100	J	640	4300		940
Duplicate of J1RN49	J1RN54	5/28/13	5.2		0.23	259	X	0.087	10.2	X	0.11	36.3		0.082	31.3	X	0.35	3000	J	690	4400		1000
EXC3-1	J1RN42	5/28/13	7.1		0.26	311	X	0.098	11.6	X	0.12	40.4		0.092	36.3	X	0.39	4000		670	5600		980
EXC3-2	J1RN43	5/28/13	3.6		0.25	247	X	0.093	11.2	X	0.11	29.9		0.087	30.3	X	0.37	1500	J	660	2100	J	970
EXC3-3	J1RN44	5/28/13	4.0		0.24	231	X	0.090	13.9	X	0.11	27.3		0.085	28.6	X	0.36	2500	J	680	3600	J	1000
EXC3-4	J1RN45	5/28/13	4.1		0.25	253	X	0.092	10.8	X	0.11	34.7		0.086	30.1	X	0.36	1000	J	680	1100	J	1000
EXC3-5	J1RN46	5/28/13	74.8		0.23	351	X	0.086	10.2	X	0.11	45.2		0.081	42.3	X	0.34	4900		680	10000		990
EXC3-6	J1RN47	5/28/13	4.3		0.25	260	X	0.094	10.2	X	0.12	33.2		0.088	29.8	X	0.37	2700	J	670	3900		980
EXC3-7	J1RN48	5/28/13	3.7		0.26	207	X	0.098	9.4	X	0.12	33.2		0.092	27.0	X	0.39	3900		660	4500		970
EXC3-9	J1RN50	5/28/13	150		0.26	322	X	0.096	9.3	X	0.12	44.0		0.090	45.4	X	0.38	11000		670	42000		990
EXC3-10	J1RN51	5/28/13	11.1		0.23	285	X	0.086	11.6	X	0.11	36.0		0.081	35.0	X	0.34	3200	J	630	5200		930
EXC3-11	J1RN52	5/28/13	67.6		0.27	342	X	0.10	11.5	X	0.12	45.5		0.094	64.2	X	0.40	5500		650	12000		960
EXC3-12	J1RN53	5/28/13	33.5		0.25	288	X	0.092	9.9	X	0.11	40.1		0.087	49.3	X	0.37	9900		660	41000		970

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Lead mg/kg			Manganese mg/kg			Nickel mg/kg			Vanadium mg/kg			Zinc mg/kg			TPH - Diesel Range ug/kg			TPH - Diesel Range EXT ug/kg		
EXC3-8	J1RN49/ J1RN54	5/28/13	5.7			257			10.2			36.3			31.1			3050			4350		
EXC3-1	J1RN42	5/28/13	7.1			311			11.6			40.4			36.3			4000			5600		
EXC3-2	J1RN43	5/28/13	3.6			247			11.2			29.9			30.3			1500			2100		
EXC3-3	J1RN44	5/28/13	4.0			231			13.9			27.3			28.6			2500			3600		
EXC3-4	J1RN45	5/28/13	4.1			253			10.8			34.7			30.1			1000			1100		
EXC3-5	J1RN46	5/28/13	74.8			351			10.2			45.2			42.3			4900			10000		
EXC3-6	J1RN47	5/28/13	4.3			260			10.2			33.2			29.8			2700			3900		
EXC3-7	J1RN48	5/28/13	3.7			207			9.4			33.2			27.0			3900			4500		
EXC3-9	J1RN50	5/28/13	150			322			9.3			44.0			45.4			11000			42000		
EXC3-10	J1RN51	5/28/13	11.1			285			11.6			36.0			35.0			3200			5200		
EXC3-11	J1RN52	5/28/13	67.6			342			11.5			45.5			64.2			5500			12000		
EXC3-12	J1RN53	5/28/13	33.5			288			9.9			40.1			49.3			9900			41000		

Statistical Computations

	Lead	Manganese	Nickel	Vanadium	Zinc	TPH - Diesel Range	TPH - Diesel Range EXT
95% UCL based on	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), 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.
N	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%	0%
Mean	30.8	280	10.8	37.1	37.5	4429	11279
Standard deviation	45.4	44.9	1.3	6.0	11.0	3095	14440
95% UCL on mean	52.4	306	11.5	40.7	42.7	7488	30592
Maximum value	150	351	13.9	45.5	64.2	11000	42000
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise	10.2 GW & River Protection	512 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200000 ug/kg DE, GW & River Protection	200000 ug/kg DE, GW & River Protection
WAC 173-340 3-PART TEST							
95% UCL > Cleanup Limit?	YES	NA	NA	NA	NA	NO	NO
> 10% above Cleanup Limit?	YES	NA	NA	NA	NA	NO	NO
Any sample > 2X Cleanup Limit?	YES	NA	NA	NA	NA	NO	NO
WAC 173-340 Compliance?	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations

Date 08/28/13
Job No. 14655
Calc. No. 0600X-CA-V0144
Checked N. K. Schiffern

Rev. No. 0
Date 08/28/13
Sheet No. 8 of 17

600-368 and 600-369 Statistical Calculations
Verification Data - 600-369:5 (EXC5)

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium 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
EXC5-12	J1RN67	5/29/13	2.9		0.70	82.3		0.081	0.15	B	0.035	0.25		0.044	7.9		0.062	8.4	X	0.11	12.5		0.23	4.7		0.29
Duplicate of J1RN67	J1RN68	5/29/13	3.1		0.62	77.2		0.072	0.17	B	0.031	0.25		0.039	7.8		0.055	8.1	X	0.095	12.7		0.21	4.7		0.26
EXC5-1	J1RN56	5/29/13	3.5		0.71	77.1		0.082	0.17	B	0.036	0.27		0.044	9.0		0.063	8.4	X	0.11	14.1		0.24	4.8		0.29
EXC5-2	J1RN57	5/29/13	3.7		0.73	76.8		0.084	0.18	B	0.036	0.25		0.045	9.5		0.064	8.6	X	0.11	15.2		0.24	5.5		0.30
EXC5-3	J1RN58	5/29/13	3.5		0.67	75.2		0.077	0.16	B	0.033	0.24		0.041	8.6		0.059	8.3	X	0.10	15.2		0.22	5.0		0.27
EXC5-4	J1RN59	5/29/13	3.2		0.62	76.1		0.071	0.14	B	0.031	0.24		0.039	8.3		0.055	8.0	X	0.094	14.2		0.20	4.8		0.25
EXC5-5	J1RN60	5/29/13	3.2		0.65	72.3		0.074	0.14	B	0.032	0.23		0.040	7.5		0.057	8.0	X	0.098	13.7		0.21	4.9		0.26
EXC5-6	J1RN61	5/29/13	3.1		0.71	73.9		0.082	0.15	B	0.036	0.24		0.044	8.0		0.063	8.0	X	0.11	13.4		0.23	4.9		0.29
EXC5-7	J1RN62	5/29/13	2.7		0.61	69.8		0.070	0.12	B	0.030	0.24		0.038	7.2		0.053	7.9	X	0.092	12.1		0.20	4.7		0.25
EXC5-8	J1RN63	5/29/13	3.5		0.69	98.0		0.080	0.14	B	0.035	0.24		0.043	7.8		0.061	8.2	X	0.11	13.8		0.23	4.8		0.28
EXC5-9	J1RN66	5/29/13	3.4		0.65	80.5		0.075	0.17	B	0.033	0.27		0.041	9.1		0.057	8.5	X	0.099	14.4		0.21	5.0		0.27
EXC5-10	J1RN65	5/29/13	2.8		0.63	87.5		0.073	0.12	B	0.032	0.23		0.039	8.4		0.056	7.5	X	0.096	11.8		0.21	5.1		0.26
EXC5-11	J1RN64	5/29/13	3.0		0.65	72.2		0.075	0.15	B	0.033	0.24		0.040	7.9		0.057	7.9	X	0.099	13.1		0.21	4.9		0.27

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg			Barium mg/kg			Beryllium mg/kg			Cadmium mg/kg			Chromium mg/kg			Cobalt mg/kg			Copper mg/kg			Lead mg/kg		
EXC5-12	J1RN67/ J1RN68	5/29/13	3.0			79.8			0.16			0.25			7.9			8.3			12.6			4.7		
EXC5-1	J1RN56	5/29/13	3.5			77.1			0.17			0.27			9.0			8.4			14.1			4.8		
EXC5-2	J1RN57	5/29/13	3.7			76.8			0.18			0.25			9.5			8.6			15.2			5.5		
EXC5-3	J1RN58	5/29/13	3.5			75.2			0.16			0.24			8.6			8.3			15.2			5.0		
EXC5-4	J1RN59	5/29/13	3.2			76.1			0.14			0.24			8.3			8.0			14.2			4.8		
EXC5-5	J1RN60	5/29/13	3.2			72.3			0.14			0.23			7.5			8.0			13.7			4.9		
EXC5-6	J1RN61	5/29/13	3.1			73.9			0.15			0.24			8.0			8.0			13.4			4.9		
EXC5-7	J1RN62	5/29/13	2.7			69.8			0.12			0.24			7.2			7.9			12.1			4.7		
EXC5-8	J1RN63	5/29/13	3.5			98.0			0.14			0.24			7.8			8.2			13.8			4.8		
EXC5-9	J1RN66	5/29/13	3.4			80.5			0.17			0.27			9.1			8.5			14.4			5.0		
EXC5-10	J1RN65	5/29/13	2.8			87.5			0.12			0.23			8.4			7.5			11.8			5.1		
EXC5-11	J1RN64	5/29/13	3.0			72.2			0.15			0.24			7.9			7.9			13.1			4.9		

Statistical Computations

	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%
Mean	3.2	78.3	0.15	0.245	8.3	8.13	13.6	4.9
Standard deviation	0.31	7.8	0.019	0.013	0.69	0.31	1.1	0.22
95% UCL on mean	3.4	81.9	0.16	0.25	8.6	8.3	14.2	5.0
Maximum value	3.7	98.0	0.18	0.27	9.5	8.6	15.2	5.5
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW, & River Protection	200 GW Protection	1.51 GW & River Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection	10.2 GW & River Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA
> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA
WAC 173-340 Compliance?	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (10.2 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 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations

Date 08/28/13
Job No. 14655

Calc. No. 0600X-CA-V0144
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Date 08/28/13
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600-368 and 600-369 Statistical Calculations
Verification Data - 600-369:5 (EXC5)

Sample Area	Sample Number	Sample Date	Manganese mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL	TPH - Diesel Range ug/kg	Q	PQL	TPH - Diesel Range EXT ug/kg	Q	PQL
EXC5-12	J1RN67	5/29/13	378	X	0.11	8.8	X	0.13	60.7		0.10	46.8	X	0.42	20000	B	700	43000	B	1000
Duplicate of J1RN67	J1RN68	5/29/13	375	X	0.095	8.7	X	0.12	60.6		0.089	46.9	X	0.38	18000	B	690	39000	B	1000
EXC5-1	J1RN56	5/29/13	388	X	0.11	9.5	X	0.13	64.0		0.10	47.6	X	0.43	2700	JB	710	5300	B	1000
EXC5-2	J1RN57	5/29/13	373	X	0.11	10.1	X	0.14	61.6		0.10	45.7	X	0.44	3200	JB	710	7100	B	1000
EXC5-3	J1RN58	5/29/13	364	X	0.10	9.3	X	0.12	62.5		0.095	45.1	X	0.40	3400	JB	720	6200	B	1100
EXC5-4	J1RN59	5/29/13	352	X	0.094	9.6	X	0.12	61.7		0.088	44.5	X	0.37	3900	JB	720	8000	B	1100
EXC5-5	J1RN60	5/29/13	354	X	0.098	8.3	X	0.12	61.8		0.092	44.7	X	0.39	5000	B	720	11000	B	1100
EXC5-6	J1RN61	5/29/13	354	X	0.11	8.4	X	0.13	61.6		0.10	46.5	X	0.43	16000	B	720	40000	B	1100
EXC5-7	J1RN62	5/29/13	345	X	0.092	8.1	X	0.11	61.3		0.087	45.6	X	0.37	6000	B	680	14000	B	1000
EXC5-8	J1RN63	5/29/13	357	X	0.11	9.1	X	0.13	61.9		0.099	44.9	X	0.42	4600	B	680	12000	B	1000
EXC5-9	J1RN66	5/29/13	371	X	0.099	9.5	X	0.12	61.2		0.093	45.5	X	0.39	5400	B	690	11000	B	1000
EXC5-10	J1RN65	5/29/13	338	X	0.096	8.4	X	0.12	57.1		0.090	47.2	X	0.38	7000	B	710	18000	B	1000
EXC5-11	J1RN64	5/29/13	347	X	0.099	8.5	X	0.12	60.7		0.093	46.2	X	0.39	6500	B	700	17000	B	1000

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Manganese mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	TPH - Diesel Range ug/kg	TPH - Diesel Range EXT ug/kg
EXC5-12	J1RN67/ J1RN68	5/29/13	377	8.8	60.7	46.9	19000	41000
EXC5-1	J1RN56	5/29/13	388	9.5	64.0	47.6	2700	5300
EXC5-2	J1RN57	5/29/13	373	10.1	61.6	45.7	3200	7100
EXC5-3	J1RN58	5/29/13	364	9.3	62.5	45.1	3400	6200
EXC5-4	J1RN59	5/29/13	352	9.6	61.7	44.5	3900	8000
EXC5-5	J1RN60	5/29/13	354	8.3	61.8	44.7	5000	11000
EXC5-6	J1RN61	5/29/13	354	8.4	61.6	46.5	16000	40000
EXC5-7	J1RN62	5/29/13	345	8.1	61.3	45.6	6000	14000
EXC5-8	J1RN63	5/29/13	357	9.1	61.9	44.9	4600	12000
EXC5-9	J1RN66	5/29/13	371	9.5	61.2	45.5	5400	11000
EXC5-10	J1RN65	5/29/13	338	8.4	57.1	47.2	7000	18000
EXC5-11	J1RN64	5/29/13	347	8.5	60.7	46.2	6500	17000

Statistical Computations

	Manganese	Nickel	Vanadium	Zinc	TPH - Diesel Range	TPH - Diesel Range EXT
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), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%
Mean	360	9.0	61.3	45.9	6892	15883
Standard deviation	14.7	0.64	1.6	1.01	5169	12171
95% UCL on mean	368	9.3	62.1	46.4	10278	25370
Maximum value	388	10.1	64.0	47.6	20000	43000
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise	512 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200000 ug/kg DE, GW, & River Protection	200000 ug/kg DE, GW, & River Protection
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NO
> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NO
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NO
WAC 173-340 Compliance?	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	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.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations

CALCULATION SHEET

Date 08/19/13
Job No. 14655

Calc. No. 0600X-CA-V0144
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Date 08/19/13
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Ecology Software (MTCAStat) Results, 600-369:3 Subsite

DATA	ID	Arsenic 95% UCL Calculation			
	J1RN49/				
3.1	J1RN54				
9.0	J1RN42				
4.2	J1RN43	Number of samples		Uncensored values	
3.0	J1RN44	Uncensored	12	Mean	7.3
2.6	J1RN45	Censored		Lognormal mean	7.3
21.0	J1RN46	Detection limit or PQL		Std. devn.	6.1
4.2	J1RN47	Method detection limit		Median	4.4
2.7	J1RN48	TOTAL	12	Min.	2.6
16.7	J1RN50			Max.	21.0
5.6	J1RN51				
11.5	J1RN52				
4.6	J1RN53				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.908		r-squared is: 0.785	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		12.5	

DATA	ID	Barium 95% UCL Calculation			
	J1RN49/				
54.5	J1RN54				
68.9	J1RN42				
46.1	J1RN43	Number of samples		Uncensored values	
51.5	J1RN44	Uncensored	12	Mean	61.0
53.3	J1RN45	Censored		Lognormal mean	61.1
80.9	J1RN46	Detection limit or PQL		Std. devn.	12.4
58.0	J1RN47	Method detection limit		Median	58.3
43.6	J1RN48	TOTAL	12	Min.	43.6
70.2	J1RN50			Max.	81.1
58.6	J1RN51				
81.1	J1RN52				
65.2	J1RN53				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.974		r-squared is: 0.958	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		68.4	

DATA	ID	Beryllium 95% UCL Calculation			
	J1RN49/				
0.20	J1RN54				
0.25	J1RN42				
0.20	J1RN43	Number of samples		Uncensored values	
0.20	J1RN44	Uncensored	12	Mean	0.21
0.21	J1RN45	Censored		Lognormal mean	0.21
0.27	J1RN46	Detection limit or PQL		Std. devn.	0.031
0.21	J1RN47	Method detection limit		Median	0.21
0.15	J1RN48	TOTAL	12	Min.	0.15
0.22	J1RN50			Max.	0.27
0.22	J1RN51				
0.25	J1RN52				
0.20	J1RN53				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.897		r-squared is: 0.919	
		Recommendations:			
		Use normal distribution.			
		UCL (based on t-statistic) is		0.23	

DATA	ID	Boron 95% UCL Calculation			
	J1RN49/				
0.43	J1RN54				
1.3	J1RN42				
1.0	J1RN43	Number of samples		Uncensored values	
0.45	J1RN44	Uncensored	12	Mean	1.1
0.45	J1RN45	Censored		Lognormal mean	1.1
1.4	J1RN46	Detection limit or PQL		Std. devn.	0.62
0.46	J1RN47	Method detection limit		Median	1.2
0.48	J1RN48	TOTAL	12	Min.	0.43
1.4	J1RN50			Max.	2.4
2.4	J1RN51				
1.6	J1RN52				
1.3	J1RN53				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.861		r-squared is: 0.866	
		Recommendations:			
		Reject BOTH lognormal and normal distributions.			
		UCL (based on Z-statistic) is		1.4	

DATA	ID	Cadmium 95% UCL Calculation			
	J1RN49/				
0.23	J1RN54				
0.27	J1RN42				
0.23	J1RN43	Number of samples		Uncensored values	
0.21	J1RN44	Uncensored	12	Mean	0.26
0.21	J1RN45	Censored		Lognormal mean	0.26
0.30	J1RN46	Detection limit or PQL		Std. devn.	0.056
0.21	J1RN47	Method detection limit		Median	0.24
0.22	J1RN48	TOTAL	12	Min.	0.21
0.33	J1RN50			Max.	0.35
0.24	J1RN51				
0.35	J1RN52				
0.35	J1RN53				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.874		r-squared is: 0.856	
		Recommendations:			
		Reject BOTH lognormal and normal distributions.			
		UCL (based on Z-statistic) is		0.29	

DATA	ID	Chromium 95% UCL Calculation			
	J1RN49/				
9.5	J1RN54				
10.0	J1RN42				
10.0	J1RN43	Number of samples		Uncensored values	
10.0	J1RN44	Uncensored	12	Mean	9.4
8.8	J1RN45	Censored		Lognormal mean	9.4
9.2	J1RN46	Detection limit or PQL		Std. devn.	0.84
9.4	J1RN47	Method detection limit		Median	9.4
8.0	J1RN48	TOTAL	12	Min.	8.0
8.0	J1RN50			Max.	10.7
10.0	J1RN51				
10.7	J1RN52				
8.9	J1RN53				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.927		r-squared is: 0.937	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		9.8	

DATA	ID	Cobalt 95% UCL Calculation			
	J1RN49/				
5.8	J1RN54				
7.5	J1RN42				
5.4	J1RN43	Number of samples		Uncensored values	
5.0	J1RN44	Uncensored	12	Mean	6.2
5.8	J1RN45	Censored		Lognormal mean	6.2
7.8	J1RN46	Detection limit or PQL		Std. devn.	0.99
5.8	J1RN47	Method detection limit		Median	6.0
4.9	J1RN48	TOTAL	12	Min.	4.9
7.0	J1RN50			Max.	7.8
6.1	J1RN51				
7.5	J1RN52				
6.2	J1RN53				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.945		r-squared is: 0.933	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		6.8	

DATA	ID	Copper 95% UCL Calculation			
	J1RN49/				
13.9	J1RN54				
13.9	J1RN42				
13.2	J1RN43	Number of samples		Uncensored values	
11.4	J1RN44	Uncensored	12	Mean	13.6
13.4	J1RN45	Censored		Lognormal mean	13.6
16.6	J1RN46	Detection limit or PQL		Std. devn.	1.9
13.7	J1RN47	Method detection limit		Median	13.6
11.1	J1RN48	TOTAL	12	Min.	11.1
13.8	J1RN50			Max.	17.5
13.1	J1RN51				
17.5	J1RN52				
12.1	J1RN53				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.916		r-squared is: 0.891	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		14.7	

DATA	ID	Lead 95% UCL Calculation			
	J1RN49/				
5.7	J1RN54				
7.1	J1RN42				
3.6	J1RN43	Number of samples		Uncensored values	
4.0	J1RN44	Uncensored	12	Mean	30.8
4.1	J1RN45	Censored		Lognormal mean	31.4
74.8	J1RN46	Detection limit or PQL		Std. devn.	45.4
4.3	J1RN47	Method detection limit		Median	6.4
3.7	J1RN48	TOTAL	12	Min.	3.6
150	J1RN50			Max.	150
11.1	J1RN51				
67.6	J1RN52				
33.5	J1RN53				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.838		r-squared is: 0.668	
		Recommendations:			
		Reject BOTH lognormal and normal distributions.			
		UCL (based on Z-statistic) is		52.4	

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Washington Closure Hanford
Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
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DATA	ID	Manganese 95% UCL Calculation			
	J1RN49/				
257	J1RN54				
311	J1RN42				
247	J1RN43	Number of samples		Uncensored values	
231	J1RN44	Uncensored	12	Mean	280
253	J1RN45	Censored		Lognormal mean	280
351	J1RN46	Detection limit or PQL		Std. devn.	44.9
260	J1RN47	Method detection limit		Median	273
207	J1RN48	TOTAL	12	Min.	207
322	J1RN50			Max.	351
285	J1RN51				
342	J1RN52				
288	J1RN53				

Lognormal distribution? Normal distribution?
r-squared is: 0.978 r-squared is: 0.974
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 306

DATA	ID	Nickel 95% UCL Calculation			
	J1RN49/				
10.2	J1RN54				
11.6	J1RN42				
11.2	J1RN43	Number of samples		Uncensored values	
13.9	J1RN44	Uncensored	12	Mean	10.8
10.8	J1RN45	Censored		Lognormal mean	10.8
10.2	J1RN46	Detection limit or PQL		Std. devn.	1.3
10.2	J1RN47	Method detection limit		Median	10.5
9.4	J1RN48	TOTAL	12	Min.	9.3
9.3	J1RN50			Max.	13.9
11.6	J1RN51				
11.5	J1RN52				
9.9	J1RN53				

Lognormal distribution? Normal distribution?
r-squared is: 0.916 r-squared is: 0.882
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.5

DATA	ID	Vanadium 95% UCL Calculation			
	J1RN49/				
36.3	J1RN54				
40.4	J1RN42				
29.9	J1RN43	Number of samples		Uncensored values	
27.3	J1RN44	Uncensored	12	Mean	37.1
34.7	J1RN45	Censored		Lognormal mean	37.2
45.2	J1RN46	Detection limit or PQL		Std. devn.	6.0
33.2	J1RN47	Method detection limit		Median	36.1
33.2	J1RN48	TOTAL	12	Min.	27.3
44.0	J1RN50			Max.	45.5
36.0	J1RN51				
45.5	J1RN52				
40.1	J1RN53				

Lognormal distribution? Normal distribution?
r-squared is: 0.964 r-squared is: 0.965
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 40.7

DATA	ID	Zinc 95% UCL Calculation			
	J1RN49/				
31.1	J1RN54				
36.3	J1RN42				
30.3	J1RN43	Number of samples		Uncensored values	
28.6	J1RN44	Uncensored	12	Mean	37.5
30.1	J1RN45	Censored		Lognormal mean	37.5
42.3	J1RN46	Detection limit or PQL		Std. devn.	11.0
29.8	J1RN47	Method detection limit		Median	33.1
27.0	J1RN48	TOTAL	12	Min.	27.0
45.4	J1RN50			Max.	64.2
35.0	J1RN51				
64.2	J1RN52				
49.3	J1RN53				

Lognormal distribution? Normal distribution?
r-squared is: 0.896 r-squared is: 0.833
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 42.7

DATA	ID	TPH - Diesel Range 95% UCL Calculation			
	J1RN49/				
3050	J1RN54				
4000	J1RN42				
1500	J1RN43	Number of samples		Uncensored values	
2500	J1RN44	Uncensored	12	Mean	4429
1000	J1RN45	Censored		Lognormal mean	4548
4900	J1RN46	Detection limit or PQL		Std. devn.	3095
2700	J1RN47	Method detection limit		Median	3550
3900	J1RN48	TOTAL	12	Min.	1000
11000	J1RN50			Max.	11000
3200	J1RN51				
5500	J1RN52				
9900	J1RN53				

Lognormal distribution? Normal distribution?
r-squared is: 0.969 r-squared is: 0.844
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 7488

DATA	ID	TPH - Diesel Range EXT 95% UCL Calculation			
	J1RN49/				
4350	J1RN54				
5600	J1RN42				
2100	J1RN43	Number of samples		Uncensored values	
3600	J1RN44	Uncensored	12	Mean	11279
1100	J1RN45	Censored		Lognormal mean	11268
10000	J1RN46	Detection limit or PQL		Std. devn.	14440
3900	J1RN47	Method detection limit		Median	4850
4500	J1RN48	TOTAL	12	Min.	1100
42000	J1RN50			Max.	42000
5200	J1RN51				
12000	J1RN52				
41000	J1RN53				

Lognormal distribution? Normal distribution?
r-squared is: 0.924 r-squared is: 0.642
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 30592

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DATA	ID	Arsenic 95% UCL Calculation			
	J1RN67/				
3.0	J1RN68				
3.5	J1RN56				
3.7	J1RN57	Number of samples		Uncensored values	
3.5	J1RN58	Uncensored	12	Mean	3.2
3.2	J1RN59	Censored		Lognormal mean	3.2
3.2	J1RN60	Detection limit or PQL		Std. devn.	0.31
3.1	J1RN61	Method detection limit		Median	3.2
2.7	J1RN62	TOTAL	12	Min.	2.7
3.5	J1RN63			Max.	3.7
3.4	J1RN66				
2.8	J1RN65				
3.0	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.961		r-squared is: 0.965	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is	3.4		

DATA	ID	Barium 95% UCL Calculation			
	J1RN67/				
79.8	J1RN68				
77.1	J1RN56				
76.8	J1RN57	Number of samples		Uncensored values	
75.2	J1RN58	Uncensored	12	Mean	78.3
76.1	J1RN59	Censored		Lognormal mean	78.3
72.3	J1RN60	Detection limit or PQL		Std. devn.	7.8
73.9	J1RN61	Method detection limit		Median	76.5
69.8	J1RN62	TOTAL	12	Min.	69.8
98.0	J1RN63			Max.	98.0
80.5	J1RN66				
87.5	J1RN65				
72.2	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.861		r-squared is: 0.825	
		Recommendations:			
		Reject BOTH lognormal and normal distributions			
		UCL (based on Z-statistic) is	81.9		

DATA	ID	Beryllium 95% UCL Calculation			
	J1RN67/				
0.16	J1RN68				
0.17	J1RN56				
0.18	J1RN57	Number of samples		Uncensored values	
0.16	J1RN58	Uncensored	12	Mean	0.15
0.14	J1RN59	Censored		Lognormal mean	0.15
0.14	J1RN60	Detection limit or PQL		Std. devn.	0.019
0.15	J1RN61	Method detection limit		Median	0.15
0.12	J1RN62	TOTAL	12	Min.	0.12
0.14	J1RN63			Max.	0.18
0.17	J1RN66				
0.12	J1RN65				
0.15	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.945		r-squared is: 0.958	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is	0.16		

DATA	ID	Cadmium 95% UCL Calculation			
	J1RN67/				
0.25	J1RN68				
0.27	J1RN56				
0.25	J1RN57	Number of samples		Uncensored values	
0.24	J1RN58	Uncensored	12	Mean	0.25
0.24	J1RN59	Censored		Lognormal mean	0.25
0.23	J1RN60	Detection limit or PQL		Std. devn.	0.013
0.24	J1RN61	Method detection limit		Median	0.24
0.24	J1RN62	TOTAL	12	Min.	0.23
0.24	J1RN63			Max.	0.27
0.27	J1RN66				
0.23	J1RN65				
0.24	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.821		r-squared is: 0.810	
		Recommendations:			
		Reject BOTH lognormal and normal distributions			
		UCL (based on Z-statistic) is	0.25		

DATA	ID	Chromium 95% UCL Calculation			
	J1RN67/				
7.9	J1RN68				
9.0	J1RN56				
9.5	J1RN57	Number of samples		Uncensored values	
8.6	J1RN58	Uncensored	12	Mean	8.3
8.3	J1RN59	Censored		Lognormal mean	8.3
7.5	J1RN60	Detection limit or PQL		Std. devn.	0.69
8.0	J1RN61	Method detection limit		Median	8.2
7.2	J1RN62	TOTAL	12	Min.	7.2
7.8	J1RN63			Max.	9.5
9.1	J1RN66				
8.4	J1RN65				
7.9	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.982		r-squared is: 0.976	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is	8.6		

DATA	ID	Cobalt 95% UCL Calculation			
	J1RN67/				
8.3	J1RN68				
8.4	J1RN56				
8.6	J1RN57	Number of samples		Uncensored values	
8.3	J1RN58	Uncensored	12	Mean	8.1
8.0	J1RN59	Censored		Lognormal mean	8.1
8.0	J1RN60	Detection limit or PQL		Std. devn.	0.31
8.0	J1RN61	Method detection limit		Median	8.1
7.9	J1RN62	TOTAL	12	Min.	7.5
8.2	J1RN63			Max.	8.6
8.5	J1RN66				
7.5	J1RN65				
7.9	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.951		r-squared is: 0.956	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is	8.3		

DATA	ID	Copper 95% UCL Calculation			
	J1RN67/				
12.6	J1RN68				
14.1	J1RN56				
15.2	J1RN57	Number of samples		Uncensored values	
15.2	J1RN58	Uncensored	12	Mean	13.6
14.2	J1RN59	Censored		Lognormal mean	13.6
13.7	J1RN60	Detection limit or PQL		Std. devn.	1.1
13.4	J1RN61	Method detection limit		Median	13.8
12.1	J1RN62	TOTAL	12	Min.	11.8
13.8	J1RN63			Max.	15.2
14.4	J1RN66				
11.8	J1RN65				
13.1	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.968		r-squared is: 0.973	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is	14.2		

DATA	ID	Lead 95% UCL Calculation			
	J1RN67/				
4.7	J1RN68				
4.8	J1RN56				
5.5	J1RN57	Number of samples		Uncensored values	
5.0	J1RN58	Uncensored	12	Mean	4.9
4.8	J1RN59	Censored		Lognormal mean	4.9
4.9	J1RN60	Detection limit or PQL		Std. devn.	0.22
4.9	J1RN61	Method detection limit		Median	4.9
4.7	J1RN62	TOTAL	12	Min.	4.7
4.8	J1RN63			Max.	5.5
5.0	J1RN66				
5.1	J1RN65				
4.9	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.833		r-squared is: 0.815	
		Recommendations:			
		Reject BOTH lognormal and normal distributions			
		UCL (based on Z-statistic) is	5.0		

DATA	ID	Manganese 95% UCL Calculation			
	J1RN67/				
377	J1RN68				
388	J1RN56				
373	J1RN57	Number of samples		Uncensored values	
364	J1RN58	Uncensored	12	Mean	360
352	J1RN59	Censored		Lognormal mean	360
354	J1RN60	Detection limit or PQL		Std. devn.	15
354	J1RN61	Method detection limit		Median	356
345	J1RN62	TOTAL	12	Min.	338
357	J1RN63			Max.	388
371	J1RN66				
338	J1RN65				
347	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.973		r-squared is: 0.969	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is	368		

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DATA	ID	Nickel 95% UCL Calculation			
	J1RN67/				
8.8	J1RN68				
9.5	J1RN56				
10.1	J1RN57	Number of samples		Uncensored values	
9.3	J1RN58	Uncensored	12	Mean	9.0
9.6	J1RN59	Censored		Lognormal mean	9.0
8.3	J1RN60	Detection limit or PQL		Std. devn.	0.64
8.4	J1RN61	Method detection limit		Median	8.9
8.1	J1RN62	TOTAL	12	Min.	8.1
9.1	J1RN63			Max.	10.1
9.5	J1RN66				
8.4	J1RN65				
8.5	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.946		r-squared is: 0.944	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		9.3	

DATA	ID	Vanadium 95% UCL Calculation			
	J1RN67/				
60.7	J1RN68				
64.0	J1RN56				
61.6	J1RN57	Number of samples		Uncensored values	
62.5	J1RN58	Uncensored	12	Mean	61.3
61.7	J1RN59	Censored		Lognormal mean	61.3
61.8	J1RN60	Detection limit or PQL		Std. devn.	1.6
61.6	J1RN61	Method detection limit		Median	61.6
61.3	J1RN62	TOTAL	12	Min.	57.1
61.9	J1RN63			Max.	64.0
61.2	J1RN66				
57.1	J1RN65				
60.7	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.772		r-squared is: 0.783	
		Recommendations:			
		Reject BOTH lognormal and normal distributions			
		UCL (based on Z-statistic) is		62.1	

DATA	ID	Zinc 95% UCL Calculation			
	J1RN67/				
46.9	J1RN68				
47.6	J1RN56				
45.7	J1RN57	Number of samples		Uncensored values	
45.1	J1RN58	Uncensored	12	Mean	45.9
44.5	J1RN59	Censored		Lognormal mean	45.9
44.7	J1RN60	Detection limit or PQL		Std. devn.	1.0
46.5	J1RN61	Method detection limit		Median	45.7
45.6	J1RN62	TOTAL	12	Min.	44.5
44.9	J1RN63			Max.	47.6
45.5	J1RN66				
47.2	J1RN65				
46.2	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.971		r-squared is: 0.970	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		46.4	

DATA	ID	TPH - Diesel Range 95% UCL Calculation			
	J1RN67/				
19000	J1RN68				
2700	J1RN56				
3200	J1RN57	Number of samples		Uncensored values	
3400	J1RN58	Uncensored	12	Mean	6892
3900	J1RN59	Censored		Lognormal mean	6822
5000	J1RN60	Detection limit or PQL		Std. devn.	5169
16000	J1RN61	Method detection limit		Median	5200
6000	J1RN62	TOTAL	12	Min.	2700
4600	J1RN63			Max.	19000
5400	J1RN66				
7000	J1RN65				
6500	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.900		r-squared is: 0.718	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		10278	

DATA	ID	TPH - Diesel Range EXT 95% UCL Calculation			
	J1RN67/				
41000	J1RN68				
5300	J1RN56				
7100	J1RN57	Number of samples		Uncensored values	
6200	J1RN58	Uncensored	12	Mean	15883
8000	J1RN59	Censored		Lognormal mean	15885
11000	J1RN60	Detection limit or PQL		Std. devn.	12171
40000	J1RN61	Method detection limit		Median	11500
14000	J1RN62	TOTAL	12	Min.	5300
12000	J1RN63			Max.	41000
11000	J1RN66				
18000	J1RN65				
17000	J1RN64				
		Lognormal distribution?		Normal distribution?	
		r-squared is: 0.936		r-squared is: 0.759	
		Recommendations:			
		Use lognormal distribution.			
		UCL (Land's method) is		25370	

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Duplicate Analysis - 600-368

Sampling Area	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RML8	5/16/13	7980	X	1.3	0.48	JB	0.33	2.9		0.57	98.1	X	0.066	0.16	B	0.029	1.0	B	0.85	0.17		0.036	3280	X	12.3	9.0		0.050
Duplicate of J1RML8	J1RML9	5/16/13	8350	X	1.4	0.51	JB	0.34	3.1		0.59	100	X	0.068	0.18		0.029	1.2	B	0.87	0.17	B	0.037	3380	X	12.6	9.6		0.052

Analysis:

		Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium
TDL		5	0.6	10	2	0.2	2	0.2	100	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD	4.5%			1.9%				3.0%	6.5%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable

Duplicate Analysis - 600-368

Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Hexavalent Chromium			Iron			Lead			Magnesium			Manganese			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
600-368	J1RML8	5/16/13	9.9	X	0.087	12.5		0.19	0.231		0.155	23200	X	3.3	6.8		0.23	4240	X	3.2	398	X	0.087	9.9	X	0.11	1580		35.7
Duplicate of J1RML8	J1RML9	5/16/13	8.8	X	0.089	12.9		0.19	0.210		0.155	23900	X	3.4	6.7		0.24	4470	X	3.3	395	X	0.089	10.2	X	0.11	1680		36.6

Analysis:

		Cobalt	Copper	Hexavalent Chromium	Iron	Lead	Magnesium	Manganese	Nickel	Potassium
TDL		2	1	0.5	5	5	75	5	4	400
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD		3.1%		3.0%		5.3%	0.8%		
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

Duplicate Analysis - 600-368

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc			Nitrogen in Nitrite and Nitrate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RML8	5/16/13	320	JNX	4.9	142		51.3	53.0		0.082	54.2	X	0.35	3.1		0.31
Duplicate of J1RML8	J1RML9	5/16/13	368	JNX	5.0	151		52.6	53.7		0.084	55.6	X	0.36	4.1	N	0.31

Analysis:

		Silicon	Sodium	Vanadium	Zinc	Nitrogen in Nitrite and Nitrate
TDL		2	50	2.5	1	0.75
Duplicate Analysis	Both > PQL?	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)
	RPD	14.0%		1.3%	2.6%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-IU-2/6 Remediation
Subject 600-368 and 600-369 Waste Sites Cleanup Verification 95% UCL Calculations

Date 08/19/13
Job No. 14655

Calc. No. 0600X-CA-V0144
Checked N. K. Schiffern

Rev. No. 0
Date 08/19/13
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Duplicate Analysis - 600-369:8 Area D

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium			Cobalt			Copper		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-369:8 Area D	J1RMP8	5/16/13	7160	X	1.4	2.4		0.60	66.6	X	0.069	0.38		0.030	0.22		0.037	3580	X	12.8	7.4	X	0.050	6.6	X	0.091	12.7	X	0.20
Duplicate of J1RMP8	J1RMP9	5/16/13	7090	X	1.3	2.4		0.56	68.3	X	0.065	0.36		0.028	0.22		0.035	3430	X	12.0	8.6	X	0.056	6.5	X	0.085	12.6	X	0.18

Analysis:

TDL		5	10	2	0.2	0.2	100	1	2	1
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD	1.0%		2.5%			4.3%	15.0%		0.8%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - 600-369:8 Area D

Sampling Area	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-369:8	J1RMP8	5/16/13	23600	X	3.4	3.3		0.24	4360	X	3.4	339	X	0.091	8.2	X	0.11	1550		37.1	314	NX	5.1	165		53.4	61.0	X	0.085
Duplicate of J1RMP8	J1RMP9	5/16/13	22800	X	3.2	3.3		0.23	4370	X	3.2	328	X	0.085	8.0	X	0.10	1580		34.9	277	NX	4.8	150		50.2	57.5	X	0.080

Analysis:

TDL		5	5	75	5	4	400	2	50	2.5
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD	3.4%		0.2%	3.3%			12.5%		5.9%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - 600-369:8 Area D

Sampling Area	HEIS Number	Sample Date	Zinc			TPH - Diesel			TPH - Diesel Ext		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
600-369:8	J1RMP8	5/16/13	43.8	X	0.36	3000	J	680	6500		1000
Duplicate of J1RMP8	J1RMP9	5/16/13	42.7	X	0.34	4200		670	9200		990

Analysis:

TDL		1	5000	5000
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	2.5%		
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford
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Job No. 14655

Calc. No. 0600X-CA-V0144
Checked N. K. Schiffern

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Date 08/19/13
Sheet No. 16 of 17

Duplicate Analysis - EXC3-8

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Cadmium			Calcium			Chromium			Cobalt			Copper		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC3-8	J1RN49	5/28/13	6480		1.4	3.1		0.59	51.7		0.068	0.20		0.030	0.23		0.037	3460		12.7	9.8		0.052	5.7		0.090	13.6		0.20
Duplicate of J1RN49	J1RN54	5/28/13	6340		1.3	3.0		0.57	57.3		0.066	0.19		0.029	0.23		0.036	3430		12.2	9.1		0.050	5.9		0.087	14.2		0.19

Analysis:

TDL		5	10	2	0.2	0.2	100	1	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	2.2%		10.3%			0.9%	7.4%		4.3%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - EXC3-8

Sampling Area	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC3-8	J1RN49	5/28/13	15200		3.4	6.2		0.24	3930		3.3	255	X	0.090	10.1	X	0.11	817		36.9	196	JX	5.1	163		53.0	36.2		0.085
Duplicate of J1RN49	J1RN54	5/28/13	15700		3.3	5.2		0.23	3930		3.2	259	X	0.087	10.2	X	0.11	812		35.6	176	JX	4.9	159		51.2	36.3		0.082

Analysis:

TDL		5	5	75	5	4	400	2	50	2.5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	3.2%		0.0%	1.6%			10.8%		0.3%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - EXC3-8

Sampling Area	HEIS Number	Sample Date	Zinc			TPH - Diesel			TPH - Diesel Ext		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC3-8	J1RN49	5/28/13	30.9	X	0.36	3100	J	640	4300		940
Duplicate of J1RN49	J1RN54	5/28/13	31.3	X	0.35	3000	J	690	4400		1000

Analysis:

TDL		1	5000	5000
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	1.3%		
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable

CALCULATION SHEET

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Checked N. K. Schiffern

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Duplicate Analysis - EXC5-12

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
EXC5-12	J1RN67	5/29/13	7680		1.6	2.9		0.70	82.3		0.081	0.15	B	0.035	1.1	B	1.0	0.25		0.044	3720		15.0	7.9		0.062	8.4	X	0.11
Duplicate of J1RN67	J1RN68	5/29/13	7410		1.5	3.1		0.62	77.2		0.072	0.17	B	0.031	1.1	B	0.93	0.25		0.039	3630		13.3	7.8		0.055	8.1	X	0.095

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		3.6%						6.4%												2.4%			1.3%					
	Difference > 2 TDL?		Not applicable			No - acceptable			Not applicable			No - acceptable			No - acceptable			No - acceptable			Not applicable			Not applicable			No - acceptable		

Duplicate Analysis - EXC5-12

Sampling Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC5-12	J1RN67	5/29/13	12.5		0.23	24600		4.0	4.7		0.29	4510		3.9	378	X	0.11	8.8	X	0.13	1650		43.5	321		6.0	155		62.6
Duplicate of J1RN67	J1RN68	5/29/13	12.7		0.21	24800		3.6	4.7		0.26	4460		3.5	375	X	0.095	8.7	X	0.12	1650		38.7	216		5.3	154		55.8

Analysis:

TDL			1			5			5			75			5			4			400			2			50		
Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)		
	Both >5xTDL?		Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			No-Stop (acceptable)			Yes (calc RPD)			No-Stop (acceptable)		
	RPD		1.6%			0.8%						1.1%			0.8%									*39.1%*					
	Difference > 2 TDL?		Not applicable			Not applicable			No - acceptable			Not applicable			Not applicable			No - acceptable			No - acceptable			Not applicable			No - acceptable		

Duplicate Analysis - EXC5-12

Sampling Area	HEIS Number	Sample Date	Vanadium			Zinc			TPH - Diesel			TPH - Diesel Ext		
			mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC5-12	J1RN67	5/29/13	60.7		0.10	46.8	X	0.42	20000	B	700	43000	B	1000
Duplicate of J1RN67	J1RN68	5/29/13	60.6		0.089	46.9	X	0.38	18000	B	690	39000	B	1000

Analysis:

TDL			2.5			1			5000			5000																	
Duplicate Analysis	Both > PQL?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)																	
	Both >5xTDL?		Yes (calc RPD)			Yes (calc RPD)			No-Stop (acceptable)			Yes (calc RPD)																	
	RPD		0.2%			0.2%						9.8%																	
	Difference > 2 TDL?		Not applicable			Not applicable			No - acceptable			Not applicable																	

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Metals).

Sample Location	HEIS	Sample	Aluminum			Antimony			Arsenic			Barium			Beryllium		
	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RML8	5/16/13	7980	X	1.3	0.48	JB	0.33	2.9		0.57	98.1	X	0.066	0.16	B	0.029
Duplicate of J1RML8	J1RML9	5/16/13	8350	X	1.4	0.51	JB	0.34	3.1		0.59	100	X	0.068	0.18		0.029
600-369:1 Area A	J1RMN7	5/16/13	6760	X	1.4	0.35	U	0.35	2.4	N	0.61	69.5	X	0.070	0.36		0.030
600-369:1 Area B	J1RMN8	5/16/13	6500	X	1.4	0.34	U	0.34	2.5		0.59	67.7	X	0.068	0.34		0.029
600-369:2	J1RMN9	5/16/13	8530	X	1.4	0.34	U	0.34	2.7		0.58	75.6	X	0.067	0.41		0.029
600-369:4 Area A	J1RMP0	5/16/13	8680	X	1.4	0.33	U	0.33	27.0		0.58	84.8	X	0.067	0.40		0.029
600-369:4 Area B	J1RMP1	5/16/13	8690	X	1.3	0.32	U	0.32	22.3		0.56	79.7	X	0.064	0.38		0.028
600-369:6 Area A	J1RMP2	5/16/13	8080	X	1.3	0.32	U	0.32	2.8		0.56	72.6	X	0.065	0.39		0.028
600-369:6 Area B	J1RMP3	5/16/13	8160	X	1.4	0.34	U	0.34	2.6		0.59	76.2	X	0.068	0.39		0.029
600-369:7	J1RMP4	5/16/13	7450	X	1.4	0.34	U	0.34	3.3		0.59	67.1	X	0.068	0.37		0.030
600-369:8 Area A	J1RMP5	5/16/13	5310	X	1.3	0.32	U	0.32	1.9		0.56	53.3	X	0.064	0.31		0.028
600-369:8 Area B	J1RMP6	5/16/13	5630	X	1.3	0.32	U	0.32	2.1		0.56	59.6	X	0.064	0.34		0.028
600-369:8 Area C	J1RMP7	5/16/13	6240	X	1.4	0.34	U	0.34	3.3		0.59	61.6	X	0.068	0.33		0.029
600-369:8 Area D	J1RMP8	5/16/13	7160	X	1.4	0.34	U	0.34	2.4		0.60	66.6	X	0.069	0.38		0.030
Duplicate of J1RMP8	J1RMP9	5/16/13	7090	X	1.3	0.32	U	0.32	2.4		0.56	68.3	X	0.065	0.36		0.028
EXC3-8	J1RN49	5/28/13	6480		1.4	0.34	UJ	0.34	3.1		0.59	51.7		0.068	0.20		0.030
Duplicate of J1RN49	J1RN54	5/28/13	6340		1.3	0.33	UJ	0.33	3.0		0.57	57.3		0.066	0.19		0.029
EXC3-1	J1RN42	5/28/13	7750		1.5	0.53	JB	0.37	9.0		0.65	68.9		0.074	0.25		0.032
EXC3-2	J1RN43	5/28/13	6410		1.4	0.49	JB	0.35	4.2		0.61	46.1		0.071	0.20		0.031
EXC3-3	J1RN44	5/28/13	6120		1.4	0.34	UJ	0.34	3.0		0.60	51.5		0.069	0.20		0.030
EXC3-4	J1RN45	5/28/13	6610		1.4	0.35	UJ	0.35	2.6		0.60	53.3		0.070	0.21		0.030
EXC3-5	J1RN46	5/28/13	8110		1.3	0.33	UJ	0.33	21.0		0.57	80.9		0.065	0.27		0.028
EXC3-6	J1RN47	5/28/13	6520		1.5	0.36	UJ	0.36	4.2		0.62	58.0		0.071	0.21		0.031
EXC3-7	J1RN48	5/28/13	5170		1.5	0.37	UJ	0.37	2.7		0.65	43.6		0.074	0.15	B	0.032
EXC3-9	J1RN50	5/28/13	6900		1.5	0.37	UJ	0.37	16.7		0.63	70.2		0.073	0.22		0.032
EXC3-10	J1RN51	5/28/13	7050		1.3	0.33	UJ	0.33	5.6		0.57	58.6		0.065	0.22		0.028
EXC3-11	J1RN52	5/28/13	8170		1.6	0.38	UJ	0.38	11.5		0.66	81.1		0.076	0.25		0.033
EXC3-12	J1RN53	5/28/13	6710		1.4	0.35	UJ	0.35	4.6		0.61	65.2		0.070	0.20		0.031
EXC5-12	J1RN67	5/29/13	7680		1.6	0.40	U	0.40	2.9		0.70	82.3		0.081	0.15	B	0.035
Duplicate of J1RN67	J1RN68	5/29/13	7410		1.5	0.36	U	0.36	3.1		0.62	77.2		0.072	0.17	B	0.031
EXC5-1	J1RN56	5/29/13	7830		1.7	0.41	U	0.41	3.5		0.71	77.1		0.082	0.17	B	0.036
EXC5-2	J1RN57	5/29/13	8170		1.7	0.42	U	0.42	3.7		0.73	76.8		0.084	0.18	B	0.036
EXC5-3	J1RN58	5/29/13	7680		1.6	0.38	U	0.38	3.5		0.67	75.2		0.077	0.16	B	0.033
EXC5-4	J1RN59	5/29/13	7270		1.5	0.36	U	0.36	3.2		0.62	76.1		0.071	0.14	B	0.031
EXC5-5	J1RN60	5/29/13	7060		1.5	0.37	U	0.37	3.2		0.65	72.3		0.074	0.14	B	0.032
EXC5-6	J1RN61	5/29/13	7140		1.7	0.41	U	0.41	3.1		0.71	73.9		0.082	0.15	B	0.036
EXC5-7	J1RN62	5/29/13	6630		1.4	0.35	U	0.35	2.7		0.61	69.8		0.070	0.12	B	0.030
EXC5-8	J1RN63	5/29/13	7320		1.6	0.40	U	0.40	3.5		0.69	98.0		0.080	0.14	B	0.035
EXC5-9	J1RN66	5/29/13	7790		1.5	0.38	U	0.38	3.4		0.65	80.5		0.075	0.17	B	0.033
EXC5-10	J1RN65	5/29/13	6750		1.5	0.36	U	0.36	2.8		0.63	87.5		0.073	0.12	B	0.032
EXC5-11	J1RN64	5/29/13	7290		1.5	0.38	U	0.38	3.0		0.65	72.2		0.075	0.15	B	0.033
Equipment Blank	J1RMM0	5/16/13	186	X	1.4	0.35	UJ	0.35	0.60	U	0.60	2.5	X	0.069	0.037	B	0.030
Equipment Blank	J1RN55	5/28/13	218		1.5	0.36	U	0.36	0.63	U	0.63	2.1		0.072	0.032	B	0.031
Equipment Blank	J1RN69	5/29/13	211		1.5	0.36	U	0.36	0.63	U	0.63	2.1		0.072	0.031	B	0.031

Note: Gray cells indicate not applicable.

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

C = the analyte was detected in both the sample and the associated QC blank, and the sample concentration was ≤5x the blank concentration.

D = reported from a dilution

EXC3 = 600-369:3 excavation

EXC5 = 600-369:5 excavation

HEIS = Hanford Environmental Information System

J = estimate

N = recovery is outside control limits

PAH = polycyclic aromatic hydrocarbons

PCB = polychlorinated biphenyls

PEST = pesticides

PQL = practical quantitation limit

Q = qualifier

TPH = total petroleum hydrocarbons

U = undetected

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

X (organics) = > 40% difference between columns, lower result reported.

Attachment	1	Sheet No.	1 of 14
Originator	J. D. Skoglie	Date	8/28/13
Checked	N. K. Schiffern	Date	8/28/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
600-368	J1RML8	5/16/13	1.0	B	0.85	0.17		0.036	3280	X	12.3	9.0		0.050	9.9	X	0.087
Duplicate of J1RML8	J1RML9	5/16/13	1.2	B	0.87	0.17	B	0.037	3380	X	12.6	9.6		0.052	8.8	X	0.089
600-369:1 Area A	J1RMN7	5/16/13	2.1	N	0.90	0.24		0.038	3850	X	13.0	6.9	X	0.058	6.5	X	0.092
600-369:1 Area B	J1RMN8	5/16/13	1.4	B	0.87	0.21		0.036	3430	X	12.5	6.4	X	0.057	6.1	X	0.089
600-369:2	J1RMN9	5/16/13	1.1	B	0.87	0.23		0.036	3590	X	12.5	8.9	X	0.054	7.0	X	0.088
600-369:4 Area A	J1RMP0	5/16/13	1.4	B	0.86	0.26		0.036	3680	X	12.4	9.9	X	0.053	7.0	X	0.088
600-369:4 Area B	J1RMP1	5/16/13	1.2	B	0.82	0.24		0.034	3450	X	11.9	9.8	X	0.049	6.6	X	0.084
600-369:6 Area A	J1RMP2	5/16/13	1.2	B	0.83	0.24		0.035	3540	X	12.0	8.0	X	0.054	6.8	X	0.085
600-369:6 Area B	J1RMP3	5/16/13	1.4	B	0.87	0.23		0.037	3620	X	12.6	8.6	X	0.058	7.0	X	0.089
600-369:7	J1RMP4	5/16/13	0.88	U	0.88	0.30		0.037	3530	X	12.6	8.0	X	0.054	7.3	X	0.090
600-369:8 Area A	J1RMP5	5/16/13	0.83	U	0.83	0.19		0.035	3060	X	12.0	5.9	X	0.056	5.4	X	0.085
600-369:8 Area B	J1RMP6	5/16/13	0.83	U	0.83	0.22		0.035	3260	X	11.9	6.3	X	0.049	6.2	X	0.085
600-369:8 Area C	J1RMP7	5/16/13	0.97	B	0.87	0.21		0.037	3100	X	12.6	7.7	X	0.053	5.9	X	0.089
600-369:8 Area D	J1RMP8	5/16/13	0.93	B	0.89	0.22		0.037	3580	X	12.8	7.4	X	0.050	6.6	X	0.091
Duplicate of J1RMP8	J1RMP9	5/16/13	0.83	U	0.83	0.22		0.035	3430	X	12.0	8.6	X	0.056	6.5	X	0.085
EXC3-8	J1RN49	5/28/13	0.88	U	0.88	0.23		0.037	3460		12.7	9.8		0.052	5.7		0.090
Duplicate of J1RN49	J1RN54	5/28/13	0.85	U	0.85	0.23		0.036	3430		12.2	9.1		0.050	5.9		0.087
EXC3-1	J1RN42	5/28/13	1.3	B	0.96	0.27		0.040	3820		13.8	10.0		0.057	7.5		0.20
EXC3-2	J1RN43	5/28/13	1.0	B	0.91	0.23		0.038	2840		13.1	10.0		0.054	5.4		0.093
EXC3-3	J1RN44	5/28/13	0.89	U	0.89	0.21		0.037	3050		12.7	10.0		0.052	5.0		0.090
EXC3-4	J1RN45	5/28/13	0.90	U	0.90	0.21		0.038	3340		12.9	8.8		0.053	5.8		0.092
EXC3-5	J1RN46	5/28/13	1.4	B	0.84	0.30		0.035	3740		12.1	9.2		0.050	7.8		0.086
EXC3-6	J1RN47	5/28/13	0.92	U	0.92	0.21		0.039	3160		13.2	9.4		0.054	5.8		0.094
EXC3-7	J1RN48	5/28/13	0.96	U	0.96	0.22		0.040	3330		13.8	8.0		0.057	4.9		0.098
EXC3-9	J1RN50	5/28/13	1.4	B	0.94	0.33		0.039	3550		13.5	8.0		0.056	7.0		0.096
EXC3-10	J1RN51	5/28/13	2.4		0.84	0.24		0.035	3580		12.1	10.0		0.050	6.1		0.086
EXC3-11	J1RN52	5/28/13	1.6	B	0.98	0.35		0.041	3990		14.1	10.7		0.058	7.5		0.10
EXC3-12	J1RN53	5/28/13	1.3	B	0.91	0.35		0.038	3240		13.0	8.9		0.054	6.2		0.092
EXC5-12	J1RN67	5/29/13	1.1	B	1.0	0.25		0.044	3720		15.0	7.9		0.062	8.4	X	0.11
Duplicate of J1RN67	J1RN68	5/29/13	1.1	B	0.93	0.25		0.039	3630		13.3	7.8		0.055	8.1	X	0.095
EXC5-1	J1RN56	5/29/13	1.5	B	1.1	0.27		0.044	3860		15.3	9.0		0.063	8.4	X	0.11
EXC5-2	J1RN57	5/29/13	1.1	B	1.1	0.25		0.045	4030		15.5	9.5		0.064	8.6	X	0.11
EXC5-3	J1RN58	5/29/13	1.0	B	0.99	0.24		0.041	4100		14.3	8.6		0.059	8.3	X	0.10
EXC5-4	J1RN59	5/29/13	0.92	U	0.92	0.24		0.039	3870		13.3	8.3		0.055	8.0	X	0.094
EXC5-5	J1RN60	5/29/13	0.96	U	0.96	0.23		0.040	3910		13.8	7.5		0.057	8.0	X	0.098
EXC5-6	J1RN61	5/29/13	1.1	U	1.1	0.24		0.044	3830		15.2	8.0		0.063	8.0	X	0.11
EXC5-7	J1RN62	5/29/13	0.90	U	0.90	0.24		0.038	3570		13.0	7.2		0.053	7.9	X	0.092
EXC5-8	J1RN63	5/29/13	1.0	U	1.0	0.24		0.043	3950		14.8	7.8		0.061	8.2	X	0.11
EXC5-9	J1RN66	5/29/13	0.97	U	0.97	0.27		0.041	4020		13.9	9.1		0.057	8.5	X	0.099
EXC5-10	J1RN65	5/29/13	1.0	B	0.94	0.23		0.039	3620		13.5	8.4		0.056	7.5	X	0.096
EXC5-11	J1RN64	5/29/13	0.97	U	0.97	0.24		0.040	3760		13.9	7.9		0.057	7.9	X	0.099
Equipment Blank	J1RMM0	5/16/13	0.89	U	0.89	0.037	U	0.037	40.3	BX	12.8	0.095	B	0.053	0.13	BX	0.091
Equipment Blank	J1RN55	5/28/13	0.93	U	0.93	0.039	U	0.039	47.3	B	13.4	0.093	B	0.055	0.095	U	0.095
Equipment Blank	J1RN69	5/29/13	0.93	U	0.93	0.039	U	0.039	41.7	B	13.4	0.10	BC	0.055	0.10	BX	0.095

Attachment	1	Sheet No.	2 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Metals).

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
600-368	J1RML8	5/16/13	12.5		0.19	0.231		0.155	23200	X	3.3	6.8		0.23	4240	X	3.2
Duplicate of J1RML8	J1RML9	5/16/13	12.9		0.19	0.210		0.155	23900	X	3.4	6.7		0.24	4470	X	3.3
600-369:1 Area A	J1RMN7	5/16/13	12.0	X	0.20				23200	X	3.5	3.4		0.25	4210	X	3.4
600-369:1 Area B	J1RMN8	5/16/13	11.9	X	0.19				22500	X	3.4	4.0		0.24	3860	X	3.3
600-369:2	J1RMN9	5/16/13	13.9	X	0.19				23400	X	3.4	3.8		0.24	4330	X	3.3
600-369:4 Area A	J1RMP0	5/16/13	14.1	X	0.19				23300	X	3.3	59.6		0.24	4400	X	3.2
600-369:4 Area B	J1RMP1	5/16/13	13.7	X	0.18				22800	X	3.2	59.3		0.23	4270	X	3.1
600-369:6 Area A	J1RMP2	5/16/13	13.2	X	0.18				23900	X	3.2	3.8		0.23	4370	X	3.1
600-369:6 Area B	J1RMP3	5/16/13	13.8	X	0.19				24200	X	3.4	4.2		0.24	4410	X	3.3
600-369:7	J1RMP4	5/16/13	15.4	X	0.19				23100	X	3.4	5.5		0.24	3910	X	3.3
600-369:8 Area A	J1RMP5	5/16/13	10.8	X	0.18				20300	X	3.2	3.4		0.23	3690	X	3.1
600-369:8 Area B	J1RMP6	5/16/13	11.3	X	0.18				22000	X	3.2	2.9		0.23	4040	X	3.1
600-369:8 Area C	J1RMP7	5/16/13	11.2	X	0.19				20500	X	3.4	3.5		0.24	3860	X	3.3
600-369:8 Area D	J1RMP8	5/16/13	12.7	X	0.20				23600	X	3.4	3.3		0.24	4360	X	3.4
Duplicate of J1RMP8	J1RMP9	5/16/13	12.6	X	0.18				22800	X	3.2	3.3		0.23	4370	X	3.2
EXC3-8	J1RN49	5/28/13	13.6		0.20				15200		3.4	6.2		0.24	3930		3.3
Duplicate of J1RN49	J1RN54	5/28/13	14.2		0.19				15700		3.3	5.2		0.23	3930		3.2
EXC3-1	J1RN42	5/28/13	13.9		0.21				18900		3.7	7.1		0.26	4310		3.6
EXC3-2	J1RN43	5/28/13	13.2		0.20				14500		3.5	3.6		0.25	4060		3.4
EXC3-3	J1RN44	5/28/13	11.4		0.20				13200		3.4	4.0		0.24	3850		3.3
EXC3-4	J1RN45	5/28/13	13.4		0.20				15100		3.5	4.1		0.25	3810		3.4
EXC3-5	J1RN46	5/28/13	16.6		0.19				21300		3.3	74.8		0.23	4190		3.2
EXC3-6	J1RN47	5/28/13	13.7		0.20				15200		3.6	4.3		0.25	3830		3.5
EXC3-7	J1RN48	5/28/13	11.1		0.21				13400		3.7	3.7		0.26	3450		3.6
EXC3-9	J1RN50	5/28/13	13.8		0.21				19400		3.7	150		0.26	3860		3.6
EXC3-10	J1RN51	5/28/13	13.1		0.19				16500		3.3	11.1		0.23	4120		3.2
EXC3-11	J1RN52	5/28/13	17.5		0.22				20900		3.8	67.6		0.27	4410		3.7
EXC3-12	J1RN53	5/28/13	12.1		0.20				17700		3.5	33.5		0.25	3870		3.4
EXC5-12	J1RN67	5/29/13	12.5		0.23				24600		4.0	4.7		0.29	4510		3.9
Duplicate of J1RN67	J1RN68	5/29/13	12.7		0.21				24800		3.6	4.7		0.26	4460		3.5
EXC5-1	J1RN56	5/29/13	14.1		0.24				25900		4.1	4.8		0.29	4540		4.0
EXC5-2	J1RN57	5/29/13	15.2		0.24				25600		4.2	5.5		0.30	4870		4.1
EXC5-3	J1RN58	5/29/13	15.2		0.22				25300		3.8	5.0		0.27	4670		3.7
EXC5-4	J1RN59	5/29/13	14.2		0.20				24700		3.6	4.8		0.25	4620		3.5
EXC5-5	J1RN60	5/29/13	13.7		0.21				24500		3.7	4.9		0.26	4340		3.6
EXC5-6	J1RN61	5/29/13	13.4		0.23				24600		4.1	4.9		0.29	4520		4.0
EXC5-7	J1RN62	5/29/13	12.1		0.20				24200		3.5	4.7		0.25	4290		3.4
EXC5-8	J1RN63	5/29/13	13.8		0.23				24700		4.0	4.8		0.28	4620		3.9
EXC5-9	J1RN66	5/29/13	14.4		0.21				25200		3.8	5.0		0.27	4680		3.7
EXC5-10	J1RN65	5/29/13	11.8		0.21				22500		3.6	5.1		0.26	4260		3.6
EXC5-11	J1RN64	5/29/13	13.1		0.21				24200		3.8	4.9		0.27	4470		3.7
Equipment Blank	J1RMM0	5/16/13	0.23	B	0.20				637	X	3.5	0.75		0.25	22.8	X	3.4
Equipment Blank	J1RN55	5/28/13	0.21	U	0.21				283		3.6	0.35	B	0.26	23.6		3.5
Equipment Blank	J1RN69	5/29/13	0.21	U	0.21				266		3.6	0.44	B	0.26	25.1		3.5

Attachment	1	Sheet No.	3 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Metals).

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
600-368	J1RML8	5/16/13	398	X	0.087	0.0057	U	0.0057	0.23	U	0.23	9.9	X	0.11	1580		35.7
Duplicate of J1RML8	J1RML9	5/16/13	395	X	0.089	0.0054	U	0.0054	0.23	U	0.23	10.2	X	0.11	1680		36.6
600-369:1 Area A	J1RMN7	5/16/13	338	X	0.092				0.27	B	0.24	7.4	X	0.11	1460		37.8
600-369:1 Area B	J1RMN8	5/16/13	326	X	0.089				0.26	B	0.23	7.5	X	0.11	1330		36.5
600-369:2	J1RMN9	5/16/13	367	X	0.088				0.23	U	0.23	9.2	X	0.11	1460		36.2
600-369:4 Area A	J1RMP0	5/16/13	374	X	0.088				0.23	U	0.23	9.5	X	0.11	1680		36.0
600-369:4 Area B	J1RMP1	5/16/13	378	X	0.084				0.22	U	0.22	9.8	X	0.10	1690		34.5
600-369:6 Area A	J1RMP2	5/16/13	363	X	0.085				0.22	U	0.22	8.5	X	0.10	1650		34.8
600-369:6 Area B	J1RMP3	5/16/13	374	X	0.089				0.23	U	0.23	8.8	X	0.11	1660		36.5
600-369:7	J1RMP4	5/16/13	371	X	0.090				0.23	U	0.23	8.1	X	0.11	1250		36.8
600-369:8 Area A	J1RMP5	5/16/13	276	X	0.085				0.22	U	0.22	6.7	X	0.10	1150		34.8
600-369:8 Area B	J1RMP6	5/16/13	301	X	0.085				0.22	U	0.22	7.1	X	0.10	1260		34.7
600-369:8 Area C	J1RMP7	5/16/13	285	X	0.089				0.23	U	0.23	7.5	X	0.11	1360		36.5
600-369:8 Area D	J1RMP8	5/16/13	339	X	0.091				0.24	U	0.24	8.2	X	0.11	1550		37.1
Duplicate of J1RMP8	J1RMP9	5/16/13	328	X	0.085				0.22	U	0.22	8.0	X	0.10	1580		34.9
EXC3-8	J1RN49	5/28/13	255	X	0.090				0.23	U	0.23	10.1	X	0.11	817		36.9
Duplicate of J1RN49	J1RN54	5/28/13	259	X	0.087				0.23	U	0.23	10.2	X	0.11	812		35.6
EXC3-1	J1RN42	5/28/13	311	X	0.098				0.25	U	0.25	11.6	X	0.12	1270		40.1
EXC3-2	J1RN43	5/28/13	247	X	0.093				0.24	U	0.24	11.2	X	0.11	1300		38.1
EXC3-3	J1RN44	5/28/13	231	X	0.090				0.23	U	0.23	13.9	X	0.11	913		37.0
EXC3-4	J1RN45	5/28/13	253	X	0.092				0.24	U	0.24	10.8	X	0.11	839		37.5
EXC3-5	J1RN46	5/28/13	351	X	0.086				0.22	U	0.22	10.2	X	0.11	1800		35.3
EXC3-6	J1RN47	5/28/13	260	X	0.094				0.24	U	0.24	10.2	X	0.12	908		38.5
EXC3-7	J1RN48	5/28/13	207	X	0.098				0.25	U	0.25	9.4	X	0.12	703		40.2
EXC3-9	J1RN50	5/28/13	322	X	0.096				0.25	U	0.25	9.3	X	0.12	1590		39.4
EXC3-10	J1RN51	5/28/13	285	X	0.086				0.22	U	0.22	11.6	X	0.11	1200		35.3
EXC3-11	J1RN52	5/28/13	342	X	0.10				0.26	U	0.26	11.5	X	0.12	1740		41.1
EXC3-12	J1RN53	5/28/13	288	X	0.092				0.24	U	0.24	9.9	X	0.11	1370		37.9
EXC5-12	J1RN67	5/29/13	378	X	0.11				0.28	U	0.28	8.8	X	0.13	1650		43.5
Duplicate of J1RN67	J1RN68	5/29/13	375	X	0.095				0.25	U	0.25	8.7	X	0.12	1650		38.7
EXC5-1	J1RN56	5/29/13	388	X	0.11				0.32	B	0.28	9.5	X	0.13	1640		44.4
EXC5-2	J1RN57	5/29/13	373	X	0.11				0.29	U	0.29	10.1	X	0.14	1440		45.1
EXC5-3	J1RN58	5/29/13	364	X	0.10				0.26	U	0.26	9.3	X	0.12	1310		41.5
EXC5-4	J1RN59	5/29/13	352	X	0.094				0.24	U	0.24	9.6	X	0.12	1380		38.5
EXC5-5	J1RN60	5/29/13	354	X	0.098				0.25	U	0.25	8.3	X	0.12	1290		40.2
EXC5-6	J1RN61	5/29/13	354	X	0.11				0.28	U	0.28	8.4	X	0.13	1460		44.2
EXC5-7	J1RN62	5/29/13	345	X	0.092				0.24	U	0.24	8.1	X	0.11	1450		37.8
EXC5-8	J1RN63	5/29/13	357	X	0.11				0.27	U	0.27	9.1	X	0.13	1310		43.1
EXC5-9	J1RN66	5/29/13	371	X	0.099				0.26	U	0.26	9.5	X	0.12	1350		40.5
EXC5-10	J1RN65	5/29/13	338	X	0.096				0.25	U	0.25	8.4	X	0.12	1360		39.4
EXC5-11	J1RN64	5/29/13	347	X	0.099				0.26	U	0.26	8.5	X	0.12	1460		40.5
Equipment Blank	J1RMM0	5/16/13	23.9	X	0.091	0.0058	U	0.0058	0.24	U	0.24	0.15	BX	0.11	52.7	B	37.3
Equipment Blank	J1RN55	5/28/13	5.3	X	0.095				0.25	U	0.25	0.12	UX	0.12	61.8	B	39.1
Equipment Blank	J1RN69	5/29/13	6.9	X	0.095				0.25	U	0.25	0.12	UX	0.12	56.1	B	39.1

Attachment	1	Sheet No.	4 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Metals).

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
600-368	J1RML8	5/16/13	0.75	U	0.75	320	JNX	4.9	0.14	U	0.14	142		51.3	53.0		0.082
Duplicate of J1RML8	J1RML9	5/16/13	0.77	U	0.77	368	JNX	5.0	0.14	U	0.14	151		52.6	53.7		0.084
600-369:1 Area A	J1RMN7	5/16/13	0.79	UN	0.79	305	NX	5.2	0.15	U	0.15	202		54.3	62.3	X	0.087
600-369:1 Area B	J1RMN8	5/16/13	0.76	U	0.76	213	NX	5.0	0.14	U	0.14	166		52.5	58.4	X	0.084
600-369:2	J1RMN9	5/16/13	0.76	U	0.76	275	NX	5.0	0.14	U	0.14	174		52.2	57.6	X	0.083
600-369:4 Area A	J1RMP0	5/16/13	0.75	U	0.75	286	NX	5.0	0.14	U	0.14	190		51.8	57.4	X	0.082
600-369:4 Area B	J1RMP1	5/16/13	0.72	U	0.72	253	NX	4.8	0.13	U	0.13	177		49.6	52.1	X	0.079
600-369:6 Area A	J1RMP2	5/16/13	0.73	U	0.73	250	NX	4.8	0.14	U	0.14	174		50.1	57.3	X	0.080
600-369:6 Area B	J1RMP3	5/16/13	0.77	U	0.77	337	NX	5.0	0.14	U	0.14	184		52.6	59.8	X	0.084
600-369:7	J1RMP4	5/16/13	0.77	U	0.77	231	NX	5.1	0.14	U	0.14	163		52.9	56.7	X	0.084
600-369:8 Area A	J1RMP5	5/16/13	0.73	U	0.73	250	NX	4.8	0.14	U	0.14	142		50.0	53.5	X	0.080
600-369:8 Area B	J1RMP6	5/16/13	0.73	U	0.73	216	NX	4.8	0.14	U	0.14	146		50.0	59.4	X	0.080
600-369:8 Area C	J1RMP7	5/16/13	0.77	U	0.77	235	NX	5.0	0.14	U	0.14	146		52.6	57.4	X	0.084
600-369:8 Area D	J1RMP8	5/16/13	0.78	U	0.78	314	NX	5.1	0.14	U	0.14	165		53.4	61.0	X	0.085
Duplicate of J1RMP8	J1RMP9	5/16/13	0.73	U	0.73	277	NX	4.8	0.14	U	0.14	150		50.2	57.5	X	0.080
EXC3-8	J1RN49	5/28/13	0.77	U	0.77	196	JX	5.1	0.14	U	0.14	163		53.0	36.2		0.085
Duplicate of J1RN49	J1RN54	5/28/13	0.75	U	0.75	176	JX	4.9	0.14	U	0.14	159		51.2	36.3		0.082
EXC3-1	J1RN42	5/28/13	0.84	U	0.84	363	JNX	5.5	0.16	U	0.16	183		57.7	40.4		0.092
EXC3-2	J1RN43	5/28/13	0.80	U	0.80	231	JX	5.3	0.15	U	0.15	131		54.8	29.9		0.087
EXC3-3	J1RN44	5/28/13	0.78	U	0.78	195	JX	5.1	0.14	U	0.14	134		53.3	27.3		0.085
EXC3-4	J1RN45	5/28/13	0.79	U	0.79	186	JX	5.2	0.15	U	0.15	155		54.0	34.7		0.086
EXC3-5	J1RN46	5/28/13	0.74	U	0.74	317	JX	4.9	0.14	U	0.14	159		50.8	45.2		0.081
EXC3-6	J1RN47	5/28/13	0.81	U	0.81	152	JX	5.3	0.15	U	0.15	157		55.4	33.2		0.088
EXC3-7	J1RN48	5/28/13	0.84	U	0.84	232	JX	5.5	0.16	U	0.16	147		57.8	33.2		0.092
EXC3-9	J1RN50	5/28/13	0.83	U	0.83	248	JX	5.4	0.15	U	0.15	163		56.7	44.0		0.090
EXC3-10	J1RN51	5/28/13	0.74	U	0.74	222	JX	4.9	0.14	U	0.14	169		50.7	36.0		0.081
EXC3-11	J1RN52	5/28/13	0.86	U	0.86	278	JX	5.7	0.16	U	0.16	167		59.1	45.5		0.094
EXC3-12	J1RN53	5/28/13	0.80	U	0.80	215	JX	5.2	0.15	U	0.15	165		54.6	40.1		0.087
EXC5-12	J1RN67	5/29/13	0.91	U	0.91	321		6.0	0.17	U	0.17	155		62.6	60.7		0.10
Duplicate of J1RN67	J1RN68	5/29/13	0.81	U	0.81	216		5.3	0.15	U	0.15	154		55.8	60.6		0.089
EXC5-1	J1RN56	5/29/13	0.93	U	0.93	268		6.1	0.17	U	0.17	170		63.9	64.0		0.10
EXC5-2	J1RN57	5/29/13	0.95	U	0.95	364		6.2	0.18	U	0.18	173		64.9	61.6		0.10
EXC5-3	J1RN58	5/29/13	0.87	U	0.87	270		5.7	0.16	U	0.16	185		59.7	62.5		0.095
EXC5-4	J1RN59	5/29/13	0.81	U	0.81	313		5.3	0.15	U	0.15	171		55.5	61.7		0.088
EXC5-5	J1RN60	5/29/13	0.84	U	0.84	243		5.5	0.16	U	0.16	163		57.8	61.8		0.092
EXC5-6	J1RN61	5/29/13	0.93	U	0.93	283		6.1	0.17	U	0.17	164		63.7	61.6		0.10
EXC5-7	J1RN62	5/29/13	0.79	U	0.79	203		5.2	0.15	U	0.15	144		54.4	61.3		0.087
EXC5-8	J1RN63	5/29/13	0.90	U	0.90	357		6.0	0.17	U	0.17	185		62.1	61.9		0.099
EXC5-9	J1RN66	5/29/13	0.85	U	0.85	276		5.6	0.16	U	0.16	174		58.3	61.2		0.093
EXC5-10	J1RN65	5/29/13	0.83	U	0.83	250		5.4	0.15	U	0.15	152		56.6	57.1		0.090
EXC5-11	J1RN64	5/29/13	0.85	U	0.85	206		5.6	0.16	U	0.16	159		58.3	60.7		0.093
Equipment Blank	J1RMM0	5/16/13	0.78	U	0.78	107	JNX	5.1	0.15	U	0.15	53.7	U	53.7	0.43	B	0.086
Equipment Blank	J1RN55	5/28/13	0.82	U	0.82	155	X	5.4	0.15	U	0.15	56.2	U	56.2	0.27	B	0.090
Equipment Blank	J1RN69	5/29/13	0.82	U	0.82	137		5.4	0.15	U	0.15	56.3	U	56.3	0.24	B	0.09

Attachment	1	Sheet No.	5 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Zinc		
			mg/kg	Q	PQL
600-368	J1RML8	5/16/13	54.2	X	0.35
Duplicate of J1RML8	J1RML9	5/16/13	55.6	X	0.36
600-369:1 Area A	J1RMN7	5/16/13	43.3	X	0.37
600-369:1 Area B	J1RMN8	5/16/13	41.2	X	0.35
600-369:2	J1RMN9	5/16/13	44.7	X	0.35
600-369:4 Area A	J1RMP0	5/16/13	46.7	X	0.35
600-369:4 Area B	J1RMP1	5/16/13	43.9	X	0.33
600-369:6 Area A	J1RMP2	5/16/13	45.1	X	0.34
600-369:6 Area B	J1RMP3	5/16/13	45.1	X	0.35
600-369:7	J1RMP4	5/16/13	50.3	X	0.36
600-369:8 Area A	J1RMP5	5/16/13	36.8	X	0.34
600-369:8 Area B	J1RMP6	5/16/13	40.7	X	0.34
600-369:8 Area C	J1RMP7	5/16/13	40.1	X	0.35
600-369:8 Area D	J1RMP8	5/16/13	43.8	X	0.36
Duplicate of J1RMP8	J1RMP9	5/16/13	42.7	X	0.34
EXC3-8	J1RN49	5/28/13	30.9	X	0.36
Duplicate of J1RN49	J1RN54	5/28/13	31.3	X	0.35
EXC3-1	J1RN42	5/28/13	36.3	X	0.39
EXC3-2	J1RN43	5/28/13	30.3	X	0.37
EXC3-3	J1RN44	5/28/13	28.6	X	0.36
EXC3-4	J1RN45	5/28/13	30.1	X	0.36
EXC3-5	J1RN46	5/28/13	42.3	X	0.34
EXC3-6	J1RN47	5/28/13	29.8	X	0.37
EXC3-7	J1RN48	5/28/13	27.0	X	0.39
EXC3-9	J1RN50	5/28/13	45.4	X	0.38
EXC3-10	J1RN51	5/28/13	35.0	X	0.34
EXC3-11	J1RN52	5/28/13	64.2	X	0.40
EXC3-12	J1RN53	5/28/13	49.3	X	0.37
EXC5-12	J1RN67	5/29/13	46.8	X	0.42
Duplicate of J1RN67	J1RN68	5/29/13	46.9	X	0.38
EXC5-1	J1RN56	5/29/13	47.6	X	0.43
EXC5-2	J1RN57	5/29/13	45.7	X	0.44
EXC5-3	J1RN58	5/29/13	45.1	X	0.40
EXC5-4	J1RN59	5/29/13	44.5	X	0.37
EXC5-5	J1RN60	5/29/13	44.7	X	0.39
EXC5-6	J1RN61	5/29/13	46.5	X	0.43
EXC5-7	J1RN62	5/29/13	45.6	X	0.37
EXC5-8	J1RN63	5/29/13	44.9	X	0.42
EXC5-9	J1RN66	5/29/13	45.5	X	0.39
EXC5-10	J1RN65	5/29/13	47.2	X	0.38
EXC5-11	J1RN64	5/29/13	46.2	X	0.39
Equipment Blank	J1RMM0	5/16/13	1.7	X	0.36
Equipment Blank	J1RN55	5/28/13	1.2	X	0.38
Equipment Blank	J1RN69	5/29/13	1.3	X	0.38

Attachment	1	Sheet No.	6 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (TPH, Nitrate/Nitrite, and physical).

Sample Location	HEIS Number	Sample Date	TPH - Diesel			TPH - Diesel Ext			Nitrogen in Nitrite and Nitrate			Percent moisture (wet sample)		
			ug/kg	Q	PQL	ug/kg	Q	PQL	mg/kg	Q	PQL	%	Q	PQL
600-368	J1RML8	5/16/13							3.1		0.31	0.86		0.10
Duplicate of J1RML8	J1RML9	5/16/13							4.1	N	0.31	0.79		0.10
600-369:1 Area A	J1RMN7	5/16/13	12000		680	34000		1000				2.2		0.10
600-369:1 Area B	J1RMN8	5/16/13	24000		650	82000		960				2.2		0.10
600-369:2	J1RMN9	5/16/13	2900	J	680	6000		990				0.78		0.10
600-369:4 Area A	J1RMP0	5/16/13	6000		670	14000		990				0.86		0.10
600-369:4 Area B	J1RMP1	5/16/13	3000	J	680	5500		1000				0.91		0.10
600-369:6 Area A	J1RMP2	5/16/13	40000		660	78000		980				1.0		0.10
600-369:6 Area B	J1RMP3	5/16/13	6900		670	15000		990				0.66		0.10
600-369:7	J1RMP4	5/16/13	3300	J	690	6800		1000				1.3		0.10
600-369:8 Area A	J1RMP5	5/16/13	65000		660	130000		980				0.88		0.10
600-369:8 Area B	J1RMP6	5/16/13	3700	J	640	7500		940				0.82		0.10
600-369:8 Area C	J1RMP7	5/16/13	9400		670	17000		990				0.67		0.10
600-369:8 Area D	J1RMP8	5/16/13	3000	J	680	6500		1000				0.51		0.10
Duplicate of J1RMP8	J1RMP9	5/16/13	4200		670	9200		990				0.50		0.10
EXC3-8	J1RN49	5/28/13	3100	J	640	4300		940				1.6		0.10
Duplicate of J1RN49	J1RN54	5/28/13	3000	J	690	4400		1000				2.4		0.10
EXC3-1	J1RN42	5/28/13	4000		670	5600		980				1.7		0.10
EXC3-2	J1RN43	5/28/13	1500	J	660	2100	J	970				1.2		0.10
EXC3-3	J1RN44	5/28/13	2500	J	680	3600	J	1000				2.1		0.10
EXC3-4	J1RN45	5/28/13	1000	J	680	1100	J	1000				1.6		0.10
EXC3-5	J1RN46	5/28/13	4900		680	10000		990				2.4		0.10
EXC3-6	J1RN47	5/28/13	2700	J	670	3900		980				2.3		0.10
EXC3-7	J1RN48	5/28/13	3900		660	4500		970				0.89		0.10
EXC3-9	J1RN50	5/28/13	11000		670	42000		990				2.7		0.10
EXC3-10	J1RN51	5/28/13	3200	J	630	5200		930				1.5		0.10
EXC3-11	J1RN52	5/28/13	5500		650	12000		960				2.2		0.10
EXC3-12	J1RN53	5/28/13	9900		660	41000		970				1.7		0.10
EXC5-12	J1RN67	5/29/13	20000	B	700	43000	B	1000				6.7		0.10
Duplicate of J1RN67	J1RN68	5/29/13	18000	B	690	39000	B	1000				6.4		0.10
EXC5-1	J1RN56	5/29/13	2700	JB	710	5300	B	1000				8.6		0.10
EXC5-2	J1RN57	5/29/13	3200	JB	710	7100	B	1000				9.1		0.10
EXC5-3	J1RN58	5/29/13	3400	JB	720	6200	B	1100				8.5		0.10
EXC5-4	J1RN59	5/29/13	3900	JB	720	8000	B	1100				8.3		0.10
EXC5-5	J1RN60	5/29/13	5000	B	720	11000	B	1100				8.9		0.10
EXC5-6	J1RN61	5/29/13	16000	B	720	40000	B	1100				9.1		0.10
EXC5-7	J1RN62	5/29/13	6000	B	680	14000	B	1000				8.1		0.10
EXC5-8	J1RN63	5/29/13	4600	B	680	12000	B	1000				8.6		0.10
EXC5-9	J1RN66	5/29/13	5400	B	690	11000	B	1000				9.7		0.10
EXC5-10	J1RN65	5/29/13	7000	B	710	18000	B	1000				9.4		0.10
EXC5-11	J1RN64	5/29/13	6500	B	700	17000	B	1000				9.6		0.10
Equipment Blank	J1RMM0	5/16/13										0.10	U	0.10
Equipment Blank	J1RN55	5/28/13										0.10	U	0.10
Equipment Blank	J1RN69	5/29/13										0.13		0.10

Attachment	1	Sheet No.	7 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Organics).

CONSTITUENT	CLASS	600-368 - J1RML8			Duplicate of J1RML8 - J1RML9			600-369:1 Area A - J1RMN7			600-369:1 Area B - J1RMN8			600-369:2 - J1RMN9			600-369:4 Area A - J1RMP0		
		5/16/13			5/16/13			5/16/13			5/16/13			5/16/13			5/16/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.9	U	9.9	9.8	U	9.8	9.7	U	9.7	10	U	10	10	U	10	9.9	U	9.9
Acenaphthylene	PAH	8.9	U	8.9	8.8	U	8.8	8.7	U	8.7	9.1	U	9.1	9.0	U	9.0	8.9	U	8.9
Anthracene	PAH	3.0	U	3.0	3.0	U	3.0	2.9	U	2.9	3.1	U	3.1	3.1	U	3.1	3.0	U	3.0
Benzo(a)anthracene	PAH	3.2	U	3.2	3.1	U	3.1	3.1	U	3.1	3.2	U	3.2	3.2	U	3.2	13	JX	3.2
Benzo(a)pyrene	PAH	6.4	U	6.4	6.3	U	6.3	6.2	U	6.2	6.5	U	6.5	6.4	U	6.4	10	JX	6.3
Benzo(b)fluoranthene	PAH	4.2	U	4.2	4.1	U	4.1	4.1	U	4.1	4.2	U	4.2	10	J	4.2	23		4.2
Benzo(ghi)perylene	PAH	7.1	U	7.1	7.0	U	7.0	7.0	U	7.0	7.3	U	7.3	7.2	U	7.2	13	J	7.1
Benzo(k)fluoranthene	PAH	3.9	U	3.9	3.8	U	3.8	3.8	U	3.8	4.0	U	4.0	3.9	U	3.9	5.2	J	3.9
Chrysene	PAH	4.8	U	4.8	4.7	U	4.7	4.7	U	4.7	4.9	U	4.9	4.8	U	4.8	14	J	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	13	U	13	13	U	13	18	JX	13
Fluorene	PAH	5.2	U	5.2	5.2	U	5.2	5.1	U	5.1	5.3	U	5.3	5.3	U	5.3	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	24	J	12
Aroclor-1016	PCB							2.8	U	2.8	2.8	U	2.8	2.8	U	2.8	2.6	U	2.6
Aroclor-1221	PCB							8.1	U	8.1	8.2	U	8.2	8.0	U	8.0	7.4	U	7.4
Aroclor-1232	PCB							2.0	U	2.0	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9
Aroclor-1242	PCB							4.7	U	4.7	4.8	U	4.8	4.7	U	4.7	4.3	U	4.3
Aroclor-1248	PCB							4.7	U	4.7	4.8	U	4.8	4.7	U	4.7	4.3	U	4.3
Aroclor-1254	PCB							2.6	U	2.6	2.7	U	2.7	2.6	U	2.6	2.4	U	2.4
Aroclor-1260	PCB							2.6	U	2.6	2.7	U	2.7	2.6	U	2.6	2.4	U	2.4
Aldrin	PEST							0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25
Alpha-BHC	PEST							0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22
alpha-Chlordane	PEST							0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.33	U	0.33
Beta-BHC	PEST							0.67	U	0.67	0.66	U	0.66	0.67	U	0.67	0.67	U	0.67
Delta-BHC	PEST							0.40	U	0.40	0.40	U	0.40	0.40	U	0.40	0.40	U	0.40
4-4'-DDD	PEST							0.55	U	0.55	0.54	U	0.54	0.55	U	0.55	0.55	U	0.55
4-4'-DDE	PEST							0.24	U	0.24	0.24	U	0.24	0.24	U	0.24	0.24	U	0.24
4-4'-DDT	PEST							0.59	U	0.59	5.8	UD	5.8	0.59	U	0.59	0.60	U	0.60
Dieldrin	PEST							0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
Endosulfan I	PEST							0.18	U	0.18	0.17	U	0.17	0.18	U	0.18	0.18	U	0.18
Endosulfan II	PEST							0.29	U	0.29	0.28	U	0.28	0.29	U	0.29	0.29	U	0.29
Endosulfan sulfate	PEST							0.28	U	0.28	0.27	U	0.27	0.28	U	0.28	0.28	U	0.28
Endrin	PEST							0.31	U	0.31	0.30	U	0.30	0.31	U	0.31	0.31	U	0.31
Endrin aldehyde	PEST							0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST							0.49	U	0.49	0.48	U	0.48	0.49	U	0.49	0.49	U	0.49
Gamma-BHC (Lindane)	PEST							0.46	U	0.46	0.46	U	0.46	0.47	U	0.47	0.47	U	0.47
gamma-Chlordane	PEST							0.27	U	0.27	0.26	U	0.26	0.27	U	0.27	0.27	U	0.27
Heptachlor	PEST							0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22
Heptachlor epoxide	PEST							0.43	U	0.43	0.42	U	0.42	0.43	U	0.43	0.43	U	0.43
Methoxychlor	PEST							0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45
Toxaphene	PEST							16	U	16	16	U	16	16	U	16	16	U	16

Attachment	1	Sheet No.	8 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Organics).

CONSTITUENT	CLASS	600-369:4 Area B - J1RMP1			600-369:6 Area A - J1RMP2			600-369:6 Area B - J1RMP3			600-369:7 - J1RMP4			600-369:8 Area A - J1RMP5			600-369:8 Area B - J1RMP6		
		5/16/13			5/16/13			5/16/13			5/16/13			5/16/13			5/16/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.9	U	9.9	9.9	U	9.9	9.8	U	9.8	9.7	U	9.7	10	U	10	9.9	U	9.9
Acenaphthylene	PAH	8.9	U	8.9	8.9	U	8.9	8.8	U	8.8	8.7	U	8.7	9.0	U	9.0	8.9	U	8.9
Anthracene	PAH	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	2.9	U	2.9	3.1	U	3.1	3.0	U	3.0
Benzo(a)anthracene	PAH	9.6	J	3.2	3.2	U	3.2	3.1	U	3.1	3.1	U	3.1	3.2	U	3.2	3.2	U	3.2
Benzo(a)pyrene	PAH	14	J	6.4	6.3	U	6.3	6.3	U	6.3	6.2	U	6.2	6.4	U	6.4	6.3	U	6.3
Benzo(b)fluoranthene	PAH	22		4.2	4.2	U	4.2	4.1	U	4.1	4.1	U	4.1	4.2	U	4.2	4.2	U	4.2
Benzo(ghi)perylene	PAH	15	J	7.1	7.1	U	7.1	7.1	U	7.1	7.0	U	7.0	7.2	U	7.2	7.1	U	7.1
Benzo(k)fluoranthene	PAH	6.1	J	3.9	3.9	U	3.9	3.9	U	3.9	3.8	U	3.8	4.0	U	4.0	3.9	U	3.9
Chrysene	PAH	13	J	4.8	4.8	U	4.8	4.7	U	4.7	4.7	U	4.7	4.9	U	4.9	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	26	J	13	13	U	13	13	U	13	13	U	13	13	U	13	13	U	13
Fluorene	PAH	5.2	U	5.2	5.2	U	5.2	5.2	U	5.2	5.1	U	5.1	5.3	U	5.3	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Pyrene	PAH	28	J	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Aroclor-1016	PCB	2.8	U	2.8	2.8	U	2.8	2.6	U	2.6	2.6	U	2.6	2.7	U	2.7	2.7	U	2.7
Aroclor-1221	PCB	8.0	U	8.0	8.0	U	8.0	7.6	U	7.6	7.6	U	7.6	7.8	U	7.8	7.9	U	7.9
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.7	U	4.7	4.6	U	4.6	4.4	U	4.4	4.4	U	4.4	4.5	U	4.5	4.6	U	4.6
Aroclor-1248	PCB	4.7	U	4.7	4.6	U	4.6	4.4	U	4.4	4.4	U	4.4	4.5	U	4.5	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6
Aldrin	PEST	0.23	U	0.23	0.24	U	0.24	0.24	U	0.24	0.25	U	0.25	0.24	U	0.24	0.24	U	0.24
Alpha-BHC	PEST	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22	0.20	U	0.20	0.21	U	0.21
alpha-Chlordane	PEST	0.30	U	0.30	0.31	U	0.31	0.31	U	0.31	0.33	U	0.33	0.31	U	0.31	0.31	U	0.31
Beta-BHC	PEST	0.62	U	0.62	0.64	U	0.64	0.64	U	0.64	0.67	U	0.67	0.63	U	0.63	0.64	U	0.64
Delta-BHC	PEST	0.37	U	0.37	0.39	U	0.39	0.39	U	0.39	0.41	U	0.41	0.38	U	0.38	0.39	U	0.39
4-4'-DDD	PEST	0.51	U	0.51	0.53	U	0.53	0.53	U	0.53	0.55	U	0.55	0.52	U	0.52	0.53	U	0.53
4-4'-DDE	PEST	0.22	U	0.22	0.23	U	0.23	0.23	U	0.23	0.24	U	0.24	0.23	U	0.23	0.23	U	0.23
4-4'-DDT	PEST	0.55	U	0.55	0.57	U	0.57	0.57	U	0.57	0.60	U	0.60	0.56	U	0.56	0.57	U	0.57
Dieldrin	PEST	0.20	U	0.20	0.20	U	0.20	0.20	U	0.20	0.21	U	0.21	0.20	U	0.20	0.20	U	0.20
Endosulfan I	PEST	0.16	U	0.16	0.17	U	0.17	0.17	U	0.17	0.18	U	0.18	0.17	U	0.17	0.17	U	0.17
Endosulfan II	PEST	0.27	U	0.27	0.28	U	0.28	0.28	U	0.28	0.29	U	0.29	0.27	U	0.27	0.28	U	0.28
Endosulfan sulfate	PEST	0.26	U	0.26	0.27	U	0.27	0.27	U	0.27	0.28	U	0.28	0.26	U	0.26	0.27	U	0.27
Endrin	PEST	0.28	U	0.28	0.29	U	0.29	0.30	U	0.30	0.31	U	0.31	0.29	U	0.29	0.29	U	0.29
Endrin aldehyde	PEST	0.16	U	0.16	0.16	U	0.16	0.16	U	0.16	0.17	U	0.17	0.16	U	0.16	0.16	U	0.16
Endrin ketone	PEST	0.45	U	0.45	0.47	U	0.47	0.47	U	0.47	0.50	U	0.50	0.47	U	0.47	0.47	U	0.47
Gamma-BHC (Lindane)	PEST	0.43	U	0.43	0.45	U	0.45	0.45	U	0.45	0.47	U	0.47	0.44	U	0.44	0.45	U	0.45
gamma-Chlordane	PEST	0.25	U	0.25	0.26	U	0.26	0.26	U	0.26	0.27	U	0.27	0.25	U	0.25	0.26	U	0.26
Heptachlor	PEST	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22	0.20	U	0.20	0.21	U	0.21
Heptachlor epoxide	PEST	0.40	U	0.40	0.41	U	0.41	0.41	U	0.41	0.43	U	0.43	0.41	U	0.41	0.41	U	0.41
Methoxychlor	PEST	0.42	U	0.42	0.43	U	0.43	0.43	U	0.43	0.46	U	0.46	0.43	U	0.43	0.43	U	0.43
Toxaphene	PEST	15	U	15	15	U	15	15	U	15	16	U	16	15	U	15	15	U	15

Attachment	1	Sheet No.	9 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Organics).

CONSTITUENT	CLASS	600-369:8 Area C - J1RMP7			600-369:8 Area D - J1RMP8			Duplicate of J1RMP8 - J1RMP9			EXC3-8 - J1RN49			Duplicate of J1RN49 - J1RN54			EXC3-1 - J1RN42		
		5/16/13			5/16/13			5/16/13			5/28/13			5/28/13			5/28/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.8	U	9.8	9.9	U	9.9	9.9	U	9.9	10	U	10	10	U	10	10	UN	10
Acenaphthylene	PAH	8.9	U	8.9	8.9	U	8.9	8.9	U	8.9	9.0	U	9.0	9.1	U	9.1	9.1	UN	9.1
Anthracene	PAH	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	3.1	U	3.1	3.1	U	3.1	3.1	UN	3.1
Benzo(a)anthracene	PAH	3.1	U	3.1	3.2	U	3.2	3.2	U	3.2	3.2	U	3.2	3.2	U	3.2	3.2	UN	3.2
Benzo(a)pyrene	PAH	6.3	U	6.3	6.4	U	6.4	6.4	U	6.4	6.4	U	6.4	6.5	U	6.5	6.5	UN	6.5
Benzo(b)fluoranthene	PAH	4.1	U	4.1	4.2	U	4.2	4.2	U	4.2	4.2	U	4.2	4.3	U	4.3	4.2	UN	4.2
Benzo(ghi)perylene	PAH	7.1	U	7.1	7.1	U	7.1	7.1	U	7.1	7.2	U	7.2	7.3	U	7.3	7.3	UN	7.3
Benzo(k)fluoranthene	PAH	3.9	U	3.9	3.9	U	3.9	3.9	U	3.9	4.0	U	4.0	4.0	U	4.0	4.0	UN	4.0
Chrysene	PAH	4.8	U	4.8	4.8	U	4.8	4.8	U	4.8	4.9	U	4.9	4.9	U	4.9	4.9	UN	4.9
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	UN	11
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	13	U	13	13	U	13	13	UN	13
Fluorene	PAH	5.2	U	5.2	5.2	U	5.2	5.2	U	5.2	5.3	U	5.3	5.4	U	5.4	5.3	UN	5.3
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	UN	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	UN	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	UN	12
Pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	UN	12
Aroclor-1016	PCB	2.8	U	2.8	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7
Aroclor-1221	PCB	8.0	U	8.0	7.9	U	7.9	7.9	U	7.9	7.7	U	7.7	7.8	U	7.8	7.8	U	7.8
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0
Aroclor-1242	PCB	4.6	U	4.6	4.6	U	4.6	4.6	U	4.6	4.5	U	4.5	4.5	U	4.5	4.5	U	4.5
Aroclor-1248	PCB	4.6	U	4.6	4.6	U	4.6	4.6	U	4.6	4.5	U	4.5	4.5	U	4.5	4.5	U	4.5
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5
Aldrin	PEST	0.25	U	0.25	0.24	U	0.24	0.24	U	0.24	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25
Alpha-BHC	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22	0.22	U	0.22	0.22	U	0.22
alpha-Chlordane	PEST	0.32	U	0.32	0.31	U	0.31	0.31	U	0.31	0.33	U	0.33	0.33	U	0.33	0.33	U	0.33
Beta-BHC	PEST	0.66	U	0.66	0.64	U	0.64	0.64	U	0.64	0.67	U	0.67	0.67	U	0.67	0.67	U	0.67
Delta-BHC	PEST	0.40	U	0.40	0.39	U	0.39	0.39	U	0.39	0.40	U	0.40	0.41	U	0.41	0.41	U	0.41
4-4'-DDD	PEST	0.54	U	0.54	0.53	U	0.53	0.53	U	0.53	0.55	U	0.55	0.55	U	0.55	0.55	U	0.55
4-4'-DDE	PEST	0.24	U	0.24	0.23	U	0.23	0.23	U	0.23	0.24	U	0.24	0.24	U	0.24	0.24	U	0.24
4-4'-DDT	PEST	0.59	U	0.59	0.57	U	0.57	0.57	U	0.57	0.60	U	0.60	0.60	U	0.60	0.60	U	0.60
Dieldrin	PEST	0.21	U	0.21	0.20	U	0.20	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
Endosulfan I	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.18	U	0.18	0.18	U	0.18	0.18	U	0.18
Endosulfan II	PEST	0.29	U	0.29	0.28	U	0.28	0.28	U	0.28	0.29	U	0.29	0.29	U	0.29	0.29	U	0.29
Endosulfan sulfate	PEST	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28
Endrin	PEST	0.30	U	0.30	0.29	U	0.29	0.30	U	0.30	0.31	U	0.31	0.31	U	0.31	0.31	U	0.31
Endrin aldehyde	PEST	0.17	U	0.17	0.16	U	0.16	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST	0.49	U	0.49	0.47	U	0.47	0.47	U	0.47	0.49	U	0.49	0.49	U	0.49	0.50	U	0.50
Gamma-BHC (Lindane)	PEST	0.46	U	0.46	0.45	U	0.45	0.45	U	0.45	0.47	U	0.47	0.47	U	0.47	0.47	U	0.47
gamma-Chlordane	PEST	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27
Heptachlor	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22	0.22	U	0.22	0.22	U	0.22
Heptachlor epoxide	PEST	0.42	U	0.42	0.41	U	0.41	0.41	U	0.41	0.43	U	0.43	0.43	U	0.43	0.43	U	0.43
Methoxychlor	PEST	0.45	U	0.45	0.43	U	0.43	0.44	U	0.44	0.45	U	0.45	0.46	U	0.46	0.46	U	0.46
Toxaphene	PEST	16	U	16	15	U	15	15	U	15	16	UJ	16	16	UJ	16	16	UJ	16

Attachment	1	Sheet No.	10 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC3-2 - J1RN43			EXC3-3 - J1RN44			EXC3-4 - J1RN45			EXC3-5 - J1RN46			EXC3-6 - J1RN47			EXC3-7 - J1RN48		
		5/28/13			5/28/13			5/28/13			5/28/13			5/28/13			5/28/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	9.9	U	9.9	10	U	10	10	U	10	9.8	U	9.8	9.8	U	9.8
Acenaphthylene	PAH	9.0	U	9.0	8.9	U	8.9	9.1	U	9.1	9.1	U	9.1	8.8	U	8.8	8.8	U	8.8
Anthracene	PAH	3.0	U	3.0	3.0	U	3.0	3.1	U	3.1	3.1	U	3.1	3.0	U	3.0	3.0	U	3.0
Benzo(a)anthracene	PAH	3.2	U	3.2	3.2	U	3.2	3.2	U	3.2	3.2	U	3.2	3.1	U	3.1	3.1	U	3.1
Benzo(a)pyrene	PAH	6.4	U	6.4	6.4	U	6.4	6.5	U	6.5	13	J	6.5	6.3	U	6.3	6.3	U	6.3
Benzo(b)fluoranthene	PAH	4.2	U	4.2	4.2	U	4.2	4.2	U	4.2	14	J	4.2	4.1	U	4.1	4.1	U	4.1
Benzo(ghi)perylene	PAH	7.2	U	7.2	7.1	U	7.1	7.3	U	7.3	7.3	U	7.3	7.1	U	7.1	7.1	U	7.1
Benzo(k)fluoranthene	PAH	3.9	U	3.9	3.9	U	3.9	4.0	U	4.0	4.0	U	4.0	3.9	U	3.9	3.9	U	3.9
Chrysene	PAH	4.8	U	4.8	4.8	U	4.8	4.9	U	4.9	8.6	JX	4.9	4.7	U	4.7	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	13	J	13	13	U	13	13	U	13
Fluorene	PAH	5.3	U	5.3	5.2	U	5.2	5.3	U	5.3	5.3	U	5.3	5.2	U	5.2	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Pyrene	PAH	12	U	12	12	U	12	12	U	12	14	J	12	12	U	12	12	U	12
Aroclor-1016	PCB	2.7	U	2.7	2.7	U	2.7	2.6	U	2.6	2.7	U	2.7	2.7	U	2.7	2.6	U	2.6
Aroclor-1221	PCB	7.7	U	7.7	7.9	U	7.9	7.6	U	7.6	7.8	U	7.8	7.9	U	7.9	7.7	U	7.7
Aroclor-1232	PCB	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9
Aroclor-1242	PCB	4.5	U	4.5	4.6	U	4.6	4.4	U	4.4	4.5	U	4.5	4.6	U	4.6	4.4	U	4.4
Aroclor-1248	PCB	4.5	U	4.5	4.6	U	4.6	4.4	U	4.4	4.5	U	4.5	4.6	U	4.6	4.4	U	4.4
Aroclor-1254	PCB	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5
Aroclor-1260	PCB	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5
Aldrin	PEST	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25
Alpha-BHC	PEST	0.21	U	0.21	0.22	U	0.22	0.21	U	0.21	0.22	U	0.22	0.21	U	0.21	0.21	U	0.21
alpha-Chlordane	PEST	0.32	U	0.32	0.33	U	0.33	0.32	U	0.32	0.33	U	0.33	0.32	U	0.32	0.32	U	0.32
Beta-BHC	PEST	0.65	U	0.65	0.67	U	0.67	0.66	U	0.66	0.67	U	0.67	0.67	U	0.67	0.65	U	0.65
Delta-BHC	PEST	0.39	U	0.39	0.41	U	0.41	0.40	U	0.40	0.41	U	0.41	0.40	U	0.40	0.40	U	0.40
4-4'-DDD	PEST	0.54	U	0.54	0.55	U	0.55	0.54	U	0.54	0.55	U	0.55	0.55	U	0.55	0.54	U	0.54
4-4'-DDE	PEST	0.23	U	0.23	0.24	U	0.24	0.24	U	0.24	0.24	U	0.24	0.24	U	0.24	0.23	U	0.23
4-4'-DDT	PEST	0.58	U	0.58	0.60	U	0.60	0.59	U	0.59	0.60	U	0.60	0.59	U	0.59	0.58	U	0.58
Dieldrin	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
Endosulfan I	PEST	0.17	U	0.17	0.18	U	0.18	0.17	U	0.17	0.18	U	0.18	0.18	U	0.18	0.17	U	0.17
Endosulfan II	PEST	0.28	U	0.28	0.29	U	0.29	0.29	U	0.29	0.29	U	0.29	0.29	U	0.29	0.28	U	0.28
Endosulfan sulfate	PEST	0.27	U	0.27	0.28	U	0.28	0.27	U	0.27	0.28	U	0.28	0.28	U	0.28	0.27	U	0.27
Endrin	PEST	0.30	U	0.30	0.31	U	0.31	0.30	U	0.30	0.31	U	0.31	0.31	U	0.31	0.30	U	0.30
Endrin aldehyde	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST	0.48	U	0.48	0.49	U	0.49	0.49	U	0.49	0.50	U	0.50	0.49	U	0.49	0.48	U	0.48
Gamma-BHC (Lindane)	PEST	0.46	U	0.46	0.47	U	0.47	0.46	U	0.46	0.47	U	0.47	0.47	U	0.47	0.46	U	0.46
gamma-Chlordane	PEST	0.26	U	0.26	0.27	U	0.27	0.26	U	0.26	0.27	U	0.27	0.27	U	0.27	0.26	U	0.26
Heptachlor	PEST	0.21	U	0.21	0.22	U	0.22	0.21	U	0.21	0.22	U	0.22	0.21	U	0.21	0.21	U	0.21
Heptachlor epoxide	PEST	0.42	U	0.42	0.43	U	0.43	0.42	U	0.42	0.43	U	0.43	0.43	U	0.43	0.42	U	0.42
Methoxychlor	PEST	0.44	U	0.44	0.45	U	0.45	0.45	U	0.45	0.46	U	0.46	0.45	U	0.45	0.44	U	0.44
Toxaphene	PEST	16	UJ	16	16	UJ	16	16	UJ	16	16	UJ	16	16	UJ	16	16	UJ	16

Attachment	1	Sheet No.	11 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC3-9 - J1RN50			EXC3-10 - J1RN51			EXC3-11 - J1RN52			EXC3-12 - J1RN53			EXC5-12 - J1RN67			Duplicate of J1RN67 - J1RN68		
		5/28/13			5/28/13			5/28/13			5/28/13			5/29/13			5/29/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	18	JX	10	10	U	10	10	U	10	9.9	U	9.9	10	U	10	9.9	U	9.9
Acenaphthylene	PAH	9.1	U	9.1	9.1	U	9.1	9.1	U	9.1	8.9	U	8.9	9.2	U	9.2	9.0	U	9.0
Anthracene	PAH	3.1	U	3.1	3.1	U	3.1	3.1	U	3.1	3.0	U	3.0	3.1	U	3.1	3.0	U	3.0
Benzo(a)anthracene	PAH	70	X	3.2	4.1	J	3.2	3.2	U	3.2	3.2	U	3.2	3.3	U	3.3	3.2	U	3.2
Benzo(a)pyrene	PAH	92		6.5	6.5	U	6.5	30		6.5	6.4	U	6.4	6.6	U	6.6	6.4	U	6.4
Benzo(b)fluoranthene	PAH	120		4.2	5.7	J	4.2	47		4.2	4.2	U	4.2	4.3	U	4.3	4.2	U	4.2
Benzo(ghi)perylene	PAH	75		7.3	7.3	U	7.3	27	J	7.3	7.2	U	7.2	7.4	U	7.4	7.2	U	7.2
Benzo(k)fluoranthene	PAH	53		4.0	4.0	U	4.0	12	JX	4	3.9	U	3.9	4.0	U	4.0	3.9	U	3.9
Chrysene	PAH	100		4.9	4.9	U	4.9	29	J	4.9	4.8	U	4.8	5.0	U	5.0	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	170		13	13	U	13	61		13	13	U	13	13	U	13	13	U	13
Fluorene	PAH	8.1	J	5.3	5.3	U	5.3	5.3	U	5.3	5.2	U	5.2	5.4	U	5.4	5.3	U	5.3
Indeno(1,2,3-cd)pyrene	PAH	74		12	12	U	12	20	J	12	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	64		12	12	U	12	21	J	12	12	U	12	12	U	12	12	U	12
Pyrene	PAH	130		12	12	U	12	58		12	12	U	12	12	U	12	12	U	12
Aroclor-1016	PCB	2.7	U	2.7	2.5	U	2.5	2.6	U	2.6	2.6	U	2.6	2.8	U	2.8	2.8	U	2.8
Aroclor-1221	PCB	7.9	U	7.9	7.4	U	7.4	7.6	U	7.6	7.6	U	7.6	8.2	U	8.2	8.2	U	8.2
Aroclor-1232	PCB	2.0	U	2.0	1.8	U	1.8	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.6	U	4.6	4.3	U	4.3	4.4	U	4.4	4.4	U	4.4	4.8	U	4.8	4.8	U	4.8
Aroclor-1248	PCB	4.6	U	4.6	4.3	U	4.3	4.4	U	4.4	4.4	U	4.4	4.8	U	4.8	4.8	U	4.8
Aroclor-1254	PCB	2.6	U	2.6	2.4	U	2.4	2.5	U	2.5	2.5	U	2.5	2.7	U	2.7	2.7	U	2.7
Aroclor-1260	PCB	2.6	U	2.6	2.4	U	2.4	2.5	U	2.5	2.5	U	2.5	2.7	U	2.7	2.7	U	2.7
Aldrin	PEST	0.26	U	0.26	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.26	U	0.26	0.25	U	0.25
Alpha-BHC	PEST	0.22	U	0.22	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22	0.21	U	0.21
alpha-Chlordane	PEST	0.33	U	0.33	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.34	U	0.34	0.32	U	0.32
Beta-BHC	PEST	0.68	U	0.68	0.66	U	0.66	0.67	U	0.67	0.66	U	0.66	0.69	U	0.69	0.65	U	0.65
Delta-BHC	PEST	0.41	U	0.41	0.40	U	0.40	0.40	U	0.40	0.40	U	0.40	0.42	U	0.42	0.39	U	0.39
4-4'-DDD	PEST	0.56	U	0.56	0.54	U	0.54	0.55	U	0.55	0.54	U	0.54	0.57	U	0.57	0.53	U	0.53
4-4'-DDE	PEST	0.24	U	0.24	0.24	U	0.24	0.24	U	0.24	0.24	U	0.24	0.25	U	0.25	0.23	U	0.23
4-4'-DDT	PEST	3.0	UD	3.0	0.59	U	0.59	3.0	UD	3.0	0.58	U	0.58	3.1	UD	3.1	2.9	UD	2.9
Dieldrin	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22	0.21	U	0.21
Endosulfan I	PEST	0.18	U	0.18	0.17	U	0.17	0.18	U	0.18	0.17	U	0.17	0.18	U	0.18	0.17	U	0.17
Endosulfan II	PEST	0.29	U	0.29	0.28	U	0.28	0.29	U	0.29	0.28	U	0.28	0.30	U	0.30	0.28	U	0.28
Endosulfan sulfate	PEST	0.28	U	0.28	0.27	U	0.27	0.28	U	0.28	0.27	U	0.27	0.29	U	0.29	0.27	U	0.27
Endrin	PEST	0.31	U	0.31	0.30	U	0.30	0.31	U	0.31	0.30	U	0.30	0.32	U	0.32	0.30	U	0.30
Endrin aldehyde	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.18	U	0.18	0.17	U	0.17
Endrin ketone	PEST	0.50	U	0.50	0.48	U	0.48	0.49	U	0.49	0.48	U	0.48	0.51	U	0.51	0.48	U	0.48
Gamma-BHC (Lindane)	PEST	0.47	U	0.47	0.46	U	0.46	0.46	U	0.46	0.46	U	0.46	0.48	U	0.48	0.45	U	0.45
gamma-Chlordane	PEST	0.27	U	0.27	0.26	U	0.26	0.27	U	0.27	0.26	U	0.26	0.28	U	0.28	0.26	U	0.26
Heptachlor	PEST	0.22	U	0.22	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.22	U	0.22	0.21	U	0.21
Heptachlor epoxide	PEST	0.43	U	0.43	0.42	U	0.42	0.43	U	0.43	0.42	U	0.42	0.44	U	0.44	0.42	U	0.42
Methoxychlor	PEST	0.46	U	0.46	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	2.3	UD	2.3	2.2	UD	2.2
Toxaphene	PEST	16	UJ	16	16	UJ	16	16	UJ	16	16	UJ	16	16	U	16	15	U	15

Attachment	1	Sheet No.	12 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC5-1 - J1RN56			EXC5-2 - J1RN57			EXC5-3 - J1RN58			EXC5-4 - J1RN59			EXC5-5 - J1RN60			EXC5-6 - J1RN61		
		5/29/13			5/29/13			5/29/13			5/29/13			5/29/13			5/29/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	11	U	11	10	U	10	10	U	10	11	U	11	11	U	11
Acenaphthylene	PAH	9.3	U	9.3	9.6	U	9.6	9.1	U	9.1	9.3	U	9.3	9.8	U	9.8	9.5	U	9.5
Anthracene	PAH	3.1	U	3.1	3.2	U	3.2	3.1	U	3.1	3.1	U	3.1	3.3	U	3.3	3.2	U	3.2
Benzo(a)anthracene	PAH	3.3	U	3.3	3.4	UN	3.4	3.2	U	3.2	3.3	U	3.3	3.5	U	3.5	3.4	U	3.4
Benzo(a)pyrene	PAH	6.6	U	6.6	6.8	U	6.8	6.5	U	6.5	6.6	U	6.6	7.0	U	7.0	6.8	U	6.8
Benzo(b)fluoranthene	PAH	4.3	U	4.3	4.5	U	4.5	4.3	U	4.3	4.3	U	4.3	4.6	U	4.6	7.6	J	4.4
Benzo(ghi)perylene	PAH	7.4	U	7.4	7.7	U	7.7	7.3	U	7.3	7.4	U	7.4	7.9	U	7.9	7.6	U	7.6
Benzo(k)fluoranthene	PAH	4.1	U	4.1	4.2	U	4.2	4.0	U	4.0	4.1	U	4.1	4.3	U	4.3	4.2	U	4.2
Chrysene	PAH	5.0	U	5.0	5.2	U	5.2	4.9	U	4.9	5.0	U	5.0	5.3	U	5.3	5.9	J	5.1
Dibenz[a,h]anthracene	PAH	11	U	11	12	U	12	11	U	11	11	U	11	12	U	12	12	U	12
Fluoranthene	PAH	13	U	13	14	U	14	13	U	13	13	U	13	14	U	14	14	U	14
Fluorene	PAH	5.4	U	5.4	5.6	U	5.6	5.4	U	5.4	5.4	U	5.4	5.8	U	5.8	5.6	U	5.6
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	13	U	13	12	U	12	12	U	12	13	U	13	13	U	13
Naphthalene	PAH	12	U	12	13	U	13	12	U	12	12	U	12	13	U	13	13	U	13
Phenanthrene	PAH	12	U	12	13	U	13	12	U	12	12	U	12	13	U	13	13	U	13
Pyrene	PAH	12	U	12	13	U	13	12	U	12	12	U	12	13	U	13	13	U	13
Aroclor-1016	PCB	2.9	U	2.9	2.9	U	2.9	3.0	U	3.0	3.0	U	3.0	2.9	U	2.9	2.9	U	2.9
Aroclor-1221	PCB	8.4	U	8.4	8.4	U	8.4	8.6	U	8.6	8.6	U	8.6	8.5	U	8.5	8.4	U	8.4
Aroclor-1232	PCB	2.1	U	2.1	2.1	U	2.1	2.1	U	2.1	2.2	U	2.2	2.1	U	2.1	2.1	U	2.1
Aroclor-1242	PCB	4.9	U	4.9	4.9	U	4.9	5.0	U	5.0	5.0	U	5.0	5.0	U	5.0	4.9	U	4.9
Aroclor-1248	PCB	4.9	U	4.9	4.9	U	4.9	5.0	U	5.0	5.0	U	5.0	5.0	U	5.0	4.9	U	4.9
Aroclor-1254	PCB	2.7	U	2.7	2.7	U	2.7	2.8	U	2.8	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7
Aroclor-1260	PCB	2.7	U	2.7	2.7	U	2.7	2.8	U	2.8	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7
Aldrin	PEST	0.26	U	0.26	0.27	U	0.27	0.25	U	0.25	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26
Alpha-BHC	PEST	0.23	U	0.23	0.23	U	0.23	0.22	U	0.22	0.23	U	0.23	0.22	U	0.22	0.23	U	0.23
alpha-Chlordane	PEST	0.34	U	0.34	0.35	U	0.35	0.33	U	0.33	0.34	U	0.34	0.34	U	0.34	0.34	U	0.34
Beta-BHC	PEST	0.70	U	0.70	0.71	U	0.71	0.67	U	0.67	0.70	U	0.70	0.69	U	0.69	0.70	U	0.70
Delta-BHC	PEST	0.42	U	0.42	0.43	U	0.43	0.41	U	0.41	0.42	U	0.42	0.42	U	0.42	0.42	U	0.42
4-4'-DDD	PEST	0.58	U	0.58	0.59	U	0.59	0.55	U	0.55	0.57	U	0.57	0.57	U	0.57	0.57	U	0.57
4-4'-DDE	PEST	0.25	U	0.25	0.26	U	0.26	0.24	U	0.24	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25
4-4'-DDT	PEST	0.62	U	0.62	0.63	U	0.63	0.60	U	0.60	0.62	U	0.62	0.61	U	0.61	3.1	UD	3.1
Dieldrin	PEST	0.22	U	0.22	0.23	U	0.23	0.21	U	0.21	0.22	U	0.22	0.22	U	0.22	0.22	U	0.22
Endosulfan I	PEST	0.19	U	0.19	0.19	U	0.19	0.18	U	0.18	0.19	U	0.19	0.18	U	0.18	0.19	U	0.19
Endosulfan II	PEST	0.30	U	0.30	0.31	U	0.31	0.29	U	0.29	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30
Endosulfan sulfate	PEST	0.29	U	0.29	0.30	U	0.30	0.28	U	0.28	0.29	U	0.29	0.29	U	0.29	0.29	U	0.29
Endrin	PEST	0.32	U	0.32	0.33	U	0.33	0.31	U	0.31	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32
Endrin aldehyde	PEST	0.18	U	0.18	0.18	U	0.18	0.17	U	0.17	0.18	U	0.18	0.18	U	0.18	0.18	U	0.18
Endrin ketone	PEST	0.52	U	0.52	0.52	U	0.52	0.50	U	0.50	0.51	U	0.51	0.51	U	0.51	0.51	U	0.51
Gamma-BHC (Lindane)	PEST	0.49	U	0.49	0.50	U	0.50	0.47	U	0.47	0.49	U	0.49	0.48	U	0.48	0.49	U	0.49
gamma-Chlordane	PEST	0.28	U	0.28	0.29	U	0.29	0.27	U	0.27	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28
Heptachlor	PEST	0.23	U	0.23	0.23	U	0.23	0.22	U	0.22	0.23	U	0.23	0.22	U	0.22	0.23	U	0.23
Heptachlor epoxide	PEST	0.45	U	0.45	0.46	U	0.46	0.43	U	0.43	0.45	U	0.45	0.44	U	0.44	0.45	U	0.45
Methoxychlor	PEST	0.47	U	0.47	0.48	U	0.48	0.46	U	0.46	0.47	U	0.47	0.47	U	0.47	2.4	UD	2.4
Toxaphene	PEST	17	U	17	17	U	17	16	U	16	17	U	17	16	U	16	17	U	17

Attachment	1	Sheet No.	13 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Attachment 1. 600-368 and 600-369 Waste Sites Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC5-7 - J1RN62			EXC5-8 - J1RN63			EXC5-9 - J1RN66			EXC5-10 - J1RN65			EXC5-11 - J1RN64		
		5/29/13			5/29/13			5/29/13			5/29/13			5/29/13		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	11	U	11	10	U	10	11	U	11	10	U	10	11	U	11
Acenaphthylene	PAH	9.6	U	9.6	9.4	U	9.4	9.8	U	9.8	9.2	U	9.2	9.6	U	9.6
Anthracene	PAH	3.3	U	3.3	3.2	U	3.2	3.3	U	3.3	3.1	U	3.1	3.3	U	3.3
Benzo(a)anthracene	PAH	3.4	U	3.4	3.3	U	3.3	3.5	U	3.5	3.3	U	3.3	3.4	U	3.4
Benzo(a)pyrene	PAH	6.8	U	6.8	6.7	U	6.7	7.0	U	7.0	6.5	U	6.5	6.8	U	6.8
Benzo(b)fluoranthene	PAH	5.6	J	4.5	4.4	U	4.4	4.6	U	4.6	4.3	U	4.3	4.5	U	4.5
Benzo(ghi)perylene	PAH	7.7	U	7.7	7.5	U	7.5	7.9	U	7.9	7.3	U	7.3	7.7	U	7.7
Benzo(k)fluoranthene	PAH	4.2	U	4.2	4.1	U	4.1	4.3	U	4.3	4.0	U	4.0	4.2	U	4.2
Chrysene	PAH	5.2	U	5.2	5.1	U	5.1	5.3	U	5.3	4.9	U	4.9	5.2	U	5.2
Dibenz[a,h]anthracene	PAH	12	U	12	12	U	12	12	U	12	11	U	11	12	U	12
Fluoranthene	PAH	14	U	14	14	U	14	14	U	14	13	U	13	14	U	14
Fluorene	PAH	5.6	U	5.6	5.5	U	5.5	5.8	U	5.8	5.4	U	5.4	5.6	U	5.6
Indeno(1,2,3-cd)pyrene	PAH	13	U	13	13	U	13	13	U	13	12	U	12	13	U	13
Naphthalene	PAH	13	U	13	13	U	13	13	U	13	12	U	12	13	U	13
Phenanthrene	PAH	13	U	13	13	U	13	13	U	13	12	U	12	13	U	13
Pyrene	PAH	13	U	13	13	U	13	13	U	13	12	U	12	13	U	13
Aroclor-1016	PCB	2.9	U	2.9	3.0	U	3.0	2.9	U	2.9	2.8	U	2.8	2.9	U	2.9
Aroclor-1221	PCB	8.5	U	8.5	8.6	U	8.6	8.5	U	8.5	8.1	U	8.1	8.5	U	8.5
Aroclor-1232	PCB	2.1	U	2.1	2.1	U	2.1	2.1	U	2.1	2.0	U	2.0	2.1	U	2.1
Aroclor-1242	PCB	4.9	U	4.9	5.0	U	5.0	4.9	U	4.9	4.7	U	4.7	4.9	U	4.9
Aroclor-1248	PCB	4.9	U	4.9	5.0	U	5.0	4.9	U	4.9	4.7	U	4.7	4.9	U	4.9
Aroclor-1254	PCB	2.7	U	2.7	2.8	U	2.8	2.8	U	2.8	2.6	U	2.6	2.7	U	2.7
Aroclor-1260	PCB	2.7	U	2.7	2.8	U	2.8	2.8	U	2.8	2.6	U	2.6	2.7	U	2.7
Aldrin	PEST	0.25	U	0.25	0.26	U	0.26	0.26	U	0.26	0.28	U	0.28	0.26	U	0.26
Alpha-BHC	PEST	0.21	U	0.21	0.22	U	0.22	0.22	U	0.22	0.23	U	0.23	0.22	U	0.22
alpha-Chlordane	PEST	0.32	U	0.32	0.33	U	0.33	0.33	U	0.33	0.35	U	0.35	0.33	U	0.33
Beta-BHC	PEST	0.66	U	0.66	0.69	U	0.69	0.68	U	0.68	0.73	U	0.73	0.68	U	0.68
Delta-BHC	PEST	0.40	U	0.40	0.42	U	0.42	0.41	U	0.41	0.44	U	0.44	0.41	U	0.41
4-4'-DDD	PEST	0.55	U	0.55	0.57	U	0.57	0.56	U	0.56	0.60	U	0.60	0.56	U	0.56
4-4'-DDE	PEST	0.24	U	0.24	0.25	U	0.25	0.24	U	0.24	0.26	U	0.26	0.24	U	0.24
4-4'-DDT	PEST	3.0	UD	3.0	3.1	UD	3.1	3.0	UD	3.0	3.2	UD	3.2	3.0	UD	3.0
Dieldrin	PEST	0.21	U	0.21	0.22	U	0.22	0.22	U	0.22	0.23	U	0.23	0.22	U	0.22
Endosulfan I	PEST	0.18	U	0.18	0.18	U	0.18	0.18	U	0.18	0.19	U	0.19	0.18	U	0.18
Endosulfan II	PEST	0.29	U	0.29	0.30	U	0.30	0.3	U	0.3	0.31	U	0.31	0.29	U	0.29
Endosulfan sulfate	PEST	0.28	U	0.28	0.29	U	0.29	0.28	U	0.28	0.30	U	0.30	0.28	U	0.28
Endrin	PEST	0.31	U	0.31	0.32	U	0.32	0.31	U	0.31	0.34	U	0.34	0.31	U	0.31
Endrin aldehyde	PEST	0.17	U	0.17	0.18	U	0.18	0.18	U	0.18	0.19	U	0.19	0.18	U	0.18
Endrin ketone	PEST	0.49	U	0.49	0.51	U	0.51	0.50	U	0.50	0.54	U	0.54	0.50	U	0.50
Gamma-BHC (Lindane)	PEST	0.46	U	0.46	0.48	U	0.48	0.48	U	0.48	0.51	U	0.51	0.48	U	0.48
gamma-Chlordane	PEST	0.27	U	0.27	0.28	U	0.28	0.27	U	0.27	0.29	U	0.29	0.27	U	0.27
Heptachlor	PEST	0.21	U	0.21	0.22	U	0.22	0.22	U	0.22	0.23	U	0.23	0.22	U	0.22
Heptachlor epoxide	PEST	0.43	U	0.43	0.44	U	0.44	0.44	U	0.44	0.47	U	0.47	0.44	U	0.44
Methoxychlor	PEST	2.3	UD	2.3	2.3	UD	2.3	2.3	UD	2.3	2.5	UD	2.5	2.3	UD	2.3
Toxaphene	PEST	16	U	16	16	U	16	16	U	16	17	U	17	16	U	16

Attachment	1	Sheet No.	14 of 14
Originator	J. D. Skoglie	Date	8/19/13
Checked	N. K. Schiffern	Date	8/19/13
Calc. No.	0600X-CA-V0144	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 600

Discipline: Environmental Calculation No: 0600X-CA-V0145

Subject: 600-368 and 600-369 Waste Sites 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	N. K. Schiffern	I. B. Berezovskiy	D. F. Obenauer	12/3/13

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	8/19/2013	Calc. No.:	0600X-CA-V0145	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	N. K. Schiffern	Date:	8/19/2013
Subject:	600-368 and 600-369 Waste Sites 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 600-368 and 600-369 waste sites. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009a), the following criteria must be met:

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

GIVEN/REFERENCES:

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

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

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

4) WCH, 2013, *Remaining Sites Verification Package for the 600-368, Segment 4 Stained Soil #1; and 600-369, Segment 4 Bare Ground and Crusted Soil Areas Waste Sites*, Attachment to Waste Site Reclassification Forms 2013-083 and 2013-090, 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:	8/28/2013	Calc. No.:	0600X-CA-V0145	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	N. K. Schiffern	Date:	8/28/2013
Subject:	600-368 and 600-369 Waste Sites Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 4	

METHODOLOGY:

The 600-368 and 600-369 waste sites are comprised of two statistical decision units and seven composite decision units for verification sampling, consisting of 600-369:3 (EXC3), 600-369:5 (EXC5), 600-368, 600-369:1, 600-369:2, 600-369:4, 600-369:6, 600-369:7, and 600-369:8. The direct contact hazard quotient and carcinogenic risk calculations for the 600-368 and 600-369 waste sites were conservatively calculated for the entire waste sites using the greater of the statistical and composite verification soil sample results (WCH 2013). Of the contaminants of potential concern (COPCs) for these sites, boron, hexavalent chromium, molybdenum, and the detected polycyclic aromatic hyrdrocarbons (PAHs) require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead is not included in the calculation based on modeling of child blood levels, which is fundamentally different from the oral-reference dose and cancer slope factors used to calculate typical cleanup levels and associated HQs and cancer risks. Although total petroleum hydrocarbons (diesel range + diesel range extended) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. Additionally, arsenic was detected above background; however, the arsenic standard is not toxicity based. 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 2.1 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 2.9×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 2.2×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for benzo(a)pyrene is 0.092 mg/kg, divided by 0.137 mg/kg, and multiplied as indicated, is 6.7×10^{-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 1.0×10^{-6}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	8/19/2013	Calc. No.:	0600X-CA-V0145	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	N. K. Schiffern	Date:	8/19/2013
Subject:	600-368 and 600-369 Waste Sites Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 4	

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 600-368 and 600-369 Waste Sites.

Contaminants of Potential Concern	Maximum or Statistical Value [a] (mg/kg)	Noncarcinogen RAG [b] (mg/kg)	Hazard Quotient	Carcinogen RAG [b] (mg/kg)	Carcinogen Risk
Metals					
Arsenic [c]	12.5	20	--	--	--
Boron	2.1	7,200	2.9E-04	--	--
Chromium, hexavalent [d]	0.231	240	9.6E-04	2.1	1.1E-07
Lead [e]	52.4	353	--	--	--
Molybdenum	0.32	400	8.0E-04	--	--
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.018	4,800	3.8E-06	--	--
Benzo(a)anthracene	0.070	--	--	1.37	5.1E-08
Benzo(a)pyrene	0.092	--	--	0.137	6.7E-07
Benzo(b)fluoranthene	0.12	--	--	1.37	8.8E-08
Benzo(ghi)perylene [f]	0.075	2,400	3.1E-05	--	--
Benzo(k)fluoranthene	0.053	--	--	1.37	3.9E-08
Chrysene	0.10	--	--	13.7	7.3E-09
Fluoranthene	0.17	3,200	5.3E-05	--	--
Fluorene	0.0081	3,200	2.5E-06	--	--
Indeno(1,2,3-cd)pyrene	0.074	--	--	1.37	5.4E-08
Phenanthrene [f]	0.064	24,000	2.7E-06	--	--
Pyrene	0.13	2,400	5.4E-05	--	--
Total Petroleum Hydrocarbons					
TPH - Diesel Range EXT [g]	130	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**2.2E-03**		
Cumulative Excess Cancer Risk:					**1.0E-06**

Notes:

[a] = From Attachment 1

[b] = Value obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) or *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

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

[d] = Value for the carcinogen RAG calculated based on the inhalation exposure pathway (WAC) 173-340-750(3), 1996.

[e] = 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.

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

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

-- = not applicable

RAG = remedial action goal

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	8/19/2013	Calc. No.:	0600X-CA-V0145	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	N. K. Schiffern	Date:	8/19/2013
Subject:	600-368 and 600-369 Waste Sites Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 4	

CONCLUSION:

The calculations in Table 1 demonstrates that the 600-368 and 600-369 waste sites meet the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk, respectively, as identified in the RDR/RAWP (DOE-RL 2009a) and SAP (DOE-RL 2009b). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for these sites.

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 designs (WCH 2013a, 2013c). 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 designs (WCH 2013a, 2013c), the field logbook (WCH 2013b), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample designs. To ensure quality data, the SAP 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 600-368 and 600-369 waste sites were provided by the laboratories in four sample delivery groups (SDGs): SDG J01807, SDG J01809, SDG J01815, and SDG J01817. SDG J01807 and SDG J01815 were submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 600-368 and 600-369 data sets, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

SDG J01807

This SDG comprises one soil sample (J1RML8) from the 600-368 waste site. This SDG includes a field duplicate pair (J1RML8/J1RML9). These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, polycyclic aromatic hydrocarbons (PAH), nitrate/nitrite, and hexavalent chromium. In addition, one equipment blank (J1RMM0) was collected and analyzed for ICP metals and mercury. SDG J01807 was submitted for third-party validation. Minor deficiencies are as follows.

In the ICP metals analysis, the matrix spike (MS) recoveries are out of project acceptance criteria for five analytes (aluminum, antimony, iron, manganese, and silicon). For aluminum, iron, and manganese analytes the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the MS. The MS recoveries for antimony and silicon were 47% and

17%, respectively. All antimony and silicon results for SDG J01807 are qualified as estimates by third-party validation with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory control sample (LCS) recovery for silicon is below the laboratory and project recovery limits at 7%. All silicon results in SDG J01807 are qualified as estimates by third-party validation with "J" flags. The data are usable for decision-making purposes.

SDG J01809

This SDG comprises 12 composite (focused) soil samples (J1RMN7 through J1RMN9, J1RMP0 through J1RMP8) from 600-369:1, 600-369:2, 600-369:4, 600-369:6, 600-369:7, and 600-369:8 subsite excavations. This SDG includes a field duplicate pair (J1RMP8/J1RMP9). These samples were analyzed for ICP metals, PAH, total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), and pesticides. Minor deficiencies are as follows.

In the TPH analysis, the LCS recovery was outside of the project quality control (QC) limit for diesel range (47%) and diesel range extended (48%) hydrocarbons. The LCS duplicate (LCSD) recoveries were within the project QC limits. In addition, the relative percent difference (RPD) calculations from the laboratory duplicate were above the QC limits for diesel range (67%) and diesel range extended (67%) hydrocarbons. The MS and matrix spike duplicate (MSD) recoveries were outside of the QC limits. Due to multiple QC deficiencies, the laboratory reextracted and reanalyzed all the samples for TPH. The final LCS, LCSD, MS, MSD, and RPDs were within the project QC limits. However, the recommended holding time for the reanalyzed samples was exceeded by 1 day. Due to holding time exceedance by one day, but less than twice the limit, all final TPH data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, barium and zinc were detected at less than the minimum detection limit (MDL) in the method blank (MB). Therefore, there is no significant impact to the sample data and the data are usable for decision-making purposes.

In the ICP metals analysis, recovery of silicon (5%) in the LSC was outside of QC limits. Although not qualified for LCS recovery outside of QC limits, all silicon results for SDG J01809 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were outside of project acceptance criteria for aluminum (979%), antimony (43%), iron (2963%), manganese (224%), and silicon (10%). For aluminum, iron, and manganese, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample and these data may be considered estimated. Antimony and silicon did not have mismatched spike and native concentrations in the original MS. Although not qualified for MS recovery outside of QC limits, all associated analyte results may be considered estimated. Estimated data are usable for decision-making purposes.

SDG J01815

This SDG comprises 12 statistical soil samples (J1RN42 through J1RN53) from the 600-369:3 subsite excavation. This SDG includes a field duplicate pair (J1RN53/J1RN54). These samples were analyzed for ICP metals, PAH, TPH, PCBs, and pesticides. In addition, one field equipment blank (J1RN55) was collected and analyzed for ICP metals. SDG J01815 was submitted for third-party validation. Minor deficiencies are as follows.

In the pesticide analysis, QC data for the MS, MSD, and laboratory duplicate information was not provided for toxaphene. All toxaphene data for SDG J01815 were considered estimated and flagged "J" by third-party validation due to the lack of QC analysis. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were outside of project acceptance criteria for aluminum (892%), antimony (47%), iron (1,013%), and silicon (8%). For aluminum and iron, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample and these data may be considered estimated. Antimony and silicon did not have mismatched spike and native concentrations in the original MS. All antimony and silicon data were qualified as estimated and flagged "J" by third-party validation due to the MS recoveries outside the QC limits. Although not qualified for MS recovery outside of QC limits, all aluminum and iron results may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, all silicon results were considered estimated and flagged "J" by third-party validation due to a LCS outside QC limits at 20%. Estimated data are usable for decision-making purposes.

SDG J01817

This SDG comprises 12 statistical soil samples (J1RN56 through J1RN67) from the 600-369:5 subsite excavation. This SDG includes a field duplicate pair (J1RN67/J1RN68). These samples were analyzed for ICP metals, PAH, TPH, PCBs, and pesticides. In addition, one field equipment blank (J1RN69) was collected and analyzed for ICP metals. Minor deficiencies are as follows.

The sample was received at a temperature of 15.6 °C, above the target temperature of 4 °C, with no ice present in the cooler. The time between sample collection and receipt was 5 days. Due to unexpectedly prolonged transit time of the samples, the ice had melted in the cooler. The samples were received in good condition with appropriate sample labels and custody seals. Considering that the sample material and their potential contaminants had been exposed to the natural environment for decades, a few days in a relatively controlled environment (sealed glass jar, dark sample cooler, and no extreme temperature changes) would not cause a significant impact on the sample data results. Because the cooler was packaged with ice prior to shipping, it is speculated that the samples would be without ice for only 1 to 2 days. Although not qualified

for preservation temperature exceedance, all sampling data associated with SDG J01817 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, barium, chromium, and iron were detected at less than twice the MDL in the MB. Barium, chromium, and iron were detected in the field samples at significantly higher levels. Therefore, there is no significant impact to the sample data and the data are usable for decision-making purposes.

In the ICP metals analysis, although not qualified for the LCS recovery outside of the QC limits, the silicon results may be considered estimated due to an LCS below QC limits at 14%. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for five analytes (aluminum [934%], antimony [52%], iron [1,520%], manganese [163%], and silicon [24%]). For aluminum, iron, and manganese the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the original MS. The original MS recoveries for antimony and silicon were 52% and 24%, respectively. Although not qualified for MS recovery outside of QC limits, antimony and silicon results may be considered estimated. Estimated data are usable for decision-making purposes.

In the TPH analysis, contamination was detected at less than twice the MDL in the MB for diesel range and diesel range extended hydrocarbons. There is no significant impact to the sample data and 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 2013b) are the 600-369 primary and duplicate samples (J1RML8/J1RML9), 600-369:3 primary and duplicate samples (J1RN49/J1RN54), 600-369:5 primary and duplicate samples (J1RN67/J1RN68), and 600-369:8 primary and duplicate samples (J1RMP8/J1RMP9). The main and QA/QC sample results are presented in Appendix B.

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern. 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 for silicon (39.1%) in the 600-369:5 duplicate sample is above the acceptance criteria of 30%. A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than 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 600-368 and 600-369 waste sites verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 600-368 and 600-369 waste sites concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in the Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix B.

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