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

13-AMRP-0105

FEB 08 2013

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

Dear Ms. Hedges:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM NO. 2009-005 AND SUPPORTING DOCUMENTATION FOR THE 100-D-96:1, 100-D/DR ADDITIONAL FRENCH DRAINS GROUP 1 SUBSITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2009-005 and supporting "Remaining Sites Verification Package for the 100-D-96:1, 100-D/DR Additional French Drains Group 1 Subsite," Rev.0. If you have questions, please contact me or your staff may contact Tom Post, of my staff, at (509) 376-3232.

Sincerely,

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

AMRP:TCP

Attachment

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

cc w/o attach:
R. D. Cantwell, WCH
S. L. Feaster, WCH
T. Q. Howell, WCH
D. L. Plung, WCH
J. P. Shearer, CHPRC

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2009-005

Waste Site Code(s)/Subsite Code(s). 100-D-96:1

Reclassification Category: Interim ☒ Final ☐

Reclassification Status: Closed Out ☐ No Action ☒ Rejected ☐

RCRA Postclosure ☐ Consolidated ☐ None ☐

Approvals Needed: DOE ☒ Ecology ☒ EPA ☐

Description of current waste site condition:

The 100-D-96, 100-D/DR Additional French Drains waste site, located within the 100-D Area's 100-DR-1 Operable Unit, includes seven individual french drain locations, two dry well locations, and the underlying soil. Confirmatory sampling was performed per *Work Instruction For Confirmatory Sampling of the 100-D-96, 100-D/DR Additional French Drains, Washington Closure Hanford* on June 6-7, 2012; at french drains locations FD-2, FD-3, and FD-4. French Drain (FD-5) could not be sampled due to an active export water line passing through at this location; therefore, it was decided that the excavation could not be safely performed without incurring undue risk to this important safety system. Based on the confirmatory sampling results, it was determined that FD-4 will require remediation; therefore, the 100-D-96 waste site was administratively divided into subsites to address FD-4 separately. The 100-D-96:1, 100-D/DR Additional French Drains Group 1 subsite, includes six individual french drain locations, two dry well locations, and the underlying soil. The 100-D-96:2 subsite includes the FD-4 location.

The 100-D-96 waste site is a candidate site added to the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-HR-2, 100-KR-1, 100-KR-2, 1000-IU-2, 100-IU-6, and 200-CW-3 Operable Units,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington, (Remaining Sites ROD) (EPA 1999) by the Tri-Party Agreement Administrative Record *Fact Sheet: 100 Area "Plug-In" and Candidate Sites for Fiscal Year 2010, Annual Listing of Waste Sites Plugged into the Remove, Treat and Dispose Remedy in the 1999 Interim Action Record of Decision for the 100 Area,* U.S. Department of Energy, Richland, Washington (DOE-RL 2011) per 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). 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:

The confirmatory sampling results for the 100-D-96:1 subsite were evaluated in comparison to the remedial action goals (RAGs). In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 100-D-96:1 subsite to No Action. The current subsite conditions achieve the RAGs established by the Remaining Sites ROD (EPA 1999). The results of confirmatory sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Subsite contamination did not extend into the deep zone soils. 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 100-D-96:1, 100-D/DR Additional French Drains Group 1 Subsite* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2009-005

Waste Site Code(s)/Subsite Code(s). 100-D-96:1

Regulator comments:

Approval of this WSRF documents regulator agreement that the 100-D-96:1 subsite qualifies for "Interim No Action" under this Interim Action ROD. In addition, Ecology has evaluated the data for this waste site against WAC 173-340 (2007) cleanup levels for direct contact, groundwater protection, and river protection. This evaluation is documented in the letter transmitting Ecology's approval of the subsite's interim reclassification to "Interim No Action."

Waste Site Controls:

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

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

J. P. Neath		1/7/13
DOE Federal Project Director (printed)	Signature	Date
N. Menard	Nina M. Menard	1/17/13
Ecology Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-96:1, 100-D/DR ADDITIONAL FRENCH DRAINS GROUP 1 SUBSITE

Attachment to Waste Site Reclassification Form 2009-005

January 2013

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-96:1, 100-D/DR ADDITIONAL FRENCH DRAINS GROUP 1 SUBSITE

EXECUTIVE SUMMARY

The 100-D-96, 100-D/DR Additional French Drains waste site, located within the 100-DR-1 Operable Unit, included seven individual french drain locations, two dry well locations, and the underlying soil. The 100-D-96 waste site was included as a candidate site in the Tri-Party Agreement Administrative Record *Fact Sheet: 100 Area "Plug-In" and Candidate Sites for Fiscal Year 2010* (DOE-RL 2011), in accordance with 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* (Remaining Sites ROD) (EPA 1999) and the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington* (EPA 2009).

Confirmatory sampling of the 100-D-96 waste site was performed on June 6 and 7, 2012. The confirmatory sampling results indicated that the 100-D-96 waste site achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs); therefore, remediation was not necessary. However, analysis for hexavalent chromium and polycyclic aromatic hydrocarbons (PAH) was requested on all 100-D-96 confirmatory samples after the 100-D-96 RSVP was prepared and submitted for regulatory review. The additional analysis results indicated that benzo(a)pyrene was detected above the direct exposure RAG at french drain FD-4. It was determined that FD-4 location will require remediation; therefore, the 100-D-96 was administratively divided into subsites to address the FD-4 location separately as 100-D-96:2. This RSVP addresses the 100-D-96:1 subsite.

Confirmatory sampling results and additional analysis data of the remaining french drain locations included in the 100-D-96:1 subsite, indicated that this subsite achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs); therefore, remediation was not necessary. A summary of the cleanup evaluation for the soil analyses against the applicable RAGs is presented in Table ES-1. The results of the confirmatory sampling are used to make reclassification decisions for the 100-D-96:1 subsite in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011b).

Table ES-1. Summary of Remedial Action Goals for the 100-D-96:1 Subsite.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15 mrem/yr above background over 1,000 years.	Radionuclides were not COPCs for the 100-D-96:1 subsite.	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 (2.8×10^{-3}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	No carcinogenic nonradionuclide COPCs were detected above background levels; therefore, the excess cancer risk for individual carcinogens is zero and is $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The excess cancer risk for all individual carcinogens is zero; therefore, the total excess carcinogenic risk for all sampling areas is zero and is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 100-D-96:1 subsite.	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].		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Lead is present at concentrations above soil RAGs for groundwater and/or Columbia River protection. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), it is predicted that lead will not reach groundwater (and thus the Columbia River) within 1,000 years [d].	Yes

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

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

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

[d] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), lead with a distribution coefficient of 30 mL/g, is not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years. The vadose zone underlying the soil below the waste site is approximately 23 m (75.4 ft) thick. Therefore, residual concentrations of lead are predicted to be protective of groundwater and consequently are protective of the Columbia River.

COPC = contaminant of potential concern
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 100-D-96:1 subsite 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* (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River. The 100-D-96:1 subsite did not extend into the deep zone. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-96:1 subsite contaminants of potential concern and other constituents (Appendix A). Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for boron, and vanadium. The U.S. Environmental Protection Agency's ecological soil screening levels were exceeded for antimony, lead, manganese, 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 concentrations of antimony, manganese, vanadium and zinc are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the Columbia River corridor portion of the Hanford Site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-96:1, 100-D/DR ADDITIONAL FRENCH DRAINS GROUP 1 SUBSITE

STATEMENT OF PROTECTIVENESS

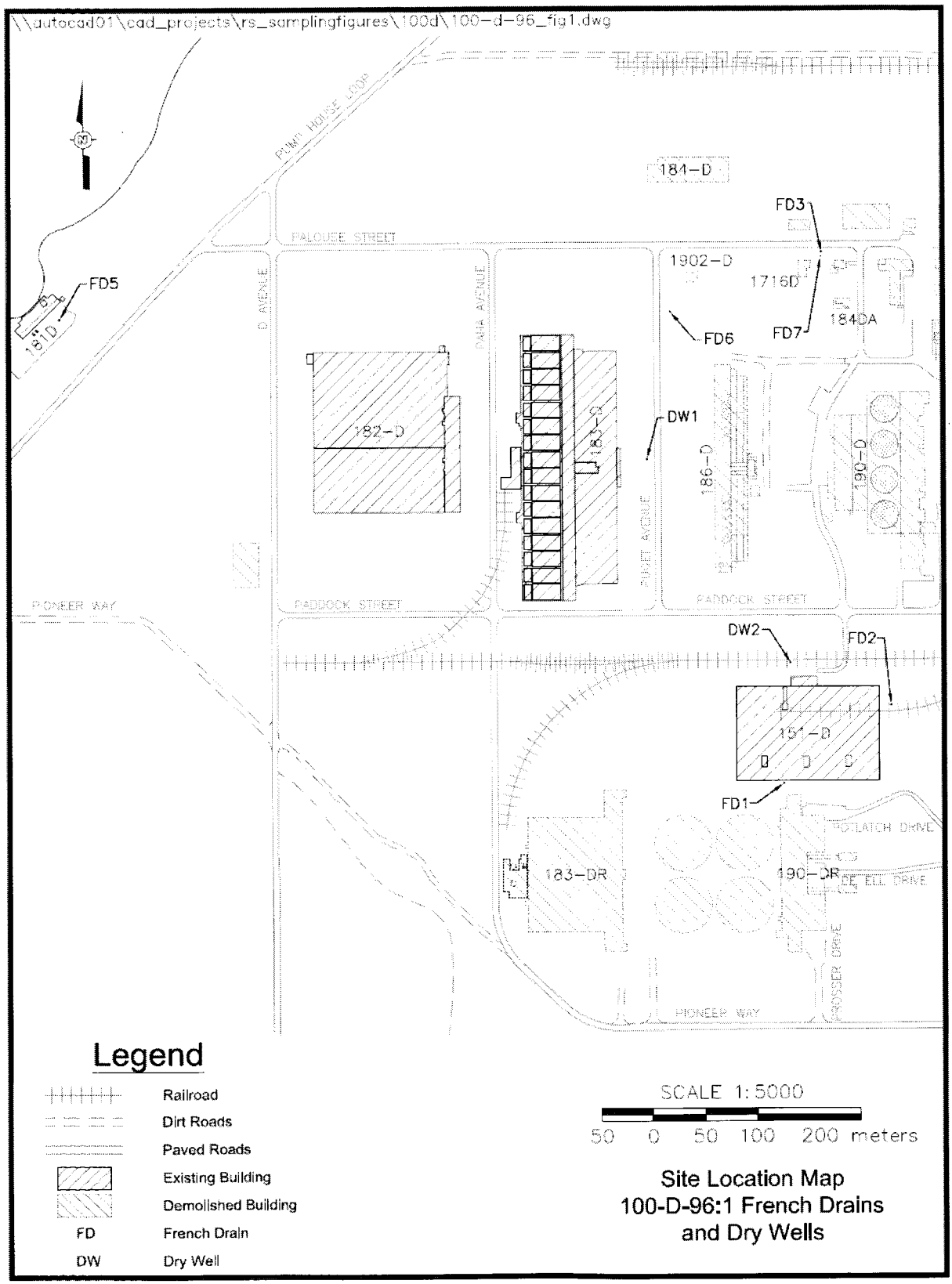
The 100-D-96:1, 100-D/DR Additional French Drains Group 1 subsite confirmatory sampling data, site evaluations, and supporting documentation demonstrate that this site meets the remedial action goals (RAGs) and remedial action objectives (RAOs) established in the *Remedial Design Report/Remedial Action 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. This subsite does not extend into the deep zone. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-96:1 subsite contaminants of potential concern and other constituents (Appendix A). Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for boron, and vanadium. The U.S. Environmental Protection Agency's ecological soil screening levels were exceeded for antimony, lead, manganese, 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 concentrations of antimony, manganese, vanadium and zinc are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the Columbia River corridor portion of the Hanford Site.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-D-96:1 subsite, located within the 100-DR-1 Operable Unit, includes six individual french drain locations, two dry well locations, and the underlying soil. The 100-D-96:1, 100-D/DR Additional French Drains Group 1 are located near the 151-D switch yard, 1716-D maintenance garage, 1902-D water tank, 181-D river pump house, 183-D clear wells, and 184-DA Building (Figure 1). Furthermore, drywell DDR-200 (designated as DW-2), which is associated with the 151-D annex building, was added to the 100-D-96:1 subsite.

Figure 1. Overall Site Location Map of the 100-D-96:1 Subsite.



The following are site descriptions for each of the eight locations comprising the 100-D-96:1 subsite, which were identified during the orphan site evaluation process (WCH 2009). Six of the locations were identified during the orphan site evaluation field investigation, and two additional french drains (at locations FD-6 and FD-7) were identified through an examination of historical building drawings. The dry well and french drain at locations DW-1 and FD-6 were subsequently removed during remediation of the 100-D-31:8 and 100-D-31:9 subsites in 2009 and 2010.

1. The FD-1 site is a 0.6-m (2-ft) concrete french drain that is 5 cm (2 in.) above grade and is filled with cobble. The site is located south of the 151-D switch yard and was visible during the site walkdown performed in December 2011.

2. The FD-2 site is a 0.45-m (1.5-ft) concrete french drain at grade level and is cobble filled. The site is located east of the 151-D switch yard and was visible during the site walkdown performed in December 2011.

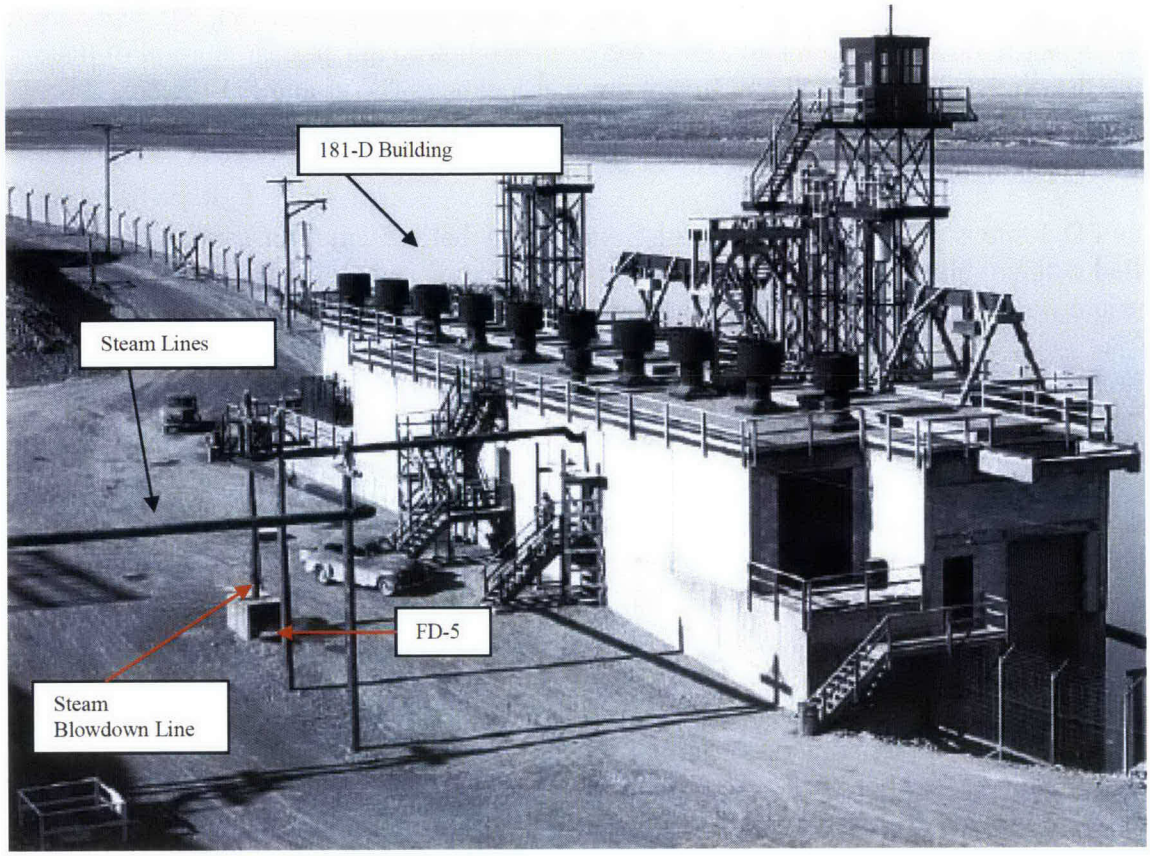
3. The FD-3 site is a 0.6-m (2-ft) concrete french drain at grade level and is covered with a steel plate with pipe inlet notch. This site is located northwest of the former 1716-D maintenance garage and was visible during the site walkdown performed in December 2011.

4. The FD-5 site is a 0.9-m (3-ft) vitrified clay pipe french drain that is 23 cm (9 in.) above grade and is filled with cobble. This site is located east of the 181-D river pump house, next to a utility pole with concrete protection barrier and was visible during the site walkdown performed in December 2011. According to historical research, this french drain supported the steam blowdown line from the 181-D Building (Figure 2). The 181-D River Pump House, pumped raw river water for the reactors from the river, using ten electric driven pumps. The steam turbine driven pumps were also installed in the 181-D Building river pump house to provide emergency backup pumping capacity should the normal electric power be interrupted. There were also occasions when one or two steam driven pumps were used continuously for several days while an electrically driven pumps were out-of-service for maintenance or repair (GE 1963).

5. The DW-1 site was a 0.9-m (3-ft) concrete dry well at grade level covered with a steel plate with pipe inlet notch. This site was located east of the former 183-D clear wells, until it was removed during remediation of the 100-D-31:9, 183-D and 186-D Process Sewer Pipelines subsite in 2009 and 2010. According to drawing H-1-9644-DR, the depth of DW-1 was approximately 3.5 ft (1.1 m) (GE 1950). Final depth for the 100-D-31:9 subsite excavation was approximately 7 m (23 ft).

6. The FD-6 site is a 0.6-m (2-ft) french drain located west of the 184-DA Building (DUN 1968, GE 1968). This french drain was not located during the discovery site investigation. However, the location of the french drain was excavated during the remediation of the 100-D-31:8, 183-D and 186-D Northern Sewer Pipelines subsite in 2009 and 2010, and the french drain would no longer be present. The final depth for the 100-D-31:8 subsite excavation was approximately 9 m (30 ft).

Figure 2. 100-D-96:1 French Drain FD-5 and Steam Blowdown Line (Photograph 1944).



7. The FD-7 site is a 0.45-m (1.5-ft) french drain located northwest of the former 1716-D maintenance garage. This french drain was not located during the discovery site investigation, and it is unknown if the french drain was removed or was covered (DUN 1968, GE 1968).

8. The DW-2 site is a 0.9-m (3-ft) concrete dry well at grade level covered with a steel plate with a concrete rim. The drywell was initially thought to be a manhole. However, after further research and a walkdown, it was determined that in accordance with drawings H-1-26509 (GE 1956) and H-1-9641-DR (GE 1950), and Hanford Plant Standard AC-4-30, the location is consistent with the pressure relief valve (PRV) for the high pressure steam supply line to the 151-D annex building. Steam condensate was discharged to DW-2 drywell location. The former 100-D-56:2 pipeline was at least 20 m (66 ft) north of the DW-2 location. According to process history of 100-D-56:2 subsite, there is no indication that 151-D annex building and DW-2 had any association with the 100-D-56:2 pipeline or could have been affected by it.

The coordinates in Washington State Plane meters determined for these structures are listed in Table 1.

Table 1. Washington State Plan Coordinates of the 100-D-96:1 French Drains and Dry Wells.

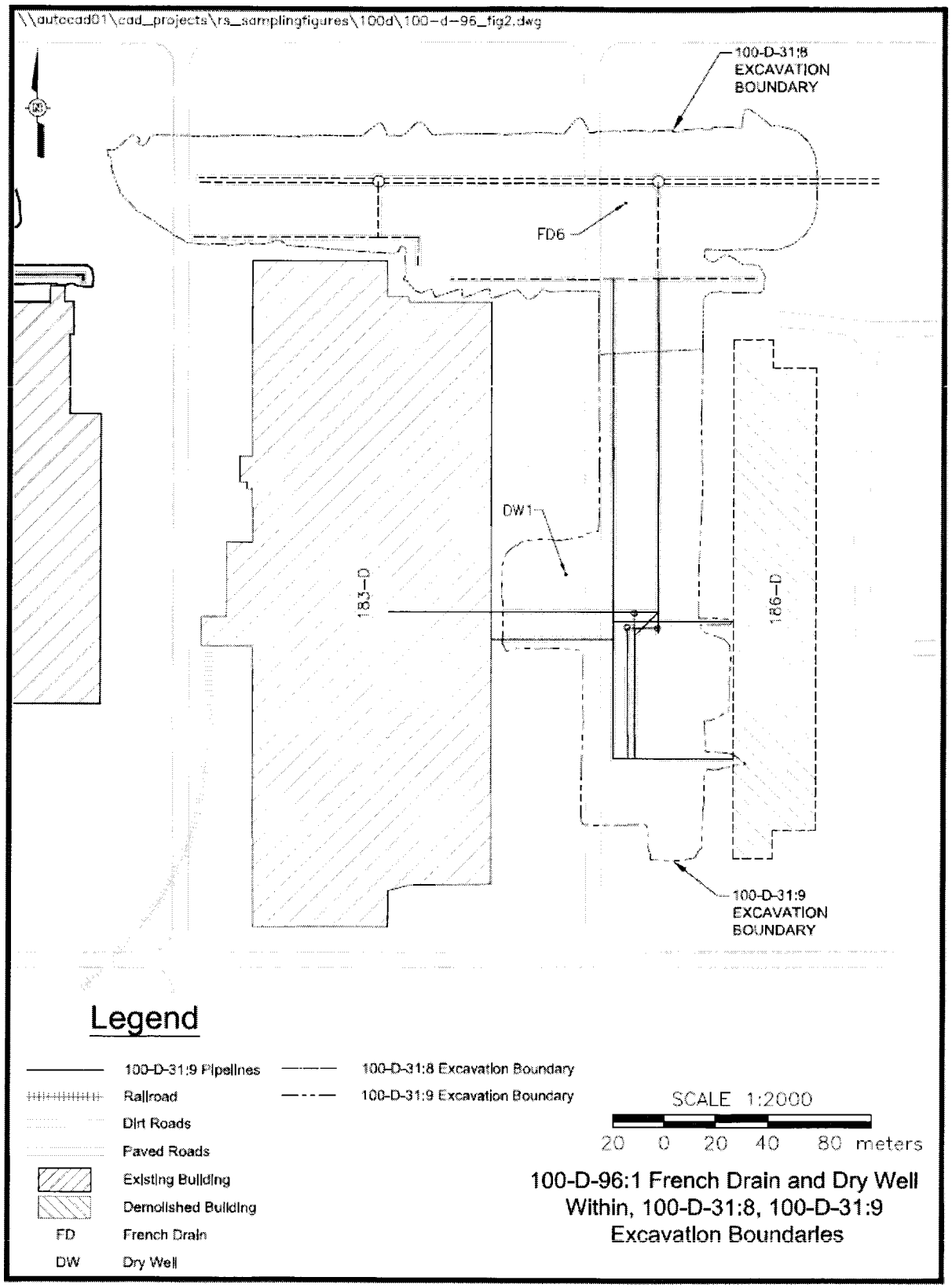
Drain Identification Number	Northing (m)	Easting (m)	Associated Building
FD-1	151277.7	573513.9	151-D switch yard
FD-2	151354.5	573618.0	151-D switch yard
FD-3	151801.6	573551.5	1716-D maintenance garage
FD-5	151736.1	572813.3	181-D river pump house
DW-1	151597.2	573383.1	183-D clear wells
FD-6	151743.0	573406.0	184-DA Building
FD-7	151797.0	573551.0	1716-D maintenance garage
DW-2	151396.2	573520.5	151-D annex building

Steam condensate discharge sites, such as the subject french drains, are located intermittently along the routes of steam transfer lines. The 184-D powerhouse boiler facility supplied high-pressure steam to 100-D/DR Area Buildings through an above-grade pipeline system. The boiler facility utilized clean, filtered water from the 183-D Filter Building to produce steam. As steam moves through pipes, a portion condenses to liquid and needs to be removed. The condensate was typically "blown-off" from the above-grade piping system into a below-grade covered french drain. Without removal of the condensed water, the steam system loses efficiency, and pipes can be damaged by accumulated, fast-moving water driven by the steam. Therefore, condensate water was collected and discharged at multiple locations along the steam pipelines.

According to the drywell standard AC-4-30 Revision 2, the drywell should be at least 36 in. below the invert of the inlet pipe (AC 1973). Drawing H-1-9644-DR indicates that the typical french drain is 42 in. deep (including an additional 6 in. below the inlet pipe), which is consistent with the information provided in the drywell standard (GE 1950).

In 2009 and 2010, the 100-D-31:8, 183-D and 186-D Northern Sewer Pipelines subsite and the 100-D-31:9, 183-D and 186-D Process Sewer Pipelines subsite were remediated and reclassified to interim closed out per the *Remaining Sites Verification Package for 100-D-31:8, 100-D-31:9, and 100-D-31:10* (WCH 2011). In the process of remediation of these waste sites, the french drains at locations DW-1 and FD-6 were removed (Figure 3).

Figure 3. 100-D-96:1 French Drain and Dry Well Locations Within the 100-D-31 Waste Site Boundaries.



Ecological and Cultural Resources

An ecological resources review for confirmatory sampling was conducted in February 2012 (WCH 2012a) for the 100-D-96 waste site. The waste site is located within a heavily disturbed area. Existing roads were to be used as much as possible when accessing the site to reduce the spread of noxious weeds and minimize impacts to existing vegetation. Nesting birds such as killdeer and nighthawks sometimes use these heavily disturbed areas for nesting, and workers were advised to watch for nesting activity. No nests or nesting activity were observed during confirmatory sampling.

No archaeological sites were known or expected to exist in the 100-D project area near the 100-D-96 waste site locations. All workers were directed to watch for cultural materials (e.g., bones, stone tools, mussel shells, cans, bottles, Hanford-era artifacts) during all work activities. No ecologically or culturally significant materials were encountered during confirmatory sampling.

Geophysical Survey

Geophysical surveys were performed at 100-D-96:1 subsite locations for excavation permit purposes prior to excavation and sampling to detect possible buried metallic debris and to identify live utilities in support of confirmatory sampling. All 100-D-96:1 subsite geophysical survey interpretation figures are included in Appendix B.

CONFIRMATORY SAMPLING SUMMARY

Confirmatory sampling of the 100-D-96:1 subsite was performed to support evaluation of the site against the remedial action goals (RAGs) specified in the Remaining Sites ROD (EPA 1999). The analytical results are evaluated against the cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b) to support a No Action or Remedial Action decision. The following sections describe the COPCs, sample design, sampling activities, and sample results.

Contaminants of Potential Concern

The COPCs for the 100-D-96:1 subsite were identified based on the process history of the 184-D powerhouse that supplied the high-pressure steam, of which a portion condensed to liquid and discharged to the below-grade covered french drains that comprise the 100-D-96:1 subsite. The COPC list includes the expanded list of inductively coupled plasma (ICP) metals and mercury. Nitrate was added as a COPC because of the nitrate plume in groundwater in the 100-D/DR Area. Ion chromatography (IC) anions were not COPCs for this waste site; however, sample analysis for IC anions was inadvertently requested. Because no suspected asbestos-containing material was observed during confirmatory sampling, analysis was not performed for asbestos. Radiological activity was not detected in the field during confirmatory sampling activities; therefore, no analysis for radionuclides was performed. Although not considered COPCs for the 100-D-96:1 subsite, hexavalent chromium and polycyclic aromatic hydrocarbon (PAH) analysis were added to the list of analytical methods after confirmatory sampling activities were performed.

Confirmatory samples were analyzed using EPA-approved methods. Table 2 identifies the analyses for confirmatory sampling.

Table 2. 100-D-96:1 Laboratory Analytical Methods.

Analytical Method	Contaminants of Potential Concern
ICP metals [a] – EPA Method 6010	Metals
Mercury – EPA Method 7471	Mercury
IC anions – EPA Method 300.0	NA [b]
PAH – EPA Method 8310	NA [c]
Hexavalent chromium – EPA Method 7196	NA [c]
Nitrate/nitrite – EPA Method 353.2	Nitrogen in nitrate and nitrite

[a] Analysis was performed for the expanded list of ICP metals to antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.
[b] Analyses were mistakenly ordered and performed for the extended list of IC anions including bromide, chloride, fluoride, nitrate, nitrite, and phosphate. IC anions are not contaminants of potential concern for the 100-D-96:1 waste site.
[c] Analyses were added and performed per Ecology's request, following confirmatory sampling activities.

EPA = U.S. Environmental Protection Agency
IC = ion chromatography
ICP = inductively coupled plasma
NA = not applicable
PAH = polycyclic aromatic hydrocarbons

Confirmatory Sample Design

One french drain from each of the building locations within the 100-D-96 waste site was selected for sampling, except locations DW-1 and FD-6 (which were removed), for a total of four french drain test pits for six french drains. The french drains to be sampled were selected based on confidence in the location, as determined by surface visibility and/or details from the historical building drawings, and accessibility. The four french drain locations selected for sampling were FD-2, FD-3, FD-4, and FD-5 (Table 1). The sample results obtained from location FD-2 would be used to make decisions (no action or remediation required) for location FD-1, as they are both associated with the 151-D switchyard. The sample results from location FD-3 were to be used to make decisions for location FD-7, as they are both associated with the same 1716-D maintenance garage. The FD-4 and FD-5 french drains were associated with the 1902-D water tank and 181-D river pump house, respectively. The FD-4 french drain was re-assigned to the 100-D-96:2 subsite, following confirmatory sampling. The french drain test pit locations and sample design details are discussed in the work instruction (WCH 2012b). The DW-2 drywell was added to 100-D-96:1 subsite following confirmatory sampling; therefore, it is not included in the confirmatory work instruction (WCH 2012b).

Based on the observations made during each test pit excavation, the sampling approach could be adjusted as necessary to achieve the following objectives: (1) collect a discrete sample of the french drain contents if possible, and (2) collect a discrete sample of the underlying soil.

Confirmatory Sampling Activities

Confirmatory sampling was performed as described in the confirmatory sampling work instruction (WCH 2012b). All sampling was performed in accordance with ENV-1, *Environmental Monitoring and Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). Field observations during sampling are provided in the field logbook (WCH 2012c). A summary of the samples collected for the 100-D-96:1 subsite confirmatory sampling is provided in Table 3.

Table 3. 100-D-96:1 Sample Summary Table.

Test Pit	Sample Media	HEIS Sample Number	WSP Coordinate Location (m)	Depth (bgs)	Sample Analysis
FD-2	French drain contents	J1PR46	N 151355 E 573618	6 ft	ICP metals [a], mercury, IC anions [b], NO_2/NO_3
	Underlying soil	J1PR47		6 ft	
	Hazardous/anomalous debris/media	None found		NA	
FD-3	French drain contents	J1PR49	N 151802 E 573552	7 ft	
	Underlying soil	J1PR50		7 ft	
	Hazardous/anomalous debris/media	None found		NA	
FD-5	French drain contents	Not sampled	N 151736 E 572813	NA	Not sampled
	Underlying soil	Not sampled		NA	
	Hazardous/anomalous debris/media	NA		NA	
Equipment blank	Silica sand	J1PR48	NA	NA	ICP metals [a], mercury

[a] The expanded list of ICP metals will include antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

[b] Analyses were mistakenly ordered and performed for the extended list of IC anions including bromide, chloride, fluoride, nitrate, nitrite, and phosphate. IC anions are not contaminants of potential concern for the 100-D-96 waste site.

bgs = below ground surface
HEIS= Hanford Environmental Information System
IC = ion chromatography
ICP = inductively coupled plasma
NA = not applicable
WSP = Washington State Plane

Confirmatory sampling data for the 100-D-96:1 subsite is presented in Appendix C. The laboratory-reported confirmatory data results for all samples and constituents associated with the 100-D-96:1 subsite is stored in the Environmental Restoration (ENRE) project-specific database prior to archival in the Hanford Environmental Information System (HEIS). Based on the confirmatory sampling data, FD-4 will require remediation; therefore, the french drain is included in the 100-D-96:2 subsite and will not be discussed further in this document. A summary of field observations and sample collection for each french drain location is provided below.

Confirmatory sampling of FD-2 was performed on June 6, 2012. The FD-2 french drain was composed of two vertical sections of reinforced concrete pipe extending to 2.1 m (7 ft) below ground surface (bgs) (Figure 4). The french drain contents were primarily large rust-stained cobbles. Near the bottom of the lower section of pipe was fine-grained silty sand. When observed inside the test pit, this material appeared to have an orange tint, speculated to be rust. However, the orange tint was not apparent on material brought up to ground surface. A sample (J1PR46) was collected of the fine-grained contents. The excavated materials from the test pit were set aside for observation and to allow collection of appropriate samples. A sample (J1PR47) was collected from the soil underlying the french drain. The concrete pipe was placed in the bottom of the excavation and demolished with the excavator. The excavation was then backfilled with the excavated materials from this test pit.

Confirmatory sampling of FD-3 was performed on June 7, 2012. The FD-3 french drain was excavated and found to be a single section of concrete pipe, measuring approximately 46 cm (18 in.) in diameter and 0.9 m (3 ft) long. The top of the pipe had been broken, possibly by a road grader or other heavy equipment traffic. As the excavation proceeded deeper, adjacent to the pipe, the pipe fell apart into the hole (Figure 5). The contents of this french drain were leach rock and sandy silt. A sample (J1PR49) was collected of the fine-grained french drain contents. A sample (J1PR50) was collected from the soil underlying the french drain. The broken concrete tile was placed in the bottom of the excavation before it was backfilled.

The FD-5 french drain, located approximately 10 m (33 ft) southeast of the 181-D river pump house, was not sampled (Figure 6). After careful investigation, it was determined that the active export water line passes through the FD-5 location, and that this excavation could not be safely performed without incurring undue risk to this important safety system.

The DW-2 drywell, located approximately 3 m (10 ft) north of the 151-D annex building (Figure 7), was added to the 100-D-96 waste site following confirmatory sampling activities. The DW-2 drywell was used to receive uncontaminated steam that was generally used in all facilities for heating purposes. The FD-2 confirmatory sampling results are expected to be analogous to the DW-2 location, because they are all associated with the same 151-D switchyard process. The confirmatory sample results obtained from location FD-2 were used to make decisions (no action or remediation required) for location DW-2.

No suspected asbestos-containing material was observed and no radiological activity was detected during confirmatory sampling at any of the sample locations.

Figure 4. Test Pit Excavation at FD-2.

Figure 5. Test Pit Excavation at FD-3.

Figure 6. FD-5 Near the 181-D River Pump House (Not Sampled).

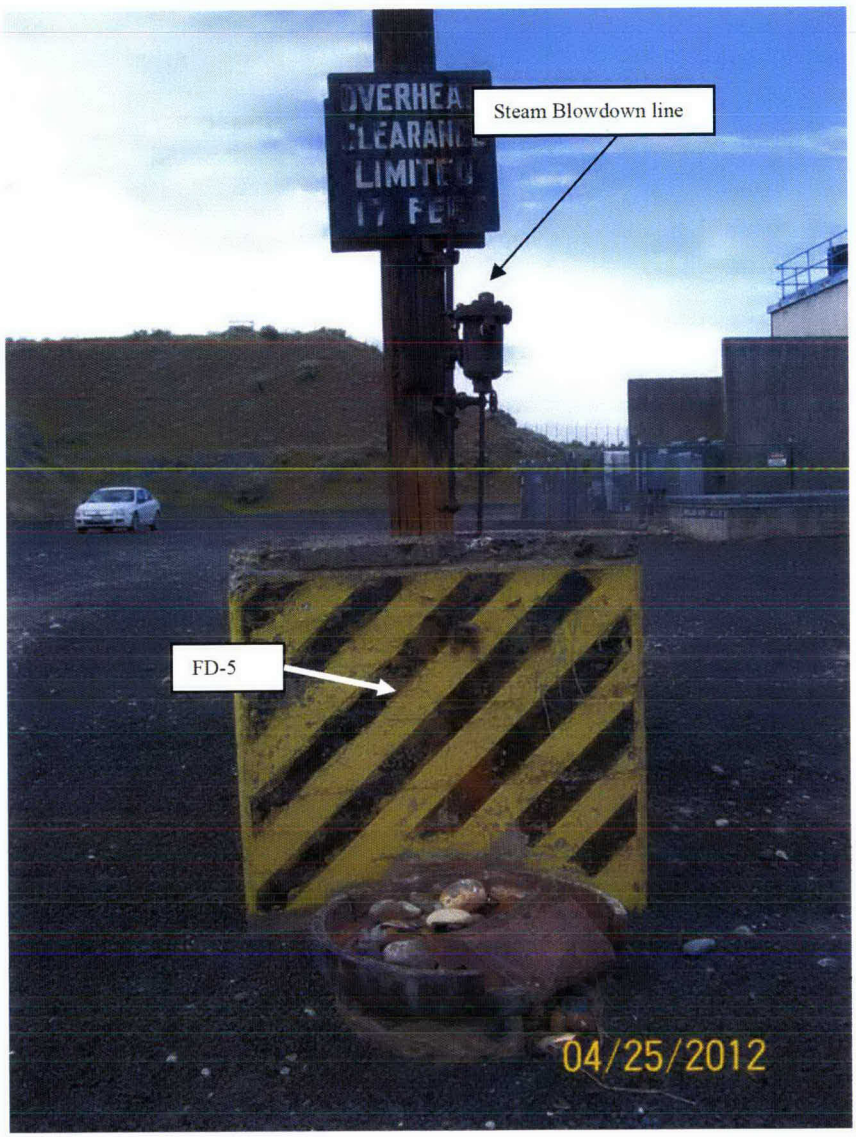


Figure 7. DW-2 North of 151-D Annex Building (Not Sampled).

Confirmatory Sample Results

Confirmatory samples were analyzed using EPA-approved analytical methods. Evaluation of the soil sample data was performed by direct comparison of the maximum detected value for each COPC against the RAGs. If no detections for a given COPC were reported in the data set, then no comparisons were performed for that COPC.

Comparisons of the maximum results for COPCs and the site RAGs for 100-D-96:1 are presented in Table 4. Contaminants that were not detected by laboratory analysis are excluded from this table. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2012) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included Table 4.

Table 4. Comparison of Maximum Contaminant Concentrations to Remedial Action Goals for the 100-D-96:1 Subsite Confirmatory Sampling Data.

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	0.498 (<BG)	32	5 [b]	5 [b]	No	--
Arsenic	2.70 (<BG)	20 [b]	20 [b]	20 [b]	No	--
Barium	99.4 (<BG)	5,600	200	400	No	--
Beryllium	0.254 (<BG)	10.4 [c]	1.51 [b]	1.51 [b]	No	--
Boron	4.50	7,200	320	-- [d]	No	--
Cadmium	0.175 (<BG)	13.9 [c]	0.81 [b]	0.81 [b]	No	--
Chromium (total)	8.86 (<BG)	80,000	18.5 [b]	18.5 [b]	No	--
Cobalt	5.27 (<BG)	24	15.7 [b]	-- [d]	No	--
Copper	21.2 (<BG)	2,960	59.2	22.0 [b]	No	--
Lead	11.7	353	10.2 [b]	10.2 [b]	Yes	Yes [e]
Manganese	248 (<BG)	3,760	512 [b]	512 [b]	No	--
Mercury	0.0307 (<BG)	24	0.33 [b]	0.33 [b]	No	--
Molybdenum	0.373	400	8	-- [d]	No	--
Nickel	8.60 (<BG)	1,600	19.1 [b]	27.4	No	--
Vanadium	46.3 (<BG)	560	85.1 [b]	-- [d]	No	--
Zinc	49.4 (<BG)	24,000	480	67.8 [b]	No	--
Nitrite (as nitrogen)	0.64	8,000	100	200	No	--
Nitrite and Nitrate (as nitrogen)	161	128,000	1,000	2,000	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 per WAC 173-340-700(4)(d)(1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).

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

[d] No parameters (bioconcentration factors or AWQC values) are available from the Cleanup Levels and Risk Calculations Database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).

[e] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), the residual concentrations of lead are not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years (based on the distribution coefficient of lead of 30 mL/g). The vadose zone underlying the soil below the site at the deepest test pit location is approximately 23 m (75.4 ft) thick. Therefore, residual concentrations of lead are predicted to be protective of groundwater and the Columbia River.

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

The laboratory-reported data results for all constituents are stored in the Environmental Restoration (ENRE) project-specific database prior to archiving in the Hanford Environmental Information System (HEIS) and are presented as an attachment to the direct contact hazard quotient and relative percent difference (RPD) calculation in Appendix C.

DATA EVALUATION

Attainment of Nonradionuclide RAGs

Table 4 compares the maximum detected confirmatory sample results to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. All COPCs for all sampling areas were quantified below their respective direct exposure soil RAGs. Lead is present at maximum concentrations above soil RAGs for groundwater and/or Columbia River protection. However, based on RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), it is predicted that lead will not reach groundwater (and thus the Columbia River) within 1,000 years. Therefore, residual contaminant concentrations are protective of groundwater and the Columbia River and do not preclude any future uses (as bounded by the rural-residential scenario).

Three-Part Test for Nonradionuclides

The WAC 173-340-740(7)(e) three-part test is a statistical evaluation of the data that does not apply to the results of focused samples such as those taken at the 100-D-96:1 subsite.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. For the 100-D-96:1 subsite, 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. The cumulative noncarcinogenic hazard quotient is 2.8×10^{-3} which is less than 1.0. Because there is no carcinogen RAG for the constituents detected above background (boron, lead, molybdenum, or nitrite and nitrate as nitrogen), the total excess cancer risk is zero. Therefore, individual contaminant carcinogenic risk is less than 1×10^{-6}, cumulative carcinogenic risk is less than 1×10^{-5}, and nonradionuclide risk requirements are met.

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

A hazard quotient calculation for protection of groundwater was not performed for the 100-D-96:1 subsite because no constituents are predicted to migrate to groundwater within 1,000 years. Lead was quantified at concentrations exceeding soil RAGs for groundwater and river protection. Data were not collected on the vertical extent of lead in the vadose zone, but given the soil-partitioning coefficient of 30 mL/g for lead, it is not expected to migrate more than 2 m (6.6 ft) vertically in 1,000 years based on RESRAD modeling discussed in Appendix C of

the RDR/RAWP (DOE-RL 2009b). The deepest confirmatory sample location for the 100-D-96:1 subsite was at 7 ft (2.1 m) below ground surface. The lowest elevation of the three sampled french drain locations is therefore 141 m and the water table is at approximately 118 m. The vadose zone underlying the soil at the deepest test pit location is approximately 23 m (75.4 ft) thick; therefore, residual concentrations of lead are predicted to be protective of groundwater. The only pathway for contaminant migration to the Columbia River is via groundwater; therefore, residual concentrations of lead are also predicted to be protective of the Columbia River. All other cleanup confirmatory data values are less than the applicable RAGs.

Data Evaluation for Additional Analysis

Following the 100-D-96:1 subsite confirmatory sampling activities and the submission of the draft RSVP for regulatory review, Ecology requested additional analysis on all confirmatory samples to include hexavalent chromium and polycyclic aromatic hydrocarbons (PAH). Per Ecology's request, additional analysis was performed on all 100-D-96:1 subsite confirmatory samples, with the exception of the equipment blank. The summary table of all additional analytical data is presented in Appendix E. Hexavalent chromium was undetected in all confirmatory samples, and therefore; meets the RAGs and associated remedial action objectives for direct exposure, groundwater protection, and river protection.

All of the PAH results for 100-D-96:1 subsite were quantified below their respective direct exposure soil RAGs. Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene and dibenz(a,h)anthracene results were quantified above the groundwater and/or river protection RAGs. However, given the soil-partitioning coefficient for these constituents (based on the lowest distribution coefficient of chrysene of 200 mL/g), they will not migrate vertically in 1,000 years, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b). 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 constituents are also predicted to be protective of the Columbia River.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the confirmatory sampling approach (WCH 2012b), the field logbook (WCH 2012c), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 100-D-96:1 subsite established that the data are of the right type, quality, and quantity to support site closeout decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site confirmation. The confirmatory 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 RPD and direct contact hazard quotient calculation in Appendix C. The detailed DQA is presented in Appendix D.

SUMMARY FOR NO ACTION DETERMINATION

The 100-D-96:1 subsite 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 RAGs and associated remedial action objectives for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 100-D-96:1 subsite to Interim No Action. The 100-D-96:1 subsite did 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.

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APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Maximum Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-D-96:1 Subsite [a].

Hazardous Substance		2007 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Maximum Result
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
	Background	Metals (mg/kg)							
Antimony	5	5	NA	NA	NA	78	NA	0.27	0.498 (<BG)
Boron	NA	0.5	NA	NA	NA	NA	NA	NA	4.5
Lead	10.2	50	500	118	120	1,700	11	56	11.7
Manganese	512	1,100 [d]	NA	1,500	220	450	4,300	4,000	248 (<BG)
Vanadium	85.1	2	NA	NA	NA	NA	7.8	280	46.3 (<BG)
Zinc	67.8	86 [d]	200	360	160	120	46	79	49.4 (<BG)

NOTE. Shaded cells indicate screening values that are exceeded.

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

[b] Available on the Internet at www.epa.gov/ecotox/ecossl.

[c] Wildlife.

[d] 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.

BG = background
EPA = U.S. Environmental Protection Agency
NA = not available
WAC = *Washington Administrative Code*

APPENDIX B

GEOPHYSICAL INTERPRETATION MAPS

Figure B-1. 100-D-96:1 Subsite Geophysical Interpretation Map for French Drain 2.

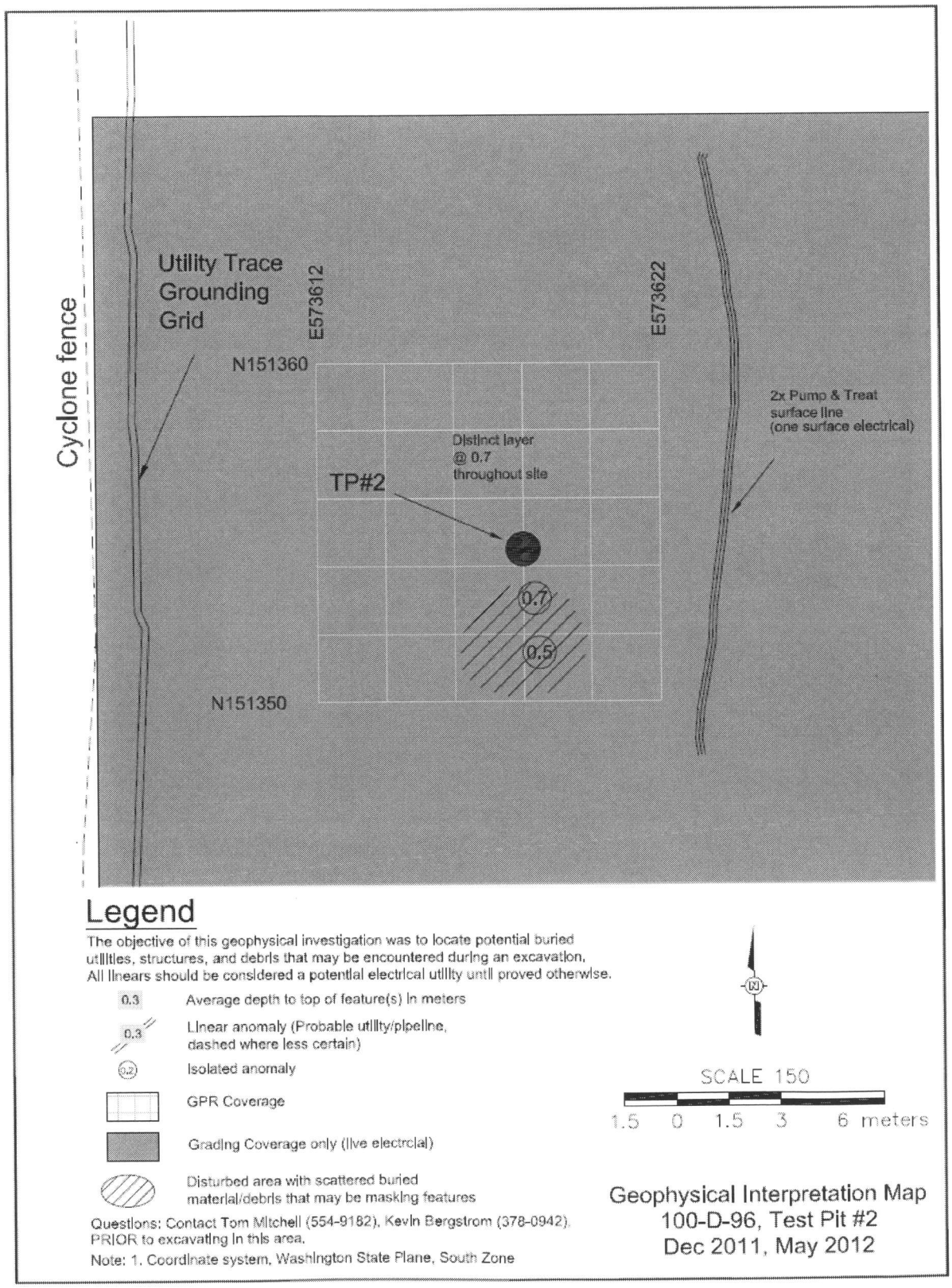


Figure B-2. 100-D-96:1 Subsite Geophysical Interpretation Map for French Drain 3.

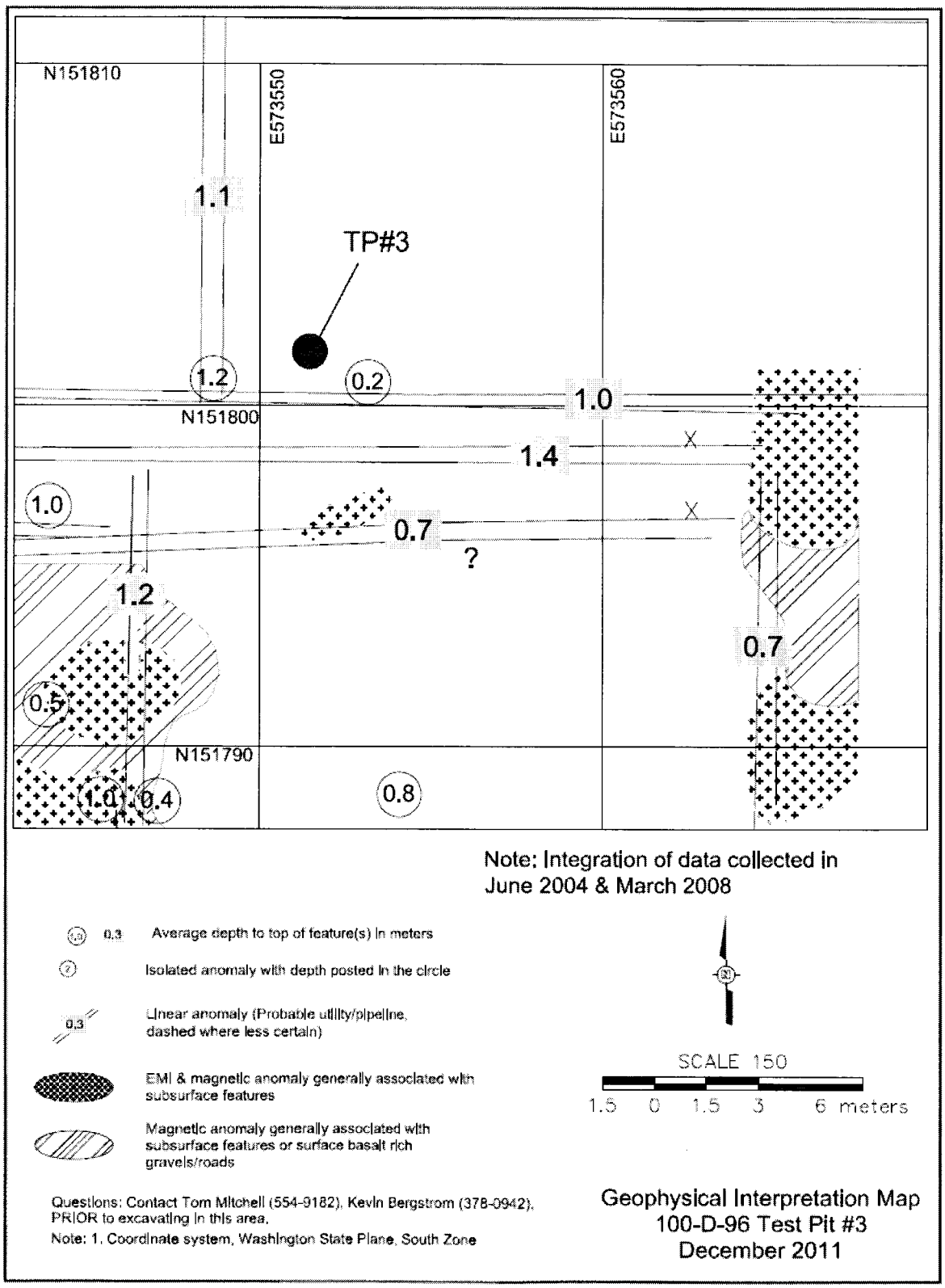
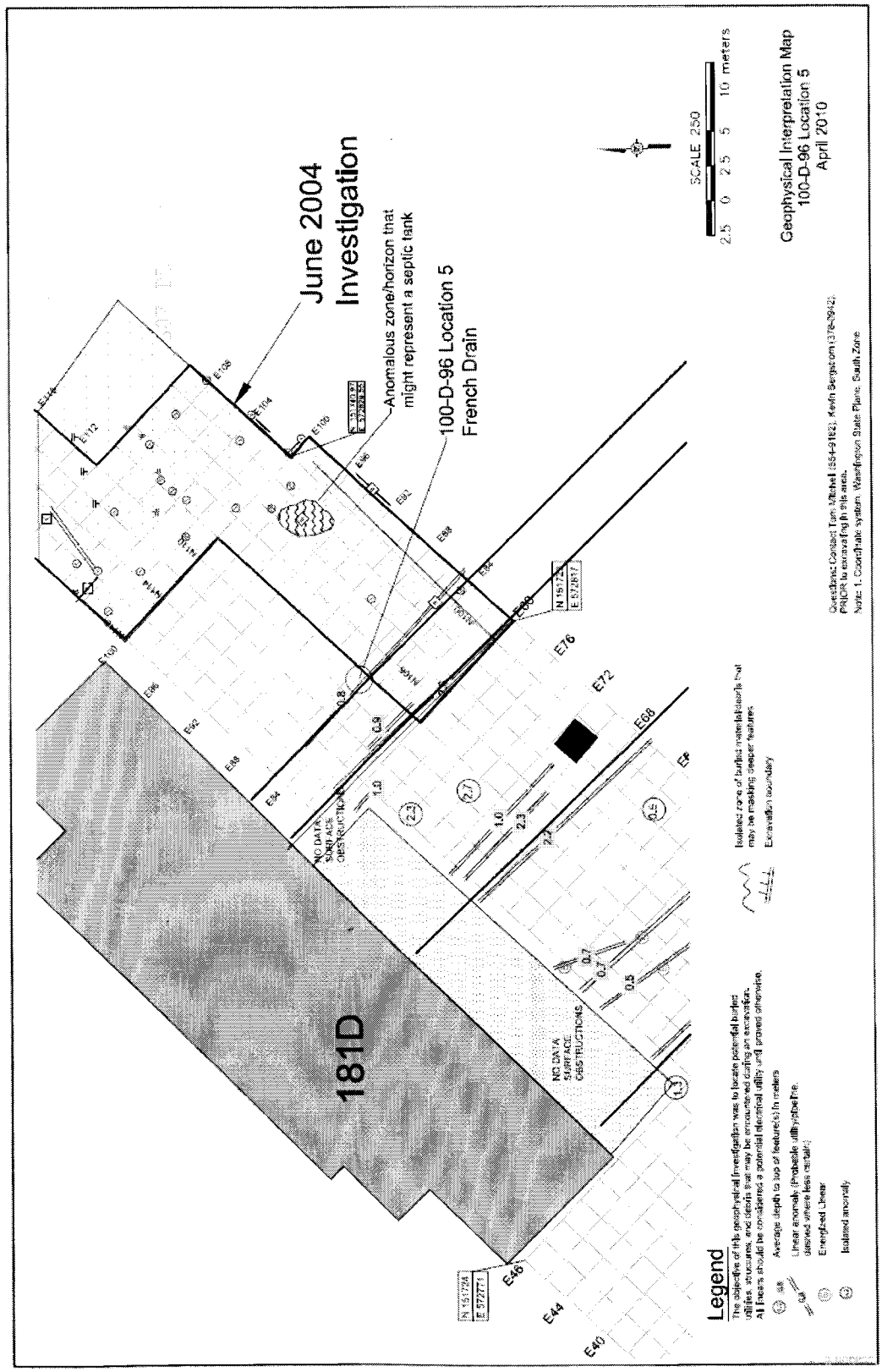


Figure B-3. 100-D-96:1 Subsite Geophysical Interpretation Map for French Drain 5 (Not Sampled).



APPENDIX C

DIRECT CONTACT HAZARD QUOTIENT AND CARCINOGENIC RISK CALCULATION

APPENDIX C

CALCULATIONS

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

100-D-96:1 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100D-CA-V0463, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-D

Discipline: Environmental Calculation No: 0100D-CA-V0463

Subject: 100-D-96:1 Subsite 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 = 3 Attachment 1 = 2 Total = 6	N. K. Schiffern N K. Schiffern	I. B. Berezovskiy I B Berezovskiy	C. H. Dobie C H Dobie	D. F. Obenauer D. F. Obenauer	1/24/13

SUMMARY OF REVISION

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

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	11/20/2012	Calc. No.:	0100D-CA-V0463	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	11/20/2012
Subject:	100-D-96:1 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 100-D-96:1 subsite. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009a), the following criteria must be met:

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

GIVEN/REFERENCES:

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

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

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

4) WCH, 2012, *Remaining Sites Verification Package for the 100-D-96:1, 100-D/DR Additional French Drains Group 1 Subsite*, Attachment to Waste Site Reclassification Form 2009-05, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate an HQ for each noncarcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the individual HQ of <1.0 (DOE-RL 2009a).

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

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the excess cancer risk of $<1 \times 10^{-6}$ (DOE-RL 2009a).

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	11/20/2012	Calc. No.:	0100D-CA-V0463	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	11/20/2012
Subject:	100-D-96:1 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	2 of 3

METHODOLOGY:

The 100-D-96:1 subsite underwent focused sampling at two french drain locations. Both french drain content and underlying soil were sampled at each french drain location. A total of four focused samples were collected at the 100-D-96:1 subsite. The direct contact hazard quotient and carcinogenic risk calculations for the 100-D-96:1 subsite were conservatively calculated using the greatest of the maximum soil sample results (WCH 2012). Of the contaminants of potential concern (COPCs) for this subsite, nitrite and nitrate in nitrogen requires HQ and risk calculations because this analyte was detected above background value. Boron and molybdenum require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead was quantitated at a concentration above Hanford Site background; however, 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. 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 4.50 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 6.3×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 2.8×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. No carcinogenic constituents met the criteria for evaluation in direct exposure at the 100-D-96:1 subsite; therefore, no calculations of excess carcinogenic risk were performed. The requirement of $<1 \times 10^{-6}$ is met. Also, the requirement for the sum of the excess cancer risk of $<1 \times 10^{-5}$ is met.

RESULTS:

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

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

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	11/20/2012	Calc. No.:	0100D-CA-V0463	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	11/20/2012
Subject:	100-D-96:1 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 3

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-D-96:1 Subsite.

Contaminants of Potential Concern	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	4.50	7,200	6.3E-04	--	--
Lead[c]	11.7	353	--	--	--
Molybdenum	0.373	400	9.3E-04	--	--
Anions					
Nitrite and Nitrate (as Nitrogen)	161	128,000	1.3E-03	--	--
Totals					
Cumulative Hazard Quotient:			**2.8E-03**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:

[a] = From WCH (2012).

[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 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.

-- = not applicable

RAG = remedial action goal

CONCLUSION:

The calculations in Tables 1 demonstrate that the 100-D-96:1 subsite meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk 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 subsite.

Attachment 1. 100-D-96:1 Subsite Confirmatory Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
FD2 - FD Content	J1PR46	6/6/2012	4660		5.17	0.621	UJ	0.621	2.63		1.03	99.4	J	0.517	0.219		0.207
FD2 - Underlying Soil	J1PR47	6/6/2012	5560		4.63	0.498	BJ	0.556	2.70		0.926	80.6	J	0.463	0.254		0.185
FD3 - FD Content	J1PR49	6/7/2012	5490		4.71	0.566	U	0.566	1.87		0.943	95.1		0.471	0.237		0.189
FD3 - Underlying Soil	J1PR50	6/7/2012	5940		3.61	0.434	U	0.434	2.23		0.723	59.0		0.361	0.230		0.145
Equipment Blank	J1PR48	6/7/2012	217		3.29	0.395	U	0.395	0.201	B	0.658	2.22		0.329	0.132	U	0.132

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
FD2 - FD Content	J1PR46	6/6/2012	4.24	J	2.07	0.175	B	0.207	5940		103	8.70		0.207	4.82		2.07
FD2 - Underlying Soil	J1PR47	6/6/2012	3.04	J	1.85	0.112	B	0.185	7480		92.6	8.86		0.185	5.21		1.85
FD3 - FD Content	J1PR49	6/7/2012	4.50		1.89	0.144	B	0.189	6860		94.3	7.15		0.189	5.04		1.89
FD3 - Underlying Soil	J1PR50	6/7/2012	1.06	B	1.45	0.0909	B	0.145	5490		72.3	6.56		0.145	5.27		1.45
Equipment Blank	J1PR48	6/7/2012	1.32	U	1.32	0.132	U	0.132	36.0	B	65.8	0.132	U	0.132	1.32	U	1.32

Sample Location	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
FD2 - FD Content	J1PR46	6/6/2012	14.3		1.03	14900		20.7	8.47		0.517	3120		77.6	215		5.17
FD2 - Underlying Soil	J1PR47	6/6/2012	13.9		0.926	15800		18.5	3.55		0.463	4170		69.5	240		4.63
FD3 - FD Content	J1PR49	6/7/2012	21.2		0.943	17000		18.9	11.7		0.471	2960		70.7	240		4.71
FD3 - Underlying Soil	J1PR50	6/7/2012	11.4		0.723	17500		14.5	3.36		0.361	3350		54.2	248		3.61
Equipment Blank	J1PR48	6/7/2012	0.658	U	0.658	296		13.2	0.479		0.329	22.9	B	49.4	7.16		3.29

Sample Location	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
FD2 - FD Content	J1PR46	6/6/2012	0.0307		0.0290	0.431	BUJ	2.07	8.45		4.14	755		414	0.310	U	0.310
FD2 - Underlying Soil	J1PR47	6/6/2012	0.0289	U	0.0289	0.443	BUJ	1.85	8.60		3.71	842		371	0.278	U	0.278
FD3 - FD Content	J1PR49	6/7/2012	0.0170	B	0.0254	0.373	B	1.89	6.99		3.77	778		377	0.283	U	0.283
FD3 - Underlying Soil	J1PR50	6/7/2012	0.0274	U	0.0274	0.363	B	1.45	6.57		2.89	928		289	0.217	U	0.217
Equipment Blank	J1PR48	6/7/2012	0.0257	U	0.0257	1.32	U	1.32	2.63	U	2.63	46.2	B	263	0.197	U	0.197

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

Gray cells indicate not applicable.

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

[a] = IC anions analysis was inadvertently requested for samples collected at this waste site. Data are provided for informational purposes only.

B = detected but below the reporting limitm result is an estimated concentration.

D = result reported from a dilution

HEIS=Hanford Environmental Information System

J = estimated

PQL = practical quantitation limit

Q = qualifier

U = analyzed for and not detected.

Attachment	1	Sheet No.	1 of 2
Originator	N. K. Schiffern	Date	11/20/12
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Attachment 1. 100-D-96:1 Subsite Confirmatory Sample Results (Metals).

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
FD2 - FD Content	J1PR46	6/6/2012	309	J	2.07	0.207	U	0.207	160	J	51.7	38.8		2.59	42.9		10.3
FD2 - Underlying Soil	J1PR47	6/6/2012	403	J	1.85	0.185	U	0.185	206	J	46.3	42.7		2.32	36.0		9.26
FD3 - FD Content	J1PR49	6/7/2012	413		1.89	0.189	U	0.189	300		47.1	45.1		2.36	49.4		9.43
FD3 - Underlying Soil	J1PR50	6/7/2012	357		1.45	0.145	U	0.145	191		36.1	46.3		1.81	36.3		7.23
Equipment Blank	J1PR48	6/7/2012	89.2		1.32	0.132	U	0.132	7.44	B	32.9	0.288	B	1.65	1.32	B	6.58

Attachment 1. 100-D-96:1 Subsite Confirmatory Sample Results (Anions).

Sample Location	HEIS Number	Sample Date	Bromide[a]			Chloride[a]			Fluoride[a]			Nitrate[a]			Nitrite[a]		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
FD2 - FD Content	J1PR46	6/6/2012	1.1	U	1.1	6.6		1.1	1.1	U	1.1	651	J	10.5	2.1	BJ	1.1
FD2 - Underlying Soil	J1PR47	6/6/2012	1.1	U	1.1	1.3	B	1.1	1.1	U	1.1	21.3	J	1.1	1.1	UR	1.1
FD3 - FD Content	J1PR49	6/7/2012	1.1	U	1.1	1.1	U	1.1	1.1	U	1.1	12.0		1.1	1.1	U	1.1
FD3 - Underlying Soil	J1PR50	6/7/2012	1.1	U	1.1	1.1	U	1.1	1.1	B	1.1	4.1	B	1.1	1.1	U	1.1

Attachment 1. 100-D-96:1 Subsite Confirmatory Sample Results (Anions and Physical).

Sample Location	HEIS Number	Sample Date	Nitrogen in Nitrite and Nitrate			Phosphate[a]			Sulfate[a]			Percent Solids		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	%	Q	PQL
FD2 - FD Content	J1PR46	6/6/2012	161	D	2.63	36.0	J	2.1	136	D	2.1	91.2		0.1
FD2 - Underlying Soil	J1PR47	6/6/2012	4.84		0.10	2.9	BJ	2.2	10.8		1.1	91.5		0.1
FD3 - FD Content	J1PR49	6/7/2012	2.85		0.11	2.5	B	2.1	11.3		1.1	93.1		0.1
FD3 - Underlying Soil	J1PR50	6/7/2012	0.98		0.11	2.3	U	2.3	4.4	B	1.1	88.7		0.1
Equipment Blank	J1PR48	6/7/2012										100		0.1

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APPENDIX D

DATA QUALITY ASSESSMENT

APPENDIX D

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 2012b). 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 2012b), the field logbook (WCH 2012a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. In addition, ion chromatography (IC) anions analysis, by EPA method 300.0, was also requested. IC anions are not contaminants of potential concern (COPCs) for 100-D-96:1 subsite.

The sample design (WCH 2012b) includes samples for the 100-D-96:1 and 100-D-96:2 subsites. The 100-D-96:2 subsite is comprised of a french drain (FD-4) which will require additional remediation. To evaluate the quality of 100-D-96:1 data set it was necessary to make use of QA/QC results derived from the 100-D-96:2 samples which were collected, analyzed, and reported concurrently with the 100-D-96:1 samples.

To ensure quality data, the SAP data assurance requirements and the data validation procedure for chemical analysis (BHI 2000) is 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 100-D-96:1 and 100-D-96:2 subsites were provided by the laboratories in two sample delivery groups (SDGs): SDG K3920 and SDG K3921. SDG K3920 was submitted for third-party validation. Deficiencies in the 100-D-96:1 and 100-D-96:2 data set are discussed in the sections below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of those data were found.

MAJOR DEFICIENCIES

Samples were collected on June 6, 2012, and were analyzed on June 12, 2012. Due to the holding time exceedances of greater than twice the limit of (48 hours) for the method 300.0 nitrate, nitrite, and orthophosphate results, third-party validation qualified the undetected nitrite results in SDG K3920 as rejected, with a "UR" flags. All detected nitrate, nitrite and orthophosphate results are qualified as estimated, with "J" flags, by third-party validation.

This result was anticipated, and EPA analytical method 353.2 was also requested to provide usable nitrate/nitrite data for decision-making purposes. Phosphate is not a regulated chemical under *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup." The rejection of the undetected nitrite and orthophosphate data does not hinder the evaluation of the 100-D-96 waste site. The resulting data set is acceptable for decision-making purposes.

MINOR DEFICIENCIES

SDG K3920

This SDG comprises two soil samples (J1PR46, J1PR47) collected from french drain 2 focused sampling location within the 100-D-96:1 subsite. These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, and IC anions. SDG K3920 was submitted for third-party validation. Minor deficiencies are as follows:

In the ICP metals analysis, molybdenum was detected at low levels in the method blank (MB). All of the field sample detections of molybdenum were of the magnitude as the MB result. Due to MB contamination all detected molybdenum results in SDG K3920 were qualified as undetected and estimated with "UJ" flags by third-party validation. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recoveries are out of project acceptance criteria for five analytes (aluminum, antimony, iron, manganese, and silicon). For aluminum, iron, and manganese analytes the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the MS. The MS recoveries for antimony and silicon are 39.1% and 279%, respectively. All antimony and silicon results for SDG K3920 are considered estimated and flagged "J" by third-party validation due to the MS recoveries below the QC limits. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory control sample (LCS) recoveries are outside the quality control limits for antimony (66.6%) and silicon (54.5%). All antimony and silicon data in SDG K3920 were qualified by third-party validation as estimated with "J" flags. Estimated data are acceptable for decision-making purposes.

In the ICP metals analysis, the RPDs for barium, boron, and sodium are outside the quality control limits of 30%, at 30.5%, 88.6%, and 53.2%, respectively. All barium, boron and sodium results in SDG K3920 were qualified by third-party validation as estimated with "J" flags. Estimated data are acceptable for decision-making purposes.

In the mercury analysis, the laboratory duplicate mercury RPD is above the project quality control limits of 30%, at 62.1%. All mercury results in SDG K3920 may be considered estimated. Estimated data are acceptable for decision-making purposes.

In the IC anions analysis, the samples were analyzed by both method 300.0 and 352.3. Due to holding time exceedances the method 300.0 data for nitrate and nitrite has all been qualified by third-party validation as either rejected or estimated data. To mitigate this result the project also requested that the samples be analyzed by method 352.3 which has a longer holding time. Because the method 353.2 data for nitrate and nitrite is of higher quality than the method 300.0 data it will be use to evaluate 100-D-96:1 subsite. The resulting data set is usable for decision-making purposes.

SDG K3921

This SDG comprises five soil samples (J1PR49 through J1PR53) collected from two french drain locations (FD-3 and FD-4) within the 100-D-96:1 and 100-D-96:2 subsites. These samples were analyzed for ICP metals, mercury, and IC anions. This SDG includes one field duplicate pair (J1PR52/J1PR53). In addition, one equipment blank (J1PR48) was collected and analyzed for ICP metals and mercury. Minor deficiencies are as follows:

In the ICP metals analysis, calcium was detected in the MB. Due to MB contamination all detected calcium results in SDG K3921 may be considered estimated. Calcium is not a regulated compound or a COPC for the 100-D-96:1 and 100-D-96:2 subsites. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for 12 analytes (aluminum, antimony, calcium, chromium, copper, iron, lead, magnesium, manganese, silicon, vanadium, and zinc). For aluminum, calcium, iron, magnesium, vanadium, zinc, and silicon, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony, chromium, copper, lead, and manganese did not have mismatched spike and native concentrations in the original MS. The MS recoveries for these analytes are as follows: antimony (35.0%), chromium (69.4%), copper (59.5%), lead (64.2%), and manganese (-14.9%). All of the data for these analytes in SDG K3921 may be considered estimated. Estimated data are usable for decision-making purposes.

In the method 300.0 IC anions analysis, the holding times for nitrate, nitrite, and orthophosphate were exceeded by more than twice the acceptable range on all samples. All detected nitrate, nitrite, and orthophosphate results in SDG 3921 may be considered estimated. Estimated data are usable for decision-making purposes. The non-detected nitrate, nitrite, and orthophosphate results are discussed in the "Major Deficiencies" section above. The IC anions are not COPCs for 100-D-96:1 and 100-D-96:2 subsites and analysis was requested by error.

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 QA/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2012a), are shown in Table D-1. The main and QA/QC sample results are presented in Table D-2.

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

Sample Area	Main Sample	Duplicate Sample
French drain 4	J1PR52	J1PR53

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 five times the target detection limit (TDL). Relative percent differences of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation.

The calculated barium (32.8%) and silicon (31.1%) RPDs for the field duplicate analysis are above the acceptance criteria of 30%. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. There is no indication that the analytical system was operating out of control. The data are usable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the 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. Sodium in the duplicate sample 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.

Table D-2. Relative Percent Difference Calculations for the 100-D-96:2 Waste Site.

100-D-96:2 Waste Site Duplicate Analysis

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
FD4 - Underlying Soil	J1PR52	6/7/2012	3670		3.36	1.25		0.672	38.7		0.336	0.173		0.134
Duplicate of J1PR52	J1PR53	6/7/2012	4820		4.85	1.58		0.971	53.9		0.485	0.204		0.194

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	27.1%		*32.8%*	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable

100-D-96:2 Waste Site Duplicate Analysis

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
FD4 - Underlying Soil	J1PR52	6/7/2012	1.02	B	1.34	0.0550	B	0.134	3500		67.2	3.29		0.134
Duplicate of J1PR52	J1PR53	6/7/2012	1.14	B	1.94	0.0682	B	0.194	4480		97.1	4.64		0.194

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)	No-Stop (acceptable)
	RPD			24.6%	
	Difference > 2 TDL?	No - acceptable	No - acceptable	Not applicable	No - acceptable

100-D-96:2 Waste Site Duplicate Analysis

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
FD4 - Underlying Soil	J1PR52	6/7/2012	5.54		1.34	11.2		0.672	16200		13.4	3.17		0.336
Duplicate of J1PR52	J1PR53	6/7/2012	7.15		1.94	13.7		0.971	20600		19.4	3.65		0.485

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		20.1%	23.9%	
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable

100-D-96:2 Waste Site Duplicate Analysis

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
FD4 - Underlying Soil	J1PR52	6/7/2012	2910		50.4	209		3.36	0.257	B	1.34	6.32		2.69
Duplicate of J1PR52	J1PR53	6/7/2012	3860		72.8	260		4.85	0.319	B	1.94	7.72		3.88

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	28.1%	21.7%		
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	No - acceptable

100-D-96:2 Waste Site Duplicate Analysis

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
FD4 - Underlying Soil	J1PR52	6/7/2012	470		269	179		1.34	217		33.6	47.7		1.68
Duplicate of J1PR52	J1PR53	6/7/2012	556		388	245		1.94	340		48.5	52.6		2.43

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		*31.1%*		9.8%
	Difference > 2 TDL?	No - acceptable	Not applicable	Yes - assess further	Not applicable

100-D-96:2 Waste Site Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Zinc			Nitrogen in Nitrite and Nitrate		
			mg/kg	Q	PQL	mg/kg	Q	PQL
FD4 - Underlying Soil	J1PR52	6/7/2012	33.9		6.72	3.04		0.09
Duplicate of J1PR52	J1PR53	6/7/2012	40.6		9.71	3.26		0.10

Analysis:

TDL		1	0.75
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)
	RPD	18.0%	
	Difference > 2 TDL?	Not applicable	No - acceptable

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 100-D-96:1 and 100-D-96:2 subsite confirmatory sampling data set found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 100-D-96:1 and 100-D96:2 subsites concluded that the data are of the right type, quality, and quantity to support the intended use. The analytical data are acceptable for decision-making purposes.

The confirmatory 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 confirmatory sample analytical data are also summarized in Appendix C.

REFERENCES

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

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

WCH, 2012a, *100-D Field Remediation and Sampling*, Logbook EL-1601-06, pp. 60-66, Washington Closure Hanford, Richland, Washington.

WCH, 2012b, *Work Instruction for Confirmatory Sampling of the 100-D-96, 100-D/DR Additional French Drains,* 0100D-WI-G0112, Rev. 0, Washington Closure Hanford, Richland, Washington.

APPENDIX E

100-D-96 WASTE SITE ADDITIONAL DATA ANALYSIS

Table E-1. 100-D-96 Waste Site Confirmatory Sample Results - Additional Analysis.

Sample Location	HEIS Number	Sample Date	Hexavalent Chromium		
			mg/kg	Q	PQL
FD4 - Underlying Soil	J1PR52	6/7/2012	0.22	U	0.22
Duplicate of J1PR52	J1PR53	6/7/2012	0.22	U	0.22
FD2 - FD Content	J1PR46	6/6/2012	0.21	U	0.21
FD2 - Underlying Soil	J1PR47	6/6/2012	0.23	U	0.23
FD3 - FD Content	J1PR49	6/7/2012	0.23	U	0.23
FD3 - Underlying Soil	J1PR50	6/7/2012	0.21	U	0.21
FD4 - FD Content	J1PR51	6/7/2012	0.21	U	0.21

Table E-1. 100-D-96 Waste Site Confirmatory Sample Results - Additional Analysis (Polycyclic Aromatic Hydrocarbons - PAH).

CONSTITUENT	CLASS	J1PR46, FD-2 contents			J1PR47, FD-2 - underlying Soil			J1PR49, FD-3 contents			J1PR50, FD-3 underlying Soil		
		6/6/12 13:50			6/6/12 14:00			6/7/12 8:59			6/7/12 9:02		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	36.5	UD	36.5	3.63	U	3.63	35.2	UD	35.2	37.5	UD	37.5
Acenaphthylene	PAH	94.8	D	36.5	5.52		3.63	454	D	35.2	37.5	UD	37.5
Anthracene	PAH	30.8	JD	36.5	3.63	U	3.63	35.2	UD	35.2	37.5	UD	37.5
Benzo(a)anthracene	PAH	118	D	36.5	8.23		3.63	34.2	JD	35.2	37.5	UD	37.5
Benzo(a)pyrene	PAH	103	D	36.5	10.6		3.63	61.6	D	35.2	44.4	D	37.5
Benzo(b)fluoranthene	PAH	142	D	36.5	9.81		3.63	25.0	JD	35.2	37.5	UD	37.5
Benzo(ghi)perylene	PAH	263	D	36.5	4.00		3.63	35.2	UD	35.2	37.5	UD	37.5
Benzo(k)fluoranthene	PAH	62.8	D	36.5	3.43	J	3.63	35.2	UD	35.2	37.5	UD	37.5
Chrysene	PAH	440	D	36.5	6.85		3.63	10.4	JD	35.2	37.5	UD	37.5
Dibenz[a,h]anthracene	PAH	12.6	JD	36.5	3.63	U	3.63	35.2	UD	35.2	37.5	UD	37.5
Fluoranthene	PAH	149	D	36.5	13.3		3.63	222	D	35.2	34.3	JD	37.5
Fluorene	PAH	36.5	UD	36.5	3.63	U	3.63	17.1	JD	35.2	20.0	JD	37.5
Indeno(1,2,3-cd)pyrene	PAH	60.4	D	36.5	9.12		3.63	35.2	UD	35.2	16.4	JD	37.5
Naphthalene	PAH	210	D	36.5	1.05	J	3.63	237	D	35.2	25.6	JD	37.5
Phenanthrene	PAH	218	D	36.5	4.78		3.63	199	D	35.2	153	D	37.5
Pyrene	PAH	96.5	D	36.5	9.47		3.63	33.9	JD	35.2	37.5	UD	37.5

CONSTITUENT	CLASS	J1PR51, FD-4 contents			J1PR52, FD-4 unrelying soil			J1PR53, duplicate of J1PR52		
		6/7/12 12:08			6/7/12 12:12			6/7/12 12:12		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	37.3	UD	37.3	3.40	U	3.40	3.39	U	3.39
Acenaphthylene	PAH	1300	D	37.3	89.4		3.40	81.3		3.39
Anthracene	PAH	37.3	UD	37.3	3.40	U	3.40	3.39	U	3.39
Benzo(a)anthracene	PAH	133	D	37.3	5.90		3.40	7.25		3.39
Benzo(a)pyrene	PAH	265	D	37.3	23.9		3.40	15.5		3.39
Benzo(b)fluoranthene	PAH	115	D	37.3	6.61		3.40	2.58	J	3.39
Benzo(ghi)perylene	PAH	37.3	UD	37.3	3.40	U	3.40	3.39	U	3.39
Benzo(k)fluoranthene	PAH	61.0	D	37.3	3.40	U	3.40	4.58		3.39
Chrysene	PAH	57.0	D	37.3	2.06	J	3.40	4.44		3.39
Dibenz[a,h]anthracene	PAH	37.3	UD	37.3	3.40	U	3.40	3.39	U	3.39
Fluoranthene	PAH	665	D	37.3	40.8		3.40	38.5		3.39
Fluorene	PAH	79.0	D	37.3	5.01		3.40	4.31		3.39
Indeno(1,2,3-cd)pyrene	PAH	89.6	D	37.3	4.27		3.40	2.08	J	3.39
Naphthalene	PAH	861	D	37.3	55.7		3.40	38.8		3.39
Phenanthrene	PAH	291	D	37.3	11.1		3.40	6.44		3.39
Pyrene	PAH	84.8	D	37.3	5.20		3.40	3.19	J	3.39