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

0099391

11-AMRC-0213

SEP 23 2011

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

Dear Ms. Hedges:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 1607-H1 SEPTIC TANK AND ASSOCIATED DRAIN FIELD, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2010-065 and supporting "Remaining Sites Verification Package for the 1607-H1, Septic Tank and Associated Drain Field," Revision 0. If you have questions, please contact me or your staff may contact Joanne Chance, of my staff, at (509) 376-0811.

Sincerely,

Mark S. French

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

AMRC:JCC

Attachment

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

cc w/o attach:
S. A. Christman, CHPRC
S. L. Feaster, WCH
C. H. Page, WCH
M. L. Proctor, WCH

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SEP 28 2011
EDMC

100-HR-2

Date Submitted: 5/4/11 Originator: M. L. Proctor Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-HR-2 Waste Site Code: 1607-H1 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2010-065

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

Description of current waste site condition:

The 1607-H1 Septic Tank and Associated Drain Field received sanitary sewage from the 105-H Reactor Building and the 151-H Primary Substation. Remediation, verification sampling, and comparison of residual contaminant concentrations against cleanup levels have been performed in accordance with the remedial action objectives (RAOs) and remedial action goals (RAGs) established by the *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland, Washington and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

Basis for reclassification:

In accordance with this evaluation, the verification sampling and modeling results for the 1607-H1 Septic Tank and Associated Drain Field have been used to show that this site meets the RAOs and corresponding RAGs established in the Remaining Interim Sites ROD. The sampling and modeling results have also been used to show that residual contamination concentrations do not preclude any future land uses (as bounded by a rural-residential scenario), and allow for unrestricted future use of shallow zone soils (i.e., surface to 4.6 m [15 ft]). The sample and modeling results have also been used to show that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Based on modeling, it is believed that contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 1607-H1 Septic Tank and Associated Drain Field* (attached).

Regulator Comments:
Approval of this Waste Site Reclassification Form documents the regulator's agreement that the 1607-H1 Septic Tank and Associated Drain Field waste site qualifies for "Interim Closed Out" under this Interim Action ROD. In addition, Ecology has evaluated the data for this site against WAC 173-340 (2007) cleanup levels for direct contact, groundwater protection, and river protection. This evaluation is documented in the letter transmitting Ecology's approval of the site's interim reclassification to "Interim Closed Out."

Waste Site Controls:

Engineered Controls: Yes ☐ No ☒ Institutional Controls: Yes ☐ No ☒ O&M Requirements: Yes ☐ No ☒
If any of the Waste Site Controls are checked Yes, specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents.

M. S. French DOE Federal Project Director (printed)	M S French Signature	8/25/11 Date
N. Menard Ecology Project Manager (printed)	Nina M. Menard Signature	9/1/11 Date
N/A EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-H1 SEPTIC TANK AND ASSOCIATED DRAIN FIELD

Attachment to Waste Site Reclassification Form 2010-065

May 2011

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-H1 SEPTIC TANK AND ASSOCIATED DRAIN FIELD

EXECUTIVE SUMMARY

The 1607-H1 waste site is located southwest of the 105-H Reactor Building and the 151-H Primary Substation, near the 118-H-2 Burial Ground, in the 100-HR-2 Operable Unit. The 1607-H1 sanitary sewer system was a nonhazardous, nonradioactive liquid waste site that began operation in 1948 to receive sanitary sewage from the 105-H Reactor Building and the 151-H Primary Substation (BHI 1995). The 1607-H1 septic tank system received waste from vitrified clay pipes as part of the 100-H-28:4, 1607-H1 Sanitary Sewers. The drain field measured 17.1 by 15.2 m (56 by 50 ft) and was oriented on a northeast-southwest line from the tank. The at-grade portion of the septic tank was a concrete pad with two manhole covers and a third manhole cover located adjacent to the tank. In 1985, the 1607-H1 septic system was reactivated and used by service trailers supporting deactivation and decommissioning (D&D) project personnel (WHC 1994).

Remedial action at the 1607-H1 waste site was performed between September 24 and November 2, 2009, and included the removal of the below-grade septic tank and the manhole cover surface features. Excavation continued until all debris and contamination associated with the septic tank, drain field pipes, and connecting pipeline structure had been removed. The site was excavated to a depth of approximately 3.2 m (10.5 ft), removing the drain and tile field pipes at approximately 2.5 m (8.2 ft) below surface grade, and to a depth of approximately 4 m (13 ft) at the septic tank and adjacent manhole structure. A total of approximately 1,166 bank cubic meters (BCM) (1,525 bank cubic yards [BCY]) of soil and debris were removed and directly loaded for disposal at the Environmental Restoration Disposal Facility, including all soils excavated from below the drain field piping. This debris included carbon steel pipes and drainage tiles/pipe from the area of the septic tank inlet and the drain field, and concrete/brick from the septic tank and adjacent manhole structure. An additional 528 BCM (691 BCY) of soil was removed from outside of the septic tank and overlying the drain field to form the overburden pile for the 1607-H1 waste site. The 1607-H1 remediation design identified the separation of overburden soil from the 1607-H1 drain field into two separate soil stockpiles. This overburden soil was intended to be used as backfill after it had been sampled, analyzed, and determined to meet cleanup criteria.

Following remediation, verification sampling was conducted July 7 through 12, 2010. Results showed that four sample locations within the overburden and one focused sample in the excavation contained concentrations of arsenic in excess of the cleanup criteria. As a result, additional remedial excavation was performed to remove the soils in the overburden pile and the focused sample location. Additional samples were collected from the original failed locations on March 23, 2011. Following the additional remediation, the results, combined with RESRAD modeling, were used to show residual contaminant concentrations met the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 1607-H1 waste site.

A summary of the cleanup evaluation for the soil results compared to the applicable cleanup criteria is presented in Table ES-1. The results of the verification sampling combined with RESRAD modeling and an evaluation of dilution-attenuation in the saturated zone were used to make this reclassification decision for the 1607-H1 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2007). In accordance with this evaluation, the verification sampling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The verification sample results show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow-zone soils (i.e., surface to 4.6 m [15 ft] deep). Based on modeling, it is believed that contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Table ES-1. Summary of Remedial Action Goals for the 1607-H1 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15-mrem/yr dose rate above background over 1,000 years.	Maximum dose rates from sum of fractions evaluations for the excavation using individual radionuclide dose-equivalent lookup values are <15 mrem/yr. The maximum dose rate for the excavation is 2.783 mrem/yr.	Yes
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	All hazard quotients are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (1.9×10^{-2}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for carcinogens is $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk (8.5×10^{-7}) is $<1 \times 10^{-5}$.	

Table ES-1. Summary of Remedial Action Goals for the 1607-H1 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Radionuclides	Attain single-COPC groundwater and river protection RAGs.	No radionuclides were quantified above groundwater/river protection soil lookup values.	Yes
	Attain national primary drinking water standards [a]. 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.	No radionuclides were quantified above groundwater/river protection soil lookup values.	
	Meet drinking water standards for alpha emitters: the most stringent of 15 pCi/L MCL or 1/25th of the derived concentration guides from DOE Order 5400.5 [b].	Activity of alpha-emitting radionuclide COPCs detected above background is less than lookup values.	
	Meet total uranium standard of 30 µg/L (21.2 pCi/L) [c].	Uranium was not quantified above background levels for this site.	
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Residual concentrations of lead, selenium, total PCBs (including aroclor-1254), 4,4'-DDE, dieldrin, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene exceeded the soil RAGs for the protection of groundwater and/or the Columbia River. However, RESRAD modeling predicts that residual concentrations of these constituents will be protective of groundwater and the river [d, e].	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 Areas, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).

[d] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead, total PCBs (including aroclor-1254), 4,4'-DDE, dieldrin, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not expected to migrate more than 2.3 m (7.6 ft) vertically in 1,000 years (based on the contaminant with the lowest distribution coefficient of 25.6 mL/g for dieldrin). The vadose zone underlying the soil below the site is approximately 3.1 m (10.2 ft) thick at the deepest portion of the excavation. Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.

[e] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) and an evaluation of dilution-attenuation in the saturated zone using the formulas from the EPA *Soil Screening Guidance: User's Guide* (EPA 1996), residual soil concentrations of selenium are predicted to be protective of groundwater and the Columbia River for 1,000 years (Appendix D).

COPC = contaminant of potential concern
DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
MCL = maximum contaminant level
PCB = polychlorinated biphenyl
RAG = remedial action goal
RESRAD = RESidual RADioactivity
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 1607-H1 waste site contaminants of potential concern and other constituents (Appendix A). The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, lead, manganese, selenium, and vanadium. Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for arsenic, boron, lead, selenium, and vanadium. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, and vanadium are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 1607-H1 SEPTIC TANK AND ASSOCIATED DRAIN FIELD

STATEMENT OF PROTECTIVENESS

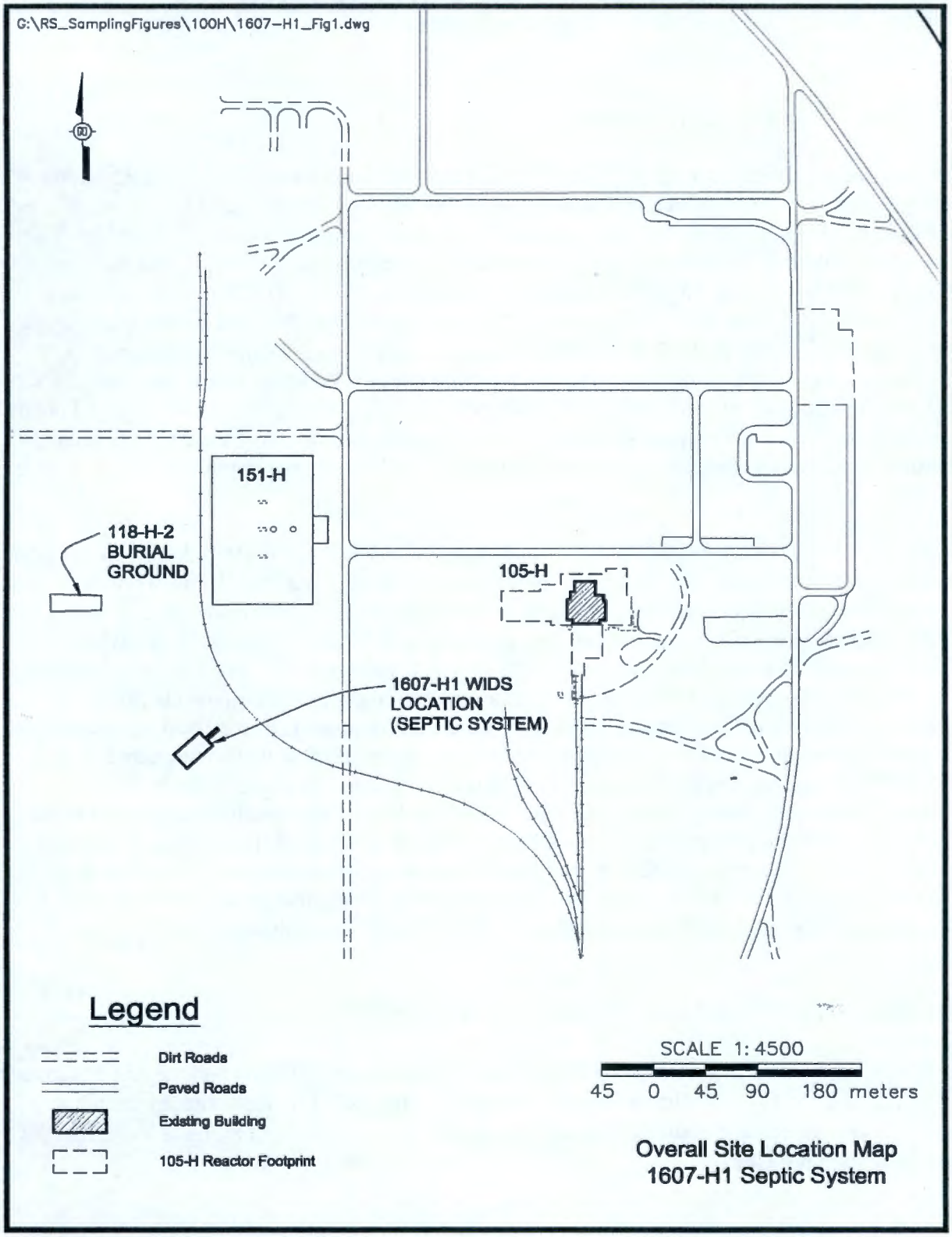
This report demonstrates that the 1607-H1 Septic Tank and Associated Drain Field waste site meets the objectives to support a reclassification of this site to Interim Closed Out as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The verification sample results show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow-zone soils (i.e., surface to 4.6 m [15 ft] deep). Based on modeling, it is believed that contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 1607-H1 waste site contaminants of concern/contaminants of potential concern and other constituents (Appendix A). The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, lead, manganese, selenium, and vanadium. Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for arsenic, boron, lead, selenium, and vanadium. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, and vanadium are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 1607-H1 waste site is located southwest of the 105-H Reactor Building and the 151-H Primary Substation, near the 118-H-2 Burial Ground (Figure 1). The 1607-H1 waste site, including a septic tank and associated drain field, and manhole and interconnecting piping, is located in the 100-HR-2 Operable Unit.

Figure 1. The 1607-H1 Waste Site Location Map.



The 1607-H1 septic tank system was a nonhazardous, nonradioactive liquid waste site that began operation in 1948, and received sanitary sewage from the 105-H Reactor Building and the 151-H Primary Substation (BHI 1995). The sanitary wastes from these buildings were conveyed to the 1607-H1 septic tank system via buried vitrified clay pipes (VCPs). These pipes are planned for remediation as the 100-H-28:4, 1607-H1 Sanitary Sewers waste site. The 151-H Primary Substation, which provided electrical service to the 100-H Area, was demolished in 1978. The 105-H Reactor Building was decommissioned in 1965, and placed into interim safe storage in 2005. The 1607-H1 drain field measured 17.1 by 15.2 m (56 by 50 ft) and was oriented on a northeast-southwest line from the tank. The at-grade portion of the septic tank was a concrete pad with two manhole covers and a third manhole cover located adjacent to the tank, which was clearly visible at the site in a photograph taken on September 30, 2009 (Figure 2).

Figure 2. Photograph of the 1607-H1 Waste Site Showing the Septic Tank Concrete Pad with Two Manhole Covers and Third Adjacent Manhole Cover (September 30, 2009).

In 1985, the 1607-H1 septic system was reactivated to be used by service trailers supporting deactivation and decommissioning (D&D) project personnel (WHC 1994). At that time, the tank was discovered to have been backfilled with fly ash. The ash was vacuumed out of the septic tank and disposed to the ground surface prior to the successful reactivation of the septic system (WHC 1994). No other records were located documenting the backfilling of the septic tank.

During an interview with a former employee it was stated that it was common practice for showers and sinks in the 100-H Area change rooms to be used for personnel decontamination, and these drains lead to the sanitary sewers not the process sewers (WHC 1994).

In January 2007, the 1607-H1 waste site was assigned for remove, treat, and dispose in the interoffice memorandum "1607-H1 Remaining Site for Remedial Action" (WCH 2007).

SUMMARY OF REMEDIAL ACTIVITIES

Remedial action at the 1607-H1 waste site was performed between September 24 and November 2, 2009, and included the removal of the below-grade septic tank and the manhole cover surface features.

Excavation continued until all debris and contamination associated with the septic tank, drain field pipes, and connecting pipeline structure had been removed. The site was excavated to a depth of approximately 3.2 m (10.5 ft), removing the drain and tile field pipes at approximately 2.5 m (8.2 ft) below surface grade, and to a depth of approximately 4 m (13 ft) at the septic tank and adjacent manhole structure. A total of approximately 1,166 bank cubic meters (BCM) (1,525 bank cubic yards [BCY]) of soil and debris were removed and directly loaded for disposal at the ERDF, including all soils excavated from below the drain field piping. This included carbon steel pipes and drainage tiles/pipe from the area of the septic tank inlet, from the drain field, and concrete/brick from the septic tank and adjacent manhole structure. The septic tank had been previously filled with fly ash, which was removed in 1985 so the septic tank could be reused. A small amount of fly ash was observed to be mixed with soil, which was disposed at the Environmental Restoration Disposal Facility (ERDF). Otherwise, no fly ash was encountered during remediation activities at this waste site. An additional 528 BCM (691 BCY) of soil from outside of the septic tank and overlying the drain field was removed, forming the overburden pile for the 1607-H1 waste site.

The 1607-H1 remedial design indicated that overburden soil removed to a depth of approximately 1.5 m (5.0 ft) was to be stockpiled separately from overburden soil excavated between 1.5 to 3.0 m (5.0 to 6.6 ft) below grade. Material excavated near the septic tank, below 3.0 m (6.6 ft), and within the drain field was to be considered contaminated and direct loaded for disposal at the ERDF. This design assumed that soil closer to the drain field VCPs and near the septic tank had a higher potential for contamination. During remediation, no staining or other visual indications were observed and one overburden pile was constructed.

The debris removed from the 1607-H1 waste site was consistent with that of a sewage system and consistent with the pre-excavation geophysical survey findings. No anomalies were discovered during the remediation. The geophysical survey was performed at the 1607-H1 waste site in September 2004, to locate and map the underground features of the septic system (BHI 2004). The survey was conducted using ground-penetrating radar, magnetic total field/vertical gradient, and electromagnetic induction. The results from the geophysical survey are provided in Figure 3. The septic tank is denoted as confined space (CS) #311, located at approximately N133/E178, in Figure 3. It should be noted that the septic tank (CS #311) is not located at the

Figure 3. Geophysical Survey of the 1607-H1 Waste Site.

location given in the Waste Information Data System. A third manhole (CS #310) was also located about 6 m (19.7 ft) to the northeast of the septic tank and in line with the pipe trending toward the 105-H Reactor Building. Vitrified pipe and concrete debris were observed on the surface of the site. Fly ash covered the ground surrounding the septic tank waste site; this is consistent with the historical information regarding the removal of fly ash from the septic tank during the 1985 D&D activities.

Global Positioning Environmental Radiological Surveyor (GPERS) surveys capable of detecting gamma radiation were conducted within the 1607-H1 waste site excavation upon completion of remedial action activities. The surveys were performed to determine if residual radiological contamination was present. The GPERS surveys of the site excavation and overburden pile identified no radiological contamination above twice background (Appendix B). A comparison to twice background is provided only as a general statement of the magnitude of field measurements. Compliance with remedial action goals (RAGs) was established through verification sampling.

Additional Remediation

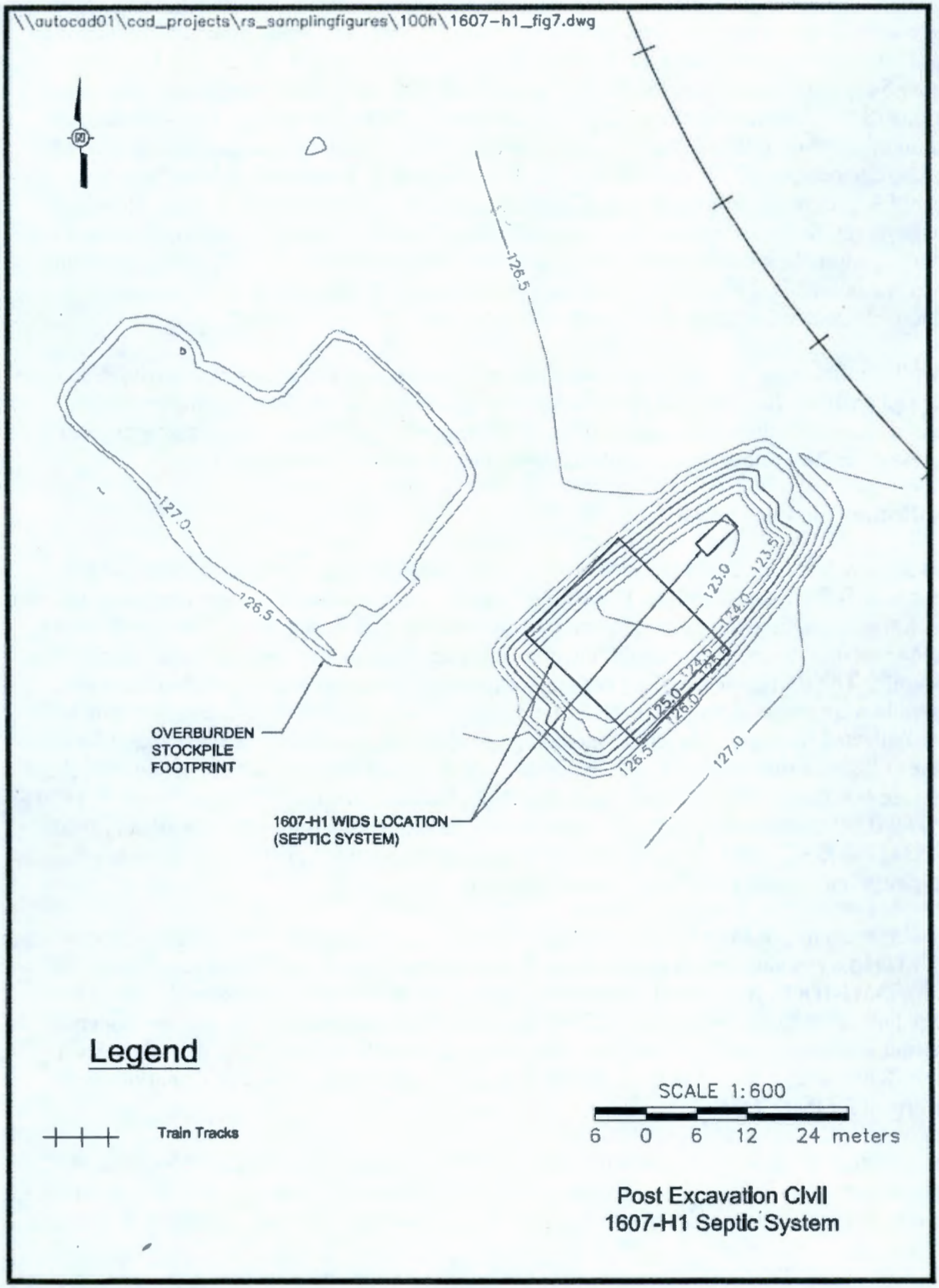
Following sample analysis of the initial remediation, it was determined that additional remediation was needed because some sample locations exceeded cleanup criteria. The direct exposure RAG of 20.0 mg/kg for arsenic was exceeded at the focused sample location and four sample locations in the overburden decision unit. Therefore, with agreement from the Washington State Department of Ecology, an additional 1.0 m (3.3 ft) of soil was removed from the focused sample location and all soil from the overburden stockpile area was removed to 0.3 m (1.0 ft) below ground surface (bgs). This additional remediation began March 8, 2011 and continued to March 17, 2011, and included the removal and disposal of 1,556 BCM (2,035 BCY) of soil material. The removal of extra material from these decision units did not change the original boundary for the areas and only sample locations that previously exceeded cleanup criteria were re-sampled after additional remediation. The post-remediation topography map is presented in Figure 4.

VERIFICATION SAMPLING ACTIVITIES

Statistical verification sampling was conducted at the 1607-H1 waste site on July 7 through 12, 2010 (WCH 2010), to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). A statistical sampling design was used to collect verification soil samples from the 1607-H1 excavation and the overburden soil stockpile to support interim closeout of the waste site. The following subsections provide additional discussion of the information used to develop the verification sampling design. The results of verification sampling are also summarized to support interim closure of the site.

Additional verification sampling was conducted at the 1607-H1 waste site on March 23, 2011 after additional remediation of the focused sample location and overburden stockpile areas was completed (WCH 2011).

Figure 4. 1607-H1 Septic System Post Excavation Civil Survey.



Contaminants of Potential Concern

The contaminants of potential concern (COPCs) for the 1607-H1 septic system were identified based on historical information for the site. The COPC list identified in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009a) includes americium-241, cobalt-60, cesium-137, europium-152, europium-154, europium-155, plutonium-239/240, strontium-90, cadmium, chromium (total), hexavalent chromium, mercury, lead, pesticides, and semivolatile organic compounds (SVOCs). Based on further site-specific evaluation of septic systems, nickel-63, carbon-14, tritium, uranium-233/234, uranium-235, uranium-238, polychlorinated biphenyls (PCBs), and nitrate were also included as COPCs. While not COPCs, antimony, arsenic, barium, beryllium, boron, cobalt, copper, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc concentrations were evaluated by performing the expanded inductively coupled plasma (ICP) metals analytical list.

After the initial sampling campaign, additional remediation was performed to remove soil in areas with soil analyses that exceeded the cleanup criteria. Additional verification samples at the focused sample location were analyzed for all of the original COPCs. Only metals analysis was requested for the overburden stockpile locations that exceeded cleanup criteria.

Verification Sample Design

This section describes the basis for selection of the sample design and determination of the number of verification samples. The 1607-H1 waste site was divided into two decision units for verification sampling, the excavation and the overburden soil stockpile. A global positioning survey was used to determine the boundaries of the excavation area and the overburden soil stockpile. The statistical sampling designs for the excavated area and the overburden soil stockpile were prepared using Visual Sample Plan[1] (VSP). Twelve verification soil samples were collected from the excavation, including one duplicate at EXC-11 at Washington State Plane (WSP) coordinates N 152408, E 577457. Also, 12 verification soil samples were collected from the overburden soil stockpile, including 1 duplicate at OB-3 at WSP coordinates N 152414, E 577420. One focused sample was taken within the septic tank footprint at WSP coordinates N 152413.3, E 577469.3. One equipment blank was collected to verify the cleanliness of equipment and supplies used for sample collection.

The verification data from the decision units was evaluated using the 95% upper confidence limit (UCL) on the true population mean for residual concentrations of COPCs as specified by the RDR/RAWP (DOE-RL 2009b). These calculations are provided in Appendix C. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected, the maximum detected value was used for comparison against the RAGs. If no detections for a given COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COPC.

One discrete soil sample was collected at each verification and focused sample location of surficial soils (0 to 0.15 m [0 to 6 in.] bgs). Each sample was analyzed for the constituent groups listed in Table 1. All samples were requested for full protocol laboratory analysis. In addition to

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

the statistical samples, one focused sample was collected within the septic tank footprint at WSP coordinates N 152413.3, E 577469.3.

After the initial verification samples were analyzed, it was determined that the reported arsenic concentrations in four overburden stockpile samples as well as the excavation focused sample exceeded site cleanup criteria for arsenic. Therefore, additional soil at the focused sample location and the entire overburden stockpile was removed and disposed at the ERDF. All sample locations that exceeded cleanup criteria were re-sampled. The focused re-sample location was analyzed for the original list of COPCs as stated in the 1607-H1 verification work instruction and the four overburden re-sample locations were re-sampled for only metals analysis (WCH 2011).

Table 1. 1607-H1 Verification Sampling Summary Table.

Sample Location	HEIS Number	WSP Coordinates		Sample Analysis
		Northing (m)	Easting (m)	
EXC-1	J1B9B8	152391.9	577452.3	ICP metals [a], mercury, hexavalent chromium, PCB, SVOA, pesticides, nitrite/nitrate, GEA, strontium-90, nickel-63, carbon-14, tritium, isotopic uranium, isotopic plutonium
EXC-2	J1B9B9	152391.9	577461.5	
EXC-3	J1B9C0	152399.9	577447.7	
EXC-4	J1B9C1	152399.9	577456.9	
EXC-5	J1B9C2	152399.9	577466.1	
EXC-6	J1B9C3	152407.8	577452.3	
EXC-7	J1B9C4	152407.8	577461.5	
EXC-8	J1B9C5	152407.8	577470.6	
EXC-9	J1B9C6	152407.8	577479.8	
EXC-10	J1B9C7	152415.7	577466.1	
EXC-11	J1B9C8	152415.7	577475.2	
EXC-12	J1B9C9	152415.7	577484.4	
EXC-duplicate [b]	J1B9D0	152415.7	577475.2	
FS-1	J1B9D1	152413.3	577469.3	
OB-1	J1B9D2	152405.5	577424.4	
OB-2	J1B9D3	152413.8	577410.1	
OB-3	J1B9D4	152413.8	577419.7	
OB-4	J1B9D5	152413.8	577429.2	
OB-5	J1B9D6	152422.1	577405.3	
OB-6	J1B9D7	152422.1	577414.9	
OB-7	J1B9D8	152422.1	577424.4	
OB-8	J1B9D9	152422.1	577434.0	
OB-9	J1B9F0	152430.3	577400.6	
OB-10	J1B9F1	152430.3	577410.1	
OB-11	J1B9F2	152430.3	577419.7	
OB-12	J1B9F3	152430.3	577429.2	
OB- duplicate [b]	J1B9F4	152413.8	577419.7	
Equipment blank	J1B9F5	NA	NA	ICP metals [a], mercury, SVOA

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

[b] One duplicate was obtained from a statistical sample location in the excavation and another was obtained from a sample location in the overburden. The duplicate soil sample locations were at the discretion of the project analytical lead. Split samples, if collected, were also at the discretion of the project analytical lead.

GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
WSP = Washington State Plane

A summary of the initial verification samples and laboratory analyses performed is provided in Table 1. Table 2 provides the summary of the verification samples and laboratory analyses performed for the samples collected after additional remediation of the failed sample areas. Figure 5 is a map of the statistical and focused sample locations. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the SAP (DOE-RL 2009a). Additional information related to verification sampling can be found in the field sampling logbook (WCH 2010).

Table 2. 1607-H1 Resample Summary Table.

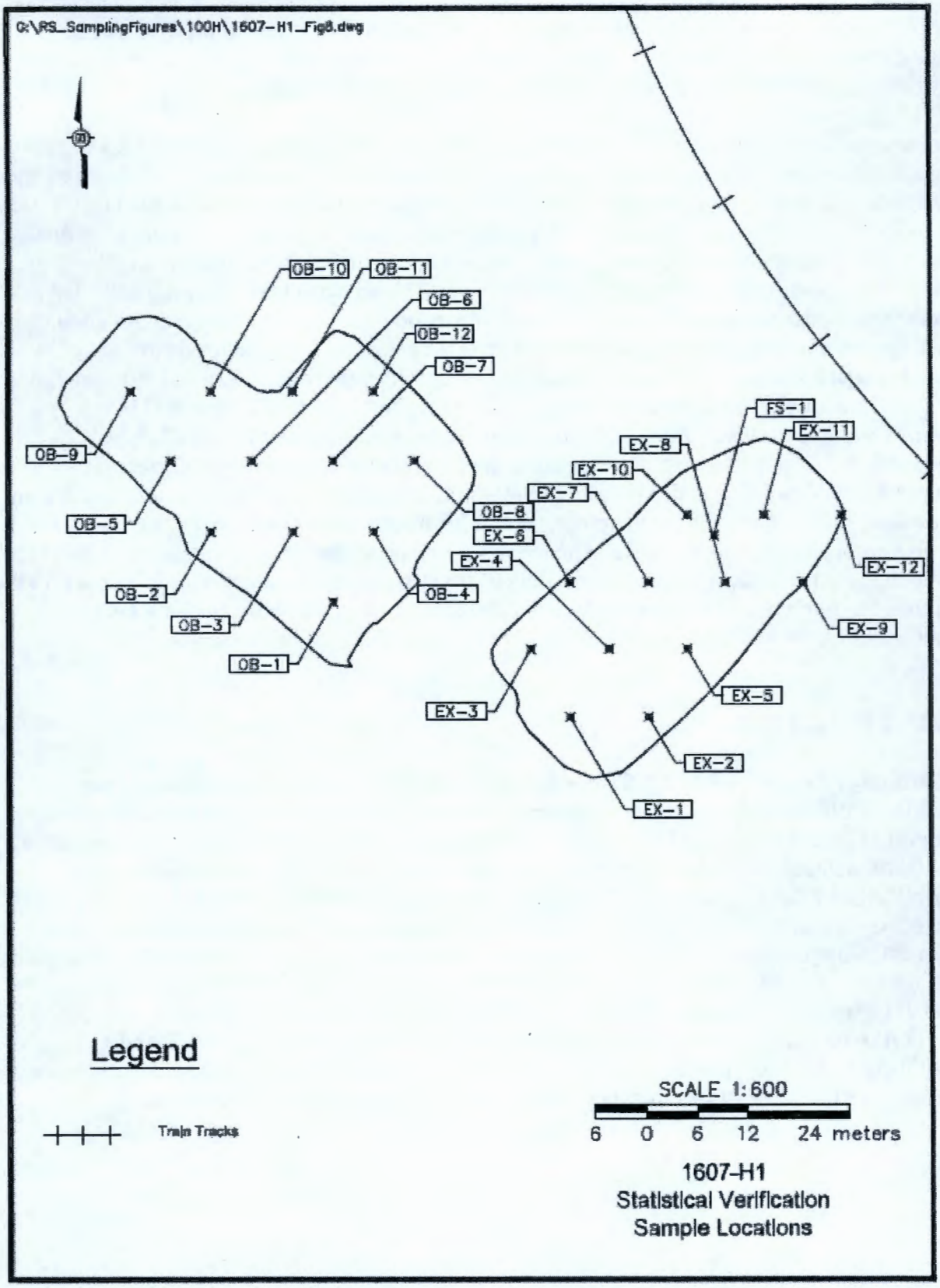
Sample Location	HEIS Number	WSP Coordinates		Sample Analysis
		Northing (m)	Easting (m)	
Focused Sample				
FS-1	J1FXW2	152413.3	577469.3	ICP metals [a], mercury, hexavalent chromium, PCB, SVOA, pesticides, nitrite/nitrate, GEA, strontium-90, nickel-63, carbon-14, tritium, isotopic uranium, isotopic plutonium
Overburden Area				
OB-2	J1FXV7	152413.8	577410.1	ICP metals [a], mercury
OB-3	J1FXV8	152413.8	577419.7	
OB-7	J1FXV9	152422.1	577424.4	
OB-8	J1FXW0	152422.1	577434.0	
OB- duplicate [b]	J1FXW1	152413.8	577419.7	

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

[b] One duplicate was obtained from a statistical sample location in the overburden. The duplicate soil sample locations were at the discretion of the project analytical lead. Split samples, if collected were also at the discretion of the project analytical lead.

GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
WSP = Washington State Plane

Figure 5. 1607-H1 Statistical Verification Sample Locations.



Verification Sampling Results

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

Comparisons of the results for each COPC from the 1607-H1 excavation against site RAGs are summarized in Table 3. Comparisons of the results for each COPC from the 1607-H1 overburden pile against site RAGs are summarized in Table 4. Comparisons of the results for each COPC from the 1607-H1 focused sample against site RAGs are summarized in Table 5. Contaminants that were not detected by laboratory analysis are excluded from these tables. Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the decision units, but are not included in the comparison tables, as these isotopes are unrelated to the operational history of the site and were detected below background levels (based on an assumption of secular equilibrium, the background activities for radium-228 and thorium-228 are equal to the statistical background activity of 1.32 pCi/g for thorium-232 provided in *Hanford Site Background: Part 2, Soil Background for Radionuclides* [DOE-RL 1996]). Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2009) under WAC 173-340-740(3) for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium; therefore, these constituents 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 Environmental Restoration (ENRE) project-specific database prior to archival in the Hanford Environmental Information System (HEIS), and are presented in the 95% UCL calculations (Appendix C).

DATA EVALUATION

Evaluation of the results listed in Tables 3, 4, and 5 from the verification sampling at the 1607-H1 waste site indicate that no contaminants exceed direct exposure RAGs. Groundwater and/or the Columbia River protection soil RAGs are exceeded by lead, selenium, aroclor-1254, 4,4'-DDE, dieldrin, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene. The residual concentrations of lead, aroclor-1254, 4,4'-DDE, dieldrin, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are not expected to migrate more than 2.25 m (7.5 ft) vertically in 1,000 years (based on the contaminant with the lowest distribution coefficient of 25.6 mL/g for dieldrin). The vadose zone beneath the 1607-H1 excavation is approximately 7.0 m (23.0 ft) thick. Based on RESidual RADioactivity (RESRAD) modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), constituents with a soil-partitioning coefficient of 10 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater within 1,000 years.

Table 3. Comparison of Statistical Values to Action Levels for the 1607-H1 Excavation Verification Samples. (2 Pages)

COPC	Statistical Result [b] (pCi/g)	Soil Lookup Values (pCi/g) [a]			Does the Statistical Result Exceed Lookup Values?	Do the Results Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Soil Lookup Value for Groundwater Protection	Soil Lookup Value for River Protection		
Carbon-14	1.51	8.69	-- [c]	-- [c]	No	--
Cesium-137	0.030 (<BG)	6.2	1,465	2,930	No	--
Plutonium-238	0.079	38.8	-- [c]	-- [c]	No	--
Tritium [d]	2.03	459	12.6	25.2	No	--
Uranium-233/234	0.0 (<BG)	1.1 [e]	1.1 [e]	1.1 [e]	No	--
Uranium-238	0.0 (<BG)	1.1 [e]	1.1 [e]	1.1 [e]	No	--
COPC	**Statistical Result [b] (mg/kg)**	**Remedial Action Goals (mg/kg) [a]**			**Does the Statistical Result Exceed RAGs?**	**Does the Statistical Result Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Antimony	0.208 (<BG)	32	5 [e]	5 [e]	No	--
Arsenic	9.95	20 [e]	20 [e]	20 [e]	No	--
Barium	81.5 (<BG)	5,600	200	400	No	--
Beryllium	0.226 (<BG)	10.4 [f]	1.51 [e]	1.51 [e]	No	--
Boron [g]	3.38	7,200	320	-- [h]	No	--
Cadmium [i]	0.127 (<BG)	13.9 [f]	0.81 [e]	0.81 [e]	No	--
Chromium	13.0 (<BG)	80,000	18.5 [e]	18.5 [e]	No	--
Cobalt	7.03 (<BG)	24	15.7 [e]	-- [h]	No	--
Copper	15.0 (<BG)	2,960	59.2	22.0 [e]	No	--
Hexavalent chromium [g]	0.12	2.1 [f]	4.8	2	No	--
Lead	32.3	353	10.2 [e]	10.2 [e]	Yes	Yes [j]
Manganese	317 (<BG)	3,760	512 [e]	512 [e]	No	--
Mercury	0.0967 (<BG)	24	0.33 [e]	0.33 [e]	No	--
Molybdenum [g]	0.388	400	8	-- [h]	No	--
Nickel	11.9 (<BG)	1,600	19.1 [e]	27.4	No	--
Vanadium	50.5 (<BG)	560	85.1 [e]	-- [h]	No	--
Zinc	43.4 (<BG)	24,000	480	67.8 [e]	No	--
Aroclor-1254	0.0193	0.5	0.017 [k]	0.017 [k]	Yes	Yes [j]
Aroclor-1260	0.0152	0.5	0.017 [k]	0.017 [k]	No	--
Total PCBs	0.0345	0.5	0.017 [k]	0.017 [k]	Yes	Yes [j]
Fluoride	2.7 (<BG)	4,800	96	400	No	--
Nitrogen in nitrate and nitrite	3.12 (<BG)	128,000	1,000	2,000		
Sulfate	21.7 (<BG)	--	25,000	--	No	--
DDE, 4,4'-	0.00398	2.94	0.0257	0.0033 [k]	Yes	Yes [j]
DDT, 4,4'-	0.00129	2.94	0.0257	0.0033 [k]	No	--
Dieldrin	0.00390	0.0625	0.0033 [k]	0.0033 [k]	Yes	Yes [j]

Table 3. Comparison of Statistical Values to Action Levels for the 1607-H1 Excavation Verification Samples. (2 Pages)

COPC	Statistical Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Benzo(a)anthracene	0.0728	1.37	0.015 [k]	0.015 [k]	Yes	Yes [j]
Benzo (a) pyrene	0.0678	0.137	0.015 [k]	0.015 [k]	Yes	Yes [j]
Benzo(k)fluoranthene	0.0548	1.37	0.015 [k]	0.015 [k]	Yes	Yes [j]
Bis(2-ethylhexyl)phthalate	0.211	71.4	0.6	0.36	No	--
Chrysene	0.0783	13.7	0.12	0.1 [k]	No	--
Di-n-butylphthalate	0.253	8,000	160	540	No	--
Fluoranthene	0.171	3,200	64	18.0	No	--
Phenanthrene [l]	0.153	24,000	240	1,920	No	--
Pyrene	0.233	2,400	48	192	No	--

[a] Lookup values and RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted. Radionuclide soil activities protective of groundwater and the river were calculated using RESRAD Version 6.4 assuming that no uncontaminated vadose zone exists between the contaminated zone and groundwater.

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

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

[d] Tritium samples will be taken 15.2 cm (6 in.) below the excavation surface. If tritium is detected, a path forward will be developed with the lead regulatory agency for appropriate cleanup verification sampling (per TPA-CN-177).

[e] Where cleanup levels are less than background, cleanup levels default to background (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 2.12.1 of the RDR/RAWP (DOE-RL 2009b).

[f] 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]).

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

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

[i] Hanford Site-specific background not available. Value is Washington State background from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[j] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentration of lead, total PCBs (including aroclor-1254), 4,4-DDE, dieldrin, benzo(a)anthracene, benzo(a)pyrene, and benzo(k)fluoranthene are not predicted to migrate more than 2.3 m (7.6 ft) vertically within 1,000 years (based on the contaminant with the lowest distribution coefficient of 25.6 mL/g for dieldrin. RESRAD modeling predicts that any contaminant with a distribution coefficient greater than 10 mL/g will not migrate more than 7.0 m (23 ft) within 1,000 years. Therefore, residual concentrations of all constituents are predicted to be protective of groundwater and the Columbia River.

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

[l] Toxicity data for this chemical is not available. Cleanup levels are based on surrogate chemicals.
Contaminant: phenanthrene; surrogate: anthracene

-- = not applicable
BG = background
COPC = contaminant of potential concern
PCB = polychlorinated biphenyl
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Table 4. Comparison of Statistical Values to Action Levels for the 1607-H1 Overburden Soil Stockpile Verification Samples. (2 Pages)

COPC	Statistical Result [b] (pCi/g)	Generic Lookup Values (pCi/g) [a]			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Soil Lookup Value for Groundwater Protection	Soil Lookup Value for River Protection		
Carbon-14	1.52	8.69	-- [c]	-- [c]	No	--
Uranium-233/234	0.0 (<BG)	1.1 [d]	1.1 [d]	1.1 [d]	No	--
Uranium-238	0.0 (<BG)	1.1 [d]	1.1 [d]	1.1 [d]	No	--
COPC	**Statistical Result [b] (mg/kg)**	**Remedial Action Goals (mg/kg) [a]**			**Does the Result Exceed RAGs?**	**Do the Results Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Antimony	0.42 (<BG)	32	5 [d]	5 [d]	No	--
Arsenic	16.0	20 [d]	20 [d]	20 [d]	No	--
Barium	79.4 (<BG)	5,600	200	400	No	--
Beryllium	0.216 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Boron [f]	3.68	7,200	320	-- [g]	No	--
Cadmium [h]	0.107 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium	12.2 (<BG)	80,000	18.5 [d]	18.5 [d]	No	--
Cobalt	6.25 (<BG)	24	15.7 [d]	-- [g]	No	--
Copper	14.3 (<BG)	2,960	59.2	22.0 [d]	No	--
Hexavalent chromium [f]	0.15	2.1 [e]	4.8	2	No	--
Lead	69.7	353	10.2 [d]	10.2 [d]	Yes	Yes [i]
Manganese	298 (<BG)	3,760	512 [d]	512 [d]	No	--
Mercury	0.0175 (<BG)	24	0.33 [d]	0.33 [d]	No	--
Molybdenum [f]	0.363	400	8	-- [g]	No	--
Nickel	11.2 (<BG)	1,600	19.1 [d]	27.4	No	--
Selenium	1.2	400	5	1	Yes	Yes [j]
Vanadium	46.5 (<BG)	560	85.1 [d]	-- [g]	No	--
Zinc	39.2 (<BG)	24,000	480	67.8 [d]	No	--
Chloride	10.5 (<BG)	--	25,000	--	No	--
Fluoride	1.4 (<BG)	4,800	96	400	No	--
Nitrogen in nitrate and nitrite	21.0	128,000	1,000	2,000	No	--
Sulfate	57.2 (<BG)	--	25,000	--	No	--
BHC, beta	0.00137	0.556	0.00486	0.00554	No	--
Dieldrin	0.00201	0.0625	0.0033 [k]	0.0033 [k]	No	--
Benzo(b)fluoranthene	0.0559	1.37	0.015 [k]	0.015 [k]	Yes	Yes [i]
Bis(2-ethylhexyl)phthalate	0.282	71.4	0.6	0.36	No	--
Fluoranthene	0.0711	3,200	64	18.0	No	--

Table 4. Comparison of Statistical Values to Action Levels for the 1607-H1 Overburden Soil Stockpile Verification Samples. (2 Pages)

COPC	Statistical Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Pyrene	0.0957	2,400	48	192	No	--

[a] Lookup values and RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted. Radionuclide soil activities protective of groundwater and the river were calculated using RESRAD Version 6.4 assuming that no uncontaminated vadose zone exists between the contaminated zone and groundwater.

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

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

[d] Where cleanup levels are less than background, cleanup levels default to background (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 2.12.1 of the RDR/RAWP (DOE-RL 2009b).

[e] 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]).

[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 Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).

[h] Hanford Site-specific background not available. Value is Washington State background from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[i] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead and benzo(b)fluoranthene are not predicted to migrate more than 1.8 m (5.9ft) vertically within 1,000 years (based on the contaminant with the lowest distribution coefficient of 30 mL/g for lead. RESRAD modeling predicts that any contaminant with a distribution coefficient greater than 10 mL/g will not migrate more than 7.0 m (23 ft) through the soil to groundwater within 1,000 years. Therefore, residual concentrations of lead and benzo(b)fluoranthene are predicted to be protective of groundwater and the Columbia River.

[j] Selenium has a distribution coefficient value of 5 mL/g. Therefore, a site specific fate and transport evaluation for selenium was developed and discussed in Appendix D. Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) and an evaluation of dilution-attenuation in the saturated zone using the formulas from the EPA *Soil Screening Guidance: User's Guide* (EPA 1996), residual soil concentrations of selenium are predicted to be protective of groundwater and the Columbia River.

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

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

Table 5. Comparison of Maximum Values to Action Levels for the 1607-H1 Test Pit Focused Verification Sample.

COPC	Maximum Result (pCi/g)	Soil Lookup Values (pCi/g) [a]			Does the Maximum Result Exceed Lookup Values?	Does the Maximum Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Soil Lookup Value for Groundwater Protection	Soil Lookup Value for River Protection		
Uranium-233/234	0.0 (<BG)	1.1 [b]	1.1 [b]	1.1 [b]	No	--
COPC	**Maximum Result (mg/kg)**	**Remedial Action Goals (mg/kg) [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	1.3 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	40.5 (<BG)	5,600	200	400	No	--
Cadmium [c]	0.055 (<BG)	13.9 [d]	0.81 [b]	0.81 [b]	No	--
Chromium	9.8 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	4.8 (<BG)	24	15.7 [b]	-- [e]	No	--
Copper	13.4 (<BG)	2,960	59.2	22.0 [b]	No	--
Lead	2.7 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	228 (<BG)	3,760	512 [b]	512 [b]	No	--
Nickel	11.2 (<BG)	1,600	19.1 [b]	27.4	No	--
Vanadium	33.5 (<BG)	560	85.1 [b]	-- [e]	No	--
Zinc	29.9 (<BG)	24,000	480	67.8 [b]	No	--
Nitrate	0.84 (<BG)	128,000	1,000	2,000	No	--
Nitrogen in nitrate and nitrite	0.57 (<BG)	128,000	1,000	2,000	No	--
Sulfate	3.0 (<BG)	--	25,000	--	No	--

[a] Lookup values and RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted. Radionuclide soil activities protective of groundwater and the river were calculated using RESRAD Version 6.4 assuming that no uncontaminated vadose zone exists between the contaminated zone and groundwater.

[b] Where cleanup levels are less than background, cleanup levels default to background (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 2.12.1 of the RDR/RAWP (DOE-RL 2009b).

[c] Hanford Site-specific background not available. Value is Washington State background from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

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

-- = not applicable
BG = background
COPC= contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

In Appendix C of the RDR/RAWP (DOE-RL 2009b), the RESRAD model was run using various distribution coefficient (K_d) values and unsaturated/uncontaminated vadose zone thicknesses to determine minimum K_d values necessary such that a contaminant will not migrate through the soil column to groundwater within 1,000 years. In the case of the 1607-H1 waste site, the contaminant with the lowest K_d value, other than selenium, which exceeds the default groundwater or river protection RAGs is dieldrin with a K_d of 25.6 mL/g. The RESRAD model evaluations show that contaminants with a K_d of 25.6 mL/g will not migrate more than 2.25 m (7.5 ft) in 1,000 years. The vadose zone thickness beneath the 1607-H1 waste site is approximately 7.0 m (23.1 ft) thick; therefore, dieldrin (and any other contaminant with a K_d of 25.6 mL/g or greater) will not migrate from the waste site to groundwater within 1,000 years. Therefore, the 1607-H1 residual soil concentrations are predicted to be protective of groundwater and the Columbia River.

Selenium concentrations also exceeded the soil RAGs for protection of the Columbia River. Selenium has a K_d value of 5 mL/g. Therefore, a site-specific fate and transport evaluation for selenium was developed and discussed in Appendix D. Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) and an evaluation of dilution-attenuation in the saturated zone using the formulas from the EPA *Soil Screening Guidance: User's Guide* (EPA 1996), residual soil concentrations of selenium are predicted to be protective of groundwater and the Columbia River.

Carbon-14 was not analyzed as part of the Hanford background study. The carbon-14 detected in the 1607-H1 verification samples, while well below the established RAGs, is likely not from natural background. Soil sample results from other waste sites analyzed for carbon-14, where it is not detected, are reported with detection limits that are lower than the activities measured in the 1607-H1 verification soil samples. Since the 1607-H1 septic system received sanitary sewage from the 105-H Reactor, it is likely that the carbon-14 is associated with neutron activation of carbon in the graphite-moderated reactor.

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 1607-H1 waste site is included in the 95% UCL calculations (Appendix C). The results of this evaluation indicate that all residual COPC concentrations pass the three-part test in comparison against applicable RAGs, except for lead, and aroclor-1254 in comparison against the soil RAGs for groundwater and/or river protection in one or more sampling areas.

An additional application of the three-part test is included for the statistical data sets which default to the maximum because less than half of the data set was detected. The results of this evaluation indicate that all residual COPC concentrations pass the three-part test in comparison

against applicable RAGs, except for lead, selenium, total PCBs (including aroclor-1254), 4,4-DDE, dieldrin, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene in comparison against the soil RAGs for groundwater and/or river protection in one or more sampling areas. However, as described above, RESRAD modeling predicts that residual concentrations of these COPCs will not migrate to groundwater within 1,000 years, and are therefore protective of groundwater and the Columbia River.

A three-part evaluation was also performed for focused sampling results. Table 5 presents the maximum value associated with each detected constituent. As shown in Table 5, no maximum results for any contaminants exceed soil RAGs for groundwater and/or river protection. Because the data set for each focused sample consists of one sample, no contaminant exceeds greater than 10% of the data for these analytes. No maximum results exceed more than twice the lowest RAG value (for groundwater and river protection).

As described above, RESRAD modeling predicts that residual concentrations of COPCs at the 1607-H1 waste site will not migrate to groundwater within 1,000 years, and are therefore protective of groundwater and the Columbia River.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. For the 1607-H1 waste site, these risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background. All individual hazard quotients for noncarcinogenic constituents were less than 1.0. The cumulative hazard quotient for those noncarcinogenic constituents above background or detected levels was 1.9×10^{-2}. The cumulative carcinogenic risk value for those noncarcinogenic constituents above background or detected levels is 8.5×10^{-7}. The 1607-H1 waste site meets the requirements for the direct contact hazard quotient and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2009b).

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 1607-H1 waste site included calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides in Appendix C. The requirements include an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. These risk values were conservatively calculated for the entire waste site using the highest value for each COPC from each of the decision units. Risk values were calculated for constituents that were detected at concentrations above Hanford Site or Washington State background values or for which there is no background value. In addition, the distribution coefficients for these contaminants are less than that necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (BHI 2005). Based on this model and a vadose zone of approximately 7.0-m (23.0-ft) thickness, a K_d of 10.0 or greater is required to show no predicted migration to groundwater in

1,000 years. Selenium has a K_d value of 5 mL/g. Therefore, a site-specific fate and transport evaluation for selenium was developed and discussed in Appendix D. Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) and an evaluation of dilution-attenuation in the saturated zone using the formulas from the EPA *Soil Screening Guidance: User's Guide* (EPA 1996), residual soil concentrations of selenium are predicted to be protective of groundwater and the Columbia River.

All individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the 1607-H1 waste site is 3.3×10^{-1}, which is less than 1.0. The only individual carcinogenic risk value was for beta-BHC at 2.8×10^{-7}, and therefore, the cumulative excess cancer risk value is also 2.8×10^{-7}. Nonradionuclide risk requirements related to groundwater are met.

Attainment of Radionuclide Direct Exposure RAGs

Table 6 compares the radionuclide cleanup verification results above background from the excavation, overburden, and focused soil samples to the direct exposure single radionuclide 15 mrem/yr dose-equivalence values and shows the sum of fractions evaluation for comparison of the total radionuclide dose to the RAG of 15 mrem/yr above background. The columns on the left side of the table are the COPCs and the radionuclide activities for the samples, corrected for background, as appropriate. The fifth column presents the single radionuclide 15 mrem/yr dose-equivalence activities, and the last column presents the radionuclide activities divided by the dose-equivalence activities. As demonstrated by the summation of these fractions, the cumulative dose contributed by residual radionuclide populations will be less than the RAG of 15 mrem/yr above background.

Table 6. Attainment of Radionuclide Direct Exposure Remedial Action Goals (Statistical Samples).

COC/COPC	95% UCL Statistical Values (pCi/g)			Activity Equivalent to 15 mrem/yr Dose [a] (pCi/g)	Fraction		
	Excavation	Overburden	Focused Sample		Excavation	Overburden	Focused Sample
Carbon-14	1.51	1.52	--	8.69	0.174	0.175	--
Cesium-137	0.030 (<BG)	--	--	6.2	0.0048	--	--
Plutonium-238	0.079	--	--	38.8	0.0020	--	--
Tritium	2.15	--	--	459	0.0047	--	--
Uranium-233/234	0.0 (<BG)	0.0 (<BG)	0.0 (<BG)	1.1 [b]	0	0	0
Uranium-238	0.0 (<BG)	0.0 (<BG)	--	1.1 [b]	0	0	--
				Total	0.1855	0.175	0.0
				Equivalent Dose (mrem/yr)	2.783	2.625	0.0

[a] Single radionuclide 15 mrem/yr dose-equivalence values and derivation methodology are presented in the RDR/RAWP (DOE-RL 2009b).
[b] Where cleanup levels are less than background, cleanup levels default to background (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 2.12.1 of the RDR/RAWP (DOE-RL 2009b).

-- = not applicable
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
UCL = upper confidence limit

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach, the field logbook (WCH 2010), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications. The DQA for the 1607-H1 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in the ENRE project-specific database for data evaluation prior to its archival in the HEIS and are summarized in Appendix C. The detailed DQA is presented in Appendix E.

SUMMARY FOR INTERIM CLOSURE

The 1607-H1 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2009b). The site was remediated by removing approximately 1,166 BCM (1,525 BCY) of material for disposal at the ERDF. Approximately 528 BCM (691 BCY) of soil (overburden) was stockpiled for evaluation for use as clean backfill. Statistical sampling results showed that the overburden was not suitable for use as backfill and subsequently, was remediated and disposed at the ERDF. Following the additional remediation, the results, combined with RESRAD modeling, were used to show residual contaminant concentrations met the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 1607-H1 waste site. In accordance with this evaluation, the verification sampling results support a reclassification of the 1607-H1 waste site to Interim Closed Out. Based on modeling, it is believed that contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

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APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Contaminants Exceeding Ecological Screening Levels for the 1607-H1 Waste Site [a].

Hazardous Substance		2007 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Maximum or Statistical Result
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
Metals (mg/kg)									
Background									
Antimony	5	5	--	--	--	78	--	0.27	0.42 (<BG)
Arsenic V	6.5 [d]	10	60	132	18	--	43	46	16.0
Boron	--	0.5	--	--	--	--	--	--	3.68
Lead	10.2	50	500	118	120	1,700	11	56	69.7
Manganese	512	1,100 [e]	--	1,500	220	450	4,300	4,000	317 (<BG)
Selenium	0.78	1	70	0.3	0.52	4.1	1.2	0.63	1.2
Vanadium	85.1	2	--	--	--	--	7.8	280	50.5 (<BG)

NOTE: Shaded cells are exceeded by the maximum or the statistical result.

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

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

[c] Wildlife.

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

[e] Benchmark replaced by Washington State natural background concentration.

-- = not available
BG = background
EPA = U.S. Environmental Protection Agency
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
WAC = *Washington Administrative Code*

APPENDIX B

GLOBAL POSITIONING ENVIRONMENTAL RADIOLOGICAL SURVEYOR (GPERS) SURVEYS

Figure B-1. GPERS Gamma Survey of 1607-H1 Waste Site Excavation.

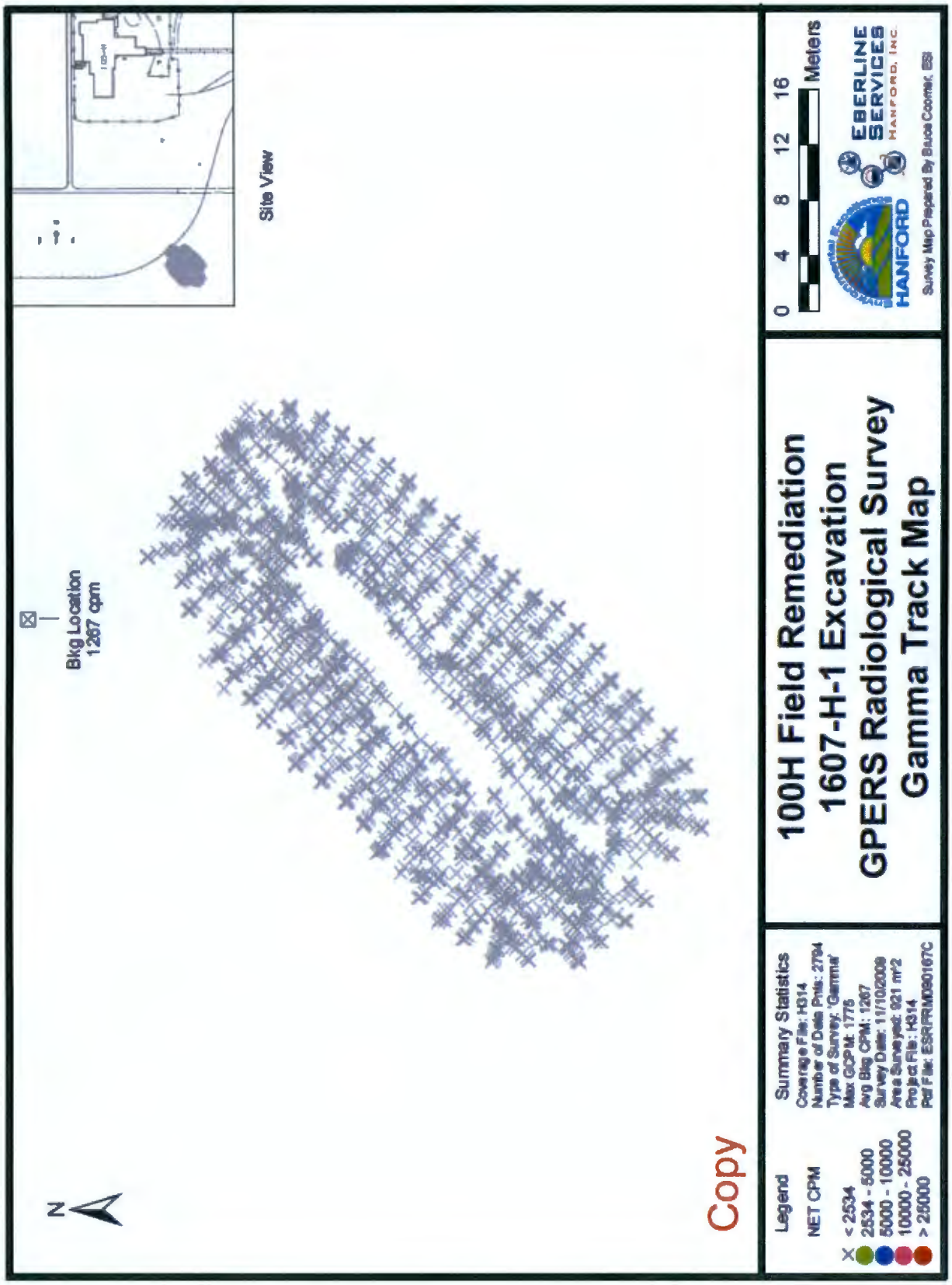
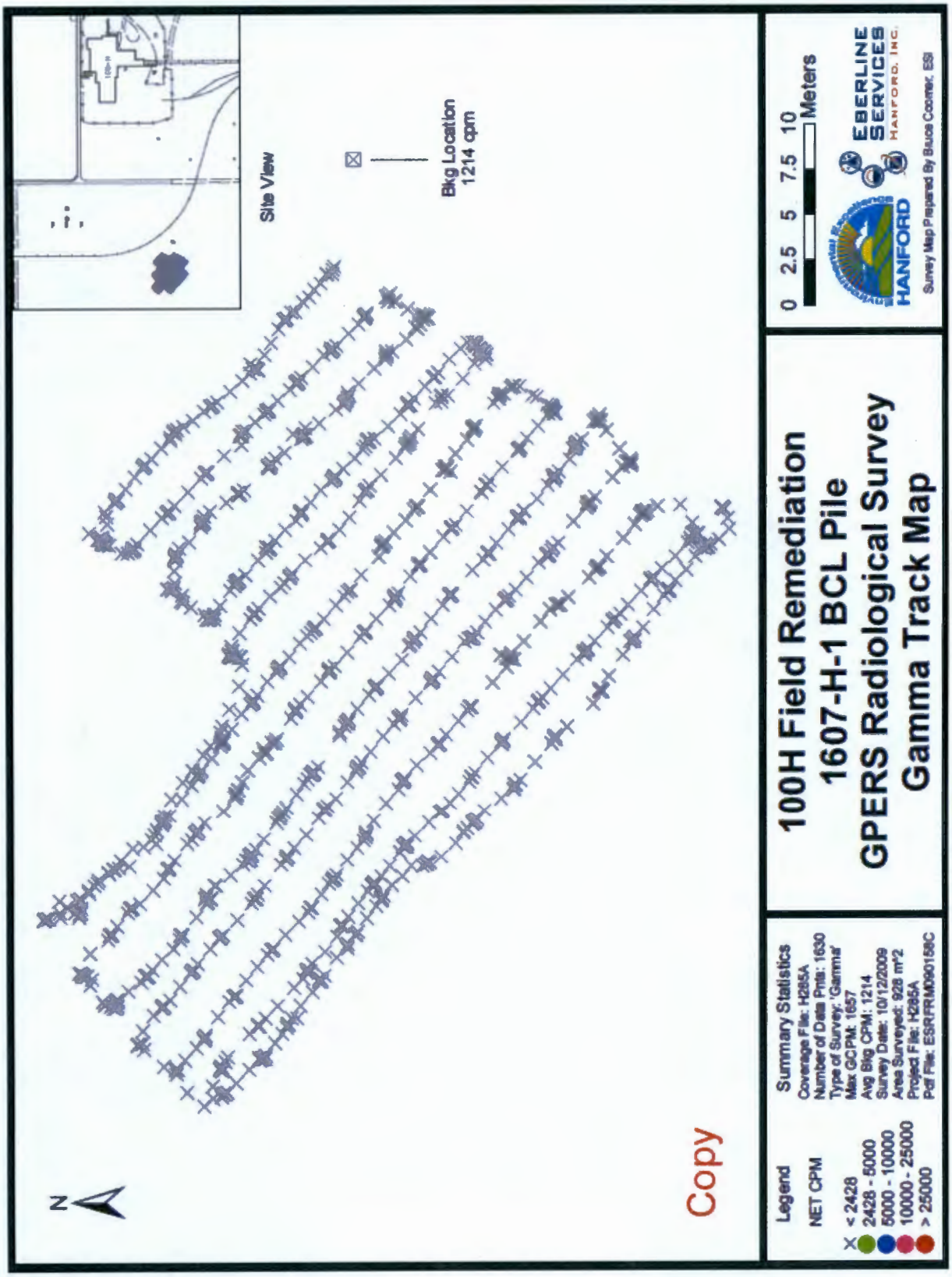


Figure B-2. GPERS Gamma Survey of 1607-H1 Waste Site Overburden.



APPENDIX C

95% UPPER CONFIDENCE LIMIT CALCULATIONS AND VERIFICATION SAMPLING RESULTS

DIRECT CONTACT HAZARD QUOTIENT AND CARCINOGENIC RISK CALCULATIONS FOR THE 1607-H1 WASTE SITE

APPENDIX C

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:

1607-H1 Cleanup Verification 95% UCL Calculations, 0100H-CA-V0140, Rev. 0, Washington Closure Hanford, Richland, Washington.

1607-H1 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100H-CA-V0141, Rev. 0, Washington Closure Hanford, Richland, Washington.

1607-H1 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100H-CA-V0144, 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-H Field Remediation **Job No. 14655**

Area: 100-H

Discipline: Environmental *Calculation No: 0100H-CA-V0140

Subject: 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 25 Attachments = 27 Total = 53	J. D. Sloglie	T. E. Queen	B. L. Vedder	D. F. Obenauer	5/17/11

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** 05/16/11	**Calc. No.** 0100H-CA-V0140	**Rev. No.** 0
Project 100-H Field Remediation	**Job No.** 14655	**Checked** T. E. Queen	**Date** 05/16/11
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations			**Sheet No.** 1 of 25

Summary

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

Table of Contents:
Sheets 1 to 4 - Calculation Sheet Summary
Sheet 5 to 16 - Calculation Sheet Verification Data - Excavation and Overburden
Sheet 17 to 23 - Ecology Software (MTCAStat) Results
Sheet 24 & 25 - Calculation Sheet Split - Duplicate Analysis
Attachment 1 - 1607-H1, Verification Sampling Results (27 sheets)

Given/References:
1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2005b), DOE-RL (2001), and Ecology (1996).
3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
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Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2009b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).

Calculation Description:
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 1607-H1 waste site. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2009b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:
The 1607-H1 waste site underwent statistical sampling at two decision units; excavation area and overburden area for verification sampling. One focused sample was also taken.

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

Washington Closure Hanford CALCULATION SHEET

Originator J. D. Skoglie Date 05/16/11 Calc. No. 0100H-CA-V0140 Rev. No. 0
Project 100-H Field Remediation Job No. 14655 Checked T. E. Queen Date 05/16/11
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 2 of 25

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

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

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

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

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

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

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

For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. If the RPD is greater than 30%, further investigation regarding the usability of the data is performed. To assist in the identification of anomalous sample pairs, when an analyte is detected in the primary or duplicate/split sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate/split result exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable RSVP.

Washington Closure Hanford CALCULATION SHEET

Originator J. D. Skoglie Date 05/04/11 Calc. No. 0100H-CA-V0140 Rev. No. 0
Project 100-H Field Remediation Job No. 14655 Checked T. E. Queen Date 05/04/11
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 3 of 25

Summary (continued)

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

Results Summary - Excavation [a]

Analyte	95% UCL Result	Maximum Result	Units
Carbon-14	1.51	–	pCi/g
Cesium-137	0.030	–	pCi/g
Plutonium-238	0.073	–	pCi/g
Tritium	2.03	–	pCi/g
Uranium-233/234	0.649	–	pCi/g
Uranium-238	0.588	–	pCi/g
Antimony	–	0.208	mg/kg
Arsenic	9.95	–	mg/kg
Barium	81.5	–	mg/kg
Beryllium	0.226	–	mg/kg
Boron	3.38	–	mg/kg
Cadmium	0.127	–	mg/kg
Chromium	13.0	–	mg/kg
Cobalt	7.03	–	mg/kg
Copper	15.0	–	mg/kg
Hexavalent chromium	0.12	–	mg/kg
Lead	32.3	–	mg/kg
Manganese	317	–	mg/kg
Mercury	–	0.0967	mg/kg
Molybdenum	0.388	–	mg/kg
Nickel	11.9	–	mg/kg
Vanadium	50.5	–	mg/kg
Zinc	43.4	–	mg/kg
Fluoride	2.7	–	mg/kg
Nitrogen in nitrate and nitrite[b]	3.12	–	mg/kg
Sulfate	21.7	–	mg/kg
Aroclor-1254	0.0193	–	mg/kg
Aroclor-1260	–	0.0152	mg/kg
DDE, 4,4'-	–	0.00398	mg/kg
DDT, 4,4'-	–	0.00129	mg/kg
Dieldrin	–	0.00390	mg/kg
Benzo(a)anthracene	–	0.0728	mg/kg
Benzo(a)pyrene	–	0.0678	mg/kg
Benzo(k)fluoranthene	–	0.0548	mg/kg
Bis(2-ethylhexyl)phthalate	–	0.211	mg/kg
Chrysene	–	0.0783	mg/kg
Di-n-butylphthalate	–	0.253	mg/kg
Fluoranthene	–	0.171	mg/kg
Phenanthrene	–	0.153	mg/kg
Pyrene	–	0.233	mg/kg

3-Part Test Evaluation:

95% UCL or maximum[a] >		
Cleanup Limit?	YES	YES
> 10% above Cleanup Limit?	YES	YES
Any sample > 2x Cleanup Limit?	YES	YES

Results Summary - Overburden [a]

Analyte	95% UCL Result	Maximum Result	Units
Carbon-14	1.52	–	pCi/g
Uranium-233/234	0.715	–	pCi/g
Uranium-238	0.697	–	pCi/g
Antimony	–	0.42	mg/kg
Arsenic	16.0	–	mg/kg
Barium	79.4	–	mg/kg
Beryllium	0.216	–	mg/kg
Boron	3.68	–	mg/kg
Cadmium	0.107	–	mg/kg
Chromium	12.2	–	mg/kg
Cobalt	6.25	–	mg/kg
Copper	14.3	–	mg/kg
Hexavalent chromium	0.15	–	mg/kg
Lead	69.7	–	mg/kg
Manganese	298	–	mg/kg
Mercury	–	0.0175	mg/kg
Molybdenum	0.363	–	mg/kg
Nickel	11.2	–	mg/kg
Selenium		1.2	mg/kg
Vanadium	46.5	–	mg/kg
Zinc	39.2	–	mg/kg
Chloride	–	10.5	mg/kg
Fluoride	1.4	–	mg/kg
Nitrogen in nitrate and nitrite[b]	21.0	–	mg/kg
Sulfate	57.2	–	mg/kg
BHC, beta	–	0.00137	mg/kg
Dieldrin	–	0.00201	mg/kg
Benzo(b)fluoranthene	–	0.0559	mg/kg
Bis(2-ethylhexyl)phthalate	–	0.282	mg/kg
Fluoranthene	–	0.0711	mg/kg
Pyrene	–	0.0957	mg/kg

3-Part Test Evaluation:

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

[a] The 95% UCL result or maximum value, depending on data censorship,

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

– = not applicable
B = blank contamination (inorganic constituents)
C = Sample was ≤5X the blank concentration
CVP = closeout verification package
D = dilution
DE = direct exposure
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
SAP = sampling and analysis plan
TDL = target detection limit
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

Washington Closure Hanford

CALCULATION SHEET

Originator J. D. Skoglie **Date** 05/02/11 **Calc. No.** 0100H-CA-V0140 **Rev. No.** 0
Project 100-H Field Remediation **Job No.** 14655 **Checked** T. E. Queen **Date** 05/02/11
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 4 of 25

Summary (continued)

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

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

Analyte	Duplicate Analysis	
	Excavation	Overburden
Potassium-40	21.6%	4.1%
Radium-226	19.7%	1.4%
Aluminum	4.4%	0.4%
Barium	1.1%	0.4%
Calcium	6.5%	0.7%
Chromium	5.7%	2.4%
Copper	2.8%	4.8%
Iron	4.5%	3.7%
Lead		1.0%
Magnesium	10.2%	1.1%
Manganese	8.0%	2.3%
Silicon	4.6%	17.7%
Vanadium	3.1%	1.7%
Zinc	3.0%	0.2%
Nitrogen in nitrate and nitrite	9.2%	7.8%
Sulfate	27.1%	5.2%

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

Focused Samples

Analyte	Result	Units
Uranium-233/234	0.265	pCi/g
Arsenic	1.30	mg/kg
Barium	40.5	mg/kg
Cadmium	0.055	mg/kg
Chromium	9.8	mg/kg
Cobalt	4.8	mg/kg
Copper	13.4	mg/kg
Lead	2.70	mg/kg
Manganese	228	mg/kg
Nickel	11.2	mg/kg
Vanadium	33.5	mg/kg
Zinc	29.9	mg/kg
Nitrate	0.84	mg/kg
Nitrogen in nitrate and nitrite	0.57	mg/kg
Sulfate	3.0	mg/kg

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Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 05/04/11
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Calc. No. 0100H-CA-V0140
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1 **1607-H1 Statistical Calculations**
2 **Verification Data -Excavation**

3	Sample	Sample	Sample	Carbon-14			Cesium-137			Plutonium-238			Tritium			Uranim-233/234			Uranium-238		
4	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
5	EXC-11	J1B9C8	7/12/10	1.12		0.784	0.038	U	0.038	0.063	U	0.241	0.647	U	1.48	0.773		0.237	0.588		0.237
6	Duplicate of J1B9C8	J1B9D0	7/12/10	1.27		0.738	0.027	U	0.027	0	U	0.365	0.302	U	1.41	0.563		0.205	0.456		0.205
7	EXC-1	J1B9B8	7/8/10	1.49		0.661	0.028	U	0.028	0	U	0.308	0	U	3.48	0.375		0.119	0.453		0.119
8	EXC-2	J1B9B9	7/8/10	0.924		0.636	0.019	U	0.019	0	U	0.306	0.286	U	3.58	0.643		0.129	0.558		0.129
9	EXC-3	J1B9C0	7/8/10	1.18		0.655	0.044	U	0.044	0.337		0.319	1.73	U	3.28	0.518		0.137	0.500		0.137
10	EXC-4	J1B9C1	7/8/10	1.56		0.665	0.019	U	0.019	0.031	U	0.342	0.567	U	3.55	0.562		0.179	0.679		0.179
11	EXC-5	J1B9C2	7/8/10	2.24		0.672	0.046	U	0.046	0	U	0.430	7.38		2.94	0.353		0.142	0.316		0.142
12	EXC-6	J1B9C3	7/8/10	1.52		0.695	0.061	U	0.061	0.031	U	0.299	1.97	U	3.17	0.418		0.152	0.596		0.152
13	EXC-7	J1B9C4	7/9/10	1.18		0.684	0.026	U	0.026	0.033	U	0.250	0	U	3.29	0.654		0.156	0.511		0.156
14	EXC-8	J1B9C5	7/12/10	1.40		0.765	0.026	U	0.026	0.038	U	0.291	0.659	U	1.44	0.681		0.174	0.590		0.174
15	EXC-9	J1B9C6	7/12/10	1.33		0.770	0.022	U	0.022	0.040	U	0.378	0.322	U	1.50	0.789		0.252	0.460		0.252
16	EXC-10	J1B9C7	7/12/10	1.15		0.754	0.024	U	0.024	0	U	0.278	1.57		1.46	0.757		0.232	0.696		0.232
17	EXC-12	J1B9C9	7/12/10	1.06		0.732	0.077		0.036	0.025	U	0.276	0.442	U	1.37	0.557		0.213	0.584		0.213

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19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Carbon-14	Cesium-137	Plutonium-238	Tritium	Uranim-233/234	Uranium-238
21	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
22	EXC-11	J1B9C8/ J1B9D0	7/12/10	1.20	0.016	0.032	0.475	0.668	0.522
23	EXC-1	J1B9B8	7/8/10	1.49	0.014	0	0	0.375	0.453
24	EXC-2	J1B9B9	7/8/10	0.924	0.010	0	0.286	0.643	0.558
25	EXC-3	J1B9C0	7/8/10	1.18	0.022	0.337	1.73	0.518	0.500
26	EXC-4	J1B9C1	7/8/10	1.56	0.010	0.031	0.567	0.562	0.679
27	EXC-5	J1B9C2	7/8/10	2.24	0.023	0	7.38	0.353	0.316
28	EXC-6	J1B9C3	7/8/10	1.52	0.031	0.031	1.97	0.418	0.596
29	EXC-7	J1B9C4	7/9/10	1.18	0.013	0.033	0	0.654	0.511
30	EXC-8	J1B9C5	7/12/10	1.40	0.013	0.038	0.659	0.681	0.590
31	EXC-9	J1B9C6	7/12/10	1.33	0.011	0.040	0.322	0.789	0.460
32	EXC-10	J1B9C7	7/12/10	1.15	0.012	0	1.57	0.757	0.696
33	EXC-12	J1B9C9	7/12/10	1.06	0.077	0.025	0.442	0.557	0.584

34 **Statistical Computations**

35		Carbon-14	Cesium-137	Plutonium-238	Tritium	Uranim-233/234	Uranium-238
36	95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
37	N	12	12	12	12	12	12
38	% < Detection limit	0%	92%	92%	83%	0%	0%
39	Mean	1.35	0.021	0.029	1.07	0.581	0.539
40	Standard deviation	0.340	0.019	0.093	2.03	0.144	0.104
41	Z-statistic	1.64	1.64	1.64	1.64	1.64	1.64
42	95% UCL on mean	1.51	0.030	0.073	2.03	0.649	0.588
43	Maximum value	2.24	0.077	0.337	7.38	0.789	0.696

CALCULATION SHEET

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Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/23/10
Job No. 14655

Calc. No. 0100H-CA-V0140
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Date 09/23/10
Sheet No. 6 of 25

1 **1607-H1 Statistical Calculations**
2 **Verification Data -Excavation**

3	Sample	Sample	Sample	Arsenic			Barium			Beryllium			Boron			Cadmium			Chromium			Cobalt			Copper		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	EXC-11	J1B9C8	7/12/10	9.67		0.851	81.3		0.425	0.249		0.170	3.79		1.70	0.114	B	0.213	12.7		0.851	6.58		2.55	14.7		1.70
6	Duplicate of J1B9C8	J1B9D0	7/12/10	10.1		1.00	82.2		0.502	0.244		0.201	3.85		2.01	0.125	B	0.251	12.0		1.00	6.24		3.01	14.3		2.01
7	EXC-1	J1B9B8	7/8/10	7.22		0.884	91.8		0.442	0.279		0.177	3.65		1.77	0.128	B	0.221	12.9		0.884	7.03		2.65	14.6		1.77
8	EXC-2	J1B9B9	7/8/10	5.47		0.957	71.7		0.478	0.282		0.191	2.43		1.91	0.134	B	0.239	13.2		0.957	7.29		2.87	14.5		1.91
9	EXC-3	J1B9C0	7/8/10	5.84		0.656	49.2		0.328	0.167		0.131	1.06	B	1.31	0.112	B	0.164	10.0		0.656	5.29		1.97	13.4		1.31
10	EXC-4	J1B9C1	7/8/10	8.16		0.840	73.1		0.420	0.265		0.168	1.41	B	1.68	0.128	B	0.210	12.9		0.840	7.54		2.52	15.8		1.68
11	EXC-5	J1B9C2	7/8/10	10.6		0.881	73.0		0.441	0.270		0.176	2.48		1.76	0.125	B	0.220	12.7		0.881	6.82		2.64	14.5		1.76
12	EXC-6	J1B9C3	7/8/10	5.91		0.728	65.3		0.364	0.240		0.146	1.88		1.46	0.115	B	0.182	11.7		0.728	6.50		2.18	13.9		1.46
13	EXC-7	J1B9C4	7/9/10	9.14		0.690	68.3		0.344	0.235		0.137	1.19	B	1.37	0.127	B	0.172	12.9		0.690	6.64		2.06	16.6		1.37
14	EXC-8	J1B9C5	7/12/10	3.56		0.796	63.3		0.398	0.230		0.159	2.36		1.59	0.114	B	0.199	13.7		0.796	6.67		2.39	15.6		1.59
15	EXC-9	J1B9C6	7/12/10	6.61		0.740	92.3		0.370	0.290		0.148	3.30		1.48	0.122	B	0.185	13.4		0.740	7.23		2.22	12.9		1.48
16	EXC-10	J1B9C7	7/12/10	15.3		0.652	65.6		0.326	0.220		0.130	1.70		1.30	0.0949	B	0.163	11.5		0.652	5.94		1.95	13.4		1.30
17	EXC-12	J1B9C9	7/12/10	7.03		0.851	88.5		0.425	0.272		0.170	4.42		1.70	0.134	B	0.213	13.1		0.851	7.11		2.55	13.8		1.70

19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
21	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
22	EXC-11	J1B9C8/ J1B9D0	7/12/10	9.89	81.8	0.247	3.82	0.120	12.4	6.41	14.5
23	EXC-1	J1B9B8	7/8/10	7.22	91.8	0.279	3.65	0.128	12.9	7.03	14.6
24	EXC-2	J1B9B9	7/8/10	5.47	71.7	0.282	2.43	0.134	13.2	7.29	14.5
25	EXC-3	J1B9C0	7/8/10	5.84	49.2	0.167	1.06	0.112	10.0	5.29	13.4
26	EXC-4	J1B9C1	7/8/10	8.16	73.1	0.265	1.41	0.128	12.9	7.54	15.8
27	EXC-5	J1B9C2	7/8/10	10.6	73.0	0.270	2.48	0.125	12.7	6.82	14.5
28	EXC-6	J1B9C3	7/8/10	5.91	65.3	0.240	1.88	0.115	11.7	6.50	13.9
29	EXC-7	J1B9C4	7/9/10	9.14	68.3	0.235	1.19	0.127	12.9	6.64	16.6
30	EXC-8	J1B9C5	7/12/10	3.56	63.3	0.230	2.36	0.114	13.7	6.67	15.6
31	EXC-9	J1B9C6	7/12/10	6.61	92.3	0.290	3.30	0.122	13.4	7.23	12.9
32	EXC-10	J1B9C7	7/12/10	15.3	65.6	0.220	1.70	0.0949	11.5	5.94	13.4
33	EXC-12	J1B9C9	7/12/10	7.03	88.5	0.272	4.42	0.134	13.1	7.11	13.8

34 **Statistical Computations**

35		Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
36	95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat normal distribution..	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
37	N	12	12	12	12	12	12	12	12
38	% < Detection limit	0%	0%	0%	0%	0%	0%	0%	0%
39	Mean	7.89	73.7	0.250	2.48	0.121	12.5	6.71	14.5
40	Standard deviation	3.07	12.9	0.0345	1.10	0.0110	1.02	0.627	1.09
41	95% UCL on mean	9.95	81.5	0.226	3.38	0.127	13.0	7.03	15.0
42	Maximum value	15.3	92.3	0.290	4.42	0.134	13.7	7.54	16.6
43	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection
44	**WAC 173-340 3-PART TEST**								
45	95% UCL > Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NA
46	> 10% above Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NA
47	Any sample > 2X Cleanup Limit?	NO	NA	NA	NO	NA	NA	NA	NA
48	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (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.

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1 **1607-H1 Statistical Calculations**
2 **Verification Data -Excavation**

3	Sample	Sample	Sample	Hexavalent chromium			Lead			Manganese			Molybdenum			Nickel			Vanadium			Zinc			Aroclor-1254		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	EXC-11	J1B9C8	7/12/10	0.20	U	0.20	24.0		0.851	287		0.851	0.260	B	0.851	12.0		2.13	46.1		0.851	40.5		2.55	0.00701	J	0.0132
6	Duplicate of J1B9C8	J1B9D0	7/12/10	0.20	U	0.20	24.4		1.00	265		1.00	0.323	B	1.00	11.2		2.51	44.7		1.00	39.3		3.01	0.00998	J	0.0131
7	EXC-1	J1B9B8	7/8/10	0.11	B	0.20	21.6		0.884	312		0.884	0.393	B	0.884	11.7		2.21	52.1		0.884	41.1		2.65	0.0131	U	0.0131
8	EXC-2	J1B9B9	7/8/10	0.14	B	0.20	12.4		0.957	320		0.957	0.447	B	0.957	12.0		2.39	53.6		0.957	42.3		2.87	0.0133	U	0.0133
9	EXC-3	J1B9C0	7/8/10	0.15	B	0.20	10.7		0.656	221		0.656	0.361	B	0.656	8.84		1.64	46.5		0.656	46.8		1.97	0.0385		0.0128
10	EXC-4	J1B9C1	7/8/10	0.09	B	0.20	18.8		0.840	341		0.840	0.415	B	0.840	11.5		2.10	52.3		0.840	45.7		2.52	0.0238		0.0310
11	EXC-5	J1B9C2	7/8/10	0.12	B	0.20	34.9		0.881	306		0.881	0.421	B	0.881	11.1		2.20	51.1		0.881	41.0		2.64	0.0134	U	0.0134
12	EXC-6	J1B9C3	7/8/10	0.20	U	0.20	19.2		0.728	282		0.728	0.386	B	0.728	11.8		1.82	47.8		0.728	42.6		2.18	0.0201		0.0132
13	EXC-7	J1B9C4	7/9/10	0.12	B	0.20	29.5		0.690	307		0.690	0.347	B	0.690	11.2		1.72	44.5		0.687	42.1		2.06	0.0301		0.0129
14	EXC-8	J1B9C5	7/12/10	0.20	U	0.20	5.98		0.796	280		0.796	0.277	B	0.796	12.4		1.99	48.1		0.796	36.2		2.39	0.0133	U	0.0133
15	EXC-9	J1B9C6	7/12/10	0.20	U	0.20	5.96		0.740	340		0.740	0.293	B	0.740	12.1		1.85	49.0		0.740	41.6		2.22	0.0130	U	0.0130
16	EXC-10	J1B9C7	7/12/10	0.20	U	0.20	31.7		0.652	263		0.652	0.245	B	0.652	11.1		1.63	43.0		0.652	39.0		1.95	0.0131	U	0.0131
17	EXC-12	J1B9C9	7/12/10	0.20	U	0.20	27.8		0.851	315		0.851	0.284	B	0.851	11.8		2.13	50.9		0.851	43.6		2.55	0.0132	U	0.0132

18
19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Hexavalent chromium	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc	Aroclor-1254
21	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
22	EXC-11	J1B9C8/ J1B9D0	7/12/10	0.10	24.2	276	0.292	11.6	45.4	39.9	0.00850
23	EXC-1	J1B9B8	7/8/10	0.11	21.6	312	0.393	11.7	52.1	41.1	0.00655
24	EXC-2	J1B9B9	7/8/10	0.14	12.4	320	0.447	12.0	53.6	42.3	0.00665
25	EXC-3	J1B9C0	7/8/10	0.15	10.7	221	0.361	8.8	46.5	46.8	0.0385
26	EXC-4	J1B9C1	7/8/10	0.09	18.8	341	0.415	11.5	52.3	45.7	0.0238
27	EXC-5	J1B9C2	7/8/10	0.12	34.9	306	0.421	11.1	51.1	41.0	0.00670
28	EXC-6	J1B9C3	7/8/10	0.10	19.2	282	0.386	11.8	47.8	42.6	0.0201
29	EXC-7	J1B9C4	7/9/10	0.12	29.5	307	0.347	11.2	44.5	42.1	0.0301
30	EXC-8	J1B9C5	7/12/10	0.10	5.98	280	0.277	12.4	48.1	36.2	0.00665
31	EXC-9	J1B9C6	7/12/10	0.10	5.96	340	0.293	12.1	49.0	41.6	0.00650
32	EXC-10	J1B9C7	7/12/10	0.10	31.7	263	0.245	11.1	43.0	39.0	0.00655
33	EXC-12	J1B9C9	7/12/10	0.10	27.8	315	0.284	11.8	50.9	43.6	0.00660

34 **Statistical Computations**

35		Hexavalent chromium	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc	Aroclor-1254
36	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.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
37	N	12	12	12	12	12	12	12	12
38	% < Detection limit	50%	0%	0%	0%	0%	0%	0%	58%
39	Mean	0.11	20.2	297	0.347	11.4	48.7	41.8	0.0139
40	Standard deviation	0.02	9.86	34.3	0.0669	0.91	3.39	2.83	0.0113
41	95% UCL on mean	0.12	32.3	317	0.388	11.9	50.5	43.4	0.0193
42	Maximum value	0.15	34.9	341	0.447	12.4	53.6	46.8	0.0385
43	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	2 River Protection	10.2 GW & River Protection	512 GW & River Protection	8.0 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	0.017 GW & River Protection
44	**WAC 173-340 3-PART TEST**								
45	95% UCL > Cleanup Limit?	NO	YES	NA	NO	NA	NA	NA	YES
46	> 10% above Cleanup Limit?	NO	YES	NA	NO	NA	NA	NA	YES
47	Any sample > 2X Cleanup Limit?	NO	YES	NA	NO	NA	NA	NA	YES
48	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/23/10
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

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Date 09/23/10
Sheet No. 8 of 25

1 **1607-H1 Statistical Calculations**
2 **Verification Data -Excavation**

3	Sample	Sample	Sample	Fluoride			Nitrogen in nitrate and nitrite[a]			Sulfate		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	EXC-11	J1B9C8	7/12/10	1.9	B	2.2	5.22		0.18	36.9		2.2
6	Duplicate of J1B9C8	J1B9D0	7/12/10	1.3	B	2.2	4.76		0.18	28.1		2.2
7	EXC-1	J1B9B8	7/8/10	1.2	B	2.3	1.42		0.18	4.7		2.3
8	EXC-2	J1B9B9	7/8/10	7.2		2.5	0.60		0.20	4.6		2.5
9	EXC-3	J1B9C0	7/8/10	1.0	B	2.6	3.69		0.20	16.6		2.6
10	EXC-4	J1B9C1	7/8/10	1.6	B	2.3	0.84		0.19	5.7		2.3
11	EXC-5	J1B9C2	7/8/10	1.6	B	2.3	0.82		0.19	7.0		2.3
12	EXC-6	J1B9C3	7/8/10	0.8	B	2.2	3.42		0.18	7.6		2.2
13	EXC-7	J1B9C4	7/9/10	1.7	B	2.3	0.99		0.18	27.1		2.3
14	EXC-8	J1B9C5	7/12/10	1.0	B	2.3	0.45		0.18	3.5		2.3
15	EXC-9	J1B9C6	7/12/10	1.2	B	2.3	0.95		0.18	6.6		2.3
16	EXC-10	J1B9C7	7/12/10	1.6	B	2.5	1.73		0.20	18.3		2.5
17	EXC-12	J1B9C9	7/12/10	1.7	B	2.1	1.16		0.17	13.4		2.1

18
19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Fluoride			Nitrogen in nitrate and nitrite[a]			Sulfate		
21	Area	Number	Date	mg/kg			mg/kg			mg/kg		
22	EXC-11	J1B9C8/ J1B9D0	7/12/10	1.6			4.99			32.5		
23	EXC-1	J1B9B8	7/8/10	1.2			1.42			4.7		
24	EXC-2	J1B9B9	7/8/10	7.2			0.60			4.6		
25	EXC-3	J1B9C0	7/8/10	1.0			3.69			16.6		
26	EXC-4	J1B9C1	7/8/10	1.6			0.84			5.7		
27	EXC-5	J1B9C2	7/8/10	1.6			0.82			7.0		
28	EXC-6	J1B9C3	7/8/10	0.8			3.42			7.6		
29	EXC-7	J1B9C4	7/9/10	1.7			0.99			27.1		
30	EXC-8	J1B9C5	7/12/10	1.0			0.45			3.5		
31	EXC-9	J1B9C6	7/12/10	1.2			0.95			6.6		
32	EXC-10	J1B9C7	7/12/10	1.6			1.73			18.3		
33	EXC-12	J1B9C9	7/12/10	1.7			1.16			13.4		

34 **Statistical Computations**

35		Fluoride			Nitrogen in nitrate and nitrite[a]			Sulfate		
36	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.		
37	N	12			12			12		
38	% < Detection limit	0%			0%			0%		
39	Mean	1.9			1.76			12.3		
40	Standard deviation	1.7			1.46			9.6		
41	95% UCL on mean	2.7			3.12			21.7		
42	Maximum value	7.2			5.22			36.9		
43	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	96	GW Protection		1000	GW Protection		25000	GW Protection	
44	**WAC 173-340 3-PART TEST**									
45	95% UCL > Cleanup Limit?	NO			NA			NA		
46	> 10% above Cleanup Limit?	NO			NA			NA		
47	Any sample > 2X Cleanup Limit?	NO			NA			NA		
48	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.			Because all values are below background (11.8 mg/kg) the WAC 173-340 3-part test is not required.			Because all values are below background (237 mg/kg) the WAC 173-340 3-part test is not required.		

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

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/27/10
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

Rev. No. 0
Date 09/27/10
Sheet No. 9 of 25

1 1607-H1 Maximum Calculations
2 Verification Data -Excavation

3	Sample	Sample	Sample	Antimony			Mercury			Aroclor-1260			DDE, 4,4'-			DDT, 4,4'-			Dieldrin			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(k)fluoranthene		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	EXC-11	J1B9C8	7/12/10	0.851	U	0.851	0.0162	B	0.0258	0.0132	U	0.0132	0.00132	UD	0.00132	0.00132	UD	0.00132	0.00132	UD	0.00132	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
6	Duplicate of J1B9C8	J1B9D0	7/12/10	1.00	U	1.00	0.00949	B	0.0244	0.0130	J	0.0131	0.00132	UD	0.00132	0.00132	UD	0.00132	0.00132	UD	0.00132	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
7	EXC-1	J1B9B8	7/8/10	0.884	U	0.884	0.0283	U	0.0283	0.0131	U	0.0131	0.00131	UD	0.00131	0.00131	UD	0.00131	0.00131	UD	0.00131	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
8	EXC-2	J1B9B9	7/8/10	0.957	U	0.957	0.0277	U	0.0277	0.0133	U	0.0133	0.00134	UD	0.00134	0.00134	UD	0.00134	0.00134	UD	0.00134	0.335	U	0.335	0.335	U	0.335	0.335	U	0.335
9	EXC-3	J1B9C0	7/8/10	0.656	U	0.656	0.0268		0.0263	0.0152		0.0128	0.00128	UD	0.00128	0.00128	UD	0.00128	0.00128	UD	0.00128	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338
10	EXC-4	J1B9C1	7/8/10	0.840	U	0.840	0.0252	U	0.0252	0.00895	J	0.0131	0.00131	UD	0.00131	0.00131	UD	0.00131	0.00131	UD	0.00131	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
11	EXC-5	J1B9C2	7/8/10	0.881	U	0.881	0.0232	U	0.0232	0.0134	U	0.0134	0.00134	UD	0.00134	0.00134	UD	0.00134	0.00134	UD	0.00134	0.0728	J	0.0728	0.0678	J	0.0678	0.0548	J	0.0548
12	EXC-6	J1B9C3	7/8/10	0.728	U	0.728	0.0258	U	0.0258	0.00884	J	0.0132	0.00132	UD	0.00132	0.00132	UD	0.00132	0.00132	UD	0.00132	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
13	EXC-7	J1B9C4	7/9/10	0.208	B	0.690	0.0967		0.0274	0.0148		0.0129	0.00398	JD	0.00129	0.00129	JD	0.00129	0.00129	UD	0.00129	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
14	EXC-8	J1B9C5	7/12/10	0.796	U	0.796	0.0258	U	0.0258	0.0133	U	0.0133	0.00133	UD	0.00133	0.00133	UD	0.00133	0.00133	UD	0.00133	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
15	EXC-9	J1B9C6	7/12/10	0.740	U	0.740	0.0226	U	0.0226	0.0130	U	0.0130	0.00130	UD	0.00130	0.00130	UD	0.00130	0.00390	JD	0.00130	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
16	EXC-10	J1B9C7	7/12/10	0.652	U	0.652	0.0238	U	0.0238	0.0131	U	0.0131	0.00131	UD	0.00131	0.00131	UD	0.00131	0.00131	UD	0.00131	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
17	EXC-12	J1B9C9	7/12/10	0.851	U	0.851	0.0266	U	0.0266	0.0132	U	0.0132	0.00132	UD	0.00132	0.00132	UD	0.00132	0.00132	UD	0.00132	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331

18
19 Statistical Computations

20		Antimony	Mercury	Aroclor-1260	DDE, 4,4'-	DDT, 4,4'-	Dieldrin	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(k)fluoranthene
21	% < Detection limit	92%	75%	58%	92%	92%	92%	92%	92%	92%
22	Maximum value	0.208	0.0967	0.0152	0.00398	0.00129	0.00390	0.0728	0.0678	0.0548
23	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	5 GW & River Protection	0.33 GW & River Protection	0.017 GW & River Protection	0.0033 River Protection	0.0033 River Protection	0.0033 GW and River Protection	0.015 GW and River Protection	0.015 GW and River Protection	0.015 GW and River Protection
24	**3-PART TEST**									
25	Maximum > Cleanup Limit?	NA	NA	NO	YES	NO	YES	YES	YES	YES
26	> 10% above Cleanup Limit?	NA	NA	NO	NO	NO	NO	YES	YES	YES
27	Any sample > 2X Cleanup Limit?	NA	NA	NO	NO	NO	NO	YES	YES	YES
28	**3-Part Test Compliance?**	Because all values are below background (5.0 mg/kg) the 3-part test is not required.	Because all values are below background (0.33 mg/kg) the 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/27/10
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

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1 **1607-H1 Maximum Calculations**
2 **Verification Data -Excavation**

3	Sample	Sample	Sample	Bis(2-ethylhexyl)phthalate			Chrysene			Di-n-butylphthalate			Fluoranthene			Phenanthrene			Pyrene		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	EXC-11	J1B9C8	7/12/10	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
6	Duplicate of J1B9C8	J1B9D0	7/12/10	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
7	EXC-1	J1B9B8	7/8/10	0.211	J	0.232	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
8	EXC-2	J1B9B9	7/8/10	0.335	U	0.335	0.335	U	0.335	0.335	U	0.335	0.335	U	0.335	0.335	U	0.335	0.335	U	0.335
9	EXC-3	J1B9C0	7/8/10	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338
10	EXC-4	J1B9C1	7/8/10	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
11	EXC-5	J1B9C2	7/8/10	0.332	U	0.332	0.0783	J	0.0783	0.332	U	0.332	0.171	J	0.171	0.153	J	0.153	0.233	J	0.233
12	EXC-6	J1B9C3	7/8/10	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
13	EXC-7	J1B9C4	7/9/10	0.331	U	0.331	0.331	U	0.331	0.253	J	0.253	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
14	EXC-8	J1B9C5	7/12/10	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
15	EXC-9	J1B9C6	7/12/10	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332
16	EXC-10	J1B9C7	7/12/10	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331
17	EXC-12	J1B9C9	7/12/10	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331	0.331	U	0.331

18
19 **Statistical Computations**

20		Bis(2-ethylhexyl)phthalate	Chrysene	Di-n-butylphthalate	Fluoranthene	Phenanthrene	Pyrene
21	% < Detection limit	92%	92%	92%	92%	92%	92%
22	Maximum value	0.211	0.0783	0.253	0.171	0.153	0.233
23	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	0.36 River Protection	0.1 River Protection	160 GW Protection	18.0 River Protection	240 GW Protection	48 GW & River Protection
24	**3-PART TEST**						
25	Maximum > Cleanup Limit?	NO	NO	NO	NO	NO	NO
26	> 10% above Cleanup Limit?	NO	NO	NO	NO	NO	NO
27	Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO	NO
28	**3-Part Test Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

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CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/26/11
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

Rev. No. 0
Date 04/26/11
Sheet No. 11 of 25

1 **1607-H1 Statistical Calculations**
2 **Verification Data -Overburden**

3	Sample	Sample	Sample	Carbon-14			Uranium-233/234			Uranium-238		
4	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
5	OB-3	J1B9D4	7/7/10	1.25	J	0.728	0.685		0.187	0.709		0.187
6	Duplicate of J1B9D4	J1B9F4	7/7/10	0.914	J	0.765	0.795		0.174	0.613		0.174
7	OB-1	J1B9D2	7/7/10	1.25	J	0.695	0.745		0.173	0.632		0.173
8	OB-2	J1B9D3	7/7/10	1.25	J	0.704	0.823		0.150	0.607		0.150
9	OB-4	J1B9D5	7/7/10	1.29	J	0.712	0.697		0.137	1.02		0.137
10	OB-5	J1B9D6	7/7/10	0.222	UJ	0.772	0.370		0.167	0.545		0.167
11	OB-6	J1B9D7	7/7/10	0.930	J	0.734	0.607		0.145	0.702		0.145
12	OB-7	J1B9D8	7/8/10	1.74		0.693	0.469		0.128	0.519		0.128
13	OB-8	J1B9D9	7/8/10	1.93		0.688	0.783		0.130	0.579		0.130
14	OB-9	J1B9F0	7/8/10	1.77		0.639	0.612		0.180	0.259		0.180
15	OB-10	J1B9F1	7/8/10	1.47		0.631	0.597		0.158	0.638		0.158
16	OB-11	J1B9F2	7/8/10	1.39		0.632	0.835		0.355	0.742		0.355
17	OB-12	J1B9F3	7/8/10	1.34		0.672	0.304		0.198	0.394		0.137

18
19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Carbon-14			Uranium-233/234			Uranium-238		
21	Area	Number	Date	pCi/g			pCi/g			pCi/g		
22	OB-3	J1B9D4/ J1B9F4	7/7/10	1.08			0.740			0.66		
23	OB-1	J1B9D2	7/7/10	1.25			0.745			0.632		
24	OB-2	J1B9D3	7/7/10	1.25			0.823			0.607		
25	OB-4	J1B9D5	7/7/10	1.29			0.697			1.02		
26	OB-5	J1B9D6	7/7/10	0.222			0.370			0.545		
27	OB-6	J1B9D7	7/7/10	0.930			0.607			0.702		
28	OB-7	J1B9D8	7/8/10	1.74			0.469			0.519		
29	OB-8	J1B9D9	7/8/10	1.93			0.783			0.579		
30	OB-9	J1B9F0	7/8/10	1.77			0.612			0.259		
31	OB-10	J1B9F1	7/8/10	1.47			0.597			0.638		
32	OB-11	J1B9F2	7/8/10	1.39			0.835			0.742		
33	OB-12	J1B9F3	7/8/10	1.34			0.304			0.394		

34 **Statistical Computations**

35		Carbon-14			Uranium-233/234			Uranium-238		
36	95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.		
37	N	12			12			12		
38	% < Detection limit	8%			0%			0%		
39	Mean	1.31			0.632			0.608		
40	Standard deviation	0.447			0.174			0.186		
41	Z-statistic	1.64			1.64			1.64		
42	95% UCL on mean	1.52			0.715			0.697		
43	Maximum value	1.93			0.835			1.02		

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/26/11
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

Rev. No. 0
Date 04/26/11
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1607-H1 Statistical Calculations

Verification Data -Overburden

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
OB-3[a]	J1FXV8	3/23/11	3.50		0.670	58.8		0.077	0.033	U	0.033	1.70	B	0.99	0.054	B	0.041	9.0		0.059	5.70	X	0.1	12.7		0.22
Duplicate of J1FXV8[a]	J1FXW1	3/23/11	3.40		0.710	66.5		0.082	0.042	B	0.035	1.80	B	1.10	0.072	B	0.044	9.7		0.062	6.20	X	0.11	15.2		0.23
OB-1	J1B9D2	7/7/10	8.28		0.850	63.9		0.425	0.215		0.170	2.79		1.70	0.109	B	0.213	11.7		0.850	6.52		2.55	16.1		1.70
OB-2[a]	J1FXV7	3/23/11	4.30		0.650	68.6		0.075	0.033	U	0.033	2.80	M	0.97	0.093	BM	0.041	10.2		0.057	5.7	X	0.099	14.2		0.21
OB-4	J1B9D5	7/7/10	15.6		0.799	86.5		0.400	0.231		0.160	7.26		1.60	0.102	B	0.200	10.6		0.799	5.93		2.40	12.4		1.60
OB-5	J1B9D6	7/7/10	9.06		0.752	61.8		0.376	0.218		0.150	2.13		1.50	0.102	B	0.188	12.7		0.752	6.30		2.26	13.5		1.50
OB-6	J1B9D7	7/7/10	12.3		0.659	78.9		0.330	0.236		0.132	3.33		1.32	0.106	B	0.165	11.9		0.659	6.22		1.98	14.0		1.32
OB-7[a]	J1FXV9	3/23/11	3.40		0.690	93.6		0.080	0.046	B	0.035	1.90	B	1.00	0.084	B	0.043	10.9		0.061	6.2	X	0.10	14.6		0.23
OB-8[a]	J1FXW0	3/23/11	26.6		0.77	85.9		0.089	0.080	B	0.039	3.00		1.10	0.048	U	0.048	11.9		0.068	6.2	X	0.12	12.5		0.25
OB-9	J1B9F0	7/8/10	8.80		0.746	68.4		0.373	0.267		0.149	1.95		1.49	0.112	B	0.187	14.0		0.746	6.35		2.24	14.0		1.49
OB-10	J1B9F1	7/8/10	10.6		0.812	72.2		0.406	0.245		0.162	1.93		1.62	0.119	B	0.203	11.9		0.812	6.21		2.44	13.9		1.62
OB-11	J1B9F2	7/8/10	9.83		0.686	60.9		0.343	0.219		0.137	2.96		1.37	0.0989	B	0.171	11.7		0.686	5.63		2.06	12.7		1.37
OB-12	J1B9F3	7/8/10	11.3		0.951	75.8		0.476	0.244		0.190	3.85		1.90	0.121	B	0.238	11.1		0.951	6.05		2.85	13.6		1.90

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
OB-3[a]	J1FXV8/ J1FXW1	3/23/11	3.45	62.7	0.0293	1.75	0.063	9.4	5.95	14.0
OB-1	J1B9D2	7/7/10	8.28	63.9	0.215	2.79	0.109	11.7	6.52	16.1
OB-2[a]	J1FXV7	3/23/11	4.30	68.6	0.017	2.8	0.093	10.2	5.70	14.2
OB-4	J1B9D5	7/7/10	15.6	86.5	0.231	7.26	0.102	10.6	5.93	12.4
OB-5	J1B9D6	7/7/10	9.06	61.8	0.218	2.13	0.102	12.7	6.30	13.5
OB-6	J1B9D7	7/7/10	12.3	78.9	0.236	3.33	0.106	11.9	6.22	14.0
OB-7[a]	J1FXV9	3/23/11	3.40	93.6	0.046	1.90	0.084	10.9	6.20	14.6
OB-8[a]	J1FXW0	3/23/11	26.6	85.9	0.080	3.00	0.024	11.9	6.20	12.5
OB-9	J1B9F0	7/8/10	8.80	68.4	0.267	1.95	0.112	14.0	6.35	14.0
OB-10	J1B9F1	7/8/10	10.6	72.2	0.245	1.93	0.119	11.9	6.21	13.9
OB-11	J1B9F2	7/8/10	9.83	60.9	0.219	2.96	0.0989	11.7	5.63	12.7
OB-12	J1B9F3	7/8/10	11.3	75.8	0.244	3.85	0.121	11.1	6.05	13.6

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), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), 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%	8%	0%	8%	0%	0%	0%
Mean	10.3	73.3	0.171	2.97	0.094	11.5	6.11	13.8
Standard deviation	6.31	10.9	0.0964	1.50	0.0272	1.20	0.263	1.01
95% UCL on mean	16.0	79.4	0.216	3.68	0.107	12.2	6.25	14.3
Maximum value	26.6	93.6	0.267	7.3	0.121	14.0	6.52	16.1
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 direct exposure 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.

[a] **Result presented is from re-sample data. Original sample results are provided in Attachment 1.**

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/26/11
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

Rev. No. 0
Date 04/26/11
Sheet No. 13 of 25

1607-H1 Statistical Calculations

Verification Data -Overburden

Sample Area	Sample Number	Sample Date	Lead mg/kg	Lead Q	Lead PQL	Manganese mg/kg	Manganese Q	Manganese PQL	Molybdenum mg/kg	Molybdenum Q	Molybdenum PQL	Nickel mg/kg	Nickel Q	Nickel PQL	Vanadium mg/kg	Vanadium Q	Vanadium PQL	Zinc mg/kg	Zinc Q	Zinc PQL
OB-3[a]	J1FXV8	3/23/11	15.4		0.270	271		0.10	0.300	B	0.26	9.70	X	0.12	40.4		0.095	34.7	X	0.40
Duplicate of J1FXV8[a]	J1FXW1	3/23/11	14.8		0.290	287		0.11	0.280	U	0.28	9.90	X	0.13	41.5		0.10	39.0	X	0.43
OB-1	J1B9D2	7/7/10	25.3		0.850	286		0.850	0.278	B	0.850	10.8		2.13	48.1		0.850	37.5		2.55
OB-2[a]	J1FXV7	3/23/11	9.70		0.270	283		0.099	0.370	B	0.260	11.1	X	0.12	43.1		0.093	37.2	X	0.39
OB-4	J1B9D5	7/7/10	50.9		0.799	267		0.799	0.318	B	0.799	9.63		2.00	46.2		0.799	38.2		2.40
OB-5	J1B9D6	7/7/10	29.1		0.752	284		0.752	0.281	B	0.752	11.9		1.88	47.2		0.752	37.8		2.26
OB-6	J1B9D7	7/7/10	39.4		0.659	285		0.659	0.271	B	0.659	11.0		1.65	47.9		0.659	39.0		1.98
OB-7[a]	J1FXV9	3/23/11	8.50		0.280	311		0.100	0.270	B	0.270	10.5	X	0.13	43.6		0.098	39.5	X	0.42
OB-8[a]	J1FXW0	3/23/11	152		0.320	350		0.120	0.300	U	0.300	10.8	X	0.14	40.8		0.110	40.6	X	0.47
OB-9	J1B9F0	7/8/10	29.9		0.746	287		0.746	0.324	B	0.746	11.5		1.87	47.9		0.746	39.2		2.24
OB-10	J1B9F1	7/8/10	36.8		0.812	281		0.812	0.332	B	0.812	11.6		2.03	47.6		0.812	40.1		2.44
OB-11	J1B9F2	7/8/10	33.2		0.686	250		0.686	0.284	B	0.686	10.7		1.71	42.6		0.686	34.2		2.06
OB-12	J1B9F3	7/8/10	36.5		0.951	266		0.951	0.618	B	0.951	9.83		2.38	44.0		0.951	38.6		2.85

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Lead mg/kg	Manganese mg/kg	Molybdenum mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg
OB-3[a]	J1FXV8/ J1FXW1	3/23/11	15.1	279	0.220	9.80	41.0	36.9
OB-1	J1B9D2	7/7/10	25.3	286	0.278	10.8	48.1	37.5
OB-2[a]	J1FXV7	3/23/11	9.70	283	0.370	11.1	43.1	37.2
OB-4	J1B9D5	7/7/10	50.9	267	0.318	9.63	46.2	38.2
OB-5	J1B9D6	7/7/10	29.1	284	0.281	11.9	47.2	37.8
OB-6	J1B9D7	7/7/10	39.4	285	0.271	11.0	47.9	39.0
OB-7[a]	J1FXV9	3/23/11	8.50	311	0.270	10.5	43.6	39.5
OB-8[a]	J1FXW0	3/23/11	152	350	0.150	10.8	40.8	40.6
OB-9	J1B9F0	7/8/10	29.9	287	0.324	11.5	47.9	39.2
OB-10	J1B9F1	7/8/10	36.8	281	0.332	11.6	47.6	40.1
OB-11	J1B9F2	7/8/10	33.2	250	0.284	10.7	42.6	34.2
OB-12	J1B9F3	7/8/10	36.5	266	0.618	9.83	44.0	38.6

Statistical Computations

	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc
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), 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%	8%	0%	0%	0%
Mean	38.9	286	0.310	10.8	45.0	38.2
Standard deviation	37.8	25.0	0.112	0.73	2.79	1.71
95% UCL on mean	69.7	298	0.363	11.2	46.5	39.2
Maximum value	152	350	0.618	11.9	48.1	40.6
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	10.2 GW & River Protection	512 GW & River Protection	8.0 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	YES	NA	NO	NA	NA	NA
> 10% above Cleanup Limit?	YES	NA	NO	NA	NA	NA
Any sample > 2X Cleanup Limit?	YES	NA	NO	NA	NA	NA
WAC 173-340 Compliance?	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.

[a] **Result presented is from re-sample data. Original sample results are provided in Attachment 1.**

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/26/11
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

Rev. No. 0
Date 04/26/11
Sheet No. 14 of 25

1 **1607-H1 Statistical Calculations**
2 **Verification Data -Overburden**

3	Sample	Sample	Sample	Hexavalent chromium			Fluoride			Nitrogen in nitrate and nitrite[b]			Sulfate		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	OB-3	J1B9D4	7/7/10	0.12	B	0.20	1.2	B	2.5	26.7	D	0.99	131	D	12.4
6	Duplicate of J1B9D4	J1B9D2	7/7/10	0.15	B	0.20	2.1	B	2.3	24.7	D	0.94	138	D	11.7
7	OB-1	J1B9D2	7/7/10	0.18	B	0.20	0.8	B	2.6	2.42		0.21	4.7		2.6
8	OB-2	J1FXV7	7/7/10	0.11	B	0.21	1.1	B	2.3	28.7	D	0.91	160	D	11.4
9	OB-4	J1B9D5	7/7/10	0.15	B	0.20	1.4	B	2.6	7.11		0.21	17.1		2.6
10	OB-5	J1B9D6	7/7/10	0.17	B	0.20	1.4	B	2.2	1.56		0.18	3.8		2.2
11	OB-6	J1B9D7	7/7/10	0.10	B	0.20	1.0	B	2.5	4.75		0.20	17.6		2.5
12	OB-7	J1FXV9	7/8/10	0.16	B	0.20	1.4	B	2.3	2.27		0.19	9.5		2.3
13	OB-8	J1FXW0	7/8/10	0.18	B	0.21	1.4	B	2.4	1.09		0.19	7.0		2.4
14	OB-9	J1B9F0	7/8/10	0.20	U	0.20	1.3	B	2.5	1.02		0.20	3.6		2.5
15	OB-10	J1B9F1	7/8/10	0.20	U	0.20	1.1	B	2.4	0.99		0.19	3.6		2.4
16	OB-11	J1B9F2	7/8/10	0.20	U	0.20	1.4	B	2.5	2.95		0.20	5.5		2.5
17	OB-12	J1B9F3	7/8/10	0.21	U	0.21	1.2	B	2.3	5.36		0.18	7.5		2.3

18
19 **Statistical Computation Input Data**

20	Sample	Sample	Sample	Hexavalent chromium			Fluoride			Nitrogen in nitrate and nitrite[b]			Sulfate		
21	Area	Number	Date	mg/kg			mg/kg			mg/kg			mg/kg		
22	OB-3	J1B9D4/ J1B9F4	7/7/10	0.14			1.7			25.7			135		
23	OB-1	J1B9D2	7/7/10	0.18			0.8			2.42			4.7		
24	OB-2	J1B9D3	7/7/10	0.11			1.1			28.7			160		
25	OB-4	J1B9D5	7/7/10	0.15			1.4			7.11			17.1		
26	OB-5	J1B9D6	7/7/10	0.17			1.4			1.56			3.8		
27	OB-6	J1B9D7	7/7/10	0.10			1.0			4.75			17.6		
28	OB-7	J1B9D8	7/8/10	0.16			1.4			2.27			9.5		
29	OB-8	J1B9D9	7/8/10	0.18			1.4			1.09			7.0		
30	OB-9	J1B9F0	7/8/10	0.10			1.3			1.02			3.6		
31	OB-10	J1B9F1	7/8/10	0.10			1.1			0.99			3.6		
32	OB-11	J1B9F2	7/8/10	0.10			1.4			2.95			5.5		
33	OB-12	J1B9F3	7/8/10	0.11			1.2			5.36			7.5		

34 **Statistical Computations**

35		Hexavalent chromium	Fluoride	Nitrogen in nitrate and nitrite[b]	Sulfate
36	95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
37	N	12	12	12	12
38	% < Detection limit	33%	0%	0%	0%
39	Mean	0.13	1.3	6.99	31.2
40	Standard deviation	0.034	0.2	9.65	54.7
41	95% UCL on mean	0.15	1.4	21.0	57.2
42	Maximum value	0.18	2.1	28.7	160
43	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	2 River Protection	96 GW Protection	1000 GW Protection	25000 GW Protection
44	**WAC 173-340 3-PART TEST**				
45	95% UCL > Cleanup Limit?	NO	NA	NO	NA
46	> 10% above Cleanup Limit?	NO	NA	NO	NA
47	Any sample > 2X Cleanup Limit?	NO	NA	NO	NA
48	**WAC 173-340 Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (2.81 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (237 mg/kg) the WAC 173-340 3-part test is not required.

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

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/26/11
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

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Date 04/26/11
Sheet No. 15 of 25

1 **1607-H1 Maximum Calculations**
2 **Verification Data -Overburden**

3	Sample	Sample	Sample	BHC, beta			Dieldrin			Benzo(b)fluoranthene			Bis(2-ethylhexyl)phthalate			Fluoranthene			Pyrene			Chloride		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	OB-3	J1B9D4	7/7/10	0.00126	UD	0.00126	0.00126	UD	0.00126	0.333	U	0.333	0.333	U	0.333	0.0552	J	0.333	0.0751	J	0.0751	7.2		2.5
6	Duplicate of J1B9D4	J1B9F4	7/7/10	0.00133	UD	0.00133	0.00133	UD	0.00133	0.333	U	0.333	0.282	J	0.333	0.333	U	0.333	0.333	U	0.333	8.7		2.3
7	OB-1	J1B9D2	7/7/10	0.00132	UD	0.00132	0.00132	UD	0.00132	0.337	U	0.337	0.337	U	0.337	0.337	U	0.337	0.337	U	0.337	2.6	U	2.6
8	OB-2	J1B9D3	7/7/10	0.00137	JD	0.00137	0.00137	UD	0.00137	0.340	U	0.340	0.340	U	0.340	0.340	U	0.340	0.340	U	0.340	10.5		2.3
9	OB-4	J1B9D5	7/7/10	0.00131	UD	0.00131	0.00131	UD	0.00131	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338	0.338	U	0.338	2.6	U	2.6
10	OB-5	J1B9D6	7/7/10	0.00131	UD	0.00131	0.00131	UD	0.00131	0.333	U	0.333	0.333	U	0.333	0.333	U	0.333	0.333	U	0.333	2.2	U	2.2
11	OB-6	J1B9D7	7/7/10	0.00126	UD	0.00126	0.00126	UD	0.00126	0.335	U	0.335	0.335	U	0.335	0.335	U	0.335	0.335	U	0.335	2.5	U	2.5
12	OB-7	J1B9D8	7/8/10	0.00135	UD	0.00135	0.00135	UD	0.00135	0.0559	J	0.336	0.336	U	0.336	0.0711	J	0.0711	0.0957	J	0.0957	2.3	U	2.3
13	OB-8	J1B9D9	7/8/10	0.00129	UD	0.00129	0.00129	UD	0.00129	0.339	U	0.339	0.339	U	0.339	0.339	U	0.339	0.339	U	0.339	3.8		2.4
14	OB-9	J1B9F0	7/8/10	0.00134	UD	0.00134	0.00134	UD	0.00134	0.335	U	0.335	0.335	U	0.335	0.335	U	0.335	0.335	U	0.335	2.5	U	2.5
15	OB-10	J1B9F1	7/8/10	0.00134	UD	0.00134	0.00134	UD	0.00134	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	0.332	U	0.332	2.4	U	2.4
16	OB-11	J1B9F2	7/8/10	0.00134	UD	0.00134	0.00134	UD	0.00134	0.335	U	0.335	0.193	J	0.335	0.335	U	0.335	0.335	U	0.335	2.5	U	2.5
17	OB-12	J1B9F3	7/8/10	0.00136	UD	0.00136	0.00201	JD	0.00201	0.339	U	0.339	0.339	U	0.339	0.339	U	0.339	0.339	U	0.339	2.3	U	2.3

18
19 **Statistical Computations**

20		BHC, beta	Dieldrin	Benzo(b)fluoranthene	Bis(2-ethylhexyl)phthalate	Fluoranthene	Pyrene	Chloride
21	% < Detection limit	92%	92%	92%	83%	83%	83%	75%
22	Maximum value	0.00137	0.00201	0.0559	0.282	0.0711	0.0957	10.5
23	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	0.00486 GW Protection	0.0033 GW & River Protection	0.015 GW & River Protection	0.36 River Protection	18.0 River Protection	48 GW Protection	25000 GW Protection
24	**3-PART TEST**							
25	Maximum > Cleanup Limit?	NO	NO	YES	NO	NO	NO	NO
26	> 10% above Cleanup Limit?	NO	NO	NO	NO	NO	NO	NO
27	Any sample > 2X Cleanup Limit?	NO	NO	YES	NO	NO	NO	NO
28	**3-Part Test Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 05/02/11
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

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Date 05/02/11
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1 **1607-H1 Maximum Calculations**
2 **Verification Data -Overburden**

3	Sample	Sample	Sample	Antimony			Mercury			Selenium		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	OB-3[a]	J1FXV8	3/23/11	0.380	U	0.380	0.0062	U	0.0062	1.2		0.870
6	Duplicate of J1FXV8[a]	J1FXW1	3/23/11	0.410	U	0.410	0.0060	U	0.0060	0.930	U	0.930
7	OB-1	J1B9D2	7/7/10	0.850	UJ	0.850	0.0103	B	0.0248	0.255	U	0.255
8	OB-2[a]	J1FXV7	3/23/11	0.420	B	0.380	0.00600	U	0.00600	0.890	B	0.850
9	OB-4	J1B9D5	7/7/10	0.799	UJ	0.799	0.0271	U	0.0271	0.240	U	0.240
10	OB-5	J1B9D6	7/7/10	0.752	UJ	0.752	0.0105	B	0.0233	0.226	U	0.226
11	OB-6	J1B9D7	7/7/10	0.659	UJ	0.659	0.0175	B	0.0269	0.198	U	0.198
12	OB-7[a]	J1FXV9	3/23/11	0.400	U	0.400	0.0058	U	0.0058	0.900	U	0.900
13	OB-8[a]	J1FXW0	3/23/11	0.450	U	0.450	0.00600	U	0.00600	1.0	U	1.0
14	OB-9	J1B9F0	7/8/10	0.746	U	0.746	0.0269	U	0.0269	0.224	U	0.224
15	OB-10	J1B9F1	7/8/10	0.812	U	0.812	0.0266	U	0.0266	0.244	U	0.244
16	OB-11	J1B9F2	7/8/10	0.686	U	0.686	0.0247	U	0.0247	0.206	U	0.206
17	OB-12	J1B9F3	7/8/10	0.951	U	0.951	0.0136	B	0.0231	0.285	U	0.285

18
19 **Statistical Computations**

20		Antimony		Mercury		Selenium	
21	% < Detection limit	92%		67%		83%	
22	Maximum value	0.420		0.0175		1.2	
23	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted**	5	GW & River Protection	0.33	GW & River Protection	1	River Protection
24	**3-PART TEST**						
25	Maximum > Cleanup Limit?	NA		NO		YES	
26	> 10% above Cleanup Limit?	NA		NO		NO	
27	Any sample > 2X Cleanup Limit?	NA		NO		NO	
28	**3-Part Test Compliance?**	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.		Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.		A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	

[a] **Result presented is from re-sample data. Original sample results are provided in Attachment 1.**

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 04/26/11
Job No. 14655

Calc. No. 0100H-CA-V0140
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Ecology Software (MTCAStat) Results, 1607-H1 Excavation

Arsenic 95% UCL Calculation

DATA	ID
9.89	J1B9C8/ J1B9D0
7.22	J1B9B8
5.47	J1B9B9
5.84	J1B9C0
8.16	J1B9C1
10.6	J1B9C2
5.91	J1B9C3
9.14	J1B9C4
3.56	J1B9C5
6.61	J1B9C6
15.3	J1B9C7
7.03	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	7.89
Censored		Lognormal mean	7.94
Detection limit or PQL		Std. devn.	3.07
Method detection limit		Median	7.13
TOTAL	12	Min.	3.56
		Max.	15.3

Lognormal distribution? r-squared is: 0.967
Normal distribution? r-squared is: 0.902
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 9.95

Barium 95% UCL Calculation

DATA	ID
81.8	J1B9C8/ J1B9D0
91.8	J1B9B8
71.7	J1B9B9
49.2	J1B9C0
73.1	J1B9C1
73.0	J1B9C2
65.3	J1B9C3
68.3	J1B9C4
63.3	J1B9C5
92.3	J1B9C6
65.6	J1B9C7
88.5	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	73.7
Censored		Lognormal mean	73.8
Detection limit or PQL		Std. devn.	12.9
Method detection limit		Median	72.4
TOTAL	12	Min.	49.2
		Max.	92.3

Lognormal distribution? r-squared is: 0.932
Normal distribution? r-squared is: 0.945
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 81.5

Beryllium 95% UCL Calculation

DATA	ID
0.247	J1B9C8/ J1B9D0
0.279	J1B9B8
0.282	J1B9B9
0.167	J1B9C0
0.265	J1B9C1
0.270	J1B9C2
0.240	J1B9C3
0.235	J1B9C4
0.230	J1B9C5
0.290	J1B9C6
0.220	J1B9C7
0.272	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	0.250
Censored		Lognormal mean	0.250
Detection limit or PQL		Std. devn.	0.0345
Method detection limit		Median	0.256
TOTAL	12	Min.	0.167
		Max.	0.290

Lognormal distribution? r-squared is: 0.839
Normal distribution? r-squared is: 0.894
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 0.226

Boron 95% UCL Calculation

DATA	ID
3.82	J1B9C8/ J1B9D0
3.65	J1B9B8
2.43	J1B9B9
1.06	J1B9C0
1.41	J1B9C1
2.48	J1B9C2
1.88	J1B9C3
1.19	J1B9C4
2.36	J1B9C5
3.30	J1B9C6
1.70	J1B9C7
4.42	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	2.48
Censored		Lognormal mean	2.51
Detection limit or PQL		Std. devn.	1.10
Method detection limit		Median	2.40
TOTAL	12	Min.	1.06
		Max.	4.42

Lognormal distribution? r-squared is: 0.971
Normal distribution? r-squared is: 0.956
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3.38

Cadmium 95% UCL Calculation

DATA	ID
0.120	J1B9C8/ J1B9D0
0.128	J1B9B8
0.134	J1B9B9
0.112	J1B9C0
0.128	J1B9C1
0.125	J1B9C2
0.115	J1B9C3
0.127	J1B9C4
0.114	J1B9C5
0.122	J1B9C6
0.0949	J1B9C7
0.134	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	0.121
Censored		Lognormal mean	0.121
Detection limit or PQL		Std. devn.	0.0110
Method detection limit		Median	0.124
TOTAL	12	Min.	0.0949
		Max.	0.134

Lognormal distribution? r-squared is: 0.869
Normal distribution? r-squared is: 0.902
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 0.127

Chromium 95% UCL Calculation

DATA	ID
12.4	J1B9C8/ J1B9D0
12.9	J1B9B8
13.2	J1B9B9
10.0	J1B9C0
12.9	J1B9C1
12.7	J1B9C2
11.7	J1B9C3
12.9	J1B9C4
13.7	J1B9C5
13.4	J1B9C6
11.5	J1B9C7
13.1	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	12.5
Censored		Lognormal mean	12.5
Detection limit or PQL		Std. devn.	1.02
Method detection limit		Median	12.9
TOTAL	12	Min.	10.0
		Max.	13.7

Lognormal distribution? r-squared is: 0.816
Normal distribution? r-squared is: 0.847
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 13.0

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
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Date 04/26/11
Job No. 14655

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Ecology Software (MTCAStat) Results, 1607-H1 Excavation

Cobalt 95% UCL Calculation

DATA	ID
6.41	J1B9C8/ J1B9D0
7.03	J1B9B8
7.29	J1B9B9
5.29	J1B9C0
7.54	J1B9C1
6.82	J1B9C2
6.50	J1B9C3
6.64	J1B9C4
6.67	J1B9C5
7.23	J1B9C6
5.94	J1B9C7
7.11	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	6.71
Censored		Lognormal mean	6.71
Detection limit or PQL		Std. devn.	0.627
Method detection limit		Median	6.75
TOTAL	12	Min.	5.29
		Max.	7.54

Lognormal distribution? r-squared is: 0.899
Normal distribution? r-squared is: 0.929
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 7.03

Copper 95% UCL Calculation

DATA	ID
14.5	J1B9C8/ J1B9D0
14.6	J1B9B8
14.5	J1B9B9
13.4	J1B9C0
15.8	J1B9C1
14.5	J1B9C2
13.9	J1B9C3
16.6	J1B9C4
15.6	J1B9C5
12.9	J1B9C6
13.4	J1B9C7
13.8	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	14.5
Censored		Lognormal mean	14.5
Detection limit or PQL		Std. devn.	1.09
Method detection limit		Median	14.5
TOTAL	12	Min.	12.9
		Max.	16.6

Lognormal distribution? r-squared is: 0.957
Normal distribution? r-squared is: 0.947
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 15.0

Hexavalent chromium 95% UCL Calculation

DATA	ID
0.10	J1B9C8/ J1B9D0
0.11	J1B9B8
0.14	J1B9B9
0.15	J1B9C0
0.09	J1B9C1
0.12	J1B9C2
0.10	J1B9C3
0.12	J1B9C4
0.10	J1B9C5
0.10	J1B9C6
0.10	J1B9C7
0.10	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	0.11
Censored		Lognormal mean	0.11
Detection limit or PQL		Std. devn.	0.02
Method detection limit		Median	0.10
TOTAL	12	Min.	0.09
		Max.	0.15

Lognormal distribution? r-squared is: 0.842
Normal distribution? r-squared is: 0.815
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 0.12

Lead 95% UCL Calculation

DATA	ID
24.2	J1B9C8/ J1B9D0
21.6	J1B9B8
12.4	J1B9B9
10.7	J1B9C0
18.8	J1B9C1
34.9	J1B9C2
19.2	J1B9C3
29.5	J1B9C4
5.98	J1B9C5
5.96	J1B9C6
31.7	J1B9C7
27.8	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	20.2
Censored		Lognormal mean	21.1
Detection limit or PQL		Std. devn.	9.86
Method detection limit		Median	20.4
TOTAL	12	Min.	5.96
		Max.	34.9

Lognormal distribution? r-squared is: 0.900
Normal distribution? r-squared is: 0.967
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 32.3

Manganese 95% UCL Calculation

DATA	ID
276	J1B9C8/ J1B9D0
312	J1B9B8
320	J1B9B9
221	J1B9C0
341	J1B9C1
306	J1B9C2
282	J1B9C3
307	J1B9C4
280	J1B9C5
340	J1B9C6
263	J1B9C7
315	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	297
Censored		Lognormal mean	297
Detection limit or PQL		Std. devn.	34.3
Method detection limit		Median	307
TOTAL	12	Min.	221
		Max.	341

Lognormal distribution? r-squared is: 0.901
Normal distribution? r-squared is: 0.933
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 317

Molybdenum 95% UCL Calculation

DATA	ID
0.292	J1B9C8/ J1B9D0
0.393	J1B9B8
0.447	J1B9B9
0.361	J1B9C0
0.415	J1B9C1
0.421	J1B9C2
0.386	J1B9C3
0.347	J1B9C4
0.277	J1B9C5
0.293	J1B9C6
0.245	J1B9C7
0.284	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	0.347
Censored		Lognormal mean	0.347
Detection limit or PQL		Std. devn.	0.0669
Method detection limit		Median	0.354
TOTAL	12	Min.	0.245
		Max.	0.447

Lognormal distribution? r-squared is: 0.945
Normal distribution? r-squared is: 0.950
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.388

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

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Ecology Software (MTCAStat) Results, 1607-H1 Excavation

Nickel 95% UCL Calculation

DATA	ID
11.6	J1B9C8/ J1B9D0
11.7	J1B9B8
12.0	J1B9B9
8.84	J1B9C0
11.5	J1B9C1
11.1	J1B9C2
11.8	J1B9C3
11.2	J1B9C4
12.4	J1B9C5
12.1	J1B9C6
11.1	J1B9C7
11.8	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	11.4
Censored		Lognormal mean	11.4
Detection limit or PQL		Std. devn.	0.91
Method detection limit		Median	11.7
TOTAL	12	Min.	8.84
		Max.	12.4

Lognormal distribution? r-squared is: 0.682
Normal distribution? r-squared is: 0.727
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 11.9

Vanadium 95% UCL Calculation

DATA	ID
45.4	J1B9C8/ J1B9D0
52.1	J1B9B8
53.6	J1B9B9
46.5	J1B9C0
52.3	J1B9C1
51.1	J1B9C2
47.8	J1B9C3
44.5	J1B9C4
48.1	J1B9C5
49.0	J1B9C6
43.0	J1B9C7
50.9	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	48.7
Censored		Lognormal mean	48.7
Detection limit or PQL		Std. devn.	3.39
Method detection limit		Median	48.6
TOTAL	12	Min.	43.0
		Max.	53.6

Lognormal distribution? r-squared is: 0.971
Normal distribution? r-squared is: 0.974
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 50.5

Zinc 95% UCL Calculation

DATA	ID
39.9	J1B9C8/ J1B9D0
41.1	J1B9B8
42.3	J1B9B9
46.8	J1B9C0
45.7	J1B9C1
41.0	J1B9C2
42.6	J1B9C3
42.1	J1B9C4
36.2	J1B9C5
41.6	J1B9C6
39.0	J1B9C7
43.6	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	41.8
Censored		Lognormal mean	41.8
Detection limit or PQL		Std. devn.	2.83
Method detection limit		Median	41.9
TOTAL	12	Min.	36.2
		Max.	46.8

Lognormal distribution? r-squared is: 0.959
Normal distribution? r-squared is: 0.964
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 43.4

Aroclor-1254 95% UCL Calculation

DATA	ID
8.50	J1B9C8/ J1B9D0
6.55	J1B9B8
6.65	J1B9B9
38.5	J1B9C0
23.8	J1B9C1
6.70	J1B9C2
20.1	J1B9C3
30.1	J1B9C4
6.65	J1B9C5
6.50	J1B9C6
6.55	J1B9C7
6.60	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	13.9
Censored		Lognormal mean	13.8
Detection limit or PQL		Std. devn.	11.3
Method detection limit		Median	6.68
TOTAL	12	Min.	6.50
		Max.	38.5

Lognormal distribution? r-squared is: 0.741
Normal distribution? r-squared is: 0.721
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 19.3

Fluoride 95% UCL Calculation

DATA	ID
1.6	J1B9C8/ J1B9D0
1.2	J1B9B8
7.2	J1B9B9
1.0	J1B9C0
1.6	J1B9C1
1.6	J1B9C2
0.8	J1B9C3
1.7	J1B9C4
1.0	J1B9C5
1.2	J1B9C6
1.6	J1B9C7
1.7	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	1.9
Censored		Lognormal mean	1.8
Detection limit or PQL		Std. devn.	1.7
Method detection limit		Median	1.6
TOTAL	12	Min.	0.8
		Max.	7.2

Lognormal distribution? r-squared is: 0.715
Normal distribution? r-squared is: 0.462
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 2.7

Nitrogen in nitrate and nitrite 95% UCL Calculation

DATA	ID
4.99	J1B9C8/ J1B9D0
1.42	J1B9B8
0.60	J1B9B9
3.69	J1B9C0
0.84	J1B9C1
0.82	J1B9C2
3.42	J1B9C3
0.99	J1B9C4
0.45	J1B9C5
0.95	J1B9C6
1.73	J1B9C7
1.16	J1B9C9

Number of samples		Uncensored values	
Uncensored	12	Mean	1.76
Censored		Lognormal mean	1.77
Detection limit or PQL		Std. devn.	1.46
Method detection limit		Median	1.08
TOTAL	12	Min.	0.45
		Max.	4.99

Lognormal distribution? r-squared is: 0.944
Normal distribution? r-squared is: 0.795
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3.12

CALCULATION SHEET

Washington Closure Hanford

Originator	J. D. Skoglie	**Date**	04/26/11	**Calc. No.**	0100H-CA-V0140
Project	100-H Field Remediation	**Job No.**	14655	**Checked**	T. E. Queen
Subject	1607-H1 Waste Site Cleanup Verification 95% UCL Calculations				

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1	DATA	ID	**Sulfate 95% UCL Calculation**			
2	32.5	J1B9C8/ J1B9D0				
3	4.7	J1B9B8				
4	4.6	J1B9B9	Number of samples		Uncensored values	
5	16.6	J1B9C0	Uncensored	12	Mean	12.3
6	5.7	J1B9C1	Censored		Lognormal mean	12.5
7	7.0	J1B9C2	Detection limit or PQL		Std. devn.	9.6
8	7.6	J1B9C3	Method detection limit		Median	7.3
9	27.1	J1B9C4	TOTAL	12	Min.	3.5
10	3.5	J1B9C5			Max.	32.5
11	6.6	J1B9C6				
12	18.3	J1B9C7				
13	13.4	J1B9C9				
14						
15						
16						
17			Lognormal distribution?		Normal distribution?	
18			r-squared is: 0.945		r-squared is: 0.841	
19			Recommendations:			
20			Use lognormal distribution.			
21						
22			UCL (Land's method) is		21.7	
23						

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
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Ecology Software (MTCAStat) Results, 1607-H1 Overburden

Arsenic 95% UCL Calculation

DATA	ID
3.45	J1FXV8/ J1FXW1
8.28	J1B9D2
4.30	J1FXV7
15.6	J1B9D5
9.06	J1B9D6
12.3	J1B9D7
3.40	J1FXV9
26.6	J1FXW0
8.80	J1B9F0
10.6	J1B9F1
9.83	J1B9F2
11.3	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	10.3
Censored		Lognormal mean	10.5
Detection limit or PQL		Std. devn.	6.31
Method detection limit		Median	9.45
TOTAL	12	Min.	3.40
		Max.	26.6

Lognormal distribution? r-squared is: 0.929
Normal distribution? r-squared is: 0.835
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 16.0

Barium 95% UCL Calculation

DATA	ID
62.7	J1FXV8/ J1FXW1
63.9	J1B9D2
68.6	J1FXV7
86.5	J1B9D5
61.8	J1B9D6
78.9	J1B9D7
93.6	J1FXV9
85.9	J1FXW0
68.4	J1B9F0
72.2	J1B9F1
60.9	J1B9F2
75.8	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	73.3
Censored		Lognormal mean	73.3
Detection limit or PQL		Std. devn.	10.9
Method detection limit		Median	70.4
TOTAL	12	Min.	60.9
		Max.	93.6

Lognormal distribution? r-squared is: 0.945
Normal distribution? r-squared is: 0.932
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 79.4

Beryllium 95% UCL Calculation

DATA	ID
0.0293	J1FXV8/ J1FXW1
0.215	J1B9D2
0.0165	J1FXV7
0.231	J1B9D5
0.218	J1B9D6
0.236	J1B9D7
0.0460	J1FXV9
0.0800	J1FXW0
0.267	J1B9F0
0.245	J1B9F1
0.219	J1B9F2
0.244	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.171
Censored		Lognormal mean	0.204
Detection limit or PQL		Std. devn.	0.0964
Method detection limit		Median	0.219
TOTAL	12	Min.	0.017
		Max.	0.267

Lognormal distribution? r-squared is: 0.748
Normal distribution? r-squared is: 0.795
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 0.216

Boron 95% UCL Calculation

DATA	ID
1.75	J1FXV8/ J1FXW1
2.79	J1B9D2
2.80	J1FXV7
7.26	J1B9D5
2.13	J1B9D6
3.33	J1B9D7
1.90	J1FXV9
3.00	J1FXW0
1.95	J1B9F0
1.93	J1B9F1
2.96	J1B9F2
3.85	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	2.97
Censored		Lognormal mean	2.96
Detection limit or PQL		Std. devn.	1.50
Method detection limit		Median	2.80
TOTAL	12	Min.	1.75
		Max.	7.26

Lognormal distribution? r-squared is: 0.868
Normal distribution? r-squared is: 0.701
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 3.68

Cadmium 95% UCL Calculation

DATA	ID
0.0630	J1FXV8/ J1FXW1
0.109	J1B9D2
0.0930	J1FXV7
0.102	J1B9D5
0.102	J1B9D6
0.106	J1B9D7
0.0840	J1FXV9
0.0240	J1FXW0
0.112	J1B9F0
0.119	J1B9F1
0.0989	J1B9F2
0.121	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.0945
Censored		Lognormal mean	0.0976
Detection limit or PQL		Std. devn.	0.0272
Method detection limit		Median	0.102
TOTAL	12	Min.	0.0240
		Max.	0.121

Lognormal distribution? r-squared is: 0.628
Normal distribution? r-squared is: 0.801
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 0.107

Chromium 95% UCL Calculation

DATA	ID
9.35	J1FXV8/ J1FXW1
11.7	J1B9D2
10.2	J1FXV7
10.6	J1B9D5
12.7	J1B9D6
11.9	J1B9D7
10.9	J1FXV9
11.9	J1FXW0
14.0	J1B9F0
11.9	J1B9F1
11.7	J1B9F2
11.1	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	11.5
Censored		Lognormal mean	11.5
Detection limit or PQL		Std. devn.	1.20
Method detection limit		Median	11.7
TOTAL	12	Min.	9.35
		Max.	14.0

Lognormal distribution? r-squared is: 0.954
Normal distribution? r-squared is: 0.949
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 12.2

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-H Field Remediation
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Cobalt 95% UCL Calculation

DATA	ID
5.95	J1FXV8/ J1FXW1
6.52	J1B9D2
5.70	J1FXV7
5.93	J1B9D5
6.30	J1B9D6
6.22	J1B9D7
6.20	J1FXV9
6.20	J1FXW0
6.35	J1B9F0
6.21	J1B9F1
5.63	J1B9F2
6.05	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	6.11
Censored		Lognormal mean	6.11
Detection limit or PQL		Std. devn.	0.263
Method detection limit		Median	6.20
TOTAL	12	Min.	5.63
		Max.	6.52

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

Normal distribution? r-squared is: 0.948

UCL (Land's method) is 6.25

Copper 95% UCL Calculation

DATA	ID
14.0	J1FXV8/ J1FXW1
16.1	J1B9D2
14.2	J1FXV7
12.4	J1B9D5
13.5	J1B9D6
14.0	J1B9D7
14.6	J1FXV9
12.5	J1FXW0
14.0	J1B9F0
13.9	J1B9F1
12.7	J1B9F2
13.6	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	13.8
Censored		Lognormal mean	13.8
Detection limit or PQL		Std. devn.	1.01
Method detection limit		Median	13.9
TOTAL	12	Min.	12.4
		Max.	16.1

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

Normal distribution? r-squared is: 0.901

UCL (Land's method) is 14.3

Hexavalent chromium 95% UCL Calculation

DATA	ID
0.14	J1B9D4/ J1B9F4
0.18	J1B9D2
0.11	J1B9D3
0.15	J1B9D5
0.17	J1B9D6
0.10	J1B9D7
0.16	J1B9D8
0.18	J1B9D9
0.10	J1B9F0
0.10	J1B9F1
0.10	J1B9F2
0.11	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.13
Censored		Lognormal mean	0.13
Detection limit or PQL		Std. devn.	0.034
Method detection limit		Median	0.12
TOTAL	12	Min.	0.10
		Max.	0.18

Lognormal distribution? r-squared is: 0.852
Recommendations:
Reject BOTH lognormal and normal distributions

Normal distribution? r-squared is: 0.853

UCL (based on Z-statistic) is 0.15

Lead 95% UCL Calculation

DATA	ID
15.1	J1FXV8/ J1FXW1
25.3	J1B9D2
9.70	J1FXV7
50.9	J1B9D5
29.1	J1B9D6
39.4	J1B9D7
8.50	J1FXV9
152	J1FXW0
29.9	J1B9F0
36.8	J1B9F1
33.2	J1B9F2
36.5	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	38.9
Censored		Lognormal mean	39.0
Detection limit or PQL		Std. devn.	37.8
Method detection limit		Median	31.6
TOTAL	12	Min.	8.50
		Max.	152

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

Normal distribution? r-squared is: 0.615

UCL (Land's method) is 69.7

Manganese 95% UCL Calculation

DATA	ID
279	J1FXV8/ J1FXW1
286	J1B9D2
283	J1FXV7
267	J1B9D5
284	J1B9D6
285	J1B9D7
311	J1FXV9
350	J1FXW0
287	J1B9F0
281	J1B9F1
250	J1B9F2
266	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	286
Censored		Lognormal mean	286
Detection limit or PQL		Std. devn.	25.0
Method detection limit		Median	284
TOTAL	12	Min.	250
		Max.	350

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

Normal distribution? r-squared is: 0.812

UCL (based on Z-statistic) is 298

Molybdenum 95% UCL Calculation

DATA	ID
0.22	J1FXV8/ J1FXW1
0.278	J1B9D2
0.37	J1FXV7
0.318	J1B9D5
0.281	J1B9D6
0.271	J1B9D7
0.27	J1FXV9
0.15	J1FXW0
0.324	J1B9F0
0.332	J1B9F1
0.284	J1B9F2
0.618	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	0.31
Censored		Lognormal mean	0.31
Detection limit or PQL		Std. devn.	0.112237
Method detection limit		Median	0.2825
TOTAL	12	Min.	0.15
		Max.	0.618

Lognormal distribution? r-squared is: 0.868
Recommendations:
Reject BOTH lognormal and normal distributions

Normal distribution? r-squared is: 0.764

UCL (based on Z-statistic) is 0.3630

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

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Nickel 95% UCL Calculation

DATA	ID
9.80	J1FXV8/ J1FXW1
10.8	J1B9D2
11.1	J1FXV7
9.63	J1B9D5
11.9	J1B9D6
11.0	J1B9D7
10.5	J1FXV9
10.8	J1FXW0
11.5	J1B9F0
11.6	J1B9F1
10.7	J1B9F2
9.83	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	10.8
Censored		Lognormal mean	10.8
Detection limit or PQL		Std. devn.	0.730
Method detection limit		Median	10.8
TOTAL	12	Min.	9.63
		Max.	11.9

Lognormal distribution? r-squared is: 0.954
Normal distribution? r-squared is: 0.960
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.2

Vanadium 95% UCL Calculation

DATA	ID
41.0	J1FXV8/ J1FXW1
48.1	J1B9D2
43.1	J1FXV7
46.2	J1B9D5
47.2	J1B9D6
47.9	J1B9D7
43.6	J1FXV9
40.8	J1FXW0
47.9	J1B9F0
47.6	J1B9F1
42.6	J1B9F2
44.0	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	45.0
Censored		Lognormal mean	45.0
Detection limit or PQL		Std. devn.	2.79
Method detection limit		Median	45.1
TOTAL	12	Min.	40.8
		Max.	48.1

Lognormal distribution? r-squared is: 0.900
Normal distribution? r-squared is: 0.901
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 46.5

Zinc 95% UCL Calculation

DATA	ID
36.9	J1FXV8/ J1FXW1
37.5	J1B9D2
37.2	J1FXV7
38.2	J1B9D5
37.8	J1B9D6
39.0	J1B9D7
39.5	J1FXV9
40.6	J1FXW0
39.2	J1B9F0
40.1	J1B9F1
34.2	J1B9F2
38.6	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	38.2
Censored		Lognormal mean	38.2
Detection limit or PQL		Std. devn.	1.71
Method detection limit		Median	38.4
TOTAL	12	Min.	34.2
		Max.	40.6

Lognormal distribution? r-squared is: 0.915
Normal distribution? r-squared is: 0.931
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 39.2

Fluoride 95% UCL Calculation

DATA	ID
1.7	J1B9D4/ J1B9F4
0.8	J1B9D2
1.1	J1B9D3
1.4	J1B9D5
1.4	J1B9D6
1.0	J1B9D7
1.4	J1B9D8
1.4	J1B9D9
1.3	J1B9F0
1.1	J1B9F1
1.4	J1B9F2
1.2	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	1.3
Censored		Lognormal mean	1.3
Detection limit or PQL		Std. devn.	0.2
Method detection limit		Median	1.4
TOTAL	12	Min.	0.8
		Max.	1.7

Lognormal distribution? r-squared is: 0.891
Normal distribution? r-squared is: 0.920
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 1.4

Nitrogen in nitrate and nitrite 95% UCL Calculation

DATA	ID
25.7	J1B9D4/ J1B9F4
2.42	J1B9D2
28.7	J1B9D3
7.11	J1B9D5
1.56	J1B9D6
4.75	J1B9D7
2.27	J1B9D8
1.09	J1B9D9
1.02	J1B9F0
0.99	J1B9F1
2.95	J1B9F2
5.36	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	6.99
Censored		Lognormal mean	6.87
Detection limit or PQL		Std. devn.	9.65
Method detection limit		Median	2.69
TOTAL	12	Min.	0.99
		Max.	28.7

Lognormal distribution? r-squared is: 0.913
Normal distribution? r-squared is: 0.640
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 21.0

Sulfate 95% UCL Calculation

DATA	ID
135	J1B9D4/ J1B9F4
4.70	J1B9D2
160	J1B9D3
17.1	J1B9D5
3.80	J1B9D6
17.6	J1B9D7
9.50	J1B9D8
7.00	J1B9D9
3.60	J1B9F0
3.60	J1B9F1
5.50	J1B9F2
7.50	J1B9F3

Number of samples		Uncensored values	
Uncensored	12	Mean	31.2
Censored		Lognormal mean	26.7
Detection limit or PQL		Std. devn.	54.7
Method detection limit		Median	7.25
TOTAL	12	Min.	3.60
		Max.	160

Lognormal distribution? r-squared is: 0.807
Normal distribution? r-squared is: 0.544
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 57.2

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-H Field Remediation
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/27/10
Job No. 14655

Calc. No. 0100H-CA-V0140
Checked T. E. Queen

Rev. No. 0
Date 09/27/10
Sheet No. 24 of 25

Duplicate Analysis - 1607-H1 Waste Site Excavation

Sampling Area	Sample Number	Sample Date	Carbon-14			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranium-238			Aluminum		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	1.12		0.784	12.8		0.245	0.535		0.049	0.754		0.099	0.806		0.034	0.754		0.099	0.773		0.237	0.588		0.237	8370		17.0
Duplicate of J1B9C8	J1B9D0	7/12/10	1.27		0.738	15.9		0.285	0.652		0.048	0.950		0.125	0.945		0.033	0.950		0.125	0.563		0.205	0.456		0.205	8010		20.1

Analysis:

	TDL	1	0.5	0.1	0.2	1	1	1	1	5
Duplicate Analysis	Both > PQL?	Yes (continue)		Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		21.6%	19.7%						4.4%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 1607-H1 Waste Site Excavation

Sampling Area	HEIS Number	Sample Date	Arsenic			Barium			Beryllium			Boron			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
EXC-11	J1B9C8	7/12/10	9.67		0.851	81.3		0.425	0.249		0.170	3.79		1.70	0.114	B	0.213	5720		17.0	12.7		0.851	6.58		2.55	14.7		1.70
Duplicate of J1B9C8	J1B9D0	7/12/10	10.1		1.00	82.2		0.502	0.244		0.201	3.85		2.01	0.125	B	0.251	5360		20.1	12.0		1.00	6.24		3.01	14.3		2.01

Analysis:

	TDL	10	2	0.2	2	0.2	100	1	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	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		1.1%				6.5%	5.7%		2.8%
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - 1607-H1 Waste Site Excavation

Sampling Area	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	18100		17.0	24.0		0.851	4320		4.25	287		0.851	0.0162	B	0.0258	0.260	B	0.851	12.0		2.13	1420		85.1	467		5.11
Duplicate of J1B9C8	J1B9D0	7/12/10	17300		20.1	24.4		1.00	3900		5.02	265		1.00	0.00949	B	0.0244	0.323	B	1.00	11.2		2.51	1420		100	489		6.02

Analysis:

	TDL	5	5	75	5	0.2	2	4	400	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)			No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	4.5%		10.2%	8.0%					4.6%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 1607-H1 Waste Site Excavation

Sampling Area	HEIS Number	Sample Date	Sodium			Vanadium			Zinc			Aroclor-1254			Fluoride			Nitrogen in nitrate and nitrite			Phosphate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	240		42.5	46.1		0.851	40.5		2.55	0.00701	J	0.0132	1.9	B	2.2	5.22		0.18	7.4		2.2	36.9		2.2
Duplicate of J1B9C8	J1B9D0	7/12/10	224		50.2	44.7		1.00	39.3		3.01	0.00998	J	0.0131	1.3	B	2.2	4.76		0.18	5.3		2.2	28.1		2.2

Analysis:

	TDL	50	2.5	1	0.02	5	0.75	5	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)			Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		3.1%	3.0%			9.2%		27.1%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	Not applicable

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie **Date** 09/23/10 **Calc. No.** 0100H-CA-V0140 **Rev. No.** 0
Project 100-H Field Remediation **Job No.** 14655 **Checked** T. E. Queen **Date** 09/23/10
Subject 1607-H1 Waste Site Cleanup Verification 95% UCL Calculations **Sheet No.** 25 of 25

Duplicate Analysis - 1607-H1 Waste Site Overburden

Sampling Area	Sample Number	Sample Date	Carbon-14			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranium-238			Aluminum		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
OB-3	J1B9D4	7/7/10	1.25	J	0.728	14.2		0.244	0.62		0.055	0.977		0.124	0.826		0.032	0.977		0.124	0.685		0.187	0.709		0.187	9010		12.6
Duplicate of J1B9D4	J1B9F4	7/7/10	0.914	J	0.765	14.8		0.213	0.629		0.039	1.02		0.095	0.930		0.035	1.02		0.095	0.795		0.174	0.613		0.174	9050		15.0

Analysis:

	TDL	1	0.5	0.1	0.2	1	1	1	1	5
Duplicate Analysis	Both > PQL?	Yes (continue)		Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		4.1%	1.4%						0.4%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 1607-H1 Waste Site Overburden

Sampling Area	HEIS Number	Sample Date	Arsenic			Barium			Beryllium			Boron			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
OB-3	J1B9D4	7/7/10	31.6		0.630	97.5		0.315	0.288		0.126	5.11		1.26	0.0967	B	0.158	5360		12.6	12.9		0.630	6.58		1.89	14.2		1.26
Duplicate of J1B9D4	J1B9F4	7/7/10	31.6		0.752	97.9		0.376	0.288		0.150	4.84		1.50	0.104	B	0.188	5400		15.0	12.6		0.752	6.70		2.26	14.9		1.50

Analysis:

	TDL	10	2	0.2	2	0.2	100	1	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	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		0.4%				0.7%	2.4%		4.8%
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Sampling Area	HEIS Number	Sample Date	Hexavalent chromium			Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
OB-3	J1B9D4	7/7/10	0.12	B	0.20	18700		12.6	102		0.630	4470		3.15	306		0.630	0.0133	B	0.0252	0.307	B	0.630	11.3		1.58	1600		63.0
Duplicate of J1B9D4	J1B9F4	7/7/10	0.15	B	0.20	19400		15.0	101		0.752	4520		3.76	313		0.752	0.0163	B	0.0275	0.310	B	0.752	12.5		1.88	1560		75.2

Analysis:

	TDL	0.5	5	5	75	5	0.2	2	4	400
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?		Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)			No-Stop (acceptable)	No-Stop (acceptable)
	RPD		3.7%	1.0%	1.1%	2.3%				
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

Duplicate Analysis - 1607-H1 Waste Site Overburden

Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc			Chloride			Fluoride			Nitrogen in nitrate and nitrite			Phosphate			Sulfate		
			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
OB-3	J1B9D4	7/7/10	391	J	3.78	244		31.5	46.0		0.630	45.7		1.89	7.2		2.5	7.2		2.5	26.7	D	0.99	6.4	J	2.5	131	D	12.4
Duplicate of J1B9D4	J1B9F4	7/7/10	467	J	4.51	246		37.6	46.8		0.752	45.8		2.26	8.7		2.3	8.7		2.3	24.7	D	0.94	6.6	J	2.3	138	D	11.7

Analysis:

	TDL	2	50	2.5	1	2	5	0.75	5	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	17.7%		1.7%	0.2%			7.8%		5.2%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	Not applicable

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Radionuclides).

Sample Location	HEIS Number	Sample Date	Americium-241 GEA			Barium-133			Carbon-14			Cesium-137			Cobalt-60		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-11	J1B9C8	7/12/10	0.038	U	0.038	0.026	U	0.026	1.12		0.784	0.038	U	0.038	0.024	U	0.024
Duplicate of J1B9C8	J1B9D0	7/12/10	0.039	U	0.039	0.028	U	0.028	1.27		0.738	0.027	U	0.027	0.025	U	0.025
EXC-1	J1B9B8	7/8/10	0.045	U	0.045	0.031	U	0.031	1.49		0.661	0.028	U	0.028	0.029	U	0.029
EXC-2	J1B9B9	7/8/10	0.032	U	0.032	0.022	U	0.022	0.924		0.636	0.019	U	0.019	0.020	U	0.020
EXC-3	J1B9C0	7/8/10	0.373	U	0.373	0.048	U	0.048	1.18		0.655	0.044	U	0.044	0.047	U	0.047
EXC-4	J1B9C1	7/8/10	0.034	U	0.034	0.021	U	0.021	1.56		0.665	0.019	U	0.019	0.023	U	0.023
EXC-5	J1B9C2	7/8/10	0.122	U	0.122	0.026	U	0.026	2.24		0.672	0.046	U	0.046	0.017	U	0.017
EXC-6	J1B9C3	7/8/10	0.344	U	0.344	0.043	U	0.043	1.52		0.695	0.061	U	0.061	0.047	U	0.047
EXC-7	J1B9C4	7/9/10	0.178	U	0.178	0.040	U	0.040	1.18		0.684	0.026	U	0.026	0.024	U	0.024
EXC-8	J1B9C5	7/12/10	0.091	U	0.091	0.022	U	0.022	1.40		0.765	0.026	U	0.026	0.026	U	0.026
EXC-9	J1B9C6	7/12/10	0.041	U	0.041	0.024	U	0.024	1.33		0.770	0.022	U	0.022	0.025	U	0.025
EXC-10	J1B9C7	7/12/10	0.093	U	0.093	0.022	U	0.022	1.15		0.754	0.024	U	0.024	0.024	U	0.024
EXC-12	J1B9C9	7/12/10	0.044	U	0.044	0.032	U	0.032	1.06		0.732	0.077		0.036	0.028	U	0.028
OB-3	J1B9D4	7/7/10	0.114	U	0.114	0.028	U	0.028	1.25	J	0.728	0.030	U	0.030	0.050	U	0.050
Duplicate of J1B9D4	J1B9F4	7/7/10	0.109	U	0.109	0.026	U	0.026	0.914	J	0.765	0.031	U	0.031	0.020	U	0.020
OB-1	J1B9D2	7/7/10	0.047	U	0.047	0.030	U	0.030	1.25	J	0.695	0.031	U	0.031	0.028	U	0.028
OB-2	J1B9D3	7/7/10	0.117	U	0.117	0.031	U	0.031	1.25	J	0.704	0.026	U	0.026	0.023	U	0.023
OB-4	J1B9D5	7/7/10	0.050	U	0.050	0.033	U	0.033	1.29	J	0.712	0.029	U	0.029	0.033	U	0.033
OB-5	J1B9D6	7/7/10	0.170	U	0.170	0.027	U	0.027	0.222	UJ	0.772	0.024	U	0.024	0.023	U	0.023
OB-6	J1B9D7	7/7/10	0.042	U	0.042	0.025	U	0.025	0.93	J	0.734	0.027	U	0.027	0.028	U	0.028
OB-7	J1B9D8	7/8/10	0.103	U	0.103	0.027	U	0.027	1.74		0.693	0.018	U	0.018	0.021	U	0.021
OB-8	J1B9D9	7/8/10	0.112	U	0.112	0.026	U	0.026	1.93		0.688	0.028	U	0.028	0.029	U	0.029
OB-9	J1B9F0	7/8/10	0.043	U	0.043	0.026	U	0.026	1.77		0.639	0.028	U	0.028	0.031	U	0.031
OB-10	J1B9F1	7/8/10	0.040	U	0.040	0.027	U	0.027	1.47		0.631	0.033	U	0.033	0.027	U	0.027
OB-11	J1B9F2	7/8/10	0.359	U	0.359	0.047	U	0.047	1.39		0.632	0.069	U	0.069	0.041	U	0.041
OB-12	J1B9F3	7/8/10	0.110	U	0.110	0.027	U	0.027	1.34		0.672	0.031	U	0.031	0.027	U	0.027
FS-1[a]	J1B9D1	7/12/10	0.203	U	0.203	0.032	U	0.032	1.25		0.755	0.212		0.034	0.027	U	0.027
FS-1	J1FXW2	3/23/11	-0.0567	U	0.128	-0.00469	U	0.0354	0.362	U	0.449	-0.00727	U	0.0272	0.0048	U	0.0307

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

[a] Resampled due to exceedance of cleanup criteria.

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

B = blank contamination (inorganic constituents)

HEIS = Hanford Environmental Information System

J = estimate

L = dilution indicating physical and chemical interference are present

M = Sample duplicate precision not met

PQL = practical quantitation limit

Q = qualifier

R = rejected

U = undetected

Attachment	1	Sheet No.	1 of 27
Originator	J. D. Skoglie	Date	5/2/11
Checked	T. E. Queen	Date	5/2/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Radionuclides).

Sample Location	HEIS Number	Sample Date	Europium-152			Europium-154			Europium-155			Nickel-63			Plutonium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-11	J1B9C8	7/12/10	0.059	U	0.059	0.081	U	0.081	0.067	U	0.067	0.238	U	3.16	0.063	U	0.241
Duplicate of J1B9C8	J1B9D0	7/12/10	0.069	U	0.069	0.095	U	0.095	0.068	U	0.068	-0.372	U	3.30	-0.099	U	0.365
EXC-1	J1B9B8	7/8/10	0.072	U	0.072	0.097	U	0.097	0.082	U	0.082	1.23	U	3.15	-0.032	U	0.308
EXC-2	J1B9B9	7/8/10	0.050	U	0.050	0.069	U	0.069	0.062	U	0.062	0.464	U	2.88	0	U	0.306
EXC-3	J1B9C0	7/8/10	0.114	U	0.114	0.153	U	0.153	0.124	U	0.124	1.34	U	2.93	0.337		0.319
EXC-4	J1B9C1	7/8/10	0.052	U	0.052	0.079	U	0.079	0.081	U	0.081	-0.123	U	3.05	0.031	U	0.342
EXC-5	J1B9C2	7/8/10	0.044	U	0.044	0.052	U	0.052	0.080	U	0.080	0.310	U	2.89	-0.078	U	0.430
EXC-6	J1B9C3	7/8/10	0.100	U	0.100	0.125	U	0.125	0.113	U	0.113	0.782	U	3.07	0.031	U	0.299
EXC-7	J1B9C4	7/9/10	0.067	U	0.067	0.079	U	0.079	0.090	U	0.090	1.45	U	2.77	0.033	U	0.250
EXC-8	J1B9C5	7/12/10	0.066	U	0.066	0.090	U	0.090	0.066	U	0.066	1.05	U	3.21	0.038	U	0.291
EXC-9	J1B9C6	7/12/10	0.051	U	0.051	0.078	U	0.078	0.072	U	0.072	-0.83	U	3.15	0.040	U	0.378
EXC-10	J1B9C7	7/12/10	0.061	U	0.061	0.085	U	0.085	0.068	U	0.068	0.560	U	3.19	-0.058	U	0.278
EXC-12	J1B9C9	7/12/10	0.074	U	0.074	0.093	U	0.093	0.079	U	0.079	-0.085	U	3.40	0.025	U	0.276
OB-3	J1B9D4	7/7/10	0.075	U	0.075	0.097	U	0.097	0.081	U	0.081	-0.189	U	2.57	-0.036	U	0.277
Duplicate of J1B9D4	J1B9F4	7/7/10	0.068	U	0.068	0.075	U	0.075	0.084	U	0.084	-0.552	U	2.68	-0.037	U	0.406
OB-1	J1B9D2	7/7/10	0.061	U	0.061	0.097	U	0.097	0.101	U	0.101	-1.2	U	2.63	-0.029	U	0.225
OB-2	J1B9D3	7/7/10	0.073	U	0.073	0.077	U	0.077	0.092	U	0.092	0	U	2.47	0	U	0.398
OB-4	J1B9D5	7/7/10	0.083	U	0.083	0.118	U	0.118	0.088	U	0.088	-1.43	U	2.70	0	U	0.339
OB-5	J1B9D6	7/7/10	0.062	U	0.062	0.075	U	0.075	0.095	U	0.095	-0.078	U	2.66	-0.045	U	0.343
OB-6	J1B9D7	7/7/10	0.054	U	0.054	0.082	U	0.082	0.074	U	0.074	-0.528	U	2.76	-0.034	U	0.375
OB-7	J1B9D8	7/8/10	0.062	U	0.062	0.071	U	0.071	0.096	U	0.096	1.90	U	3.07	-0.054	U	0.260
OB-8	J1B9D9	7/8/10	0.071	U	0.071	0.096	U	0.096	0.085	U	0.085	2.11	U	3.02	0.030	U	0.229
OB-9	J1B9F0	7/8/10	0.067	U	0.067	0.103	U	0.103	0.060	U	0.060	0.464	U	2.88	-0.023	U	0.177
OB-10	J1B9F1	7/8/10	0.064	U	0.064	0.086	U	0.086	0.070	U	0.070	1.42	U	3.02	0	U	0.351
OB-11	J1B9F2	7/8/10	0.108	U	0.108	0.124	U	0.124	0.118	U	0.118	0.889	U	3.01	0	U	0.305
OB-12	J1B9F3	7/8/10	0.071	U	0.071	0.100	U	0.100	0.132	U	0.132	-0.425	U	2.88	0	U	0.213
FS-1*	J1B9D1	7/12/10	0.074	U	0.074	0.088	U	0.088	0.153	U	0.153	-0.395	U	3.16	-0.030	U	0.335
FS-1	J1FXW2	3/23/11	0.00302	U	0.0781	0.0362	U	0.0952	-0.00876	U	0.0918	1.35	U	14.2	0	U	0.117

Attachment	1	Sheet No.	2 of 27
Originator	J. D. Skoglie	Date	5/2/11
Checked	T. E. Queen	Date	5/2/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Radionuclides).

Sample Location	HEIS Number	Sample Date	Plutonium-239/240			Potassium-40			Radium-226			Radium-228			Silver-108 metastable		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-11	J1B9C8	7/12/10	0.031	U	0.241	12.8		0.245	0.535		0.049	0.754		0.099	0.016	U	0.016
Duplicate of J1B9C8	J1B9D0	7/12/10	-0.033	U	0.253	15.9		0.285	0.652		0.048	0.950		0.125	0.018	U	0.018
EXC-1	J1B9B8	7/8/10	0.032	U	0.246	13.3		0.235	0.670		0.058	0.864		0.141	0.020	U	0.020
EXC-2	J1B9B9	7/8/10	0.032	U	0.244	13.7		0.183	0.592		0.040	0.713		0.106	0.014	U	0.014
EXC-3	J1B9C0	7/8/10	0.026	U	0.198	13.7		0.588	0.509		0.083	0.739		0.153	0.030	U	0.030
EXC-4	J1B9C1	7/8/10	0	U	0.237	15.0		0.225	0.735		0.048	0.890		0.103	0.016	U	0.016
EXC-5	J1B9C2	7/8/10	-0.039	U	0.298	13.9		0.160	0.557		0.032	0.762		0.073	0.012	U	0.012
EXC-6	J1B9C3	7/8/10	0.094	U	0.239	13.9		0.279	0.552		0.076	0.807		0.171	0.026	U	0.026
EXC-7	J1B9C4	7/9/10	0	U	0.250	16.0		0.206	0.577		0.049	0.831		0.113	0.018	U	0.018
EXC-8	J1B9C5	7/12/10	0	U	0.291	13.4		0.263	0.475		0.044	0.716		0.092	0.017	U	0.017
EXC-9	J1B9C6	7/12/10	0	U	0.302	14.6		0.250	0.676		0.046	1.04		0.110	0.016	U	0.016
EXC-10	J1B9C7	7/12/10	0	U	0.222	13.8		0.240	0.561		0.044	0.839		0.092	0.017	U	0.017
EXC-12	J1B9C9	7/12/10	0.050	U	0.191	13.4		0.290	0.651		0.055	0.978		0.119	0.019	U	0.019
OB-3	J1B9D4	7/7/10	0.108	U	0.277	14.2		0.244	0.620		0.055	0.977		0.124	0.020	U	0.020
Duplicate of J1B9D4	J1B9F4	7/7/10	0.110	U	0.281	14.8		0.213	0.629		0.039	1.02		0.095	0.017	U	0.017
OB-1	J1B9D2	7/7/10	0.147	U	0.225	14.6		0.310	0.648		0.050	0.830		0.107	0.018	U	0.018
OB-2	J1B9D3	7/7/10	0.042	U	0.318	15.0		0.240	0.688		0.051	0.984		0.119	0.021	U	0.021
OB-4	J1B9D5	7/7/10	0.035	U	0.270	14.7		0.380	0.580		0.072	0.830		0.156	0.023	U	0.023
OB-5	J1B9D6	7/7/10	0.090	U	0.343	13.8		0.217	0.564		0.043	0.805		0.094	0.017	U	0.017
OB-6	J1B9D7	7/7/10	0.238	U	0.260	14.9		0.299	0.566		0.048	0.906		0.111	0.016	U	0.016
OB-7	J1B9D8	7/8/10	0	U	0.208	14.8		0.203	0.617		0.042	0.975		0.096	0.017	U	0.017
OB-8	J1B9D9	7/8/10	0.030	U	0.229	14.1		0.299	0.612		0.048	0.918		0.132	0.019	U	0.019
OB-9	J1B9F0	7/8/10	0.023	U	0.177	14.6		0.354	0.640		0.052	0.912		0.122	0.020	U	0.020
OB-10	J1B9F1	7/8/10	0	U	0.243	13.0		0.226	0.461		0.049	0.759		0.105	0.018	U	0.018
OB-11	J1B9F2	7/8/10	-0.032	U	0.244	14.3		0.306	0.669		0.078	0.836		0.182	0.029	U	0.029
OB-12	J1B9F3	7/8/10	-0.028	U	0.213	13.9		0.222	0.550		0.053	0.847		0.139	0.019	U	0.019
FS-1	J1B9D1	7/12/10	0	U	0.232	15.1		0.309	0.752		0.056	1.04		0.119	0.021	U	0.021
FS-1	J1FXW2	3/23/11	0	U	0.117										0.00441	U	0.0233

Attachment	1	Sheet No.	3 of 27
Originator	J. D. Skoglie	Date	5/2/11
Checked	T. E. Queen	Date	5/2/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Radionuclides).

Sample Location	HEIS Number	Sample Date	Thorium-228 GEA			Thorium-232 GEA			Total beta radiostrontium			Tritium			Uranium-233/234		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-11	J1B9C8	7/12/10	0.806		0.034	0.754		0.099	-0.026	U	0.239	0.647	U	1.48	0.773		0.237
Duplicate of J1B9C8	J1B9D0	7/12/10	0.945		0.033	0.950		0.125	-0.025	U	0.247	0.302	U	1.41	0.563		0.205
EXC-1	J1B9B8	7/8/10	0.893		0.035	0.864		0.141	0.138	U	0.291	-0.334	U	3.48	0.375		0.119
EXC-2	J1B9B9	7/8/10	0.903		0.029	0.713		0.106	0.053	U	0.298	0.286	U	3.58	0.643		0.129
EXC-3	J1B9C0	7/8/10	0.619		0.056	0.739		0.153	-0.126	U	0.314	1.73	U	3.28	0.518		0.137
EXC-4	J1B9C1	7/8/10	0.853		0.029	0.890		0.103	-0.023	U	0.384	0.567	U	3.55	0.562		0.179
EXC-5	J1B9C2	7/8/10	0.782		0.025	0.762		0.073	-0.065	U	0.320	7.38		2.94	0.353		0.142
EXC-6	J1B9C3	7/8/10	0.714		0.052	0.807		0.171	0.036	U	0.328	1.97	U	3.17	0.418		0.152
EXC-7	J1B9C4	7/9/10	0.814		0.034	0.831		0.113	0.043	U	0.314	-2.27	U	3.29	0.654		0.156
EXC-8	J1B9C5	7/12/10	0.584		0.027	0.716		0.092	-0.040	U	0.216	0.659	U	1.44	0.681		0.174
EXC-9	J1B9C6	7/12/10	0.909		0.029	1.04		0.110	0.034	U	0.246	0.322	U	1.50	0.789		0.252
EXC-10	J1B9C7	7/12/10	0.713		0.027	0.839		0.092	0.091	U	0.309	1.57		1.46	0.757		0.232
EXC-12	J1B9C9	7/12/10	1.11		0.058	0.978		0.119	-0.063	U	0.225	0.442	U	1.37	0.557		0.213
OB-3	J1B9D4	7/7/10	0.826		0.032	0.977		0.124	-0.046	U	0.309	0.461	UJ	3.61	0.685		0.187
Duplicate of J1B9D4	J1B9F4	7/7/10	0.930		0.035	1.02		0.095	0.014	U	0.296	-0.828	UJ	3.46	0.795		0.174
OB-1	J1B9D2	7/7/10	0.763		0.033	0.830		0.107	0.078	U	0.292	-0.205	UJ	3.22	0.745		0.173
OB-2	J1B9D3	7/7/10	0.977		0.038	0.984		0.119	0.053	U	0.243	-1.46	UJ	3.4	0.823		0.150
OB-4	J1B9D5	7/7/10	1.04		0.068	0.830		0.156	-0.064	U	0.328	-0.911	UJ	3.36	0.697		0.137
OB-5	J1B9D6	7/7/10	0.787		0.036	0.805		0.094	-0.100	U	0.306	1.05	UJ	3.13	0.370		0.167
OB-6	J1B9D7	7/7/10	0.762		0.031	0.906		0.111	0.042	U	0.313	-0.148	UJ	3.09	0.607		0.145
OB-7	J1B9D8	7/8/10	1.11		0.051	0.975		0.096	0.036	U	0.330	0.754	U	3.15	0.469		0.128
OB-8	J1B9D9	7/8/10	0.720		0.032	0.918		0.132	-0.031	U	0.307	2.48	U	3.17	0.783		0.130
OB-9	J1B9F0	7/8/10	0.880		0.038	0.912		0.122	-0.045	U	0.209	0.880	U	3.06	0.612		0.180
OB-10	J1B9F1	7/8/10	0.761		0.036	0.759		0.105	0.106	U	0.226	1.50	U	2.94	0.597		0.158
OB-11	J1B9F2	7/8/10	0.800		0.051	0.836		0.182	-0.035	U	0.206	1.18	U	2.96	0.835		0.355
OB-12	J1B9F3	7/8/10	0.735		0.032	0.847		0.139	-0.032	U	0.204	0.711	U	3.18	0.304		0.198
FS-1[a]	J1B9D1	7/12/10	0.983		0.038	1.04		0.119	0.047	U	0.230	0.912	U	1.48	0.576		0.130
FS-1	J1FXW2	3/23/11							0.0622	U	0.188	0.0156	U	0.0201	0.265		0.152

Attachment	1	Sheet No.	4 of 27
Originator	J. D. Skoglie	Date	5/2/11
Checked	T. E. Queen	Date	5/2/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Radionuclides).

Sample Location	HEIS Number	Sample Date	Uranium-235			Uranium-235 GEA			Uranium-238			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-11	J1B9C8	7/12/10	0.112	U	0.286	0.152	U	0.152	0.588		0.237	2.89	U	2.89
Duplicate of J1B9C8	J1B9D0	7/12/10	0.162	U	0.248	0.137	U	0.137	0.456		0.205	3.10	U	3.10
EXC-1	J1B9B8	7/8/10	0.057	U	0.145	0.185	U	0.185	0.453		0.119	3.35	U	3.35
EXC-2	J1B9B9	7/8/10	0.061	U	0.157	0.124	U	0.124	0.558		0.129	2.34	U	2.34
EXC-3	J1B9C0	7/8/10	0.022	U	0.165	0.254	U	0.254	0.500		0.137	5.64	U	5.64
EXC-4	J1B9C1	7/8/10	0.028	U	0.217	0.114	U	0.114	0.679		0.179	2.73	U	2.73
EXC-5	J1B9C2	7/8/10	0.045	U	0.172	0.125	U	0.125	0.316		0.142	1.89	U	1.89
EXC-6	J1B9C3	7/8/10	0.024	U	0.184	0.232	U	0.232	0.596		0.152	4.48	U	4.48
EXC-7	J1B9C4	7/9/10	0.049	U	0.189	0.180	U	0.180	0.511		0.156	3.06	U	3.06
EXC-8	J1B9C5	7/12/10	0.082	U	0.210	0.142	U	0.142	0.590		0.174	3.19	U	3.19
EXC-9	J1B9C6	7/12/10	0	U	0.304	0.134	U	0.134	0.460		0.252	2.87	U	2.87
EXC-10	J1B9C7	7/12/10	0.037	U	0.280	0.141	U	0.141	0.696		0.232	3.30	U	3.30
EXC-12	J1B9C9	7/12/10	0.034	U	0.258	0.182	U	0.182	0.584		0.213	3.48	U	3.48
OB-3	J1B9D4	7/7/10	0.059	U	0.226	0.175	U	0.175	0.709		0.187	3.45	U	3.45
Duplicate of J1B9D4	J1B9F4	7/7/10	0.028	U	0.210	0.167	U	0.167	0.613		0.174	2.56	U	2.56
OB-1	J1B9D2	7/7/10	0.055	U	0.209	0.152	U	0.152	0.632		0.173	3.26	U	3.26
OB-2	J1B9D3	7/7/10	0.095	U	0.182	0.187	U	0.187	0.607		0.150	3.18	U	3.18
OB-4	J1B9D5	7/7/10	0.043	U	0.166	0.201	U	0.201	1.02		0.137	3.78	U	3.78
OB-5	J1B9D6	7/7/10	0	U	0.202	0.178	U	0.178	0.545		0.167	2.49	U	2.49
OB-6	J1B9D7	7/7/10	0.023	U	0.176	0.140	U	0.140	0.702		0.145	3.07	U	3.07
OB-7	J1B9D8	7/8/10	0	U	0.155	0.158	U	0.158	0.519		0.128	2.74	U	2.74
OB-8	J1B9D9	7/8/10	0.021	U	0.158	0.165	U	0.165	0.579		0.130	3.55	U	3.55
OB-9	J1B9F0	7/8/10	0.028	U	0.218	0.145	U	0.145	0.259		0.180	3.67	U	3.67
OB-10	J1B9F1	7/8/10	0.075	U	0.191	0.159	U	0.159	0.638		0.158	2.94	U	2.94
OB-11	J1B9F2	7/8/10	0.393	U	0.430	0.234	U	0.234	0.742		0.355	5.14	U	5.14
OB-12	J1B9F3	7/8/10	0.022	U	0.166	0.167	U	0.167	0.394		0.137	3.76	U	3.76
FS-1*	J1B9D1	7/12/10	0.020	U	0.157	0.198	U	0.198	0.576		0.130	3.08	U	3.08
FS-1	J1FXW2	3/23/11	-0.0076	U	0.133				0.105	U	0.177			

Attachment	1	Sheet No.	5 of 27
Originator	J. D. Skoglie	Date	5/2/11
Checked	T. E. Queen	Date	5/2/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	8370		17.0	0.851	U	0.851	9.67		0.851	81.3		0.425	0.249		0.170	3.79		1.70
Duplicate of J1B9C8	J1B9D0	7/12/10	8010		20.1	1.00	U	1.00	10.1		1.00	82.2		0.502	0.244		0.201	3.85		2.01
EXC-1	J1B9B8	7/8/10	9170		17.7	0.884	U	0.884	7.22		0.884	91.8		0.442	0.279		0.177	3.65		1.77
EXC-2	J1B9B9	7/8/10	9000		19.1	0.957	U	0.957	5.47		0.957	71.7		0.478	0.282		0.191	2.43		1.91
EXC-3	J1B9C0	7/8/10	6110		13.1	0.656	U	0.656	5.84		0.656	49.2		0.328	0.167		0.131	1.06	B	1.31
EXC-4	J1B9C1	7/8/10	8220		16.8	0.840	U	0.840	8.16		0.840	73.1		0.420	0.265		0.168	1.41	B	1.68
EXC-5	J1B9C2	7/8/10	8610		17.6	0.881	U	0.881	10.6		0.881	73.0		0.441	0.270		0.176	2.48		1.76
EXC-6	J1B9C3	7/8/10	7600		14.6	0.728	U	0.728	5.91		0.728	65.3		0.364	0.240		0.146	1.88		1.46
EXC-7	J1B9C4	7/9/10	7860		13.7	0.208	B	0.690	9.14		0.690	68.3		0.344	0.235		0.137	1.19	B	1.37
EXC-8	J1B9C5	7/12/10	8210		15.9	0.796	U	0.796	3.56		0.796	63.3		0.398	0.230		0.159	2.36		1.59
EXC-9	J1B9C6	7/12/10	9950		14.8	0.740	U	0.740	6.61		0.740	92.3		0.370	0.290		0.148	3.30		1.48
EXC-10	J1B9C7	7/12/10	7560		13.0	0.652	U	0.652	15.3		0.652	65.6		0.326	0.220		0.130	1.70		1.30
EXC-12	J1B9C9	7/12/10	9530		17.0	0.851	U	0.851	7.03		0.851	88.5		0.425	0.272		0.170	4.42		1.70
OB-3[a]	J1B9D4	7/7/10	9010		12.6	0.630	UJ	0.630	31.6		0.630	97.5		0.315	0.288		0.126	5.11		1.26
Duplicate of J1B9D4[a]	J1B9F4	7/7/10	9050		15.0	0.752	UJ	0.752	31.6		0.752	97.9		0.376	0.288		0.150	4.84		1.50
OB-3 re-sample	J1FXV8	3/23/11	6800		1.6	0.38	U	0.38	3.50		0.670	58.8		0.077	0.033	U	0.033	1.70	B	0.99
Duplicate of J1FXV8	J1FXW1	3/23/11	7640		1.7	0.41	U	0.41	3.40		0.710	66.5		0.082	0.042	B	0.035	1.80	B	1.10
OB-1	J1B9D2	7/7/10	7330		17.0	0.850	UJ	0.850	8.28		0.850	63.9		0.425	0.215		0.170	2.79		1.70
OB-2[a]	J1B9D3	7/7/10	8890		14.3	0.715	UJ	0.715	20.3		0.715	136		0.358	0.319		0.143	11.7		1.43
OB-2 re-sample	J1FXV7	3/23/11	7520		1.5	0.42	B	0.38	4.30		0.650	68.6		0.075	0.033	U	0.033	2.80	M	0.97
OB-4	J1B9D5	7/7/10	7670		16.0	0.799	UJ	0.799	15.6		0.799	86.5		0.400	0.231		0.160	7.26		1.60
OB-5	J1B9D6	7/7/10	7870		15.0	0.752	UJ	0.752	9.06		0.752	61.8		0.376	0.218		0.150	2.13		1.50
OB-6	J1B9D7	7/7/10	8160		13.2	0.659	UJ	0.659	12.3		0.659	78.9		0.330	0.236		0.132	3.33		1.32
OB-7[a]	J1B9D8	7/8/10	9030		17.0	0.849	U	0.849	28.9		0.849	88.6		0.425	0.296		0.170	3.48		1.70
OB-7 re-sample	J1FXV9	3/23/11	8390		1.6	0.400	U	0.400	3.40		0.690	93.6		0.080	0.046	B	0.035	1.90	B	1.00
OB-8[a]	J1B9D9	7/8/10	8780		15.6	0.778	U	0.778	22.2		0.778	102		0.389	0.278		0.156	3.26		1.56
OB-8 re-sample	J1FXW0	3/23/11	9000		1.8	0.450	U	0.450	26.6		0.77	85.9		0.089	0.080	B	0.039	3.00		1.10
OB-9	J1B9F0	7/8/10	7950		14.9	0.746	U	0.746	8.80		0.746	68.4		0.373	0.267		0.149	1.95		1.49
OB-10	J1B9F1	7/8/10	7860		16.2	0.812	U	0.812	10.6		0.812	72.2		0.406	0.245		0.162	1.93		1.62
OB-11	J1B9F2	7/8/10	6810		13.7	0.686	U	0.686	9.83		0.686	60.9		0.343	0.219		0.137	2.96		1.37
OB-12	J1B9F3	7/8/10	7710		19.0	0.951	U	0.951	11.3		0.951	75.8		0.476	0.244		0.190	3.85		1.90
FS-1[a]	J1B9D1	7/12/10	13900		19.5	0.422	B	0.970	21.4		0.970	220		0.486	0.511		0.195	13.4		1.95
FS-1 re-sample	J1FXW2	3/23/11	5870		1.7	0.4	U	0.400	1.30		0.700	40.5		0.081	0.035	U	0.035	1.00	U	1.00
Equipment Blank	J1B9F5	7/7/10	218		12.7	0.633	UJ	0.633	0.427	B	0.633	1.87		0.317	0.0686	B	0.127	1.27	U	1.27

[a] Resampled due to exceedance of cleanup criteria.

Attachment	1	Sheet No.	6 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	0.114	B	0.213	5720		17.0	12.7		0.851	6.58		2.55	14.7		1.70	0.20	U	0.20
Duplicate of J1B9C8	J1B9D0	7/12/10	0.125	B	0.251	5360		20.1	12.0		1.00	6.24		3.01	14.3		2.01	0.20	U	0.20
EXC-1	J1B9B8	7/8/10	0.128	B	0.221	5620		17.7	12.9		0.884	7.03		2.65	14.6		1.77	0.11	B	0.20
EXC-2	J1B9B9	7/8/10	0.134	B	0.239	5760		19.1	13.2		0.957	7.29		2.87	14.5		1.91	0.14	B	0.20
EXC-3	J1B9C0	7/8/10	0.112	B	0.164	4420		13.1	10.0		0.656	5.29		1.97	13.4		1.31	0.15	B	0.20
EXC-4	J1B9C1	7/8/10	0.128	B	0.210	5190		16.8	12.9		0.840	7.54		2.52	15.8		1.68	0.09	B	0.20
EXC-5	J1B9C2	7/8/10	0.125	B	0.220	6380		17.6	12.7		0.881	6.82		2.64	14.5		1.76	0.12	B	0.20
EXC-6	J1B9C3	7/8/10	0.115	B	0.182	5840		14.6	11.7		0.728	6.50		2.18	13.9		1.46	0.20	U	0.20
EXC-7	J1B9C4	7/9/10	0.127	B	0.172	6750		13.7	12.9		0.690	6.64		2.06	16.6		1.37	0.12	B	0.20
EXC-8	J1B9C5	7/12/10	0.114	B	0.199	6340		15.9	13.7		0.796	6.67		2.39	15.6		1.59	0.20	U	0.20
EXC-9	J1B9C6	7/12/10	0.122	B	0.185	4140		14.8	13.4		0.740	7.23		2.22	12.9		1.48	0.20	U	0.20
EXC-10	J1B9C7	7/12/10	0.0949	B	0.163	5110		13.0	11.5		0.652	5.94		1.95	13.4		1.30	0.20	U	0.20
EXC-12	J1B9C9	7/12/10	0.134	B	0.213	4770		17.0	13.1		0.851	7.11		2.55	13.8		1.70	0.20	U	0.20
OB-3[a]	J1B9D4	7/7/10	0.0967	B	0.158	5360		12.6	12.9		0.630	6.58		1.89	14.2		1.26	0.12	B	0.20
Duplicate of J1B9D4[a]	J1B9F4	7/7/10	0.104	B	0.188	5400		15.0	12.6		0.752	6.70		2.26	14.9		1.50	0.15	B	0.20
OB-3 re-sample	J1FXV8	3/23/11	0.054	B	0.041	4240		14.3	9.0		0.059	5.70	X	0.1	12.7		0.22			
Duplicate of J1FXV8	J1FXW1	3/23/11	0.072	B	0.044	5230		15.2	9.7		0.062	6.20	X	0.11	15.2		0.23			
OB-1	J1B9D2	7/7/10	0.109	B	0.213	6460		17.0	11.7		0.850	6.52		2.55	16.1		1.70	0.18	B	0.20
OB-2[a]	J1B9D3	7/7/10	0.111	B	0.179	6870		14.3	12.4		0.715	6.46		2.15	15.6		1.43	0.11	B	0.21
OB-2 re-sample	J1FXV7	3/23/11	0.093	BM	0.041	6940	M	14.0	10.2		0.057	5.7	X	0.099	14.2		0.21			
OB-4	J1B9D5	7/7/10	0.102	B	0.200	5760		16.0	10.6		0.799	5.93		2.40	12.4		1.60	0.15	B	0.20
OB-5	J1B9D6	7/7/10	0.102	B	0.188	5890		15.0	12.7		0.752	6.30		2.26	13.5		1.50	0.17	B	0.20
OB-6	J1B9D7	7/7/10	0.106	B	0.165	5790		13.2	11.9		0.659	6.22		1.98	14.0		1.32	0.10	B	0.20
OB-7[a]	J1B9D8	7/8/10	0.134	B	0.212	5210		17.0	12.6		0.849	7.09		2.55	14.4		1.70	0.16	B	0.20
OB-7 re-sample	J1FXV9	3/23/11	0.084	B	0.043	4690		14.8	10.9		0.061	6.2	X	0.10	14.6		0.23			
OB-8[a]	J1B9D9	7/8/10	0.123	B	0.194	5700		15.6	20.0		0.778	7.17		2.33	15.2		1.56	0.18	B	0.21
OB-8 re-sample	J1FXW0	3/23/11	0.048	U	0.048	3910		16.5	11.9		0.068	6.2	X	0.12	12.5		0.25			
OB-9	J1B9F0	7/8/10	0.112	B	0.187	5780		14.9	14.0		0.746	6.35		2.24	14.0		1.49	0.20	U	0.20
OB-10	J1B9F1	7/8/10	0.119	B	0.203	6020		16.2	11.9		0.812	6.21		2.44	13.9		1.62	0.20	U	0.20
OB-11	J1B9F2	7/8/10	0.0989	B	0.171	5160		13.7	11.7		0.686	5.63		2.06	12.7		1.37	0.20	U	0.20
OB-12	J1B9F3	7/8/10	0.121	B	0.238	5730		19.0	11.1		0.951	6.05		2.85	13.6		1.90	0.21	U	0.21
FS-1[a]	J1B9D1	7/12/10	0.242	B	0.243	10200		19.5	16.5		0.970	8.83		2.92	29.6		1.95	0.20	U	0.20
FS-1 re-sample	J1FXW2	3/23/11	0.055	B	0.044	3610		15.0	9.8		0.062	4.8	X	0.11	13.4		0.23	0.15	U	0.15
Equipment Blank	J1B9F5	7/7/10	0.158	U	0.158	45.1		12.7	0.302	B	0.633	1.90	U	1.90	0.450	B	1.27			

[a] Resampled due to exceedance of cleanup criteria.

Attachment	1	Sheet No.	7 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	18100		17.0	24.0		0.851	4320		4.25	287		0.851	0.0162	B	0.0258	0.260	B	0.851
Duplicate of J1B9C8	J1B9D0	7/12/10	17300		20.1	24.4		1.00	3900		5.02	265		1.00	0.00949	B	0.0244	0.323	B	1.00
EXC-1	J1B9B8	7/8/10	20700		17.7	21.6		0.884	4520		4.42	312		0.884	0.0283	U	0.0283	0.393	B	0.884
EXC-2	J1B9B9	7/8/10	21300		19.1	12.4		0.957	4560		4.78	320		0.957	0.0277	U	0.0277	0.447	B	0.957
EXC-3	J1B9C0	7/8/10	16100		13.1	10.7		0.656	3700		3.28	221		0.656	0.0268		0.0263	0.361	B	0.656
EXC-4	J1B9C1	7/8/10	20700		16.8	18.8		0.840	4390		4.20	341		0.840	0.0252	U	0.0252	0.415	B	0.840
EXC-5	J1B9C2	7/8/10	20300		17.6	34.9		0.881	4320		4.41	306		0.881	0.0232	U	0.0232	0.421	B	0.881
EXC-6	J1B9C3	7/8/10	19000		14.6	19.2		0.728	4200		3.64	282		0.728	0.0258	U	0.0258	0.386	B	0.728
EXC-7	J1B9C4	7/9/10	17300		13.7	29.5		0.690	4100		3.44	307		0.690	0.0967		0.0274	0.347	B	0.690
EXC-8	J1B9C5	7/12/10	17800		15.9	5.98		0.796	4660		3.98	280		0.796	0.0258	U	0.0258	0.277	B	0.796
EXC-9	J1B9C6	7/12/10	20300		14.8	5.96		0.740	4280		3.70	340		0.740	0.0226	U	0.0226	0.293	B	0.740
EXC-10	J1B9C7	7/12/10	16600		13.0	31.7		0.652	4080		3.26	263		0.652	0.0238	U	0.0238	0.245	B	0.652
EXC-12	J1B9C9	7/12/10	20100		17.0	27.8		0.851	4480		4.25	315		0.851	0.0266	U	0.0266	0.284	B	0.851
OB-3[a]	J1B9D4	7/7/10	18700		12.6	102		0.630	4470		3.15	306		0.630	0.0133	B	0.0252	0.307	B	0.630
Duplicate of J1B9D4[a]	J1B9F4	7/7/10	19400		15.0	101		0.752	4520		3.76	313		0.752	0.0163	B	0.0275	0.310	B	0.752
OB-3 re-sample	J1FXV8	3/23/11	15100	X	3.8	15.4		0.270	3880		3.7	271		0.10	0.0062	U	0.0062	0.300	B	0.26
Duplicate of J1FXV8	J1FXW1	3/23/11	16900	X	4.1	14.8		0.290	4150		4.0	287		0.11	0.0060	U	0.0060	0.280	U	0.28
OB-1	J1B9D2	7/7/10	18900		17.0	25.3		0.850	4300		4.25	286		0.850	0.0103	B	0.0248	0.278	B	0.850
OB-2[a]	J1B9D3	7/7/10	18000		14.3	60.4		0.715	4400		3.58	293		0.715	0.0226	B	0.0258	0.420	B	0.715
OB-2 re-sample	J1FXV7	3/23/11	16000	X	3.8	9.70		0.270	4150		3.70	283		0.099	0.00600	U	0.00600	0.370	B	0.260
OB-4	J1B9D5	7/7/10	17700		16.0	50.9		0.799	3960		4.00	267		0.799	0.0271	U	0.0271	0.318	B	0.799
OB-5	J1B9D6	7/7/10	18300		15.0	29.1		0.752	4380		3.76	284		0.752	0.0105	B	0.0233	0.281	B	0.752
OB-6	J1B9D7	7/7/10	19000		13.2	39.4		0.659	4380		3.30	285		0.659	0.0175	B	0.0269	0.271	B	0.659
OB-7[a]	J1B9D8	7/8/10	20100		17.0	85.9		0.849	4420		4.25	321		0.849	0.0270	U	0.0270	0.590	B	0.849
OB-7 re-sample	J1FXV9	3/23/11	17700	X	4.0	8.50		0.280	4200		3.90	311		0.100	0.0058	U	0.0058	0.270	B	0.270
OB-8[a]	J1B9D9	7/8/10	20300		15.6	65.3		0.778	4500		3.89	316		0.778	0.0280	U	0.0280	0.492	B	0.778
OB-8 re-sample	J1FXW0	3/23/11	17600	X	4.5	152		0.320	4240		4.30	350		0.120	0.00600	U	0.00600	0.300	U	0.300
OB-9	J1B9F0	7/8/10	18600		14.9	29.9		0.746	4210		3.73	287		0.746	0.0269	U	0.0269	0.324	B	0.746
OB-10	J1B9F1	7/8/10	18600		16.2	36.8		0.812	4170		4.06	281		0.812	0.0266	U	0.0266	0.332	B	0.812
OB-11	J1B9F2	7/8/10	16600		13.7	33.2		0.686	3630		3.43	250		0.686	0.0247	U	0.0247	0.284	B	0.686
OB-12	J1B9F3	7/8/10	17300		19.0	36.5		0.951	3810		4.76	266		0.951	0.0136	B	0.0231	0.618	B	0.951
FS-1[a]	J1B9D1	7/12/10	21000		19.5	80.8		0.970	5800		4.86	373		0.970	0.0997		0.0294	0.462	B	0.970
FS-1 re-sample	J1FXW2	3/23/11	12400	X	4.0	2.70		0.290	3870		3.90	228		0.110	0.00580	U	0.00580	0.280	U	0.280
Equipment Blank	J1B9F5	7/7/10	1100		12.7	0.261	B	0.633	51.5		3.17	5.66		0.633	0.0243	U	0.0243	0.633	U	0.633

[a] Resampled due to exceedance of cleanup criteria.

Attachment	I	Sheet No.	8 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	12.0		2.13	1420		85.1	0.255	U	0.255	467		5.11	0.851	U	0.851	240		42.5
Duplicate of J1B9C8	J1B9D0	7/12/10	11.2		2.51	1420		100	0.301	U	0.301	489		6.02	1.00	U	1.00	224		50.2
EXC-1	J1B9B8	7/8/10	11.7		2.21	1600		88.4	0.265	U	0.265	598		5.3	0.884	U	0.884	221		44.2
EXC-2	J1B9B9	7/8/10	12.0		2.39	1440		95.7	0.287	U	0.287	965		5.74	0.957	U	0.957	250		47.8
EXC-3	J1B9C0	7/8/10	8.84		1.64	783		65.6	0.197	U	0.197	316		3.94	0.656	U	0.656	174		32.8
EXC-4	J1B9C1	7/8/10	11.5		2.10	1260		84.0	0.252	U	0.252	496		5.04	0.840	U	0.840	212		42.0
EXC-5	J1B9C2	7/8/10	11.1		2.20	1380		88.1	0.264	U	0.264	501		5.29	0.881	U	0.881	219		44.1
EXC-6	J1B9C3	7/8/10	11.8		1.82	1390		72.8	0.218	U	0.218	430		4.37	0.728	U	0.728	199		36.4
EXC-7	J1B9C4	7/9/10	11.2		1.72	1150		68.7	0.206	U	0.206	343		4.12	0.687	U	0.687	207		34.4
EXC-8	J1B9C5	7/12/10	12.4		1.99	1190		79.6	0.239	U	0.239	369		4.78	0.796	U	0.796	277		39.8
EXC-9	J1B9C6	7/12/10	12.1		1.85	1890		74.0	0.222	U	0.222	416		4.44	0.740	U	0.740	207		37.0
EXC-10	J1B9C7	7/12/10	11.1		1.63	1190		65.2	0.195	U	0.195	309		3.91	0.652	U	0.652	197		32.6
EXC-12	J1B9C9	7/12/10	11.8		2.13	2030		85.1	0.255	U	0.255	526		5.10	0.851	U	0.851	217		42.5
OB-3[a]	J1B9D4	7/7/10	11.3		1.58	1600		63.0	0.189	U	0.189	391	J	3.78	0.630	U	0.630	244		31.5
Duplicate of J1B9D4[a]	J1B9F4	7/7/10	12.5		1.88	1560		75.2	0.226	U	0.226	467	J	4.51	0.752	U	0.752	246		37.6
OB-3 re-sample	J1FXV8	3/23/11	9.7	X	0.12	1670		41.5	1.2		0.870	328		5.70	0.160	U	0.160	186		59.7
Duplicate of J1FXV8	J1FXW1	3/23/11	9.9	X	0.13	1930		44.1	0.930	U	0.930	383		6.10	0.170	U	0.170	189		63.5
OB-1	J1B9D2	7/7/10	10.8		2.13	1170		85.0	0.255	U	0.255	409	J	5.10	0.850	U	0.850	197		42.5
OB-2[a]	J1B9D3	7/7/10	11.7		1.79	1420		71.5	0.215	U	0.215	437	J	4.29	0.715	U	0.715	279		35.8
OB-2 re-sample	J1FXV7	3/23/11	11.1	X	0.12	1580		40.6	0.890	B	0.850	315		5.60	0.160	U	0.160	230		58.4
OB-4	J1B9D5	7/7/10	9.63		2.00	1180		79.9	0.240	U	0.240	405	J	4.80	0.799	U	0.799	250		40.0
OB-5	J1B9D6	7/7/10	11.9		1.88	1250		75.2	0.226	U	0.226	404	J	4.51	0.752	U	0.752	206		37.6
OB-6	J1B9D7	7/7/10	11.0		1.65	1240		65.9	0.198	U	0.198	363	J	3.96	0.659	U	0.659	256		33.0
OB-7[a]	J1B9D8	7/8/10	11.6		2.12	1540		84.9	0.255	U	0.255	614		5.09	0.849	U	0.849	215		42.5
OB-7 re-sample	J1FXV9	3/23/11	10.5	X	0.13	1850		43.0	0.900	U	0.900	393		5.90	0.170	U	0.170	231		61.8
OB-8[a]	J1B9D9	7/8/10	14.4		1.94	1390		77.8	0.233	U	0.233	444		4.67	0.778	U	0.778	244		38.9
OB-8 re-sample	J1FXW0	3/23/11	10.8	X	0.14	2280		48.1	1.0	U	1.0	424		6.60	0.190	U	0.190	208		69.2
OB-9	J1B9F0	7/8/10	11.5		1.87	1220		74.6	0.224	U	0.224	484		4.48	0.746	U	0.746	229		37.3
OB-10	J1B9F1	7/8/10	11.6		2.03	1260		81.2	0.244	U	0.244	493		4.87	0.812	U	0.812	193		40.6
OB-11	J1B9F2	7/8/10	10.7		1.71	1130		68.6	0.206	U	0.206	344		4.11	0.686	U	0.686	182		34.3
OB-12	J1B9F3	7/8/10	9.83		2.38	1200		95.1	0.285	U	0.285	476		5.71	0.951	U	0.951	212		47.6
FS-1[a]	J1B9D1	7/12/10	17.1		2.43	2740		97.3	0.292	U	0.292	634		5.84	0.973	U	0.973	348		48.6
FS-1 re-sample	J1FXW2	3/23/11	11.2	X	0.13	872		43.7	0.920	U	0.920	187		6.00	0.170	U	0.170	293		62.9
Equipment Blank	J1B9F5	7/7/10	0.482	B	1.58	70.4		63.3	0.190	U	0.190	153	J	3.80	0.633	U	0.633	31.7	U	31.7

[a] Resampled due to exceedance of cleanup criteria.

Attachment	1	Sheet No.	9 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	46.1		0.851	40.5		2.55
Duplicate of J1B9C8	J1B9D0	7/12/10	44.7		1.00	39.3		3.01
EXC-1	J1B9B8	7/8/10	52.1		0.884	41.1		2.65
EXC-2	J1B9B9	7/8/10	53.6		0.957	42.3		2.87
EXC-3	J1B9C0	7/8/10	46.5		0.656	46.8		1.97
EXC-4	J1B9C1	7/8/10	52.3		0.840	45.7		2.52
EXC-5	J1B9C2	7/8/10	51.1		0.881	41.0		2.64
EXC-6	J1B9C3	7/8/10	47.8		0.728	42.6		2.18
EXC-7	J1B9C4	7/9/10	44.5		0.687	42.1		2.06
EXC-8	J1B9C5	7/12/10	48.1		0.796	36.2		2.39
EXC-9	J1B9C6	7/12/10	49.0		0.740	41.6		2.22
EXC-10	J1B9C7	7/12/10	43.0		0.652	39.0		1.95
EXC-12	J1B9C9	7/12/10	50.9		0.851	43.6		2.55
OB-3[a]	J1B9D4	7/7/10	46.0		0.630	45.7		1.89
Duplicate of J1B9D4[a]	J1B9F4	7/7/10	46.8		0.752	45.8		2.26
OB-3 re-sample	J1FXV8	3/23/11	40.4		0.095	34.7	X	0.40
Duplicate of J1FXV8	J1FXW1	3/23/11	41.5		0.10	39.0	X	0.43
OB-1	J1B9D2	7/7/10	48.1		0.850	37.5		2.55
OB-2[a]	J1B9D3	7/7/10	46.6		0.715	40.0		2.15
OB-2 re-sample	J1FXV7	3/23/11	43.1		0.093	37.2	X	0.39
OB-4	J1B9D5	7/7/10	46.2		0.799	38.2		2.40
OB-5	J1B9D6	7/7/10	47.2		0.752	37.8		2.26
OB-6	J1B9D7	7/7/10	47.9		0.659	39.0		1.98
OB-7[a]	J1B9D8	7/8/10	49.5		0.849	43.7		2.55
OB-7 re-sample	J1FXV9	3/23/11	43.6		0.098	39.5	X	0.42
OB-8[a]	J1B9D9	7/8/10	51.3		0.778	43.5		2.33
OB-8 re-sample	J1FXW0	3/23/11	40.8		0.110	40.6	X	0.47
OB-9	J1B9F0	7/8/10	47.9		0.746	39.2		2.24
OB-10	J1B9F1	7/8/10	47.6		0.812	40.1		2.44
OB-11	J1B9F2	7/8/10	42.6		0.686	34.2		2.06
OB-12	J1B9F3	7/8/10	44.0		0.951	38.6		2.85
FS-1[a]	J1B9D1	7/12/10	48.6		0.973	73.6		2.92
FS-1 re-sample	J1FXW2	3/23/11	33.5		0.100	29.9	X	0.42
Equipment Blank	J1B9F5	7/7/10	1.20		0.633	2.40	UJ	1.90

[a] Resampled due to exceedance of cleanup criteria.

Attachment	1	Sheet No.	10 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-11 - J1B9C8, 7/12/10			Duplicate of J1B9C8 - J1B9D0, 7/12/10			EXC-1 - J1B9B8, 7/8/10			EXC-2 - J1B9B9, 7/8/10			EXC-3 - J1B9C0, 7/8/10			EXC-4 - J1B9C1, 7/8/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	13.2	U	13.2	13.1	U	13.1	13.1	U	13.1	13.3	U	13.3	12.8	U	12.8	13.1	U	13.1
Aroclor-1221	PCB	13.2	U	13.2	13.1	U	13.1	13.1	U	13.1	13.3	U	13.3	12.8	U	12.8	13.1	U	13.1
Aroclor-1232	PCB	13.2	U	13.2	13.1	U	13.1	13.1	U	13.1	13.3	U	13.3	12.8	U	12.8	13.1	U	13.1
Aroclor-1242	PCB	13.2	U	13.2	13.1	U	13.1	13.1	U	13.1	13.3	U	13.3	12.8	U	12.8	13.1	U	13.1
Aroclor-1248	PCB	13.2	U	13.2	13.1	U	13.1	13.1	U	13.1	13.3	U	13.3	12.8	U	12.8	13.1	U	13.1
Aroclor-1254	PCB	7.01	J	13.2	9.98	J	13.1	13.1	U	13.1	13.3	U	13.3	38.5		12.8	23.8		13.1
Aroclor-1260	PCB	13.2	U	13.2	13.0	J	13.1	13.1	U	13.1	13.3	U	13.3	15.2		12.8	8.95	J	13.1
Aldrin	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Alpha-BHC	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
alpha-Chlordane	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Delta-BHC	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Dichlorodiphenyldichloroethane	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Dichlorodiphenyldichloroethylene	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Dichlorodiphenyltrichloroethane	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Dieldrin	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Endosulfan I	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Endosulfan II	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Endosulfan sulfate	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Endrin	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Endrin aldehyde	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Endrin ketone	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Gamma-BHC (Lindane)	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
gamma-Chlordane	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Heptachlor	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Heptachlor epoxide	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Methoxychlor	PEST	1.32	UD	1.32	1.32	UD	1.32	1.31	UD	1.31	1.34	UD	1.34	1.28	UD	1.28	1.31	UD	1.31
Toxaphene	PEST	19.8	UD	19.8	19.8	UD	19.8	19.7	UD	19.7	20.1	UD	20.1	19.2	UD	19.2	19.7	UD	19.7

Attachment	1	Sheet No.	11 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-5 - J1B9C2, 7/8/10			EXC-6 - J1B9C3, 7/8/10			EXC-7 - J1B9C4, 7/9/10			EXC-8 - J1B9C5, 7/12/10			EXC-9 - J1B9C6, 7/12/10			EXC-10 - J1B9C7, 7/12/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	13.4	U	13.4	13.2	U	13.2	12.9	U	12.9	13.3	U	13.3	13	U	13	13.1	U	13.1
Aroclor-1221	PCB	13.4	U	13.4	13.2	U	13.2	12.9	U	12.9	13.3	U	13.3	13	U	13	13.1	U	13.1
Aroclor-1232	PCB	13.4	U	13.4	13.2	U	13.2	12.9	U	12.9	13.3	U	13.3	13	U	13	13.1	U	13.1
Aroclor-1242	PCB	13.4	U	13.4	13.2	U	13.2	12.9	U	12.9	13.3	U	13.3	13	U	13	13.1	U	13.1
Aroclor-1248	PCB	13.4	U	13.4	13.2	U	13.2	12.9	U	12.9	13.3	U	13.3	13	U	13	13.1	U	13.1
Aroclor-1254	PCB	13.4	U	13.4	20.1		13.2	30.1		12.9	13.3	U	13.3	13	U	13	13.1	U	13.1
Aroclor-1260	PCB	13.4	U	13.4	8.84	J	13.2	14.8		12.9	13.3	U	13.3	13	U	13	13.1	U	13.1
Aldrin	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Alpha-BHC	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
alpha-Chlordane	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Delta-BHC	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Dichlorodiphenyldichloroethane	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Dichlorodiphenyldichloroethylene	PEST	1.34	UD	1.34	1.32	UD	1.32	3.98	JD	3.98	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Dichlorodiphenyltrichloroethane	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	JD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Dieldrin	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	3.9	JD	1.3	1.31	UD	1.31
Endosulfan I	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Endosulfan II	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Endosulfan sulfate	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Endrin	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Endrin aldehyde	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Endrin ketone	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Gamma-BHC (Lindane)	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
gamma-Chlordane	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Heptachlor	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Heptachlor epoxide	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Methoxychlor	PEST	1.34	UD	1.34	1.32	UD	1.32	1.29	UD	1.29	1.33	UD	1.33	1.3	UD	1.3	1.31	UD	1.31
Toxaphene	PEST	20.1	UD	20.1	19.8	UD	19.8	19.4	UD	19.4	20	UD	20	19.5	UD	19.5	19.7	UD	19.7

Attachment	1	Sheet No.	12 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-12 - J1B9C9, 7/12/10			OB-3 - J1B9D4, 7/7/10			Duplicate of J1B9D4 - J1B9F4, 7/7/10			OB-1 - J1B9D2, 7/7/10			OB-2 - J1B9D3, 7/7/10			OB-4 - J1B9D5, 7/7/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	13.2	U	13.2	12.6	U	12.6	13.2	U	13.2	13.2	U	13.2	13.6	U	13.6	13.1	U	13.1
Aroclor-1221	PCB	13.2	U	13.2	12.6	U	12.6	13.2	U	13.2	13.2	U	13.2	13.6	U	13.6	13.1	U	13.1
Aroclor-1232	PCB	13.2	U	13.2	12.6	U	12.6	13.2	U	13.2	13.2	U	13.2	13.6	U	13.6	13.1	U	13.1
Aroclor-1242	PCB	13.2	U	13.2	12.6	U	12.6	13.2	U	13.2	13.2	U	13.2	13.6	U	13.6	13.1	U	13.1
Aroclor-1248	PCB	13.2	U	13.2	12.6	U	12.6	13.2	U	13.2	13.2	U	13.2	13.6	U	13.6	13.1	U	13.1
Aroclor-1254	PCB	13.2	U	13.2	12.6	U	12.6	13.2	U	13.2	13.2	U	13.2	13.6	U	13.6	13.1	U	13.1
Aroclor-1260	PCB	13.2	U	13.2	12.6	U	12.6	13.2	U	13.2	13.2	U	13.2	13.6	U	13.6	13.1	U	13.1
Aldrin	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Alpha-BHC	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
alpha-Chlordane	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	JD	1.37	1.31	UD	1.31
Delta-BHC	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Dichlorodiphenyldichloroethane	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Dichlorodiphenyldichloroethylene	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Dichlorodiphenyltrichloroethane	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Dieldrin	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Endosulfan I	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Endosulfan II	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Endosulfan sulfate	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Endrin	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Endrin aldehyde	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Endrin ketone	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Gamma-BHC (Lindane)	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
gamma-Chlordane	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Heptachlor	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Heptachlor epoxide	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Methoxychlor	PEST	1.32	UD	1.32	1.26	UD	1.26	1.33	UD	1.33	1.32	UD	1.32	1.37	UD	1.37	1.31	UD	1.31
Toxaphene	PEST	19.9	UD	19.9	19	UJD	19	19.9	UJD	19.9	19.8	UJD	19.8	20.5	UJD	20.5	19.6	UJD	19.6

Attachment	1	Sheet No.	13 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	OB-5 - J1B9D6, 7/7/10			OB-6 - J1B9D7, 7/7/10			OB-7 - J1B9D8, 7/8/10			OB-8 - J1B9D9, 7/8/10			OB-9 - J1B9F0, 7/8/10			OB-10 - J1B9F1, 7/8/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	13.1	U	13.1	12.6	U	12.6	13.5	U	13.5	12.8	U	12.8	13.4	U	13.4	13.4	U	13.4
Aroclor-1221	PCB	13.1	U	13.1	12.6	U	12.6	13.5	U	13.5	12.8	U	12.8	13.4	U	13.4	13.4	U	13.4
Aroclor-1232	PCB	13.1	U	13.1	12.6	U	12.6	13.5	U	13.5	12.8	U	12.8	13.4	U	13.4	13.4	U	13.4
Aroclor-1242	PCB	13.1	U	13.1	12.6	U	12.6	13.5	U	13.5	12.8	U	12.8	13.4	U	13.4	13.4	U	13.4
Aroclor-1248	PCB	13.1	U	13.1	12.6	U	12.6	13.5	U	13.5	12.8	U	12.8	13.4	U	13.4	13.4	U	13.4
Aroclor-1254	PCB	13.1	U	13.1	12.6	U	12.6	13.5	U	13.5	12.8	U	12.8	13.4	U	13.4	13.4	U	13.4
Aroclor-1260	PCB	13.1	U	13.1	12.6	U	12.6	13.5	U	13.5	12.8	U	12.8	13.4	U	13.4	13.4	U	13.4
Aldrin	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Alpha-BHC	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
alpha-Chlordane	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Delta-BHC	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Dichlorodiphenyldichloroethane	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Dichlorodiphenyldichloroethylene	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Dichlorodiphenyltrichloroethane	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Dieldrin	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Endosulfan I	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Endosulfan II	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Endosulfan sulfate	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Endrin	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Endrin aldehyde	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Endrin ketone	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Gamma-BHC (Lindane)	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
gamma-Chlordane	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Heptachlor	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Heptachlor epoxide	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Methoxychlor	PEST	1.31	UD	1.31	1.26	UD	1.26	1.35	UD	1.35	1.29	UD	1.29	1.34	UD	1.34	1.34	UD	1.34
Toxaphene	PEST	19.6	UJD	19.6	19	UJD	19	20.2	UD	20.2	19.3	UD	19.3	20.1	UD	20.1	20.1	UD	20.1

Attachment	1	Sheet No.	14 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	OB-11 - J1B9F2, 7/8/10			OB-12 - J1B9F3, 7/8/10			FS-1[a] - J1B9D1, 7/12/10			FS-1 - J1FXW2, 3/23/11			Equipment Blank - J1B9F5, 7/7/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	13.4	U	13.4	13.6	U	13.6	13.4	U	13.4	3.1	U	3.1			
Aroclor-1221	PCB	13.4	U	13.4	13.6	U	13.6	13.4	U	13.4	8.9	U	8.9			
Aroclor-1232	PCB	13.4	U	13.4	13.6	U	13.6	13.4	U	13.4	2.2	U	2.2			
Aroclor-1242	PCB	13.4	U	13.4	13.6	U	13.6	13.4	U	13.4	5.1	U	5.1			
Aroclor-1248	PCB	13.4	U	13.4	13.6	U	13.6	13.4	U	13.4	5.1	U	5.1			
Aroclor-1254	PCB	13.4	U	13.4	13.6	U	13.6	67.6		13.4	2.9	U	2.9			
Aroclor-1260	PCB	13.4	U	13.4	13.6	U	13.6	24.7		13.4	2.9	U	2.9			
Aldrin	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.26	U	0.26			
Alpha-BHC	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.23	U	0.23			
alpha-Chlordane	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.34	U	0.34			
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.7	U	0.7			
Delta-BHC	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.42	U	0.42			
Dichlorodiphenyldichloroethane	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	JD	1.34	0.58	U	0.58			
Dichlorodiphenyldichloroethylene	PEST	1.34	UD	1.34	1.36	UD	1.36	4.03	JD	1.34	0.25	U	0.25			
Dichlorodiphenyltrichloroethane	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.62	U	0.62			
Dieldrin	PEST	1.34	UD	1.34	2.01	JD	2.01	7.05	D	1.34	0.22	U	0.22			
Endosulfan I	PEST	1.34	UD	1.34	1.36	UD	1.36	1.68	JD	1.34	0.19	U	0.19			
Endosulfan II	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.3	U	0.3			
Endosulfan sulfate	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.29	U	0.29			
Endrin	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.32	U	0.32			
Endrin aldehyde	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.18	UN	0.18			
Endrin ketone	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.52	U	0.52			
Gamma-BHC (Lindane)	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.49	U	0.49			
gamma-Chlordane	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.28	U	0.28			
Heptachlor	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.23	U	0.23			
Heptachlor epoxide	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.45	U	0.45			
Methoxychlor	PEST	1.34	UD	1.34	1.36	UD	1.36	1.34	UD	1.34	0.47	U	0.47			
Toxaphene	PEST	20.2	UD	20.2	20.4	UD	20.4	20.1	UD	20.1	17	U	17			

[a] Resampled due to exceedance of cleanup criteria.

Attachment	1	Sheet No.	15 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-11 - J1B9C8, 7/12/10			Duplicate of J1B9C8 - J1B9D0, 7/12/10			EXC-1 - J1B9B8, 7/8/10			EXC-2 - J1B9B9, 7/8/10			EXC-3 - J1B9C0, 7/8/10			EXC-4 - J1B9C1, 7/8/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
1,2-Dichlorobenzene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
1,3-Dichlorobenzene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
1,4-Dichlorobenzene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2,4,5-Trichlorophenol	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2,4,6-Trichlorophenol	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2,4-Dichlorophenol	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2,4-Dimethylphenol	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2,4-Dinitrophenol	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1670	U	1670	1690	U	1690	1660	U	1660
2,4-Dinitrotoluene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2,6-Dinitrotoluene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2-Chloronaphthalene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2-Chlorophenol	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2-Methylnaphthalene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2-Methylphenol (cresol, o-)	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
2-Nitroaniline	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1670	U	1670	1690	U	1690	1660	U	1660
2-Nitrophenol	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
3+4 Methylphenol (cresol, m+p)	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
3,3'-Dichlorobenzidine	SVOA	663	U	663	662	U	662	665	U	665	669	U	669	675	U	675	665	U	665
3-Nitroaniline	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1670	U	1670	1690	U	1690	1660	U	1660
4,6-Dinitro-2-methylphenol	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
4-Bromophenylphenyl ether	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
4-Chloro-3-methylphenol	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
4-Chloroaniline	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
4-Chlorophenylphenyl ether	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
4-Nitroaniline	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1670	U	1670	1690	U	1690	1660	U	1660
4-Nitrophenol	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1670	U	1670	1690	U	1690	1660	U	1660
Acenaphthene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Acenaphthylene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Anthracene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Benzo(a)anthracene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Benzo(a)pyrene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332

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Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-5 - J1B9C2, 7/8/10			EXC-6 - J1B9C3, 7/8/10			EXC-7 - J1B9C4, 7/9/10			EXC-8 - J1B9C5, 7/12/10			EXC-9 - J1B9C6, 7/12/10			EXC-10 - J1B9C7, 7/12/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
1,2-Dichlorobenzene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
1,3-Dichlorobenzene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
1,4-Dichlorobenzene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2,4,5-Trichlorophenol	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2,4,6-Trichlorophenol	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2,4-Dichlorophenol	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2,4-Dimethylphenol	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2,4-Dinitrophenol	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1650	U	1650	1660	U	1660	1660	U	1660
2,4-Dinitrotoluene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2,6-Dinitrotoluene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2-Chloronaphthalene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2-Chlorophenol	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2-Methylnaphthalene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2-Methylphenol (cresol, o-)	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
2-Nitroaniline	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1650	U	1650	1660	U	1660	1660	U	1660
2-Nitrophenol	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
3+4 Methylphenol (cresol, m+p)	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
3,3'-Dichlorobenzidine	SVOA	663	U	663	663	U	663	662	U	662	662	U	662	664	U	664	662	U	662
3-Nitroaniline	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1650	U	1650	1660	U	1660	1660	U	1660
4,6-Dinitro-2-methylphenol	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
4-Bromophenylphenyl ether	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
4-Chloro-3-methylphenol	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
4-Chloroaniline	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
4-Chlorophenylphenyl ether	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
4-Nitroaniline	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1650	U	1650	1660	U	1660	1660	U	1660
4-Nitrophenol	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1650	U	1650	1660	U	1660	1660	U	1660
Acenaphthene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Acenaphthylene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Anthracene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Benzo(a)anthracene	SVOA	72.8	J	72.8	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Benzo(a)pyrene	SVOA	67.8	J	67.8	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331

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Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-12 - J1B9C9, 7/12/10			OB-3 - J1B9D4, 7/7/10			Duplicate of J1B9D4 - J1B9F4, 7/7/10			OB-1 - J1B9D2, 7/7/10			OB-2 - J1B9D3, 7/7/10			OB-4 - J1B9D5, 7/7/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
1,2-Dichlorobenzene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
1,3-Dichlorobenzene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
1,4-Dichlorobenzene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2,4,5-Trichlorophenol	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2,4,6-Trichlorophenol	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2,4-Dichlorophenol	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2,4-Dimethylphenol	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2,4-Dinitrophenol	SVOA	1660	U	1660	1660	UJ	1660	1660	UJ	1660	1680	UJ	1680	1700	UJ	1700	1690	UJ	1690
2,4-Dinitrotoluene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2,6-Dinitrotoluene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2-Chloronaphthalene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2-Chlorophenol	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2-Methylnaphthalene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2-Methylphenol (cresol, o-)	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
2-Nitroaniline	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1680	U	1680	1700	U	1700	1690	U	1690
2-Nitrophenol	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
3+4 Methylphenol (cresol, m+p)	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
3,3'-Dichlorobenzidine	SVOA	662	U	662	665	U	665	665	U	665	673	U	673	680	U	680	675	U	675
3-Nitroaniline	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1680	U	1680	1700	U	1700	1690	U	1690
4,6-Dinitro-2-methylphenol	SVOA	331	U	331	333	UJ	333	333	UJ	333	337	UJ	337	340	UJ	340	338	UJ	338
4-Bromophenylphenyl ether	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
4-Chloro-3-methylphenol	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
4-Chloroaniline	SVOA	331	U	331	333	UJ	333	333	UJ	333	337	UJ	337	340	UJ	340	338	UJ	338
4-Chlorophenylphenyl ether	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
4-Nitroaniline	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1680	U	1680	1700	U	1700	1690	U	1690
4-Nitrophenol	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1680	U	1680	1700	U	1700	1690	U	1690
Acenaphthene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Acenaphthylene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Anthracene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Benzo(a)anthracene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Benzo(a)pyrene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338

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Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	OB-5 - J1B9D6, 7/7/10			OB-6 - J1B9D7, 7/7/10			OB-7 - J1B9D8, 7/8/10			OB-8 - J1B9D9, 7/8/10			OB-9 - J1B9F0, 7/8/10			OB-10 - J1B9F1, 7/8/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
1,2-Dichlorobenzene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
1,3-Dichlorobenzene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
1,4-Dichlorobenzene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2,4,5-Trichlorophenol	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2,4,6-Trichlorophenol	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2,4-Dichlorophenol	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2,4-Dimethylphenol	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2,4-Dinitrophenol	SVOA	1660	UJ	1660	1680	UJ	1680	1680	U	1680	1690	U	1690	1670	U	1670	1660	U	1660
2,4-Dinitrotoluene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2,6-Dinitrotoluene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2-Chloronaphthalene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2-Chlorophenol	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2-Methylnaphthalene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2-Methylphenol (cresol, o-)	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
2-Nitroaniline	SVOA	1660	U	1660	1680	U	1680	1680	U	1680	1690	U	1690	1670	U	1670	1660	U	1660
2-Nitrophenol	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
3+4 Methylphenol (cresol, m+p)	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
3,3'-Dichlorobenzidine	SVOA	665	U	665	670	U	670	672	U	672	677	U	677	670	U	670	664	U	664
3-Nitroaniline	SVOA	1660	U	1660	1680	U	1680	1680	U	1680	1690	U	1690	1670	U	1670	1660	U	1660
4,6-Dinitro-2-methylphenol	SVOA	333	UJ	333	335	UJ	335	336	U	336	339	U	339	335	U	335	332	U	332
4-Bromophenylphenyl ether	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
4-Chloro-3-methylphenol	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
4-Chloroaniline	SVOA	333	UJ	333	335	UJ	335	336	U	336	339	U	339	335	U	335	332	U	332
4-Chlorophenylphenyl ether	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
4-Nitroaniline	SVOA	1660	U	1660	1680	U	1680	1680	U	1680	1690	U	1690	1670	U	1670	1660	U	1660
4-Nitrophenol	SVOA	1660	U	1660	1680	U	1680	1680	U	1680	1690	U	1690	1670	U	1670	1660	U	1660
Acenaphthene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Acenaphthylene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Anthracene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Benzo(a)anthracene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Benzo(a)pyrene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332

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Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	OB-11 - J1B9F2, 7/8/10			OB-12 - J1B9F3, 7/8/10			FS-1[a] - J1B9D1, 7/12/10			FS-1 - J1B9D1, 7/12/10			Equipment Blank - J1B9F5, 7/7/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	SVOA	335	U	335	339	U	339	334	U	334	31	U	31	330	U	330
1,2-Dichlorobenzene	SVOA	335	U	335	339	U	339	334	U	334	24	U	24	330	U	330
1,3-Dichlorobenzene	SVOA	335	U	335	339	U	339	334	U	334	13	U	13	330	U	330
1,4-Dichlorobenzene	SVOA	335	U	335	339	U	339	334	U	334	15	U	15	330	U	330
2,4,5-Trichlorophenol	SVOA	335	U	335	339	U	339	334	U	334	11	U	11	330	U	330
2,4,6-Trichlorophenol	SVOA	335	U	335	339	U	339	334	U	334	11	U	11	330	U	330
2,4-Dichlorophenol	SVOA	335	U	335	339	U	339	334	U	334	11	U	11	330	U	330
2,4-Dimethylphenol	SVOA	335	U	335	339	U	339	334	U	334	73	U	73	330	U	330
2,4-Dinitrophenol	SVOA	1670	U	1670	1690	U	1690	1670	U	1670	370	U	370	1650	UJ	1650
2,4-Dinitrotoluene	SVOA	335	U	335	339	U	339	334	U	334	73	U	73	330	U	330
2,6-Dinitrotoluene	SVOA	335	U	335	339	U	339	334	U	334	31	U	31	330	U	330
2-Chloronaphthalene	SVOA	335	U	335	339	U	339	334	U	334	11	U	11	330	U	330
2-Chlorophenol	SVOA	335	U	335	339	U	339	334	U	334	23	U	23	330	U	330
2-Methylnaphthalene	SVOA	335	U	335	339	U	339	55.9	J	334	21	U	21	330	U	330
2-Methylphenol (cresol, o-)	SVOA	335	U	335	339	U	339	334	U	334	14	U	14	330	U	330
2-Nitroaniline	SVOA	1670	U	1670	1690	U	1690	1670	U	1670	55	U	55	1650	U	1650
2-Nitrophenol	SVOA	335	U	335	339	U	339	334	U	334	11	U	11	330	U	330
3+4 Methylphenol (cresol, m+p)	SVOA	335	U	335	339	U	339	334	U	334	100	U	100	330	U	330
3,3'-Dichlorobenzidine	SVOA	670	U	670	678	U	678	668	U	668	37	U	37	660	U	660
3-Nitroaniline	SVOA	1670	U	1670	1690	U	1690	1670	U	1670	81	U	81	1650	U	1650
4,6-Dinitro-2-methylphenol	SVOA	335	U	335	339	U	339	334	U	334	370	U	370	330	UJ	330
4-Bromophenylphenyl ether	SVOA	335	U	335	339	U	339	334	U	334	21	U	21	330	U	330
4-Chloro-3-methylphenol	SVOA	335	U	335	339	U	339	334	U	334	73	U	73	330	U	330
4-Chloroaniline	SVOA	335	U	335	339	U	339	334	U	334	91	U	91	330	UJ	330
4-Chlorophenylphenyl ether	SVOA	335	U	335	339	U	339	334	U	334	23	U	23	330	U	330
4-Nitroaniline	SVOA	1670	U	1670	1690	U	1690	1670	U	1670	80	U	80	1650	U	1650
4-Nitrophenol	SVOA	1670	U	1670	1690	U	1690	1670	U	1670	110	U	110	1650	U	1650
Acenaphthene	SVOA	335	U	335	339	U	339	334	U	334	11	U	11	330	U	330
Acenaphthylene	SVOA	335	U	335	339	U	339	334	U	334	19	U	19	330	U	330
Anthracene	SVOA	335	U	335	339	U	339	334	U	334	19	U	19	330	U	330
Benzo(a)anthracene	SVOA	335	U	335	339	U	339	334	U	334	22	U	22	330	U	330
Benzo(a)pyrene	SVOA	335	U	335	339	U	339	334	U	334	22	U	22	330	U	330

[a] Resampled due to exceedance of cleanup criteria.

Attachment	1	Sheet No.	20 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-11 - J1B9C8, 7/12/10			Duplicate of J1B9C8 - J1B9D0, 7/12/10			EXC-1 - J1B9B8, 7/8/10			EXC-2 - J1B9B9, 7/8/10			EXC-3 - J1B9C0, 7/8/10			EXC-4 - J1B9C1, 7/8/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Benzo(b)fluoranthene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Benzo(ghi)perylene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Benzo(k)fluoranthene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Bis(2-chloro-1-methylethyl)ether	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Bis(2-Chloroethoxy)methane	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Bis(2-chloroethyl) ether	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Bis(2-ethylhexyl) phthalate	SVOA	331	U	331	331	U	331	211	J	332	335	U	335	338	U	338	332	U	332
Butylbenzylphthalate	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Carbazole	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Chrysene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Di-n-butylphthalate	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Di-n-octylphthalate	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Dibenz[a,h]anthracene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Dibenzofuran	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Diethyl phthalate	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Dimethyl phthalate	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Fluoranthene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Fluorene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Hexachlorobenzene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Hexachlorobutadiene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Hexachlorocyclopentadiene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Hexachloroethane	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Indeno(1,2,3-cd)pyrene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Isophorone	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
N-Nitroso-di-n-dipropylamine	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
N-Nitrosodiphenylamine	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Naphthalene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Nitrobenzene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Pentachlorophenol	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1670	U	1670	1690	U	1690	1660	U	1660
Phenanthrene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Phenol	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332
Pyrene	SVOA	331	U	331	331	U	331	332	U	332	335	U	335	338	U	338	332	U	332

Attachment	1	Sheet No.	21 of 27
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Checked	T. E. Queen	Date	4/26/11
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Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-5 - J1B9C2, 7/8/10			EXC-6 - J1B9C3, 7/8/10			EXC-7 - J1B9C4, 7/9/10			EXC-8 - J1B9C5, 7/12/10			EXC-9 - J1B9C6, 7/12/10			EXC-10 - J1B9C7, 7/12/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Benzo(b)fluoranthene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Benzo(ghi)perylene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Benzo(k)fluoranthene	SVOA	54.8	J	54.8	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Bis(2-chloro-1-methylethyl)ether	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Bis(2-Chloroethoxy)methane	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Bis(2-chloroethyl) ether	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Bis(2-ethylhexyl) phthalate	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Butylbenzylphthalate	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Carbazole	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Chrysene	SVOA	78.3	J	78.3	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Di-n-butylphthalate	SVOA	332	U	332	332	U	332	253	J	253	331	U	331	332	U	332	331	U	331
Di-n-octylphthalate	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Dibenz[a,h]anthracene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Dibenzofuran	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Diethyl phthalate	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Dimethyl phthalate	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Fluoranthene	SVOA	171	J	171	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Fluorene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Hexachlorobenzene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Hexachlorobutadiene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Hexachlorocyclopentadiene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Hexachloroethane	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Indeno(1,2,3-cd)pyrene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Isophorone	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
N-Nitroso-di-n-dipropylamine	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
N-Nitrosodiphenylamine	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Naphthalene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Nitrobenzene	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Pentachlorophenol	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1650	U	1650	1660	U	1660	1660	U	1660
Phenanthrene	SVOA	153	J	153	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Phenol	SVOA	332	U	332	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331
Pyrene	SVOA	233	J	233	332	U	332	331	U	331	331	U	331	332	U	332	331	U	331

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Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
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Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	EXC-12 - J1B9C9, 7/12/10			OB-3 - J1B9D4, 7/7/10			Duplicate of J1B9D4 - J1B9F4, 7/7/10			OB-1 - J1B9D2, 7/7/10			OB-2 - J1B9D3, 7/7/10			OB-4 - J1B9D5, 7/7/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Benzo(b)fluoranthene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Benzo(ghi)perylene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Benzo(k)fluoranthene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Bis(2-chloro-1-methylethyl)ether	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Bis(2-Chloroethoxy)methane	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Bis(2-chloroethyl) ether	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Bis(2-ethylhexyl) phthalate	SVOA	331	U	331	333	U	333	282	J	333	337	U	337	340	U	340	338	U	338
Butylbenzylphthalate	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Carbazole	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Chrysene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Di-n-butylphthalate	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Di-n-octylphthalate	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Dibenz[a,h]anthracene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Dibenzofuran	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Diethyl phthalate	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Dimethyl phthalate	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Fluoranthene	SVOA	331	U	331	55.2	J	333	333	U	333	337	U	337	340	U	340	338	U	338
Fluorene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Hexachlorobenzene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Hexachlorobutadiene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Hexachlorocyclopentadiene	SVOA	331	U	331	333	UJ	333	333	UJ	333	337	UJ	337	340	UJ	340	338	UJ	338
Hexachloroethane	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Indeno(1,2,3-cd)pyrene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Isophorone	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
N-Nitroso-di-n-dipropylamine	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
N-Nitrosodiphenylamine	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Naphthalene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Nitrobenzene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Pentachlorophenol	SVOA	1660	U	1660	1660	U	1660	1660	U	1660	1680	U	1680	1700	U	1700	1690	U	1690
Phenanthrene	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Phenol	SVOA	331	U	331	333	U	333	333	U	333	337	U	337	340	U	340	338	U	338
Pyrene	SVOA	331	U	331	75.1	J	75.1	333	U	333	337	U	337	340	U	340	338	U	338

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Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	OB-5 - J1B9D6, 7/7/10			OB-6 - J1B9D7, 7/7/10			OB-7 - J1B9D8, 7/8/10			OB-8 - J1B9D9, 7/8/10			OB-9 - J1B9F0, 7/8/10			OB-10 - J1B9F1, 7/8/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Benzo(b)fluoranthene	SVOA	333	U	333	335	U	335	55.9	J	336	339	U	339	335	U	335	332	U	332
Benzo(ghi)perylene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Benzo(k)fluoranthene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Bis(2-chloro-1-methylethyl)ether	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Bis(2-Chloroethoxy)methane	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Bis(2-chloroethyl) ether	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Bis(2-ethylhexyl) phthalate	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Butylbenzylphthalate	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Carbazole	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Chrysene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Di-n-butylphthalate	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Di-n-octylphthalate	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Dibenz[a,h]anthracene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Dibenzofuran	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Diethyl phthalate	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Dimethyl phthalate	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Fluoranthene	SVOA	333	U	333	335	U	335	71.1	J	71.1	339	U	339	335	U	335	332	U	332
Fluorene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Hexachlorobenzene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Hexachlorobutadiene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Hexachlorocyclopentadiene	SVOA	333	UJ	333	335	UJ	335	336	U	336	339	U	339	335	U	335	332	U	332
Hexachloroethane	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Indeno(1,2,3-cd)pyrene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Isophorone	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
N-Nitroso-di-n-dipropylamine	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
N-Nitrosodiphenylamine	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Naphthalene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Nitrobenzene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Pentachlorophenol	SVOA	1660	U	1660	1680	U	1680	1680	U	1680	1690	U	1690	1670	U	1670	1660	U	1660
Phenanthrene	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Phenol	SVOA	333	U	333	335	U	335	336	U	336	339	U	339	335	U	335	332	U	332
Pyrene	SVOA	333	U	333	335	U	335	95.7	J	95.7	339	U	339	335	U	335	332	U	332

Attachment	1	Sheet No.	24 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Organics).

CONSTITUENT	CLASS	OB-11 - J1B9F2, 7/8/10			OB-12 - J1B9F3, 7/8/10			FS-1[a] - J1B9D1, 7/12/10			FS-1 - J1B9D1, 7/12/10			Equipment Blank - J1B9F5, 7/7/10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Benzo(b)fluoranthene	SVOA	335	U	335	339	U	339	334	U	334	29	U	29	330	U	330
Benzo(ghi)perylene	SVOA	335	U	335	339	U	339	334	U	334	18	U	18	330	U	330
Benzo(k)fluoranthene	SVOA	335	U	335	339	U	339	334	U	334	44	U	44	330	U	330
Bis(2-chloro-1-methylethyl)ether	SVOA	335	U	335	339	U	339	334	U	334	25	U	25	330	U	330
Bis(2-Chloroethoxy)methane	SVOA	335	U	335	339	U	339	334	U	334	25	U	25	330	U	330
Bis(2-chloroethyl) ether	SVOA	335	U	335	339	U	339	334	U	334	18	U	18	330	U	330
Bis(2-ethylhexyl) phthalate	SVOA	193	J	335	339	U	339	334	U	334	51	U	51	165	J	330
Butylbenzylphthalate	SVOA	335	U	335	339	U	339	334	U	334	48	U	48	330	U	330
Carbazole	SVOA	335	U	335	339	U	339	334	U	334	40	U	40	330	U	330
Chrysene	SVOA	335	U	335	339	U	339	334	U	334	30	U	30	330	U	330
Di-n-butylphthalate	SVOA	335	U	335	339	U	339	334	U	334	21	U	21	330	U	330
Di-n-octylphthalate	SVOA	335	U	335	339	U	339	334	U	334	22	U	22	330	U	330
Dibenz[a,h]anthracene	SVOA	335	U	335	339	U	339	334	U	334	29	U	29	330	U	330
Dibenzofuran	SVOA	335	U	335	339	U	339	334	U	334	25	U	25	330	U	330
Diethyl phthalate	SVOA	335	U	335	339	U	339	178	J	178	32	U	32	330	U	330
Dimethyl phthalate	SVOA	335	U	335	339	U	339	334	U	334	16	U	16	330	U	330
Fluoranthene	SVOA	335	U	335	339	U	339	334	U	334	40	U	40	330	U	330
Fluorene	SVOA	335	U	335	339	U	339	334	U	334	20	U	20	330	U	330
Hexachlorobenzene	SVOA	335	U	335	339	U	339	334	U	334	32	U	32	330	U	330
Hexachlorobutadiene	SVOA	335	U	335	339	U	339	334	U	334	11	U	11	330	U	330
Hexachlorocyclopentadiene	SVOA	335	U	335	339	U	339	334	U	334	55	U	55	330	UJ	330
Hexachloroethane	SVOA	335	U	335	339	U	339	334	U	334	24	U	24	330	U	330
Indeno(1,2,3-cd)pyrene	SVOA	335	U	335	339	U	339	334	U	334	24	U	24	330	U	330
Isophorone	SVOA	335	U	335	339	U	339	334	U	334	19	U	19	330	U	330
N-Nitroso-di-n-dipropylamine	SVOA	335	U	335	339	U	339	334	U	334	34	U	34	330	U	330
N-Nitrosodiphenylamine	SVOA	335	U	335	339	U	339	334	U	334	24	U	24	330	U	330
Naphthalene	SVOA	335	U	335	339	U	339	51	J	51	34	U	34	330	U	330
Nitrobenzene	SVOA	335	U	335	339	U	339	334	U	334	23	U	23	330	U	330
Pentachlorophenol	SVOA	1670	U	1670	1690	U	1690	1670	U	1670	370	U	370	1650	U	1650
Phenanthrene	SVOA	335	U	335	339	U	339	334	U	334	19	U	19	330	U	330
Phenol	SVOA	335	U	335	339	U	339	334	U	334	20	U	20	330	U	330
Pyrene	SVOA	335	U	335	339	U	339	334	U	334	13	U	13	330	U	330

[a] Resampled due to exceedance of cleanup criteria.

Attachment	1	Sheet No.	25 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Anions).

Sample Location	HEIS Number	Sample Date	Bromide			Chloride			Fluoride			Nitrate			Nitrite		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	2.2	U	2.2	2.2	U	2.2	1.9	B	2.2	23.7		2.2	2.2	U	2.2
Duplicate of J1B9C8	J1B9D0	7/12/10	2.2	U	2.2	2.2	U	2.2	1.3	B	2.2	21.6		2.2	2.2	U	2.2
EXC-1	J1B9B8	7/8/10	2.3	U	2.3	2.3	U	2.3	1.2	B	2.3	5.8		2.3	2.3	U	2.3
EXC-2	J1B9B9	7/8/10	2.5	U	2.5	2.5	U	2.5	7.2		2.5	1.5	B	2.5	2.5	U	2.5
EXC-3	J1B9C0	7/8/10	2.6	U	2.6	2.6	U	2.6	1.0	B	2.6	16.5		2.6	2.6	U	2.6
EXC-4	J1B9C1	7/8/10	2.3	U	2.3	2.3	U	2.3	1.6	B	2.3	3		2.3	2.3	U	2.3
EXC-5	J1B9C2	7/8/10	2.3	U	2.3	2.3	U	2.3	1.6	B	2.3	2.8		2.3	2.3	U	2.3
EXC-6	J1B9C3	7/8/10	2.2	U	2.2	2.2	U	2.2	0.8	B	2.2	15.7		2.2	2.2	U	2.2
EXC-7	J1B9C4	7/9/10	2.3	U	2.3	2.3	U	2.3	1.7	B	2.3	3.7		2.3	2.3	U	2.3
EXC-8	J1B9C5	7/12/10	2.3	U	2.3	2.3	U	2.3	1.0	B	2.3	0.9	B	2.3	2.3	U	2.3
EXC-9	J1B9C6	7/12/10	2.3	U	2.3	2.3	U	2.3	1.2	B	2.3	3.5		2.3	2.3	U	2.3
EXC-10	J1B9C7	7/12/10	2.5	U	2.5	2.5	U	2.5	1.6	B	2.5	7.1		2.5	2.5	U	2.5
EXC-12	J1B9C9	7/12/10	2.1	U	2.1	2.1	U	2.1	1.7	B	2.1	4.5		2.1	2.1	U	2.1
OB-3	J1B9D4	7/7/10	2.5	U	2.5	7.2		2.5	1.2	B	2.5	103	DJ	12.4	2.5	UR	2.5
Duplicate of J1B9D4	J1B9F4	7/7/10	2.3	U	2.3	8.7		2.3	2.1	B	2.3	104	DJ	11.7	2.3	UR	2.3
OB-1	J1B9D2	7/7/10	2.6	U	2.6	2.6	U	2.6	0.8	B	2.6	10.3	J	2.6	2.6	UR	2.6
OB-2	J1B9D3	7/7/10	2.3	U	2.3	10.5		2.3	1.1	B	2.3	115	DJ	11.4	2.3	UR	2.3
OB-4	J1B9D5	7/7/10	2.6	U	2.6	2.6	U	2.6	1.4	B	2.6	32.0	J	2.6	2.6	UR	2.6
OB-5	J1B9D6	7/7/10	2.2	U	2.2	2.2	U	2.2	1.4	B	2.2	6.6	J	2.2	2.2	UR	2.2
OB-6	J1B9D7	7/7/10	2.5	U	2.5	2.5	U	2.5	1.0	B	2.5	21.5	J	2.5	2.5	UR	2.5
OB-7	J1B9D8	7/8/10	2.3	U	2.3	2.3	U	2.3	1.4	B	2.3	8.6		2.3	2.3	U	2.3
OB-8	J1B9D9	7/8/10	2.4	U	2.4	3.8		2.4	1.4	B	2.4	4.1		2.4	2.4	U	2.4
OB-9	J1B9F0	7/8/10	2.5	U	2.5	2.5	U	2.5	1.3	B	2.5	3.2		2.5	2.5	U	2.5
OB-10	J1B9F1	7/8/10	2.4	U	2.4	2.4	U	2.4	1.1	B	2.4	3.2		2.4	2.4	U	2.4
OB-11	J1B9F2	7/8/10	2.5	U	2.5	2.5	U	2.5	1.4	B	2.5	12.2		2.5	2.5	U	2.5
OB-12	J1B9F3	7/8/10	2.3	U	2.3	2.3	U	2.3	1.2	B	2.3	24.6		2.3	2.3	U	2.3
FS-1[a]	J1B9D1	7/12/10	2.5	U	2.5	2.5	U	2.5	3.5		2.5	38.1		2.5	2.5	U	2.5
FS-1 re-sample	J1FXW2	3/23/11	0.43	U	0.43	2.2	U	2.2	0.92	U	0.92	0.84	B	0.35	0.38	U	0.38
Equipment Blank	J1B9F5	7/7/10															

[a] Resampled due to exceedance of cleanup criteria.

Attachment	1	Sheet No.	26 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Attachment 1. 1607-H1 Waste Site Verification Sample Results (Anions).

Sample Location	HEIS Number	Sample Date	Nitrogen in Nitrite and Nitrate			Phosphate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-11	J1B9C8	7/12/10	5.22		0.18	7.4		2.2	36.9		2.2
Duplicate of J1B9C8	J1B9D0	7/12/10	4.76		0.18	5.3		2.2	28.1		2.2
EXC-1	J1B9B8	7/8/10	1.42		0.18	5.1		2.3	4.7		2.3
EXC-2	J1B9B9	7/8/10	0.60		0.20	3.6		2.5	4.6		2.5
EXC-3	J1B9C0	7/8/10	3.69		0.20	9.6		2.6	16.6		2.6
EXC-4	J1B9C1	7/8/10	0.84		0.19	11.8		2.3	5.7		2.3
EXC-5	J1B9C2	7/8/10	0.82		0.19	4.1		2.3	7.0		2.3
EXC-6	J1B9C3	7/8/10	3.42		0.18	10.2		2.2	7.6		2.2
EXC-7	J1B9C4	7/9/10	0.99		0.18	27.6		2.3	27.1		2.3
EXC-8	J1B9C5	7/12/10	0.45		0.18	0.7	B	2.3	3.5		2.3
EXC-9	J1B9C6	7/12/10	0.95		0.18	4.8		2.3	6.6		2.3
EXC-10	J1B9C7	7/12/10	1.73		0.20	3.1		2.5	18.3		2.5
EXC-12	J1B9C9	7/12/10	1.16		0.17	6.1		2.1	13.4		2.1
OB-3	J1B9D4	7/7/10	26.7	D	0.99	6.4	J	2.5	131	D	12.4
Duplicate of J1B9D4	J1B9F4	7/7/10	24.7	D	0.94	6.6	J	2.3	138	D	11.7
OB-1	J1B9D2	7/7/10	2.42		0.21	3.9	J	2.6	4.7		2.6
OB-2	J1B9D3	7/7/10	28.7	D	0.91	4.0	J	2.3	160	D	11.4
OB-4	J1B9D5	7/7/10	7.11		0.21	2.9	J	2.6	17.1		2.6
OB-5	J1B9D6	7/7/10	1.56		0.18	3.6	J	2.2	3.8		2.2
OB-6	J1B9D7	7/7/10	4.75		0.20	4.2	J	2.5	17.6		2.5
OB-7	J1B9D8	7/8/10	2.27		0.19	3.8		2.3	9.5		2.3
OB-8	J1B9D9	7/8/10	1.09		0.19	3.6		2.4	7.0		2.4
OB-9	J1B9F0	7/8/10	1.02		0.20	1.8	B	2.5	3.6		2.5
OB-10	J1B9F1	7/8/10	0.99		0.19	1.6	B	2.4	3.6		2.4
OB-11	J1B9F2	7/8/10	2.95		0.20	3.1		2.5	5.5		2.5
OB-12	J1B9F3	7/8/10	5.36		0.18	1.8	B	2.3	7.5		2.3
FS-1[a]	J1B9D1	7/12/10	8.36		0.20	19.9		2.5	18.1		2.5
FS-1 re-sample	J1FXW2	3/23/11	0.57	BM	0.40	1.4	U	1.4	3.0	B	1.9
Equipment Blank	J1B9F5	7/7/10									

[a] Resampled due to exceedance of cleanup criteria.

Attachment	1	Sheet No.	27 of 27
Originator	J. D. Skoglie	Date	4/26/11
Checked	T. E. Queen	Date	4/26/11
Calc. No.	0100H-CA-V0140	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-H

Discipline: Environmental *Calculation No: 0100H-CA-V0141

Subject: 1607-H1 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 4 Total = 5	J. D. Skoglie	T. E. Queen	B. L. Vedder	D. F. Obenauer	5/17/11

SUMMARY OF REVISION

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/27/2011	Calc. No.:	0100H-CA-V0141	Rev.:	0
Project:	100-H Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	4/27/2011
Subject:	1607-H1 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 4

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 1607-H1 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009a), the following criteria must be met:

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

GIVEN/REFERENCES:

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

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

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

4) WCH, 2011, *Remaining Sites Verification Package for the 1607-H1 Septic Tank and Associated Drain Field*, Attachment to Waste Site Reclassification Form 2010-065, 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:	5/2/2011	Calc. No.:	0100H-CA-V0141	Rev.:	0
Project:	100-H Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/2/2011
Subject:	1607-H1 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 4	

METHODOLOGY:

The 1607-H1 waste site is comprised of two decision units for verification sampling, consisting of the excavation and the overburden. The direct contact hazard quotient and carcinogenic risk calculations for the 1607-H3 waste site were conservatively calculated for the entire waste site using the statistical and focused verification soil sample results (WCH 2011). Of the contaminants of potential concern (COPCs) for this site selenium and nitrogen in nitrate and nitrite require HQ and risk calculations because these analytes were detected above background values. Boron, hexavalent chromium, molybdenum, the detected polycyclic aromatic hydrocarbons, pesticides, semivolatiles, and polychlorinated biphenyls require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead was detected above background; however, lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake. 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 3.68 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 5.1×10^{-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 1.9×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for hexavalent chromium is 0.15 mg/kg, divided by 2.1 mg/kg, and multiplied as indicated, is 7.1×10^{-8}. 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 8.5×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/27/2011	Calc. No.:	0100H-CA-V0141	Rev.:	0
Project:	100-H Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	4/27/2011
Subject:	1607-H1 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 4	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 1607-H1 Waste Site (2 pages).

Contaminants of Potential Concern	Statistical or Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Arsenic[c]	16.0	20	--	--	--
Boron	3.68	7,200	5.1E-04	--	--
Chromium, hexavalent[d]	0.15	240	6.3E-04	2.1	7.1E-08
Lead[e]	69.7	353	--	--	--
Molybdenum	0.388	400	9.7E-04	--	--
Selenium	1.2	400	3.0E-03	--	--
Anions					
Nitrogen in nitrate and nitrite	21.0	128,000	1.6E-04	--	--
Semivolatiles					
Bis(2-ethylhexyl) phthalate	0.282	1,600	1.8E-04	71.4	3.9E-09
Di-n-butylphthalate	0.253	8,000	3.2E-05	--	--
Polyaromatic Hydrocarbons					
Benzo(a)anthracene	0.0728	--	--	1.37	5.3E-08
Benzo(a)pyrene	0.0678	--	--	0.137	4.9E-07
Benzo(b)fluoranthene	0.0559	--	--	1.37	4.1E-08
Benzo(k)fluoranthene	0.0548	--	--	1.37	4.0E-08
Chrysene	0.0783	--	--	13.7	5.7E-09
Fluoranthene	0.171	3,200	5.3E-05	--	--
Phenanthrene[f]	0.153	24,000	6.4E-06	--	--
Pyrene	0.233	2,400	9.7E-05	--	--
Pesticides					
BHC, beta (Hexachlorocyclohexane)	0.00137	--	--	0.556	2.5E-09
DDE, 4,4'-	0.00398	--	--	2.94	1.4E-09
DDT, 4,4'-	0.00129	40	3.2E-05	2.94	4.4E-10
Dieldrin	0.00390	4	9.8E-04	0.0625	6.2E-08
Polychlorinated Biphenyls					
Aroclor-1254	0.0193	1.6	1.2E-02	0.5	3.9E-08
Aroclor-1260	0.0152	--	--	0.5	3.0E-08
Totals					
Cumulative Hazard Quotient:			**1.9E-02**		
Cumulative Excess Cancer Risk:					**8.5E-07**

[a] = From WCH (2011).

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

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

[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 phenanthrene is not available. The cleanup level is based on use of surrogate chemicals. phenanthrene surrogate: anthracene

-- = not applicable RAG = remedial action goal

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	4/27/2011	Calc. No.:	0100H-CA-V0141	Rev.:	0
Project:	100-H Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	4/27/2011
Subject:	1607-H1 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 4	

CONCLUSION:

The calculations in Table 1 demonstrates that the 1607-H1 waste site meets the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk, respectively, as identified in the RDR/RAWP (DOE-RL 2009a) and SAP (DOE-RL 2009b). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-H

Discipline: Environmental *Calculation No: 0100H-CA-V0144

Subject: 1607-H1 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 3 Total = 4	C. H. Dobie	T. E. Queen	B. L. Vedder	D. F. Obenauer	5/17/11

SUMMARY OF REVISION

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	C. H. Dobie	Date:	5/11/2011	Calc. No.:	0100H-CA-V0144	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/11/2011
Subject:	1607-H1 Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for the 1607-H1 site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009), the following criteria must be met:

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

GIVEN/REFERENCES:

1) BHI, 2005, *100 Area Analogous Sites RESRAD Evaluation*, Calculation No. 0100X-CA-V0050 Rev 0, Bechtel Hanford, Inc., Richland, Washington.

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

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

4) WCH, 2011, *1607-H1 Waste Site Cleanup Verification 95% UCL Calculations*, 0100H-CA-V0140, Rev. 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate a HQ for each noncarcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

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

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	C. H. Dobie	Date:	5/3/2011	Calc. No.:	0100H-CA-V0144	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/3/2011
Subject:	1607-H1 Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation					Sheet No. 2 of 3	

METHODOLOGY:

The 1607-H1 waste site was divided into two decision units for the purpose of verification sampling; the excavation, and the overburden soil stockpile. Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at the 1607-H1 site were conservatively calculated for the entire waste site using the statistical or maximum value for each analyte in all decision units from the 95% UCL calculation (WCH 2011). Boron, hexavalent chromium, selenium, nitrogen in nitrate and nitrite, di-n-butylphthalate, and beta BHC are included because they do not have a Hanford Site-specific or Washington State background value available and their respective distribution coefficient is less than necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (BHI 2005). Based on this model and a vadose zone of approximately 7.0 m (23 ft) thickness, a K_d of 10.0 or greater is required to show no predicted migration to groundwater in 1,000 years. All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than or equal to 10.0. Additionally, arsenic was detected above background; however, the arsenic standard is not toxicity based, therefore a groundwater HQ is not calculated. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (mg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720(3)(a)(ii)(A), 1996) x 100 x 1 mg/1000 mg (conversion factor)). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii)(A) (1996). For example, the maximum value for boron of 3.68 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg is 1.2×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The cumulative HQ for the 1607-H1 waste site is 3.3×10^{-1}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, and then multiplied by 1×10^{-6}. For example, the maximum value for beta BHC is 0.00137 mg/kg, divided by 0.00486 mg/kg, and multiplied as indicated, is 2.8×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-6}$, this criterion is met. The cumulative excess cancer risk for the 1607-H1 waste site is also 2.8×10^{-7} since beta BHC is the only COPC subject to the carcinogenic risk calculation. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

4) The soil cleanup RAGs for protection of groundwater are based on the "100 times" provision in WAC 173-340-740(3)(a)(ii)(A). WAC 173-340-740(3)(a)(ii)(A) (1996) provides the "100 times rule" but also states "unless it can be demonstrated that a higher soil concentration is protective of ground water at the site." When the "100 times rule" values are exceeded, RESRAD was used to demonstrate that higher soil concentrations may be protective of groundwater.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	C. H. Dobie	Date:	5/11/2011	Calc. No.:	0100H-CA-V0144	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/11/2011
Subject:	1607-H1 Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	3 of 3

RESULTS:

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

Table 1 shows the results of the calculations.

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 1607-H1 Waste Site.

Contaminants of Potential Concern	Statistical or Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Arsenic	16	20[c]	–	–	–
Boron	3.68	320	1.2E-02	–	–
Chromium, hexavalent	0.15	4.8	3.1E-02	–	–
Selenium	1.2	8	1.5E-01	–	–
Inorganic Anions and TPH					
Nitrogen in Nitrate and Nitrite	21.0	160	1.3E-01	–	–
Semivolatiles					
Di-n-butylphthalate	0.253	160	1.6E-03	–	–
Pesticides					
BHC, beta (Hexachlorocyclohexane)	0.00137	--	–	0.00486	2.8E-07
Polychlorinated Biphenyls					
Totals					
Cumulative Hazard Quotient:			**3.3E-01**		
Cumulative Excess Cancer Risk:					**2.8E-07**

Notes:
[a] = From WCH (2011).
[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.
[c] = The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009a). The arsenic standard is not toxicity based, therefore, will not have a hazard quotient calculated.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 1607-H1 site meets the requirements for the hazard quotients and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2009).

APPENDIX D

SITE-SPECIFIC RESRAD CALCULATION FOR SELENIUM

CALCULATION COVER SHEET

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

Area: 100-H

Discipline: Environmental *Calculation No: 0100H-CA-V0161

Subject: 1607-H1/116-H-1 RESRAD Calculation Brief for Groundwater and River Protection

Computer Program: RESRAD Program No: Version 6.5

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 pg Summary – 5 pg Attm. 1 - 19 pg Attm. 2 - 10 pg Total – 35 pages	S. W. Clark	M. W. Perrott	C. H. Dobie	D. F. Obenauer	4/6/11

SUMMARY OF REVISION

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

Washington Closure Hanford DRAFT CALCULATION SHEET

Originator:	S. W. Clark	Date:	4/6/11	Calc. No.:	0100H-CA-V0161	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	M. W. Perrott	Date:	4/6/11
Subject:	1607-H1/116-H-5 RESRAD Calculation Brief for Groundwater and River Protection					Sheet No. 1 of 5	

PURPOSE:

Predict the groundwater and Columbia River concentrations over a period of 1,000 years from selenium analyses of the soil at the 1607-H1 and 116-H-5 cleanup verification sampling sites.

GIVEN/REFERENCES:

1) Cleanup verification samples were collected from the excavations at the 1607-H1 and 116-H-5 waste sites. Selenium analyses of 1607-H1 sample J1FXV8 (1.2 mg/kg) and 116-H-5 samples JIFKK1 (1.3 mg/kg) and JIFKK2 (1.6 mg/kg) exceeded the selenium soil cleanup level for protection of the Columbia River of 1 mg/kg. The selenium analyses were evaluated by site-specific RESidual RADioactivity (RESRAD) modeling for nonradionuclides as described in Appendix C of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP). Site-specific RESRAD evaluations were performed to predict the selenium concentrations in groundwater due to selenium in the soil at the individual sampling areas. Dilution and attenuation of selenium concentrations in groundwater as it flows from the area of the 1607-H1 and 116-H-5 waste sites to the Columbia River was calculated using the formulas from the U.S. Environmental Protection Agency (EPA) *Soil Screening Guidance: User's Guide*, OSWER 9355.4-23, U.S. Environmental Protection Agency, Washington, D.C.
2) Selenium analyses for HEIS sample numbers J1FXV8, JIFKK1, and JIFKK2 were obtained from laboratory sample data reports.
3) Use of site-specific RESRAD evaluations to predict constituent concentrations in groundwater due to constituent concentrations in the soil at the individual sampling areas is discussed in Appendix C of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) The RESidual RADioactivity (RESRAD) computer code, version 6.5, was developed for the U.S. Department of Energy by the Environmental Assessment Division of Argonne National Laboratory, Argonne, Illinois, to calculate compliance with residual radioactivity guidelines and may be accessed at < http://www.ead.anl.gov/resrad >.
5) Formulas for calculation of dilution and attenuation in groundwater between the waste sites and the Columbia River were obtained from the *Soil Screening Guidance: User's Guide*, OSWER 9355.4-23, July 1996, U.S. Environmental Protection Agency, Washington, D.C.

SOLUTION:

1) As discussed in Section 3.6.9 of the RDR/RAWP, the residual concentrations of nonradionuclides in the soil are compared to the soil remedial action goals (RAGs) for Columbia River protection developed in Table B-6 of Appendix B of the RDR/RAWP. The river protection RAG is attained if the residual concentrations in soil are less than the Table B-6 RAGs and each sample data set meets the requirements of the WAC 173-340-740(7)(e) (1996) three-part test. If this is not the case, a more detailed assessment using RESRAD or other appropriate methods (e.g., dilution-attenuation evaluations) is used to

assess the potential of residual site soil contaminants to impact groundwater and the river. If this assessment indicates that the residual contamination in the site soils will not impact groundwater or the river at concentrations above groundwater or surface water cleanup levels, then the groundwater and river protection RAGs have been attained.

2) Site-specific RESRAD evaluations were performed for the selenium concentrations where the river protection RAG (1 mg/kg) was exceeded at the 1607-H1 and 116-H-5 sample locations. The areas of influence of the site-specific samples for purposes of the RESRAD evaluation are shown in Table 1, which includes other parameters used in the RESRAD and dilution-attenuation calculations. Input factors for the RESRAD evaluation are also shown in the "Summary" section of the RESRAD "Mixture Sums and Single Radionuclide Guidelines" printout in Attachment 1 to this Calculation Summary.

Table 1. Waste Site-Specific Parameters for RESRAD and Dilution-Attenuation Modeling

Parameter	Units	1607-H1 J1FXV8	116-H-5 J1FKK1	116-H-5 J1FKK2
Contaminant-Specific Input Parameters				
Radionuclide Surrogates for Selenium		Cl-36	Cs-135	Gd-152
Selenium Concentrations	mg/kg	1.2	1.3	1.6
Selenium Kd Value	mL/g	5	5	5
Contaminated Zone Dimensions				
Cover Depth	m	0	0	0
Area of Contaminated Zone (CZ)	m^2	3522	427	427
Length Parallel to Aquifer Flow	m	60	21	21
Thickness of Vadose Zone Horizons				
Thickness: Contaminated Zone	m	1.0	1.0	1.0
Thickness: Unsaturated Zone	m	10	0	0
Distance from the Waste Sites to the Columbia River				
Saturated Zone Groundwater Flow Distance	m	850	66.5	56.5

3) The years when the peak selenium concentrations are predicted to occur in groundwater from the waste sites were determined by preliminary RESRAD runs. These years were then added for all horizons for the final RESRAD runs. For the water pathways, the peak years for selenium in groundwater are predicted to occur at year 433 for 1607-H1 (J1FXV8) and at year 16 for 116-H-5 (J1FKK1 and J1FKK2).

METHODOLOGY:

1) Using the methodology described in Appendix C of the RDR/RAWP, RESRAD modeling was used to determine if residual soil concentrations of selenium are protective of groundwater. Runs of RESRAD version 6.5 were completed for the selenium concentrations where the river protection RAG (1 mg/kg) was exceeded in the 1607-H1 and 116-H-5 waste

Washington Closure Hanford DRAFT CALCULATION SHEET

Originator:	S. W. Clark	Date:	4/6/11	Calc. No.:	0100H-CA-V0161	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	M. W. Perrott	Date:	4/6/11
Subject:	1607-H1/116-H-5 RESRAD Calculation Brief for Groundwater and River Protection					Sheet No. 3 of 5	

site cleanup verification sampling activities using long half-life radionuclides chlorine-36 (Cl-36), cesium-135 (Cs-135), and gadolinium-152 (Gd-152) as surrogates for evaluation of the three selenium concentrations shown in Table 1. RESRAD numerical output reports of predicted selenium concentrations in soil and groundwater are presented in Attachment 2 to this calculation summary.

2) Methodology for modeling to predict if soil concentrations are protective of the Columbia River is similar to that for modeling the protection of groundwater, with the groundwater concentration reduced by using a factor to account for dilution and attenuation as contaminants migrate through the groundwater to the river. Calculation of an appropriate dilution factor is accomplished using the formulas in the EPA *Soil Screening Guidance: User's Guide*. The following Excel spreadsheet incorporates the formulas for calculation of the dilution factor to account for dilution and attenuation as contaminants migrate through the groundwater to the river:

Table 2. Excel Calculation of Dilution Factor for Protection of the Columbia River

	A	B	C	D	E	F	G	H
1	Apparent Mixing Zone Depth (d) calculated from EPA *Soil Screening Guidance: User's Guide*, Equation 12:							
2	Apparent Mixing Zone Depth (d) = $(0.0112*L^2)^{0.5} + d_a(1 - \exp((-L*I)/(K*i*d_a)))$							
3	Variable	Value	Description					
4	L1	850	m, Distance to the Columbia River from J1FXV8					
	L2	66.5	m, Distance to the Columbia River from J1FKK1					
	L3	56.5	m, Distance to the Columbia River from J1FKK2					
5	d_a	10	m, Aquifer Thickness					
6	I	0.07992	m/yr, Infiltration Rate, from I = (1-Ce((1-Cr)Pr + Irr					
7	Ce	0.91	Evapotranspiration Coefficient					
8	Cr	0.2	Runoff Coefficient					
9	Pr	0.16	m/yr, Precipitation					
10	Irr	0.76	m/yr, Irrigation					
11	K	5530	m/yr, Aquifer Hydraulic Conductivity					
12	i	0.00125	m/m, Hydraulic Gradient					
13								
14	Calculation of Dilution Factor per the EPA *Soil Screening Guidance: User's Guide*, Equation 11.							
15	Dilution Factor, D = 1 + (K*i*d/I*L)							
16	Variable	Value	Description					
17	K	5530	m/yr, Aquifer Hydraulic Conductivity					
18	i	0.00125	m/m, Hydraulic Gradient					
19	d	107.2	m, Apparent Mixing Zone Depth (see formula below)					
20	I	0.07992	m/yr, Infiltration Rate, from I = (1-Ce((1-Cr)Pr + Irr					
21	L1	850	m, Distance to the Columbia River from J1FXV8					
	L2	66.5	m, Distance to the Columbia River from J1FKK1					
	L3	56.5	m, Distance to the Columbia River from J1FKK2					
22	Apparent Mixing Zone Depth (d) = E24 = ((0.0112*B4*B4)^0.5)+(B5*(1-EXP((-B4)*(B6)/(B11*B12*B5)))							
23	Dilution Factor (D) = E25 = 1+((B17*B18*B19)/(B20*B21))							
24	J1FXV8 Apparent Mixing Zone Depth (d) =				96.2	m		
	J1FKK1 Apparent Mixing Zone Depth (d) =				7.04	m		
	J1FKK2 Apparent Mixing Zone Depth (d) =				5.98	m		
25	J1FXV8 Dilution Factor (D) =				10.8			
	J1FKK1 Dilution Factor (D) =				10.1			
	J1F KK2 Dilution Factor (D) =				10.2			

Washington Closure Hanford DRAFT CALCULATION SHEET

Originator:	S. W. Clark SWC	Date:	4/6/11	Calc. No.:	0100H-CA-V0161	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	M. W. Perrott MWP	Date:	4/6/11
Subject:	1607-H1/116-H-5 RESRAD Calculation Brief for Groundwater and River Protection					Sheet No. 4 of 5	

RESULTS:

1) Groundwater Protection

The selenium concentrations in groundwater at different time intervals for 1,000 years were calculated by the RESRAD model using Cl-36, Cs-135, and Gd-152 as radionuclide surrogates for selenium. RESRAD output is presented in Attachment 2 and summarized in Table 3. Selenium is predicted to reach groundwater within the 1,000 years of the RESRAD model evaluation and is predicted to peak at year 433 for 1607-H1 and at year 16 for 116-H-5 at the maximum groundwater concentrations shown in Table 3, which are less than the groundwater remedial action goal (RAG) of 50 ug/L per Table B-2 of Appendix B of the RDR/RAWP.

Table 3. Predicted Groundwater (Well Water/Drinking Water) Concentrations at 1607-H1 and 116-H-5

Contaminant	Waste Site & HEIS Number	Groundwater Concentrations in ug/L at Each Time Interval (yr)								RAG, ug/L
		0	1	10	16	30	433	500	1000	
Selenium	1607-H1; J1FXV8	0	0	0	0	0	28.4	14.8	0.11	50[a]
Selenium	116-H-5; J1FKK1	0	0.84	8.00	12.4	10.8	0.21	0.11	0	50[a]
Selenium	116-H-5; J1FKK2	0	1.03	9.85	15.3	13.3	0.26	0.14	0	50[a]

[a] Based on the maximum contaminant level (MCL) for selenium from 40 CFR 141, as discussed in Appendix B, Table B-2, of the 100 Area RDR/RAWP.

2) Columbia River Protection

Predicted selenium concentrations in groundwater at the Columbia River were calculated by dividing the predicted groundwater concentrations at the 1607-H1 and 116-H-5 waste sites in Table 3 by the dilution factors determined in Table 2. Results are summarized in Table 4. Due to dilution and attenuation, selenium is predicted to reach the river at maximum groundwater concentrations less than the remedial action goal (RAG) of 5.0 ug/L, per Table B-3 in Appendix B of the RDR/RAWP.

Table 4. Predicted Groundwater Concentrations at the Columbia River Based on Dilution and Attenuation of Groundwater from 1607-H1 and 116-H-5

Contaminant	Waste Site & HEIS Number	Groundwater Concentrations in ug/L at Each Time Interval (yr)								RAG, ug/L
		0	1	10	16	30	433	500	1000	
Selenium	1607-H1; J1FXV8	0	0	0	0	0	2.63	1.37	0.010	5.0[a]
Selenium	116-H-5; J1FKK1	0	0.083	0.79	1.23	1.07	0.021	0.011	0	5.0[a]
Selenium	116-H-5; J1FKK2	0	0.101	0.97	1.50	1.30	0.025	0.014	0	5.0[a]

[a] Based on the surface water ambient water quality criteria (AWQC) for selenium from 40 CFR 131.36, as discussed in Appendix B, Table B-3, of the 100 Area RDR/RAWP.

Washington Closure Hanford DRAFT CALCULATION SHEET

Originator:	S. W. Clark	Date:	4/6/11	Calc. No.:	0100H-CA-V0161	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	M. W. Perrott	Date:	4/6/11
Subject:	1607-H1/116-H-5 RESRAD Calculation Brief for Groundwater and River Protection					Sheet No. 5 of 5	

CONCLUSIONS:

- Maximum selenium concentrations in the soil at the 1607-H1 and 116-H-5 waste sites are predicted to be protective of groundwater and the Columbia River for 1,000 years based upon RESRAD vadose zone modeling and evaluation of dilution-attenuation in the saturated zone using the formulas in the EPA *Soil Screening Guidance: User's Guide.*

- The selenium concentrations in groundwater at different time intervals to 1,000 years as calculated by the RESRAD model using Cl-36, Cs-135, and Gd-152 as radionuclide surrogates are summarized in Table 3. Selenium concentrations in groundwater at 1607-H1 are predicted to peak at year 433 at a maximum concentration of 28.4 ug/L. Selenium concentrations in groundwater at 116-H-5 are predicted to peak at year 16 at a maximum concentration of 15.3 ug/L. The predicted maximum groundwater concentrations at both 1607-H1 and 116-H-5 are less than the groundwater cleanup RAG of 50 ug/L per Table B-2 in Appendix B of the RDR/RAWP.

- Selenium concentrations in groundwater at the Columbia River were calculated by dividing the predicted groundwater concentrations at the 1607-H1 and 116-H-5 waste sites in Table 3 by the dilution factors determined in Table 2. Results are summarized in Table 4. Due to dilution and attenuation, selenium from 1607-H1 is predicted to reach the river at a maximum concentration of 2.63 ug/L. Selenium from 116-H-5 is predicted to reach the river at a maximum concentration of 1.50 ug/L. The predicted maximum groundwater concentrations at the river from both 1607-H1 and 116-H-5 are predicted to be less than the surface water cleanup RAG of 5.0 ug/L per Table B-3 of Appendix B of the RDR/RAWP.

ATTACHMENTS:

1. RESRAD Output: 1607-H1 and 116-H-5 Selenium Groundwater and River Protection – Mixture Sums and Single Radionuclide Guidelines (19 pages)
2. RESRAD Output: 1607-H1 and 116-H-5 Selenium Groundwater and River Protection – Concentration of Radionuclides, (10 pages)

ATTACHMENT 1

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1RESRAD, Version 6.5      T« Limit = 180 days       04/05/2011  14:44  Page   1
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
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Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page   2
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD

                         Dose Conversion Factor (and Related) Parameter Summary
                                     Dose Library: FGR 12 & FGR 11
0       ³                                                       ³  Current  ³   Base    ³ Parameter
 Menu ³                          Parameter                      ³  Value#   ³   Case*   ³   Name
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 A-1  ³ DCF's for external ground radiation, (mrem/yr)/(pCi/g)  ³           ³           ³
 A-1  ³ Cl-36    (Source: FGR 12)                               ³ 2.391E-03 ³ 2.391E-03 ³ DCF1(  1)
 A-1  ³ Cs-135   (Source: FGR 12)                               ³ 3.830E-05 ³ 3.830E-05 ³ DCF1(  2)
 A-1  ³ Gd-152   (Source: FGR 12)                               ³ 0.000E+00 ³ 0.000E+00 ³ DCF1(  3)
      ³                                                         ³           ³           ³
 B-1  ³ Dose conversion factors for inhalation, mrem/pCi:       ³           ³           ³
 B-1  ³ Cl-36                                                   ³ 2.190E-05 ³ 2.190E-05 ³ DCF2(  1)
 B-1  ³ Cs-135                                                  ³ 4.550E-06 ³ 4.550E-06 ³ DCF2(  2)
 B-1  ³ Gd-152                                                  ³ 2.430E-01 ³ 2.430E-01 ³ DCF2(  3)
      ³                                                         ³           ³           ³
 D-1  ³ Dose conversion factors for ingestion, mrem/pCi:        ³           ³           ³
 D-1  ³ Cl-36                                                   ³ 3.030E-06 ³ 3.030E-06 ³ DCF3(  1)
 D-1  ³ Cs-135                                                  ³ 7.070E-06 ³ 7.070E-06 ³ DCF3(  2)
 D-1  ³ Gd-152                                                  ³ 1.610E-04 ³ 1.610E-04 ³ DCF3(  3)
      ³                                                         ³           ³           ³
 D-34 ³ Food transfer factors:                                  ³           ³           ³
 D-34 ³ Cl-36      , plant/soil concentration ratio, dimensionless ³ 2.000E+01 ³ 2.000E+01 ³ RTF(  1,1)
 D-34 ³ Cl-36      , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ³ 6.000E-02 ³ 6.000E-02 ³ RTF(  1,2)
 D-34 ³ Cl-36      , milk/livestock-intake ratio, (pCi/L)/(pCi/d)  ³ 2.000E-02 ³ 2.000E-02 ³ RTF(  1,3)
 D-34 ³                                                         ³           ³           ³
 D-34 ³ Cs-135     , plant/soil concentration ratio, dimensionless ³ 4.000E-02 ³ 4.000E-02 ³ RTF(  2,1)
 D-34 ³ Cs-135     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ³ 3.000E-02 ³ 3.000E-02 ³ RTF(  2,2)
 D-34 ³ Cs-135     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)  ³ 8.000E-03 ³ 8.000E-03 ³ RTF(  2,3)
 D-34 ³                                                         ³           ³           ³
 D-34 ³ Gd-152     , plant/soil concentration ratio, dimensionless ³ 2.500E-03 ³ 2.500E-03 ³ RTF(  3,1)
 D-34 ³ Gd-152     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ³ 2.000E-03 ³ 2.000E-03 ³ RTF(  3,2)
 D-34 ³ Gd-152     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)  ³ 2.000E-05 ³ 2.000E-05 ³ RTF(  3,3)
      ³                                                         ³           ³           ³
 D-5  ³ Bioaccumulation factors, fresh water, L/kg:             ³           ³           ³
 D-5  ³ Cl-36      , fish                                       ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC(  1,1)
 D-5  ³ Cl-36      , crustacea and mollusks                     ³ 1.900E+02 ³ 1.900E+02 ³ BIOFAC(  1,2)
 D-5  ³                                                         ³           ³           ³
 D-5  ³ Cs-135     , fish                                       ³ 2.000E+03 ³ 2.000E+03 ³ BIOFAC(  2,1)
 D-5  ³ Cs-135     , crustacea and mollusks                     ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  2,2)
 D-5  ³                                                         ³           ³           ³
 D-5  ³ Gd-152     , fish                                       ³ 2.500E+01 ³ 2.500E+01 ³ BIOFAC(  3,1)
 D-5  ³ Gd-152     , crustacea and mollusks                     ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC(  3,2)
ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
 #For DCF1(xxx) only, factors are for infinite depth & area.  See ETFG table in Ground Pathway of Detailed Report.
 *Base Case means Default.Lib w/o Associate Nuclide contributions.
```

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Originator: S. W. Clark	Date 4/6/2011
Chk'd By M. W. Perrott	Date 4/6/2011
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ATTACHMENT 1

```
1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page   3
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of HEIS # J1FXV8 contaminated zone (m**2)	3.522E+03	1.000E+04	---	AREA
R011	Area of HEIS # J1FKK1 contaminated zone (m**2)	4.270E+02	1.000E+04	---	AREA
R011	Area of HEIS # J1FKK2 contaminated zone (m**2)	4.270E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.000E+00	2.000E+00	---	THICKO
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	HEIS # J1FXV8 Length parallel to aquifer flow (m)	6.000E+01	1.000E+02	---	LCZPAQ
R011	HEIS # J1FKK1 Length parallel to aquifer flow (m)	2.100E+01	1.000E+02	---	LCZPAQ
R011	HEIS # J1FKK2 Length parallel to aquifer flow (m)	2.100E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	1.000E+01	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.600E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	3.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	4.330E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	5.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Cl-36	1.200E+00	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Cs-135	1.300E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Gd-152	1.600E+00	0.000E+00	---	S1(3)
R012	Concentration in groundwater (pCi/L): Cl-36	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Cs-135	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Gd-152	not used	0.000E+00	---	W1(3)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVERD
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	1.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.400E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.100E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.600E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	7.600E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03	---	VWT

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Chk'd By M. W. Perrott Date 4/6/2011
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ATTACHMENT 1

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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page   4
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	HEIS # J1FXV8 Unsat. zone 1, thickness (m)	1.000E+01	4.000E+00	---	H(1)
R015	HEIS # J1FKK1 Unsat. zone 1, thickness (m)	0.000E+00	4.000E+00	---	H(1)
R015	HEIS # J1FKK2 Unsat. zone 1, thickness (m)	0.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	1.500E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.500E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Cl-36				
R016	Contaminated zone (cm**3/g)	5.000E+00	1.000E-01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+00	1.000E-01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	5.000E+00	1.000E-01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.754E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Cs-135				
R016	Contaminated zone (cm**3/g)	5.000E+00	4.600E+03	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+00	4.600E+03	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	5.000E+00	4.600E+03	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.754E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Gd-152				
R016	Contaminated zone (cm**3/g)	5.000E+00	-1.000E+00	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+00	-1.000E+00	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	5.000E+00	-1.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.754E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
RD17	Inhalation rate (m**3/yr)	not used	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	not used	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	not used	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	not used	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	not used	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	not used	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	not used	1.000E+00	>0 shows circular AREA.	FS

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Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
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ATTACHMENT 1

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1RESRAD, Version 6.5      T½ Limit = 180 days        04/05/2011  14:44  Page   5
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI

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Originator: S. W. Clark Date 4/6/2011
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ATTACHMENT 1

```
1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page   6
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	not used	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL

Attachment 1 Sheet No. 6 of 19
Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
Calc. No. 0100H-CA-V0161 Rev. No. 0

ATTACHMENT 1

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1RESRAD, Version 6.5      T½ Limit = 180 days       04/05/2011  14:44  Page   7
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	1	---	---	LYMAX
TITL	Maximum number of integration points for risk	5	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	suppressed
2 -- inhalation (w/o radon)	suppressed
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	suppressed
9 -- radon	suppressed
Find peak pathway doses	suppressed

Attachment	1	Sheet No.	7 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
Calc. No.	0100H-CA-V0161	Rev. No.	0

ATTACHMENT 1

1RESRAD, Version 6.5 T« Limit = 180 days 04/05/2011 14:44 Page 8
Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD

Contaminated Zone Dimensions	
HEIS # J1FXV8 Area:	427.00 square meters
HEIS # J1FKK1 Area:	427.00 square meters
HEIS # J1FKK2 Area:	427.00 square meters
Thickness:	1.00 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g	
Cl-36	1.200E+00
Cs-135	1.300E+00
Gd-152	1.600E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	1.000E+01	1.600E+01	3.000E+01	3.000E+02	4.330E+02	5.000E+02	1.000E+03
TDOSE(t):	0.000E+00	1.266E-01	1.215E+00	1.883E+00	1.643E+00	1.180E-01	3.225E-02	1.678E-02	1.278E-04
M(t):	0.000E+00	8.440E-03	8.101E-02	1.256E-01	1.095E-01	7.867E-03	2.150E-03	1.118E-03	8.523E-06

Maximum TDOSE(t): 1.884E+00 mrem/yr at t = 15.97 ñ 0.03 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.597E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.597E+01 years
Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	2.533E-02	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.533E-02	0.0134
Cs-135	6.402E-02	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.402E-02	0.0340
Gd-152	1.794E+00	0.9526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.794E+00	0.9526
Total	1.884E+00	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.884E+00	1.0000

0*Sum of all water independent and dependent pathways.

Attachment 1	Sheet No. 8 of 19
Originator: S. W. Clark	Date 4/6/2011
Chk'd By M. W. Perrott	Date 4/6/2011
Calc. No. 0100H-CA-V0161	Rev. No. 0

ATTACHMENT 1

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1RESRAD, Version 6.5      T½ Limit = 180 days        04/05/2011  14:44  Page   9
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Attachment 1 Sheet No. 9 of 19
Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
Calc. No. 0100H-CA-V0161 Rev. No. 0

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1RESRAD, Version 6.5      T½ Limit = 180 days        04/05/2011  14:44  Page  10
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio- Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Cl-36	1.702E-03	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.702E-03	0.0134
Cs-135	4.303E-03	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.303E-03	0.0340
Gd-152	1.206E-01	0.9526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.206E-01	0.9526
Total	1.266E-01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.266E-01	1.0000

*Sum of all water independent and dependent pathways.

Attachment	1	Sheet No.	10 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page  11
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	1.634E-02	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.634E-02	0.0134
Cs-135	4.130E-02	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.130E-02	0.0340
Gd-152	1.158E+00	0.9526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.158E+00	0.9526
Total	1.215E+00	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.215E+00	1.0000

*Sum of all water independent and dependent pathways.

Attachment	1	Sheet No.	11 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
Calc. No.	0100H-CA-V0161	Rev. No.	0

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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page  12
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.600E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.600E+01 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	2.532E-02	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.532E-02	0.0134
Cs-135	6.401E-02	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.401E-02	0.0340
Gd-152	1.794E+00	0.9526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.794E+00	0.9526
Total	1.883E+00	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.883E+00	1.0000

*Sum of all water independent and dependent pathways.

Attachment	1	Sheet No.	12 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
Calc. No.	0100H-CA-V0161	Rev. No.	0

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1RESRAD, Version 6.5      T« Limit = 180 days       04/05/2011  14:44  Page  13
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	2.209E-02	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.209E-02	0.0134
Cs-135	5.584E-02	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.584E-02	0.0340
Gd-152	1.565E+00	0.9526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.565E+00	0.9526
Total	1.643E+00	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.643E+00	1.0000

*Sum of all water independent and dependent pathways.

Attachment 1 Sheet No. 13 of 19
Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
Calc. No. 0100H-CA-V0161 Rev. No. 0

ATTACHMENT 1

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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page  14
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	1.586E-03	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.586E-03	0.0134
Cs-135	4.010E-03	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.010E-03	0.0340
Gd-152	1.124E-01	0.9526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.124E-01	0.9526
Total	1.180E-01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.180E-01	1.0000

*Sum of all water independent and dependent pathways.

Attachment	1	Sheet No.	14 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
Calc. No.	0100H-CA-V0161	Rev. No.	0

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1RESRAD, Version 6.5      T« Limit = 180 days       04/05/2011  14:44  Page  15
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.330E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.330E+02 years
Water Dependent Pathways

Radio- Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Cl-36	4.332E-04	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.332E-04	0.0134
Cs-135	1.096E-03	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.096E-03	0.0340
Gd-152	3.072E-02	0.9526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.072E-02	0.9526
Total	3.225E-02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.225E-02	1.0000

*Sum of all water independent and dependent pathways.

Attachment	1	Sheet No.	15 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
Calc. No.	0100H-CA-V0161	Rev. No.	0

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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page  16
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	2.253E-04	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.253E-04	0.0134
Cs-135	5.701E-04	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.701E-04	0.0340
Gd-152	1.598E-02	0.9526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.598E-02	0.9526
Total	1.678E-02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.678E-02	1.0000

*Sum of all water independent and dependent pathways.

Attachment	1	Sheet No.	16 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
Calc. No.	0100H-CA-V0161	Rev. No.	0

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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page  17
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-135	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Gd-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cl-36	1.715E-06	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.715E-06	0.0134
Cs-135	4.344E-06	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.344E-06	0.0340
Gd-152	1.218E-04	0.9526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.218E-04	0.9526
Total	1.278E-04	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.278E-04	1.0000

*Sum of all water independent and dependent pathways.

Attachment	1	Sheet No.	17 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
Calc. No.	0100H-CA-V0161	Rev. No.	0

ATTACHMENT 1

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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page  18
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD

                                   Dose/Source Ratios Summed Over All Pathways
                             Parent and Progeny Principal Radionuclide Contributions Indicated
0  Parent    Product    Thread                          DSR(j,t) At Time in Years   (mrem/yr)/(pCi/g)
    (i)       (j)      Fraction   0.000E+00 1.000E+00 1.000E+01 1.600E+01 3.000E+01 3.000E+02 4.330E+02 5.000E+02 1.000E+03
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 Cl-36      Cl-36      1.000E+00  0.000E+00 1.419E-03 1.361E-02 2.110E-02 1.841E-02 1.321E-03 3.610E-04 1.878E-04 1.429E-06
0Cs-135     Cs-135     1.000E+00  0.000E+00 3.310E-03 3.177E-02 4.924E-02 4.295E-02 3.085E-03 8.430E-04 4.385E-04 3.341E-06
0Gd-152     Gd-152     1.000E+00  0.000E+00 7.537E-02 7.234E-01 1.121E+00 9.782E-01 7.026E-02 1.920E-02 9.988E-03 7.612E-05
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 The DSR includes contributions from associated (half-life ó 180 days) daughters.
0
                                   Single Radionuclide Soil Guidelines G(i,t) in pCi/g
                                      Basic Radiation Dose Limit = 1.500E+01 mrem/yr
0Nuclide
   (i)     t= 0.000E+00   1.000E+00   1.000E+01   1.600E+01   3.000E+01   3.000E+02   4.330E+02   5.000E+02   1.000E+03
 ÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄ
 Cl-36     *3.302E+10   1.057E+04   1.102E+03   7.108E+02   8.149E+02   1.135E+04   4.155E+04   7.989E+04   1.050E+07
 Cs-135    *1.152E+09   4.532E+03   4.722E+02   3.046E+02   3.492E+02   4.862E+03   1.779E+04   3.420E+04   4.489E+06
 Gd-152    *2.179E+01  *2.179E+01   2.073E+01   1.338E+01   1.533E+01  *2.179E+01  *2.179E+01  *2.179E+01  *2.179E+01
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 *At specific activity limit
0
            Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
            and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
         at tmin = time of minimum single radionuclide soil guideline
      and at tmax = time of maximum total dose =   15.97 ñ 0.03 years
0Nuclide  Initial        tmin       DSR(i,tmin) G(i,tmin) DSR(i,tmax) G(i,tmax)
   (i)    (pCi/g)      (years)                  (pCi/g)                (pCi/g)
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ
 Cl-36   1.200E+00   15.97 ñ 0.03   2.111E-02 7.107E+02 2.111E-02 7.107E+02
 Cs-135  1.300E+00   15.97 ñ 0.03   4.925E-02 3.046E+02 4.925E-02 3.046E+02
 Gd-152  1.600E+00   15.97 ñ 0.03   1.122E+00 1.337E+01 1.122E+00 1.337E+01
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Attachment	1	Sheet No.	18 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
Calc. No.	0100H-CA-V0161	Rev. No.	0

ATTACHMENT 1

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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page  19
 Summary : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD

                                   Individual Nuclide Dose Summed Over All Pathways
                                     Parent Nuclide and Branch Fraction Indicated
ONuclide Parent   THF(i)                                        DOSE(j,t), mrem/yr
   (j)     (i)            t= 0.000E+00 1.000E+00 1.000E+01 1.600E+01 3.000E+01 3.000E+02 4.330E+02 5.000E+02 1.000E+03
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ
 Cl-36   Cl-36   1.000E+00    0.000E+00 1.702E-03 1.634E-02 2.532E-02 2.209E-02 1.586E-03 4.332E-04 2.253E-04 1.715E-06
OCs-135  Cs-135  1.000E+00    0.000E+00 4.303E-03 4.130E-02 6.401E-02 5.584E-02 4.010E-03 1.096E-03 5.701E-04 4.344E-06
OGd-152  Gd-152  1.000E+00    0.000E+00 1.206E-01 1.158E+00 1.794E+00 1.565E+00 1.124E-01 3.072E-02 1.598E-02 1.218E-04
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 THF(i) is the thread fraction of the parent nuclide.


                                   Individual Nuclide Soil Concentration
                                     Parent Nuclide and Branch Fraction Indicated
ONuclide Parent   THF(i)                                          S(j,t), pCi/g
   (j)     (i)            t= 0.000E+00 1.000E+00 1.000E+01 1.600E+01 3.000E+01 3.000E+02 4.330E+02 5.000E+02 1.000E+03
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ
 Cl-36   Cl-36   1.000E+00    1.200E+00 1.188E+00 1.088E+00 1.027E+00 8.955E-01 6.428E-02 1.756E-02 9.134E-03 6.953E-05
OCs-135  Cs-135  1.000E+00    1.300E+00 1.287E+00 1.179E+00 1.112E+00 9.702E-01 6.968E-02 1.904E-02 9.905E-03 7.547E-05
OGd-152  Gd-152  1.000E+00    1.600E+00 1.584E+00 1.451E+00 1.369E+00 1.194E+00 8.577E-02 2.344E-02 1.219E-02 9.292E-05
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 THF(i) is the thread fraction of the parent nuclide.
ORESCALC.EXE execution time =    6.00 seconds
```

Attachment	1	Sheet No.	19 of 19
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
Calc. No.	0100H-CA-V0161	Rev. No.	0

ATTACHMENT 2

```
1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page   1
 Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD

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                    ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
          Part IV: Concentration of Radionuclides
          ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ

 Concentration of radionuclides in different media
      Time= 0.000E+00 ..................................   2
      Time= 1.000E+00 ..................................   3
      Time= 1.000E+01 ..................................   4
      Time= 1.600E+01 ..................................   5
      Time= 3.000E+01 ..................................   6
      Time= 3.000E+02 ..................................   7
      Time= 4.330E+02 ..................................   8
      Time= 5.000E+02 ..................................   9
      Time= 1.000E+03 ..................................  10
```

Attachment 2 Sheet No. 1 of 10
Originator: S. W. Clark SWC Date 4/6/2011
Chk'd By M. W. Perrott MWP Date 4/6/2011
Calc. No. 0100H-CA-V0161 Rev. No. 0

ATTACHMENT 2

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1RESRAD, Version 6.5      T« Limit = 180 days       04/05/2011  14:44  Page   2
 Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Concentration of radionuclides in environmental media
at t = 0.000E+00 years

Radio-Nuclide	Contaminated Zone pCi/g	Surface Soil* pCi/g	Air Particulate pCi/m**3	Well Water pCi/L	Surface Water pCi/L
Cl-36	1.200E+00	1.200E+00	1.353E-05	0.000E+00	0.000E+00
Cs-135	1.300E+00	1.300E+00	1.173E-05	0.000E+00	0.000E+00
Gd-152	1.600E+00	1.600E+00	1.444E-05	0.000E+00	0.000E+00

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 0.000E+00 years*

Radio-Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
Cl-36	0.000E+00	2.400E+04	2.400E+04	2.400E+04	2.400E+04	9.796E+04	2.641E+04	0.000E+00	0.000E+00
Cs-135	0.000E+00	5.200E+01	5.200E+01	5.200E+01	5.200E+01	1.256E+02	2.808E+01	0.000E+00	0.000E+00
Gd-152	0.000E+00	4.001E+00	4.004E+00	4.004E+00	4.004E+00	2.145E+00	2.040E-02	0.000E+00	0.000E+00

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment	2	Sheet No.	2 of 10
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
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ATTACHMENT 2

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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page   3
 Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Concentration of radionuclides in environmental media
at t = 1.000E+00 years

Radio-Nuclide	Contaminated Zone pCi/g	Surface Soil* pCi/g	Air Particulate pCi/m**3	Well Water pCi/L	Surface Water pCi/L
Cl-36	1.188E+00	1.188E+00	1.340E-05	0.000E+00	0.000E+00
Cs-135	1.287E+00	1.287E+00	1.162E-05	8.360E-01	6.763E-03
Gd-152	1.584E+00	1.584E+00	1.430E-05	1.029E+00	8.324E-03

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.000E+00 years*

Radio-Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
Cl-36	0.000E+00	2.378E+04	2.377E+04	2.381E+04	2.380E+04	9.717E+04	2.619E+04	0.000E+00	0.000E+00
Cs-135	8.337E-01	5.258E+01	5.675E+01	5.632E+01	5.659E+01	1.354E+02	3.111E+01	1.327E+01	6.634E-01
Gd-152	1.026E+00	5.259E+00	1.040E+01	9.788E+00	1.015E+01	3.014E+00	3.029E-02	2.041E-01	8.165E+00

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment	2	Sheet No.	3 of 10
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
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1RESRAD, Version 6.5      T« Limit = 180 days       04/05/2011  14:44  Page   4
 Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Concentration of radionuclides in environmental media
at t = 1.000E+01 years

Radio-Nuclide	Contaminated Zone pCi/g	Surface Soil* pCi/g	Air Particulate pCi/m**3	Well Water pCi/L	Surface Water pCi/L
Cl-36	1.088E+00	1.088E+00	1.228E-05	0.000E+00	0.000E+00
Cs-135	1.179E+00	1.179E+00	1.064E-05	8.004E+00	6.475E-02
Gd-152	1.451E+00	1.451E+00	1.310E-05	9.851E+00	7.970E-02

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.000E+01 years*

Radio-Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
Cl-36	0.000E+00	2.178E+04	2.177E+04	2.181E+04	2.180E+04	8.901E+04	2.399E+04	0.000E+00	0.000E+00
Cs-135	8.002E+00	5.778E+01	9.770E+01	1.015E+02	1.018E+02	2.368E+02	5.974E+01	1.293E+02	6.463E+00
Gd-152	9.849E+00	1.651E+01	6.559E+01	7.038E+01	7.071E+01	1.200E+01	1.238E-01	1.989E+00	7.955E+01

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment	2	Sheet No.	4 of 10
Originator:	S. W. Clark	Date	4/6/2011
Chk'd By	M. W. Perrott	Date	4/6/2011
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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page   5
Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Concentration of radionuclides in environmental media
at t = 1.600E+01 years

Radio-Nuclide	Contaminated Zone pCi/g	Surface Soil* pCi/g	Air Particulate pCi/m**3	Well Water pCi/L	Surface Water pCi/L
Cl-36	1.027E+00	1.027E+00	1.158E-05	0.000E+00	0.000E+00
Cs-135	1.112E+00	1.112E+00	1.004E-05	1.240E+01	1.003E-01
Gd-152	1.369E+00	1.369E+00	1.235E-05	1.526E+01	1.235E-01

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.600E+01 years*

Radio-Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
Cl-36	0.000E+00	2.054E+04	2.053E+04	2.057E+04	2.056E+04	8.394E+04	2.262E+04	0.000E+00	0.000E+00
Cs-135	1.240E+01	6.099E+01	1.228E+02	1.295E+02	1.298E+02	2.996E+02	7.743E+01	2.007E+02	1.004E+01
Gd-152	1.527E+01	2.347E+01	9.948E+01	1.079E+02	1.082E+02	1.757E+01	1.816E-01	3.088E+00	1.235E+02

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 2 Sheet No. 5 of 10
Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page   6
 Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
```

Concentration of radionuclides in environmental media
at t = 3.000E+01 years

Radio-Nuclide	Contaminated Zone pCi/g	Surface Soil* pCi/g	Air Particulate pCi/m**3	Well Water pCi/L	Surface Water pCi/L
Cl-36	8.955E-01	8.955E-01	1.010E-05	0.000E+00	0.000E+00
Cs-135	9.702E-01	9.702E-01	8.756E-06	1.082E+01	8.753E-02
Gd-152	1.194E+00	1.194E+00	1.078E-05	1.332E+01	1.077E-01

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 3.000E+01 years*

Radio-Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
Cl-36	0.000E+00	1.792E+04	1.791E+04	1.794E+04	1.793E+04	7.323E+04	1.973E+04	0.000E+00	0.000E+00
Cs-135	1.082E+01	5.321E+01	1.071E+02	1.137E+02	1.136E+02	2.627E+02	6.772E+01	1.751E+02	8.754E+00
Gd-152	1.332E+01	2.048E+01	8.678E+01	9.495E+01	9.490E+01	1.544E+01	1.589E-01	2.694E+00	1.077E+02

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 2 Sheet No. 6 of 10
Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
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Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD

Concentration of radionuclides in environmental media
at t = 3.000E+02 years

Radio-Nuclide	Contaminated Zone pCi/g	Surface Soil* pCi/g	Air Particulate pCi/m**3	Well Water pCi/L	Surface Water pCi/L
Cl-36	6.428E-02	6.428E-02	7.250E-07	0.000E+00	0.000E+00
Cs-135	6.968E-02	6.968E-02	6.289E-07	7.770E-01	6.286E-03
Gd-152	8.577E-02	8.577E-02	7.740E-07	9.564E-01	7.737E-03

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 3.000E+02 years*

Radio-Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
Cl-36	0.000E+00	1.286E+03	1.286E+03	1.288E+03	1.287E+03	5.256E+03	1.417E+03	0.000E+00	0.000E+00
Cs-135	7.770E-01	3.821E+00	7.695E+00	8.164E+00	8.160E+00	1.887E+01	4.864E+00	1.257E+01	6.287E-01
Gd-152	9.565E-01	1.471E+00	6.233E+00	6.819E+00	6.816E+00	1.109E+00	1.142E-02	1.935E-01	7.739E+00

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 2 Sheet No. 7 of 10
Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
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1RESRAD, Version 6.5 T« Limit = 180 days 04/05/2011 14:44 Page 8
Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD

Concentration of radionuclides in environmental media
at t = 4.330E+02 years

Radio-Nuclide	Contaminated Zone pCi/g	Surface Soil* pCi/g	Air Particulate pCi/m**3	Well Water pCi/L	Surface Water pCi/L
Cl-36	1.756E-02	1.756E-02	1.981E-07	2.841E+01	6.635E-01
Cs-135	1.904E-02	1.904E-02	1.718E-07	2.123E-01	1.718E-03
Gd-152	2.344E-02	2.344E-02	2.115E-07	2.614E-01	2.114E-03

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 4.330E+02 years*

Radio-Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
Cl-36	2.841E+01	6.332E+02	8.894E+02	6.633E+02	6.630E+02	2.792E+03	8.204E+02	6.636E+02	1.261E+02
Cs-135	2.123E-01	1.044E+00	2.103E+00	2.231E+00	2.230E+00	5.155E+00	1.329E+00	3.436E+00	1.718E-01
Gd-152	2.614E-01	4.019E-01	1.703E+00	1.864E+00	1.863E+00	3.031E-01	3.120E-03	5.287E-02	2.115E+00

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 2 Sheet No. 8 of 10
Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
Calc. No. 0100H-CA-V0161 Rev. No. 0

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1RESRAD, Version 6.5 T« Limit = 180 days 04/05/2011 14:44 Page 9
Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
File : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD

Concentration of radionuclides in environmental media
at t = 5.000E+02 years

Radio-Nuclide	Contaminated Zone pCi/g	Surface Soil* pCi/g	Air Particulate pCi/m**3	Well Water pCi/L	Surface Water pCi/L
Cl-36	9.134E-03	9.134E-03	1.030E-07	1.478E+01	3.451E-01
Cs-135	9.905E-03	9.905E-03	8.940E-08	1.105E-01	8.936E-04
Gd-152	1.219E-02	1.219E-02	1.100E-07	1.360E-01	1.100E-03

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 5.000E+02 years*

Radio-Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
Cl-36	1.478E+01	3.294E+02	4.626E+02	3.450E+02	3.448E+02	1.452E+03	4.267E+02	3.452E+02	6.559E+01
Cs-135	1.105E-01	5.432E-01	1.094E+00	1.161E+00	1.160E+00	2.682E+00	6.914E-01	1.788E+00	8.938E-02
Gd-152	1.360E-01	2.091E-01	8.861E-01	9.695E-01	9.690E-01	1.577E-01	1.623E-03	2.751E-02	1.100E+00

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 2 Sheet No. 9 of 10
Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
Calc. No. 0100H-CA-V0161 Rev. No. 0

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1RESRAD, Version 6.5      T« Limit = 180 days        04/05/2011  14:44  Page  10
 Concent : 1607-H1/116-H-5 Selenium Groundwater and Columbia River Protection
 File    : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\1607-H1_116-H-5_SELENIUM.RAD
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Concentration of radionuclides in environmental media
at t = 1.000E+03 years

Radio-Nuclide	Contaminated Zone pCi/g	Surface Soil* pCi/g	Air Particulate pCi/m**3	Well Water pCi/L	Surface Water pCi/L
Cl-36	6.953E-05	6.953E-05	7.842E-10	1.125E-01	2.627E-03
Cs-135	7.547E-05	7.547E-05	6.811E-10	8.416E-04	6.809E-06
Gd-152	9.292E-05	9.292E-05	8.386E-10	1.036E-03	8.383E-06

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.000E+03 years*

Radio-Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
Cl-36	1.125E-01	2.507E+00	3.521E+00	2.626E+00	2.625E+00	1.105E+01	3.248E+00	2.627E+00	4.992E-01
Cs-135	8.417E-04	4.139E-03	8.335E-03	8.843E-03	8.838E-03	2.043E-02	5.268E-03	1.362E-02	6.810E-04
Gd-152	1.036E-03	1.593E-03	6.753E-03	7.388E-03	7.384E-03	1.201E-03	1.237E-05	2.096E-04	8.384E-03

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 2 Sheet No. 10 of 10
Originator: S. W. Clark Date 4/6/2011
Chk'd By M. W. Perrott Date 4/6/2011
Calc. No. 0100H-CA-V0161 Rev. No. 0

APPENDIX E

DATA QUALITY ASSESSMENT

APPENDIX E

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

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

A review of the sample design (WCH 2010b), the field logbook (WCH 2010a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical analysis and radiochemical analysis (BHI 2000a, BHI 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 1607-H1 waste site were provided by the laboratories in three sample delivery groups (SDGs): SDG K2128, SDG K2131, and SDG K2132. SDG K2128 was submitted for third-party validation. Major and minor deficiencies were identified in the analytical data set, and are discussed below.

MAJOR DEFICIENCIES

Holding times greater than twice the established acceptable hold time of 2 days for nitrite became the basis for a third-party validation rejection ("R" flag) of the undetected ion chromatograph (IC) anion results for nitrite in SDG K2128. The samples for SDG K2128 were collected on July 7, 2010, and extracted and analyzed on July 14, 2010. In addition, the holding time for nitrite was exceeded by greater than twice the limit in SDG K2131. The samples for SDG K2131 were collected on July 8, 2010, and extracted and analyzed on July 14, 2010. The project rejected the undetected IC anion results for nitrite in SDG K2131, and flagged these results with an "R." It was anticipated that meeting the hold time requirement for IC anions would be challenging, and the U.S. Environmental Protection Agency (EPA) analytical method 353.2 was requested in the 1607-H1 sample design (WCH 2010b) to provide acceptable nitrate/nitrite data for decision-making purposes. Rejection of the undetected nitrite data does not hinder the evaluation of the 1607-H1 waste site.

MINOR DEFICIENCIES

Minor deficiencies are discussed for the 1607-H1 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

SDG K2128

This SDG comprises seven statistical soil samples (J1B9D2 through J1B9D7, and J1B9F4) from the overburden area of the 1607-H1 waste site. A field duplicate pair (J1B9D4/J1B9F4) is included in this SDG. These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, polychlorinated biphenyls (PCBs), semivolatile organic compounds (SVOCs), pesticides, nitrate/nitrite, IC anions, strontium-90, isotopic plutonium, isotopic uranium; and carbon-14, tritium, and nickel-63 by liquid scintillation. In addition, one equipment blank (J1B9F5) was collected and analyzed for ICP metals, mercury, and SVOCs. Minor deficiencies are as follows:

In the IC anion analysis by EPA Method 300.0, the holding time requirement for nitrate and orthophosphate is 2 days. The samples for SDG K2128 were collected on July 7, 2010, and extracted and analyzed on July 14, 2010. Due to holding times being exceeded by greater than twice the limit, the detected nitrate and orthophosphate results were considered estimated and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

All of the toxaphene data in SDG K2128 was qualified by third-party validation as estimated with "J" flags, due to lack of a matrix spike (MS), matrix spike duplicate (MSD), or lab control sample (LCS) analysis for the analyte. Estimated, or "J"-flagged, data are acceptable for decision-making purposes.

In the radionuclide analysis, all carbon-14 and tritium results were qualified as estimates and flagged "J" by third-party validation, due to the lack of a MS analysis. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the zinc result for sample J1B9F5 (the equipment blank) is of similar magnitude as the method blank result. Third-party validation qualified the result as undetected and flagged "UJ" due to method blank contamination. The data is usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for four analytes (aluminum, iron, antimony, and silicon). For aluminum, iron, and silicon the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 48%. All antimony data were qualified as estimates and flagged "J" by third-party validation. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, all silicon results were qualified as estimates and flagged "J" by third-party validation, due to a LCS recovery below quality control (QC) limits at 60%. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the LCS recoveries for 2,4-dinitrophenol (29%), 4,6-dinitro-2-methylphenol (46%), 4-chloroanaline (48%), and hexachlorocyclopentadiene (34%) are below the QC limits. The data for these SVOCs were considered estimated and flagged "J" by third-party validation. The data are usable for decision-making purposes.

In the SVOC analysis, the relative percent difference (RPD) for 2,4-dinitrophenol and 4,6-dinitro-2-methylphenol was above the QC limit of 30%, at 57% and 36%, respectively. All 2,4-dinitrophenol and 4,6-dinitro-2-methylphenol results were qualified as estimates and flagged "J" by third-party validation. The data are usable for decision-making purposes.

SDG K2131

This SDG comprises seven statistical soil samples (J1B9B8 through J1B9B9, and J1B9C0 through J1B9C4) from the excavation area, and six statistical soil samples (J1B9D8 through J1B9D9, and J1B9F0 through J1B9F3) from the overburden area of the 1607-H1 waste site. These samples were analyzed for ICP metals, mercury, hexavalent chromium, PCBs, SVOCs, volatile organic compounds (VOCs), pesticides, polycyclic aromatic hydrocarbons (PAH), nitrate/nitrite, IC anions, strontium-90, isotopic plutonium, isotopic uranium; and carbon-14, tritium, and nickel-63 by liquid scintillation. Minor deficiencies are as follows:

In the IC anion analysis by EPA Method 300.0, the holding time requirement for nitrate and orthophosphate is 2 days. The samples for SDG K2131 were collected on July 8, 2010, and extracted and analyzed on July 14, 2010. Due to holding times being exceeded by greater than twice the limit, the detected nitrate and orthophosphate results may be considered estimated. Estimated data are usable for decision-making purposes.

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

In the pesticides analysis, all of the toxaphene data in SDG K2131 may be considered estimated due to lack of a MS, MSD, or LCS analysis for the analyte. Estimated data are acceptable for decision-making purposes.

Also in the pesticides analysis, the MS and MSD were out of project acceptance criteria for 4,4'-DDT at 73.9% and 74.4%, respectively. The MSDs for endrin and endrin aldehyde were 73% and 64.8%, respectively. The data for these analytes may be considered estimated. Estimated data are acceptable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for four analytes (aluminum, iron, antimony, and silicon). For aluminum, iron, and silicon the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the

native concentration rather than a measure of the recovery from the sample. Antimony did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 45%. All antimony data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, all boron results may be considered estimated due to a RPD above QC limits at 37%. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, all silicon results may be considered estimated due to a LCS below QC limits at 68%. Estimated data are usable for decision-making purposes.

The RPD for hexavalent chromium is above the QC criteria at 43%. Elevated RPDs in environmental soil samples are generally attributed to heterogeneities in the sample matrix and not to deficiencies in the laboratory procedures. The data are usable for decision-making purposes.

In the SVOC analysis, the LCS recoveries for 2,4-dinitrophenol (29%), 4,6-dinitro-2-methylphenol (46%), 4-chloroaniline (48%), and hexachlorocyclopentadiene (34%) are below the QC limits. The data for these SVOCs in all samples, except J1B9F0, may be considered estimated. The data are usable for decision-making purposes.

In the SVOC analysis, the MS/MSD RPD for 2,4-dinitrophenol and 4-nitrophenol are above the QC limit of 30%, at 34% and 36%, respectively. All 2,4-dinitrophenol and 4-nitrophenol results, except J1B9F0, may be considered estimated. The data are usable for decision-making purposes.

For sample J1B9F0 in the SVOC analysis, the associated MS/MSD RPD for 2,4-dinitrophenol and pentachlorophenol are above the QC limit of 30%, at 42% and 32%, respectively. The 2,4-dinitrophenol and pentachlorophenol results for sample J1B9F0 may be considered estimated. The data are usable for decision-making purposes.

SDG K2132

This SDG comprises six statistical soil samples (J1B9C5 through J1B9C9, and J1B9D0), and one focused sample (J1B9D1) from the excavation area of the 1607-H1 waste site. A field duplicate pair (J1B9C8/J1B9D0) is included in this SDG. These samples were analyzed for ICP metals, mercury, hexavalent chromium, PCBs, SVOCs, VOCs, pesticides, PAH, nitrate/nitrite, strontium-90, isotopic plutonium, isotopic uranium; and carbon-14, tritium, and nickel-63 by liquid scintillation. Minor deficiencies are as follows:

In the radionuclide analysis, all carbon-14 and tritium results may be considered estimated due to the lack of a MS analysis. In addition, the LCS recovery for tritium was below the acceptance criteria at 72%. Estimated data are usable for decision-making purposes.

In the IC anion analysis by EPA Method 300.0, the holding time requirement for nitrate, nitrite, and orthophosphate is 2 days. The samples for SDG K2132 were collected on July 12, 2010, extracted on July 14, 2010, and analyzed on July 15, 2010. Due to holding times being exceeded

by less than twice the limit, the nitrate, nitrite, and orthophosphate results may be considered estimated. Estimated data are usable for decision-making purposes.

In the pesticides analysis, all of the toxaphene data in SDG K2132 may be considered estimated due to lack of a MS, MSD, or LCS analysis for the analyte. Estimated data are acceptable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for five analytes (aluminum, iron, manganese, antimony, and silicon). For most of these 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 analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 46%. All antimony data may be considered estimated. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the MS and MSD recoveries for 2,4-dinitrophenol were below the QC criteria at 25% and 24%, respectively. In addition, the MS for 4,6-dinitro-2-methylphenol was below the acceptance criteria at 38%. The results for these SVOCs may be considered estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2010a), are shown in Table C-1. The main and QA/QC sample results are presented in Appendix C.

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

Sample Area	Main Sample	Duplicate Sample
Excavation Area	J1B9C8	J1B9D0
Overburden Area	J1B9D4	J1B9F4

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of concern (COC). Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than 5 times the target detection limit (TDL). Relative percent differences of

analytes detected at low concentrations (less than 5 times the detection limit) are not considered to be indicative of the analytical system performance. The 95% upper confidence limit (UCL) calculation brief in Appendix C provides details on duplicate pair evaluation and RPD calculation.

The RPDs calculated for aroclor-1254 in the excavation duplicate sample (J1B9D0) is above the acceptance criteria of 30% at 35%. A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than 5 times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix C) to indicate that a visual check of the data is required by the reviewer. No sample results 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 1607-H1 waste site verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 1607-H1 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data, with the exception of the rejected undetected IC anion results for nitrite, were found acceptable for decision-making purposes. The verification sample analytical data are stored in the Environmental Restoration (ENRE) project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System (HEIS) database. The verification sample analytical data are also summarized in Appendix C.

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