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

12-AMRC-0003

OCT 07 2011

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

Dear Mr. Faulk:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 600-186, HANFORD CONSTRUCTION CAMP SEPTIC TANKS AND SEWAGE TREATMENT PLANTS, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2011-069 and supporting, "Remaining Sites Verification Package for the 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants," Rev. 0. If you have questions, please contact me or your staff may contact Jamie Zeisloft, of my staff, at (509) 372-0188.

Sincerely,

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

AMRC:JHZ

Attachment

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

cc w/o attach:
R. D. Cantwell, WCH
S. L. Feaster, WCH
C. H. Page, WCH
M. L. Proctor, WCH
J. P. Shearer, CHPRC

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Date Submitted: 7/6/11 Originator: M. L. Proctor Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-IU-6 Waste Site Code: 600-186 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☐ No Action ☒ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2011-069

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 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants waste site consists of all of the septic tanks, sewage treatment plants, and associated piping at the Hanford Construction Camp. The Hanford Construction Camp was built on top of and around the original Hanford town site. The 600-186 waste site is 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 (EPA 2009) as a candidate site for further evaluation. Confirmatory sampling of the 600-186 waste site was conducted between May 26, 2010, and March 24, 2011, in accordance with remedial action objectives and goals established by the *Interim Action Record of Decision for the100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999). 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 No Action.

Basis for reclassification:

In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 600-186 waste site to No Action. The current site conditions achieve the remedial action goals established by the Remaining Sites ROD (EPA 1999). The evaluation of the results of confirmatory sampling resulted in a determination that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow-zone soils (i.e., surface to 4.6 m [15 ft] deep). The analytical results and rationale presented in the attached remaining sites verification package demonstrate that residual contaminant concentrations are protective of direct exposure, groundwater, and the Columbia River. The waste site contamination did not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep-zone soil are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants* (attached).

Waste Site Controls:

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

M. S. French DOE Federal Project Director (printed)	M S French Signature	9/13/11 Date
N/A Ecology Project Manager (printed)	Signature	Date
C. Guzzetti EPA Project Manager (printed)	Signature	9/14/11 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-186, HANFORD CONSTRUCTION CAMP SEPTIC TANKS AND SEWAGE TREATMENT PLANTS

Attachment to Waste Site Reclassification Form 2011-069

July 2011

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-186, HANFORD CONSTRUCTION CAMP SEPTIC TANKS AND SEWAGE TREATMENT PLANTS

EXECUTIVE SUMMARY

The 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants waste site is part of the 100-IU-6 Operable Unit. The Hanford Construction Camp was built on top of and around the original Hanford town site covering an area of 607 ha (1,500 ac) approximately 4.2 km (2.6 mi) long and 1.6 km (1 mi) wide (WHC 1993). The 600-186 waste site is included in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington* (EPA 2009) as a candidate site for further evaluation.

The construction camp housed approximately 50,000 people between 1943 and 1945. The 600-186 waste site consists of all of the septic tanks, sewage treatment plants, and associated piping at the Hanford Construction Camp. Three former sewage treatment plant settling basins were identified from depressions or large trenches at the site. Other septic related features were identified through the orphan sites evaluation process.

Confirmatory sampling was conducted in accordance to the *Work Instruction for Confirmatory Sampling of the 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants* (WCH 2010b). The confirmatory work instruction provided for the sampling of three large settling basins, the three largest septic tanks, and four other suspected septic related features. One of the suspected septic related features proved not to be septic related, but rather a water well dating back to the original Hanford township. Consequently, a confirmatory sample was not collected at that location (test pit 2). All of the remaining samples prescribed in the confirmatory work instruction (WCH 2010b) were collected between May 26, 2010 and March 24, 2011.

The confirmatory sample results indicate that the 600-186 waste site meets the remedial action objectives (RAOs) and remedial action goals (RAGs) for the waste site. A summary of the evaluation for the soil sample results against the applicable criteria is presented in Table ES-1. These results are used to make reclassification decisions for the 600-186 waste site in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2007).

Table ES-1. Summary of Remedial Action Goals for the 600-186 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15-mrem/yr above background over 1,000 years.	Elevated radiological activity was not detected in the field. Therefore, radionuclides were not considered COPCs for the 600-186 waste site.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for all sampling areas (4.0×10^{-1}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	Excess cancer risk values for individual nonradionuclide COPCs are $<1 \times 10^{-6}$.	
Risk Requirements – Nonradionuclides	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess carcinogenic risk for all sampling areas (4.7×10^{-7}) is $<1 \times 10^{-5}$.	Yes
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Elevated radiological activity was not detected in the field. Therefore, radionuclides were not considered COPCs for the 600-186 waste site.	NA
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [a].		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 21.2 pCi/L [c].		

Table ES-1. Summary of Remedial Action Goals for the 600-186 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Cadmium, chromium, copper, lead, mercury, silver, zinc, aroclor-1260, and the total PCBs are present at concentrations above soil RAGs for groundwater and/or Columbia River protection. However, an evaluation based upon RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) shows that residual concentrations of these constituents are not predicted to migrate more than 3 m (9.8 ft) within 1,000 years based on the soil-partitioning coefficient (K_d) of 22 mL/g for copper (the contaminant with the lowest K_d value). The thickness of the vadose zone beneath 600-186 is a minimum of 7.0 m (23.0 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the river.	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).

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

In accordance with this evaluation, the confirmatory sampling results support a reclassification of this site to No Action. The current site conditions achieve the RAOs and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow-zone soil (i.e., surface to 4.6 m [15 ft]), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River. The excavation area is Interim Closed Out using the more restrictive of the shallow-zone direct exposure and groundwater/river protection criteria; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

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

REMAINING SITES VERIFICATION PACKAGE FOR THE 600-186, HANFORD CONSTRUCTION CAMP SEPTIC TANKS AND SEWAGE TREATMENT PLANTS

STATEMENT OF PROTECTIVENESS

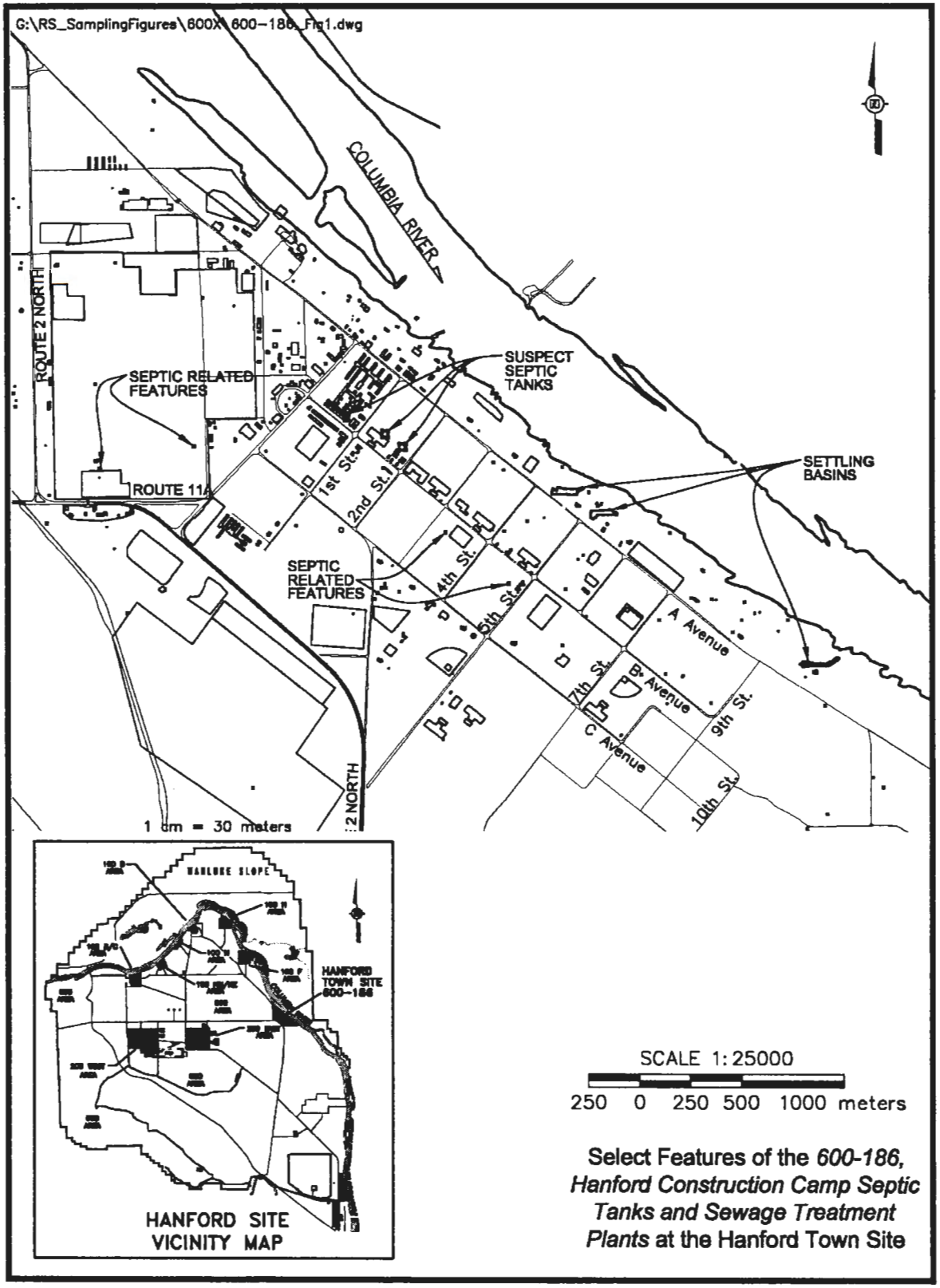
The 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants waste site confirmatory sampling data, site evaluations, and supporting documentation demonstrate that this site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (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). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow-zone soil (i.e., surface to 4.6 m [15 ft]) and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. The excavation area is Interim Closed Out using the more restrictive of the shallow-zone direct exposure and groundwater/river protection criteria; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

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 (Appendix A). Those constituents exceeding the ecological screening level in the *Washington Administrative Code* Chapter 173-340, Table 749-3 were barium, boron, chromium, lead, mercury, selenium, silver, zinc, and vanadium. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for antimony, cadmium, chromium, copper, lead, manganese, silver, vanadium, and zinc. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because the maximum detected levels of antimony, barium, manganese, selenium, and vanadium are below Hanford Site background values, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of the final closeout decision for the Columbia River corridor portion of the Hanford Site.

GENERAL SITE INFORMATION AND BACKGROUND

The Hanford Construction Camp was built on top of and around the original Hanford town site (Figure 1). Following the removal of the local residents, the U.S. Army created the construction camp, which eventually housed approximately 50,000 people between 1943 and 1945. The construction camp covered an area of 607 ha (1,500 ac) approximately 4.2 km (2.6 mi) long and 1.6 km (1 mi) wide (WHC 1993).

Figure 1. 600-186 Hanford Construction Camp and Former Hanford Townsite Location Map.



Preparation for the construction camp began in March 1943, with construction of trailer camps beginning on May 20, 1943 (WHC 1993). Some of the pre-Manhattan Project Hanford town site facilities remained and were used to support the construction camp. Existing facilities included several residences, a passenger and freight station, grange hall, Masonic hall, high school, church, and the branch line for the Chicago Milwaukee Railroad (HEW 1945a).

The basic elements of the trailer camps included canopies, bathhouses, ice houses, coal storage buildings, playgrounds, clothes drying lots, a trailer office, a trailer camp warehouse, and a dog pound. The trailer camps provided the residents with roadways, walkways, telephones, landscaping, water service, electrical service, and a septic system. Water was provided to central locations between adjacent lots with 7.6-m (25-ft)-long rubber hoses to allow residents to fill water reservoirs in their trailers for household use. Individual sewer drains were available for each lot for trailer sink and toilet connections. Bathing, laundry, and additional restroom facilities were provided separate from the trailers in 139 bathhouses that were generally located in the center of each block and provided services to an average of 26 families (HEW 1945a).

Operation of the camp was terminated on February 17, 1945 (HEW 1945b, 1945c). Following the termination of operations at the camp, a small force of patrol, fire, and boat repair personnel remained. All portable hutments were dismantled and shipped offsite. Trailers left in the camp were disposed of by the Benton County Sheriff. When the construction camp was dismantled, about 80% of the camp was sold to a Chicago salvage company with the remaining 20% kept as a residual camp for potential future use.

The Hanford Construction Camp was supported by a system of underground sanitary waste treatment facilities. These facilities consisted of approximately 80 septic tanks and 3 waste treatment plants, in addition to an unspecified number of septic tanks and drain fields that predate the construction camp but were used for camp purposes. DuPont (HEW 1945a) describes three sewage treatment plants for the camp. Each included a system of septic tanks and a waste treatment facility connected by 4- to 30-in.-diameter vitrified clay or concrete pipe. Septic tanks were "standard design, three pass baffle, wooden box type," varying in size from 1.2 by 4.9 by 1.8 m up to 7.3 by 18.3 by 3.05 m (4 by 16 by 6 ft up to 24 by 60 by 10 ft). The septic tanks were scattered throughout the camp area at required locations (HEW 1945a). At the beginning of the Hanford Construction Camp, wooden grease traps were provided to separate the grease from the main sewage going to the settling basins. Serious trouble resulted when the grease traps were inadequate both in size and design. Garbage from the mess hall kitchens was also a problem, so a device to collect both grease and garbage was required. All sewage carried by the three sewage disposal systems was chlorinated.

The 600-186 waste site is part of the 100-IU-6 Operable Unit and consists of all of the septic tanks, sewage treatment plants, and associated piping at the Hanford Construction Camp. Several of the components of this waste site have been identified by observations made in the field. Three former sewage treatment plant settling basins were identified from depressions or large trenches on the river side of "A" Avenue (Figure 1). The northernmost basin, near the east end of Fifth Street, is the largest and deepest, beginning at a group of trees, extending to the river, and cutting into the Columbia River bank. Small pieces of concrete, concrete pipe, vitrified clay pipe, and wood have been observed around the trench. The bottom of the trench

has fine soil that does not appear to be sludge derived from sewage. The middle trench, just south of the first trench, is shallower and not as obvious in appearance with small pieces of concrete also observed at the head and around the exterior of the trench. A layer of material observed on the east side of the middle trench may be sludge associated with sewage treatment. At the southernmost depression, the outline of a foundation is apparent on the north side.

Confirmatory Sampling Activities

Confirmatory sampling was conducted in accordance to the *Work Instruction for Confirmatory Sampling of the 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants* (WCH 2010b). The confirmatory work instruction provided for sampling at 10 locations. Four locations corresponding to various suspected septic related features were indicated (Figures 2 and 3). One of the suspected septic related features proved not to be septic related but rather to be a water well dating back to the original Hanford township. Consequently, a confirmatory sample was not collected at that location (test pit 2). Three sampling locations were large septic tanks associated with the administration buildings, mess halls, and the Olympic office buildings, which serviced the construction camp (Figure 4). Additionally, three surface samples within the large settling basins near the river were indicated (Figures 5 and 6). Samples were collected between May 26, 2010 and March 24, 2011.

Discussions between the EPA, the U.S. Department of Energy, and Washington Closure Hanford concluded that the 600-186 septic system should be sampled at locations with the highest potential for nonhuman-waste-related contaminants. Samples from the three settling basins along the Columbia River and four septic related features (two residential, two industrial) were determined to be sufficient to characterize the 600-186 waste site (EPA 2008).

Samples from the septic tanks and septic related features were collected from within or below those installations. Samples of the three settling basins were collected from 0.3 m (1 ft) below ground surface to avoid wind blown materials that have been deposited on the surface. Samples were collected in accordance with ENV-1, *Environmental Monitoring & Management* to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009a).

Confirmatory Sampling Results

All of the explicitly specified samples collected during confirmatory sampling were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, and polychlorinated biphenyls (PCBs) with the exception of the equipment blank which was analyzed for ICP metals and mercury. In addition, at test pit 3 dark staining was observed during excavation and sampled (sample J1CP02). In addition to the analyses performed on the other field samples, sample J1CP02 was also analyzed for total petroleum hydrocarbons (TPH) and polyaromatic hydrocarbons (PAH).

Figure 2. Industrial Septic Related Features (Test Pits 1 and 2).

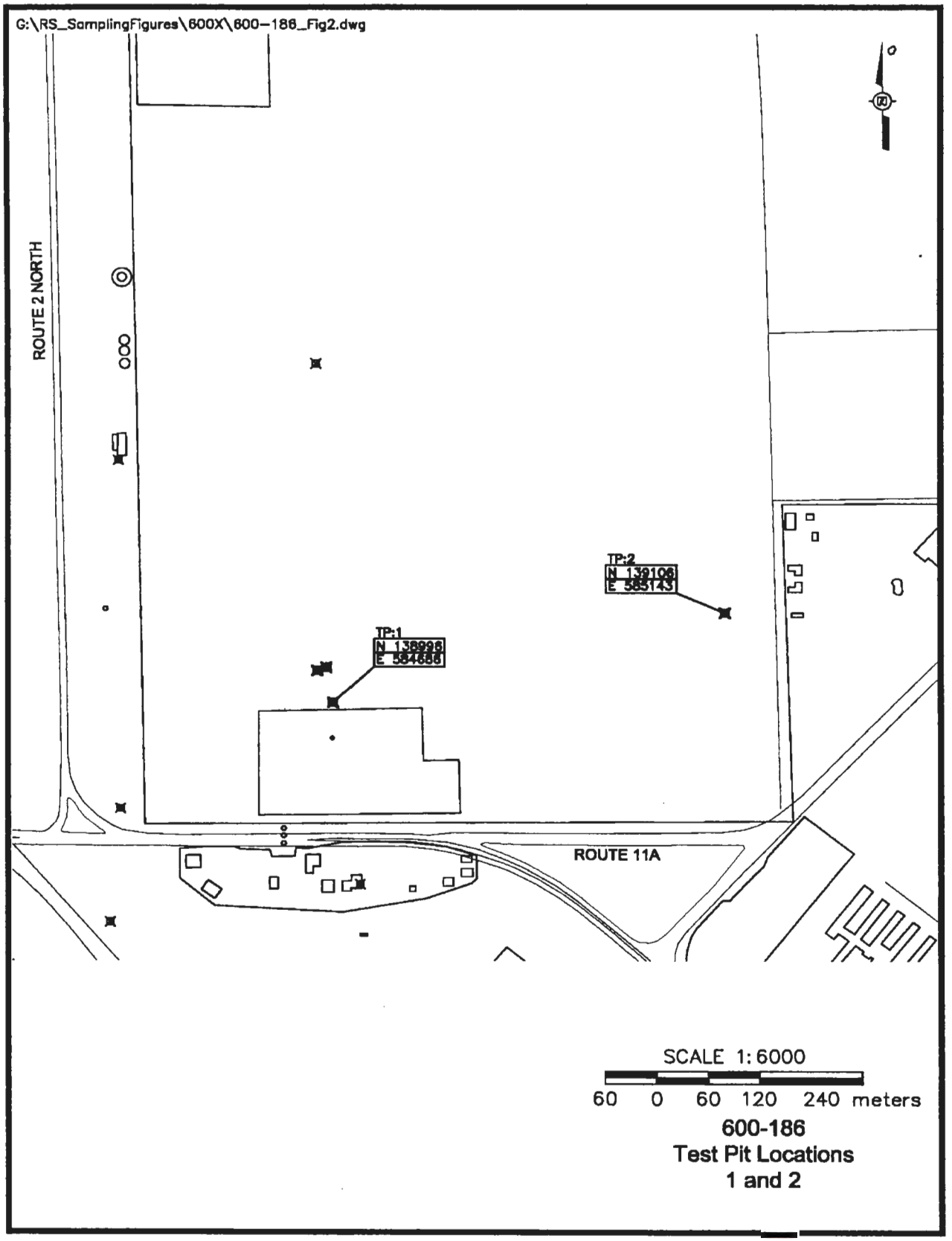


Figure 3. Residential Septic Related Features (Test Pits 6 and 7).

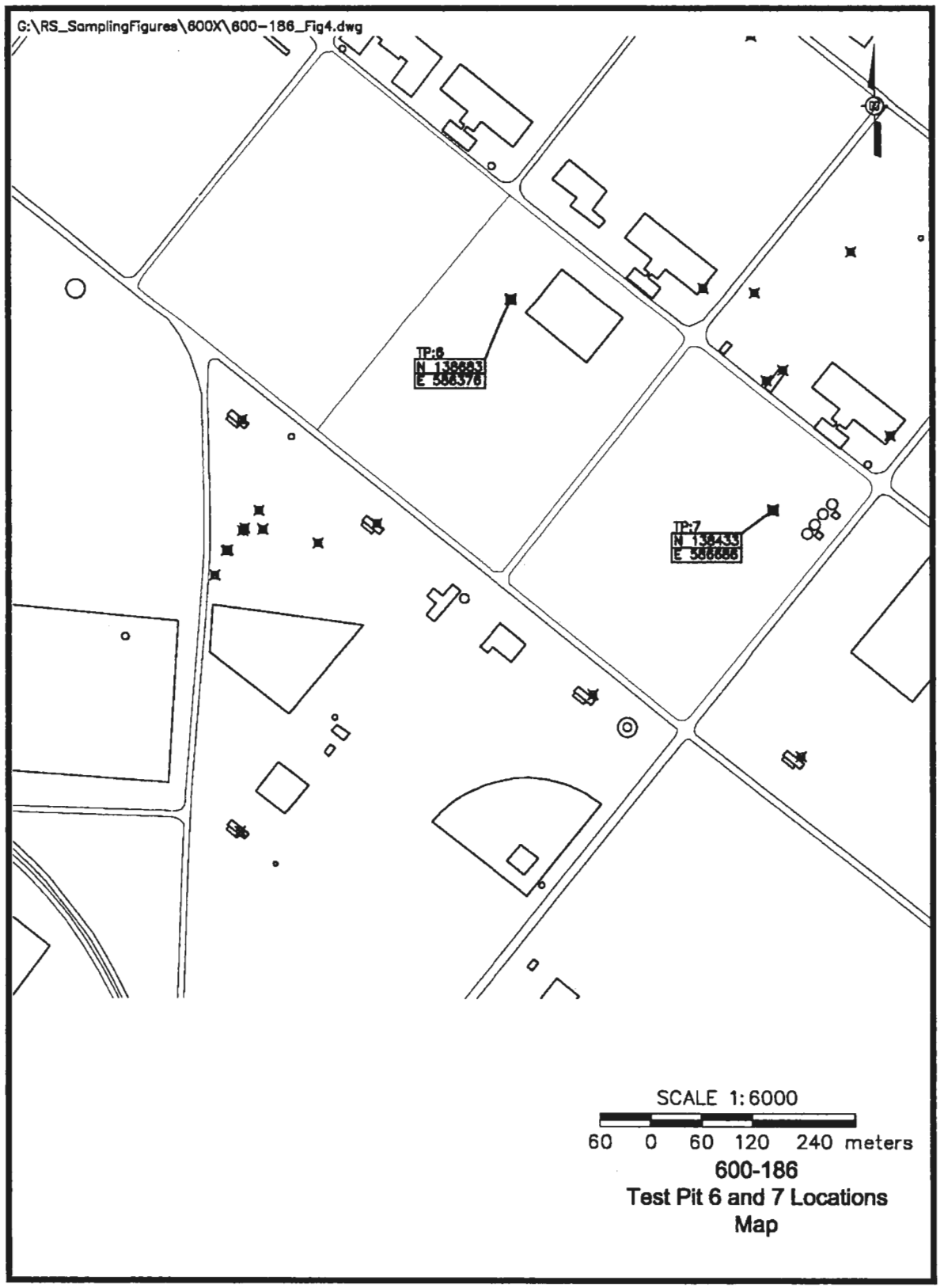


Figure 4. Large Septic Tanks (Test Pits 3, 4, and 5).

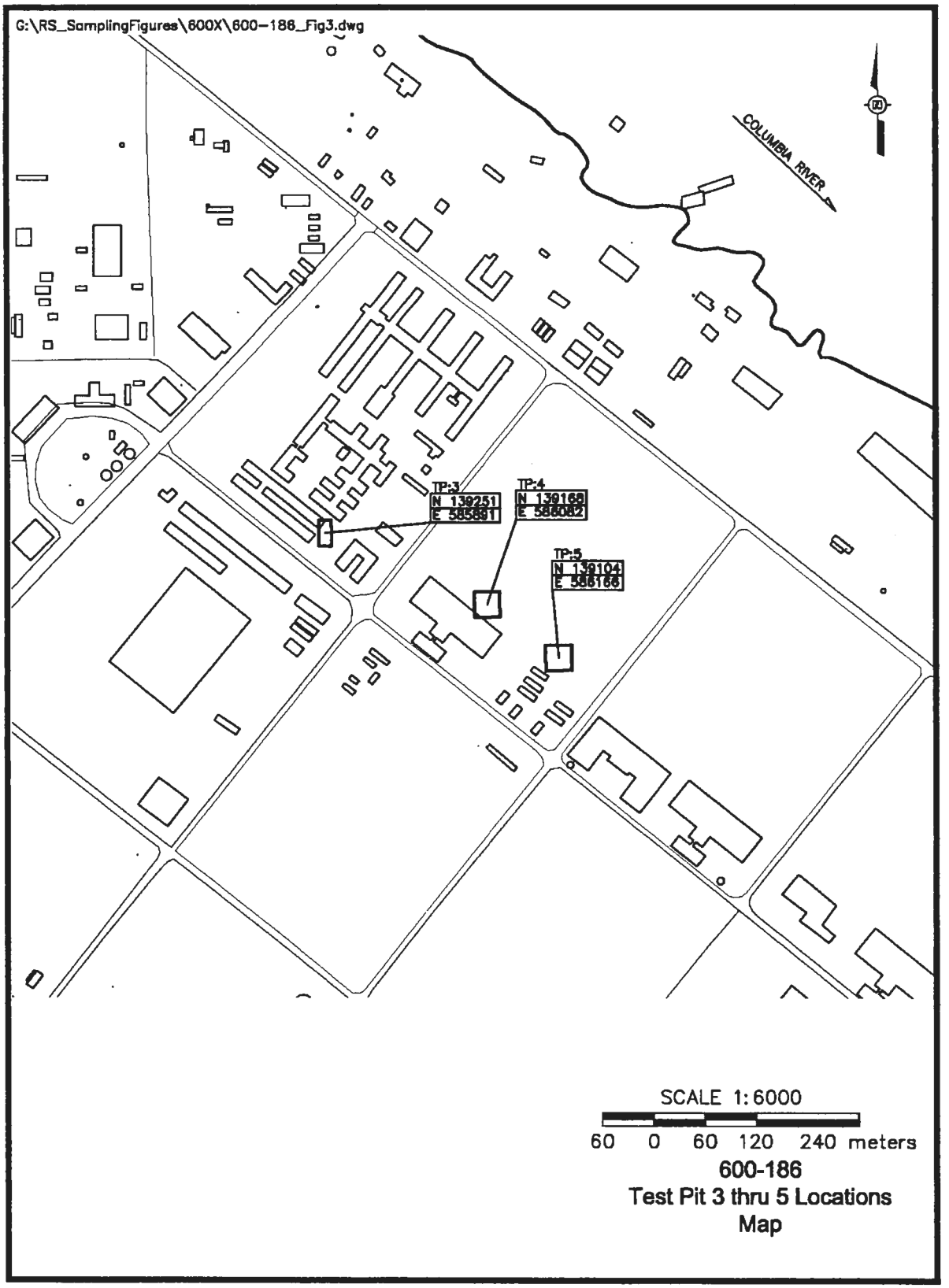


Figure 5. Northern and Middle Settling Basins (Test Pits 8 and 9).

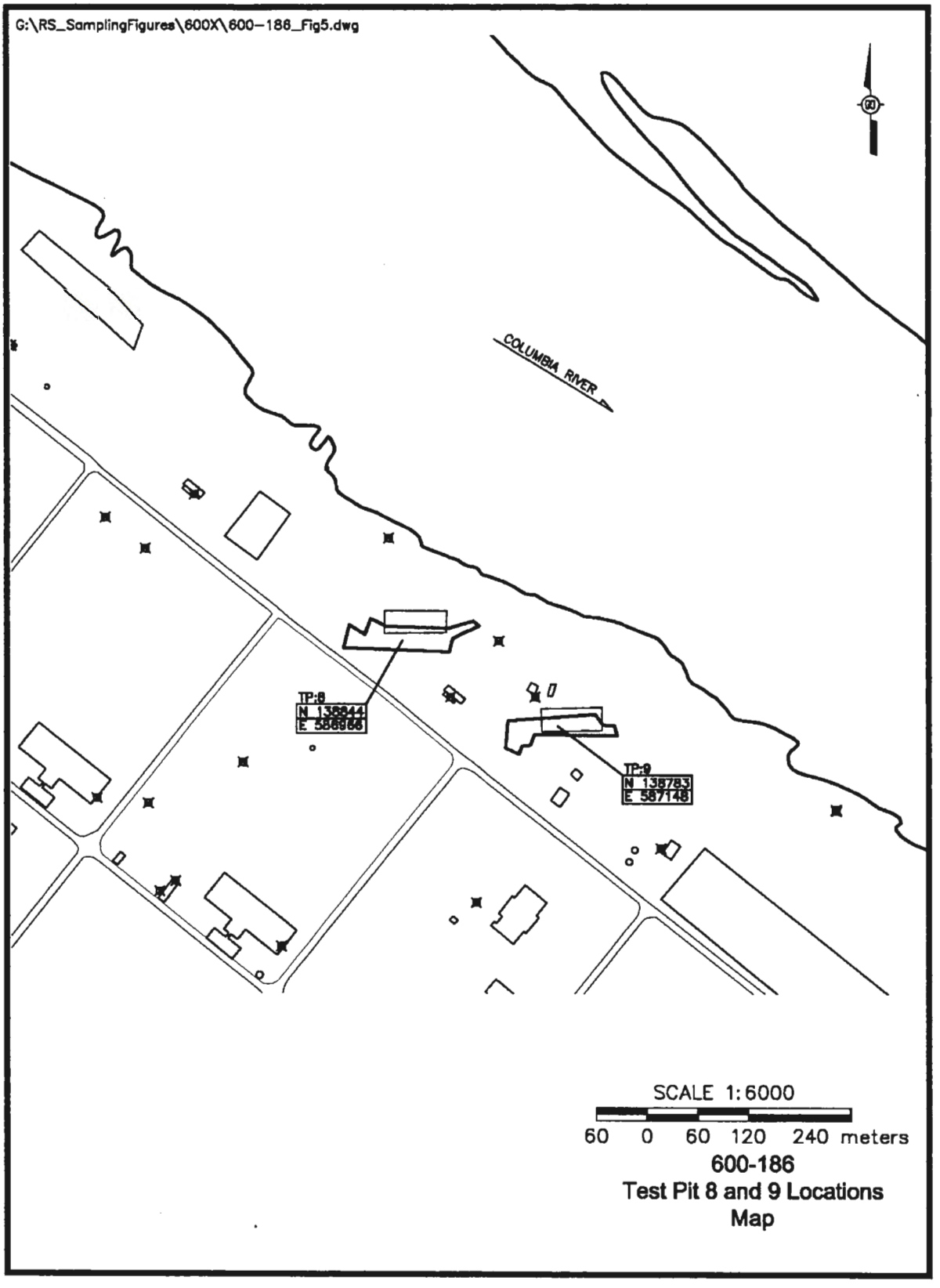
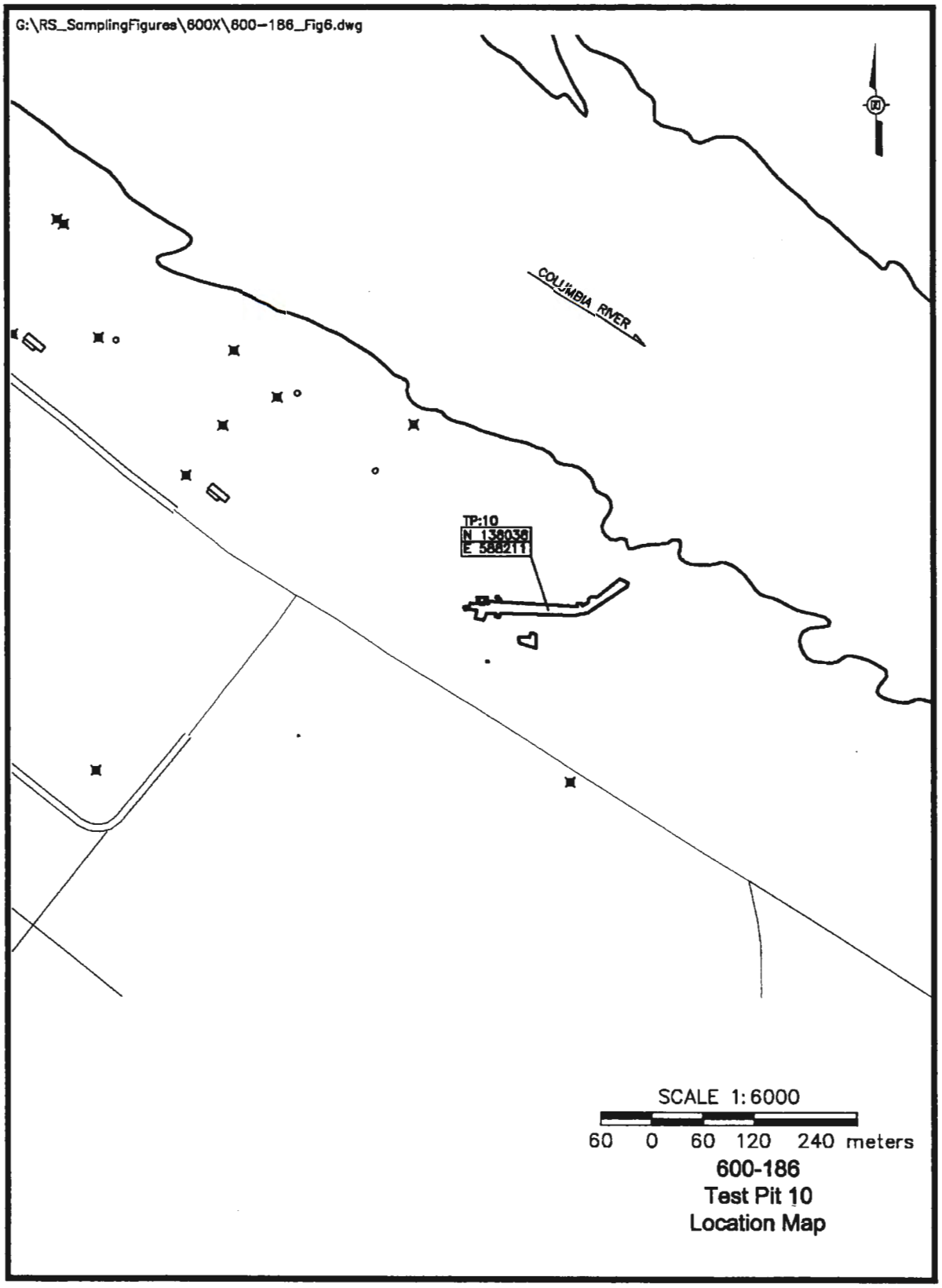


Figure 6. Southern Settling Basin (Test Pit 10).



Contaminants of Potential Concern

Historical information and process knowledge suggest that the 600-186 waste site does not contain radiological contaminants in sufficient quantities to result in a risk to human health or the environment. However, a radiological control technician using instrumentation capable of detecting alpha, beta, and gamma radiation during field activities was employed to identify potential radiologically contaminated materials. If such materials had been detected during field operations radiological analyses would have been performed on the associated samples. However, as expected, elevated levels of radioactivity were not detected during confirmatory sampling.

Mercury was included as a contaminant of potential concern (COPC) due to its potential use in water monitoring and pumping equipment used throughout the site. Polychlorinated biphenyls related to electrical systems may have been discharged to the septic systems and were included as COPCs. Hexavalent chromium was included as a COPC for the 600-186 waste site because of its use in the upstream reactors. Although not considered COPCs, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc were evaluated by performing analyses for the constituents of the expanded ICP metals list.

Field screening for volatile organic compounds (VOCs) was performed during sampling activities using an organic vapor monitor (OVM). Volatile organic analysis would have been on the analysis list for the field samples if elevated VOC readings had been detected, but they were not.

Potential oil-stained soil was observed during excavation for confirmatory sampling at test pit 3 (Figure 4). Sample J1CP02 was collected to evaluate the staining. This sample was analyzed for the same COPCs listed above and also for PAH and TPH.

A more detailed discussion of COPCs can be found in the *Work Instruction for Confirmatory Sampling of the 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants* (WCH 2010b).

A summary of all the analytical methods and contaminants analyzed for is provided in Table 1. A summary of the confirmatory samples collected is presented in Table 2.

Table 1. Laboratory Analytical Methods. (2 Pages)

Analytical Method	Contaminants of Potential Concern
ICP metals [a] – EPA Method 6010	Metals
Hexavalent chromium – EPA Method 7196	Hexavalent chromium
Mercury EPA Method 7471	Mercury
PCBs – EPA Method 8082	Polychlorinated biphenyls
PAH [b]– EPA Method 8310	Polycyclic aromatic hydrocarbons

Table 1. Laboratory Analytical Methods. (2 Pages)

Analytical Method	Contaminants of Potential Concern
TPH [b] – NWTPH-dx	Petroleum hydrocarbons

[a] Analyses were performed 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.
[b] PAH and TPH analysis were performed on sample J1CP02 due to staining observed at test pit 3.

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

Table 2. 600-186 Confirmatory Sampling Summary Table.

Sample Location	HEIS Number	Sample Date	WSP Coordinates (m)	Sample Analysis
TP1	J1CP03	2/15/11	N 138996, E 584686	ICP metals [a], mercury, hexavalent chromium, PCBs
Stained soil (TP3) - 1ft bgs	J1CP02	2/15/11	N 139251, E 585891	ICP metals [a], mercury, hexavalent chromium, PCBs, PAH, TPH
TP3 - 10ft bgs	J1CP06	2/15/11		ICP metals [a], mercury, hexavalent chromium, PCBs
TP4	J1CP07	3/24/11	N 139168, E 586082	ICP metals [a], mercury, hexavalent chromium, PCBs
Duplicate of J1CP07	J1FXD8	3/24/11		
TP5	J1CP04	2/14/11	N 139104, E 586166	ICP metals [a], mercury, hexavalent chromium, PCBs
Duplicate of J1CP04	J1CP05	2/14/11		
TP6	J1CNY9	2/14/11	N 138683, E 586376	ICP metals [a], mercury, hexavalent chromium, PCBs
TP7	J1CP00	2/14/11	N 138433, E 586686	ICP metals [a], mercury, hexavalent chromium, PCBs
Northern trench (TP8)	J1B4K4	5/26/10	N 138844, E 586966	ICP metals [a], mercury, hexavalent chromium, PCBs
Middle trench (TP9)	J1B4K3	5/26/10	N 138783, E 587148	ICP metals [a], mercury, hexavalent chromium, PCBs
Southern trench (TP 10)	J1B4K2	5/26/10	N 138038, E 588211	ICP metals [a], mercury, hexavalent chromium, PCBs
Duplicate of J1B4K2	J1B4K5	5/26/10		
Equipment blank	J1B4K6	5/26/10	NA	ICP metals [a], mercury
Equipment blank	J1CP01	2/14/11	NA	ICP metals [a], mercury

[a] Analysis for the expanded list of ICP metals were performed to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

bgs = below ground surface
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbons
WSP = Washington State Plane

Confirmatory Sample Results

Confirmatory samples were analyzed using EPA-approved analytical methods. Statistical analysis (e.g., calculation of a 95% upper confidence limit value) is inappropriate for the evaluation of focused samples; therefore, the results from the 600-186 confirmatory sample set are evaluated using the maximum detected concentration for each COPC and comparing that value directly to the RAG values. Table 3 provides a comparison of the maximum results from all of the sampling locations against the cleanup criteria. Individual sample results are provided in Appendix B. If no detections for a given COPC were reported in the data set, then no evaluations were performed for that COPC.

Table 3. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-186 Confirmatory Sampling Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.650 (<BG)	32	5 [b]	5 [b]	No	--
Arsenic	5.64 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	139	5,600	200	400	No	--
Beryllium	0.471 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Boron [d]	3.29	7,200	320	-- [e]	No	--
Cadmium [f]	0.871	13.9 [c]	0.81 [b]	0.81 [b]	Yes	Yes [g]
Chromium (total)	98.0	80,000	18.5 [b]	18.5 [b]	Yes	Yes [g]
Hexavalent chromium [d]	0.32	2.1 [c]	4.8	2.0	No	--
Cobalt	8.99(<BG)	24	15.7 [b]	-- [e]	No	--
Copper	42.3	2,960	59.2	22.0 [b]	Yes	Yes [g]
Lead	93.5	353	10.2 [b]	10.2 [b]	Yes	Yes [g]
Manganese	307(<BG)	3,760	512 [b]	512 [b]	No	--
Mercury	0.854	24	0.33 [b]	0.33 [b]	Yes	Yes [g]
Molybdenum [d]	1.23	400	8	-- [e]	No	--
Nickel	17.4 (<BG)	1,600	19.1 [b]	27.4	No	--
Selenium	0.393 (<BG)	400	5	1	No	--
Silver	21.9	400	8	0.73 [b]	Yes	Yes [g]
Vanadium	141	560	85.1 [b]	-- [e]	Yes	Yes [g]
Zinc	137	24,000	480	67.8 [b]	Yes	Yes [g]
TPH – motor oil	18.5	200	200	200	No	--
Aroclor 1260	0.0499	0.5	0.017 [h]	0.017 [h]	Yes	Yes [g]
Aroclor-1268	0.0506	0.5	0.017 [h]	0.017 [h]	Yes	Yes [g]
Total PCBs	0.101	0.5 [i]	0.017 [h]	0.017 [h]	Yes	Yes [g]
Benzo(a)anthracene	0.00167	1.37	0.015 [h]	0.015 [h]	No	--
Benzo(a)pyrene	0.00532	0.137	0.015 [h]	0.015 [h]	No	--
Benzo(b)fluoranthene	0.00968	1.37	0.015 [h]	0.015 [h]	No	--
Benzo(ghi)perylene	0.00650	2,400	48	192	No	--
Benzo(k)fluoranthene	0.00270	1.37	0.015 [h]	0.015 [h]	No	--
Chrysene	0.00155	13.7	0.12	0.1 [h]	No	--

Table 3. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 600-186 Confirmatory Sampling Data. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Maximum Result Exceed RAGs?	Do the Results Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Dibenz[a,h]anthracene	0.000983	1.37	0.030 [h]	0.030 [h]	No	--
Fluoranthene	0.00263	3,200	64	18.0	No	--
Indeno(1,2,3-cd)pyrene	0.00578	1.37	0.033 [h]	0.033 [h]	No	--
Phenanthrene	0.00105	24,000	240	1,920	No	--
Pyrene	0.00811	2,400	48	192	No	--

[a] RAGs obtained from the RDR/RAWP (DOE-RL 2009b) unless otherwise noted.
[b] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[c] Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750(3), 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[d] No Hanford Site-specific or Washington State background value available.
[e] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2011) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).
[f] Hanford Site-specific background value is not available; it was not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[g] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of cadmium, total-chromium, copper, lead, mercury, silver, zinc, aroclor-1260, aroclor-1268, total-PCBs, and vanadium are not expected to migrate 3 m (9.8 ft) within 1,000 years based on s soil-partitioning coefficient (K_d) of 22 mL/g for copper (the contaminant with the lowest K_d value). The thickness of the vadose zone beneath 600-186 is a minimum of 7.0 m (23.0 ft). Therefore, residual concentrations of these constituents are predicted to be protective of groundwater and the Columbia River.
[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).
[i] The soil cleanup value for PCBs is based on the formula presented WAC 173-340-740(3)(a)(iii)(B)(1996), and the cancer potency factor for ingestion of PCBs of 2.0 kg-day/mg (soils) from the EPA Integrated Risk Information System (IRIS) on the internet at http://www.epa.gov/iris.

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

Calculated cleanup levels for calcium, magnesium, potassium, silicon, and sodium are not presented in the RDR/RAWP (DOE-RL 2009b). Parameters to calculate cleanup levels for these constituents are not presented in the Cleanup Levels and Risk Calculations (CLARC) Database (Ecology 2011) under WAC 173-340-740(3) or other reference databases. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. The laboratory-reported data results for all constituents are stored in the Environmental Restoration (ENRE) project-specific database prior to provision to the Hanford Environmental Information System (HEIS) and are presented as an attachment to the direct contact hazard quotient and relative percent difference calculation in Appendix B.

DATA EVALUATION

This section demonstrates that contaminant concentrations at the 600-186 waste site achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the Remaining Sites ROD (EPA 1999) and documented in the RDR/RAWP (DOE-RL 2009b).

Nonradionuclide Soil RAGs for Direct Exposure and Groundwater and River Protection Attained

Table 3 compares the cleanup verification sample values to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. All confirmatory data values pass in direct comparison to the applicable RAGs, with the exception of cadmium, total-chromium, copper, lead, mercury, silver, zinc, aroclor-1260, aroclor-1268, total PCBs, and vanadium, which were quantified at concentrations exceeding soil protection RAGs for groundwater and/or river protection. Data were not collected on the vertical extent of these contaminants, but an evaluation based upon RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) shows that residual concentrations of these constituents are not expected to migrate more than 3.0 m (9.8 ft) vertically in 1,000 years given the soil-partitioning coefficient (K_d) of 22 mL/g for copper, the contaminant with the lowest K_d value. The thickness of the vadose zone beneath the 600-186 waste site is a minimum of 7.0 m (23.0 ft); therefore, residual concentrations of these constituents are predicted to be protective of groundwater. The only pathway for contaminant migration to the Columbia River is via groundwater; therefore, residual concentrations of these contaminants are also predicted to be protective of the Columbia River. All other cleanup verification data values pass in direct comparison to the applicable RAGs.

Nonradionuclide Hazard Quotient and Carcinogenic Risk RAGs Attained

Calculation of the 600-186 waste site direct contact hazard quotient and carcinogenic risk is presented in Appendix B. Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. For the 600-186 waste site, these risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background levels. All individual hazard quotients for noncarcinogenic constituents were less than 1.0. The cumulative hazard quotient for those noncarcinogenic constituents above background or detected levels is 4.0×10^{-1}. The total carcinogenic risk is 4.7×10^{-7}.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the confirmatory sampling approach (WCH 2010b), the field logbook (WCH 2010a), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 600-186 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in the ENRE project-specific database for data evaluation prior to archival in the HEIS and are provided as an attachment to the relative percent difference and direct contact hazard quotient calculation in Appendix B. The detailed DQA is presented in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 600-186 waste site has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2009b). Confirmatory sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at this site meet the RAOs for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 600-186 waste site to No Action. The waste site contamination does not extend into the deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

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 the Environment,* as amended, U. S. Department of Energy, Washington, D.C.

DOE-RL, 2007, *Tri-Party Agreement Handbook Management Procedures,* RL-TPA-90-0001, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," Rev. 1, 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 Areas,* DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

Ecology, 1996, "Model Toxics Control Act – Cleanup," *Washington Administrative Code* (WAC) 173-340, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/>.

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

EPA, 1989, *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)*, Interim Final, EPA/540/1-89/002, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

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.

EPA, 2008, "600-186 Camp Hanford Septic System/Settling Basins," CCN 149198 to J. Zeisloft, U.S. Department of Energy, Richland Operations Office, from L. Gadbois, U.S. Environmental Protection Agency, Richland, Washington, December 16.

EPA, 2009, *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.

HEW, 1945a, *Hanford Engineer Works, History of the Project,* HAN-10970, Vols. 1 and II, Du Pont de Nemours & Company, Wilmington, Delaware.

HEW, 1945b, *Monthly Field Progress Report HEW Project 9536 Period Ending 03/31/1945*, Hanford Engineer Works, HAN-2914, Du Pont de Nemours & Company, Wilmington, Delaware.

HEW, 1945c, *Status Report HEW 01/01/1945 Through 03/31/1945*, IN-3023, Hanford Engineer Works, Du Pont de Nemours & Company, Wilmington, Delaware.

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

WCH, 2010, *Work Instruction for Confirmatory Sampling of the 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants,* 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.

WHC, 1993, *Manhattan Project Buildings and Facilities at the Hanford Site: A Construction History*, WHC-MR-0425, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

ECOLOGICAL SCREENING LEVELS

A-1. Ecological Screening Levels [a].

Hazardous Substance		2007 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Waste Site Analyses
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
Metals (mg/kg):									
	Background								
Antimony	5	5	--	--	--	78	--	0.27	0.650 (<BG)
Barium	132	500	--	102	--	330	--	2,000	139
Boron	--	0.5	--	--	--	--	--	--	3.29
Cadmium	0.81	4	20	14	32	140	0.77	0.36	0.871
Chromium (total)	18.5	42 [d]	42 [d]	67	--	--	26	34	98.0
Copper	22	100	50	217	70	80	28	49	42.3
Lead	10.2	50	500	118	120	1,700	11	56	93.5
Manganese	512	1,100 [d]	--	1,500	220	450	4,300	4,000	307 (<BG)
Mercury, inorganic	0.33	0.3	0.1	5.5	--	--	--	--	0.854
Selenium	0.78	1	70	0.3	0.52	4.1	1.2	0.63	0.393 (<BG)
Silver	0.73	2	--	--	560	--	4.2	14	21.9
Vanadium	85.1	2	--	--	--	--	7.8	280	141
Zinc	67.8	86 [d]	200	360	160	120	46	79	137

[a] Per WAC 173-340-7490(4)(b), "Terrestrial Ecological Evaluation Procedures," *Washington Administrative Code* (Ecology 2007), soil concentrations deeper than the standard point of compliance of 4.6 m (15 ft) are not considered in evaluation of risk to ecological receptors because this represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities, resulting in exposure by ecological receptors. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. All exceedances must be evaluated in the context of additional lines of evidence for ecological effects following a baseline risk assessment for the River Corridor portion of the Hanford Site which will include a more complete quantitative ecological risk assessment.

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

[c] Wildlife.

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

-- = no value exists
BG = background
Ecology = Washington State Department of Ecology
EPA = U.S. Environmental Protection Agency
WAC = *Washington Administrative Code*

APPENDIX B

RELATIVE PERCENT DIFFERENCE AND DIRECT CONTACT HAZARD QUOTIENT CALCULATIONS

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-IU-6

Discipline: Environmental Calculation No: 0600X-CA-V0123

Subject: 600-186 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 = 11 Attachment 1 = 3 Total = 15	J. D. Skoglie	T. E. Queen	B. L. Vedder	D. F. Obenauer	7/28/11

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	7/27/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	7/27/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 11	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 600-186 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 the 600-186 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, 2011, *Remaining Sites Verification Package for the 600-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants*, Attachment to Waste Site Reclassification Form 2011-069, 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:	J. D. Skoglie	Date:	5/24/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/24/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 11	

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 (2011) to perform the RPD calculations for primary-duplicate sample pairs, as required.

METHODOLOGY:

The 600-186 waste site is comprised of three trenches and six test pits. The direct contact hazard quotient and carcinogenic risk calculations for the 600-186 waste site were conservatively calculated for the entire waste site using the greater of the confirmation soil sample results (WCH 2011). Of the contaminants of potential concern (COPCs) for this site, barium, cadmium, chromium, copper, mercury, silver, vanadium, and zinc require HQ and risk calculations because these analytes were detected above Washington State or Hanford Site background values. Of the contaminants of potential concern (COPCs) for this site, boron, hexavalent chromium, molybdenum, the detected polycyclic aromatic hyrdrocarbons, and the detected polychlorinated biphenyls require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead is not included in the calculation based on modeling of child blood levels, which is fundamentally different from the oral-reference dose and cancer slope factors used to calculate typical cleanup levels and associated HQs and cancer risks. Although total petroleum hydrocarbons (motor oil) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron is 3.29 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 4.6×10^{-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 4.0×10^{-1}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for benzo(a)pyrene is 0.00532 mg/kg, divided by 0.137 mg/kg, and multiplied as indicated, is 3.9×10^{-8}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 4.7×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	5/19/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/19/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 11	

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 2011), 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}: None
4) List the cumulative excess cancer risk for carcinogens >1 x 10^{-5}: None

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

Table 2 shows the results of the RPD calculations for the 600-186 waste site. 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:	J. D. Skoglie	Date:	5/24/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/24/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 11	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 600-186 Waste Site (2 pages).

Contaminants of Potential Concern	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Barium	139	5,600	2.5E-02	--	--
Boron	3.29	7,200	4.6E-04	--	--
Cadmium	0.871	80	1.1E-02	13.9	6.3E-08
Chromium, total	98.0	80,000	1.2E-03	--	--
Chromium, hexavalent[c]	0.32	240	1.3E-03	2.1	1.5E-07
Copper	42.3	2,960	1.4E-02	--	--
Lead[d]	93.5	353	--	--	--
Mercury	0.854	24	3.6E-02	--	--
Molybdenum	1.23	400	3.1E-03	--	--
Silver	21.9	400	5.5E-02	--	--
Vanadium	141	560	2.5E-01	--	--
Zinc	137	24,000	5.7E-03	--	--
Total Petroleum Hydrocarbons					
TPH - motor oil (high boiling)[e]	18.5	200	--	--	--
Polycyclic Aromatic Hydrocarbons					
Benzo(a)anthracene	0.00167	--	--	1.37	1.2E-09
Benzo(a)pyrene	0.00532	--	--	0.137	3.9E-08
Benzo(b)fluoranthene	0.00968	--	--	1.37	7.1E-09
Benzo(ghi)perylene[f]	0.00650	2,400	2.7E-06	--	--
Benzo(k)fluoranthene	0.00270	--	--	1.37	2.0E-09
Chrysene	0.00155	--	--	13.7	1.1E-10
Dibenz(a,h)anthracene	0.000983	--	--	1.37	7.2E-10
Fluoranthene	0.00263	3,200	8.2E-07	--	--
Indeno(1,2,3-cd)pyrene	0.00578	--	--	1.37	4.2E-09
Phenanthrene[f]	0.00105	24,000	4.4E-08	--	--
Pyrene	0.00811	2,400	3.4E-06	--	--

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	5/24/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/24/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 5 of 11	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 600-186 Waste Site (2 pages).

Contaminants of Potential Concern	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Polychlorinated Biphenyls					
Aroclor-1260	0.0499	--	--	0.5	1.0E-07
Aroclor-1268	0.0506	--	--	0.5	1.0E-07
Totals					
Cumulative Hazard Quotient:			**4.0E-01**		
Cumulative Excess Cancer Risk:					**4.7E-07**

Notes:

[a] = From WCH (2011).

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

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

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

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

[f] = Toxicity data for benzo(ghi)perylene and phenanthrene are not available. The cleanup levels are based on the use of surrogate chemicals.

benzo(ghi)perylene surrogate: pyrene

phenanthrene surrogate: anthracene

-- = not applicable RAG = remedial action goal

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	7/27/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	7/27/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 6 of 11	

Table 2. Relative Percent Difference Calculations for the 600-186 Waste Site. (6 Pages)

600-186 Duplicate Analysis Southern Trench

Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	9140		3.86	3.83		0.772	91.5		0.386	0.314		0.154
Duplicate of J1B4K2	J1B4K5	5/26/10	8480		4.21	3.73		0.843	86.1		0.421	0.291		0.169

Analysis:

TDL		5	10	2	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	7.5%		6.1%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable

600-186 Duplicate Analysis Southern Trench

Sampling Area	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	1.66		1.54	0.24		0.154	4850		77.2	16.7		0.154
Duplicate of J1B4K2	J1B4K5	5/26/10	1.44	B	1.69	0.215		0.169	4410		84.3	16.6		0.169

Analysis:

TDL		2	0.2	100	1
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?		No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD			9.5%	0.6%
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	Not applicable

600-186 Duplicate Analysis Southern Trench

Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	6.27		1.54	15.4		0.772	19500		15.4	10.6		0.386
Duplicate of J1B4K2	J1B4K5	5/26/10	6.01		1.69	13.6		0.843	18900		16.9	10.4		0.421

Analysis:

TDL		2	1	5	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		12.4%	3.1%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable

600-186 Duplicate Analysis Southern Trench

Sampling Area	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	5460		57.9	303		3.86	0.260		0.0295	0.277	B	1.54
Duplicate of J1B4K2	J1B4K5	5/26/10	5170		63.2	266		4.21	0.306		0.0285	0.277	B	1.69

Analysis:

TDL		75	5	0.2	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	
	RPD	5.5%	13.0%		
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable

B = estimated result. Result is less than the RL but greater than the MDL.
EX = excavation
HEIS = Hanford Environmental Information System
J = estimate
PQL = practical quantitation limit.
Q = qualifier.
RPD = relative percent difference.
TDL = target detection limit

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	7/27/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	7/27/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 7 of 11	

Table 2. Relative Percent Difference Calculations for the 600-186 Waste Site. (6 Pages)

600-186 Duplicate Analysis Southern Trench

Sampling Area	HEIS Number	Sample Date	Nickel			Potassium			Silicon			Silver		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	13.7		3.09	1690		309	523		1.54	0.479		0.154
Duplicate of J1B4K2	J1B4K5	5/26/10	12.8		3.37	1540		337	560		1.69	0.424		0.169

Analysis:

TDL		4	400	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD			6.8%	
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	No - acceptable

600-186 Duplicate Analysis Southern Trench

Sampling Area	HEIS Number	Sample Date	Sodium			Vanadium			Zinc			Aroclor-1268		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	192		38.6	43.8		1.93	76.2		7.72	6.09	J	14.1
Duplicate of J1B4K2	J1B4K5	5/26/10	175		42.1	43.0		2.11	69.8		8.43	5.86	J	14.0

Analysis:

TDL		50	2.5	1	20
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	
	RPD		1.8%	8.8%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	5/24/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/24/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 8 of 11	

Table 3. Relative Percent Difference Calculations for the 600-186 Waste Site. (6 Pages)

600-186 Duplicate Analysis Test Pit 4

Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4	J1CP07	3/24/11	6200		3.98	3.29		0.796	58.5		0.398	0.223		0.159
Duplicate of J1CP07	J1FXD8	3/24/11	6250		3.54	3.08		0.708	51.7		0.354	0.201		0.142

Analysis:

	TDL	5	10	2	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	0.8%		12.3%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable

600-186 Duplicate Analysis Test Pit 4

Sampling Area	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4	J1CP07	3/24/11	0.994	B	1.59	0.067	B	0.159	5910		79.6	12.5		0.159
Duplicate of J1CP07	J1FXD8	3/24/11	1.13	B	1.42	0.071	B	0.142	6320		70.8	12.7		0.142

Analysis:

	TDL	2	0.2	100	1
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?			Yes (calc RPD)	Yes (calc RPD)
	RPD			6.7%	1.6%
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	Not applicable

600-186 Duplicate Analysis Test Pit 4

Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4	J1CP07	3/24/11	5.38		1.59	11.0		0.796	16200		15.9	4.12		0.398
Duplicate of J1CP07	J1FXD8	3/24/11	5.07		1.42	12.7		0.708	15600		14.2	3.58		0.354

Analysis:

	TDL	2	1	5	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		14.3%	3.8%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable

600-186 Duplicate Analysis Test Pit 4

Sampling Area	HEIS Number	Sample Date	Magnesium			Manganese			Molybdenum			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4	J1CP07	3/24/11	4320		59.7	261		3.98	0.224	B	1.59	10.7		3.19
Duplicate of J1CP07	J1FXD8	3/24/11	4210		53.1	258		3.54	0.222	B	1.42	10.2		2.83

Analysis:

	TDL	75	5	2	4
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)		No-Stop (acceptable)
	RPD	2.6%	1.2%		
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	5/24/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/24/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 9 of 11	

Table 3. Relative Percent Difference Calculations for the 600-186 Waste Site. (6 Pages)

600-186 Duplicate Analysis Test Pit 4

Sampling Area	HEIS Number	Sample Date	Potassium			Silicon			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4	J1CP07	3/24/11	898		319	743		1.59	174		39.8	41.2		1.99
Duplicate of J1CP07	J1FXD8	3/24/11	902		283	741		1.42	173		35.4	37.7		1.77

Analysis:

	TDL	400	2	50	2.5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		0.3%		8.9%
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable

600-186 Duplicate Analysis Test Pit 4

Sampling Area	HEIS Number	Sample Date	Zinc		
			mg/kg	Q	PQL
TP4	J1CP07	3/24/11	30.8		7.96
Duplicate of J1CP07	J1FXD8	3/24/11	29.3		7.08

Analysis:

	TDL	1
Duplicate Analysis	Both > PQL?	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)
	RPD	5.0%
	Difference > 2 TDL?	Not applicable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	5/24/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/24/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	10 of 11

Table 4. Relative Percent Difference Calculations for the 600-186 Waste Site. (6 Pages)

600-186 Duplicate Analysis Test Pit 5

Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP5	J1CP04	2/14/11	6460		4.38	2.78		0.877	62.6		0.438	0.234		0.175
Duplicate of J1CP04	J1CP05	2/14/11	5650		3.77	2.46		0.755	55.8		0.377	0.207		0.151

Analysis:

TDL		5	10	2	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	13.4%		11.5%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable

600-186 Duplicate Analysis Test Pit 5

Sampling Area	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP5	J1CP04	2/14/11	0.986	B	1.75	0.136	B	0.175	4130		87.7	9.93		0.175
Duplicate of J1CP04	J1CP05	2/14/11	0.948	B	1.51	0.141	B	0.151	3930		75.5	8.82		0.151

Analysis:

TDL		2	0.2	100	1
Duplicate Analysis	Both > PQL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both >5xTDL?			Yes (calc RPD)	Yes (calc RPD)
	RPD			5.0%	11.8%
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	Not applicable

600-186 Duplicate Analysis Test Pit 5

Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP5	J1CP04	2/14/11	5.19		1.75	10.4		0.877	17900		17.5	7.36		0.438
Duplicate of J1CP04	J1CP05	2/14/11	5.07		1.51	11.6		0.755	16900		15.1	7.43		0.377

Analysis:

TDL		2	1	5	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		10.9%	5.7%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable

600-186 Duplicate Analysis Test Pit 5

Sampling Area	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP5	J1CP04	2/14/11	3930		65.8	260		4.38	0.063		0.03	0.542	B	1.75
Duplicate of J1CP04	J1CP05	2/14/11	3550		56.6	242		3.77	0.115		0.03	0.606	B	1.51

Analysis:

TDL		75	5	0.2	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	
	RPD	10.2%	7.2%		
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	5/24/2011	Calc. No.:	0600X-CA-V0123	Rev.:	0
Project:	100-IU-2/6 Field Remediation	Job No:	14655	Checked:	T. E. Queen	Date:	5/24/2011
Subject:	600-186 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 11 of 11	

Table 4. Relative Percent Difference Calculations for the 600-186 Waste Site. (6 Pages)

600-186 Duplicate Analysis Test Pit 5

Sampling Area	HEIS Number	Sample Date	Nickel			Potassium			Silicon			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP5	J1CP04	2/14/11	8.68		3.51	1100		351	379		1.75	202		43.8
Duplicate of J1CP04	J1CP05	2/14/11	7.40		3.02	901		302	330		1.51	181		37.7

Analysis:

TDL		4	400	2	50
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD			13.8%	
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	No - acceptable

600-186 Duplicate Analysis Test Pit 5

Sampling Area	HEIS Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
TP5	J1CP04	2/14/11	45.2		2.19	44.3		8.77
Duplicate of J1CP04	J1CP05	2/14/11	42.5		1.89	46.4		7.55

Analysis:

TDL		2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)
	RPD	6.2%	4.6%
	Difference > 2 TDL?	Not applicable	Not applicable

CONCLUSION:

The calculations in Tables 1 through 4 demonstrate that the 600-186 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. 600-186 Waste Site Confirmatory Results Summary

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	9140		3.86	0.463	U	0.463	3.83		0.772	91.5		0.386	0.314		0.154	1.66		1.54
Duplicate of J1B4K2	J1B4K5	5/26/10	8480		4.21	0.506	U	0.506	3.73		0.843	86.1		0.421	0.291		0.169	1.44	B	1.69
Middle Trench	J1B4K3	5/26/10	12100		3.69	0.443	U	0.443	4.27		0.738	139		0.369	0.471		0.148	1.20	B	1.48
Northern Trench	J1B4K4	5/26/10	9590		4.52	0.542	U	0.542	5.09		0.904	120		0.452	0.324		0.181	3.29		1.81
TP4	J1CP07	3/24/11	6200		3.98	0.478	U	0.478	3.29		0.796	58.5		0.398	0.223		0.159	0.994	B	1.59
Duplicate of J1CP07	J1FXD8	3/24/11	6250		3.54	0.425	U	0.425	3.08		0.708	51.7		0.354	0.201		0.142	1.13	B	1.42
TP5	J1CP04	2/14/11	6460		4.38	0.326	BJ	0.530	2.78		0.877	62.6		0.438	0.234		0.175	0.986	B	1.75
Duplicate of J1CP04	J1CP05	2/14/11	5650		3.77	0.453	UJ	0.453	2.46		0.755	55.8		0.377	0.207		0.151	0.948	B	1.51
TP1	J1CP03	2/15/11	8150		4.31	0.650		0.520	5.64		0.863	94.8		0.431	0.305		0.173	3.13		1.73
TP3 - 1ft bgs	J1CP02	2/15/11	4440		11.1	1.33	U	1.33	3.16		2.21	43.7		1.11	0.244	B	0.442	4.42	U	4.42
TP3 - 10ft bgs	J1CP06	2/15/11	7480		4.51	0.541	U	0.541	3.52		0.901	58.4		0.451	0.289		0.180	1.15	B	1.80
TP6	J1CNY9	2/14/11	6040		3.95	0.474	UJ	0.474	3.42		0.790	65.7		0.395	0.247		0.158	1.50	B	1.58
TP7	J1CP00	2/14/11	6080		4.75	0.570	UJ	0.570	5.57		0.951	53.5		0.475	0.225		0.190	2.82		1.90
Equipment Blank	J1B4K6	5/26/10	134		4.64	0.556	U	0.556	0.927	U	0.927	1.49		0.464	0.185	U	0.185	1.85	U	1.85
Equipment Blank	J1CP01	2/14/11	172		3.98	0.478	UJ	0.478	0.796	U	0.796	1.52		0.398	0.159	U	0.159	1.59	U	1.59

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Hexavalent Chromium			Cobalt			Copper		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	0.240		0.154	4850		77.2	16.7		0.154	0.22	U	0.22	6.27		1.54	15.4		0.772
Duplicate of J1B4K2	J1B4K5	5/26/10	0.215		0.169	4410		84.3	16.6		0.169	0.22	U	0.22	6.01		1.69	13.6		0.843
Middle Trench	J1B4K3	5/26/10	0.164		0.148	4810		73.8	15.4		0.148	0.21	U	0.21	8.99		1.48	24.9		0.738
Northern Trench.	J1B4K4	5/26/10	0.871		0.181	5030		90.4	98.0		0.181	4.12	U	4.12	6.05		1.81	24.0		0.904
TP4	J1CP07	3/24/11	0.067	B	0.159	5910		79.6	12.5		0.159	0.51	U	0.51	5.38		1.59	11.0		0.796
Duplicate of J1CP07	J1FXD8	3/24/11	0.071	B	0.142	6320		70.8	12.7		0.142	0.51	U	0.51	5.07		1.42	12.7		0.708
TP5	J1CP04	2/14/11	0.136	B	0.175	4130	J	87.7	9.93		0.175	0.52	UJ	0.52	5.19		1.75	10.4		0.877
Duplicate of J1CP04	J1CP05	2/14/11	0.141	B	0.151	3930	J	75.5	8.82		0.151	0.51	UJ	0.51	5.07		1.51	11.6		0.755
TP1	J1CP03	2/15/11	0.284		0.173	4640		86.3	24.2		0.173	0.28	B	0.54	6.54		1.73	42.3		0.863
TP3 - 1ft bgs	J1CP02	2/15/11	0.442	U	0.442	3210		221	15.3		0.442	0.54	U	0.54	4.59		4.42	8.12		2.21
TP3 - 10ft bgs	J1CP06	2/15/11	0.084	B	0.180	4570		90.1	16.2		0.180	0.32	B	0.52	6.31		1.80	13.7		0.901
TP6	J1CNY9	2/14/11	0.115	B	0.158	5210	J	79.0	8.35		0.158	0.54	UJ	0.54	6.48		1.58	11.4		0.790
TP7	J1CP00	2/14/11	0.122	B	0.190	4150	J	95.1	9.31		0.190	0.62	UJ	0.62	4.93		1.90	9.58		0.951
Equipment Blank	J1B4K6	5/26/10	0.185	U	0.185	31.5	B	92.7	0.185	U	0.185				1.85	U	1.85	0.927	U	0.927
Equipment Blank	J1CP01	2/14/11	0.159	U	0.159	30.9	UJB	79.6	0.179		0.159				1.59	U	1.59	0.796	U	0.796

B = estimated result, result is less than the RL but greater than the MDL
J = estimated result
HEIS = Hanford Environmental Information System
PQL = practical quantitation limit
Q = qualifier
U = undetected

Attachment	1	Sheet No.	1 of 3
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Attachment 1. 600-186 Waste Site Confirmatory Results Summary

Sample Location	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	19500		15.4	10.6		0.386	5460		57.9	303		3.86	0.260		0.0295	0.277	B	1.54
Duplicate of J1B4K2	J1B4K5	5/26/10	18900		16.9	10.4		0.421	5170		63.2	266		4.21	0.306		0.0285	0.277	B	1.69
Middle Trench	J1B4K3	5/26/10	26900		14.8	6.13		0.369	5710		55.3	284		3.69	0.0197	E	0.0281	0.437	B	1.48
Northern Trench.	J1B4K4	5/26/10	19800		18.1	27.9		0.452	5120		67.8	221		4.52	0.854		0.0281	0.460	B	1.81
TP4	J1CP07	3/24/11	16200		15.9	4.12		0.398	4320		59.7	261		3.98	0.0262	U	0.0262	0.224	B	1.59
Duplicate of J1CP07	J1FXD8	3/24/11	15600		14.2	3.58		0.354	4210		53.1	258		3.54	0.0270	U	0.0270	0.222	B	1.42
TP5	J1CP04	2/14/11	17900		17.5	7.36		0.438	3930		65.8	260		4.38	0.0631		0.0259	0.542	B	1.75
Duplicate of J1CP04	J1CP05	2/14/11	16900		15.1	7.43		0.377	3550		56.6	242		3.77	0.115		0.0250	0.606	B	1.51
TP1	J1CP03	2/15/11	29600		17.3	93.5		0.431	4270		64.7	300		4.31	0.0543		0.0272	1.23	B	1.73
TP3 - 1ft bgs	J1CP02	2/15/11	101000		44.2	8.20		1.11	2500		166	294		11.1	0.0108	B	0.0262	4.42	U	4.42
TP3 - 10ft bgs	J1CP06	2/15/11	21100		18.0	4.62		0.451	4370		67.6	307		4.51	0.0248	U	0.0248	0.302	B	1.80
TP6	J1CNY9	2/14/11	20900		15.8	8.92		0.395	3880		59.2	292		3.95	0.0268	U	0.0268	0.298	B	1.58
TP7	J1CP00	2/14/11	16900		19.0	17.3		0.475	3570		71.3	234		4.75	0.0327	U	0.0327	0.260	B	1.90
Equipment Blank	J1B4K6	5/26/10	173		18.5	0.332	B	0.464	20.6	B	69.6	3.87	B	4.64	0.0273	U	0.0273	1.85	U	1.85
Equipment Blank	J1CP01	2/14/11	213		15.9	0.299	B	0.398	18.8	B	59.7	3.89	B	3.98	0.0258	U	0.0258	1.59	U	1.59

Sample Location	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Southern Trench	J1B4K2	5/26/10	13.7		3.09	1690		309	0.231	U	0.231	523		1.54	0.479		0.154	192		38.6
Duplicate of J1B4K2	J1B4K5	5/26/10	12.8		3.37	1540		337	0.253	U	0.253	560		1.69	0.424		0.169	175		42.1
Middle Trench	J1B4K3	5/26/10	14.0		2.95	1450		295	0.221	U	0.221	280		1.48	0.237		0.148	218		36.9
Northern Trench.	J1B4K4	5/26/10	13.1		3.62	1750		362	0.385		0.270	605		1.81	21.9		0.181	186		45.2
TP4	J1CP07	3/24/11	10.7		3.19	898		319	0.239	U	0.239	743		1.59	0.159	U	0.159	174		39.8
Duplicate of J1CP07	J1FXD8	3/24/11	10.2		2.83	902		283	0.212	U	0.212	741		1.42	0.142	U	0.142	173		35.4
TP5	J1CP04	2/14/11	8.68		3.51	1100		351	0.263	U	0.263	379	J	1.75	0.175	U	0.175	202		43.8
Duplicate of J1CP04	J1CP05	2/14/11	7.40		3.02	901		302	0.226	U	0.226	330	J	1.51	0.151	U	0.151	181		37.7
TP1	J1CP03	2/15/11	17.4		3.45	2250		345	0.393		0.260	584		1.73	0.173	U	0.173	408		43.1
TP3 - 1ft bgs	J1CP02	2/15/11	5.72	B	8.85	870	B	885	0.663	U	0.663	444		4.42	0.442	U	0.442	106	B	111
TP3 - 10ft bgs	J1CP06	2/15/11	10.9		3.60	1180		360	0.270	U	0.270	387		1.80	0.659		0.180	194		45.1
TP6	J1CNY9	2/14/11	8.28		3.16	1740		316	0.237	U	0.237	459	J	1.58	0.158	U	0.158	229		39.5
TP7	J1CP00	2/14/11	8.08		3.80	1580		380	0.285	U	0.285	496	J	1.90	0.190	U	0.190	190		47.5
Equipment Blank	J1B4K6	5/26/10	3.71	U	3.71	29.6	B	371	0.278	U	0.278	164		1.85	0.185	U	0.185	46.4	U	46.4
Equipment Blank	J1CP01	2/14/11	3.18	U	3.18	34.8	B	318	0.239	U	0.239	170	J	1.59	0.159	U	0.159	39.8	U	39.8

Sample Location	HEIS Number	Sample Date	Vanadium			Zinc			Total petroleum hydrocarbons - diesel range			Total petroleum hydrocarbons - motor oil (high boiling)			Percent Solids		
			mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	%	Q	PQL
Southern Trench	J1B4K2	5/26/10	43.8		1.93	76.2		7.72							92.6		0.1
Duplicate of J1B4K2	J1B4K5	5/26/10	43.0		2.11	69.8		8.43							92.7		0.1
Middle Trench	J1B4K3	5/26/10	69.9		1.84	64.3		7.38							94.1		0.1
Northern Trench.	J1B4K4	5/26/10	50.0		2.26	137		9.04							97.1		0.1
TP4	J1CP07	3/24/11	41.2		1.99	30.8		7.96							98.1		0.1
Duplicate of J1CP07	J1FXD8	3/24/11	37.7		1.77	29.3		7.08							98.1		0.1
TP5	J1CP04	2/14/11	45.2		2.19	44.3		8.77							96.6		0.1
Duplicate of J1CP04	J1CP05	2/14/11	42.5		1.89	46.4		7.55							97.4		0.1
TP1	J1CP03	2/15/11	48.1		2.16	72.2		8.63							92.0		0.1
TP3 - 1ft bgs	J1CP02	2/15/11	141		5.53	50.6		22.1	3580	U	3580	18500		10800	92.9		0.1
TP3 - 10ft bgs	J1CP06	2/15/11	53.3		2.25	39.8		9.01							95.7		0.1
TP6	J1CNY9	2/14/11	51.2		1.97	42.3		7.90							93.1		0.1
TP7	J1CP00	2/14/11	41.5		2.38	40.3		9.51							80.9		0.1
Equipment Blank	J1B4K6	5/26/10	0.267	B	2.32	9.27	U	9.27							99.8		0.1
Equipment Blank	J1CP01	2/14/11	0.254	B	1.99	0.926	UJB	7.96							99.7		0.1

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Attachment 1. 600-186 Waste Site Confirmatory Results Summary

CONSTITUENT	CLASS	Southern Trench - J1B4K2			Duplicate of J1B4K2 - J1B4K5			Middle Trench - J1B4K3			Northern Trench - J1B4K4			TP4 - J1CP07			Duplicate of J1CP07 - J1FXD8			TP5 - J1CP04		
		5/26/10			5/26/10			5/26/10			5/26/10			3/24/11			3/24/11			2/14/11		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	14.1	U	14.1	14.0	U	14.0	14.0	U	14.0	13.5	U	13.5	13.5	U	13.5	13.4	U	13.4	13.5	U	13.5
Aroclor-1221	PCB	14.1	U	14.1	14.0	U	14.0	14.0	U	14.0	13.5	U	13.5	13.5	U	13.5	13.4	U	13.4	13.5	U	13.5
Aroclor-1232	PCB	14.1	U	14.1	14.0	U	14.0	14.0	U	14.0	13.5	U	13.5	13.5	U	13.5	13.4	U	13.4	13.5	U	13.5
Aroclor-1242	PCB	14.1	U	14.1	14.0	U	14.0	14.0	U	14.0	13.5	U	13.5	13.5	U	13.5	13.4	U	13.4	13.5	U	13.5
Aroclor-1248	PCB	14.1	U	14.1	14.0	U	14.0	14.0	U	14.0	13.5	U	13.5	13.5	U	13.5	13.4	U	13.4	13.5	U	13.5
Aroclor-1254	PCB	14.1	U	14.1	14.0	U	14.0	14.0	U	14.0	13.5	U	13.5	13.5	U	13.5	13.4	U	13.4	13.5	U	13.5
Aroclor-1260	PCB	14.1	U	14.1	5.26	J	14.0	14.0	U	14.0	49.9		13.5	13.5	U	13.5	13.4	U	13.4	13.5	U	13.5
Aroclor-1262	PCB													13.5	U	13.5	13.4	U	13.4	13.5	U	13.5
Aroclor-1268	PCB	6.09	J	14.1	5.86	J	14.0	14.0	U	14.0	50.6		13.5	13.5	U	13.5	13.4	U	13.4	13.5	U	13.5

CONSTITUENT	CLASS	Duplicate of J1CP04 - J1CP05			TP1 - J1CP03			TP3 - 1ft bgs - J1CP02			TP3 - 10ft bgs - J1CP06			TP6 - J1CNY9			TP7 - J1CP00		
		2/14/11			2/15/11			2/15/11			2/15/11			2/14/11			2/14/11		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH							3.51	U	3.51									
Acenaphthylene	PAH							3.51	U	3.51									
Anthracene	PAH							3.51	U	3.51									
Benzo(a)anthracene	PAH							1.67	J	3.51									
Benzo(a)pyrene	PAH							5.32		3.51									
Benzo(b)fluoranthene	PAH							9.68		3.51									
Benzo(ghi)perylene	PAH							6.5		3.51									
Benzo(k)fluoranthene	PAH							2.7	J	3.51									
Chrysene	PAH							1.55	J	3.51									
Dibenz[a,h]anthracene	PAH							0.983	J	3.51									
Fluoranthene	PAH							2.63	J	3.51									
Fluorene	PAH							3.51	U	3.51									
Indeno(1,2,3-cd)pyrene	PAH							5.78		3.51									
Naphthalene	PAH							3.51	U	3.51									
Phenanthrene	PAH							1.05	J	3.51									
Pyrene	PAH							8.11		3.51									
Aroclor-1016	PCB	13.7	U	13.7	14.3	U	14.3	14.2	U	14.2	13.6	U	13.6	13.8	U	13.8	16.3	U	16.3
Aroclor-1221	PCB	13.7	U	13.7	14.3	U	14.3	14.2	U	14.2	13.6	U	13.6	13.8	U	13.8	16.3	U	16.3
Aroclor-1232	PCB	13.7	U	13.7	14.3	U	14.3	14.2	U	14.2	13.6	U	13.6	13.8	U	13.8	16.3	U	16.3
Aroclor-1242	PCB	13.7	U	13.7	14.3	U	14.3	14.2	U	14.2	13.6	U	13.6	13.8	U	13.8	16.3	U	16.3
Aroclor-1248	PCB	13.7	U	13.7	14.3	U	14.3	14.2	U	14.2	13.6	U	13.6	13.8	U	13.8	16.3	U	16.3
Aroclor-1254	PCB	13.7	U	13.7	14.3	U	14.3	14.2	U	14.2	13.6	U	13.6	13.8	U	13.8	16.3	U	16.3
Aroclor-1260	PCB	5.27	J	13.7	4.96	J	14.3	14.2	U	14.2	13.6	U	13.6	13.8	U	13.8	16.3	U	16.3
Aroclor-1262	PCB	13.7	U	13.7	14.3	U	14.3	14.2	U	14.2	13.6	U	13.6	13.8	U	13.8	16.3	U	16.3
Aroclor-1268	PCB	13.7	U	13.7	13.6	J	14.3	14.2	U	14.2	13.6	U	13.6	13.8	U	13.8	16.3	U	16.3

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Checked	T. E. Queen	Date	2/28/11
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APPENDIX C

DATA QUALITY ASSESSMENT

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DATA QUALITY ASSESSMENT

CONFIRMATORY SAMPLING

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

A review of the sample design (WCH 2010b), the field logbook (WCH 2010a), and applicable analytical data packages has been performed as part of this DQA. All samples that could be collected were collected and analyzed per the sample design. A sample indicated for one "septic related feature" (test pit 2) was not collected because the feature proved to be a well and not a septic related feature or related to the 600-186 waste site. The resulting data set is sufficient for the intended purposes.

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

Confirmatory sample data collected at the 600-186 waste site were provided by the laboratories in four sample delivery groups (SDGs). The four data packages are SDG K2073, SDG K3180, SDG K3181, and SDG K3277. SDG K3180 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 600-186 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 K2073

This SDG comprises four field samples (J1B4K2 through J1B4K5), and one equipment blank (J1B4K6). The field samples were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, and polychlorinated biphenyls (PCBs). The equipment blank was analyzed for ICP metals. Sample J1B4K5 is a field duplicate of sample J1B4K2. Minor deficiencies are as follows:

In the PCB analysis, the surrogate decachlorobiphenyl recovered above the quality control limits at 163%. This indicates a possible high bias in the sample data. High biased data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recoveries were out of project acceptance criteria for five analytes (aluminum, calcium, iron, silicon, and antimony). To confirm quantiation the laboratory has performed post digestion spikes (PDSs) with acceptable results for all of these analytes. In the case of aluminum, iron, and silicon, the initial spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. For antimony and calcium, there are not any mismatched spike concentrations in the original MSs. The original MS recoveries for antimony and calcium were 46% and 137%, respectively. All antimony and calcium data for SDG K2073 may be considered estimated. Estimated data are usable for decision-making purposes.

SDG K3180

This SDG comprises four field samples (J1CNY9, J1CP00, J1CP04 and J1CP05), and one equipment blank (J1CP01). The field samples were analyzed for ICP metals, mercury, hexavalent chromium, and PCBs. The equipment blank was analyzed for ICP metals. Sample J1CP05 is a field duplicate of sample J1CP04. SDG K3180 was submitted for third-party validation. Minor deficiencies are as follows:

In the ICP metals analysis, contamination was identified in the method blank associated with sample J1CP01 for the analytes calcium and zinc. Third-party validation qualified the calcium and zinc results for sample J1CP01 as undetected with "UJ" flags. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for antimony (42%) and calcium (67%) are outside the acceptance quality control (QC) limits. Third-party validation qualified all antimony and calcium results in SDG K3180 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory control sample (LCS) recovery for silicon (65%) is outside the QC limits. Third-party validation qualified all silicon results in SDG K3180 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the hexavalent chromium analysis, the MS recovery of hexavalent chromium (62%) is outside the quality control limits. Third-party-validation qualified all hexavalent chromium results in SDG K3180 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

SDG K3181

This SDG comprises three field samples (J1CP02, J1CP03, and J1CP06), and one equipment blank (J1CP01). The field samples were analyzed for ICP metals, mercury, hexavalent chromium, and PCBs. Additionally, because of soil stains observed on the site sample J1CP02 was analyzed for total petroleum hydrocarbons (TPH) in the diesel range and in the motor oil range as well as for polycyclic aromatic hydrocarbons (PAH). Minor deficiencies are as follows:

In the PCB analysis, the surrogate decachlorobiphenyl recovered above the quality control limits at 151%. This indicates a possible high bias in the sample data. High biased data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of acceptance criteria for five analytes (aluminum, vanadium, iron, silicon, manganese, and antimony). To confirm quantiation the laboratory has PDSs with acceptable results for all of these analytes. In the case of aluminum, vanadium, iron, silicon, and manganese, the initial spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. For antimony was not a mismatched spike concentration. The original MS recoveries for antimony are 52%. All antimony data for SDG K3181 may be considered estimated. Estimated data are usable for decision-making purposes.

SDG K3277

This SDG comprises two field samples (J1CP07 and J1FXD8). The field samples were analyzed for ICP metals, mercury, hexavalent chromium, and PCBs. Sample J1CP07 is a field duplicate of sample J1FXD8. Minor deficiencies are as follows:

In the PCB analysis, the LCS sample recovered low (12-15%) for both the spiked analytes and the surrogates. This tight grouping of results indicates a laboratory error. The MS results confirm quantiation by the analytical system. There is no impact to the field sample results. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of acceptance criteria for five analytes (aluminum, vanadium, iron, silicon, manganese, and antimony). To confirm quantiation the laboratory has performed PDSs with acceptable results for all of these analytes. In the case of aluminum, vanadium, iron, silicon, and manganese, the initial spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. For antimony was not a mismatched spike concentration. The original MS recovery for antimony is 49%. All antimony data for SDG K3277 may be considered estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Three duplicate pairs are identified for the

600-186 waste site (J1B4K5/J1B4K2, J1CP07/J1FXD8, and J1CP04/J1CP05. The main and QA/QC sample results are presented in Appendix B.

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern (COPC). Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than 5 times the target detection limit (TDL). Relative percent differences of analytes detected at low concentrations (less than 5 times the detection limit) are not considered to be indicative of the analytical system performance. The calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation.

No RPDs are above the acceptance criteria of 30%. A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than 5 times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix C) to indicate that a visual check of the data is required by the reviewer. No data required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

SUMMARY

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above, are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 600-186 waste site verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 600-186 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in the Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix A.

REFERENCES

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

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

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

WCH, 2010a, *Work Instruction for Confirmatory Sampling of the 60-186, Hanford Construction Camp Septic Tanks and Sewage Treatment Plants,* 0600X-WI-G0033, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2010b, *Remaining Sites Sampling and Field Activities*, Logbook EL-1643-01, Washington Closure Hanford, Richland, Washington.