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

11-AMRC-0109

MAR 24 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 THE APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 100-H-41, 100-H CONTAMINATION AREA, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2010-003 and supporting "Remaining Sites Verification Package for the 100-H-41, 100-H Contamination Area," 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:
R. D. Cantwell, WCH
S. L. Feaster, WCH
T. A. Foster, WCH
M. L. Proctor, WCH

Date Submitted: 8/3/10 Originator: M. L. Proctor Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-HR-1 Waste Site Code: 100-H-41 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2010-003

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

Description of current waste site condition:
The 100-H-41, 100-H Contamination Area waste site is located in the 100-HR-1 Operable Unit at Washington State Plane coordinates N 152652.9, E 577883.1. A 35.6-cm (14-in.)-diameter, vertically oriented, concrete pipe was located in a posted radiological Contamination Area. Excavation of the site for confirmatory sampling purposes identified radioactively contaminated mud dauber nests located on the inside of the pipe. Because this contamination was found to be due to the presence of mud dauber nests, the contaminated 100-H-41 pipe and associated soil were removed and disposed at the Environmental Restoration Disposal Facility as part of the 100-H-37, 100-H Mud Dauber Contamination Area remediation activities. The 100-H-37 site consisted of dispersed radiological contamination caused by mud dauber activities, including mud dauber nests similar to those found inside the 100-H-41 vertical pipe. After the pipe and soil were removed due to the mud dauber contamination, a confirmatory soil sample and duplicate soil sample were collected at the base of the 100-H-41 excavation. The sample results do not indicate the presence of any environmental contamination.

Confirmatory sampling and comparison of residual contaminant concentrations against cleanup levels have been performed in accordance with remedial action objectives and goals established by the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. The selected action involved: (1) evaluating the site using available process information, (2) demonstrating through confirmatory sampling that cleanup goals have been achieved, and (3) proposing the site for reclassification to Interim Closed Out. The 100-H-41 waste site was included in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington as a candidate site for confirmatory sampling.

Basis for reclassification:
Evaluation of confirmatory sampling data for the 100-H-41 waste site demonstrates that this site meets the remedial action objectives specified in the Remaining Sites ROD. This site will support future unrestricted land uses that can be represented (or bounded) by a rural-residential scenario. Sampling results also showed that this site will support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]) and is protective of groundwater and the Columbia River. Site contamination does not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required. In accordance with this evaluation, the confirmatory sampling results support a reclassification of this site to Interim Closed Out. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-H-41, 100-H Contaminated Area Waste Site* (attached).

Regulator Comments:
Approval of this WSRF documents regulator agreement that 100-H-41 waste site qualifies for "Interim Closed Out" under this Interim Action ROD. In addition, Ecology has evaluated the data for this site against WAC 173-340 (2007) clean-up levels for direct contact, groundwater protection, and river protection. This evaluation is documented in the letter transmitting Ecology's conditional 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)	Signature	2/4/11 Date
N. Menard Ecology Project Manager (printed)	Signature	3/15/11 Date
NA EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-H-41, 100-H CONTAMINATED AREA WASTE SITE

Attachment to Waste Site Reclassification Form 2010-003

March 2011

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-H-41, 100-H CONTAMINATED AREA WASTE SITE

EXECUTIVE SUMMARY

The 100-H-41, 100-H Contaminated Area waste site is located within the 100-HR-1 Operable Unit on the Hanford Site in southeastern Washington State. The Waste Information Data System describes the 100-H-41 waste site as a posted radiological Contamination Area (CA). A 35.6-cm (14-in.)-diameter, vertically orientated, concrete pipe was present within the posted CA.

It was suspected that the 35.6-cm (14-in.) concrete structure may have been associated with underground pipelines. The basis for the radiological posting of the site as CA was unknown; however it was thought that the posting may have been associated with the spread of mud dauber contamination that was prevalent in the surrounding area.

On November 10, 2009, confirmatory sampling of the 100-H-41 waste site was initiated to collect information to support evaluation of the site against the remedial action goals (RAGs). The contaminants of potential concern (COPCs) for confirmatory sampling included carbon-14, cobalt-60, cesium-137, europium-152, europium-154, strontium-90, nickel-63, lead, hexavalent chromium, antimony, cadmium, total chromium, mercury, nickel, zinc, polychlorinated biphenyls (PCBs), pesticides, sulfate, semivolatile organic compounds (SVOCs), and polyaromatic hydrocarbons (PAH) (WCH 2009b).

Mud dauber nests were found inside the concrete pipe and determined to be the source of the radiological contamination that resulted in the CA posting. On November 12, 2009, the Field Remediation project excavated and removed the contaminated materials, including the concrete pipe and associated soil, for disposal at the Environmental Restoration Disposal Facility as part of the ongoing 100-H-37 remediation effort. On November 23, 2009, after removal of the mud dauber contamination, a confirmatory sample and duplicate sample of the soil from the excavated area was collected at a depth of 1.8 m (6 ft).

Results of confirmatory sampling analyses show that residual soil concentrations of contaminants are in compliance with the remedial action objectives and RAGs for the 100-H-41 waste site. A summary of the confirmatory sampling analytical results evaluated against the applicable criteria is presented in Table ES-1. The results of the confirmatory sampling are used to make reclassification decisions for the 100-H-41 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 confirmatory sampling results support a reclassification of this site to Interim Closed Out. Removal of the contaminated material and soil associated with mud dauber contamination was performed as authorized within the 100-H-37 remediation effort.

Table ES-1. Summary of Remedial Action Goals for the 100-H-41 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years.	No radionuclide COPCs were detected above soil lookup values.	Yes
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria [a].	Yes
Direct Contact Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	All individual hazard quotients are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (1.5×10^{-2}) is <1.	
Risk Requirements – Nonradionuclides	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	All excess cancer risk for individual carcinogens is $<1 \times 10^{-6}$ [b].	Yes
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The direct exposure total excess cancer risk (9.9×10^{-6}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single-COPC groundwater and river protection RAGs.	All individual radionuclide COPC concentrations are below the soil RAGs for groundwater and river protection.	Yes
	Attain national primary drinking water standards [c]: 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.		
	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 [d].		
	Meet total uranium standard of 30 µg/L (21.2 pCi/L) [e].	Uranium was not a COPC at the 100-H-41 waste site.	
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Contaminant concentrations were below soil RAGs for the protection of groundwater and the Columbia River [f].	

[a] Benzo(a)pyrene was detected at a concentration exceeding direct exposure RAGs; however, this constituent is due to cross-contamination by asphalt in the sample.

[b] The calculated benzo(a)pyrene cancer risk exceeded 1×10^{-6}; however, this constituent is due to cross-contamination by asphalt in the sample.

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

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

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

[f] Groundwater and river protection standards were exceeded for carbazole and several PAH constituents; however, these constituents were present due to cross-contamination in the sample from asphalt material.

COPC = contaminant of potential concern
DOE = U.S. Department of Energy
MCL = maximum contaminant level
PAH = polycyclic aromatic hydrocarbons
RAG = remedial action goal

Soil cleanup levels were established in the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site COPCs and other constituents. The U.S. Environmental Protection Agency's ecological soil screening levels were exceeded for manganese, vanadium, zinc, and high molecular weight PAH. Ecological screening levels from *Washington Administrative Code* 173-340, "Model Toxics Control Act – Cleanup," were exceeded for boron and vanadium. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors.

Because concentrations of manganese, vanadium, and zinc are below background levels (*Remedial Design Report/Remedial Action Work Plan for the 100 Area* [DOE-RL 2009b], *National Background Soil Metals Concentrations in Washington State* [Ecology 1994]), it is believed that the presence of these constituents does not pose a risk to ecological receptors. No established background value is available for boron. A final cleanup level for boron, including consideration of background, will be established through the integrated 100 Area remedial investigation/feasibility study process. Exceedences for boron will be evaluated in the context of additional lines of evidence for ecological receptors. Concentrations of PAH are associated with cross-contamination from asphalt material present at the site and do not require further evaluation.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-H-14, 100-H CONTAMINATED AREA WASTE SITE

STATEMENT OF PROTECTIVENESS

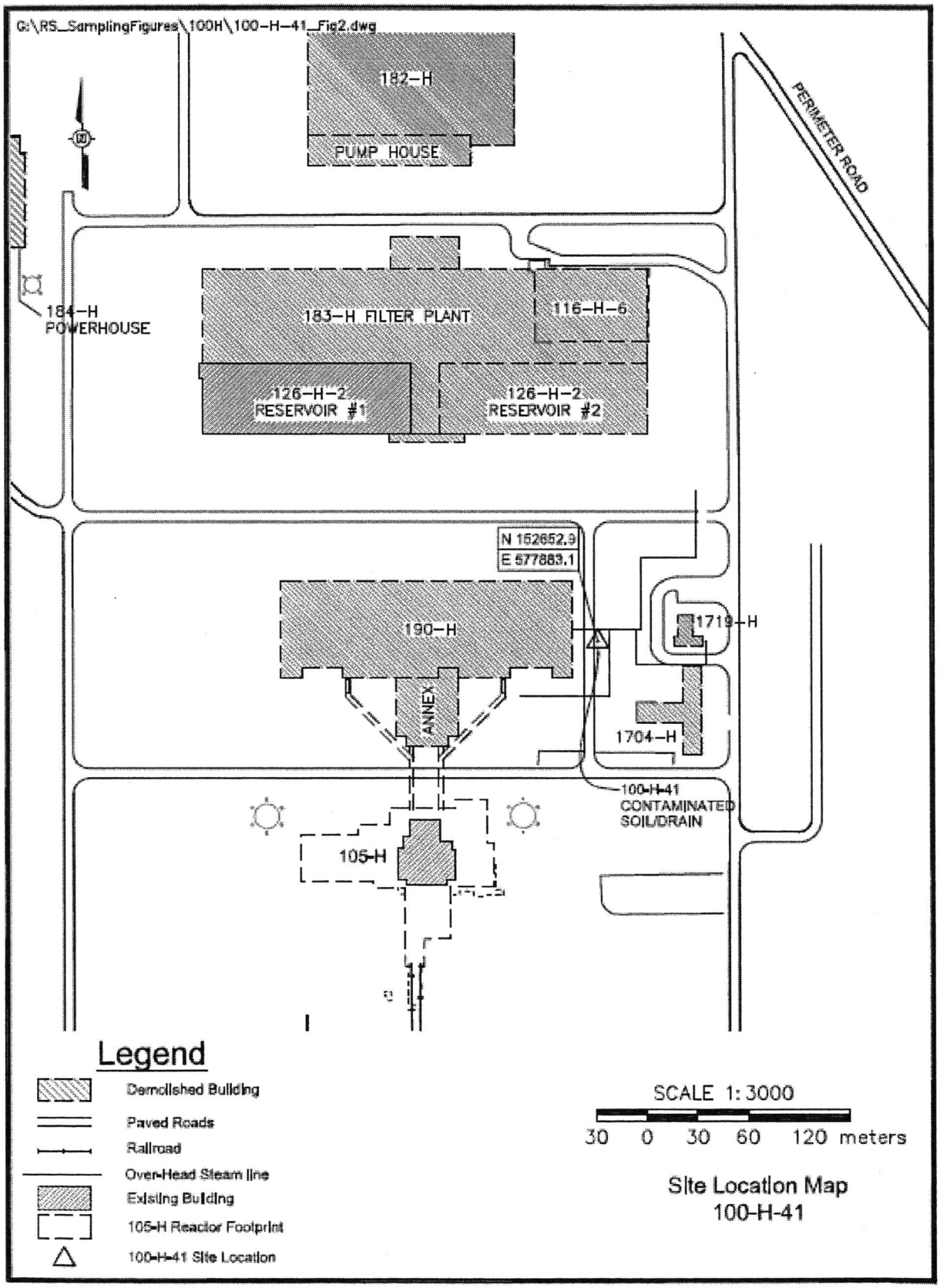
This report demonstrates that the 100-H-41, 100-H Contaminated Area waste site meets the remedial action objectives and remediation action goals (RAGs) for Interim Closed Out as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The results of confirmatory sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The site does not have a deep zone or residual contaminant concentrations that would require any institutional controls.

Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of potential concern and other constituents. The U.S. Environmental Protection Agency's ecological soil screening levels were exceeded for manganese, vanadium, zinc, and high molecular weight polyaromatic hydrocarbons (PAH). Ecological screening levels from *Washington Administrative Code* 173-340, "Model Toxics Control Act – Cleanup," were exceeded for boron and vanadium. Exceeding screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of manganese, vanadium, and zinc are below background levels (*100 Area Remedial Action Sampling and Analysis Plan* [DOE-RL 2009a], *National Background Soil Metals Concentrations in Washington State* [Ecology 1994]), it is believed that the presence of these constituents does not pose a risk to ecological receptors. No established background value is available for boron. A final cleanup level for boron, including consideration of background, will be established through the integrated 100 Area remedial investigation/feasibility study process. Exceedences for boron will be evaluated in the context of additional lines of evidence for ecological receptors. Concentrations of PAH are associated with cross-contamination from asphalt material present at the site and do not require further evaluation.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-H-41 waste site is located approximately 16.3 m (53.4 ft) east of the demolished 190-H Building in the 100-HR-1 Operable Unit of the Hanford Site (Figure 1). The Waste Information Data System (WIDS) and the River Corridor Closure Stewardship Information System (SIS) describe this site as a posted radiological Contamination Area (CA).

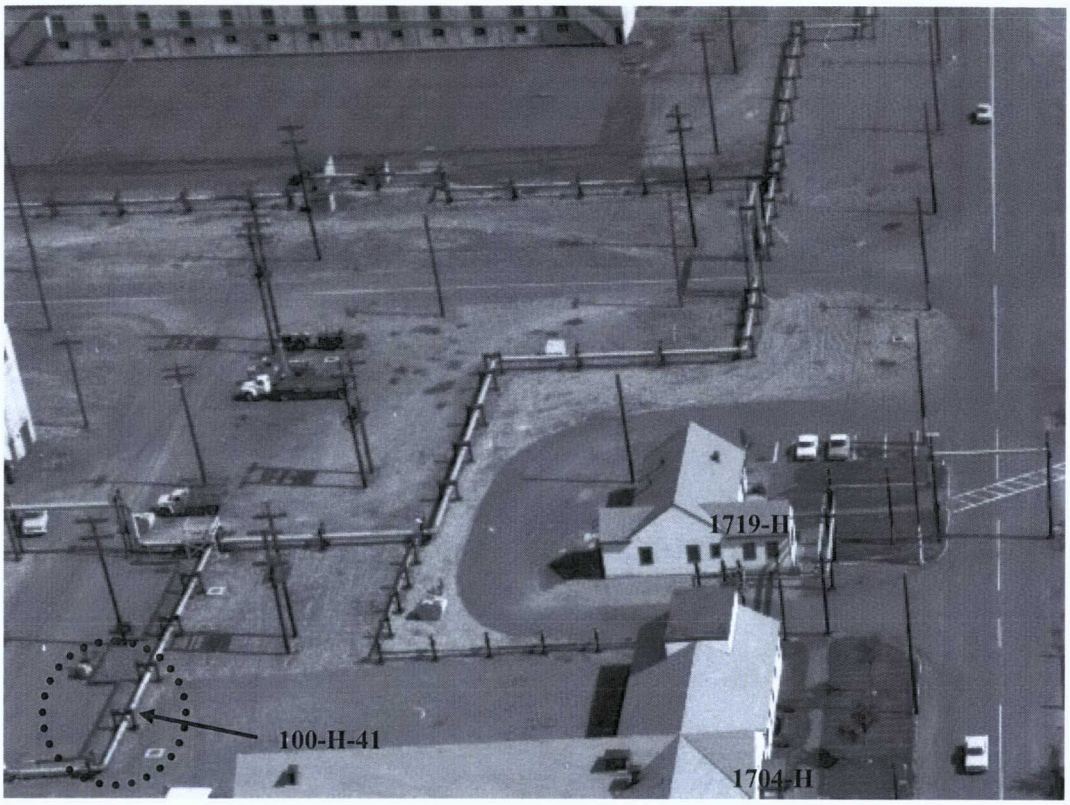
Figure 1. The 100-H-41 Waste Site Location Map.



A 35.6-cm (14-in.)-diameter, vertically orientated, concrete pipe was present within the posted CA (Figure 2). The Washington State Plane (WSP) coordinates for the site are N 152652.9, E 577883.1. Figure 3 shows the approximate location of the 100-H-41 waste site on a photograph from the operational time period of the 100-H Area as interpreted from historical site construction drawings (GE 1948a, 1948b). The overhead steam distribution pipeline can be seen in the photograph.

Figure 2. Photograph of the Concrete Drain at the 100-H-41 Waste Site.

Figure 3. Approximate Location of the 100-H-41 Waste Site Indicated on 1964 Photograph.



As described in the WIDS and the SIS reports, it was suspected that the concrete structure was associated with a filtered water line from the 183-H facility that serviced the 190-H Building operations via a 61-cm (24-in.) cast iron pipe. It was also suspected that the structure may have been related to the 100-H-28 Water Treatment Facilities Underground Pipelines or the 100-H-35 100- H Service Water Pipelines. The structure was located 7 m (23 ft) from the nearest steam line and was not believed to be associated with steam condensate. Figure 4 shows the locations of the pipelines near the 100-H-41 waste site (GE 1948a, 1948b). The basis for the radiological posting of the site as a CA was unknown. There was no process knowledge indicating radiological contamination would be present at the location. It was also believed that the radiological CA posting may have been associated with mud dauber contamination that was prevalent in the surrounding area. Because process knowledge was inconclusive, WIDS information identified the site as an Unplanned Release.

Geophysical Investigation

A geophysical investigation to support excavation for confirmatory sampling of the 100-H-28:2 waste subsite was conducted in March 2008. The 100-H-41 waste site is located within the boundaries of the survey area and is indicated on the survey as a "CA" near N650 and E886 (Figure 5). Ground-penetrating radar and electromagnetic induction were used in the geophysical survey. The survey showed several linear anomalies near the site; one appears to terminate at the concrete structure and was suspected to be a pipeline at a depth of 1.3 m (4.3 ft).

Figure 4. Pipelines Located Near the 100-H-41 Waste Site.

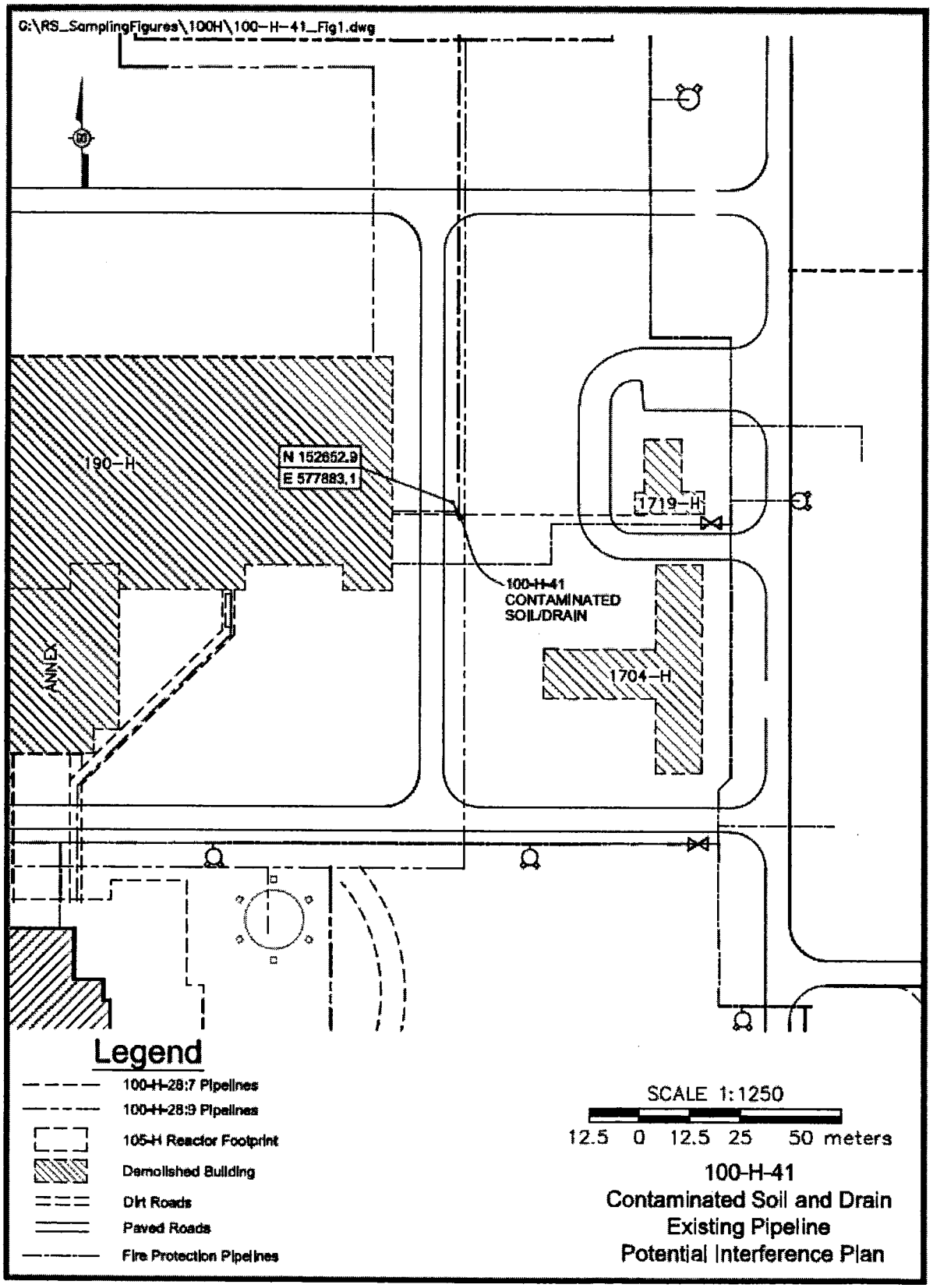
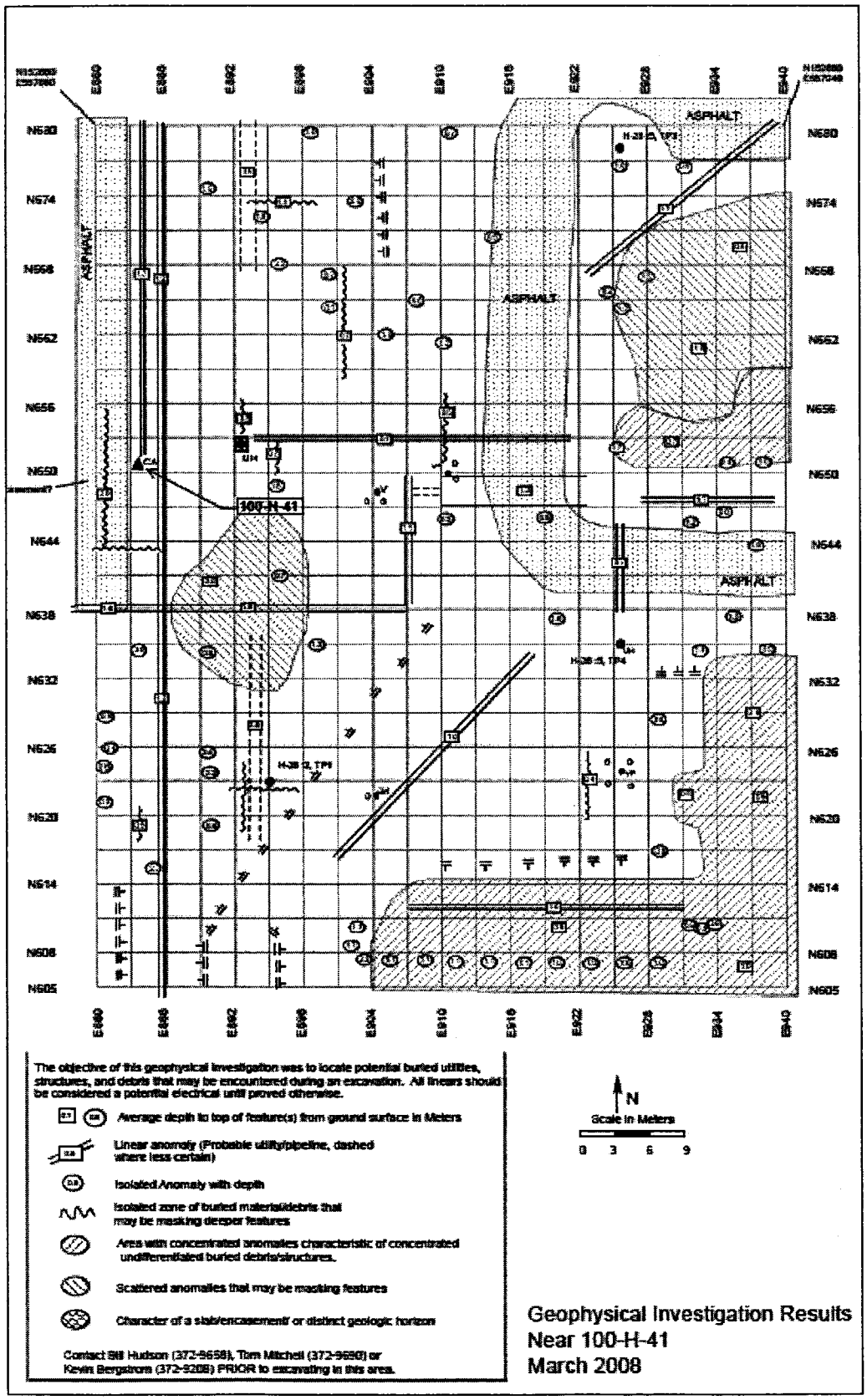


Figure 5. Geophysical Investigation Results.



CONFIRMATORY SAMPLING SUMMARY

On November 10, 2009, confirmatory sampling of the 100-H-41 waste site was initiated as specified in the confirmatory sampling work instruction (WCH 2009b). Prior to performing the excavation, a radiological survey of the surface soil was performed with no radiological contamination detected above background. As the excavation proceeded, plastic sheeting was noted approximately 15 cm (6 in.) below the ground surface, holding the soil above it from entering the pipe. The pipe was empty below the plastic to a depth of approximately 0.9 m (3 ft). Mud dauber nests were found on the inside of the pipe (Figures 6, 7, and 8). Field radiological surveys of the nests identified up to 450,000 disintegrations per minute beta-gamma contamination on the nests. Figure 9 shows the location of mud dauber contamination associated with 100-H-37 near the 100-H-41 waste site.

Because the contamination was determined to be due to the presence of mud dauber nests, it was determined that the contamination was more appropriately identified as part of the 100-H-37 Mud Dauber Contamination Area waste site. Therefore, on November 12, 2009, the Field Remediation project excavated and removed the contaminated materials, including the pipe and soil, for disposal at the Environmental Restoration Disposal Facility as part of the ongoing 100-H-37 remediation effort.

Figure 6. Photograph of the Concrete Drain During Excavation.

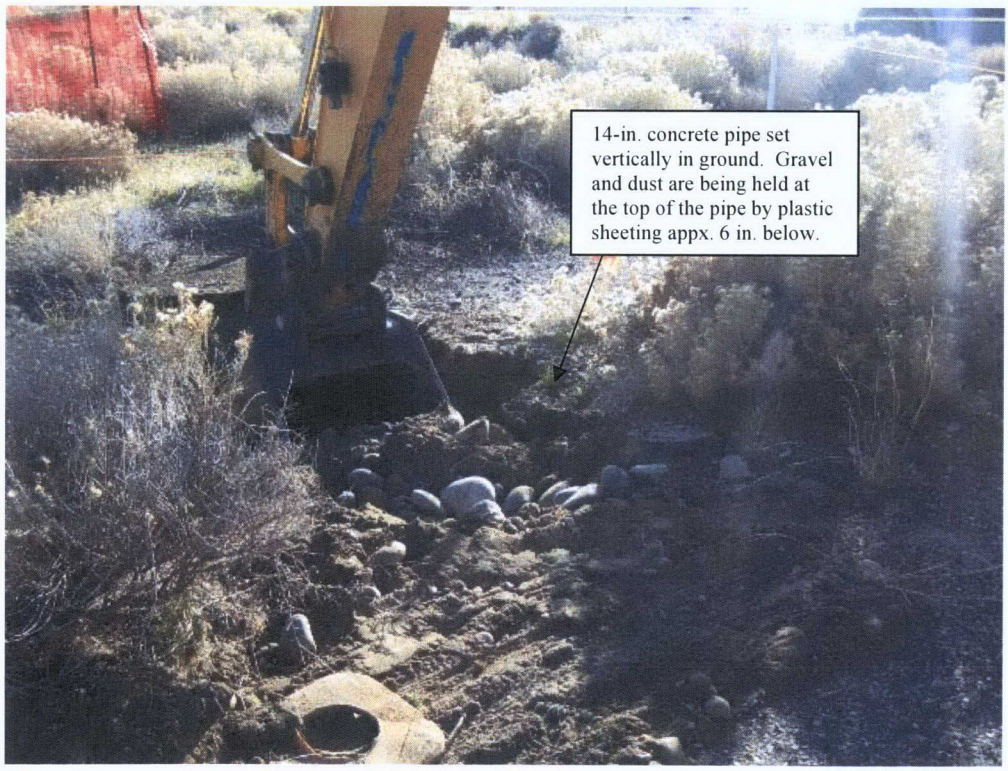


Figure 7. Photograph of the Concrete Drain During Excavation.

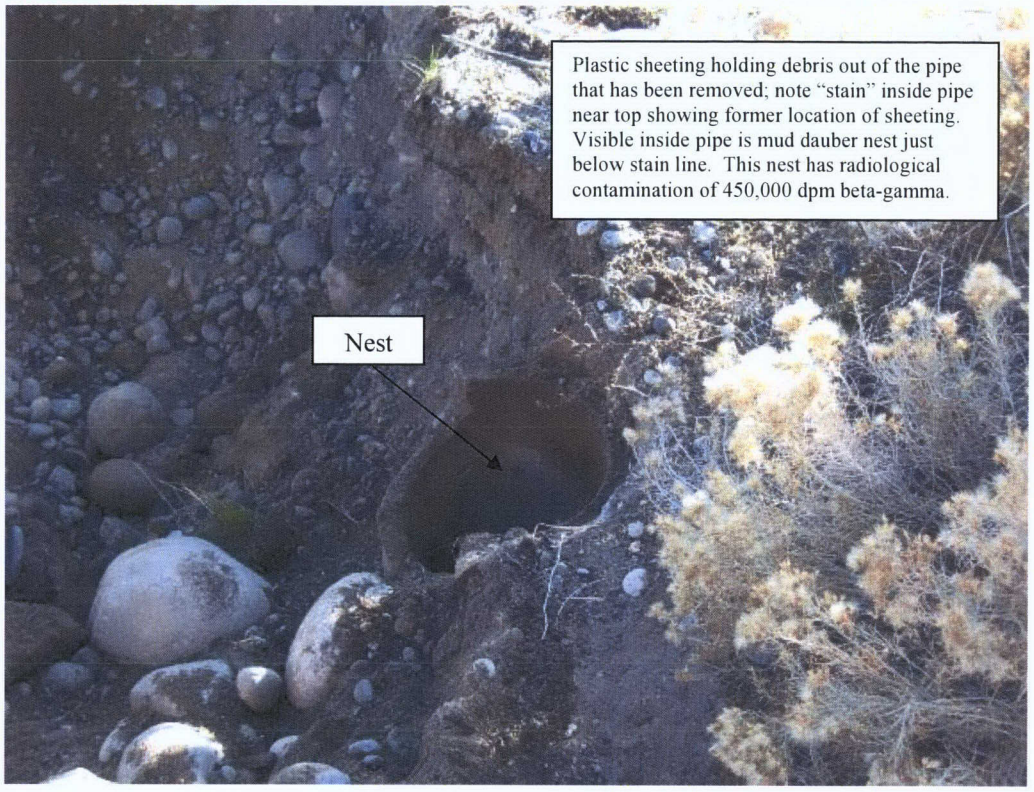
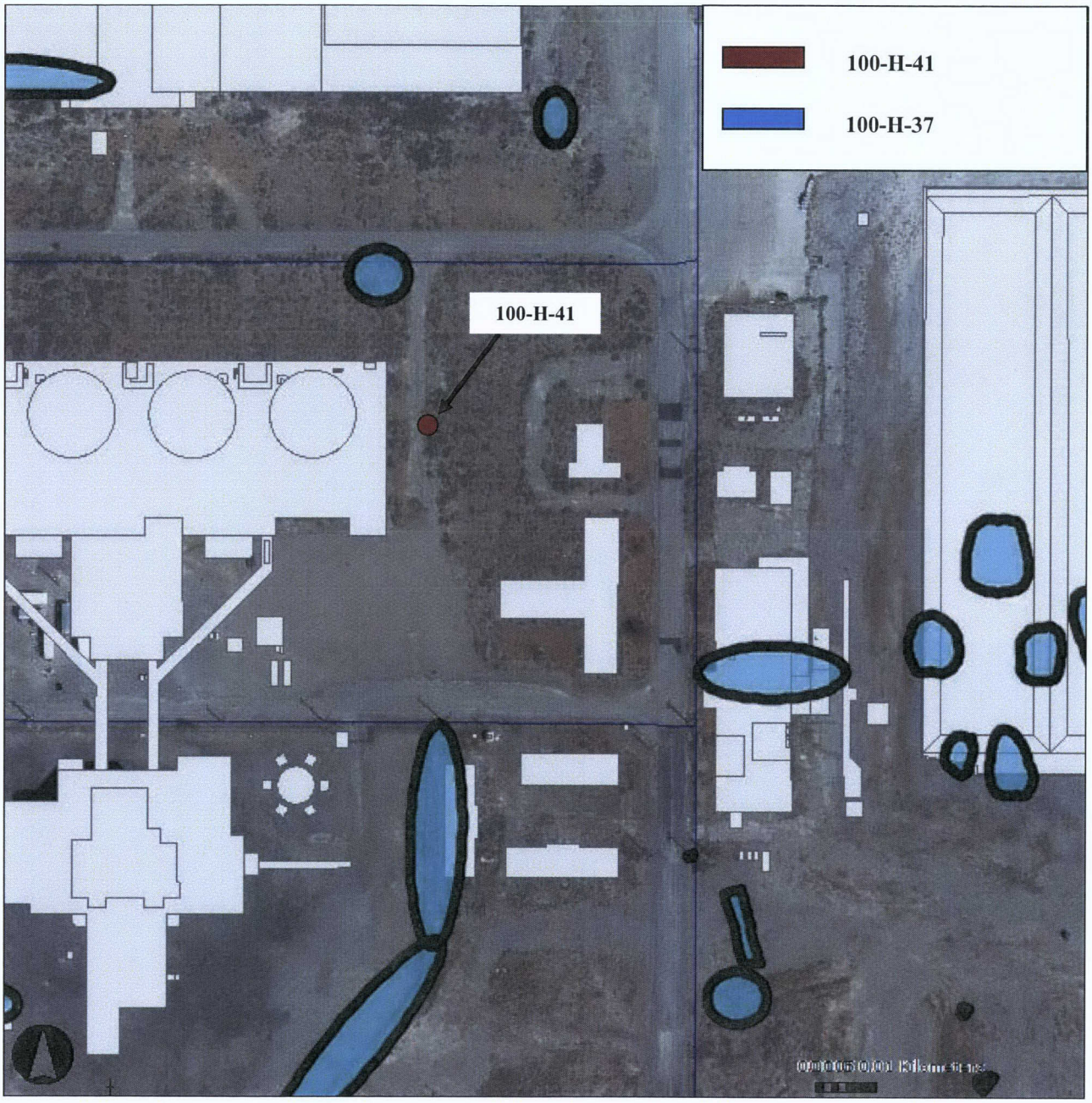


Figure 8. Mud Dauber Nests Inside of the Concrete Pipe.

Figure 9. 100-H-37 Waste Site Mud Dauber Contamination Located Near the 100-H-41 Waste Site.



On November 23, 2009, after removal of the mud dauber contamination, confirmatory sampling for the 100-H-41 waste site was performed to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The following subsections provide additional discussion of the confirmatory sampling design and resulting field investigation. A more detailed discussion of the confirmatory sample design can be found in the confirmatory work instruction (WCH 2009b).

Contaminants of Potential Concern

The contaminants of potential concern (COPCs) for the 100-H-41 waste site were identified in consideration of those associated with the 100-H-28:2, South Process Sewers waste site as identified during confirmatory sampling (WCH 2009b) and contaminants that may be associated with mud daubers. The COPCs included carbon-14, cobalt-60, cesium-137, europium-152, europium-154, strontium-90, nickel-63, lead, hexavalent chromium, antimony, cadmium, total chromium, mercury, nickel, zinc, polychlorinated biphenyls (PCBs), pesticides, sulfate, and semivolatile organic compounds (SVOCs). Polyaromatic hydrocarbons (PAH) were included in the sample analysis because asphalt was present in the area of the waste site and could result in cross-contamination and interference in the SVOC analysis. Although not COPCs, arsenic, barium, beryllium, boron, cobalt, copper, manganese, molybdenum, selenium, silver, and vanadium were also evaluated by performing analyses for the constituents of the expanded inductively coupled plasma (ICP) metals list. Gross alpha activity and gross beta activity were also included in the sample analyses.

Confirmatory Sample Design

This section describes the sample design and the number of confirmatory samples that were collected.

The 100-H-41 waste site was evaluated by excavating one test pit at the location of the concrete structure (WSP Coordinates N 152652.9, E 577883.1). As previously stated, mud dauber nests were identified inside the concrete structure and determined to be the source of radiological contamination at the waste site. On November 23, 2009, after removal of the mud dauber contaminated concrete structure and associated soil, the excavation proceeded to a depth of approximately 1.8 m (6 ft). The concrete structure was originally suspected to be associated with nearby pipelines. However, field observations during excavation determined that the structure was isolated and not associated with any pipeline or other structure. The structure (vertical concrete pipe) was approximately 0.9 m (3 ft) long. Two pipelines were encountered within the base of the excavation at a depth of approximately 1.8 m (6 ft.). A 51-cm (20-in.) pipeline was found and underlain by a cement and asphalt slab. The slab appeared to protect a 76-cm (30-in) pipeline. Neither of the pipelines ran directly beneath the 100-H-41 concrete structure. Additionally, field observations determined that these pipelines are not associated with the 100-H-41 vertical concrete structure. The 51-cm (20-in) pipeline is believed to be the 100-H-35 pipeline and the 76-cm (30-in) pipeline is believed to be the100-H-28:2 pipeline, both located near 100-H-41 (Figure 10).

One soil sample and a duplicate soil sample were collected at the base of the excavation, at a depth of 1.8 m (6 ft), and below the location of the removed concrete structure (WCH 2009a). Asphalt was present within the excavation as part of the concrete slab that protected the 76.2-cm (30-in.) pipeline and difficulty was encountered during sample collection to prohibit asphalt from being incorporated into the sample media removed with the backhoe bucket. The soil samples were submitted for laboratory analysis as specified in the work instruction for confirmatory sampling (WCH 2009b). All sampling was performed in accordance with applicable ENV-1, *Environmental Monitoring & Management* procedures. A summary of the analytical methods

that were performed for the confirmatory samples at the 100-H-41 waste site is provided in Table 1, and a summary of the confirmatory samples collected is provided in Table 2.

Figure 10. Pipelines Located Near the 100-H-41 Waste Site.

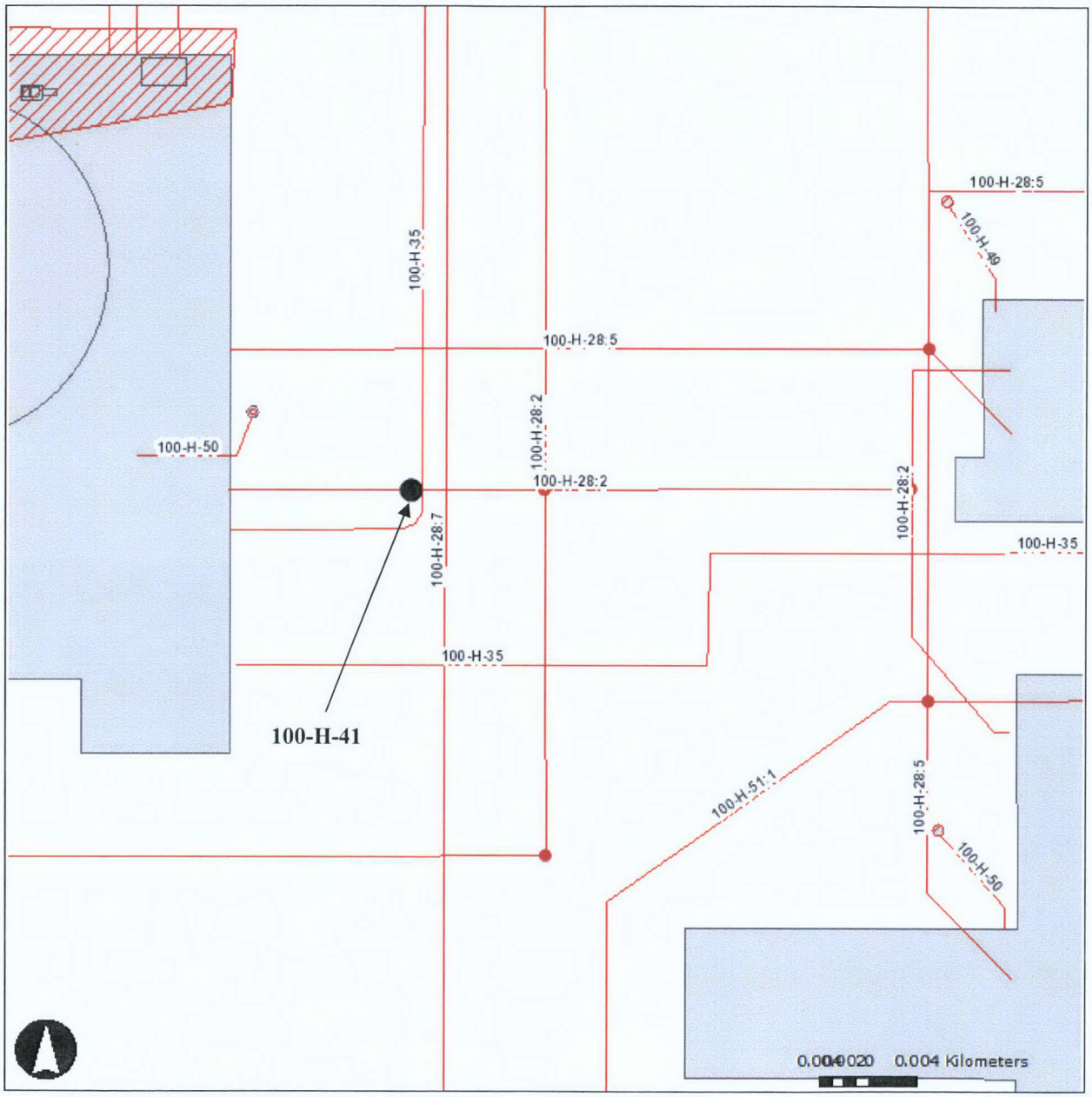


Table 1. Laboratory Analytical Methods.

Analytical Method	Contaminant of Potential Concern
ICP metals [a] – EPA Method 6010	Antimony, cadmium, total chromium, lead, nickel, zinc
Mercury – EPA Method 7471	Mercury
Hexavalent chromium – EPA Method 7196	Hexavalent chromium
PCB – EPA Method 8082	Polychlorinated biphenyl
Pesticides – Method 8081	Pesticides
SVOA – EPA Method 8270	Semivolatile organic compounds
GEA – Gamma spectroscopy	Co-60, Cs-137, Eu-152, Eu-154
PAH – EPA Method 8310	PAH
IC anions – EPA Method 300.0	Sulfate
C-14 – Liquid scintillation counting	Carbon-14
Ni-63 – Liquid scintillation counting	Nickel-63
Gross alpha b[b] – Proportional counting	Alpha-emitting radionuclides
Gross beta [c] – Proportional counting	Beta-emitting radionuclides, including Sr-90

[a] Analysis for the expanded list of ICP metals including antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc was performed.
[b] If gross alpha activity was detected above 15 pCi/g, the GEA would be evaluated to determine if further alpha-specific analysis is necessary.
[c] If gross beta activity was detected above 23 pCi/g, strontium-90 analysis would be performed.

EPA = U.S. Environmental Protection Agency
GEA = gamma energy analysis
IC = ion chromatography
ICP = inductively coupled plasma
PAH = polyaromatic hydrocarbons
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis

Table 2. 100-H-41 Confirmatory Sampling Summary Table.

Sample Description	HEIS Number	Northing (m)	Easting (m)	Sample Analysis
Soil directly below vertical concrete structure	J19CY2	N 152652.9	E 577883.1	ICP metals,[a] mercury, hexavalent chromium, GEA, gross alpha, gross beta, carbon-14, nickel-63, PCB, SVOA, PAH, pesticides, anions
Soil (duplicate)	J19CY3	N 152652.9	E 577883.1	
Equipment blank	J19CY1	NA	NA	ICP metals,[a] mercury, SVOA, hexavalent chromium

[a] Sample analysis for ICP metals will include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis

Confirmatory Sample Results

All confirmatory samples were analyzed using analytical methods approved by the U.S. Environmental Protection Agency (DOE-RL 2009b). Evaluation of the confirmatory data from the test pits was performed by direct comparison of the maximum sample results for each COPC against cleanup criteria.

Comparisons of the results for each COPC against site RAGs are summarized in Table 3. Contaminants that were not detected by laboratory analysis are excluded from this table. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2009) under *Washington Administrative Code* (WAC) 173-340-740(3) for aluminum, calcium, iron, magnesium, phosphate, potassium, silicon, and sodium; therefore, these constituents are not considered site COPCs and are also not included in Table 3.

Table 3. Comparison of Maximum Values to Action Levels for the 100-H-41 Test Pit Confirmation Samples. (2 Pages)

COPC	Maximum Result (mg/kg)	Soil Cleanup Levels (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Protective of Groundwater	Protective of the River		
Metals (mg/kg)						
Arsenic	8.02	20 [b]	20 [b]	20 [b]	No	--
Barium	86.2 (<BG)	5,600	200	400	No	--
Beryllium	0.298 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Boron [d]	1.11	7,200	320	--	No	--
Cadmium	0.088 (<BG)	13.9 [c]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	18.5 (BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	6.07 (<BG)	24	15.7 [b]	--	No	--
Copper	14.2 (<BG)	2,960	59.2	22.0 [b]	No	--
Hexavalent chromium [d]	0.20	2.1 [c]	4.8	2	No	--
Lead	7.69 (<BG)	353	10.2 [b]	10.2 [b]	No	--
Manganese	281 (<BG)	3,760	512 [b]	512 [b]	No	--
Molybdenum [d]	0.237	400	8	NA	No	--
Nickel	15.3 (<BG)	1,600	19.1 [b]	27.4	No	--
Vanadium	40.9 (<BG)	560	85.1 [b]	--	No	--
Zinc	46.5 (<BG)	24,000	480	67.8 [b]	No	--
Anions (mg/kg)						
Fluoride	0.5 (<BG)	4,800	96	400	No	--
Sulfate	2.8 (<BG)	NA	25,000	--	No	--
Organics (mg/kg)						
Acenaphthene	0.0746	4,800	96	129	No	--
Acenaphthylene	0.104	4,800	96	129	No	--
Anthracene	0.341	24,000	240	1,920	No	--
Benz(a)anthracene	1.11	1.37	0.015 [e]	0.015 [e]	Yes	NA [f]
Benzo(a)pyrene	0.971	0.137	0.015 [e]	0.015 [e]	Yes	NA [f]
Benzo(b)fluoranthene	1.27	1.37	0.015 [e]	0.015 [e]	Yes	NA [f]

Table 3. Comparison of Maximum Values to Action Levels for the 100-H-41 Test Pit Confirmation Samples. (2 Pages)

COPC	Maximum Result (mg/kg)	Soil Cleanup Levels (mg/kg)[a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Protective of Groundwater	Protective of the River		
Benzo[g,h,i]perylene	0.431	2,400	48	192	No	--
Benzo(k)fluoranthene	0.396	1.37	0.015[e]	0.015[e]	Yes	NA[f]
Carbazole	3.74	50	0.438	NA	Yes	NA[f]
Crysene	0.854	13.7	0.12	0.1[e]	Yes	NA[f]
Dibenz[a,h]anthracene	0.123	1.37	0.03[e]	0.03[e]	Yes	NA[f]
Dibenzofuran	1.63	160	3.20	NA	No	--
Fluoranthene	2.31	3,200	64	18.0	No	--
Fluorene	0.200	3,200	64	260	No	--
Indeno[1,2,3-cd]pyrene	0.593	1.37	0.33[e]	0.33[e]	Yes	NA[f]
2-Methylnapthalene	0.501[g]	320	3.2	NA	No	--
Napthalene	0.622	1,600	16.0	988	No	--
Phenanthrene	1.31	24,000	240	1,920	No	--
Pyrene	1.53	2,400	48	192	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) unless otherwise noted.
[b] Where cleanup levels are less than background cleanup levels default to background per WAC 173-340-700(4)(d). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[c] 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]).
[d] No Hanford Site-specific or Washington State background value available.
[e] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).
[f] PAH concentrations and carbazole are due to cross-contamination in sample from asphalt material.
[g] Both the split and duplicate soil sample result required dilution; the data from the sample having the lesser dilution was used.

-- = not applicable
BG = background
COPC = contaminant of potential concern
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
RAG = remedial action goal
RDL = required detection limit
RESRAD = RESidual RADioactivity
WAC = *Washington Administrative Code*

Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected; however, these isotopes are naturally occurring and not related to the operational history of the Hanford Site and are excluded from further evaluation. Method 8310 results were used in lieu of Method 8270 results for determining the maximum concentrations for PAH constituents since Method 8310 results are more precise for PAH and preferred over using Method 8270 results for these constituents. The complete laboratory results are stored in the Environmental Restoration (ENRE) project-specific database prior to submission to the Hanford Environmental Information System for archiving and are provided in Appendix A.

CONFIRMATORY SAMPLE DATA EVALUATION

Evaluation of the results listed in Table 3 from confirmatory sampling at the 100-H-41 waste site indicates that residual concentrations of all site COPCs are below soil RAGs for direct exposure and protection of groundwater and/or the Columbia River. Polyaromatic hydrocarbons were detected at concentrations exceeding criteria for protection of groundwater and the Columbia River; however, as previously discussed, these detections were due to the presence of asphalt material in the sample media and not related to site contamination.

Assessment of the risk requirements for the 100-H-41 waste site is determined by calculation of the direct contact hazard quotient and excess cancer risk values for nonradionuclides. These calculations are located in Appendix A, and the ecological risk comparison table follows in Appendix B. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. These risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. Polyaromatic hydrocarbons associated with the presence of asphalt in the sample media are not related to site contamination; however, these constituents were included in the direct exposure evaluation. The results (Appendix A) indicate that all individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the noncarcinogenic constituents is 1.5×10^{-2}. All individual carcinogenic risks were less than 1×10^{-6}, with the exception of benzo(a)pyrene. As noted, this PAH constituent is associated with asphalt material and therefore is not a site contaminant. The cumulative carcinogenic risk was 9.9×10^{-6}. Therefore, all risk requirements for the 100-H-41 site are met.

An additional calculation of the hazard quotient and carcinogenic (excess cancer) risk values for the potential impact to groundwater was performed for nonradionuclides. The comparisons for the groundwater pathway include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. Risk values were not calculated for constituents that were not detected, were detected at concentrations below Hanford Site background values, or were not predicted to reach groundwater in 1,000 years according to fate and transport modeling. One constituent, boron, met the criteria for the calculation of a protection of groundwater hazard quotient for noncarcinogenic constituents, and the result was 3.5×10^{-3}. Therefore, the cumulative hazard quotient for the 100-H-41 waste site is also less than 1.0. No carcinogenic constituents met the criteria for groundwater evaluation at the 100-H-41 waste site; therefore, no calculations of excess carcinogenic risk were performed. Nonradionuclide risk requirements related to groundwater are met.

A three-part evaluation was also performed for the focused confirmatory soil sampling results. The test was not performed for carbazole and PAHs as these constituents are present due to cross-contamination of asphalt material in the sample media. The maximum value for each constituent in the confirmatory soil sampling data set is less than the applicable cleanup criteria. Therefore, if the maximum value does not exceed the cleanup level, the value also will not exceed twice the cleanup level, and since the maximum value is below the RAG, less than 10%

of the results will exceed the RAG. Consequently, all of these constituents satisfy the three-part test criteria in comparison to the cleanup criteria.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the confirmatory sampling approaches and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications. The DQA for the 100-H-41 waste site establishes that the data are of the right type, quality, and quantity to support site confirmatory decisions within specified error tolerances. The evaluation verified that the sample design and resulting data set are acceptable for decision-making purposes. The detailed DQA is presented in Appendix C.

SUMMARY FOR INTERIM CLOSED OUT

The 100-H-41 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999). Confirmatory sampling results support the evaluation that residual contaminant concentrations at the 100-H-41 waste site do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Therefore, the 100-H-41 waste site does not pose a risk to human health or the environment, and no institutional controls are required.
A reclassification to Interim Closed Out is supported for the 100-H-41, 100-H Contaminated Area waste site.

REFERENCES

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

BHI, 2001, *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE Order 5400.5, *Radiation Protection of the Public and Environment*, as amended, U.S. Department of Energy, Washington, D.C.

DOE-RL, 2007, *Tri-Party Agreement Handbook Management Procedures,* RL-TPA-90-0001, Rev. 1, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

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

Ecology, 1994, *National Background Soil Metals Concentrations in Washington State,* Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2009, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington. <https://fortress.wa.gov/ecy/clarc.CLARCHome.aspx>

ENV-1, *Environmental Monitoring & Management*, Washington Closure Hanford, Richland, Washington.

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

GE, 1948a, "Site Work – Overhead Steam Distribution," Drawing P-1248, Sheet 4, General Electric Company, Richland, Washington.

GE, 1948b, "Underground Services – Sewer & Water Section 10," Drawing P-1220, Rev. 17, General Electric Company, Richland, Washington.

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

WCH, 2009a, *Miscellaneous Sampling, 100-H Remaining Sites*, Logbook EL-1601-3, Washington Closure Hanford, Richland, Washington.

WCH, 2009b, *Work Instruction for Confirmatory Sampling of the 100-H-41, 100-H Contaminated Area*, 0100H-WI-G0029, Rev. 0, Washington Closure Hanford, Richland, Washington.

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

APPENDIX A

CALCULATION BRIEFS

APPENDIX A

CALCULATION BRIEFS

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

100-H-41 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100H-CA-V0135, Rev. 1, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

CALCULATION COVER SHEET

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

Area: 100-H

Discipline: Environmental Calculation No: 0100H-CA-V0135

Subject: 100-H-41 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 7 Attachment 1 = 6 Total = 14	T. E. Queen	J. D. Skoglie	B. L. Vedder	D. F. Obenauer	Signed 6/10/2010
1	Cover = 1 Summary = 7 Attachment 1 = 6 Total = 14	T. E. Queen TEQueen	J. D. Skoglie [signature]	B. L. Vedder BLVedder	D. F. Obenauer D.F. Obenauer	7/6/10

SUMMARY OF REVISION

1	Sheet 2, Lines 38-40: Language added to address the cancer risk value of benzo(a)pyrene.

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	6/2/2010	Calc. No.:	0100H-CA-V0135	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	6/2/2010
Subject:	100-H-41 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 7	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 100-H-41 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.

Also, calculate the relative percent difference (RPD) for primary-duplicate sample pairs from 100-H-41 confirmatory sampling, as necessary.

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) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013. U.S. Environmental Protection Agency, Washington, D.C.

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

5) WCH, 2010, *Remaining Sites Verification Package for the 100-H-41, 100-H Contaminated Area Waste Site*, Attachment to Waste Site Reclassification Form 2010-003, 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).

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	6/24/2010	Calc. No.:	0100H-CA-V0135	Rev.:	1
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	6/24/2010
Subject:	100-H-41 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 7	

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

5) Use data from WCH (2010) to perform the RPD calculations for primary-duplicate sample pairs, as required.

METHODOLOGY:

The 100-H-41 waste site is comprised of a single decision unit for confirmation. The direct contact hazard quotient and carcinogenic risk calculations for the 100-H-41 waste site were conservatively calculated for the entire waste site using the confirmatory soil sample and duplicate soil sample results (WCH 2010). Of the contaminants of potential concern (COPCs) for this site, boron, hexavalent chromium, molybdenum, carbazole, dibenzofuran, acenapthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylnapthalene, naphthalene, phenanthrene, and pyrene require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Chromium was detected at background levels and is conservatively included in the HQ and risk calculation. Due to the intent of Method A cleanup values and the allowance to use such values for arsenic (DOE-RL 2009a), arsenic has been excluded from the Method B individual analyte and cumulative risk requirements. 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 1.11 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 1.5×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 1.5×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for hexavalent chromium is 0.20 mg/kg, divided by 2.1 mg/kg, and multiplied as indicated, is 9.5×10^{-8}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met for all constituents with the exception of benzo(a)pyrene. However, benzo(a)pyrene is associated with the presence of asphalt material cross-contaminating the sample media and is therefore not a site contaminant.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 9.9×10^{-6}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	6/24/2010	Calc. No.:	0100H-CA-V0135	Rev.:	1
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	6/24/2010
Subject:	100-H-41 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 7	

5) The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed for certain analytes in Table II-1 of the SAP (DOE-RL 2009b). Other analytes will have their own pre-determined constituents and will have their own TDLs 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:

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

where, M = main sample value D = duplicate sample value

When an analyte is detected in the primary or duplicate 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 results exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. This assessment is provided in the data quality assessment section of the RSVP.

For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. No split samples were collected for cleanup verification of the subject site. Additional discussion is provided in the data quality assessment section of the applicable RSVP (WCH 2010), as necessary.

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}: benzo(a)pyrene
4) List the cumulative excess cancer risk for carcinogens >1 x 10^{-5}: None

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

Table 2 shows the results of the RPD calculations for SDG K1841. The evaluation of the QA/QC duplicate RPD calculations is performed within the data quality assessment section of the RSVP.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	6/10/2010	Calc. No.:	0100H-CA-V0135	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	6/10/2010
Subject:	100-H-41 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 7	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-H-41 Waste Site.

Contaminants of Potential Concern	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.11	7,200	1.5E-04	--	--
Chromium, total	18.5	80,000	2.3E-04	--	--
Chromium, hexavalent[c]	0.20	240	8.3E-04	2.1	9.5E-08
Molybdenum	0.237	400	5.9E-04	--	--
Semivolatiles					
Carbazole	3.74	--	--	50	7.5E-08
Dibenzofuran[d]	1.63	160	1.0E-02	--	--
Methylnapthalene; 2-[d]	0.501	320	1.6E-03	--	--
Polyaromatic Hydrocarbons					
Acenaphthene	0.0746	4,800	1.6E-05	--	--
Acenaphthylene[e]	0.104	4,800	2.2E-05	--	--
Anthracene	0.341	24,000	1.4E-05	--	--
Benzo(a)anthracene	1.11	--	--	1.37	8.1E-07
Benzo(a)pyrene	0.971	--	--	0.137	7.1E-06
Benzo(b)fluoranthene	1.27	--	--	1.37	9.3E-07
Benzo(ghi)perylene	0.431	2,400	1.8E-04	--	--
Benzo(k)fluoranthene	0.396	--	--	1.37	2.9E-07
Chrysene	0.854	--	--	13.7	6.2E-08
Dibenz(a,h)anthracene	0.123	--	--	1.37	9.0E-08
Fluoranthene	2.31	3,200	7.2E-04	--	--
Fluorene	0.200	3,200	6.3E-05	--	--
Indeno(1,2,3-cd)pyrene	0.593	--	--	1.37	4.3E-07
Naphthalene	0.622	1,600	3.9E-04	--	--
Phenanthrene[e]	1.31	24,000	5.5E-05	--	--
Pyrene	1.53	2,400	6.4E-04	--	--
Totals					
Cumulative Hazard Quotient:			**1.5E-02**		
Cumulative Excess Cancer Risk:					**9.9E-06**

Notes:

[a] = From WCH (2010).

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

[d] = When more than one dilution is performed, data from the lesser of the dilutions are used for those analytes not requiring the dilution.

[e] = Toxicity data for acenaphthylene and phenanthrene are not available. The cleanup level is based on use of surrogate chemicals.

acenaphthylene surrogate: acenaphthene

phenanthrene surrogate: anthracene

-- = not applicable

RAG = remedial action goal

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	6/2/2010	Calc. No.:	0100H-CA-V0135	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	6/2/2010
Subject:	100-H-41 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 5 of 7	

Table 2. Relative Percent Difference Calculations for SDG K1841. (3 Pages)

100-H-41 Duplicate Analysis

Sampling Area	Sample Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil	J19CY2	11/23/2009	10.2		2.38	15.5		5.35	18.1		0.282	0.740		0.055
Duplicate of J19CY2	J19CY3	11/23/2009	6.20		2.70	13.0		6.90	16.4		0.197	0.665		0.035

Analysis:

TDL				0.5	0.1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	*48.8%*	17.5%	9.9%	10.7%
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable

100-H-41 Duplicate Analysis

Sampling Area	Sample Number	Sample Date	Radium-228			Thorium-228			Thorium-232			Fluoride		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
Soil	J19CY2	11/23/2009	1.13		0.149	1.43		0.063	1.13		0.149	0.4	B	2.6
Duplicate of J19CY2	J19CY3	11/23/2009	1.04		0.082	1.10		0.025	1.04		0.082	0.5	B	2.6

Analysis:

TDL		0.2	1	1	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	
	RPD	8.3%			
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable

100-H-41 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Sulfate			Aluminum			Arsenic			Barium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	J19CY2	11/23/2009	1.8	B	2.6	9210		3.43	7.00		0.686	76.9		0.343
Duplicate of J19CY2	J19CY3	11/23/2009	2.8		2.6	9830		3.79	8.02		0.759	86.2		0.379

Analysis:

TDL		5	5	10	2
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?		Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		6.5%		11.4%
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable

100-H-41 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Beryllium			Boron			Cadmium			Calcium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	J19CY2	11/23/2009	0.284		0.137	1.01	B	1.37	0.0818	B	0.137	6410		68.6
Duplicate of J19CY2	J19CY3	11/23/2009	0.298		0.152	1.11	B	1.52	0.0882	B	0.152	8490		75.9

Analysis:

TDL		0.2	2	0.2	100
Duplicate Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)			Yes (calc RPD)
	RPD				27.9%
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	Not applicable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	6/2/2010	Calc. No.:	0100H-CA-V0135	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	6/2/2010
Subject:	100-H-41 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 6 of 7	

Table 2. Relative Percent Difference Calculations for the 100-H-41 Waste Site. (3 Pages)

100-H-41 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	J19CY2	11/23/2009	17.7		0.137	5.77		1.37	13.2		0.686	0.17	B	0.21
Duplicate of J19CY2	J19CY3	11/23/2009	18.5		0.152	6.07		1.52	14.2		0.759	0.20	B	0.21

Analysis:

	TDL	1	2	1	0.5
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	No-Stop (acceptable)
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	
	RPD	4.42%		7.3%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable

100-H-41 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	J19CY2	11/23/2009	17600		13.7	7.46		0.343	5310		51.5	270		3.43
Duplicate of J19CY2	J19CY3	11/23/2009	18300		15.2	7.69		0.379	5550		56.9	281		3.79

Analysis:

	TDL	5	5	75	5
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	3.9%		4.4%	4.0%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable

100-H-41 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Molybdenum			Nickel			Potassium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	J19CY2	11/23/2009	0.20	B	1.37	14.3		2.75	1460		275	499	J	1.37
Duplicate of J19CY2	J19CY3	11/23/2009	0.24	B	1.52	15.3		3.04	1550		304	618	J	1.52

Analysis:

	TDL	2	4	400	2
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?		No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD				21.3%
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	Not applicable

100-H-41 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Sodium			Vanadium			Zinc			Anthracene		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	µg/kg	Q	PQL
Soil	J19CY2	11/23/2009	208		34.3	38.7		1.72	42.8		6.86	212	JD	34.4
Duplicate of J19CY2	J19CY3	11/23/2009	225		37.9	40.9		1.9	46.5		7.59	341	J	3.45

Analysis:

	TDL	50	2.5	1	15
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD		5.5%	8.3%	*46.7%*
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	Not applicable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	T. E. Queen	Date:	6/2/2010	Calc. No.:	0100H-CA-V0135	Rev.:	0
Project:	100-H Area Field Remediation	Job No:	14655	Checked:	J. D. Skoglie	Date:	6/2/2010
Subject:	100-H-41 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 7 of 7	

Table 2. Relative Percent Difference Calculations for the 100-H-41 Waste Site. (3 Pages)

100-H-41 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene			Benzo(ghi)perylene		
			µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Soil	J19CY2	11/23/2009	762	JD	34.4	711	JD	34.4	696	JD	34.4	426	JD	34.4
Duplicate of J19CY2	J19CY3	11/23/2009	1110	J	3.45	971	J	3.45	1270	J	3.45	431	J	3.45

Analysis:

	TDL	15	15	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	*37.2%*	*30.9%*	*58.4%*	1.2%
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable

Sampling Area	HEIS Number	Sample Date	Benzo(k)fluoranthene			Chrysene			Dibenz(a,h)anthracene			Fluoranthene		
			µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Soil	J19CY2	11/23/2009	292	JD	34.4	570	JD	34.4	107	JD	34.4	1350	JD	34.4
Duplicate of J19CY2	J19CY3	11/23/2009	396	J	3.45	854	J	3.45	123	J	3.45	2310	J	3.45

Analysis:

	TDL	15	15	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	*30.2%*	*39.9%*	13.9%	*52.5%*
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable

100-H-41 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Fluorene			Indeno(1,2,3-cd) pyrene			Phenanthrene			Pyrene		
			µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Soil	J19CY2	11/23/2009	81.3	JD	34.4	172	JD	34.4	815	JD	34.4	1010	JD	34.4
Duplicate of J19CY2	J19CY3	11/23/2009	200	J	3.45	593	J	3.45	1310	J	3.45	1530	J	3.45

Analysis:

	TDL	15	15	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	*84.4%*	*110.1%*	*46.6%*	*40.9%*
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	Not applicable

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

CONCLUSION:

The calculations in Tables 1 and 2 demonstrate that the 100-H-41 waste site meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk and RPDs, respectively, as identified in the RDR/RAWP (DOE-RL 2009a) and SAP (DOE-RL 2009b). The hazard quotients and carcinogenic (excess cancer) risk and RPD calculations are for use in the RSVP for this site.

Attachment 1. 100-H-41 Confirmatory Sample Results - Radionuclides.

Sample Description	HEIS Number	Sample Date	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil	J19CY2	11/23/2009	0.125	U	0.125	-3.22	UJ	6.05	0.033	U	0.033	0.033	U	0.033	0.090	U	0.090	0.113	U	0.113
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	0.117	U	0.117	-0.718	UJ	6.18	0.016	U	0.016	0.016	U	0.016	0.045	U	0.045	0.051	U	0.051

Sample Description	HEIS Number	Sample Date	Europium-155			Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil	J19CY2	11/23/2009	0.105	U	0.105	10.2		2.38	15.5		5.35	18.1		0.282	0.740		0.055	1.13		0.149
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	0.063	U	0.063	6.20		2.70	13.0		6.90	16.4		0.197	0.665		0.035	1.04		0.082

Sample Description	HEIS Number	Sample Date	Thorium-228			Thorium-232			Tritium			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil	J19CY2	11/23/2009	1.43		0.063	1.13		0.149	-1.01	UJ	6.85	0.212	U	0.212	4.20	U	4.20
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	1.10		0.025	1.04		0.082	-0.385	UJ	6.94	0.106	U	0.106	1.93	U	1.93

Note: Gray cells indicate not applicable.

B = estimated result; result is less than the RL but greater than the MDL.
D = analyte reported from a dilution
E = concentration exceeds the calibration range
J = estimated result
HEIS = Hanford Environmental Information System
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
R = rejected
SVOA = semivolatile organic analysis

Attachment	1	Sheet No.	1 of 6
Originator	T. E. Queen	Date	6/2/10
Checked	J. D. Skoglie	Date	6/2/10
Calc. No.	0100H-CA-V0135	Rev. No.	0

Attachment 1. 100-H-41 Confirmatory Sample Results - Anions.

Sample Description	HEIS Number	Sample Date	Bromide			Chloride			Fluoride			Nitrate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	J19CY2	11/23/2009	2.6	U	2.6	2.6	U	2.6	0.4	B	2.6	2.6	UR	2.6
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	2.6	U	2.6	2.6	U	2.6	0.5	B	2.6	2.6	UR	2.6

Sample Description	HEIS Number	Sample Date	Nitrite			Phosphate			Sulfate			pH		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	pH units	Q	PQL
Soil	J19CY2	11/23/2009	2.6	UR	2.6	2.6	UR	2.6	1.8	B	2.6	8.12	J	0.10
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	2.6	UR	2.6	2.5	BJ	2.6	2.8		2.6	8.14	J	0.10

Attachment	1	Sheet No.	2 of 6
Originator	T. E. Queen	Date	6/2/10
Checked	J. D. Skoglie	Date	6/2/10
Calc. No.	0100H-CA-V0135	Rev. No.	0

Attachment 1. 100-H-41 Confirmatory Sample Results - Metals.

Sample Description	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
Equipment Blank	J19CY1	11/23/2009	109		4.26	0.511	UJ	0.511	0.851	U	0.851	1.21		0.426	0.170	U	0.170	1.70	U	1.70
Soil	J19CY2	11/23/2009	9210		3.43	0.412	UJ	0.412	7.00		0.686	76.9		0.343	0.284		0.137	1.01	B	1.37
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	9830		3.79	0.455	UJ	0.455	8.02		0.759	86.2		0.379	0.298		0.152	1.11	B	1.52

Sample Description	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
Equipment Blank	J19CY1	11/23/2009	0.170	U	0.170	18.6	BUJ	85.1	0.170	U	0.170	1.70	U	1.70	0.851	U	0.851	0.18	B	0.20
Soil	J19CY2	11/23/2009	0.0818	B	0.137	6410		68.6	17.7		0.137	5.77		1.37	13.2		0.686	0.17	B	0.21
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	0.0882	B	0.152	8490		75.9	18.5		0.152	6.07		1.52	14.2		0.759	0.20	B	0.21

Sample Description	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
Equipment Blank	J19CY1	11/23/2009	157		17.0	0.264	B	0.426	9.59	B	63.9	3.24	B	4.26	0.0274	U	0.0274	1.70	U	1.70
Soil	J19CY2	11/23/2009	17600		13.7	7.46		0.343	5310		51.5	270		3.43	0.0265	U	0.0265	0.198	B	1.37
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	18300		15.2	7.69		0.379	5550		56.9	281		3.79	0.0300	U	0.0300	0.237	B	1.52

Sample Description	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
Equipment Blank	J19CY1	11/23/2009	3.41	U	3.41	66.9	B	341	0.255	U	0.255	115	J	1.70	0.170	U	0.170	42.6	U	42.6
Soil	J19CY2	11/23/2009	14.3		2.75	1460		275	0.206	U	0.206	499	J	1.37	0.137	U	0.137	208		34.3
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	15.3		3.04	1550		304	0.228	U	0.228	618	J	1.52	0.152	U	0.152	225		37.9

Sample Description	HEIS Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
Equipment Blank	J19CY1	11/23/2009	2.13	U	2.13	0.944	B	8.51
Soil	J19CY2	11/23/2009	38.7		1.72	42.8		6.86
Soil (Duplicate of J19CY2)	J19CY3	11/23/2009	40.9		1.90	46.5		7.59

Attachment	1	Sheet No.	3 of 6
Originator	T. E. Queen	Date	6/2/10
Checked	J. D. Skoglie	Date	6/2/10
Calc. No.	0100H-CA-V0135	Rev. No.	0

Attachment 1. 100-H-41 Confirmatory Sample Results - Organics (3 Pages)

Constituent	J19CY1 Equipment Blank 11/23/2009			J19CY2 Soil 11/23/2009			J19CY3 Soil (Duplicate) 11/23/2009			J19CY3 Re-run (SVOA) 11/23/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated biphenyls (PCBs)												
Aroclor-1016				13.7	U	13.7	13.7	U	13.7			
Aroclor-1221				13.7	U	13.7	13.7	U	13.7			
Aroclor-1232				13.7	U	13.7	13.7	U	13.7			
Aroclor-1242				13.7	U	13.7	13.7	U	13.7			
Aroclor-1248				13.7	U	13.7	13.7	U	13.7			
Aroclor-1254				13.7	U	13.7	13.7	U	13.7			
Aroclor-1260				13.7	U	13.7	13.7	U	13.7			
Pesticides												
Aldrin				1.37	U	1.37	1.37	U	1.37			
Alpha-BHC				1.37	U	1.37	1.37	U	1.37			
alpha-Chlordane				1.37	U	1.37	1.37	U	1.37			
beta-1,2,3,4,5,6-Hexachlorocyclohexane				1.37	U	1.37	1.37	U	1.37			
Delta-BHC				1.37	UJ	1.37	1.37	UJ	1.37			
Dichlorodiphenyl dichloroethane				1.37	U	1.37	1.37	U	1.37			
Dichlorodiphenyl dichloroethylene				1.37	U	1.37	1.37	U	1.37			
Dichlorodiphenyl trichloroethane				1.37	U	1.37	1.37	U	1.37			
Dieldrin				1.37	U	1.37	1.37	U	1.37			
Endosulfan I				1.37	U	1.37	1.37	U	1.37			
Endosulfan II				1.37	U	1.37	1.37	U	1.37			
Endosulfan sulfate				1.37	U	1.37	1.37	U	1.37			
Endrin				1.37	U	1.37	1.37	U	1.37			
Endrin aldehyde				1.37	U	1.37	1.37	U	1.37			
Endrin ketone				1.37	U	1.37	1.37	U	1.37			
Gamma-BHC (Lindane)				1.37	U	1.37	1.37	U	1.37			
gamma-Chlordane				1.37	U	1.37	1.37	U	1.37			
Heptachlor				1.37	U	1.37	1.37	U	1.37			
Heptachlor epoxide				1.37	U	1.37	1.37	U	1.37			
Methoxychlor				1.37	U	1.37	1.37	U	1.37			
Toxaphene				20.6	UJ	20.6	20.6	UJ	20.6			
Polycyclic aromatic hydrocarbons (PAH)												
Acenaphthene				344	UJ	344	74.6	J	34.5			
Acenaphthylene				344	UJ	344	104	J	34.5			
Anthracene				212	JD	34.4	341	J	3.45			
Benzo(a)anthracene				762	JD	34.4	1110	J	3.45			
Benzo(a)pyrene				711	JD	34.4	971	J	3.45			
Benzo(b)fluoranthene				696	JD	34.4	1270	J	3.45			
Benzo(ghi)perylene				426	JD	34.4	431	J	3.45			
Benzo(k)fluoranthene				292	JD	34.4	396	J	3.45			
Chrysene				570	JD	34.4	854	J	3.45			
Dibenz[a,h]anthracene				107	JD	34.4	123	J	3.45			
Fluoranthene				1350	JD	34.4	2310	J	3.45			
Fluorene				81.3	JD	34.4	200	J	3.45			
Indeno(1,2,3-cd)pyrene				172	JD	34.4	593	J	3.45			
Naphthalene				344	UJ	344	622	J	34.5			
Phenanthrene				815	JD	34.4	1310	J	3.45			
Pyrene				1010	JD	34.4	1530	J	3.45			

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Attachment 1. 100-H-41 Confirmatory Sample Results - Organics (3 Pages)

Constituent	J19CY1 Equipment Blank 11/23/2009			J19CY2 Soil 11/23/2009			J19CY3 Soil (Duplicate) 11/23/2009			J19CY3 Re-run (SVOA) 11/23/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile organic compounds (SVOCs)												
1,2,4-Trichlorobenzene	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
1,2-Dichlorobenzene	332	UJ	332	340	U	340	341	U	341	3410	U	3410
1,3-Dichlorobenzene	332	UJ	332	340	U	340	341	U	341	3410	U	3410
1,4-Dichlorobenzene	332	UJ	332	340	U	340	341	U	341	3410	U	3410
2,4,5-Trichlorophenol	332	UJ	332	340	UJ	340	341	UJ	341	3410	UR	3410
2,4,6-Trichlorophenol	332	UJ	332	340	U	340	341	UJ	341	3410	UR	3410
2,4-Dichlorophenol	332	UJ	332	340	UJ	340	341	UJ	341	3410	UR	3410
2,4-Dimethylphenol	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
2,4-Dinitrophenol	1660	UJ	1660	1700	UJ	1700	1700	UJ	1700	17000	UJ	17000
2,4-Dinitrotoluene	332	UJ	332	340	U	340	341	U	341	3410	U	3410
2,6-Dinitrotoluene	332	UJ	332	340	U	340	341	U	341	3410	U	3410
2-Chloronaphthalene	332	UJ	332	340	U	340	341	U	341	3410	U	3410
2-Chlorophenol	332	UJ	332	340	U	340	341	U	341	3410	U	3410
2-Methylnaphthalene	332	UJ	332	340	UJ	340	501	J	341	610	J	3410
2-Methylphenol (cresol, o-)	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
2-Nitroaniline	1660	UJ	1660	1700	U	1700	1700	U	1700	17000	U	17000
2-Nitrophenol	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
3+4 Methylphenol (cresol, m+p)	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
3,3'-Dichlorobenzidine	663	UJ	663	680	U	680	681	U	681	6810	U	6810
3-Nitroaniline	1660	UJ	1660	1700	U	1700	1700	U	1700	17000	U	17000
4,6-Dinitro-2-methylphenol	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
4-Bromophenylphenyl ether	332	UJ	332	340	U	340	341	UJ	341	3410	UR	3410
4-Chloro-3-methylphenol	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
4-Chloroaniline	332	UJ	332	340	U	340	341	UJ	341	3410	UJ	3410
4-Chlorophenylphenyl ether	332	UJ	332	340	U	340	341	UJ	341	3410	UR	3410
4-Nitroaniline	1660	UJ	1660	1700	U	1700	1700	U	1700	17000	U	17000
4-Nitrophenol	1660	UJ	1660	1700	U	1700	1700	U	1700	17000	U	17000
Acenaphthene	332	UJ	332	340	U	340	2690		341	3230		3410
Acenaphthylene	332	UJ	332	340	U	340	341	U	341	3410	U	3410
Anthracene	332	UJ	332	51.8	J	340	5980	E	341	6830	D	3410
Benzo(a)anthracene	332	UJ	332	187	J	340	10800	E	341	12100	D	3410
Benzo(a)pyrene	332	UJ	332	168	J	340	9760	E	341	10600	D	3410
Benzo(b)fluoranthene	332	UJ	332	143	J	340	9310	E	341	10200	D	3410
Benzo(ghi)perylene	332	UJ	332	90.0	J	340	6710	E	341	5180	D	3410
Benzo(k)fluoranthene	332	UJ	332	171	J	340	6950	E	341	9580	D	3410
Bis(2-chloro-1-methylethyl)ether	332	UJ	332	340	U	340	341	UJ	341	3410	UR	3410

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Attachment 1. 100-H-41 Confirmatory Sample Results - Organics (3 Pages)

Constituent	J19CY1 Equipment Blank 11/23/2009			J19CY2 Soil 11/23/2009			J19CY3 Soil (Duplicate) 11/23/2009			J19CY3 Re-run (SVOA) 11/23/2009		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile organic compounds (SVOCs), continued.												
Bis(2-Chloroethoxy)methane	332	UJ	332	340	UJ	340	341	UJ	341	3410	UR	3410
Bis(2-chloroethyl) ether	332	UJ	332	340	U	340	341	UJ	341	3410	UR	3410
Bis(2-ethylhexyl) phthalate	332	UJ	332	340	U	340	341	U	341	3410	U	3410
Butylbenzylphthalate	332	UJ	332	340	U	340	341	U	341	3410	U	3410
Carbazole	332	UJ	332	340	U	340	3310	E	341	3740	D	3410
Chrysene	332	UJ	332	196	J	340	10300	E	341	11300	D	3410
Di-n-butylphthalate	332	UJ	332	340	U	340	341	U	341	3410	U	3410
Di-n-octylphthalate	332	UJ	332	340	U	340	341	U	341	3410	U	3410
Dibenz[a,h]anthracene	332	UJ	332	340	U	340	2410		341	2370		3410
Dibenzofuran	332	UJ	332	340	U	340	1630		341	2020		3410
Diethylphthalate	332	UJ	332	340	U	340	341	U	341	3410	U	3410
Dimethyl phthalate	332	UJ	332	340	U	340	341	U	341	3410	U	3410
Fluoranthene	332	UJ	332	355		340	15700	E	341	14800	D	3410
Fluorene	332	UJ	332	340	U	340	2440		341	3250		3410
Hexachlorobenzene	332	UJ	332	340	U	340	341	U	341	3410	U	3410
Hexachlorobutadiene	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
Hexachlorocyclopentadiene	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
Hexachloroethane	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
Indeno(1,2,3-cd)pyrene	332	UJ	332	76.6	J	340	6350	E	341	5050	D	3410
Isophorone	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
N-Nitroso-di-n-dipropylamine	332	UJ	332	340	U	340	341	U	341	3410	UJ	3410
N-Nitrosodiphenylamine	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
Naphthalene	332	UJ	332	340	UJ	340	1740	J	341	2160	J	3410
Nitrobenzene	332	UJ	332	340	UJ	340	341	UJ	341	3410	UJ	3410
Pentachlorophenol	1660	UJ	1660	1700	U	1700	1700	UJ	1700	1700	UR	1700
Phenanthrene	332	UJ	332	224	J	340	18100	E	341	20500	D	3410
Phenol	332	UJ	332	340	U	340	341	U	341	3410	U	3410
Pyrene	332	UJ	332	318	J	340	15300	EJ	341	17200	DJ	3410

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APPENDIX B

ECOLOGICAL RISK COMPARISON TABLE

Table B-1. Maximum Contaminant Concentrations That Exceed Ecological Screening Levels for the 100-H-41 Waste Site. [a]

Hazardous Substance	Background	2001 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)							
Boron	NA	0.5	—	—	—	—	—	—	1.11
Manganese	512	1,100	—	1,500	220	450	4,300	4,000	281 (<BG)
Vanadium	85.1	2	—	—	—	—	7.8	280	40.9 (<BG)
Zinc	67.8	86	200	360	160	120	46	79	46.5
Organics (mg/kg)									
High Molecular Weight PAH [d]						18		1.1	7.278

[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 that will include a more complete quantitative ecological risk assessment.

[b] Available on the internet at <www.epa.gov/ecotox/ecossl>.

[c] Wildlife.

[d] High molecular weight polynuclear aromatic hydrocarbons (HMW-PAH), e.g., benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz[a,h]anthracene, indeno[1,2,3-cd]pyrene, perylene, and pyrene.

— = not available
BG = background
EPA = U.S. Environmental Protection Agency
NA = not applicable
PAH = polyaromatic hydrocarbons
WAC = *Washington Administrative Code*

APPENDIX C

DATA QUALITY ASSESSMENT

APPENDIX C

DATA QUALITY ASSESSMENT

CONFIRMATORY SAMPLING

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

A review of the sample design (WCH 2009b), the field logbook (WCH 2009a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the 100 Area SAP 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).

Sample data collected at the 100-H-41 waste site were provided by the laboratory in one sample delivery group (SDG), SDG K1841 which was also submitted for third-party validation. Major and minor deficiencies were identified in the analytical data set, and are discussed below.

MAJOR DEFICIENCIES

In the semi-volatile organic analysis (SVOA), high concentrations of target analytes in sample J19CY3 resulted in laboratory applied "E" flags to indicate that some of the analytes exceeded the calibration curve. To mitigate these exceedances the laboratory diluted the sample and re-analyzed under the sample identification, J19CY3-R. A surrogate recovery in sample J19CY3-R is below the quality control (QC) limits at 8%. Third-party validation has qualified the associated analytes in sample J19CY3-R with "R" flags as rejected data. These rejected analytes are 2,4-dichlorophenol, 2,4,6-trichlorophenol, 2,4,5-trichlorophenol, pentachlorophenol, bis(2-chloroisopropyl)ether, bis(2-chloroethoxy) methane, 4-chlorophenyl phenyl ether, and 4-bromophenyl phenyl ether. However, none of these analytes were qualified with "E" flags in the original analysis of sample J19CY3. Data from the lower dilution (J19CY3) are used for site evaluation, except for those analytes qualified with "E" flags. Data from the higher dilution of sample J19CY3-R are used for site evaluation of those analytes that were qualified with "E" flags in sample J19CY3. None of the rejected data from sample J19CY3-R are used for site evaluation. The SVOA data are usable for decision-making purposes.

In the anions analysis, holding times for nitrate, nitrite, and orthophosphate were exceeded by more than twice the limit. Third-party validation qualified all of undetected nitrate, nitrite, and orthophosphate data with "UR" flags as undetected and rejected data. The U.S. Environmental Protection Agency (EPA) Method 300 anions analysis was selected in order to evaluate sulfate, which is a contaminant of potential concern (COPC) for the 100-H-41 waste site. Nitrate, nitrite, and orthophosphate are incidental analytes included with the anions data. Therefore, the rejection of the nitrate, nitrite and orthophosphate data does not impact the evaluation of the 100-H-41 waste site.

MINOR DEFICIENCIES

Minor deficiencies are discussed for the 100-H-41 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 K1842

This SDG comprises one primary soil sample (J19CY2), a duplicate (DUP) (J19CY3), and an equipment blank (EB) (J19CY1). The EB was analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, and semivolatile organic compounds (SVOCs). The primary sample and duplicate were analyzed for the same analytes as the EB plus, gross alpha, gross beta, carbon-14, nickel-63, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAH), pesticides, sulfate, and by gamma energy analysis (GEA).

SDG K1842 was submitted for third-party validation. Minor deficiencies and qualification from third-party validation are as follows:

In the SVOA, the laboratory did not analyze the EB (J19CY1) at the same time as the other samples. This oversight was not corrected before the holding time for the EB was exceeded by one day. Third-party validation qualified all of the SVOA results for sample J19CY1 with "J" flags as estimated data due to exceedance of the hold time by less than twice the acceptance limit. Estimated data are usable for decision-making purposes.

In the SVOA, the matrix spike (MS) and/or matrix spike duplicate (MSD) recoveries for 4-chloroanaline (30%, 28%), 1,2,4-trichlorobenzene (45%), hexachlorobutadiene (49%), and isophorone (49%), associated with all of the samples except the EB, are above the acceptance criteria. Third-party validation qualified all of these results in SDG K1842 with "J" flags as estimated. Estimated data are usable for decision-making purposes.

In the SVOA, the MS/MSD recoveries associated with the EB (J19CY1) for 2,4-dinitrophenol (28%, 20%), 3,3-dichlorobenzidine (45%), 4,6-dinitro-2-methylphenol (49%, 38%), 4-chloroanaline (40%, 44%) and 4-nitrophenol (39%) and pentachlorophenol (46%) are outside the QC limits. Third-party validation qualified all of the results for these analytes in sample J19CY1 with "J" flags as estimated values. Estimated data are usable for decision-making purposes.

In the SVOA, for all field samples except the EB, the laboratory control sample (LCS) recoveries for 1,2,4-trichlorobenzene (35%), 2,4,5-trichlorophenol (48%), 2,4-dichlorophenol (38%), 2,4,-dimethylphenol (39%), 2,4-dinitrophenol (30%), 2-methylnaphthalene (42%), 4-chloro-3-methylphenol (38%), 4-chloroanaline (28%), 3 and 4-methylphenol (46%), bis(2chloroethoxy)methane (485), hexachlorobutadiene (39%), Hexachlorocyclopentadiene (47%), hexachloroethane (46%), isophorone (39%), naphthalene (42%), nitrobenzene (45%), n-nitrosodiphenylamine (48%), and pyrene (48%) are outside QC limits. Third-party validation qualified these results with "J" flags as estimated data. Estimated data are usable for decision-making purposes.

In the SVOA, LCS recoveries associated with the EB (C19CY1) for 2,4-dinitrophenol (23%), and 4,6-dinitro-2-methylphenol (44%) are outside QC limits. Third-party validation qualified these results with "J" flags as estimated data. Estimated data are usable for decision-making purposes.

In the SVOA, a surrogate recovery in sample J19CY3 is below the QC limits at 16%. Third-party validation has qualified the associated analytes (2,4-dichlorophenol, 2,4,6-trichlorophenol, 2,4,5-trichlorophenol, pentachlorophenol, bis[2-chhloroisopropyl]ether, bis[2-chloroethoxy] methane, 4-chlorophenyl phenyl ether, 4- bromophenyl phenyl ether) with "J" flags as estimated data. Estimated data are usable for decision-making purposes.

In the SVOA, the relative percent difference (RPD), calculated between the MS and the MSD associated with sample J19CY1, for 2,4-dinitrophenol is outside QC limits (<30%) at 36%. Third-party validation qualified results for 2,4-dinitrophenol in sample J19CY1 with a "J" flag as estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis by EPA Method 8310, several MS recoveries are outside QC limits. All of the PAH analytes, analyzed by method 8310 in SDG K1841, except dibenz(a,h)anthracene, pyrene, fluoranthene, and acenaphthylene were qualified by third-party validation with "J" flags as estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis by EPA Method 8310, a MS recovery associated with sample J19CY2 and the analyte acenaphthylene is above the QC limit at 193%. This may indicate a high bias for acenaphthylene in sample J19CY2. Third-party validation qualified the acenaphthylene result in sample J19CY2 with a "J" flag as estimated. Estimated and/or high biased data are usable for decision-making purposes.

In the PAH analysis by EPA Method 8310, several MSD recoveries associated with sample J19CY2 are outside QC limits. With the exception of naphthalene, acenapthylene, and acenaphthene, all of the PAH results were qualified by third-party validation with "J" flags as estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis by EPA Method 8310, a surrogate recovery associated with sample J19CY3 is above the acceptance criteria at 422%. This may indicate a high bias for all data in sample J19CY2. Third-party validation qualified all of the Method 8310 data for sample J19CY3 with

"J" flags as estimated. Estimated and/or high biased data are usable for decision-making purposes.

In the PAH analysis by EPA Method 8310, due to high RPDs calculated between the MS and MSD, third-party validation qualified all PAH results with "J" flags as estimated. Estimated data are usable for decision-making purposes.

In the radiochemical analysis, tritium and carbon-14 were not included in the MSs. Third-party validation qualified all of the tritium and carbon-14 results with "J" flags as estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, low level concentrations of calcium and potassium detected in the MB are similar to concentrations detections in the equipment blank (J19CY1). Third-party validation qualified the calcium and potassium results in sample J19CY1 with "UJ" flags as undetected and estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery for antimony is below acceptance limits at 31%. Third-party validation qualified all antimony results in SDG K1841 with "J" flags as estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon is above acceptance limits at 134%. Third-party validation qualified all silicon results in SDG K1841 with "J" flags as estimated. Estimated data are usable for decision-making purposes.

In the chlorinated pesticides analysis, MS and MSD recoveries (49%, 41%) for delta-BHC are below the acceptance limits. Third-party validation qualified all delta-BHC results in SDG K1841 with "J" flags as estimated. Estimated data are usable for decision-making purposes.

In the chlorinated pesticide analysis, the analyte toxaphene was not included in the MS, MSD, or LCS samples. Toxaphene is actually a mixture of compounds rather than a discrete analyte. While the overall concentration of toxaphene can be calculated using several unobstructed peaks in the chromatography, the inclusion of toxaphene in the spiking mixture would be problematic for the other pesticide analytes. The laboratory typically quantitates toxaphene but does not include toxaphene in quality assurance (QA)/QC samples. Third-party validation qualified all toxaphene results in SDG K1841 with "J" flags as estimated. Estimated data are usable for decision-making purposes.

In the pH and anions analyses, holding times were exceeded by more than twice the limit for nitrate, nitrite, orthophosphate, and pH. Third-party validation qualified all of the pH and all of the detected nitrate, nitrite, and orthophosphate data with "J" flags as estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field QA/QC measures are used to assess potential sources of error and cross-contamination of samples that could bias results. Field QA/QC 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 2009a), are summarized in Table C-1. The main and QA/QC sample results are presented in Appendix A.

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

Sample Area	Main Sample	Duplicate Sample
Excavation	J19CY2	J19CY3

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). RPDs are not calculated for analytes that are not detected in both the main and duplicate sample at more than 5 times the target detection limit. The RPDs of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The *Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation* in Appendix A provides details on duplicate pair evaluation and RPD calculation.

The RPDs calculated for gross alpha (48.0%), anthracene (46.7%), benzo(a)anthracene (37.2%), benzo(a)pyrene (30.9%), benzo(b)fluoranthene (58.4%), benzo(k)fluoranthene (30.2%), chrysene (39.9%), fluoranthene (52.5%), fluorene (84.4%), indeno(1,2,3-cd)pyrene (110.1%), phenanthrene (46.6%), and pyrene (40.9%) are above the acceptance criteria (<30%). Elevated RPDs such as these are generally attributed to natural heterogeneities in the sample matrix. The data are usable for decision-making purposes.

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

SUMMARY

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above, are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 100-H-41 waste site sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 100- H-41 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The 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 analytical data are also summarized in Appendix A.

REFERENCES

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

BHI, 2000b, *Data Validation Procedure for Radiochemical Analysis*, BHI-01433, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

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

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

WCH, 2009a, *Miscellaneous Sampling, 100-H Remaining Sites*, Logbook EL-1601-3, Washington Closure Hanford, Richland, Washington.

WCH, 2009b, *Work Instruction for Confirmatory Sampling of 100-H-41, 100-H Contaminated Area,* Work Instruction No. 0100H-WI-G0029, Rev. 0, Washington Closure Hanford, Richland, Washington.