



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

13-AMRP-0104

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. 2012-072
AND SUPPORTING DOCUMENTATION FOR THE 100-D-65, 116-D-5 OUTFALL
SPILLWAY WASTE SITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2012-072,
and supporting "Remaining Sites Verification Package for the 100-D-65, 116-D-5 Outfall
Spillway Waste Site," 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.: 2012-072

Waste Site Code(s)/Subsite Code(s): 100-D-65, 116-D-5 Outfall Spillway Waste Site

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-65, 116-D-5 Outfall Spillway waste site is located within the 100-DR-1 Operable Unit, on the shore of the Columbia River, approximately 115 m (377 ft) northwest of the former location of the 116-D-7 (107-D) Retention Basin. The spillway was a 6.4-m (21-ft)-wide concrete structure that received overflow from the former 1904-D outfall (116-D-5 waste site) in the event that effluent could not be completely discharged via the outfall pipelines (100-D-60 waste site). The 1904-D outfall was used to discharge radioactive cooling water effluent from the 107-D and 107-DR retention basins (116-D-7 and 116-DR-9 waste sites). The sidewalls of the spillway tapered from 1.5 m (5 ft) tall at the outfall structure to 0.7 m (2 ft) tall at its discharge to a riprap erosion barrier at the river shoreline. The spillway was demolished in place in 1978, and the majority of the spillway was covered with fill material at that time.

Because the 100-D-65 spillway extended into the Columbia River, the ordinary high water mark (OHWM) was used to partition the remediation of the waste site into an upland segment, located above the OHWM, and a shoreline segment, located below the OHWM. Remediation of the upland portion of the spillway was initiated on September 1, 2011 and was completed on September 15, 2011. Approximately 468 bulk cubic meters of material was removed for disposal at the Environmental Restoration Disposal Facility (ERDF). Remediation of the portion of the 100-D-65 spillway located below the OHWM was performed November 11, 2011 through November 13, 2011, with excavation and backfill being done the same day to preclude fish stranding due to fluctuating Columbia River flow rates. Approximately 336 bulk cubic meters of material was removed from the shoreline segment and disposed at ERDF.

Verification sampling of the upland segment was performed on July 18, 2012, to determine if the waste site meets the remedial action objectives (RAOs) and remedial action goals (RAGs) established by the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (Remaining Sites ROD) (EPA 1999). The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at ERDF at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out.

The results of the sampling of the shoreline segment is included in the *Remaining Sites Verification Package for the 100-D-65 Spillway Waste Site* (attached) and will be provided for consideration as part of the final record of decision for the 100-D Area.

Basis for reclassification:

The verification sample results for the upland segment of the 100-D-65 waste site were evaluated in comparison to the RAGs. In accordance with this evaluation, the sampling results for the 100-D-65 waste site support a reclassification of the waste site to Interim Closed Out. The current site conditions achieve the RAOs and RAGs established by the Remaining Sites ROD (EPA 1999). The results of verification 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 analytical results and rationale presented in the attached remaining sites verification package also demonstrate that residual contaminant concentrations meet direct exposure cleanup criteria and are protective of groundwater and the Columbia River. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

The sediment sample results collected within the remediated shoreline of the 100-D-65 waste site exceed soil RAGs for upland areas. However, interim action soil RAGs are not appropriately applied to sediments collected below the OHWM, and the interim action ROD does not provide in-water cleanup levels for sediment. The sediment analytical results exceeding upland soil RAGs are for metals concentrations that are comparable to concentrations measured at reference sites for the River Corridor Baseline Risk Assessment. Negotiations during the Project Manager's dispute initiated 2/10/2012 addressed rewetted zones and river sediment waste sites. During these negotiations, the U.S. Department of Energy agreed to specifically evaluate the 116-H-5 outfall and related shoreline sites in the upcoming 100-D/100-H Remedial Investigation/Feasibility Study. This evaluation should include at a minimum discussions of river sediment backgrounds and specific applicability of modeling methods to soils in the periodically rewetted zone along the shoreline.

The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-D-65 Spillway Waste Site* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1

Control No.: 2012-072

Waste Site Code(s)/Subsite Code(s): 100-D-65, 116-D-5 Outfall Spillway Waste Site

Regulator comments:

Approval of this WSRF documents regulator agreement that the 100-D-65 waste site qualifies for "Interim Closed Out" under this Interim Action ROD. In addition, Ecology has evaluated the data for this site against WAC 173-340 (2007) clean-up levels for direct contact, groundwater protection, and river protection. This evaluation is documented in the letter transmitting Ecology's approval of the site's interim reclassification to "Interim Closed Out."

Waste Site Controls:

Engineered Controls:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Institutional Controls:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	O&M Requirements:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> 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

DOE Federal Project Director (printed)

Signature

Date

N. Menard

Ecology Project Manager (printed)

Signature

Date

N/A

EPA Project Manager (printed)

Signature

Date

**REMAINING SITES VERIFICATION PACKAGE FOR THE
100-D-65, 116-D-5 OUTFALL SPILLWAY WASTE SITE**

Attachment to Waste Site Reclassification Form 2012-072

January 2013

**REMAINING SITES VERIFICATION PACKAGE FOR THE
100-D-65, 116-D-5 OUTFALL SPILLWAY WASTE SITE****EXECUTIVE SUMMARY**

The 100-D-65, 116-D-5 Outfall Spillway waste site, located in the 100-DR-1 Operable Unit, was a concrete structure that received overflow from the former 1904-D outfall in the event that effluent could not be completely discharged via the outfall pipelines (100-D-60 waste site). The 1904-D outfall was used to discharge radioactive cooling water effluent from the 107-D and 107-DR retention basins (116-D-7 and 116-DR-9 waste sites). The spillway was demolished in place in 1978, and the majority of the spillway was covered with fill material at that time.

The 100-D-65 spillway waste site was identified for remove-treat-dispose (RTD) in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision* (Remaining Sites ESD) (EPA 2009) based on confirmatory sampling performed on January 4 through 5, 2006, as specified in the confirmatory sampling work instruction (WCH 2005). A test pit was hand-excavated with a pick and shovel to access the shallower downstream portion of the spillway through the rock and cobble cover. An approximate 0.6- by 1.2-m (2- by 4-ft) section of the concrete spillway was exposed for sample collection. Concrete from the surface of the spillway was scabbled and collected into a primary sample and a duplicate sample for laboratory analysis. Cesium-137, cobalt-60, europium-152, nickel-63, and total beta radiostrontium were detected at activity levels that would exceed the cumulative direct exposure remedial action goal (RAG) for beta and gamma emitters (15 mrem/yr above background), based on RESidual RADioactivity modeling (DOE-RL 2009b). Multiple nonradioactive metals were also detected at concentrations exceeding direct exposure RAGs and/or soil RAGs for the protection of groundwater and/or the Columbia River. Therefore, it was determined that remediation of the spillway was necessary.

The 100-D-65 spillway waste site consists of two components: an upland segment located above the Columbia River ordinary high water mark (OHWM) and a shoreline segment located below the OHWM and above the ordinary low water mark (OLWM). Remediation of the upland segment of the outfall was performed September 1 through September 15, 2011, consistent with existing protocols specified in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b). Approximately 468 bulk cubic meters of material was excavated, stockpiled, and later disposed at the Environmental Restoration Disposal Facility (ERDF).

Remediation, verification sampling, and backfill of the below OHWM segment of the waste site was performed November 11 through November 13, 2011, during low Columbia River flows, as agreed to with the Washington State Department of Ecology (Ecology) to preclude fish stranding due to fluctuating Columbia River flow rates. Approximately 336 bulk cubic meters of material was removed from the shoreline area and disposed at ERDF. The portion of the concrete spillway remaining below water on the day of excavation was left in place and a sample of concrete exposed just above the water was collected. Maximum contaminant concentrations for sediment samples collected within the remediated shoreline area exceed upland soil RAGs for chromium (total), copper, lead, manganese, nickel, and zinc. Arsenic, antimony, copper, lead,

and zinc detected in the concrete exceed upland soil RAGs. However, no further remediation of the shoreline area is recommended since interim action soil RAGs are not appropriately applied to sediments collected below the OHWM 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) does not provide in-water cleanup levels for sediment. The sediment analytical results exceeding upland soil RAGs are for metals concentrations that are comparable to concentrations measured at reference sites for the River Corridor Baseline Risk Assessment (WCH 2006a, 2006b). Negotiations during the Project Manager's dispute initiated February 10, 2012, addressed rewetted zones and river sediment waste sites. During these negotiations, the U.S. Department of Energy (DOE) agreed to specifically evaluate the 116-H-5 Outfall and related shoreline sites in the upcoming 100-D/100-H Remedial Investigation/Feasibility Study (WCH 2012d). This evaluation should include at a minimum discussions of river sediment backgrounds and specific applicability of modeling methods to soils in the periodically rewetted zone along the shoreline.

Verification sampling of the upland segment of the soil within the excavation was conducted on July 18, 2012. The results indicated that the waste removal action achieved compliance with the remedial action objectives (RAOs) for the 100-D-65 waste site. A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 100-D-65 waste site in accordance with the *Tri-Party Agreement Handbook Management Procedures*, TPA-MP-14 procedure (DOE-RL 2011).

In accordance with this evaluation, the verification sampling results support a reclassification of this site to Interim Closed Out with the understanding that the DOE has agreed to evaluate shoreline sites and river sediments in the upcoming 100-D/H Feasibility Study (WCH 2012d). For the upland portion of the site, the current site conditions achieve the RAOs and the corresponding RAGs established in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The results of verification sampling for the upland segment 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 for the upland segment also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The upland segment of the site does not have residual contaminant concentrations that would require any institutional controls.

Table ES-1. Summary of Remedial Action Goals for the Upland Segment of the 100-D-65 Waste Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years.	Dose rate from sum-of-fractions evaluation for the excavation using dose-equivalent lookup values is less than 15 mrem/yr. The maximum cumulative dose rate for the waste site is 0.858 mrem/yr.	Yes
Direct Exposure – Nonradionuclides	Attain individual COC/COPC RAGs.	All detected COCs/COPCs were quantified below the direct exposure RAGs.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of less than 1 for all individual noncarcinogens.	All individual hazard quotients are less than 1.	Yes
	Attain a cumulative hazard quotient of less than 1 for noncarcinogens.	The cumulative hazard quotient (1.6×10^{-3}) is less than 1.	
	Attain an excess cancer risk of less than 1×10^{-6} for individual carcinogens.	All individual carcinogens are less than 1×10^{-6} cancer risk.	
	Attain a cumulative excess cancer risk of less than 1×10^{-5} for carcinogens.	The excess cancer risk (5.8×10^{-8}) is less than 1×10^{-5} .	
Groundwater/River Protection – Radionuclides	Attain single COC/COPC groundwater and river protection RAGs.	Radionuclide COPCs were not quantified at activities above groundwater/river protection lookup values.	Yes
	Attain national primary drinking water standards ^a : 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.	Radionuclide COPCs were not quantified at activities above groundwater/river protection lookup values.	
	Meet drinking water standards for alpha emitters: the most stringent of 15 pCi/L MCL or 1/25th of the derived concentration guides from DOE Order 5400.5 ^b .	No alpha-emitting radionuclide COPCs were quantified above groundwater/river protection lookup values.	
	Meet total uranium standard of 30 µg/L (21.2 pCi/L) ^c .	Uranium was not quantified above background levels for this site.	
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	All detected COCs/COPCs were quantified below groundwater and river protection RAGs.	Yes

^a "National Primary Drinking Water Regulations" (40 Code of Federal Regulations 141).

^b *Radiation Protection of the Public and the 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).

COC = contaminant of concern

COPC = contaminant of potential concern

MCL = maximum contaminant level

RAG = remedial action goal

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-65 waste site contaminants of concern, contaminants of potential concern, and other constituents and is presented in Appendix A. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for manganese and vanadium. Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for boron and vanadium. Because the concentrations of manganese and vanadium are below the Hanford Site (DOE-RL 2001) background values, it is believed that the presence of these constituents does not pose risk to ecological receptors. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-65 SPILLWAY WASTE SITE

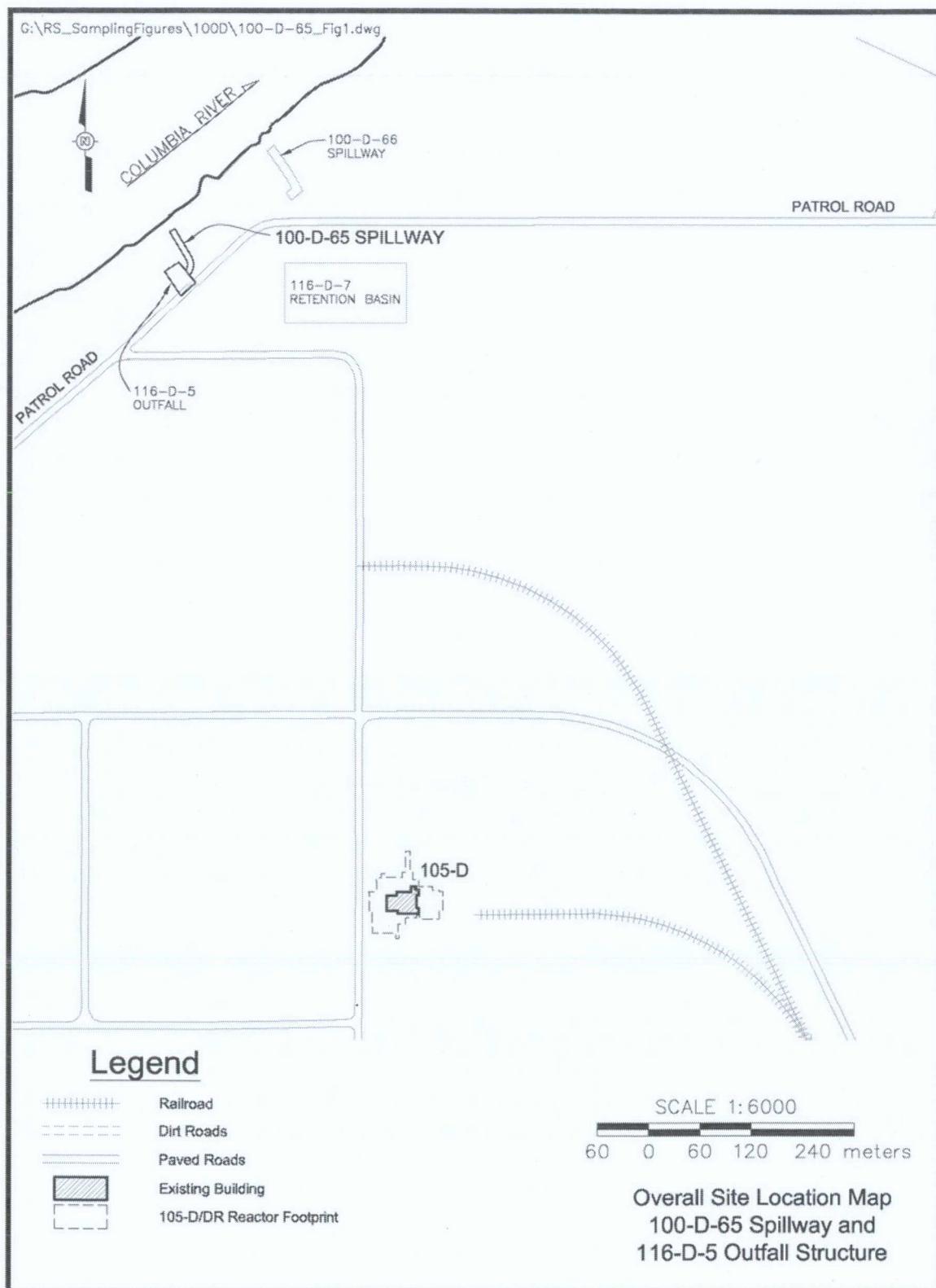
STATEMENT OF PROTECTIVENESS

This report demonstrates that the 100-D-65, 116-D-5 Outfall Spillway waste site meets the objectives for interim closure as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The results of verification 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 sufficiently protective of groundwater and the Columbia River. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-65 waste site contaminants of concern (COCs), contaminants of potential concern (COPCs), and other constituents and is presented in Appendix A. The U.S. Environmental Protection Agency (EPA) ecological soil screening levels were exceeded for manganese and vanadium. Ecological screening levels from *Washington Administrative Code* (WAC) 173-340 were exceeded for boron and vanadium. Because the concentrations of manganese and vanadium are below the Hanford Site (DOE-RL 2001) background values, it is believed that the presence of these constituents does not pose risk to ecological receptors. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

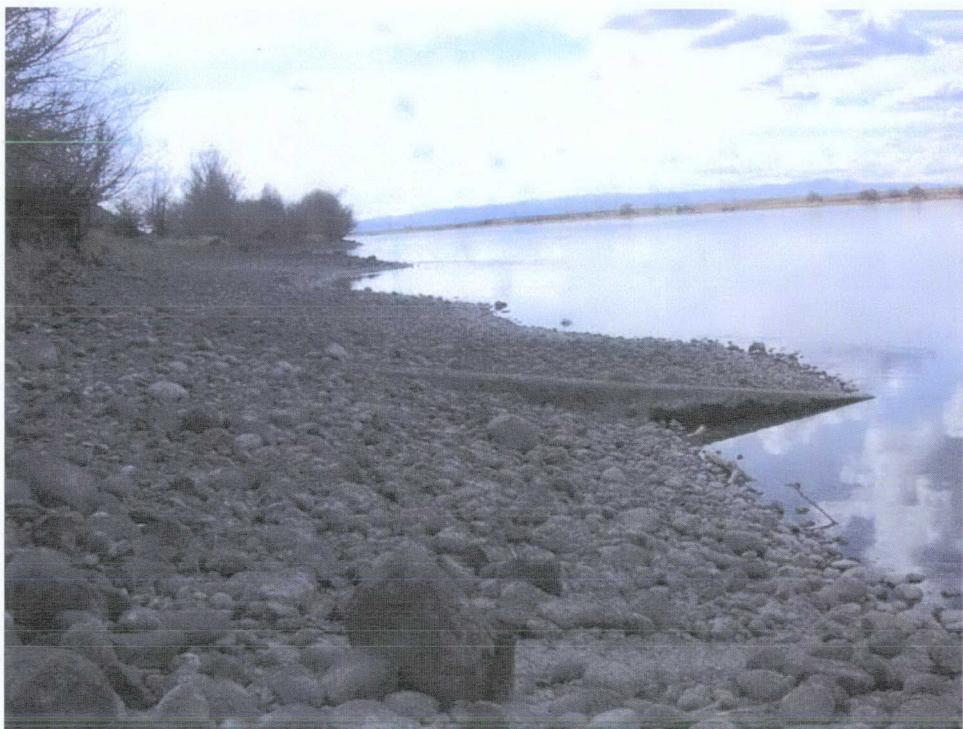
GENERAL SITE INFORMATION AND BACKGROUND

The 100-D-65, 116-D-5 Outfall Spillway waste site is located within the 100-DR-1 Operable Unit, on the shore of the Columbia River, approximately 115 m (377 ft) northwest of the former location of the 116-D-7 (107-D) retention basin and 145 m (476 ft) upstream of the 100-D-66 spillway (Figure 1).

Figure 1. 100-D-65 Waste Site Location Map.

The spillway was a 6.4-m (21-ft)-wide concrete structure that received overflow from the former 1904-D outfall (116-D-5 waste site) in the event that effluent could not be completely discharged via the outfall pipelines (100-D-60 waste site). The 1904-D outfall was used to discharge radioactive cooling water effluent from the 107-D and 107-DR retention basins (116-D-7 and 116-DR-9 waste sites). The sidewalls of the spillway tapered from 1.5 m (5 ft) tall at the outfall structure to 0.7 m (2 ft) tall at its discharge to a riprap erosion barrier at the river shoreline. A majority of the spillway structure was covered with soil in about 1978 when the outfall structure was partially demolished; the bottom portion of the spillway structure was still visible during low water conditions (Figure 2).

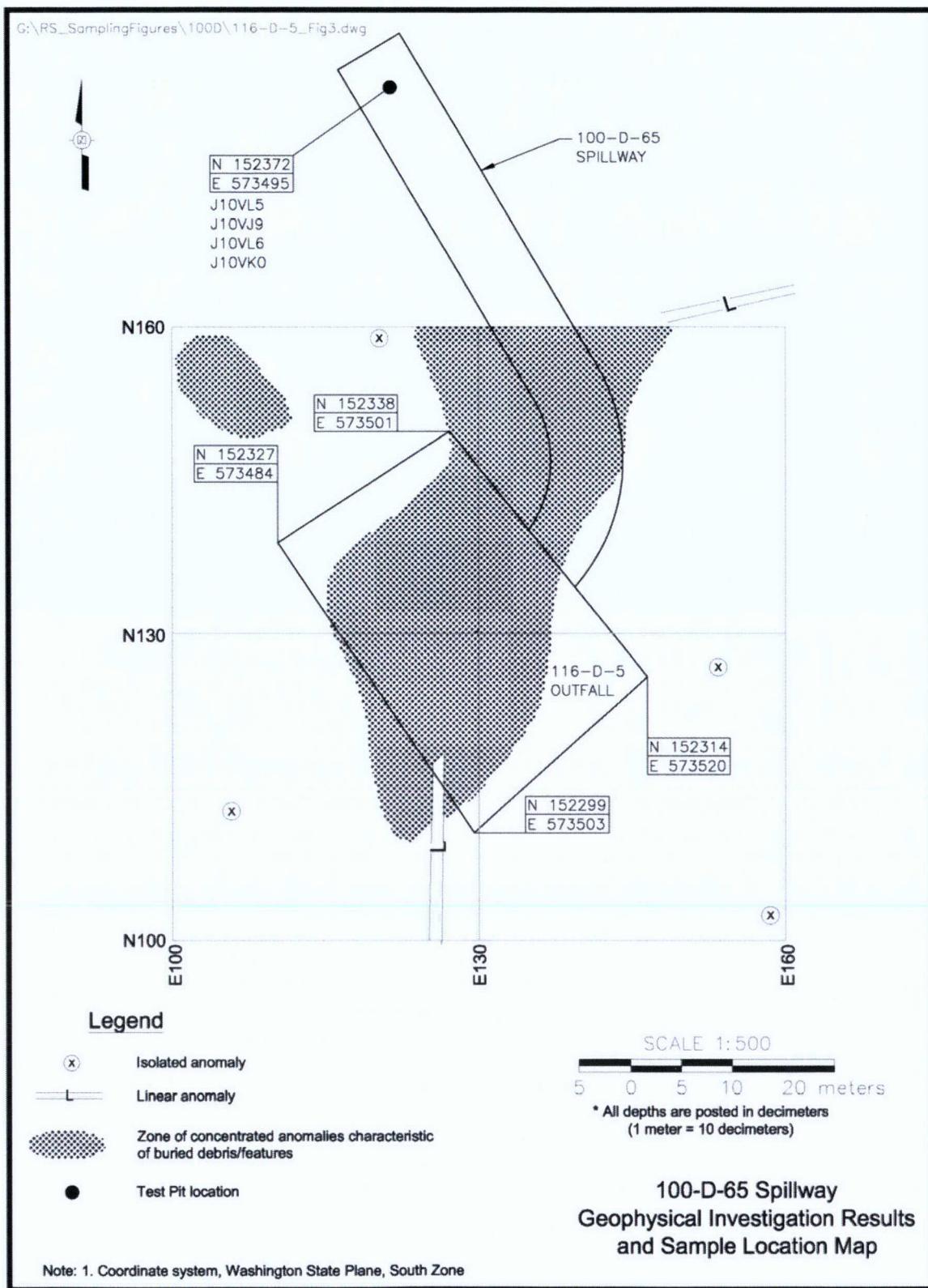
Figure 2. Pre-Remediation Photograph of the 100-D-65 Spillway Waste Site During Low River Water Conditions (2010).



Site Geophysical Survey Information

A geophysical survey was performed at the 100-D-65 waste site in May 2004 to locate and map subsurface features (Bergstrom and Mitchell 2004). Data collection was restricted by steep terrain in several areas; interpreted results for the area surveyed are shown in Figure 3. A large anomalous zone dominated the area surveyed and is most likely indicative of the demolished outfall structure and adjacent residual spillway. The survey also identified subsurface linear features in the southern and northeastern portions of the survey area. The southern linear anomaly correlates with the 100-D-31 underground pipeline that formerly discharged to the 116-D-5 outfall. The northeastern linear is believed to be related to the 0.23-m (9-in.) discharge line from the 100-D-1 storm drain.

Figure 3. Geophysical Survey Results and Confirmatory Sampling Location at the 100-D-65 Waste Site.



REMEDIAL ACTION SUMMARY

Because the spillway extended into the Columbia River, the ordinary high water mark (OHWM) was used to partition the remediation of the waste site into an upland segment, located above the OHWM, and a shoreline segment, located below the OHWM. The remedial design for the spillway structure was approved by the Washington State Department of Ecology (Ecology). Remediation of the spillway was performed consistent with protocols as specified in the 100 Area RDR/RAWP (DOE-RL 2009b). Figure 4 is a photograph of the site prior to remediation, and Figure 5 shows the site during remediation of the shoreline segment located below the OHWM.

**Figure 4. Photograph of the 100-D-65 Spillway Waste Site,
Taken Prior to Remediation (November 2010).**



Figure 5. Photograph of the 100-D-65 Spillway Waste Site, Taken During Remediation of the Shoreline Segment Located Below the OHWM (November 2011).



Remedial action of the upland portion of the 100-D-65 waste site was initiated on September 1, 2011, and was completed on September 15, 2011. Approximately 468 bulk cubic meters (BCM) of material was removed for disposal at the Environmental Restoration Disposal Facility (ERDF).

Remediation of the portion of the 100-D-65 waste site located below the OHWM was performed November 11 through November 13, 2011. This below-the-OHWM portion of the site was excavated and sampled separately. This excavation was performed in a manner to allow for backfill the same day as excavation to preclude fish stranding due to fluctuating Columbia River flow rates. Approximately 336 BCM from the shoreline area below the OHWM was removed for disposal at ERDF.

Material that was removed during the 100-D-65 spillway remediation from above and below the OHWM was staged with soils removed during remediation of the 100-D-66 spillway waste site. This material has been disposed at ERDF. The footprints of these waste staging areas were addressed as part of the verification sampling and site closeout of the 100-D-66 spillway waste site (WCH 2012c).

A post-excavation Global Positioning Environmental Radiological Surveyor (GPERS) survey of the excavation was conducted on September 27, 2011. A hand-held sodium iodide survey was performed on December 20, 2011, for a portion of the remediation that was not surveyed using GPERS. The results of these surveys are provided in Appendix B and do not indicate the presence of radiological contamination.

After excavation of the upland portion of the 100-D-65 waste site, in-process soil samples were collected from within the base of the excavation and used to evaluate the site to determine readiness for collection of verification soil samples. The results of this sampling are provided in Appendix C and indicated that the site was ready for verification sampling.

A post-excavation civil survey for the 100-D-65 waste site is provided in Figure 6. Figure 7 shows the location of the upland and shoreline portions of the remediated waste site and coordinates for the top portion of the concrete spillway remaining in the river.

VERIFICATION SAMPLING ACTIVITIES

Verification sampling of the upland segment of the 100-D-65 waste site excavation was performed on July 18, 2012. Verification sampling was performed to support a determination that residual contaminant concentrations at this site meet the cleanup criteria specified in the 100 Area RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The verification sample results are provided in Appendix D.

Verification sampling of the shoreline segment was performed on November 13, 2011. In addition to sediment samples, one sample of concrete below the river level remaining after remediation was collected. The results of this sampling are provided in Appendix E and will be considered as part of the final action evaluation for this waste site.

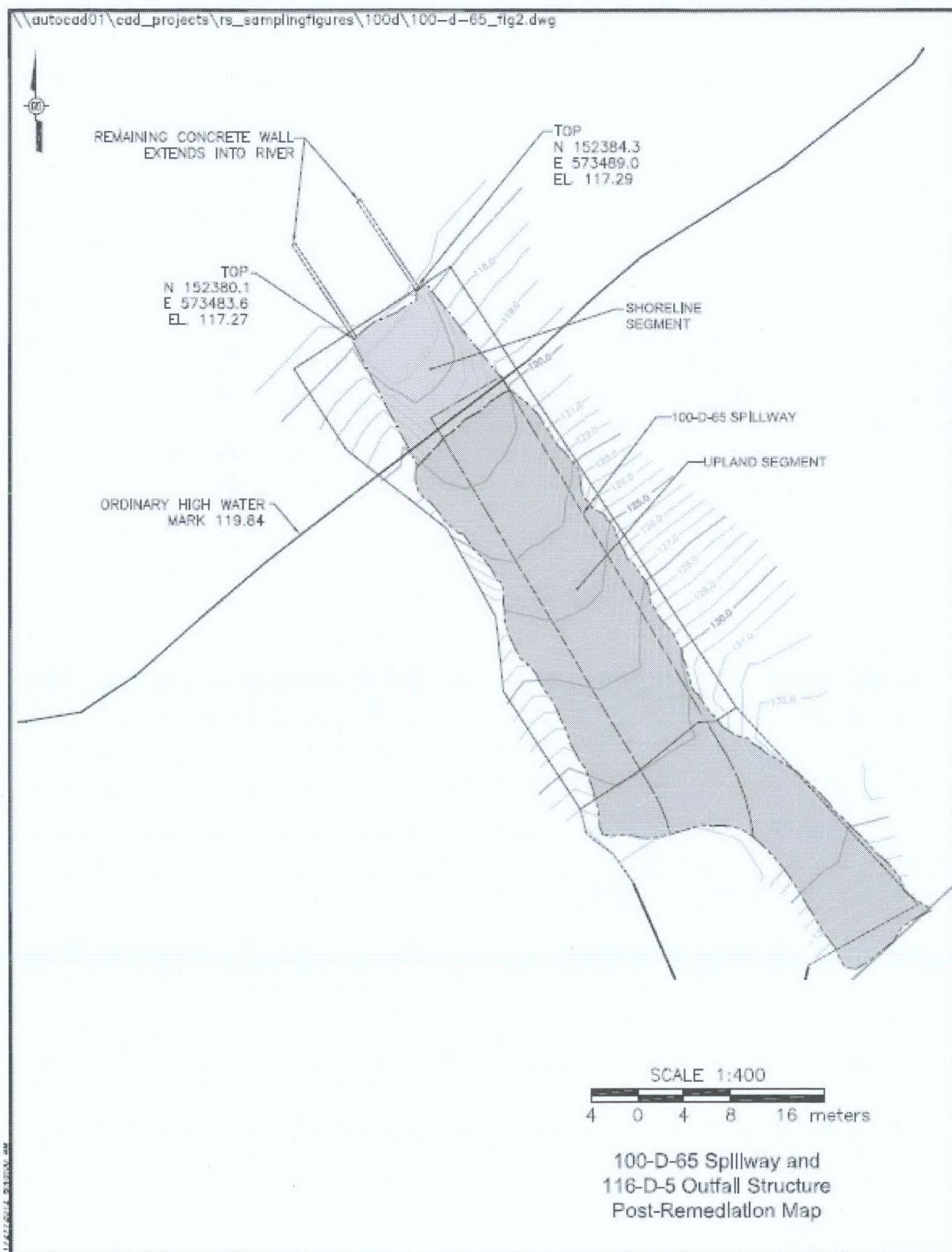
The following subsections provide additional discussion of the information used to develop the verification sampling design. A more detailed discussion of the verification sample design for the upland segment of the outfall can be found in the *Work Instruction for Verification Sampling of the Upland Portion of the 100-D-65, Spillway Waste Site* (WCH 2012b). Discussion of the verification sampling design for the shoreline segment is provided in the *Work Instruction for Verification Sampling of the 100-D-65 Spillway Waste Site Below the Ordinary High Water Mark* (WCH 2011b).

Contaminants of Concern and Contaminants of Potential Concern

The COPCs for verification sampling after removal of the 100-D-65 spillway were selected based upon a review of the results of the January 2005 confirmatory sampling event and process history for upstream waste sites. Cesium-137, cobalt-60, europium-152, nickel-63, and strontium-90 were detected at concentrations that cumulatively exceeded direct exposure RAGs during confirmatory sampling and were retained as COPCs.

Figure 6. Post-Excavation Civil Survey Drawing for the Upland Portion of the 100-D-65 Waste Site.

NOTES																					
<p>1. REFL SURVEY PERFORMED JANUARY 8, 2012, FIELD DATA COLLECTED IN SPREAD SHEET FILE. REF-BIDS IN MID-APRIL, 2012.</p> <p>2. COORDINATES ARE REFERENCED TO WAD 83/91, WASHINGTON SOUTH ZONE, UNLESS OTHERWISE SPECIFIED.</p> <p>3. CONTOUR INTERVAL 0.5 FEET OR METERS, DRAWN ON WEST COASTAL TRANSFORMER (44°41'45", ELEVATION 542.25).</p> <p>4. ALL UNITS ARE IN METERS.</p> <p>5. SEE DRAWING 81020-10-02010 FOR GENERAL MILEMARKS AND SYMBOLS LIST.</p> <p>7. SEE DRAWING 81020-10-02010 FOR DRAINING INDEX.</p>																					
<p>DEPICTION</p> <p>DRAWING 01000-00-00012 TWO QDR AREA FYD2 RESIDUAL ACTIVATION CIVL PLT PLAN - 1:1000-D-65.</p>																					
<p>SURVEYOR'S STATEMENT</p> <p>LAWN A. IRVING, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF WASHINGTON REG# 211364, HEREBY STATE THAT THE MAP CORRECTLY REPRESENTS A STRUCTURE-CONTROLLED LINE OF 1000' LENGTH IN SECTION 201 AT THE PERTINENT OF TERMINATION. RECORDED 2012-01-08 BY THE HIRING CONTRACTOR.</p>																					
<p>DATE _____</p> <p>STATE: _____</p> <p>SECTION: _____</p>																					
<p> SITE - VOLUME TABLE</p> <table border="1"> <thead> <tr> <th> SITE</th> <th>CUT</th> <th>FILL</th> <th>NET</th> <th>NET-HO</th> </tr> </thead> <tbody> <tr> <td>100-D-65</td> <td>716</td> <td>2</td> <td>714</td> <td>50</td> </tr> <tr> <td>POTENTIAL AREA</td> <td>26</td> <td>0</td> <td>26</td> <td>12.5</td> </tr> <tr> <td>TOTAL</td> <td>802</td> <td>2</td> <td>804</td> <td>62</td> </tr> </tbody> </table> <p>SEE NARRATIVE FOR UNACCUMULATED VOLUME TOTALS.</p>		SITE	CUT	FILL	NET	NET-HO	100-D-65	716	2	714	50	POTENTIAL AREA	26	0	26	12.5	TOTAL	802	2	804	62
SITE	CUT	FILL	NET	NET-HO																	
100-D-65	716	2	714	50																	
POTENTIAL AREA	26	0	26	12.5																	
TOTAL	802	2	804	62																	
<p>VALUE SURVEY DATA</p> <p>EXCAVATED AREA CUT/NET VOLUME (VOLUME IN CUBIC METERS)</p> <p>EXCAVATED AREA FILL VOLUME (VOLUME IN CUBIC METERS)</p> <p>GENERAL COMMENTS NOTED ON THE AREA NOT EXCAVATED YET</p>																					
<p> U.S. DEPARTMENT OF ENERGY USE: WILDLAND OPERATIONS OFFICE WILDERNESS CONSIDERATION CONTRACT</p> <p>100-D-65 WASHINGTON (LOSSES) HARFORD LLC, Seattle, Washington</p> <p>100 QDR AREA FYD2 RESIDUAL ACTIVATION CIVL SURVEY - 1:1000-D-65</p> <p>VOL SURVEY USE: USE: USE: USE: USE:</p> <p>Ref ID: 81020-10-02010-14555 100000121000000</p> <table border="1"> <thead> <tr> <th>DATE</th> <th>TYPE</th> <th>DESCRIPTION</th> <th>AMOUNT</th> <th>UNIT</th> <th>REF ID</th> </tr> </thead> <tbody> <tr> <td>14555</td> <td>14555</td> <td>14555</td> <td>10000</td> <td>00000-00-00772</td> <td>0</td> </tr> </tbody> </table>		DATE	TYPE	DESCRIPTION	AMOUNT	UNIT	REF ID	14555	14555	14555	10000	00000-00-00772	0								
DATE	TYPE	DESCRIPTION	AMOUNT	UNIT	REF ID																
14555	14555	14555	10000	00000-00-00772	0																
<p>Remaining Sites Verification Package for the 100-D-65 Spillway Waste Site</p> <p>Page 8</p>																					

Figure 7. Post-Excavation Map for the 100-D-65 Spillway

Techneium-99, americium-241, europium-154, europium-155, plutonium isotopes, and polychlorinated biphenyls (PCBs) were not detected by confirmatory sampling; however, americium-241, plutonium-238, and PCBs were retained as COPCs based on process history of upstream waste sites.

Uranium isotopes, total uranium, total chromium, and mercury were not detected above background levels in confirmatory samples; however, uranium-233/234, uranium-235, uranium-238, total chromium, and mercury were also retained as COPCs based on process history of upstream waste sites. While hexavalent chromium was not detected in confirmatory samples, radionuclide results indicated that the 100-D-65 spillway was historically used to discharge cooling water effluent; therefore, hexavalent chromium was retained as a COPC for verification sampling. Radionuclide-specific analysis was not performed for carbon-14 during confirmatory sampling, and therefore it was retained as a COPC. Antimony, arsenic, cadmium, copper, lead, and zinc were detected in confirmatory samples at concentrations exceeding cleanup criteria and were therefore retained as COPCs. Although not considered COPCs, barium, beryllium, boron, cobalt, manganese, molybdenum, nickel, selenium, silver, and vanadium were evaluated by performing analyses for the constituents of the expanded inductively coupled plasma (ICP) metals list. Polycyclic aromatic hydrocarbons, semivolatile organic compounds, anions, and pesticides were also included as COPCs based on process history of upstream waste sites. Volatile organic compounds were not detected in the field during confirmatory sampling or during remediation and were therefore not included as COPCs. Stained or oily soils were not observed during confirmatory sampling or during remediation, and therefore total petroleum hydrocarbons were not included as COPCs.

A summary of all the contaminants analyzed is provided in Table 1.

Table 1. 100-D-65 Laboratory Analytical Methods and COPCs. (2 Pages)

Analytical Method	Contaminants of Potential Concern
ICP metals ^a – EPA Method 6010	Antimony, arsenic, cadmium, total chromium, copper, lead, zinc
Mercury – EPA Method 7471	Mercury
Hexavalent chromium – EPA Method 7196	Hexavalent chromium
IC anions – EPA Method 300.0	Inorganic anions
NO ₂ /NO ₃ ^b – EPA Method 353	Nitrate/nitrite
PCB – EPA Method 8082	Polychlorinated biphenyls
PAH ^c – EPA Method 8310	Polycyclic aromatic hydrocarbons
Pesticides – EPA Method 8081	Pesticides
SVOA – EPA Method 8270	Semivolatile organic compounds
GEA – Gamma spectroscopy	Americium-241, cobalt-60, cesium-137, europium-152, europium-154, europium-155
Sr-90 – Liquid scintillation counting	Strontium-90
Ni-63 – Liquid scintillation counting	Nickel-63
C-14 – Liquid scintillation counting	Carbon-14
Isotopic plutonium	Plutonium-238, plutonium-239/240

Table 1. 100-D-65 Laboratory Analytical Methods and COPCs. (2 Pages)

Analytical Method	Contaminants of Potential Concern
Isotopic uranium	Uranium-233/234, uranium-235, uranium-238

^a Analysis for the expanded list of ICP metals was performed to include barium, beryllium, boron, cobalt, manganese, molybdenum, nickel, selenium, silver, and vanadium.

^b To preclude holding time issues associated with EPA Method 300.0 for nitrites and nitrates, EPA Method 353 was performed.

^c Because method 8310 is specifically meant to analyze for PAH, data from this method were used preferentially over method 8270 data for site evaluation of the PAH analytes.

EPA = U.S. Environmental Protection Agency

PAH = polycyclic aromatic hydrocarbons

GEA = gamma energy analysis

PCB = polychlorinated biphenyl

IC = ion chromatography

SVOA = semivolatile organic analysis

ICP = inductively coupled plasma

Verification Sample Design

Two separate sample designs were developed for the 100-D-65 waste site: one for the upland segment (WCH 2012b) and another for the shoreline segment (WCH 2011b). A statistical sampling design was used for each of these segments, with 12 soil samples collected from within each of the 2 excavation footprint areas. In addition, a sample of the concrete spillway remaining in the shoreline segment exposed at the river was collected for information. All sampling was performed 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). Additional information related to sampling can be found in the field sampling logbooks (WCH 2011a, 2012a).

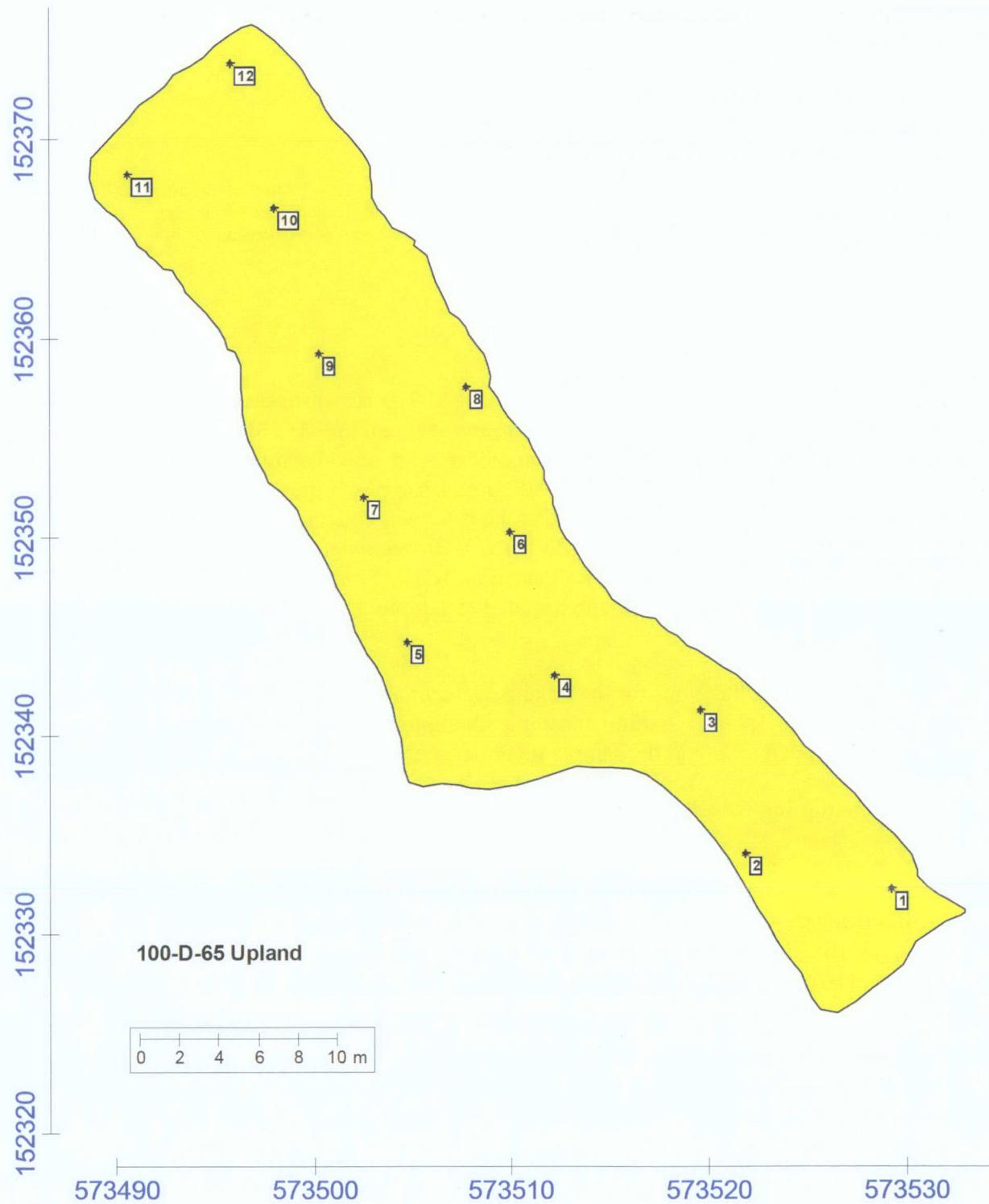
The verification sample locations for the upland segment are shown in Figure 8 and the sample locations are listed in Table 2. Sediment sample locations for the shoreline segment are shown in Figure 9 and Appendix E and the sample locations are listed in Table 3.

Verification Sampling Results

Verification samples were analyzed using EPA-approved analytical methods. The laboratory-reported verification data results for all constituents are stored in the Environmental Restoration (ENRE) project-specific database prior to archival in the Hanford Environmental Information System (HEIS) and are presented as Attachment 1 of the 95% upper confidence limit (UCL) calculation (Appendix D). The analytical results for the shoreline segment are provided in Appendix E.

The 95% UCLs on the true population means for residual concentrations of COCs and COPCs were calculated for the excavation as specified by the 100 Area RDR/RAWP (DOE-RL 2009b), with calculations provided in Appendix D. When a nonradionuclide COC or COPC was detected in fewer than 50% of the verification samples collected for the area, the maximum detected value was used for comparison to RAGs. If no detections for a given COC/COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COC/COPC.

Figure 8. Location of Verification Samples for the Upland Segment of the 100-D-65 Spillway Waste Site.



**Table 2. 100-D-65 Verification Sample Summary Table
(Upland Segment).**

Sample Location	HEIS Sample Number	Sample Date	Washington State Plane Coordinates		Sample Analysis
			Easting	Northing	
1	J1PVL2	7/18/12	573529.2	152332.4	ICP metals ^a , mercury, hexavalent chromium, GEA, strontium-90, isotopic plutonium, isotopic uranium, nickel-63, carbon-14, PCB, pesticides, IC anions, nitrate/nitrite, PAH, and SVOA
2	J1PVL3	7/18/12	573521.8	152334.1	
3	J1PVL4	7/18/12	573519.5	152341.3	
4	J1PVL5	7/18/12	573512.1	152343.0	
5	J1PVL6	7/18/12	573504.7	152344.7	
6	J1PVL7	7/18/12	573509.9	152350.3	
7	J1PVL8	7/18/12	573502.5	152352.0	
8	J1PVL9	7/18/12	573507.7	152357.6	
9	J1PVM0	7/18/12	573500.3	152359.3	
10	J1PVM1	7/18/12	573498.0	152366.5	
11	J1PVM2	7/18/12	573490.6	152368.3	
12	J1PVM3	7/18/12	573495.8	152373.8	
Duplicate of J1PVL2	J1PVM4	7/18/12	573529.2	152332.4	
Equipment blank	J1PVM5	7/18/12	NA	NA	ICP metals ^a , mercury, SVOA

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

GEA = gamma energy analysis

HEIS = Hanford Environmental Information System

IC = ion chromatography

ICP = inductively coupled plasma

NA = not applicable

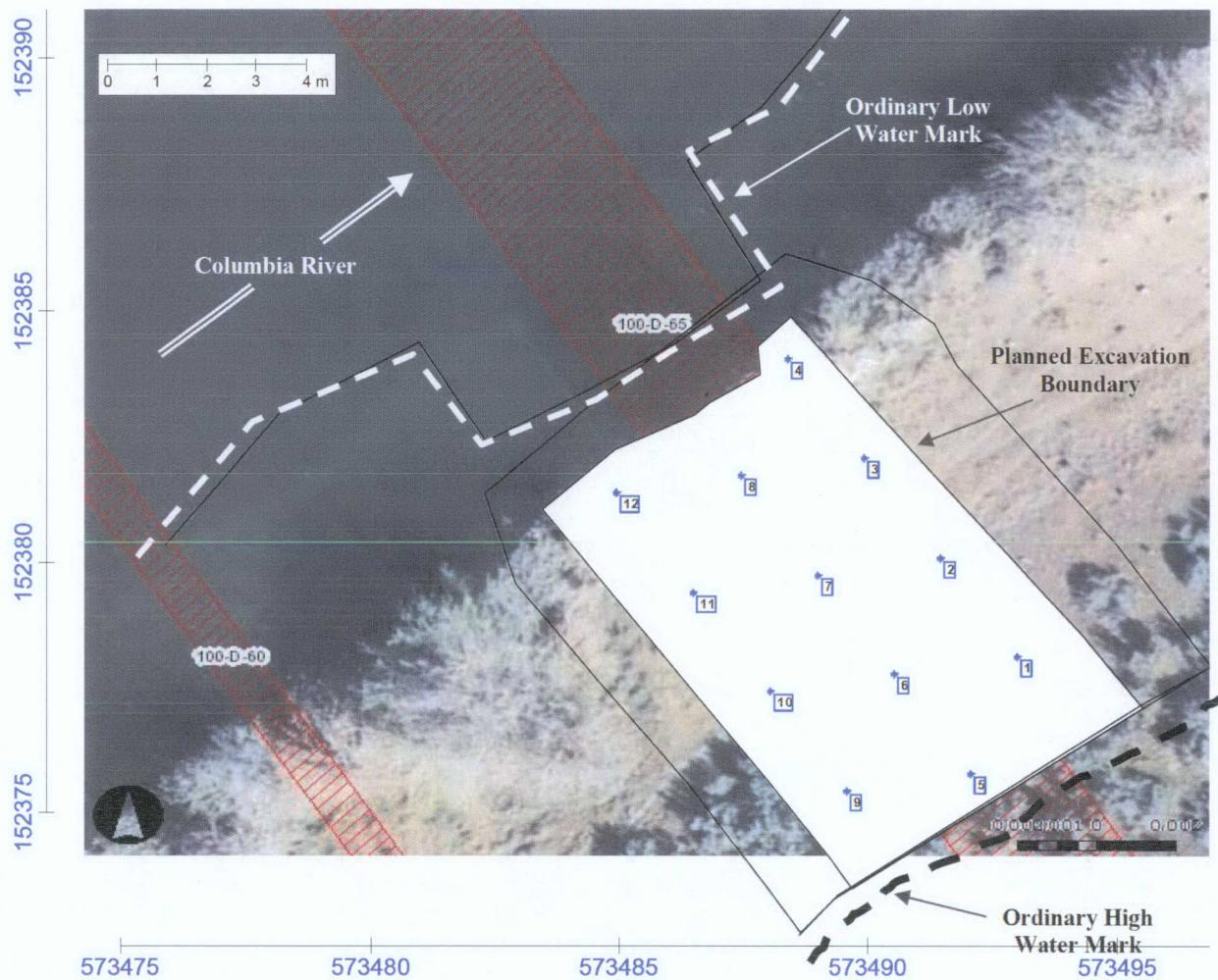
PAH = polycyclic aromatic hydrocarbons

PCB = polychlorinated biphenyl

SVOA = semivolatile organic analysis

TBD = to be determined

Figure 9. Location of Sediment Samples for Shoreline Segment of the 100-D-65 Waste Site – Below the Ordinary High Water Mark.



**Table 3. 100-D-65 Verification Sample Summary Table
(Shoreline Segment). (2 Pages)**

Sample Location	HEIS Sample Number	Sample Date	Washington State Plane Coordinates		Sample Analysis
			Easting	Northing	
1	J1M6T3	11/13/11	573493.0	152378.1	ICP metals ^a , mercury, hexavalent chromium, IC anions, nitrite/nitrate ^b , PAHs, PCBs, SVOAs, pesticides, GEA, carbon-14, nickel-63, strontium-90, isotopic plutonium, isotopic uranium
2	J1M6T4	11/13/11	573491.5	152380.1	
3	J1M6T5	11/13/11	573489.9	152382.1	
4	J1M6T6	11/13/11	573488.4	152384.1	
5	J1M6T7	11/13/11	573492.1	152375.8	
6	J1M6T8	11/13/11	573490.5	152377.8	
7	J1M6T9	11/13/11	573489.0	152379.8	
8	J1M6V0	11/13/11	573487.4	152381.8	
9	J1M6V1	11/13/11	573489.6	152375.5	
10	J1M6V2	11/13/11	573488.0	152377.4	

**Table 3. 100-D-65 Verification Sample Summary Table
(Shoreline Segment). (2 Pages)**

Sample Location	HEIS Sample Number	Sample Date	Washington State Plane Coordinates		Sample Analysis
			Easting	Northing	
11	J1M6V3	11/13/11	573486.5	152379.4	ICP metals ^a , mercury, hexavalent chromium, IC anions, nitrite/nitrate ^b , PAHs, PCBs, SVOAs, pesticides, GEA, carbon-14, nickel-63, strontium-90, isotopic plutonium, isotopic uranium
12	J1M6V4	11/13/11	573485.0	152381.4	
Duplicate (J1M6T7)	J1M6V5	11/13/11	573492.1	152375.8	
Concrete	J1MM46	11/16/11	573483.6	152381.0	
Equipment Blank	J1M6V7	11/13/11	NA	NA	ICP metals ^a , mercury, SVOA

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

GEA = gamma energy analysis

HEIS = Hanford Environmental Information System

IC = ion chromatography

ICP = inductively coupled plasma

NA = not applicable

PAH = polycyclic aromatic hydrocarbons

PCB = polychlorinated biphenyl

SVOA = semivolatile organic analysis

TBD = to be determined

Comparisons of the statistical and maximum results for the COPCs against the site RAGs for the upland segment of the excavation are summarized in Table 4. Contaminants that were not detected by laboratory analysis are excluded from these tables but are reported in Appendix D. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations database (Ecology 2011) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (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 not included in these tables. The laboratory-reported data results for all constituents are stored in the ENRE project-specific database prior to provision to HEIS and are presented as an attachment to the statistical calculations in Appendix D.

Evaluation of the verification sampling results in Table 4 shows that all direct exposure, groundwater protection, and Columbia River protection cleanup levels are met for all areas of the upland segment of the 100-D-65 waste site.

Table 4. Comparison of the Maximum or Statistical Contaminant Concentrations to Action Levels for the 100-D-65 Verification Samples. (2 Pages)

COPC	Statistical Result ^b (pCi/g)	Soil Lookup Values (pCi/g) ^a			Does the Result Exceed Lookup Values?	Do the Results Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Soil Lookup Value for Groundwater Protection	Soil Lookup Value for River Protection		
Cesium-137	0.101 (<BG)	6.2	1,465	2,930	No	--
Europium-152	0.135	3.3	-- ^c	--	No	--
Uranium-234	0.660 (<BG)	1.1 ^d	1.1 ^d	1.1 ^d	No	--
Uranium-238	0.751 (<BG)	1.1 ^d	1.1 ^d	1.1 ^d	No	--
COPC	Statistical or Maximum Result (mg/kg) ^b	Soil Cleanup Levels (mg/kg) ^a			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Protective of Groundwater	Protective of the River		
Arsenic	2.65 (<BG)	20 ^d	20 ^d	20 ^d	No	--
Barium	66.8 (<BG)	5,600	200	400	No	--
Beryllium	0.287 (<BG)	10.4 ^e	1.51 ^d	1.51 ^d	No	--
Boron ^f	1.48	7,200	320	--	No	--
Cadmium	0.113 (<BG)	13.9 ^e	0.81 ^d	0.81 ^d	No	--
Chromium, total	10.9 (<BG)	80,000	18.5 ^d	18.5 ^d	No	--
Cobalt	6.61 (<BG)	24	15.7 ^d	--	No	--
Copper	13.7 (<BG)	2,960	59.2	22.0 ^d	No	--
Lead	3.82 (<BG)	353	10.2 ^d	10.2 ^d	No	--
Manganese	276 (<BG)	3,760	512 ^d	512 ^d	No	--
Mercury	0.0235 (<BG)	24	0.33 ^d	0.33 ^d	No	--
Molybdenum ^f	0.539	400	8	--	No	--
Nickel	10.7 (<BG)	1,600	19.1 ^d	27.4	No	--
Vanadium	51.5 (<BG)	560	85.1 ^d	--	No	--
Zinc	44.3 (<BG)	24,000	480	67.8 ^d	No	--
Chloride	7.1 (<BG)	--	25,000	--	No	--
Nitrogen in nitrate	3.6	128,000	1,000	2,000	No	--
Nitrogen in nitrite	0.3	8,000	100	200	No	--
Nitrogen in nitrite and nitrate	3.68	8,000	100	200	No	--
Sulfate	18.9 (<BG)	--	25,000	--	No	--
Acenaphthene	0.00801	4,800	96	129	No	--
Acenaphthylene ^f	0.00266	4,800	96	129	No	--
Benzo(a)anthracene	0.00350	1.37	0.015 ^g	0.015 ^g	No	--
Benzo(a)pyrene	0.00586	0.137	0.015 ^g	0.015 ^g	No	--
Benzo(b)fluoranthene	0.00514	1.37	0.015 ^g	0.015 ^g	No	--
Benzo(g,h,i)perylene ^f	0.00329	1.37	0.015 ^g	0.015 ^g	No	--
Benzo(k)fluoranthene	0.00301	1.37	0.015 ^g	0.015 ^g	No	--
Chrysene	0.00768	13.7	0.12	0.1 ^g	No	--
Fluorene	0.0020	3,200	64	260	No	--
Fluoranthene	0.00957	3,200	64	18.0	No	--
Indeno(1,2,3-cd) pyrene	0.00823	1.37	0.33 ^g	0.33 ^g	No	--
Naphthalene	0.00516	1,600	16.0	988	No	--
Phenanthrene ^f	0.00541	24,000	240	1,920	No	--

Table 4. Comparison of the Maximum or Statistical Contaminant Concentrations to Action Levels for the 100-D-65 Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result (mg/kg) ^b	Soil Cleanup Levels (mg/kg) ^a			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling
		Direct Exposure	Protective of Groundwater	Protective of the River		
Pyrene	0.00487	2,400	48	192	No	--

^a Lookup values and RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted. Radionuclide soil activities protective of groundwater and the river were calculated using RESRAD Version 6.4 assuming that no uncontaminated vadose zone exists between the contaminated zone and groundwater.

^b The statistical or maximum values for each COPC is determined in the 95% UCL calculation, which is located in Appendix D.

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

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

^e Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996) using an airborne particulate mass-loading rate of 0.0001 g/m³ (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

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

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

-- = not applicable

RDL = required detection limit

BG = background

RDR/RAWP = Remedial Design Report/Remedial Action Work Plan for the 100 Area

COPC = contaminant of potential concern

RESRAD = RESidual RADioactivity (dose assessment model)

EPA = U.S. Environmental Protection Agency

UCL = upper confidence limit

RAG = remedial action goal

WAC = Washington Administrative Code

Table 5 provides a comparison of the maximum sample results (Appendix E) for sediment samples collected from the shoreline segment against upland soil RAGs. This comparison is provided for information, but is not presented for making cleanup decisions concerning the shoreline, located below the OHWM. The sediment sample results collected within the remediated shoreline segment exceed upland soil RAGs for chromium (total), copper, lead, manganese, nickel, and zinc. However, no further remediation of the-below-OHWM portion of the 100-D-65 waste site using the remove, treat, and dispose (RTD) remedy is recommended because interim action soil RAGs are not appropriately applied to sediments collected below the OHWM and the Remaining Sites ROD (EPA 1999) does not provide in-water cleanup levels for sediment. The sediment analytical results exceeding upland soil RAGs are for metals concentrations that are comparable to concentrations measured at reference sites for the River Corridor Baseline Risk Assessment (WCH 2006a, 2006b).

Table 5. Comparison of the Maximum Contaminant Concentrations to Action Levels for the 100-D-65 Waste Site Shoreline Segment Verification Sediment Samples. (2 Pages)

COPC	Maximum Result (pCi/g)	Soil Lookup Values (pCi/g) ^a			Does the Result Exceed Lookup Values?
		Shallow Zone Lookup Value	Soil Lookup Value for Groundwater Protection	Soil Lookup Value for River Protection	
Cesium-137	0.0444	6.2	1,465	2,930	No
Uranium-234	0.523 (<BG)	1.1 ^b	1.1 ^b	1.1 ^b	No
Uranium-238	0.445 (<BG)	1.1 ^b	1.1 ^b	1.1 ^b	No

Table 5. Comparison of the Maximum Contaminant Concentrations to Action Levels for the 100-D-65 Waste Site Shoreline Segment Verification Sediment Samples. (2 Pages)

COPC	Maximum Result (mg/kg)	Soil Cleanup Levels (mg/kg) ^a			Does the Result Exceed RAGs?
		Direct Exposure	Protective of Groundwater	Protective of the River	
Antimony ^c	1.2 (<BG)	32	5 ^b	5 ^b	No
Arsenic	11.7	20 ^b	20 ^b	20 ^b	No
Barium	163 (<BG)	5,600	200	400	No
Beryllium	1.2 (<BG)	10.4 ^d	1.51 ^b	1.51 ^b	No
Boron	3.6	7,200	320	--	No
Cadmium ^c	0.58 (<BG)	13.9 ^d	0.81 ^b	0.81 ^b	No
Chromium, total	44.2	80,000	18.5 ^b	18.5 ^b	Yes ⁱ
Hexavalent chromium ^e	0.953	2.1 ^d	4.8	2	No
Cobalt	10.9 (<BG)	24	15.7 ^b	-- ^f	No
Copper	30.2	2,960	59.2	22.0 ^b	Yes ⁱ
Lead	11	353	10.2 ^b	10.2 ^b	Yes ⁱ
Manganese	639	3,760	512 ^b	512 ^b	Yes ⁱ
Mercury	0.011	24	0.33 ^b	0.33 ^b	No
Molybdenum ^e	0.8	400	8	-- ^f	No
Nickel	21.9	1,600	19.1 ^b	27.4	Yes ⁱ
Vanadium	64.3 (<BG)	560	85.1 ^b	-- ^f	No
Zinc	96.1	24,000	480	67.8 ^b	Yes ⁱ
Acenaphthene	0.230	4,800	96	129	No
Benzo(a)anthracene	0.0059	1.37	0.015 ^g	0.015 ^g	No
Benzo(a)pyrene	0.0095	0.137	0.015 ^g	0.015 ^g	No
Benzo(b)fluoranthene	0.0091	1.37	0.015 ^g	0.015 ^g	No
Benzo(k)fluoranthene	0.0089	1.37	0.015 ^g	0.015 ^g	No
Chrysene	0.009	13.7	0.12	0.1 ^g	No
Fluorene	0.0085	3,200	64	260	No
Dimethylphthalate	0.360	80,000	1,600	14,400	No
4,4'-DDE	0.00033	2.94	0.0257	0.0033 ^g	No

^a Lookup values and RAGs obtained from the 100 Area RDR/RAWP (DOE-RL 2009b) unless otherwise noted. Radionuclide soil activities protective of groundwater and the river were calculated using RESRAD Version 6.4 assuming that no uncontaminated vadose zone exists between the contaminated zone and groundwater.

^b Where cleanup levels are less than background, cleanup levels default to background 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 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).

^d Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996) using an airborne particulate mass-loading rate of 0.0001 g/m³ (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

^e No Hanford Site-specific or Washington State background value is available.

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

^g Where cleanup levels are less than RDLS, cleanup levels default to RDLS (DOE-RL 2009b) per WAC 173-340-707(2) (Ecology 1996).

ⁱ The result exceeds RAGs for upland soil and will be considered as part of future decisions for the Columbia River shoreline.

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

CLEANUP VERIFICATION DATA EVALUATION

This section demonstrates that remedial action at the 100-D-65 waste site has achieved the applicable RAGs developed to support unrestricted land use at the 100-D Area as documented in the 100 Area RDR/RAWP (DOE-RL 2009b).

Three-Part Test for Nonradionuclides

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. The WAC 173-340 three-part test consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection can exceed two times the cleanup criteria, and (3) the percentage of samples exceeding the cleanup criteria must be less than 10% of the data set. The application of the three-part test for the 100-D-65 waste site is included in the statistical calculations (Appendix D). For the statistical data sets, no COPCs fail the "Model Toxics Control Act – Cleanup" three-part test (WAC 173-340, 1996). An additional application of the three-part test is included for the statistical data sets, which default to the maximum because less than half of the data set was detected. The results of this evaluation also indicate that all residual COPC concentrations pass the three-part test.

Direct Contact Noncarcinogenic Hazard Quotient Remedial Action Goal

Assessment of the risk requirements for the upland portion of the 100-D-65 waste site was determined by calculation of the hazard quotient and excess carcinogenic risk. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6} , and a cumulative excess carcinogenic risk of less than 1×10^{-5} . Hazard quotient and excess carcinogenic risk calculations for direct contact were conservatively performed for the 100-D-65 waste site using the highest of the statistical values from all areas. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients are below 1.0, and all individual excess carcinogenic risk values are below 1×10^{-6} . The direct contact cumulative hazard quotient for the 100-D-65 waste site is 1.6×10^{-3} , and the cumulative excess carcinogenic risk value is 5.8×10^{-8} , satisfying the criteria of less than 1.0 and less than 1×10^{-5} , respectively. Therefore, the nonradionuclide risk requirements are met.

Hazard Quotient and Carcinogenic Risk Calculation for Groundwater

Assessment of the risk requirements for the upland portion of the 100-D-65 waste site included calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides. The requirements include an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than 1×10^{-6} , and a cumulative excess carcinogenic risk of less than 1×10^{-5} . These risk values were conservatively calculated for the entire waste site using the highest value for each COPC from each of the decision units. Risk values were calculated for constituents that were detected at concentrations above Hanford Site or Washington State background values or for which there is no

background value. In addition, the distribution coefficients for these contaminants are less than that necessary to show no migration to groundwater in 1,000 years based on RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100 Area RDR/RAWP (DOE-RL 2009b). The cumulative hazard quotient is 7.5×10^{-2} , which is less than 1.0. No carcinogenic constituents required evaluation for groundwater protection. Therefore, nonradionuclide risk requirements related to groundwater are met.

Attainment of Radionuclide Direct Exposure RAGs

Evaluation of the radionuclide cleanup verification results (Table 3) indicates that all samples were below lookup values. Evaluation of direct exposure RAG attainment for radionuclides was performed using the single-radionuclide dose-equivalence lookup values to do sum of fractions evaluations. The model used to develop these dose-equivalence lookup values is presented in the 100 Area RDR/RAWP (DOE-RL 2009b).

Table 5 compares the radionuclide cleanup verification results above background from the verification samples to direct exposure single radionuclide 15 mrem/yr dose-equivalence values and shows the sum-of-fractions evaluation for comparison of the total radionuclide dose to the RAG of 15 mrem/yr above background. The columns on the left side of the table are the COPCs and the radionuclide activities for the samples, with uranium values corrected for background, as appropriate. The third column presents the single radionuclide 15 mrem/yr dose-equivalence activities, and the last column presents the radionuclide activities divided by the dose-equivalence activities. As demonstrated by the summation of the fractions, the maximum cumulative dose values contributed by the residual radionuclide populations is predicted to be less than the RAG of 15 mrem/yr above background.

Table 5. Attainment of Radionuclide Direct Exposure Remedial Action Goals.

COC/COPC	95% UCL Statistical Values (pCi/g)	Activity Equivalent to 15 mrem/yr Dose ^a (pCi/g)	Fraction
Cesium-137	0.101 (<BG)	6.2	0.0163
Europium-152	0.135	3.3	0.0409
Uranium-233/234	0 (<BG) ^b	0.58	0
Uranium-238	0 (<BG) ^b	0.61	0
		Total	0.0572
		Equivalent Dose (mrem/yr)	0.858

^a Single radionuclide 15 mrem/yr dose-equivalence values and derivation methodology are presented in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b).

^b Background values have been subtracted from the 95% UCL statistical value resulting in no contribution to the sum of fractions for evaluation of dose.

-- = not applicable

COPC = contaminant of potential concern

BG = background

SPA = staging pile area

COC = contaminant of concern

UCL = upper confidence limit

Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the site but are not considered in the statistical calculations. These isotopes are excluded from consideration based on natural occurrence and were all detected below

background levels (based on an assumption of secular equilibrium, the background activities for radium-228 and thorium-228 are equal to the statistical background activity of 1.32 pCi/g for thorium-232) (DOE-RL 2009a).

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach, the field logbooks, and resulting analytical data with the sampling and data requirements specified by the project objectives and performance specifications. This review involves an 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) and completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006). This DQA was performed in accordance with site-specific data quality objectives found in the SAP (DOE-RL 2009a).

The DQA for the 100-D-65 waste site established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The data set was found to be acceptable for decision-making purposes. 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 HEIS and are summarized in Appendix D. The detailed DQA is presented in Appendix F.

SUMMARY FOR INTERIM CLOSURE

The upland segment of the 100-D-65 waste site has been remediated and evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the 100 Area RDR/RAWP (DOE-RL 2009b). Statistical sampling to verify the completeness of remediation was performed, and analytical results were shown to meet the applicable cleanup objectives for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the verification sampling results support a reclassification of the 100-D-65 waste site to Interim Closed Out.

The sediment sample results collected within the remediated shoreline segment exceed upland soil RAGs. However, no further remediation of the below OHWM portion of the 100-D-65 waste site using the RTD remedy is recommended because interim action soil RAGs are not appropriately applied to sediments collected below the OHWM and the Remaining Sites ROD (EPA 1999) does not provide in-water cleanup levels for sediment. The sediment analytical results exceeding upland soil RAGs are for metals concentrations that are comparable to concentrations measured at reference sites for the River Corridor Baseline Risk Assessment (WCH 2006a, 2006b).

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.
- Bergstrom, K. A. and T. H. Mitchell, 2004, "Supersedes CCN 114934, Results of Geophysical Investigation at the 100-D/DR Area Phase II Remaining Sites," CCN 115042 to R. A. Carlson, Bechtel Hanford, Inc., Richland, Washington, July 27.
- DOE Order 5400.5, *Radiation Protection of the Public and Environment*, as amended, U.S. Department of Energy, Washington, D.C.
- DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE-RL, 2011, *Tri-Party Agreement Handbook Management Procedures*, RL-TPA-90-0001, Rev. 2, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," 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/CLARCHome.aspx>](https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx).
- 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, 2006, *Data Quality Assessment: A Reviewer's Guide*, EPA QA/G-9R, EPA/240/B-06/002, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

EPA, 2009, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington, August 2009*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

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

WCH, 2005, *Work Instruction for Confirmatory Sampling of the 100-D-65 Spillway Waste Site*, 0100D-WI-G0018, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH 2006a, *100 Area and 300 Area Component of the RCBRA Fall 2005 Data Compilation*, WCH-85, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH 2006b, *100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment Spring 2006 Data Compilation*, WCH-139, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2011a, *100-D Field Remediation Miscellaneous Sampling Activities*, EL-1662, pp. 17 - 23, Washington Closure Hanford, Richland, Washington.

WCH, 2011b, *Work Instruction for Verification Sampling of the 100-D-65 Spillway Waste Site Below the Ordinary High Water Mark*, 0100D-WI-G0100, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2012a, *100-D Field Remediation Project Sampling and Field Notes*, EL-1607-14, pp. 37 - 39, Washington Closure Hanford, Richland, Washington.

WCH, 2012b, *Work Instruction for Verification Sampling of the Upland Portion of the 100-D-65 Spillway Waste Site*, 0100D-WI-G0118, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2012c, *Work Instruction for Verification Sampling of the Upland Portion of the 100-D-66 Spillway Waste Site*, 0100D-WI-G0122, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2012d, "Remaining Sites Verification Package for the 100-D-8, 105-DR Process Sewer Outfall Waste Site," Attachment to Waste Site Reclassification Form 2012-016, August 2, 2012, Content ID # 2017769, Washington Closure Hanford, Richland, Washington.

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

APPENDIX A
ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Maximum or Statistical Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-D-65 Waste Site^a. (2 Pages)

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	
Metals (mg/kg)							
Background	6.5*	--	--	7	18	--	46
Arsenic III	6.5*	10	60	132	--	330	--
Arsenic V	6.5*	500	--	102	--	40	2,000
Barium	132	--	--	--	--	--	21
Beryllium	1.51	10	--	--	--	--	0.287 (<BG)
Boron	--	0.5	--	--	--	--	1.48
Cadmium	0.81	4	20	14	32	140	0.77
Chromium (total)	18.5	42 ^d	42 ^d	67	--	--	34
Cobalt	15.7	20	--	--	13	--	120
Copper	22	100	50	217	70	80	28
Lead	10.2	50	500	118	120	1,700	11
Manganese	512	1,100 ^d	--	1,500	220	450	4,300
Mercury, inorganic	0.33	0.3	0.1	5.5	--	--	--
Molybdenum	--	2	--	7	--	--	--
Nickel	19.1	30	200	980	38	280	210
Vanadium	85.1	2	--	--	--	7.8	130
Zinc	67.8	86 ^d	200	360	160	120	46
Other Chlorinated Organics (mg/kg)							
Low molecular weight PAH ^e	--	--	--	29	--	--	100
High molecular weight PAH ^f	--	--	--	18	--	--	1.1
Benzo(a)pyrene	--	--	--	12	--	--	0.00586

Table A-1. Maximum or Statistical Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-D-65 Waste Site^a. (2 Pages)

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	
Fluorene	--	30	--	--	--	--	0.002

NOTE Shaded cells indicate screening values that are exceeded.

* The Hanford Site background for arsenic is 6.5 mg/kg. An arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE-RL-96-17, Rev. 6.

^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 Columbia River corridor portion of the Hanford Site, which will include a more complete quantitative ecological risk assessment.

^b Available at www.epa.gov/ecotox/ecoss.

^c Wildlife.

d Benchmark replaced by Washington State natural background concentration.

e Low molecular weight polynuclear aromatic hydrocarbons (LMW-PAHs), e.g., acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, and phenanthrene.

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

-- = not available

BG = background

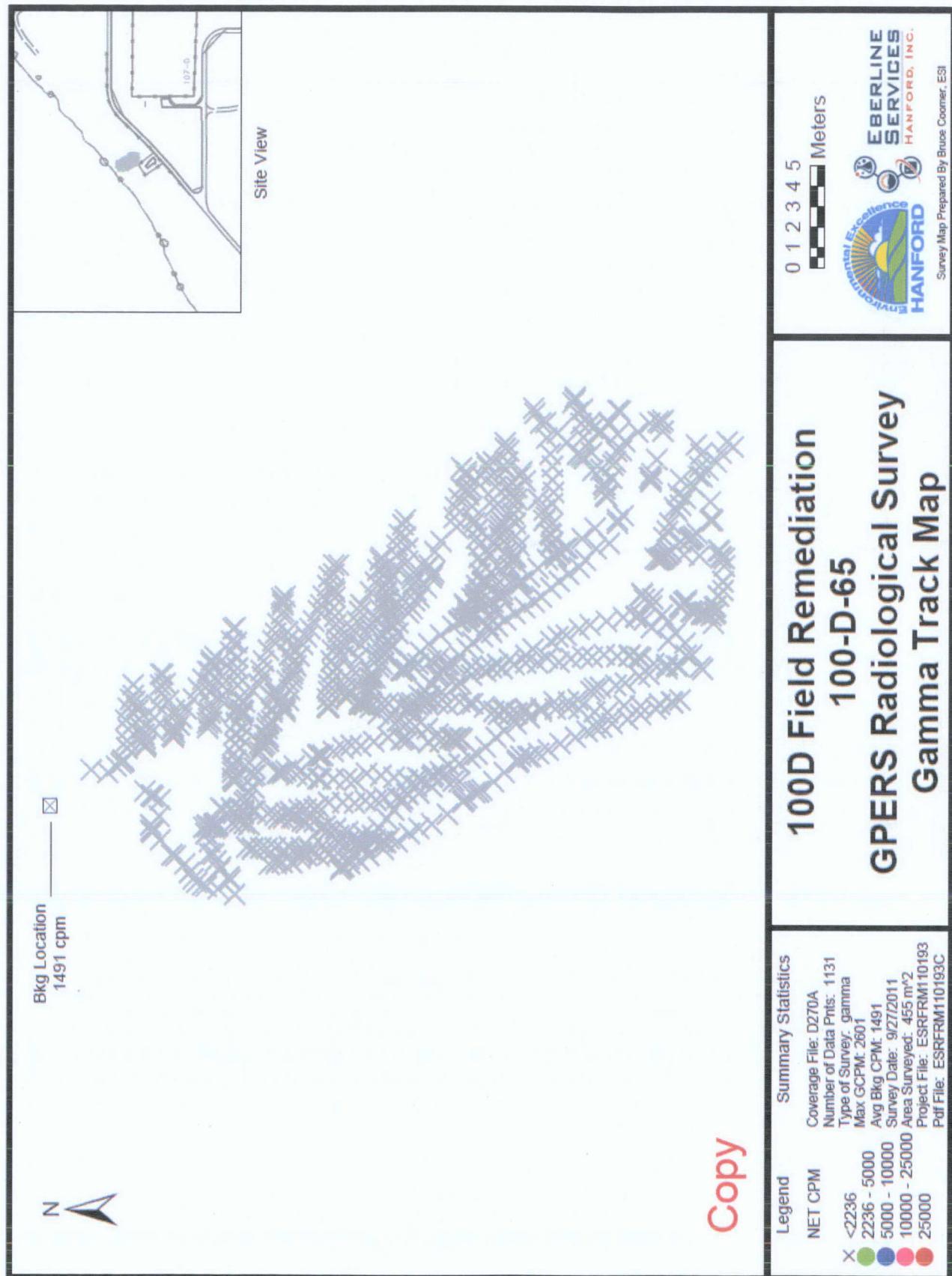
EPA = U.S. Environmental Protection Agency
WAC = Washington Administrative Code

PAH = polycyclic aromatic hydrocarbons

RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*

WAC = *Washington Administrative Code*

APPENDIX B
RADIOLOGICAL SURVEY RESULTS

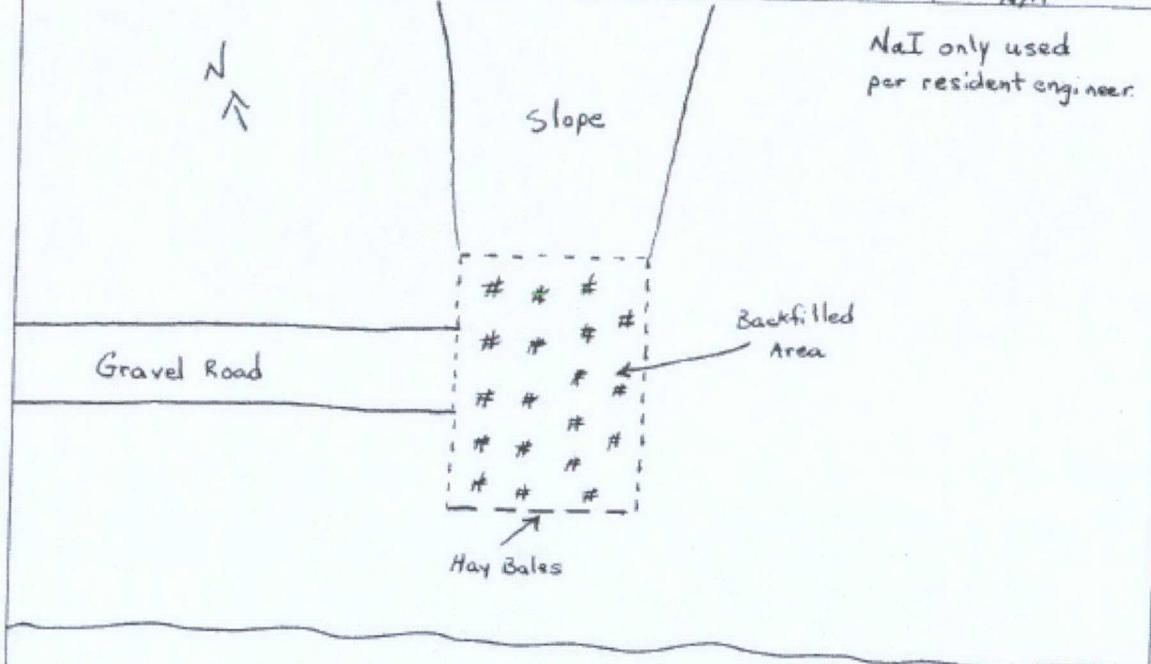


COPY

Acrobat 8.0

WCH ENVIRONMENTAL RADIOLOGICAL SURVEY RECORD

Survey Number ESR 100-D-1000-11-0065	Project: 1000	Date/Time: 12-20-11 12-20-11/1035
Sampling Document Number(s) DOI: RL 96-2d	Project Location: 100-D-65	RWP Number n/a



n/a only used
per resident engineer.

Environmental Survey Instrument Data Sheet (ESIS) Number:			ERSTI/Procedure Number:					
ESIS - 1000-11-0007			ERSTI - 04-0004/Rev. 3					
LEGEND:								
CA Contamination Area	URMA Underground Radioactivity Area	RA Radiation Area	RMA Radioactive Material Area	SCA Soil Contamination Area	RMSA Radioactive Material Storage Area			
<input checked="" type="radio"/> CPM	#	Direct	Contact 30 cm	General Area Dose Rate Rates = Uncorrected Meter Reading (mR/hr)	Radiological Boundary x---x---	Micro Rem (μ rem/hr)	RBA Radiological Buffer Area	
INSTRUMENT(S)								
Instrument				Probe			Efficiency	
Model No.	Serial No.	Calibration Due Date	Model No.	Serial No.	Calibration Due Date	Bkgd	α	$\beta\gamma$
4360	0019	5-24-12	44-10	0034	5-24-12	Site Below	N/A	4.2%
A	A	A	A	A	A	A	A	A

Remarks:

Background: n/a AM 894 cpm

RCT Name/Signature/Date

Terry S. Beasley / Terry S. Beasley

RCT Supervisor Name/Signature/Date

Terry S. Beasley, Terry S. Beasley, 12-22-11

WCH ENVIRONMENTAL RADIOLOGICAL SURVEY RECORD

RADIODILOGICAL SURVEY DATA

Location	Survey Type	Survey Type	Corrected Dose Rate			Contamination Measurement Information			Sample ID
			Static	Scanning	Sample	β (WC-WC)	Units	γ (WC)	
Area 1: Driveway Area	soil/cable	X				n/a	n/a	n/a	

A handwritten graph is plotted on the grid. The Y-axis is labeled "N" and the X-axis is labeled "P". A curve starts at the top left, descends to a minimum, and then rises towards the bottom right. A large letter "A" is written above the curve.

APPENDIX C
IN-PROCESS SAMPLE RESULTS

Table C-2. 100-D-65 In-process Inorganic Sample Results - Inorganics. (3 Pages)

Sample Description	Sample 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
Soil	JINJP8	2/21/12	7330	1.6	0.4	0.4	0.4	0.4	2.9	0.7	67.8	X	0.08	0.55	0.035	1	U	1		
Soil	JINJP9	2/21/12	10000	1.6	0.39	U	0.39	3	0.68	98	X	0.078	0.69	0.034	1	B	1			
Soil	JINJR0	2/21/12	8540	1.5	0.36	U	0.36	3.6	0.62	89.5	X	0.071	0.57	0.031	1	B	0.92			
Soil	JINJR1	2/21/12	10200	1.5	0.37	U	0.37	6.4	0.64	89.4	X	0.073	0.61	0.032	2.3	0.94				
Soil	JINJR2	2/21/12	8250	1.6	0.39	U	0.39	3.1	0.68	75	X	0.078	0.55	0.034	1.4	B	1			
Soil	JINJR3	2/21/12	7640	1.7	0.42	U	0.42	3.4	0.73	72.6	X	0.084	0.64	0.036	1.1	U	1.1			
Soil	JINJR4	2/21/12	8940	1.7	0.41	U	0.41	3.5	0.72	76.7	X	0.083	0.59	0.036	1.2	B	1.1			
Soil	JINJR5	2/21/12	5080	1.6	0.39	U	0.39	2.8	0.67	54.9	X	0.077	0.47	0.034	0.99	U	0.99			
Soil	JINJR6	2/21/12	7160	1.6	0.38	U	0.38	3.3	0.67	72.4	X	0.077	0.61	0.033	1.4	B	0.99			
Soil	JINJR7	2/21/12	8120	1.5	0.38	U	0.38	3	0.66	75.6	X	0.076	0.59	0.033	1.2	B	0.98			
Soil	JINJR8	2/21/12	6380	1.4	0.35	U	0.35	2.9	0.61	62.7	X	0.07	0.43	0.03	0.9	U	0.9			
Soil	JINJR9	2/21/12	6930	1.5	0.38	U	0.38	2.8	0.65	68.8	X	0.075	0.46	0.033	0.97	U	0.97			

Sample Description	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	JINJP8	2/21/12	0.043	U	0.043	7820	X	14.9	10.6	X	0.061	8	X	0.11	17.1	0.23	0.155	U	0.155	
Soil	JINJP9	2/21/12	0.042	U	0.042	7180	X	14.5	12.3	X	0.06	8.4	X	0.1	19.4	0.22	0.155	U	0.155	
Soil	JINJR0	2/21/12	0.051	B	0.039	7390	X	13.3	17.7	X	0.055	7.9	X	0.094	20.7	0.2	0.34		0.155	
Soil	JINJR1	2/21/12	0.039	U	0.039	14900	X	13.6	13.1	X	0.056	8.1	X	0.096	21.3	0.21	0.155	U	0.155	
Soil	JINJR2	2/21/12	0.042	U	0.042	5780	X	14.4	11.1	X	0.059	7.6	X	0.1	16.7	0.22	0.155	U	0.155	
Soil	JINJR3	2/21/12	0.045	U	0.045	12000	X	15.5	9.2	X	0.064	9.6	X	0.11	21.5	0.24	0.198		0.155	
Soil	JINJR4	2/21/12	0.045	U	0.045	11700	X	15.4	13.2	X	0.063	7.4	X	0.11	22.8	0.24	0.27		0.155	
Soil	JINJR5	2/21/12	0.042	U	0.042	9670	X	14.3	6.3	X	0.059	7.2	X	0.1	15.9	0.22	0.27		0.155	
Soil	JINJR6	2/21/12	0.042	U	0.042	9090	X	14.3	8.7	X	0.059	8.2	X	0.1	18.3	0.22	0.362		0.155	
Soil	JINJR7	2/21/12	0.041	U	0.041	8560	X	14.1	10.9	X	0.058	7.9	X	0.1	18.4	0.22	0.155	U	0.155	
Soil	JINJR8	2/21/12	0.038	U	0.038	7240	X	13	10.1	X	0.053	6.3	X	0.092	14.5	0.2	0.155	U	0.155	
Soil	JINJR9	2/21/12	0.041	U	0.041	7830	X	14	11.4	X	0.057	6.4	X	0.099	15	0.21	0.155	U	0.155	

Table C-2. 100-D-65 In-process Inorganic Sample Results - Inorganics. (3 Pages)

Sample Description	Sample 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
Soil	JINJP8	2/21/12	21400	X	4	4.2	0.29	5330	X	3.9	330	X	0.11	0.006	U	0.27
Soil	JINJP9	2/21/12	23300	X	3.9	5.3	0.28	5470	X	3.8	310	X	0.1	0.0067	B	0.27
Soil	JINJR0	2/21/12	20500	X	3.6	5.9	0.25	4580	X	3.5	290	X	0.094	0.16	0.006	0.24
Soil	JINJR1	2/21/12	21300	X	3.7	6.2	0.26	5080	X	3.6	334	X	0.096	0.0087	B	0.25
Soil	JINJR2	2/21/12	20800	X	3.9	4.8	0.28	4690	X	3.8	323	X	0.1	0.0055	B	0.27
Soil	JINJR3	2/21/12	25800	X	4.2	4.1	0.3	5350	X	4.1	362	X	0.11	0.0064	U	0.29
Soil	JINJR4	2/21/12	20300	X	4.1	5.4	0.29	5210	X	4	289	X	0.11	0.032	U	0.28
Soil	JINJR5	2/21/12	19000	X	3.9	3.3	0.27	3730	X	3.8	265	X	0.1	0.0084	B	0.26
Soil	JINJR6	2/21/12	22900	X	3.8	5.3	0.27	4470	X	3.7	308	X	0.1	0.011	B	0.26
Soil	JINJR7	2/21/12	22200	X	3.8	5.2	0.27	4920	X	3.7	335	X	0.1	0.0054	B	0.26
Soil	JINJR8	2/21/12	17000	X	3.5	3.2	0.25	4400	X	3.4	281	X	0.092	0.0058	U	0.24
Soil	JINJR9	2/21/12	18000	X	3.8	3.4	0.27	4730	X	3.7	289	X	0.099	0.0055	U	0.26

Sample Description	Sample 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
Soil	JINJP8	2/21/12	13.8	X	0.13	1130	43.3	0.91	496	X	6	0.17	U	0.117	319	62.3
Soil	JINJP9	2/21/12	11.8	X	0.13	1280	42.1	0.88	322	X	5.8	0.16	U	0.16	313	60.6
Soil	JINJR0	2/21/12	10.7	X	0.12	1130	38.6	0.81	318	X	5.3	0.15	U	0.15	265	55.5
Soil	JINJR1	2/21/12	11.9	X	0.12	1650	39.5	0.83	523	X	5.4	0.15	U	0.15	321	56.8
Soil	JINJR2	2/21/12	12.1	X	0.13	1590	41.9	0.88	416	X	5.8	0.16	U	0.16	241	60.4
Soil	JINJR3	2/21/12	11.5	X	0.14	1230	45.1	0.95	503	X	6.2	0.18	U	0.18	337	65
Soil	JINJR4	2/21/12	12	X	0.13	1300	44.7	0.94	404	X	6.2	0.17	U	0.17	344	64.3
Soil	JINJR5	2/21/12	7.1	X	0.12	823	41.6	0.87	425	X	5.7	0.16	U	0.16	234	59.9
Soil	JINJR6	2/21/12	10.2	X	0.12	1130	41.5	0.87	412	X	5.7	0.16	U	0.16	334	59.7
Soil	JINJR7	2/21/12	11.7	X	0.12	1370	40.9	0.86	454	X	5.6	0.16	U	0.16	295	58.8
Soil	JINJR8	2/21/12	10.9	X	0.11	1080	37.8	0.79	357	X	5.2	0.15	U	0.15	224	54.3
Soil	JINJR9	2/21/12	12.8	X	0.12	1130	40.6	0.85	532	X	5.6	0.16	U	0.16	281	58.5

**Table C-2. 100-D-65 In-process Inorganic Sample Results -
Inorganics. (3 Pages)**

Sample Description	Sample Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	J1F1C8	2/17/11	53.9		0.099	41.2	X	0.42
Soil	J1F1C9	2/17/11	48.7		0.097	46.1	X	0.41
Soil	J1F1D0	2/17/11	45.3		0.088	51.7	X	0.37
Soil	J1F1D1	2/17/11	48		0.09	56.6	X	0.38
Soil	J1F1D2	2/17/11	47.1		0.096	44.5	X	0.41
Soil	J1F1D3	2/17/11	60.3		0.1	48.3	X	0.44
Soil	J1F1D4	2/17/11	45.3		0.1	48.9	X	0.43
Soil	J1F1D5	2/17/11	44.6		0.095	39.7	X	0.4
Soil	J1F1D6	2/17/11	57.8		0.095	50	X	0.4
Soil	J1F1D7	2/17/11	53.7		0.094	44.6	X	0.4
Soil	J1F1D8	2/17/11	41.9		0.087	35.1	X	0.37
Soil	J1F1D9	2/17/11	45.3		0.093	37	X	0.39

Table C-3. 100-D-65 In-process Sample Results - Organics. (9 Pages)

Constituent	J1NJP8			J1NJP9			J1NJR0			J1NJR1		
	2/21/2012			2/21/2012			2/21/2012			2/21/2012		
	µg/kg	Q	PQL									
PAHs												
Acenaphthene	11	U	11									
Acenaphthylene	9.6	U	9.6	9.9	U	9.9	9.8	U	9.8	10	U	10
Anthracene	3.3	U	3.3	3.4	U	3.4	3.3	U	3.3	3.5	U	3.5
Benzo(a)anthracene	3.4	U	3.4	3.5	U	3.5	3.5	U	3.5	3.6	U	3.6
Benzo(a)pyrene	6.9	U	6.9	7.1	U	7.1	6.9	U	6.9	7.3	U	7.3
Benzo(b)fluoranthene	4.5	U	4.5	4.6	U	4.6	4.6	U	4.6	4.8	U	4.8
Benzo(ghi)perylene	7.7	U	7.7	8	U	8	7.8	U	7.8	8.2	U	8.2
Benzo(k)fluoranthene	4.2	U	4.2	4.4	U	4.4	4.3	U	4.3	4.5	U	4.5
Chrysene	5.2	U	5.2	5.4	U	5.4	5.2	U	5.2	5.5	U	5.5
Dibenz[a,h]anthracene	12	U	12									
Fluoranthene	14	U	14	14	U	14	14	U	14	15	U	15
Fluorene	5.6	U	5.6	5.8	U	5.8	5.7	U	5.7	6	U	6
Indeno(1,2,3-cd)pyrene	13	U	13	13	U	13	13	U	13	14	U	14
Naphthalene	13	U	13	13	U	13	13	U	13	14	U	14
Phenanthrene	13	U	13	13	U	13	13	U	13	14	U	14
Pyrene	13	U	13	13	U	13	13	U	13	14	U	14
Pesticides												
Aldrin	0.27	U	0.27	0.28	U	0.28	0.26	U	0.26	0.27	U	0.27
Alpha-BHC	0.23	U	0.23	0.24	U	0.24	0.22	U	0.22	0.23	U	0.23
alpha-Chlordane	0.34	U	0.34	0.36	U	0.36	0.34	U	0.34	0.35	U	0.35
beta-1,2,3,4,5,6-Hexachlorocyclohexane	0.7	U	0.7	0.74	U	0.74	0.69	U	0.69	0.72	U	0.72
Delta-BHC	0.42	U	0.42	0.45	U	0.45	0.42	U	0.42	0.44	U	0.44
Dichlorodiphenyldichloroethane	0.58	U	0.58	0.61	U	0.61	0.57	U	0.57	0.59	U	0.59
Dichlorodiphenyldichloroethylene	0.25	U	0.25	0.27	U	0.27	1.4	J	0.25	0.26	U	0.26
Dichlorodiphenyltrichloroethane	0.63	U	0.63	0.66	J	0.66	1.3	J	0.61	0.64	U	0.64
Dieldrin	0.22	U	0.22	0.23	U	0.23	0.22	U	0.22	0.23	U	0.23
Endosulfan I	0.19	U	0.19	0.2	U	0.2	0.18	U	0.18	0.19	U	0.19
Endosulfan II	0.3	U	0.3	0.32	U	0.32	0.3	U	0.3	0.31	U	0.31
Endosulfan sulfate	0.29	U	0.29	0.31	U	0.31	0.29	U	0.29	0.3	U	0.3
Endrin	0.32	U	0.32	0.34	U	0.34	0.32	U	0.32	0.33	U	0.33
Endrin aldehyde	0.18	U	0.18	0.19	U	0.19	0.18	U	0.18	0.19	U	0.19
Endrin ketone	0.52	U	0.52	0.55	U	0.55	0.51	U	0.51	0.53	U	0.53
Gamma-BHC (Lindane)	0.49	U	0.49	0.52	U	0.52	0.48	U	0.48	0.5	U	0.5
gamma-Chlordane	0.28	U	0.28	0.3	U	0.3	0.28	U	0.28	0.29	U	0.29
Heptachlor	0.23	U	0.23	0.24	U	0.24	0.22	U	0.22	0.23	U	0.23
Heptachlor epoxide	0.45	U	0.45	0.48	U	0.48	0.44	U	0.44	0.46	U	0.46
Methoxychlor	0.48	U	0.48	0.5	U	0.5	0.47	U	0.47	0.49	U	0.49
Toxaphene	17	U	17	18	U	18	16	U	16	17	U	17

Table C-3. 100-D-65 In-process Sample Results - Organics. (9 Pages)

Constituent	J1NJP8			J1NJP9			J1NJR0			J1NJR1		
	2/21/2012			2/21/2012			2/21/2012			2/21/2012		
	µg/kg	Q	PQL									
SVOAs												
1,2,4-Trichlorobenzene	30	U	30	29	U	29	29	U	29	30	U	30
1,2-Dichlorobenzene	23	U	23									
1,3-Dichlorobenzene	13	U	13	13	U	13	12	U	12	13	U	13
1,4-Dichlorobenzene	14	U	14									
2,4,5-Trichlorophenol	11	U	11	10	U	10	10	U	10	11	U	11
2,4,6-Trichlorophenol	11	U	11	10	U	10	10	U	10	11	U	11
2,4-Dichlorophenol	11	U	11	10	U	10	10	U	10	11	U	11
2,4-Dimethylphenol	70	U	70	69	U	69	68	U	68	70	U	70
2,4-Dinitrophenol	350	U	350	350	U	350	340	U	340	350	U	350
2,4-Dinitrotoluene	70	U	70	69	U	69	68	U	68	70	U	70
2,6-Dinitrotoluene	30	U	30	29	U	29	29	U	29	30	U	30
2-Chloronaphthalene	11	U	11	10	U	10	10	U	10	11	U	11
2-Chlorophenol	22	U	22									
2-Methylnaphthalene	20	U	20									
2-Methylphenol (cresol, o-)	14	U	14	14	U	14	13	U	13	14	U	14
2-Nitroaniline	53	U	53	52	U	52	52	U	52	53	U	53
2-Nitrophenol	11	U	11	10	U	10	10	U	10	11	U	11
3+4 Methylphenol (cresol, m+p)	35	U	35	35	U	35	34	U	34	35	U	35
3,3'-Dichlorobenzidine	95	U	95	94	U	94	93	U	93	95	U	95
3-Nitroaniline	77	U	77	76	U	76	75	U	75	77	U	77
4,6-Dinitro-2-methylphenol	350	U	350	350	U	350	340	U	340	350	U	350
4-Bromophenylphenyl ether	20	U	20									
4-Chloro-3-methylphenol	70	U	70	69	U	69	68	U	68	70	U	70
4-Chloroaniline	87	U	87	86	U	86	85	U	85	87	U	87
4-Chlorophenylphenyl ether	22	U	22									
4-Nitroaniline	77	U	77	76	U	76	75	U	75	77	U	77
4-Nitrophenol	100	U	100									
Acenaphthene	11	U	11									
Acenaphthylene	18	U	18									
Anthracene	18	U	18									
Benzo(a)anthracene	21	U	21									
Benzo(a)pyrene	21	U	21									
Benzo(b)fluoranthene	28	U	28	27	U	27	27	U	27	28	U	28
Benzo(ghi)perylene	17	U	17									
Benzo(k)fluoranthene	42	U	42	42	U	42	41	U	41	42	U	42
Bis(2-chloro-1-methylethyl)ether	24	U	24									
Bis(2-Chloroethoxy)methane	24	U	24									
Bis(2-chloroethyl) ether	18	U	18	17	U	17	17	U	17	18	U	18
Bis(2-ethylhexyl) phthalate	49	U	49	48	U	48	47	U	47	49	U	49
Butylbenzylphthalate	46	U	46	45	U	45	44	U	44	46	U	46
Carbazole	38	U	38	38	U	38	37	U	37	38	U	38
Chrysene	29	U	29	28	U	28	28	U	28	29	U	29
Di-n-butylphthalate	31	U	31	30	U	30	30	U	30	31	U	31
Di-n-octylphthalate	15	U	15									
Dibenz[a,h]anthracene	20	U	20									
Dibenzofuran	21	U	21									

Table C-3. 100-D-65 In-process Sample Results - Organics. (9 Pages)

Constituent	J1NJP8			J1NJP9			J1NJR0			J1NJR1		
	2/21/2012			2/21/2012			2/21/2012			2/21/2012		
	µg/kg	Q	PQL									
Diethyl phthalate	28	U	28	27	U	27	27	U	27	28	U	28
Dimethyl phthalate	24	U	24									
Fluoranthene	38	U	38	38	U	38	37	U	37	38	U	38
Fluorene	19	U	19									
Hexachlorobenzene	31	U	31	30	U	30	30	U	30	31	U	31
Hexachlorobutadiene	11	U	11	10	U	10	10	U	10	11	U	11
Hexachlorocyclopentadiene	53	U	53	52	U	52	52	U	52	53	U	53
Hexachloroethane	23	U	23	22	U	22	22	U	22	23	U	23
Indeno(1,2,3-cd)pyrene	23	U	23									
Isophorone	18	U	18									
N-Nitroso-di-n-dipropylamine	33	U	33	32	U	32	32	U	32	33	U	33
N-Nitrosodiphenylamine	22	U	22									
Naphthalene	33	U	33	32	U	32	32	U	32	33	U	33
Nitrobenzene	23	U	23									
Pentachlorophenol	350	U	350	350	U	350	340	U	340	350	U	350
Phenanthrene	18	U	18									
Phenol	19	U	19									
Pyrene	13	U	13	13	U	13	12	U	12	13	U	13

Table C-3. 100-D-65 In-process Sample Results - Organics. (9 Pages)

Constituent	J1NJR2			J1NJR3			J1NJR4			J1NJR5		
	2/21/2012			2/21/2012			2/21/2012			2/21/2012		
	µg/kg	Q	PQL									
PAHs												
Acenaphthene	11	U	11	12	U	12	11	U	11	11	U	11
Acenaphthylene	9.6	U	9.6	11	U	11	9.6	U	9.6	9.7	U	9.7
Anthracene	3.3	U	3.3	3.6	U	3.6	3.2	U	3.2	3.3	U	3.3
Benzo(a)anthracene	3.4	U	3.4	3.7	U	3.7	3.4	U	3.4	3.5	U	3.5
Benzo(a)pyrene	6.8	U	6.8	7.5	U	7.5	6.8	U	6.8	6.9	U	6.9
Benzo(b)fluoranthene	4.5	U	4.5	4.9	U	4.9	4.5	U	4.5	4.5	U	4.5
Benzo(ghi)perylene	7.7	U	7.7	8.5	U	8.5	7.7	U	7.7	7.8	U	7.8
Benzo(k)fluoranthene	4.2	U	4.2	4.6	U	4.6	4.2	U	4.2	4.3	U	4.3
Chrysene	5.2	U	5.2	5.7	U	5.7	5.2	U	5.2	5.2	U	5.2
Dibenz[a,h]anthracene	12	U	12	13	U	13	12	U	12	12	U	12
Fluoranthene	14	U	14	15	U	15	14	U	14	14	U	14
Fluorene	5.6	U	5.6	6.2	U	6.2	5.6	U	5.6	5.7	U	5.7
Indeno(1,2,3-cd)pyrene	13	U	13	14	U	14	13	U	13	13	U	13
Naphthalene	13	U	13	14	U	14	13	U	13	13	U	13
Phenanthrene	13	U	13	14	U	14	13	U	13	13	U	13
Pyrene	13	U	13	14	U	14	13	U	13	13	U	13
Pesticides												
Aldrin	0.26	U	0.26	0.31	U	0.31	0.26	U	0.26	0.26	U	0.26
Alpha-BHC	0.22	U	0.22	0.26	U	0.26	0.22	U	0.22	0.22	U	0.22
alpha-Chlordane	0.34	U	0.34	0.4	U	0.4	0.33	U	0.33	0.33	U	0.33
beta-1,2,3,4,5,6-Hexachlorocyclohexane	0.69	U	0.69	0.82	U	0.82	0.68	U	0.68	0.69	U	0.69
Delta-BHC	0.42	U	0.42	0.49	U	0.49	0.41	U	0.41	0.41	U	0.41
Dichlorodiphenyldichloroethane	0.57	U	0.57	0.67	U	0.67	0.56	U	0.56	0.56	U	0.56
Dichlorodiphenyldichloroethylene	0.25	U	0.25	0.29	U	0.29	0.38	J	0.24	0.25	U	0.25
Dichlorodiphenyltrichloroethane	0.61	U	0.61	0.73	U	0.73	0.61	U	0.61	0.61	U	0.61
Die�din	0.22	U	0.22	0.26	U	0.26	0.22	U	0.22	0.22	U	0.22
Endosulfan I	0.18	U	0.18	0.22	U	0.22	0.18	U	0.18	0.18	U	0.18
Endosulfan II	0.3	U	0.3	0.35	U	0.35	0.29	U	0.29	0.3	U	0.3
Endosulfan sulfate	0.29	U	0.29	0.34	U	0.34	0.28	U	0.28	0.29	U	0.29
Endrin	0.32	U	0.32	0.38	U	0.38	0.31	U	0.31	0.32	U	0.32
Endrin aldehyde	0.18	U	0.18	0.21	U	0.21	0.18	U	0.18	0.18	U	0.18
Endrin ketone	0.51	U	0.51	0.6	U	0.6	0.5	U	0.5	0.51	U	0.51
Gamma-BHC (Lindane)	0.48	U	0.48	0.57	U	0.57	0.48	U	0.48	0.48	U	0.48
gamma-Chlordane	0.28	U	0.28	0.33	U	0.33	0.27	U	0.27	0.28	U	0.28
Heptachlor	0.22	U	0.22	0.26	U	0.26	0.22	U	0.22	0.22	U	0.22
Heptachlor epoxide	0.44	U	0.44	0.52	U	0.52	0.44	U	0.44	0.44	U	0.44
Methoxychlor	0.47	U	0.47	0.55	U	0.55	0.46	U	0.46	0.47	U	0.47
Toxaphene	16	U	16	19	U	19	16	U	16	16	U	16

Table C-3. 100-D-65 In-process Sample Results - Organics. (9 Pages)

Constituent	J1NJR2			J1NJR3			J1NJR4			J1NJR5		
	2/21/2012			2/21/2012			2/21/2012			2/21/2012		
	µg/kg	Q	PQL									
SVOAs												
1,2,4-Trichlorobenzene	30	U	30	32	U	32	30	U	30	29	U	29
1,2-Dichlorobenzene	23	U	23	25	U	25	24	U	24	22	U	22
1,3-Dichlorobenzene	13	U	13	14	U	14	13	U	13	12	U	12
1,4-Dichlorobenzene	14	U	14	15	U	15	15	U	15	14	U	14
2,4,5-Trichlorophenol	11	U	11	11	U	11	11	U	11	10	U	10
2,4,6-Trichlorophenol	11	U	11	11	U	11	11	U	11	10	U	10
2,4-Dichlorophenol	11	U	11	11	U	11	11	U	11	10	U	10
2,4-Dimethylphenol	70	U	70	75	U	75	71	U	71	67	U	67
2,4-Dinitrophenol	350	U	350	380	U	380	360	U	360	340	U	340
2,4-Dinitrotoluene	70	U	70	75	U	75	71	U	71	67	U	67
2,6-Dinitrotoluene	30	U	30	32	U	32	30	U	30	29	U	29
2-Chloronaphthalene	11	U	11	11	U	11	11	U	11	10	U	10
2-Chlorophenol	22	U	22	24	U	24	22	U	22	21	U	21
2-Methylnaphthalene	20	U	20	22	U	22	20	U	20	19	U	19
2-Methylphenol (cresol, o-)	14	U	14	15	U	15	14	U	14	13	U	13
2-Nitroaniline	53	U	53	57	U	57	54	U	54	51	U	51
2-Nitrophenol	11	U	11	11	U	11	11	U	11	10	U	10
3+4 Methylphenol (cresol, m+p)	35	U	35	38	U	38	35	U	35	34	U	34
3,3'-Dichlorobenzidine	95	U	95	100	U	100	96	U	96	92	U	92
3-Nitroaniline	77	U	77	83	U	83	78	U	78	74	U	74
4,6-Dinitro-2-methylphenol	350	U	350	380	U	380	350	U	350	340	U	340
4-Bromophenylphenyl ether	20	U	20	22	U	22	20	U	20	19	U	19
4-Chloro-3-methylphenol	70	U	70	75	U	75	71	U	71	67	U	67
4-Chloroaniline	86	U	86	93	U	93	88	U	88	83	U	83
4-Chlorophenylphenyl ether	22	U	22	24	U	24	22	U	22	21	U	21
4-Nitroaniline	77	U	77	83	U	83	78	U	78	74	U	74
4-Nitrophenol	100	U	100	110	U	110	100	U	100	99	U	99
Acenaphthene	11	U	11	12	U	12	11	U	11	10	U	10
Acenaphthylene	18	U	18	19	U	19	18	U	18	17	U	17
Anthracene	18	U	18	19	U	19	18	U	18	17	U	17
Benzo(a)anthracene	21	U	21	23	U	23	21	U	21	20	U	20
Benzo(a)pyrene	21	U	21	23	U	23	21	U	21	20	U	20
Benzo(b)fluoranthene	28	U	28	30	U	30	28	U	28	27	U	27
Benzo(ghi)perylene	17	U	17	18	U	18	17	U	17	16	U	16
Benzo(k)fluoranthene	42	U	42	46	U	46	43	U	43	41	U	41
Bis(2-chloro-1-methylethyl)ether	24	U	24	26	U	26	25	U	25	23	U	23
Bis(2-Chloroethoxy)methane	24	U	24	26	U	26	25	U	25	23	U	23
Bis(2-chloroethyl) ether	18	U	18	19	U	19	18	U	18	17	U	17
Bis(2-ethylhexyl) phthalate	49	U	49	52	U	52	49	U	49	47	U	47
Butylbenzylphthalate	45	U	45	49	U	49	46	U	46	44	U	44
Carbazole	38	U	38	41	U	41	39	U	39	37	U	37
Chrysene	28	U	28	31	U	31	29	U	29	27	U	27
Di-n-butylphthalate	31	U	31	33	U	33	31	U	31	30	U	30
Di-n-octylphthalate	15	U	15	16	U	16	15	U	15	15	U	15
Dibenz[a,h]anthracene	20	U	20	22	U	22	20	U	20	19	U	19
Dibenzofuran	21	U	21	23	U	23	21	U	21	20	U	20
Diethyl phthalate	27	U	27	30	U	30	28	U	28	26	U	26
Dimethyl phthalate	24	U	24	26	U	26	25	U	25	23	U	23
Fluoranthene	38	U	38	41	U	41	39	U	39	37	U	37

Table C-3. 100-D-65 In-process Sample Results - Organics. (9 Pages)

Constituent	J1NJR2			J1NJR3			J1NJR4			J1NJR5		
	2/21/2012			2/21/2012			2/21/2012			2/21/2012		
	µg/kg	Q	PQL									
Fluorene	19	U	19	20	U	20	19	U	19	18	U	18
Hexachlorobenzene	31	U	31	33	U	33	31	U	31	30	U	30
Hexachlorobutadiene	11	U	11	11	U	11	11	U	11	10	U	10
Hexachlorocyclopentadiene	53	U	53	57	U	57	54	U	54	51	U	51
Hexachloroethane	22	U	22	24	U	24	23	U	23	22	U	22
Indeno(1,2,3-cd)pyrene	23	U	23	25	U	25	24	U	24	22	U	22
Isophorone	18	U	18	19	U	19	18	U	18	17	U	17
N-Nitroso-di-n-dipropylamine	33	U	33	35	U	35	33	U	33	32	U	32
N-Nitrosodiphenylamine	22	U	22	24	U	24	22	U	22	21	U	21
Naphthalene	33	U	33	35	U	35	33	U	33	32	U	32
Nitrobenzene	23	U	23	25	U	25	24	U	24	22	U	22
Pentachlorophenol	350	U	350	380	U	380	350	U	350	340	U	340
Phenanthrene	18	U	18	19	U	19	18	U	18	17	U	17
Phenol	19	U	19	20	U	20	19	U	19	18	U	18
Pyrene	13	U	13	14	U	14	13	U	13	12	U	12

Table C-3. 100-D-65 In-process Sample Results - Organics. (9 Pages)

Constituent	J1NJR6			J1NJR7			J1NJR8			J1NJR9		
	2/21/2012			2/21/2012			2/21/2012			2/21/2012		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
	PAHs											
Acenaphthene	11	U	11	10	U	10	9.9	U	9.9	11	U	11
Acenaphthylene	9.5	U	9.5	9.3	U	9.3	8.9	U	8.9	9.6	U	9.6
Anthracene	3.2	U	3.2	3.2	U	3.2	3	U	3	3.2	U	3.2
Benzo(a)anthracene	5	JX	3.4	3.3	U	3.3	3.2	U	3.2	3.4	U	3.4
Benzo(a)pyrene	10	J	6.7	6.7	U	6.7	6.4	U	6.4	6.8	U	6.8
Benzo(b)fluoranthene	13	J	4.4	4.4	U	4.4	5.1	J	4.2	4.5	U	4.5
Benzo(ghi)perylene	7.6	U	7.6	7.5	U	7.5	7.1	U	7.1	7.7	U	7.7
Benzo(k)fluoranthene	5.6	J	4.1	4.1	U	4.1	3.9	U	3.9	4.2	U	4.2
Chrysene	14	J	5.1	5	U	5	4.8	U	4.8	5.1	U	5.1
Dibenz[a,h]anthracene	12	U	12	11	U	11	11	U	11	12	U	12
Fluoranthene	27	J	14	13	U	13	13	U	13	14	U	14
Fluorene	5.6	U	5.6	5.5	U	5.5	5.2	U	5.2	5.6	U	5.6
Indeno(1,2,3-cd)pyrene	13	U	13	12	U	12	12	U	12	13	U	13
Naphthalene	13	U	13	12	U	12	12	U	12	13	U	13
Phenanthrene	17	JX	13	12	U	12	12	U	12	13	U	13
Pyrene	20	JX	13	12	U	12	12	U	12	13	U	13
Pesticides												
Aldrin	0.26	U	0.26	0.27	U	0.27	0.26	U	0.26	0.26	U	0.26
Alpha-BHC	0.22	U	0.22	0.23	U	0.23	0.22	U	0.22	0.22	U	0.22
alpha-Chlordane	0.33	U	0.33	0.34	U	0.34	0.34	U	0.34	0.34	U	0.34
beta-1,2,3,4,5,6-Hexachlorocyclohexane	0.68	U	0.68	0.71	U	0.71	0.69	U	0.69	0.7	U	0.7
Delta-BHC	0.41	U	0.41	0.43	U	0.43	0.42	U	0.42	0.42	U	0.42
Dichlorodiphenyldichloroethane	0.56	U	0.56	0.58	U	0.58	0.57	U	0.57	0.57	U	0.57
Dichlorodiphenyldichloroethylene	0.28	J	0.24	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25
Dichlorodiphenyltrichloroethane	0.6	U	0.6	0.63	U	0.63	0.61	U	0.61	0.62	U	0.62
Dieldrin	0.21	U	0.21	0.22	U	0.22	0.22	U	0.22	0.22	U	0.22
Endosulfan I	0.18	U	0.18	0.19	U	0.19	0.18	U	0.18	0.18	U	0.18
Endosulfan II	0.29	U	0.29	0.31	U	0.31	0.3	U	0.3	0.3	U	0.3
Endosulfan sulfate	0.28	U	0.28	0.29	U	0.29	0.29	U	0.29	0.29	U	0.29
Endrin	0.31	U	0.31	0.33	U	0.33	0.32	U	0.32	0.32	U	0.32
Endrin aldehyde	0.17	U	0.17	0.18	U	0.18	0.18	U	0.18	0.18	U	0.18
Endrin ketone	0.5	U	0.5	0.52	U	0.52	0.51	U	0.51	0.51	U	0.51
Gamma-BHC (Lindane)	0.47	U	0.47	0.49	U	0.49	0.48	U	0.48	0.49	U	0.49
gamma-Chlordane	0.27	U	0.27	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28
Heptachlor	0.22	U	0.22	0.23	U	0.23	0.22	U	0.22	0.22	U	0.22
Heptachlor epoxide	0.44	U	0.44	0.45	U	0.45	0.44	U	0.44	0.45	U	0.45
Methoxychlor	0.46	U	0.46	0.48	U	0.48	0.47	U	0.47	0.47	U	0.47
Toxaphene	16	U	16	17	U	17	16	U	16	17	U	17

Table C-3. 100-D-65 In-process Sample Results - Organics. (9 Pages)

Constituent	J1NJR6			J1NJR7			J1NJR8			J1NJR9		
	2/21/2012			2/21/2012			2/21/2012			2/21/2012		
	µg/kg	O	PQL	µg/kg	O	POL	µg/kg	O	POL	µg/kg	O	POL
SVOAs												
1,2,4-Trichlorobenzene	29	U	29	28	U	28	28	U	28	29	U	29
1,2-Dichlorobenzene	23	U	23	22	U	22	22	U	22	23	U	23
1,3-Dichlorobenzene	13	U	13	12	U	12	12	U	12	13	U	13
1,4-Dichlorobenzene	14	U	14	13	U	13	14	U	14	14	U	14
2,4,5-Trichlorophenol	10	U	10	9.9	U	9.9	9.9	U	9.9	10	U	10
2,4,6-Trichlorophenol	10	U	10	9.9	U	9.9	9.9	U	9.9	10	U	10
2,4-Dichlorophenol	10	U	10	9.9	U	9.9	9.9	U	9.9	10	U	10
2,4-Dimethylphenol	69	U	69	65	U	65	66	U	66	69	U	69
2,4-Dinitrophenol	350	U	350	330	U	330	330	U	330	350	U	350
2,4-Dinitrotoluene	69	U	69	65	U	65	66	U	66	69	U	69
2,6-Dinitrotoluene	29	U	29	28	U	28	28	U	28	29	U	29
2-Chloronaphthalene	10	U	10	9.9	U	9.9	9.9	U	9.9	10	U	10
2-Chlorophenol	22	U	22	21	U	21	21	U	21	22	U	22
2-Methylnaphthalene	20	U	20	19	U	19	19	U	19	20	U	20
2-Methylphenol (cresol, o-)	14	U	14	13	U	13	13	U	13	14	U	14
2-Nitroaniline	52	U	52	50	U	50	50	U	50	52	U	52
2-Nitrophenol	10	U	10	9.9	U	9.9	9.9	U	9.9	10	U	10
3+4 Methylphenol (cresol, m+p)	34	U	34	33	U	33	33	U	33	34	U	34
3,3'-Dichlorobenzidine	94	U	94	89	U	89	89	U	89	94	U	94
3-Nitroaniline	76	U	76	72	U	72	72	U	72	76	U	76
4,6-Dinitro-2-methylphenol	340	U	340	330	U	330	330	U	330	340	U	340
4-Bromophenylphenyl ether	20	U	20	19	U	19	19	U	19	20	U	20
4-Chloro-3-methylphenol	69	U	69	65	U	65	66	U	66	69	U	69
4-Chloroaniline	85	U	85	81	U	81	81	U	81	85	U	85
4-Chlorophenylphenyl ether	22	U	22	21	U	21	21	U	21	22	U	22
4-Nitroaniline	76	U	76	72	U	72	72	U	72	76	U	76
4-Nitrophenol	100	U	100	96	U	96	96	U	96	100	U	100
Acenaphthene	11	U	11	10	U	10	10	U	10	11	U	11
Acenaphthylene	18	U	18	17	U	17	17	U	17	18	U	18
Anthracene	18	U	18	17	U	17	17	U	17	18	U	18
Benzo(a)anthracene	21	U	21	20	U	20	20	U	20	21	U	21
Benzo(a)pyrene	21	U	21	20	U	20	20	U	20	21	U	21
Benzo(b)fluoranthene	27	U	27	26	U	26	26	U	26	27	U	27
Benzo(ghi)perylene	17	U	17	16	U	16	16	U	16	17	U	17
Benzo(k)fluoranthene	42	U	42	40	U	40	40	U	40	42	U	42
Bis(2-chloro-1-methylethyl)ether	24	U	24	23	U	23	23	U	23	24	U	24
Bis(2-Chloroethoxy)methane	24	U	24	23	U	23	23	U	23	24	U	24
Bis(2-chloroethyl) ether	17	U	17	16	U	16	16	U	16	17	U	17
Bis(2-ethylhexyl) phthalate	48	U	48	46	U	46	46	U	46	48	U	48
Butylbenzylphthalate	45	U	45	43	U	43	43	U	43	45	U	45
Carbazole	38	U	38	36	U	36	36	U	36	38	U	38
Chrysene	28	U	28	27	U	27	27	U	27	28	U	28
Di-n-butylphthalate	30	U	30	29	U	29	29	U	29	30	U	30
Di-n-octylphthalate	15	U	15	14	U	14	14	U	14	15	U	15
Dibenz[a,h]anthracene	20	U	20	19	U	19	19	U	19	20	U	20
Dibenzofuran	21	U	21	20	U	20	20	U	20	21	U	21
Diethyl phthalate	27	U	27	26	U	26	26	U	26	27	U	27
Dimethyl phthalate	24	U	24	23	U	23	23	U	23	24	U	24
Fluoranthene	38	U	38	36	U	36	36	U	36	38	U	38
Fluorene	19	U	19	18	U	18	18	U	18	19	U	19

Table C-3. 100-D-65 In-process Sample Results - Organics. (9 Pages)

Constituent	J1NJR6			J1NJR7			J1NJR8			J1NJR9		
	2/21/2012			2/21/2012			2/21/2012			2/21/2012		
	µg/kg	Q	PQL									
Hexachlorobenzene	30	U	30	29	U	29	29	U	29	30	U	30
Hexachlorobutadiene	10	U	10	9.9	U	9.9	9.9	U	9.9	10	U	10
Hexachlorocyclopentadiene	52	U	52	50	U	50	50	U	50	52	U	52
Hexachloroethane	22	U	22	21	U	21	21	U	21	22	U	22
Indeno(1,2,3-cd)pyrene	23	U	23	22	U	22	22	U	22	23	U	23
Isophorone	18	U	18	17	U	17	17	U	17	18	U	18
N-Nitroso-di-n-dipropylamine	32	U	32	31	U	31	31	U	31	32	U	32
N-Nitrosodiphenylamine	22	U	22	21	U	21	21	U	21	22	U	22
Naphthalene	32	U	32	31	U	31	31	U	31	32	U	32
Nitrobenzene	23	U	23	22	U	22	22	U	22	23	U	23
Pentachlorophenol	340	U	340	330	U	330	330	U	330	340	U	340
Phenanthrene	18	U	18	17	U	17	17	U	17	18	U	18
Phenol	19	U	19	18	U	18	18	U	18	19	U	19
Pyrene	26	J	13	12	U	12	12	J	12	13	U	13

APPENDIX D
CALCULATION BRIEFS

APPENDIX D

CALCULATION BRIEFS

The calculations in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the file will be stored in a U.S. Department of Energy, Richland Operations Office, repository. These 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-65 Waste Site Upland Portion Cleanup Verification 95% UCL Calculation,
0100D-CA-V0466, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-65 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation,
0100D-CA-V0468, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-65 Waste Site Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation, 0100D-CA-V0469, 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 in the administrative record.

Acrobat 8.0

CALCULATION COVER SHEETProject Title: 100-D Field RemediationJob No. 14655Area: 100-DDiscipline: Environmental*Calculation No: 0100D-CA-V0466Subject: 100-D-65 Waste Site Upland Portion Cleanup Verification 95% UCL CalculationComputer Program: ExcelProgram No: Excel 2003

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

Committed Calculation Preliminary Superseded Voided

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 14 Attm. 1 = 9 Total = 24	C. H. Dobie <i>C.H. Dobie</i>	N. K. Schiffen <i>N.K. Schiffen</i>	J. D. Skoglie <i>J.D. Skoglie</i>	D. F. Obenauer <i>D.F. Obenauer</i>	1/15/13 <i>1/15/13</i>

SUMMARY OF REVISION

Washington Closure Hanford**CALCULATION SHEET**

Originator	C.H. Dobie	Date	08/09/12	Calc. No.	0100D-CA-V0466	Rev. No.	0
Project	100-D Field Remediation	Job No.	14655	Checked	N. K. Schiffem	Date	08/09/12
Subject	100-D-65 Waste Site Upland Portion Cleanup Verification 95% UCL Calculations					Sheet No.	1 of 14

1 Summary

2

3

4 Purpose:

5 Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the subject
 6 site. Also, perform the *Washington Administrative Code* (WAC) 173-340-740(7)(e) Model Toxics Control Act (MTCA)
 7 3-part test for nonradionuclide analytes and calculate the relative percent difference (RPD) for primary-duplicate
 8 sample pairs for each contaminant of concern (COC) and contaminant of potential concern (COPC), as necessary.
 9

10 Table of Contents:

11 Sheets 1 to 5 - Calculation Sheet Summary
 12 Sheets 6 to 10 - Calculation Sheet Verification Data - Excavation
 13 Sheets 11 to 13 - Ecology Software (MTCASStat) Results
 14 Sheet 14 - Calculation Sheet - Duplicate Analysis
 15 Attachment 1 - 100-D-65, Verification Sampling Results (9 pages)

16

17 Given/References:

- 18 1) Sample Results (Attachment 1).
 19 2) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 5,
 20 U.S. Department of Energy, Richland Operations Office, Richland, Washington.
 21 3) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/Rawp), DOE/RL-
 22 96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
 23 4) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of
 24 Ecology, Olympia, Washington.
 25 5) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background*
 26 *Data with Below-detection Limit or Below-PQL Values (Censored Data Sets)*, Publication #92-54, Washington
 27 Department of Ecology, Olympia, Washington.
 28 6) Ecology, 2011, *Cleanup Levels and Risk Calculations (CLARC) Database*, Washington State Department of
 29 Ecology, Olympia, Washington, <<https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>>.
 30 7) EPA, 1989, *Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual, Part A;*
 31 *Interim Final*, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D. C.
 32 8) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code*.

33 Solution:

34 Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/Rawp
 35 (DOE-RL 2009b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC
 36 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard
 37 quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining
 38 Sites Verification Package (RSVP).

39

40 Calculation Description:

41 The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the 100-
 42 D-65 waste site. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the
 43 built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in
 44 accordance with the RDR/Rawp (DOE-RL 2009b) is documented by this calculation. Duplicate RPD results are used
 45 in evaluation of data quality within the RSVP for this site.

46

47 Methodology:

48 The excavation area of 100-D-65 waste site underwent statistical sampling that consists of one decision unit for
 49 verification sampling; the excavation.

50

51 Analytical results for all sampling locations are summarized in the tables provided on sheets 3 and 4. For polycyclic
 52 aromatic hydrocarbons (PAHs), two separate analyses were performed that provided data: 8310 (PAH specific) and
 53 8270 (semi volatile organics). Only data from the 8310 PAH specific analysis are evaluated for cleanup and included
 54 in the results summary table(s). However, PAH data from both analyses is evaluated for the RPD calculation. Further
 55 information of the sample data quality is presented in the data quality assessment section of the associated RSVP.

56

57

58

59

60

61

62

63

64

65

Washington Closure Hanford**CALCULATION SHEET**

Originator	C.H. Dobie	<i>CD</i>	Date	08/09/12	Calc. No.	0100D-CA-V0466	Rev. No.	0
Project	100-D Field Remediation		Job No.	14655	Checked	N. K. Schiffen	Date	08/09/12
Subject	100-D-65 Waste Site Upland Portion Cleanup Verification 95% UCL Calculations						Sheet No.	2 of 14

1 **Summary (continued)**2 **Methodology, continued:**

4 For nonradioactive analytes with ≤50% of the data below detection limits, the statistical value calculated to evaluate the
 5 effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with >50% of the data below detection limits, as
 6 determined by direct inspection of the sample results (Attachment 1), the maximum detected value for the data set is used
 7 instead of the 95% UCL, and no further calculations are performed for those data sets. For convenience, these maximum
 8 detected values are included in the summary tables that follow. The 95% UCL was not calculated for data sets with no reported
 9 detections. Calculated cleanup levels are not available in Ecology (2011) under WAC 173-340-740(3) for calcium, magnesium,
 10 potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum
 11 and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and
 12 sodium are not considered site COCs/COPCs and are also not included in these calculations. The 95% UCL values were not
 13 calculated for potassium-40, radium-226, radium-228, and thorium-232 based on the natural occurrence at the Hanford Site.
 14

16 All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics
 17 (Ecology 1993). For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the
 18 data set, after adjustments for censored data as described above. For radionuclide data, calculation of the statistics is done
 19 using the reported value. In cases where the laboratory does not report a value below the minimum detectable activity (MDA),
 20 half of the MDA is used in the calculation. For the statistical evaluation of duplicate sample pairs, the samples are averaged
 21 before being included in the data set, after adjustments for censored data as described above.
 22

24 For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data
 25 and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets ($n < 10$),
 26 the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For
 27 nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCAStat
 28 software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP
 29 (DOE-RL 2009b) and MTCAStat coding and due to a limitation in the MTCAStat coding (no direct capability to address variable
 30 quantitation limits within a data set), substitutions for censored data are performed before software input and the resulting data
 31 set treated as uncensored.
 32

33 The WAC 173-340-740(7)(e) 3-part test is performed for nonradionuclide analytes only and determines if:
 34 1) the 95% UCL exceeds the most stringent cleanup limit for each COPC/COC,
 35 2) greater than 10% of the raw data exceed the most stringent cleanup limit for each COPC/COC,
 36 3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each COPC/COC.
 37

39 The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are
 40 greater than 5 times the target detection limit (TDL). The TDLs are pre-determined values for analytical methods and
 41 constituents with cleanup levels as listed in Table 2-1 of the SAP (DOE-RL 2009a). Table 2-1 includes nominal TDLs for
 42 identified methods based organic analyses. The nominal TDLs are also used in support of the RPD calculation for the methods
 43 based analytes. TDLs not included in Table 2-1 are based on the laboratory and/or methods used. Where direct evaluation of
 44 the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further
 45 evaluation of the RPD value was not performed. The RPD calculations use the following formula:
 46

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

49 where, M = Main Sample Value S = Split (or duplicate) Sample Value
 50

52 For quality assurance/quality control (QA/QC) split and duplicate RPD calculations, a value less than 30% indicates the data
 53 compare favorably. If the RPD is greater than 30%, further investigation regarding the usability of the data is performed. To
 54 assist in the identification of anomalous sample pairs, when an analyte is detected in the primary or duplicate sample, but was
 55 quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the
 56 difference between the primary and duplicate results exceeds a control limit of 2 times the TDL, further assessment regarding the
 57 usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the
 58 applicable RSVP.
 59
 60
 61

62

Washington Closure Hanford

CALCULATION SHEET

Originator C.H. Dobie <u>C.D.</u>	Date <u>08/15/12</u>	Calc. No. <u>0100D-CA-V0466</u>	Rev. No. <u>0</u>
Project <u>100-D Field Remediation</u>	Job No. <u>14655</u>	Checked <u>N. K. Schiffm</u> <i>nl</i>	Date <u>08/15/12</u>
Subject <u>100-D-65 Waste Site Upland Portion Cleanup Verification 95% UCL Calculations</u>			
Sheet No. <u>3 of 14</u>			

1 Summary (continued)

2

3 QUALIFIER LIST4 ^a = value converted from nitrate value5 ^b = value converted from nitrite value

6 B = blank contamination

7 C = all compounds at secondary dilution factor

8 J = estimate

9 R = rejected

10 U = undetected

11

12

13 ACRONYM LIST

14

15 -- = not applicable

16 DE = direct exposure

17 GW = groundwater

18 MTCA = *Model Toxics Control Act*

19 PQL = practical quantitation limit

20 Q = qualifier

21 QA/QC = quality assurance/quality control

22 RAG = remedial action goal

23 RDR/RAWP = remedial design report/remedial action work plan

24 RESRAD = RESidual RADioactivity (dose model)

25 RPD = relative percent difference

26 RSVP = remaining sites verification package

27 SAP = sampling and analysis plan

28 TDL = target detection limit

29 UCL = upper confidence limit

30 WAC = Washington Administrative Code

Washington Closure Hanford**CALCULATION SHEET**

Originator C.H. Dobie	<u>CD</u>	Date 08/15/12	Calc. No. 0100D-CA-V0466	Rev. No. 0
Project 100-D Field Remediation		Job No. 14655	Checked N. K. Schiffm	Date 08/15/12
Subject 100-D-65 Waste Site Upland Portion Cleanup Verification 95% UCL Calculations				Sheet No. 4 of 14

1 **Results:**
 2 The results presented in the tables that follow include the summary of the
 3 results of the 95% UCL calculations for the excavations A, B, the WAC 173-340-
 4 740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in
 5 risk analysis and the RSVP for this site.
 6

Results Summary ^a

Analyte	Excavation		Units
	95% UCL Result	Maximum Result	
Cesium-137	0.101	-	pCi/g
Europium-152	0.135	-	pCi/g
Uranium-233/234	0.660	-	pCi/g
Uranium-238 (AEA)	0.751	-	pCi/g
Arsenic	2.65	-	mg/kg
Barium	66.8	-	mg/kg
Beryllium	0.287	-	mg/kg
Boron	1.48	-	mg/kg
Cadmium	0.113	-	mg/kg
Chromium	10.9	-	mg/kg
Cobalt	6.61	-	mg/kg
Copper	13.7	-	mg/kg
Lead	3.82	-	mg/kg
Manganese	276	-	mg/kg
Mercury	-	0.0235	mg/kg
Molybdenum	0.539	--	mg/kg
Nickel	10.7	-	mg/kg
Vanadium	51.5	-	mg/kg
Zinc	44.3	-	mg/kg
Chloride	7.1	--	mg/kg
Nitrogen in Nitrate	3.6	--	mg/kg
Nitrogen in Nitrite	--	0.3	mg/kg
Nitrogen in Nitrate and nitrite	3.68	--	mg/kg
Sulfate	18.9	--	mg/kg
Acenaphthene	--	8.01	ug/kg
Acenaphthylene	--	2.66	ug/kg
Benzo(a)anthracene	3.50	-	ug/kg
Benzo(a)pyrene	--	5.86	ug/kg
Benzo(b)fluoranthene	--	5.14	ug/kg
Benzo(ghi)perylene	3.29	--	ug/kg
Benzo(k)fluoranthene	--	3.01	ug/kg
Chrysene	--	7.68	ug/kg
Fluorene	--	2.00	ug/kg
Fluoranthene	9.57	-	ug/kg
Indeno(1,2,3-cd)pyrene	8.23	--	ug/kg
Naphthalene	5.16	-	ug/kg
Phenanthrene	--	5.41	ug/kg
Pyrene	4.87	--	ug/kg

WAC 173-340-740(7)(e) Evaluation:**WAC 173-340 3-Part Test for most**50 stringent RAG: EXC

51 95% UCL or maximum> Cleanup

52 Limit? NO NO

53 > 10% above Cleanup Limit? NO NO

54 Any sample > 2x Cleanup Limit? NO NO

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

Washington Closure Hanford**CALCULATION SHEET**Originator C.H. Dobie C.D.

Project 100-D Field Remediation

Subject 100-D-65 Waste Site Upland Portion Cleanup Verification 95% UCL Calculations

Rev. No. 0
 Date 08/15/12
 Sheet No. 5 of 14

1 Summary (continued)**2****3 Relative Percent Difference Results and QA/QC Analysis^a**

4 Analyte	Duplicate Analysis
	5 Excavation
6 Potassium-40	12.1%
7 Aluminum	6.1%
8 Barium	11.6%
9 Calcium	5.5%
10 Chromium	13.3%
11 Copper	15.9%
12 Iron	9.3%
13 Magnesium	2.2%
14 Manganese	2.6%
15 Silicon	4.1%
16 Sodium	20.8%
17 Vanadium	7.0%
18 Zinc	1.2%

20 Grey cells indicate not applicable.

21 ^aRPD listed where result produced, based on criteria. If RPD not required, no value is listed. The significance of the reported RPD values, including values greater than 30%, is addressed in the data quality assessment section of the CVP.
 22
 23
 24

Washington Closure Hanford
 Originator C.H. Dobie *CD*
 Project 100-D Field Remediation
 Subject 100-D-65 Waste Site Upland Portion Cleanup Verification 95% UCL Calculations

Date 08/14/12
 Job No. 14655

Calc. No. 0100D-CA-V0466
 Checked N. K. Schiffman */V*

Rev. No. 0
 Date 08/14/12
 Sheet No. 11 of 14

CALCULATION SHEET											
Ecology Software (MTCASStat) Results, 100-D-65 Excavation											
Arsenic 95% UCL Calculation				Barium 95% UCL Calculation				Beryllium 95% UCL Calculation			
Number of samples Uncensored 12 Mean 2.42 Lognormal mean 2.42 Std. devn. 0.385 Median 2.50 Method detection limit TOTAL 12 Min. 1.94 Max. 3.03				Number of samples Uncensored 12 Mean 62.4 Lognormal mean 62.4 Std. devn. 7.80 Median 61.9 Method detection limit TOTAL 12 Min. 49.0 Max. 76.8				Number of samples Uncensored 12 Mean 0.266 Lognormal mean 0.266 Std. devn. 0.0438 Median 0.254 Method detection limit TOTAL 12 Min. 0.195 Max. 0.317			
Lognormal distribution? r-squared is: 0.925 Recommendations: Use lognormal distribution.				Lognormal distribution? r-squared is: 0.956 Recommendations: Use lognormal distribution.				Lognormal distribution? r-squared is: 0.894 Recommendations: Reject BOTH lognormal and normal distributions.			
UCL (Land's method) is 2.65				UCL (Land's method) is 66.8				UCL (based on Z-statistic) is 0.287			
Boron 95% UCL Calculation				Cadmium 95% UCL Calculation				Chromium 95% UCL Calculation			
Number of samples Uncensored 12 Mean 1.30 Lognormal mean 1.31 Std. devn. 0.38 Median 1.38 Method detection limit TOTAL 12 Min. 0.65 Max. 1.92				Number of samples Uncensored 12 Mean 0.102 Lognormal mean 0.103 Std. devn. 0.0177 Median 0.108 Method detection limit TOTAL 12 Min. 0.0752 Max. 0.136				Number of samples Uncensored 12 Mean 10.2 Lognormal mean 10.2 Std. devn. 1.25 Median 10.2 Method detection limit TOTAL 12 Min. 7.97 Max. 12.3			
Lognormal distribution? r-squared is: 0.835 Recommendations: Reject BOTH lognormal and normal distributions.				Lognormal distribution? r-squared is: 0.953 Recommendations: Use lognormal distribution.				Lognormal distribution? r-squared is: 0.966 Recommendations: Use lognormal distribution.			
UCL (based on Z-statistic) is 1.48				UCL (Land's method) is 0.113				UCL (Land's method) is 10.9			
Cobalt 95% UCL Calculation				Copper 95% UCL Calculation				Lead 95% UCL Calculation			
Number of samples Uncensored 12 Mean 5.58 Lognormal mean 6.32 Std. devn. 0.520 Median 6.42 Method detection limit TOTAL 12 Min. 5.33 Max. 6.99				Number of samples Uncensored 12 Mean 13.0 Lognormal mean 13.0 Std. devn. 1.16 Median 12.8 Method detection limit TOTAL 12 Min. 11.3 Max. 15.2				Number of samples Uncensored 12 Mean 3.50 Lognormal mean 3.50 Std. devn. 0.557 Median 3.34 Method detection limit TOTAL 12 Min. 2.56 Max. 4.25			
Lognormal distribution? r-squared is: 0.935 Recommendations: Use lognormal distribution.				Lognormal distribution? r-squared is: 0.981 Recommendations: Use lognormal distribution.				Lognormal distribution? r-squared is: 0.920 Recommendations: Use lognormal distribution.			
UCL (Land's method) is 6.61				UCL (Land's method) is 13.7				UCL (Land's method) is 3.82			

Acronyms and qualifiers are defined on sheet 3.

Attachment 1. 100-D-65 Waste Site Verification Sample Results (Metals).

LOCATION	HEIS Number	Sample Date	Nickel				Potassium				Selenium				Silver				Sodium			
			me/kg		Q	POL	me/kg		O	POL	me/kg		O	POL	me/kg		O	POL	me/kg		Q	POL
			1	JIPV12	7/18/12	10.5	3.59	858	359	0.269	496	1	1.80	0.180	U	0.180	U	0.180	324	44.9		
Duplicate of JIPV12	JIPVM4	7/18/12	8.87	3.32	869	332	0.249	476	1	1.66	0.166	U	0.166	U	0.166	263	41.5					
2	JIPVL3	7/18/12	10.5	3.69	1040	369	0.277	655	1	1.85	0.185	U	0.185	U	0.185	328	46.2					
3	JIPVL4	7/18/12	8.50	3.59	1080	359	0.269	838	1	1.79	0.179	U	0.179	U	0.179	318	44.8					
4	JIPVL5	7/18/12	8.67	3.99	1100	399	0.299	575	1	2.00	0.200	U	0.200	U	0.200	341	49.9					
5	JIPVL6	7/18/12	8.85	3.55	1120	355	0.266	478	1	1.78	0.178	U	0.178	U	0.178	402	44.4					
6	JIPVL7	7/18/12	7.70	3.71	1020	371	0.278	556	1	1.85	0.185	U	0.185	U	0.185	305	46.3					
7	JIPVL8	7/18/12	11.5	3.71	1320	371	0.278	531	1	1.85	0.185	U	0.185	U	0.185	245	46.4					
8	JIPVL9	7/18/12	7.22	3.72	1100	372	0.279	630	1	1.86	0.186	U	0.186	U	0.186	364	46.5					
9	JIPVM0	7/18/12	10.7	3.87	1200	387	0.290	463	1	1.93	0.193	U	0.193	U	0.193	319	48.4					
10	JIPVM1	7/18/12	13.0	3.85	860	385	0.289	562	1	1.93	0.193	U	0.193	U	0.193	295	48.2					
11	JIPVM2	7/18/12	9.39	4.04	1420	404	0.303	616	1	2.02	0.202	U	0.202	U	0.202	247	50.6					
12	JIPVM3	7/18/12	10.8	4.63	772	463	0.347	592	1	2.32	0.232	U	0.232	U	0.232	316	57.9					
Equipment Blank	JIPVM5	7/18/12	3.03	U	3.03	55.3	303	0.227	U	0.227	160	1	1.52	0.152	U	0.152	8.64	37.9				

LOCATION	HEIS Number	Sample Date	Vanadium				Zinc			
			me/kg		Q	POL	me/kg		O	POL
			1	JIPV12	7/18/12	41.4	2.08	32.8	9.98	9.98
2	JIPVL3	7/18/12	46.9	2.31	36.2	9.23				
3	JIPVL4	7/18/12	47.9	2.24	37.4	8.96				
4	JIPVL5	7/18/12	47.7	2.49	44.0	9.98				
5	JIPVL6	7/18/12	47.6	2.22	43.7	8.88				
6	JIPVL7	7/18/12	53.5	2.32	44.3	9.27				
7	JIPVL8	7/18/12	49.1	2.32	44.3	9.27				
8	JIPVL9	7/18/12	51.5	2.33	40.4	9.31				
9	JIPVM0	7/18/12	45.1	2.42	43.0	9.67				
10	JIPVM1	7/18/12	48.0	2.41	37.9	9.63				
11	JIPVM2	7/18/12	50.9	2.53	45.9	10.1				
12	JIPVM3	7/18/12	59.8	2.89	49.2	11.6				
Equipment Blank	JIPVM5	7/18/12	0.277		1.89	1.39	7.58			

Sheet No. 4 of 9
Date 08/13/12
Rev. No. 0Attachment 1
Originator C.H. Dobie
Checked N.K. Schiffen
Calc. No. 01000D-CA-V0466

Attachment 1. 100-D-65 Waste Site Verification Sample Results (Anions and Physical).

LOCATION	HEIS Number	Sample Date	Bromide	Chloride			Fluoride			Nitrate			Nitrite	
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	JIPVL2	7/18/12	1.0	U	1.0	1.0	U	1.0	1.0	4.8	BJ	1.0	1.0	UR 1.0
Duplicate of JIPVL2	JIPVM4	7/18/12	1.0	U	1.0	1.0	B	1.0	1.0	4.3	BJ	1.0	1.0	UR 1.0
2	JIPVL3	7/18/12	1.0	U	1.0	1.0	U	1.0	1.0	2.6	BJ	1.0	1.0	UR 1.0
3	JIPVL4	7/18/12	1.0	U	1.0	2.2	B	1.0	1.0	13.2	J	1.0	1.0	UR 1.0
4	JIPVL5	7/18/12	1.0	U	1.0	1.4	B	1.0	1.0	9.1	J	1.0	1.0	UR 1.0
5	JIPVL6	7/18/12	1.0	U	1.0	28.8		1.0	1.0	9.2	J	1.0	1.0	UR 1.0
6	JIPVL7	7/18/12	1.0	U	1.0	1.0	U	1.0	1.0	37.6	J	1.0	1.0	BJ 1.0
7	JIPVL8	7/18/12	1.0	U	1.0	1.0	U	1.0	1.0	4.9	BJ	1.0	1.0	UR 1.0
8	JIPVL9	7/18/12	1.0	U	1.0	1.0	U	1.0	1.0	11.2	J	1.0	1.0	UR 1.0
9	JIPVM0	7/18/12	1.0	U	1.0	1.0	UB	1.0	1.0	7.0	J	1.0	1.0	UR 1.0
10	JIPVM1	7/18/12	1.1	U	1.1	1.5	B	1.1	1.1	2.7	BJ	1.1	1.1	UR 1.1
11	JIPVM2	7/18/12	1.1	U	1.1	1.6	B	1.1	1.1	3.9	BJ	1.1	1.1	UR 1.1
12	JIPVM3	7/18/12	1.3	U	1.3	1.3	U	1.3	1.3	5.5	BJ	1.3	1.3	UR 1.3

LOCATION	HEIS Number	Sample Date	Nitrogen in Nitrite and Nitrate	Phosphorous in phosphate			Sulfate			Percent solids			PH Measurement
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	%	pH
1	JIPVL2	7/18/12	1.34	0.10	2.1	UR	2.1	5.0	B	1.0	94.3	0.1	9.16 J 0.10
Duplicate of JIPVL2	JIPVM4	7/18/12	1.16	0.10	2.3	BJ	1.9	5.0		1.0	97.2	0.1	9.10 J 0.10
2	JIPVL3	7/18/12	0.81	0.10	3.0	BJ	2.0	3.7	B	1.0	98.5	0.1	9.16 J 0.10
3	JIPVL4	7/18/12	3.24	0.10	2.0	UR	2.0	37.4		1.0	96.2	0.1	9.08 J 0.10
4	JIPVL5	7/18/12	2.20	0.10	2.9	BJ	2.0	11.9		1.0	96.4	0.1	9.10 J 0.10
5	JIPVL6	7/18/12	2.16	0.10	3.8	BJ	2.1	14.1		1.0	95.4	0.1	9.07 J 0.10
6	JIPVL7	7/18/12	8.93	0.10	3.3	BJ	1.9	7.6		1.0	96.3	0.1	8.76 J 0.10
7	JIPVL8	7/18/12	1.40	0.10	2.0	UR	2.0	4.7	B	1.0	96.3	0.1	9.04 J 0.10
8	JIPVL9	7/18/12	2.82	0.10	3.3	BJ	2.0	2.8	B	1.0	97.7	0.1	8.94 J 0.10
9	JIPVM0	7/18/12	1.75	0.10	3.1	BJ	2.0	4.2	B	1.0	95.7	0.1	8.68 J 0.10
10	JIPVM1	7/18/12	0.80	0.11	2.2	UR	2.2	22.5		1.1	91.1	0.1	8.75 J 0.10
11	JIPVM2	7/18/12	1.03	0.11	8.8	BJ	2.2	4.3	B	1.1	83.8	0.1	8.45 J 0.10
12	JIPVM3	7/18/12	1.45	0.13	2.5	UR	2.5	6.3		1.3	80.0	0.1	8.61 J 0.10
Equipment Blank	JIPVM5	7/18/12									100	0.1	

Attachment 1 1
 Originator C.H. Dobie
 Checked N.K. Schifern
 Calc. No. 0100D-CA-V0466
 Rev. No. 0

Sheet No. 5 of 9

Date 08/15/12
 Date 08/15/12
 Rev. No. 0

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0468

Subject: 100-D-65 Waste Site 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 Sheets = 3 Total = 4	<i>E.H. Debie</i>	<i>N. K. Schiffren</i>	<i>J. D. Skoglie</i>	<i>D. F. Obenauer</i>	<i>1/16/13</i>

SUMMARY OF REVISION

Washington Closure Hanford, Inc.		CALCULATION SHEET					
Originator:	C. H. Dobie <i>CD</i>	Date:	08/14/12	Calc. No.:	0100D-CA-V0468	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	N. K. Schiffen <i>JK</i>	Date:	08/14/12
Subject:	100-D-65 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	1 of 3

1 **PURPOSE:**

2 3 Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess
 4 carcinogenic risk for the 100-D-65 waste site. In accordance with the remedial action goals (RAGs) in
 5 the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009a), the following
 6 criteria must be met:

- 7 8 1) An HQ of <1.0 for all individual noncarcinogens
 9 2) A cumulative HQ of <1.0 for noncarcinogens
 10 3) An excess cancer risk of <1 x 10⁻⁶ for individual carcinogens
 11 4) A cumulative excess cancer risk of <1 x 10⁻⁵ for carcinogens.

12

13 **GIVEN/REFERENCES:**

- 14 15 1) DOE-RL, 2009a, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas*,
 16 DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland,
 17 Washington.
 18
 19 2) DOE-RL, 2009b, *100 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 5,
 20 U.S. Department of Energy, Richland Operations Office, Richland, Washington.
 21
 22 3) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.
 23
 24 4) WCH, 2012, *Remaining Sites Verification Package for the 100-D-65; 116-D-5 Outfall Spillway; 1904D Spillway; 100-D-60:1 Flume*, Attachment to Waste Site Reclassification Form 2012-072, Washington Closure Hanford, Inc., Richland, Washington.

25

26 **SOLUTION:**

- 27 28 1) Generate an HQ for each noncarcinogenic constituent detected above background or required
 29 detection limit/practical quantitation limit and compare it to the individual HQ of <1.0
 30 (DOE-RL 2009a).
 31
 32 2) Sum the HQs and compare this value to the cumulative HQ of <1.0.
 33
 34 3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or
 35 required detection limit/practical quantitation limit and compare it to the excess cancer risk of
 36 <1 x 10⁻⁶ (DOE-RL 2009a).
 37
 38 4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of <1 x 10⁻⁵.
 39
 40
 41
 42
 43

Washington Closure Hanford, Inc.

CALCULATION SHEET

Originator:	C. H. Dobie <i>CD</i>	Date:	08/14/12	Calc. No.:	0100D-CA-V0468	Rev.:	0
Project:	100-D Area Field Remediation	Job No.:	14655	Checked:	N. K. Schiffen <i>ns</i>	Date:	08/14/12
Subject:	100-D-65 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	2 of 3

METHODOLOGY:

The 100-D-65 waste site is comprised of one decision unit for verification sampling consisting of the excavation. The direct contact hazard quotient and carcinogenic risk calculations for the 100-D-65 waste site were conservatively calculated for the entire waste site using the greater of the statistical or maximum value for each analyte in all decision units from WCH (2012). Of the contaminants of potential concern (COPCs) for this site boron, molybdenum, nitrogen in nitrite, and the detected polycyclic aromatic hydrocarbons (PAHs) require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. 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 statistical value for boron is 1.48 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 2.1×10^{-4} . Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.
- 2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 1.6×10^{-3} . Comparing this value to the requirement of <1.0, this criterion is met.
- 3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6} . For example, the statistical value for benzo(a)anthracene is 0.00350 mg/kg, divided by 1.37 mg/kg, and multiplied as indicated, is 2.6×10^{-9} . 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 5.8×10^{-8} . Comparing these values to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

Table 1 shows the results of the calculations.

Washington Closure Hanford, Inc.

CALCULATION SHEET

Originator:	C. H. Dobie <i>CD</i>	Date:	08/14/12	Calc. No.:	0100D-CA-V0468	Rev.:	0
Project:	100-D Area Field Remediation	Job No.:	14655	Checked:	N. K. Schiffen <i>NS</i>	Date:	08/14/12
Subject:	100-D-65 Waste Site Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	3 of 3

1 **Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for**
 2 **the 100-D-65 Waste Site.**

Contaminants of Potential Concern	Statistical or Maximum Value ^a (mg/kg)	Noncarcinogen RAG ^b (mg/kg)	Hazard Quotient	Carcinogen RAG ^b (mg/kg)	Carcinogen Risk
Metals					
Boron	1.48	7,200	2.1E-04	--	--
Molybdenum	0.539	400	1.3E-03	--	--
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.00801	4,800	1.7E-06	--	--
Acenaphthylene ^c	0.00266	4,800	5.5E-07	--	--
Benzo(a)anthracene	0.00350	--	--	1.37	2.6E-09
Benzo(a)pyrene	0.00586	--	--	0.137	4.3E-08
Benzo(b)fluoranthene	0.00514	--	--	1.37	3.8E-09
Benzo(ghi)perylene ^c	0.00329	2,400	1.4E-06	--	--
Benzo(k)fluoranthene	0.00301	--	--	1.37	2.2E-09
Chrysene	0.00768	--	--	13.7	5.6E-10
Fluoranthene	0.00957	3,200	3.0E-06	--	--
Fluorene	0.00200	3,200	6.3E-07	--	--
Indeno(1,2,3-cd)pyrene	0.00823	--	--	1.37	6.0E-09
Naphthalene	0.00516	1,600	3.2E-06	--	--
Phenanthrene ^c	0.00541	24,000	2.3E-07	--	--
Pyrene	0.00487	2,400	2.0E-06	--	--
Anions					
Nitrogen in nitrite ^d	0.30	8,000	3.8E-05	--	--
Totals					
Cumulative Hazard Quotient:			1.6E-03		
Cumulative Excess Cancer Risk:					5.8E-08

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 = Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: acenaphthylene surrogate: acenaphthene

benzo(g,h,i)perylene surrogate: pyrene

phenanthrene surrogate: anthracene

^d Values obtained from nitrite value (1.0 mg/kg) by multiplying it by 0.304493.

-- = not applicable

RAG = remedial action goal

41 **CONCLUSION:**

42 The calculation in Table 1 demonstrates that the 100-D-65 waste site meets the requirements for the
 43 direct contact hazard quotients and excess carcinogenic risk as identified in the RDR/Rawp (DOE-RL
 44 2009a) and SAP (DOE-RL 2009b). The direct contact hazard quotient and carcinogenic (excess cancer)
 45 risk calculations are for use in the RSVP for this site.

Acrobat 8.0

CALCULATION COVER SHEETProject Title: 100-D Field RemediationJob No. 14655Area: 100-DDiscipline: Environmental *Calculation No: 0100D-CA-V0469Subject: 100-D-65 Waste Site Protection of Groundwater Hazard Quotient and Carcinogenic Risk CalculationComputer Program: Excel Program No: Excel 2003

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

Committed Calculation Preliminary Superseded Voided

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 3 Total = 4	C. H. Dobie <i>C.H. Dobie</i>	N. K. Schiffner <i>N.K. Schiffner</i>	J. D. Skoglie <i>J.D. Skoglie</i>	D. F. Obenauer <i>D.F. Obenauer</i>	1/15/13

SUMMARY OF REVISION

Washington Closure Hanford, Inc.

CALCULATION SHEET

Originator:	C. H. Dobie <i>CD</i>	Date:	10/23/2012	Calc. No.:	0100D-CA-V0469	Rev.:	0
Project:	100-D Area Field Remediation	Job No.:	14655	Checked:	N. K. Schiffern <i>NS</i>	Date:	10/23/2012
Subject:	100-D-65 Waste Site Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation						Sheet No. 1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for the 100-D-65 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009), the following criteria must be met:

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

GIVEN/REFERENCES:

- 1) BHI, 2005, *100 Area Analogous Sites RESRAD Evaluation*, Calculation No. 0100X-CA-V0050 Rev 0, Bechtel Hanford, Inc., Richland, Washington.
- 2) DOE-RL, 2009, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas*, DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 3) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.
- 4) WCH, 2012, *100-D-65 Upland Portion Cleanup Verification 95% UCL Calculations*, 0100D-CA-V0466, Rev. 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

- 1) Generate a HQ for each noncarcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).
- 2) Sum the HQs and compare this value to the cumulative HQ of <1.0.
- 3) Generate an excess cancer risk value for each carcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).
- 4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.

Washington Closure Hanford, Inc.		CALCULATION SHEET				
Originator:	C. H. Dobie CD	Date:	10/23/2012	Calc. No.:	0100D-CA-V0469	Rev.:
Project:	100-D Area Field Remediation	Job No.:	14655	Checked:	N. K. Schiffmern NB	Date:
Subject:	100-D-65 Waste Site Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation					Sheet No. 2 of 3

1 **METHODOLOGY:**

2

3 The 100-D-65 waste site is comprised of one decision unit for verification sampling consisting of the
 4 excavation. Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at
 5 the 100-D-65 waste site were conservatively calculated for the entire waste site using the greater of the
 6 statistical or maximum value for each analyte in the 95% UCL calculation (WCH 2012). Of the
 7 contaminants of potential concern (COPCs) for this site boron, molybdenum, nitrogen in nitrite,
 8 acenaphthene, acenaphthylene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene are
 9 included because no Hanford background value has been established and the distribution coefficient is
 10 less than that necessary to show no migration to groundwater in 1,000 years using the generic site
 11 RESRAD model (BHI 2005). Based on this model and a vadose zone of approximately 0.0 m (0.0 ft)
 12 thickness, a K_d value of 80 mL/g is adequate to show no migration to groundwater in 1,000 years using
 13 the generic RESRAD model (BHI 2005). Contaminants with a K_d of 80 mL/g are highly adsorbed to
 14 soil particles, and even when immersed in water, any migration will be negligible. Therefore, HQ and
 15 risk calculations were performed with the exclusion of these analytes with a K_d over 80mL/g. All other
 16 site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater
 17 than or equal to 80. An example of the HQ and risk calculations for soil constituents with a potential
 18 impact to groundwater is presented below:

19

- 20 1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time
 (mg/kg/day) to a reference dose for the same substance derived over the same specified time
 (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil
 (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater,
 where the RAG is the groundwater cleanup level (mg/L) (calculated with, and related to the hazard
 quotient through, WAC 173-340-720(3)(a)(ii)(A), 1996) $\times 100 \times 1 \text{ mg}/1000 \text{ mg}$ (conversion factor).
 This is based on the “100 times rule” of WAC 173-340-740(3)(a)(ii)(A) (1996). For example, the
 statistical value for boron is 1.48 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg
 produces a HQ value of 4.6×10^{-3} . Comparing this value to the requirement of <1.0, this criterion is
 met.
- 30
- 31 2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be
 obtained by summing the individual values. (To avoid errors due to intermediate rounding, the
 individual HQ values prior to rounding are used for this calculation.) The cumulative HQ for the
 100-D-65 waste site is 7.5×10^{-2} . Comparing this value to the requirement of <1.0, this criterion is
 met.
- 36
- 37 3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic
 RAG value, and then multiplied by 1×10^{-6} . The 100-D-65 waste site doesn’t have any constituents
 with carcinogen RAG, the criterion for excess cancer risk is met. Consequently, the criterion for
 cumulative excess cancer risk for carcinogens is also met.
- 41
- 42 4) The soil cleanup RAGs for protection of groundwater are based on the “100 times” provision in
 WAC 173-340-740(3)(a)(ii)(A). WAC 173-340-740(3)(a)(ii)(A) (1996) provides the “100 times
 rule” but also states “unless it can be demonstrated that a higher soil concentration is protective of
 ground water at the site.” When the “100 times rule” values are exceeded, RESRAD was used to
 demonstrate that higher soil concentrations may be protective of groundwater.

47

Washington Closure Hanford, Inc.	CALCULATION SHEET					
Originator: C. H. Dobie <i>CJL</i>	Date: 10/23/2012	Calc. No.: 0100D-CA-V0469	Rev.: 0			
Project: 100-D Area Field Remediation	Job No: 14655	Checked: N. K. Schiffen <i>NB</i>	Date: 10/23/2012			
Subject: 100-D-65 Waste Site Protection of Groundwater Hazard Quotient and Carcinogenic Risk Calculation	Sheet No. 3 of 3					

1 **RESULTS:**

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

7
8 Table 1 shows the results of the calculations.

10
11 **Table 1. Hazard Quotient and Excess Cancer Risk Results for the 100-D-65 Waste Site.**

Contaminants of Potential Concern	Statistical or Maximum Value ^a (mg/kg)	Noncarcinogen RAG ^b (mg/kg)	Hazard Quotient	Carcinogen RAG ^b (mg/kg)	Carcinogen Risk
<i>Metals</i>					
Boron	1.48	320	4.6E-03	--	--
Molybdenum	0.539	8	6.7E-02	--	--
<i>Polyaromatic Hydrocarbons</i>					
Acenaphthene	0.00801	96	8.3E-05	--	--
Acenaphthylene ^c	0.00266	96	2.8E-05	--	--
Fluoranthene	0.00957	64	1.5E-04	--	--
Fluorene	0.00200	64	3.1E-05	--	--
Naphthalene	0.00516	16	3.2E-04	--	--
Phenanthrene ^c	0.00541	240	2.3E-05	--	--
Pyrene	0.00487	48	1.0E-04	--	--
<i>Anions</i>					
Nitrogen in nitrite ^d	0.30	160	1.9E-03	--	--
<i>Totals</i>					
Cumulative Hazard Quotient:				7.5E-02	
Cumulative Excess Cancer Risk:					0.0E+00

31 Notes:

32 ^a = From WCH (2012).

33 ^b = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.

34 ^c = Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:

35 acenaphthylene surrogate: acenaphthene

36 phenanthrene surrogate: anthracene

37 ^d Value obtained from nitrite value (1.0 mg/kg) by multiplying it by 0.304493.

38 -- = not applicable

39 RAG = remedial action goal

40
41 **CONCLUSION:**

42 The calculation in Table 1 demonstrates that the 100-D-65 waste site meets the requirements for the hazard quotients and excess carcinogenic risk for protection of groundwater as identified in the RDR/RAWP (DOE-RL 2009).

APPENDIX E

VERIFICATION SAMPLE RESULTS FOR THE SHORELINE SEGMENT OF THE 100-D-65 WASTE SITE

Figure E-1. Location of Sediment Samples for Shoreline Segment of the 100-D-65 Waste Site – Below the Ordinary High Water Mark.

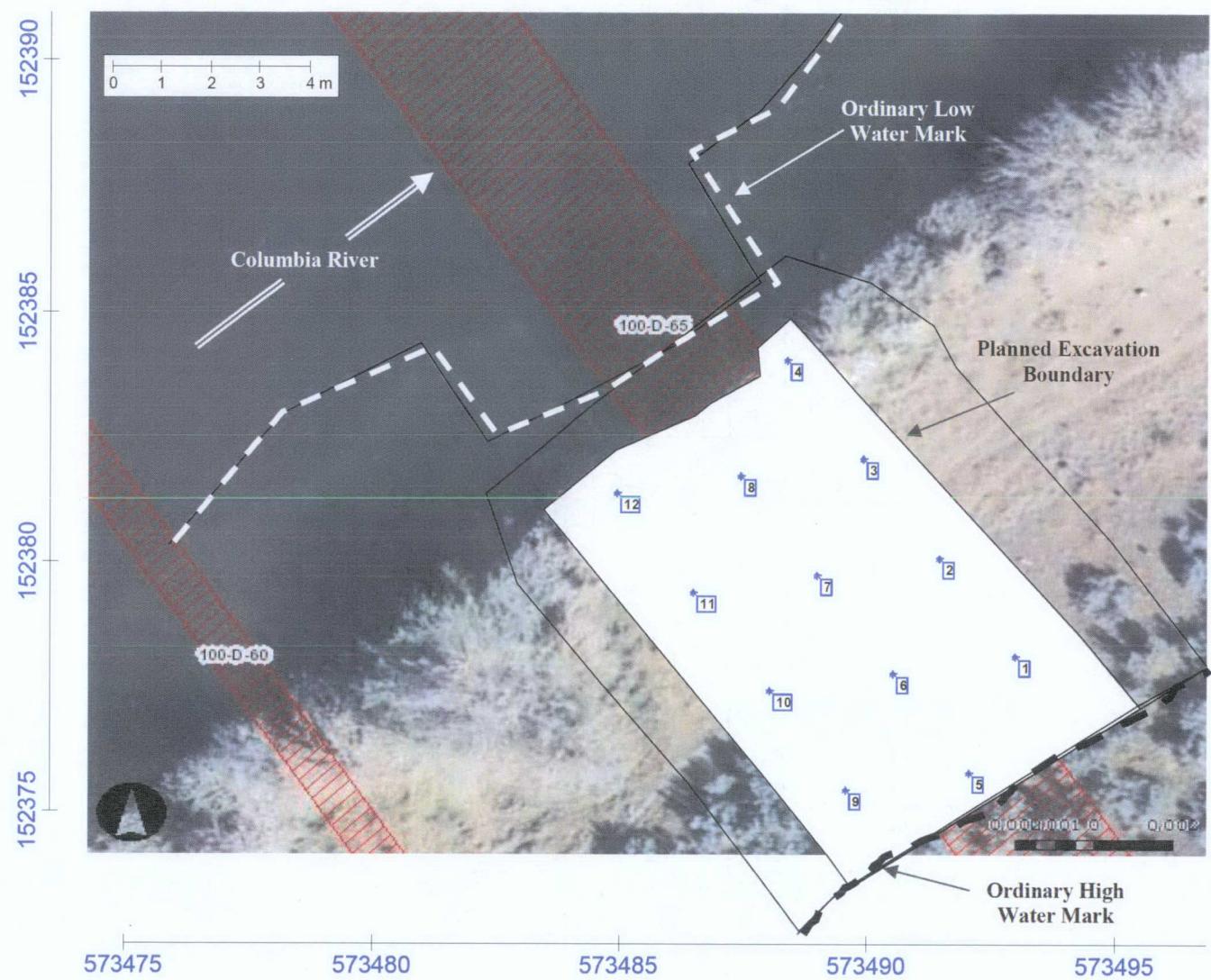


Table E-1. 100-D-65 Shoreline Segment Sample Results - Radionuclides. (2 pages)

Sample Description - Map Location	Sample Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Sediment - 1	J1M6T3	11/13/11	-0.0218	U	0.144	0.0444		0.0229	0.015	U	0.0284	0.16	U	0.08	0.0133	U	0.084	0.061	U	0.0683
Sediment - 2	J1M6T4	11/13/11	-0.03	U	0.124	0.0292	U	0.0334	0.01	U	0.0278	0.0577	U	0.082	-0.0505	U	0.084	-0.02	U	0.0939
Sediment - 3	J1M6T5	11/13/11	-0.0791	U	0.104	0.0019	U	0.0353	-0.006	U	0.0342	0.0603	U	0.1	-0.0094	U	0.105	0.076	U	0.0915
Sediment - 4	J1M6T6	11/13/11	-0.0297	U	0.0669	0.0395	U	0.0459	0.004	U	0.0383	-0.006	U	0.099	-0.0031	U	0.112	0.029	U	0.0978
Sediment - 5	J1M6T7	11/13/11	-0.0165	U	0.144	0.0009	U	0.0242	-0.003	U	0.0233	0.0175	U	0.056	-0.0119	U	0.082	0.005	U	0.0638
Sediment - 6	J1M6T8	11/13/11	0.0147	U	0.243	0.0201	U	0.0289	0.01	U	0.0292	0.0267	U	0.068	-0.0136	U	0.083	0.016	U	0.0793
Sediment - 7	J1M6T9	11/13/11	-0.0306	U	0.0622	0.0023	U	0.0351	-0.003	U	0.036	-0.01	U	0.093	-0.0533	U	0.097	0.026	U	0.09
Sediment - 8	J1M6V0	11/13/11	0.0636	U	0.109	0.0086	U	0.0352	-0.012	U	0.0304	0.0345	U	0.087	0.0134	U	0.113	0.048	U	0.0791
Sediment - 9	J1M6V1	11/13/11	-0.0089	U	0.128	0.0099	U	0.0279	-0.009	U	0.0256	-0.0109	U	0.074	0.0193	U	0.085	0.019	U	0.0935
Sediment - 10	J1M6V2	11/13/11	-0.0173	U	0.239	-2E-05	U	0.0241	0.002	U	0.0265	-0.0243	U	0.057	-0.0312	U	0.078	0.047	U	0.079
Sediment - 11	J1M6V3	11/13/11	-0.0085	U	0.126	0.0048	U	0.0284	6E-04	U	0.0262	0.0074	U	0.077	-0.0038	U	0.086	-0.021	U	0.0912
Sediment - 12	J1M6V4	11/13/11	-0.0408	U	0.104	0.0235	U	0.0344	0.004	U	0.0379	0.0109	U	0.085	-0.0171	U	0.112	0.01	U	0.0857
Duplicate	J1M6T7	11/13/11	-0.0303	U	0.0614	-0.013	U	0.0331	-0.006	U	0.0346	-0.013	U	0.088	-0.0367	U	0.103	-0.005	U	0.0861
Concrete	J1MM46	11/16/11	-0.0544	U	0.123	-9E-04	U	0.0285	0.005	U	0.0281	5E-05	U	0.079	-0.0316	U	0.086	-0.015	U	0.0888

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

B = Detected below reporting limit

J = estimate

MDA = minimum detectable activity

PQL = practical quantitation limit

Q = qualifier

U = undetected

X (metals) = interferences present

X (organics) = more than 40% difference between columns, lower result reported

Table E-1. 100-D-65 Shoreline Segment Sample Results - Radionuclides. (2 pages)

Sample Description - Map Location	Sample Number	Sample Date	Plutonium-238				Plutonium-239/240				Uranium-234				Uranium-235				Uranium-238				Total beta radiostrontium			
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Sediment - 1	J1M6T3	11/13/11	-0.0023	U	0.17	0.0431	U	0.17	0.411		0.154	0.0412	U	0.136	0.237		0.15	0.062	U	0.196						
Sediment - 2	J1M6T4	11/13/11	-0.0073	U	0.146	0.0289	U	0.108	0.448		0.171	-0.0013	U	0.097	0.445		0.178	0.065	U	0.174						
Sediment - 3	J1M6T5	11/13/11	-0.0016	U	0.116	-0.002	U	0.116	0.283		0.151	-0.0013	U	0.1	0.124	U	0.146	0.061	U	0.175						
Sediment - 4	J1M6T6	11/13/11	-0.0048	U	0.199	-0.005	U	0.199	0.456		0.0854	0.0456	U	0.085	0.387		0.085	0.04	U	0.191						
Sediment - 5	J1M6T7	11/13/11	-0.003	U	0.125	-0.002	U	0.112	0.399		0.0987	0	U	0.089	0.256		0.106	0.133	U	0.185						
Sediment - 6	J1M6T8	11/13/11	0	U	0.125	-0.003	U	0.139	0.194		0.103	0.0491	U	0.092	0.417		0.092	0.046	U	0.19						
Sediment - 7	J1M6T9	11/13/11	0	U	0.135	0	U	0.135	0.324		0.0813	0	U	0.081	0.301		0.091	0.063	U	0.225						
Sediment - 8	J1M6V0	11/13/11	0	U	0.106	-0.001	U	0.106	0.397		0.0928	0	U	0.083	0.198		0.093	0.133	U	0.173						
Sediment - 9	J1M6V1	11/13/11	0	U	0.142	0	U	0.142	0.523		0.0999	0.0215	U	0.1	0.308		0.103	0.138	U	0.18						
Sediment - 10	J1M6V2	11/13/11	0	U	0.16	0	U	0.16	0.329		0.14	-0.0034	U	0.121	0.33		0.137	0.012	U	0.172						
Sediment - 11	J1M6V3	11/13/11	0	U	0.118	-0.002	U	0.118	0.362		0.0969	0	U	0.097	0.31		0.097	0.034	U	0.17						
Sediment - 12	J1M6V4	11/13/11	-0.0022	U	0.167	0	U	0.167	0.254		0.0972	0	U	0.087	0.369		0.105	0.007	U	0.181						
Duplicate	J1M6V5	11/13/11	0	U	0.143	0	U	0.143	0.308		0.0999	0.0239	U	0.09	0.382		0.09	0.082	U	0.171						
Concrete	J1M646	11/16/11	0	U	0.173	0	U	0.173	0.213		0.155	-0.0088	U	0.138	0.39		0.151	0.075	U	0.153						

Sample Description - Map Location	Sample Number	Sample Date	Carbon-14				Nickel-63				Tritium			
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Sediment - 1	J1M6T3	11/13/11	-0.107	U	0.45	1.67	U	12.7	-0.013	U	0.0282			
Sediment - 2	J1M6T4	11/13/11	0.186	U	0.451	1.09	U	11.9	-0.016	U	0.0258			
Sediment - 3	J1M6T5	11/13/11	0.055	U	0.451	2.88	U	12.5	-0.015	U	0.0319			
Sediment - 4	J1M6T6	11/13/11	0.0979	U	0.451	-0.825	U	12.6	-0.017	U	0.0373			
Sediment - 5	J1M6T7	11/13/11	-0.125	U	0.451	-5.05	U	12.2	-0.011	U	0.0243			
Sediment - 6	J1M6T8	11/13/11	0.0492	U	0.45	2.56	U	12.3	0.021	U	0.0279			
Sediment - 7	J1M6T9	11/13/11	0.122	U	0.447	3.63	U	12.2	-0.013	U	0.0304			
Sediment - 8	J1M6V0	11/13/11	0.21	U	0.448	3.98	U	13.1	-0.017	U	0.0343			
Sediment - 9	J1M6V1	11/13/11	-0.0559	U	0.448	5.4	U	12.3	-0.007	U	0.023			
Sediment - 10	J1M6V2	11/13/11	0.0881	U	0.451	3.62	U	12.6	0.005	U	0.0358			
Sediment - 11	J1M6V3	11/13/11	0.2	U	0.449	5.33	U	13.6	0.009	U	0.0419			
Sediment - 12	J1M6V4	11/13/11	0.112	U	0.447	-0.47	U	12.7	0.024	U	0.0398			
Duplicate	J1M6V5	11/13/11	0.0892	U	0.451	5.96	U	12.6	0.013	U	0.0227			
Concrete	J1M646	11/16/11	0.508	U	0.492	-3.78	U	15.1	0.026	U	0.0826			

Table E-2. 100-D-65 Shoreline Segment Inorganic Sample Results - Inorganics. (3 Pages)

Sample Description - Map Location	Sample Number	Sample Date	Aluminum		Antimony		Arsenic		Barium		Beryllium		Boron						
			mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	PQL						
Sediment - 1	J1M6T3	11/13/11	7970		1.5	0.4	B	0.38	4.9	0.66	89.2	0.076	0.68	0.033	1.5	B	0.97		
Sediment - 2	J1M6T4	11/13/11	9220		1.6	0.96	B	0.4	11	0.7	107	0.081	0.85	0.035	3.6		1		
Sediment - 3	J1M6T5	11/13/11	8500		1.6	0.38	B	0.38	5.8	0.66	93.3	0.077	0.75	0.033	1.6	B	0.99		
Sediment - 4	J1M6T6	11/13/11	9420		1.7	0.42	B	0.42	5.2	0.73	104	0.084	0.87	0.036	1.3	B	1.1		
Sediment - 5	J1M6T7	11/13/11	7850		1.6	0.4	B	0.4	2.3	0.7	105	0.081	0.62	0.035	1	U	1		
Sediment - 6	J1M6T8	11/13/11	8290		1.6	0.5	B	0.4	6.3	0.7	88	0.081	0.68	0.035	1.8	B	1		
Sediment - 7	J1M6T9	11/13/11	8830		1.5	0.38	B	0.37	5.7	0.65	99.7	0.075	0.66	0.032	1.5	B	0.96		
Sediment - 8	J1M6V0	11/13/11	9320		1.7	0.54	B	0.42	7.7	0.73	101	0.084	0.84	0.036	2.4		1.1		
Sediment - 9	J1M6V1	11/13/11	7880		1.5	0.37	B	0.37	2.8	0.65	94.9	0.075	0.59	0.032	0.96	U	0.96		
Sediment - 10	J1M6V2	11/13/11	7830		1.7	0.42	B	0.42	3.6	0.73	82.6	0.084	0.61	0.036	1.1	U	1.1		
Sediment - 11	J1M6V3	11/13/11	8840		1.5	1.2	B	0.37	11.7	0.65	163	0.075	1.2	0.016	3.2		0.96		
Sediment - 12	J1M6V4	11/13/11	7940		1.6	0.39	B	0.39	3.5	0.68	83.2	0.078	0.86	0.034	1	U	1		
Duplicate (J1M6T7)	J1M6V5	11/13/11	8280		1.5	0.36	B	0.36	2	0.63	92.9	0.072	0.55	0.031	0.93	U	0.93		
Concrete	J1MM46	11/16/11	9330		1.3	5.2	B	0.33	33.3	0.57	101	X	0.065	0.16	B	0.028	14.2	0.84	
Equipment Blank	J1M6V7	11/13/11	232		1.4	0.36	B	0.36	0.62	U	0.62	2.1	0.071	0.031	U	0.031	0.92	U	0.92
Sample Description - Map Location	Sample Number	Sample Date	Cadmium		Calcium		Chromium		Cobalt		Copper		Hexavalent Chromium						
			mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	mg/kg	Q	PQL				
Sediment - 1	J1M6T3	11/13/11	0.17	B	0.041	9720	X	14	21.1	X	0.058	7.6	X	0.099	18	0.22	0.6	0.155	
Sediment - 2	J1M6T4	11/13/11	0.16	B	0.043	20700	X	14.9	17.9	X	0.061	8.1	X	0.11	25.1	0.23	0.384	0.155	
Sediment - 3	J1M6T5	11/13/11	0.17	B	0.041	11200	X	14.2	19.7	X	0.058	7.6	X	0.1	21.3	0.22	0.155	0.155	
Sediment - 4	J1M6T6	11/13/11	0.58	B	0.045	5250	X	15.5	44.2	X	0.064	10.9	X	0.11	21.4	0.24	0.953	0.155	
Sediment - 5	J1M6T7	11/13/11	0.065	B	0.043	2620	X	14.9	17.5	X	0.061	6.7	X	0.11	20.1	0.23	0.155	U	0.155
Sediment - 6	J1M6T8	11/13/11	0.17	B	0.044	10600	X	15	18.4	X	0.062	7.5	X	0.11	20.3	0.23	0.242	0.155	
Sediment - 7	J1M6T9	11/13/11	0.081	B	0.04	11100	X	13.8	13	X	0.057	8.3	X	0.098	21.3	0.21	0.155	U	0.155
Sediment - 8	J1M6V0	11/13/11	0.21	B	0.045	15700	X	15.5	16	X	0.064	8.6	X	0.11	24.1	0.24	0.155	U	0.155
Sediment - 9	J1M6V1	11/13/11	0.062	B	0.04	2760	X	13.9	14.1	X	0.057	5.9	X	0.098	19	0.21	0.182	U	0.155
Sediment - 10	J1M6V2	11/13/11	0.095	B	0.045	5160	X	15.5	12.7	X	0.064	6.1	X	0.11	17.3	0.24	0.155	U	0.155
Sediment - 11	J1M6V3	11/13/11	0.22	B	0.04	20100	X	13.8	15.8	X	0.057	9	X	0.49	30.2	1.1	0.155	U	0.155
Sediment - 12	J1M6V4	11/13/11	0.37	B	0.042	5650	X	14.5	24.9	X	0.06	8.8	X	0.1	18	0.22	0.415	0.155	
Duplicate (J1M6T7)	J1M6V5	11/13/11	0.071	B	0.039	2740	X	13.4	16.2	X	0.055	7.3	X	0.095	19.8	0.21	0.155	U	0.155
Concrete	J1MM46	11/16/11	0.035	U	0.035	76000	X	12.1	11	X	0.05	7.4	X	0.086	33.3	X	0.19	1.5	0.155
Equipment Blank	J1M6V7	11/13/11	0.038	U	0.038	46.9	X	13.2	0.14	B	0.054	0.094	B	0.093	0.2	U	0.2		

Table E-2. 100-D-65 Shoreline Segment Inorganic Sample Results - Inorganics. (3 Pages)

Sample Description - Map Location	Sample 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			
Sediment - 1	JIM6T3	11/13/11	18500	X	3.8	7.9	0.27	4450	3.7	273	X	0.099	0.029	0.006	0.27	B	0.26		
Sediment - 2	JIM6T4	11/13/11	19600	X	4	8	0.29	4160	3.9	297	X	0.11	0.011	B	0.007	0.8	B	0.28	
Sediment - 3	JIM6T5	11/13/11	18300	X	3.8	7.2	0.27	4230	3.7	290	X	0.1	0.095	B	0.008	0.3	B	0.26	
Sediment - 4	JIM6T6	11/13/11	25700	X	4.2	11	0.3	5970	4.1	639	X	0.11	0.011	B	0.006	0.29	U	0.29	
Sediment - 5	JIM6T7	11/13/11	15100	X	4	3.7	0.29	3290	3.9	271	X	0.11	0.068	U	0.007	0.28	U	0.28	
Sediment - 6	JIM6T8	11/13/11	18000	X	4	6.8	0.29	4070	3.9	276	X	0.11	0.077	B	0.005	0.32	B	0.28	
Sediment - 7	JIM6T9	11/13/11	16500	X	3.7	4.7	0.26	3840	3.6	324	X	0.098	0.062	U	0.006	0.33	B	0.25	
Sediment - 8	JIM6V0	11/13/11	20400	X	4.2	6.8	0.3	4570	4.1	370	X	0.11	0.011	B	0.007	0.48	B	0.29	
Sediment - 9	JIM6V1	11/13/11	15300	X	3.7	3	0.27	3270	3.6	242	X	0.098	0.082	B	0.006	0.26	U	0.26	
Sediment - 10	JIM6V2	11/13/11	15100	X	4.2	4.8	0.3	4430	4.1	238	X	0.11	0.061	U	0.006	0.29	U	0.29	
Sediment - 11	JIM6V3	11/13/11	20600	X	3.7	9.9	1.3	4530	3.6	297	X	0.098	0.055	U	0.006	0.75	B	0.25	
Sediment - 12	JIM6V4	11/13/11	22500	X	3.9	8.2	0.28	4290	3.8	297	X	0.1	0.013	B	0.006	0.27	U	0.27	
Duplicate (JIM6T7)	JIM6V5	11/13/11	15500	X	3.6	3.4	0.26	4170	3.5	263	X	0.095	0.057	U	0.006	0.25	U	0.25	
Concrete	JIMM46	11/16/11	14300	X	3.3	13.5	X	0.23	4940	X	3.2	236	X	0.086	0.067	U	0.007	2.1	0.22
Equipment Blank	JIM6V7	11/13/11	277	X	3.6	0.41	B	0.25	24.8	3.5	5.5	X	0.093	0.0056	U	0.006	0.24	U	0.24
Sample Description - Map Location	Sample Number	Sample Date	Nickel		Potassium		Selenium		Silicon		Silver		Sodium		Sodium				
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL		
Sediment - 1	JIM6T3	11/13/11	12.3	X	0.12	962	40.8	0.85	313	N	5.6	0.16	U	0.16	262	58.7			
Sediment - 2	JIM6T4	11/13/11	11.8	X	0.13	793	43.5	0.91	268	6	0.17	U	0.17	426	62.5				
Sediment - 3	JIM6T5	11/13/11	12.4	X	0.12	674	41.3	0.87	358	5.7	0.16	U	0.16	350	59.4				
Sediment - 4	JIM6T6	11/13/11	21.9	X	0.14	730	45.1	0.95	301	6.2	0.18	U	0.18	304	65				
Sediment - 5	JIM6T7	11/13/11	13	X	0.13	674	43.5	0.91	180	6	0.17	U	0.17	149	62.5				
Sediment - 6	JIM6T8	11/13/11	11.5	X	0.13	875	43.6	0.91	402	6	0.17	U	0.17	272	62.7				
Sediment - 7	JIM6T9	11/13/11	17.1	X	0.12	573	40.2	0.84	347	5.6	0.16	U	0.16	272	57.9				
Sediment - 8	JIM6V0	11/13/11	11	X	0.14	605	45.1	0.95	374	6.2	0.18	U	0.18	437	65				
Sediment - 9	JIM6V1	11/13/11	12.5	X	0.12	481	40.4	0.85	187	5.6	0.16	U	0.16	155	58.1				
Sediment - 10	JIM6V2	11/13/11	11.5	X	0.14	553	45.1	0.95	271	6.2	0.18	U	0.18	255	64.9				
Sediment - 11	JIM6V3	11/13/11	9.9	X	0.12	609	40.2	0.84	253	5.6	0.16	U	0.16	430	57.9				
Sediment - 12	JIM6V4	11/13/11	11.9	X	0.13	928	42.3	0.89	305	5.8	0.16	U	0.16	256	60.8				
Duplicate (JIM6T7)	JIM6V5	11/13/11	16.1	X	0.12	630	38.9	0.82	177	5.4	0.15	U	0.15	170	56				
Concrete	JIMM46	11/16/11	9.1	X	0.11	760	35.3	0.74	175	4.9	0.14	U	0.14	401	M	50.8			
Equipment Blank	JIM6V7	11/13/11	0.11	UX	0.11	54	B	38.3	0.8	0.8	157	5.3	0.15	U	55.1	U	55.1		

Table E-2. 100-D-65 Shoreline Segment Inorganic Sample Results - Inorganics. (3 Pages)

Sample Description - Map Location	Sample Number	Sample Date	Vanadium			Zinc			Bromide			Chloride			Fluoride			Nitrogen in NO ₃		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Sediment - 1	J1M6T3	11/13/11	42.8	X	0.093	63.3	X	0.4	0.42	U	0.42	2.1	U	2.1	1.4	BN	0.88	1.8	B	0.34
Sediment - 2	J1M6T4	11/13/11	53.1	X	0.1	87.4	X	0.42	0.42	U	0.42	2.1	U	2.1	1.8	B	0.88	0.41	B	0.34
Sediment - 3	J1M6T5	11/13/11	44.5	X	0.095	66.3	X	0.4	0.41	U	0.41	2.1	U	2.1	1.7	B	0.86	0.36	B	0.33
Sediment - 4	J1M6T6	11/13/11	60	X	0.1	95.9	X	0.44	0.44	U	0.44	2.2	U	2.2	0.93	U	0.93	0.61	B	0.36
Sediment - 5	J1M6T7	11/13/11	30	X	0.1	30.6	X	0.42	0.41	U	0.41	2.1	U	2.1	0.87	U	0.87	0.34	B	0.33
Sediment - 6	J1M6T8	11/13/11	43.9	X	0.1	64.1	X	0.42	0.44	U	0.44	2.2	U	2.2	3.4	B	0.93	0.42	B	0.35
Sediment - 7	J1M6T9	11/13/11	37.9	X	0.092	48.2	X	0.39	0.42	U	0.42	2.1	U	2.1	0.89	U	0.89	0.34	U	0.34
Sediment - 8	J1M6V0	11/13/11	61	X	0.1	73.9	X	0.44	0.42	U	0.42	2.1	U	2.1	1.3	B	0.89	0.34	U	0.34
Sediment - 9	J1M6V1	11/13/11	37.9	X	0.093	30.2	X	0.39	0.41	U	0.41	2.1	U	2.1	0.86	U	0.86	0.53	B	0.33
Sediment - 10	J1M6V2	11/13/11	42.6	X	0.1	41.6	X	0.44	0.43	U	0.43	2.2	U	2.2	0.91	U	0.91	0.64	B	0.35
Sediment - 11	J1M6V3	11/13/11	64.3	X	0.46	96.1	X	0.39	0.43	U	0.43	2.2	U	2.2	1.9	B	0.92	0.48	B	0.35
Sediment - 12	J1M6V4	11/13/11	58.2	X	0.097	74.9	X	0.41	0.42	U	0.42	2.1	U	2.1	1	B	0.89	0.64	B	0.34
Duplicate (J1M6T7)	J1M6V5	11/13/11	36.1	X	0.089	35.5	X	0.38	0.4	U	0.4	2.1	U	2.1	0.86	U	0.86	0.33	U	0.33
Concrete	J1MM46	11/16/11	38.7	0.081	218	X	0.34	0.37	0.4	U	0.4	2	U	2	2.2	BN	0.84	0.32	U	0.32
Equipment Blank	J1M6V7	11/13/11	0.32	BX	0.088	1.3	X	0.37	0.4	U	0.4	2	U	2	2.2	BN	0.84	0.32	U	0.32

Sample Description - Map Location	Sample Number	Sample Date	Nitrogen in NO ₂			Nitrogen in NO ₂ /NO ₃			Phosphorous in Phosphate			Sulfate			pH		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	Units	Q	PQL
Sediment - 1	J1M6T3	11/13/11	0.36	U	0.36	1.7	U	0.34	1.3	U	1.3	20.3	1.9	10.3	0.01		
Sediment - 2	J1M6T4	11/13/11	0.36	U	0.36	0.34	U	0.34	1.3	U	1.3	73.5	1.9	11.4	0.01		
Sediment - 3	J1M6T5	11/13/11	0.35	U	0.35	0.34	U	0.34	1.3	U	1.3	57.1	1.8	11.2	0.01		
Sediment - 4	J1M6T6	11/13/11	0.38	U	0.38	0.35	U	0.35	1.4	U	1.4	2.9	B	2	9.01	0.01	
Sediment - 5	J1M6T7	11/13/11	0.36	U	0.36	0.32	U	0.32	1.3	U	1.3	1.8	U	1.8	8.84	0.01	
Sediment - 6	J1M6T8	11/13/11	0.38	U	0.38	0.33	U	0.33	1.4	U	1.4	2.7		1.9	10.6	0.01	
Sediment - 7	J1M6T9	11/13/11	0.37	U	0.37	0.34	U	0.34	1.3	U	1.3	29.4	1.9	10.8	0.01		
Sediment - 8	J1M6V0	11/13/11	0.36	U	0.36	0.33	U	0.33	1.3	U	1.3	46.4	1.9	11.3	0.01		
Sediment - 9	J1M6V1	11/13/11	0.35	U	0.35	0.33	U	0.33	1.3	U	1.3	2.4	B	1.8	9.93	0.01	
Sediment - 10	J1M6V2	11/13/11	0.37	U	0.37	0.34	U	0.34	1.4	U	1.4	21.3		1.9	10.1	0.01	
Sediment - 11	J1M6V3	11/13/11	0.37	U	0.37	0.34	U	0.34	1.4	U	1.4	94.2		1.9	11.2	0.01	
Sediment - 12	J1M6V4	11/13/11	0.36	U	0.36	0.33	U	0.33	1.3	U	1.3	19.1		1.9	10.9	0.01	
Duplicate (J1M6T7)	J1M6V5	11/13/11	0.35	U	0.35	0.31	U	0.31	1.3	U	1.3	1.8	U	1.8	9.31	0.01	
Concrete	J1MM46	11/16/11															
Equipment Blank	J1M6V7	11/13/11	0.34	U	0.34	0.48	B	0.3	1.3	U	1.3	27		1.8	11.8	0.01	

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6T3 (1)			J1M6T4 (2)			J1M6T5 (3)			J1M6T6 (4)		
	11/13/2011			11/13/2011			11/13/2011			11/13/2011		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
PAHs												
Acenaphthene	24	JX	11	11	U	11	10	U	10	12	U	12
Acenaphthylene	9.5	U	9.5	9.6	U	9.6	9.2	U	9.2	10	U	10
Anthracene	3.2	U	3.2	3.2	U	3.2	3.1	U	3.1	3.5	U	3.5
Benzo(a)anthracene	3.4	U	3.4	3.4	U	3.4	3.3	U	3.3	3.7	U	3.7
Benzo(a)pyrene	6.8	U	6.8	6.8	U	6.8	6.6	U	6.6	7.4	U	7.4
Benzo(b)fluoranthene	4.5	U	4.5	4.5	U	4.5	4.3	U	4.3	4.9	U	4.9
Benzo(ghi)perylene	7.6	U	7.6	7.7	U	7.7	7.4	U	7.4	8.3	U	8.3
Benzo(k)fluoranthene	4.2	U	4.2	4.2	U	4.2	4	U	4	4.6	U	4.6
Chrysene	5.1	U	5.1	5.1	U	5.1	5	U	5	5.6	U	5.6
Dibenz[a,h]anthracene	12	U	12	12	U	12	11	U	11	13	U	13
Fluoranthene	14	U	14	14	U	14	13	U	13	15	U	15
Fluorene	5.6	U	5.6	5.6	U	5.6	5.4	U	5.4	6.1	U	6.1
Indeno(1,2,3-cd)pyrene	13	U	13	13	U	13	12	U	12	14	U	14
Naphthalene	13	U	13	13	U	13	12	U	12	14	U	14
Phenanthrene	13	U	13	13	U	13	12	U	12	14	U	14
Pyrene	13	U	13	13	U	13	12	U	12	14	U	14
PCBs												
Aroclor-1016	3	U	3	2.9	U	2.9	3	U	3	3.1	U	3.1
Aroclor-1221	8.8	U	8.8	8.4	U	8.4	8.7	U	8.7	9.1	U	9.1
Aroclor-1232	2.2	U	2.2	2.1	U	2.1	2.2	U	2.2	2.3	U	2.3
Aroclor-1242	5.1	U	5.1	4.9	U	4.9	5.1	U	5.1	5.3	U	5.3
Aroclor-1248	5.1	U	5.1	4.9	U	4.9	5.1	U	5.1	5.3	U	5.3
Aroclor-1254	2.9	U	2.9	2.7	U	2.7	2.8	U	2.8	2.9	U	2.9
Aroclor-1260	2.9	U	2.9	2.7	U	2.7	2.8	U	2.8	2.9	U	2.9
Pesticides												
Aldrin	0.27	U	0.27	0.28	U	0.28	0.26	U	0.26	0.27	U	0.27
Alpha-BHC	0.23	U	0.23	0.24	U	0.24	0.22	U	0.22	0.23	U	0.23
alpha-Chlordane	0.35	U	0.35	0.36	U	0.36	0.33	U	0.33	0.35	U	0.35
beta-1,2,3,4,5,6-Hexachlorocyclohexane	0.72	U	0.72	0.73	U	0.73	0.69	U	0.69	0.71	U	0.71
Delta-BHC	0.43	U	0.43	0.44	U	0.44	0.41	U	0.41	0.43	U	0.43
Dichlorodiphenyldichloroethane	0.59	U	0.59	0.6	U	0.6	0.56	U	0.56	0.58	U	0.58
Dichlorodiphenyldichloroethylene	0.33	JX	0.26	0.26	U	0.26	0.25	U	0.25	0.25	U	0.25
Dichlorodiphenyltrichloroethane	0.64	U	0.64	0.65	U	0.65	0.61	U	0.61	0.63	U	0.63
Dieeldrin	0.23	U	0.23	0.23	U	0.23	0.22	U	0.22	0.22	U	0.22
Endosulfan I	0.19	U	0.19	0.19	U	0.19	0.18	U	0.18	0.19	U	0.19
Endosulfan II	0.31	U	0.31	0.32	U	0.32	0.3	U	0.3	0.31	U	0.31
Endosulfan sulfate	0.3	U	0.3	0.31	U	0.31	0.28	U	0.28	0.3	U	0.3
Endrin	0.33	U	0.33	0.34	U	0.34	0.32	U	0.32	0.33	U	0.33
Endrin aldehyde	0.18	U	0.18	0.19	U	0.19	0.18	U	0.18	0.18	U	0.18
Endrin ketone	0.53	U	0.53	0.54	U	0.54	0.5	U	0.5	0.52	U	0.52
Gamma-BHC (Lindane)	0.5	U	0.5	0.51	U	0.51	0.48	U	0.48	0.5	U	0.5
gamma-Chlordane	0.29	U	0.29	0.29	U	0.29	0.27	U	0.27	0.28	U	0.28
Heptachlor	0.23	U	0.23	0.24	U	0.24	0.22	U	0.22	0.23	U	0.23
Heptachlor epoxide	0.46	U	0.46	0.47	U	0.47	0.44	U	0.44	0.46	U	0.46
Methoxychlor	0.49	U	0.49	0.5	U	0.5	0.46	U	0.46	0.48	U	0.48
Toxaphene	17	U	17	17	U	17	16	U	16	17	U	17

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6T3 (1)			J1M6T4 (2)			J1M6T5 (3)			J1M6T6 (4)		
	11/13/2011			11/13/2011			11/13/2011			11/13/2011		
	µg/kg	Q	PQL									
SVOAs												
1,2,4-Trichlorobenzene	29	U	29	31	U	31	31	U	31	32	U	32
1,2-Dichlorobenzene	23	U	23	24	U	24	24	U	24	25	U	25
1,3-Dichlorobenzene	12	U	12	13	U	13	13	U	13	14	U	14
1,4-Dichlorobenzene	14	U	14	15	U	15	15	U	15	16	U	16
2,4,5-Trichlorophenol	10	U	10	11	U	11	11	U	11	12	U	12
2,4,6-Trichlorophenol	10	U	10	11	U	11	11	U	11	12	U	12
2,4-Dichlorophenol	10	U	10	11	U	11	11	U	11	12	U	12
2,4-Dimethylphenol	68	U	68	72	U	72	72	U	72	76	U	76
2,4-Dinitrophenol	350	U	350	370	U	370	360	U	360	380	U	380
2,4-Dinitrotoluene	68	U	68	72	U	72	72	U	72	76	U	76
2,6-Dinitrotoluene	29	U	29	31	U	31	31	U	31	32	U	32
2-Chloronaphthalene	10	U	10	11	U	11	11	U	11	12	U	12
2-Chlorophenol	22	U	22	23	U	23	23	U	23	24	U	24
2-Methylnaphthalene	20	U	20	21	U	21	21	U	21	22	U	22
2-Methylphenol (cresol, o-)	13	U	13	14	U	14	14	U	14	15	U	15
2-Nitroaniline	52	U	52	55	U	55	55	U	55	58	U	58
2-Nitrophenol	10	U	10	11	U	11	11	U	11	12	U	12
3+4 Methylphenol (cresol, m+p)	34	U	34	36	U	36	36	U	36	38	U	38
3,3'-Dichlorobenzidine	93	U	93	99	U	99	98	U	98	100	U	100
3-Nitroaniline	76	U	76	80	U	80	80	U	80	84	U	84
4,6-Dinitro-2-methylphenol	340	U	340	360	U	360	360	U	360	380	U	380
4-Bromophenylphenyl ether	20	U	20	21	U	21	21	U	21	22	U	22
4-Chloro-3-methylphenol	68	U	68	72	U	72	72	U	72	76	U	76
4-Chloroaniline	85	U	85	90	U	90	89	U	89	94	U	94
4-Chlorophenylphenyl ether	22	U	22	23	U	23	23	U	23	24	U	24
4-Nitroaniline	75	U	75	80	U	80	79	U	79	84	U	84
4-Nitrophenol	100	U	100	110	U	110	110	U	110	110	U	110
Acenaphthene	11	U	11	11	U	11	11	U	11	12	U	12
Acenaphthylene	18	U	18	19	U	19	19	U	19	20	U	20
Anthracene	18	U	18	19	U	19	19	U	19	20	U	20
Benzo(a)anthracene	21	U	21	22	U	22	22	U	22	23	U	23
Benzo(a)pyrene	21	U	21	22	U	22	22	U	22	23	U	23
Benzo(b)fluoranthene	27	U	27	29	U	29	29	U	29	30	U	30
Benzo(ghi)perylene	17	U	17	18	U	18	17	U	17	18	U	18
Benzo(k)fluoranthene	42	U	42	44	U	44	44	U	44	46	U	46
Bis(2-chloro-1-methylethyl)ether	24	U	24	25	U	25	25	U	25	26	U	26
Bis(2-Chloroethoxy)methane	24	U	24	25	U	25	25	U	25	26	U	26
Bis(2-chloroethyl) ether	17	U	17	18	U	18	18	U	18	19	U	19
Bis(2-ethylhexyl) phthalate	48	U	48	51	U	51	50	U	50	53	U	53
Butylbenzylphthalate	45	U	45	47	U	47	47	U	47	50	U	50
Carbazole	37	U	37	40	U	40	39	U	39	41	U	41
Chrysene	28	U	28	30	U	30	29	U	29	31	U	31
Di-n-butylphthalate	30	U	30	32	U	32	32	U	32	33	U	33
Di-n-octylphthalate	15	U	15	16	U	16	16	U	16	17	U	17
Dibenz[a,h]anthracene	20	U	20	21	U	21	21	U	21	22	U	22
Dibenzofuran	21	U	21	22	U	22	22	U	22	23	U	23

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6T3 (1)			J1M6T4 (2)			J1M6T5 (3)			J1M6T6 (4)		
	11/13/2011			11/13/2011			11/13/2011			11/13/2011		
	µg/kg	Q	PQL									
Diethyl phthalate	27	U	27	29	U	29	28	U	28	30	U	30
Dimethyl phthalate	61	J	24	220	J	25	170	J	25	110	J	26
Fluoranthene	37	U	37	40	U	40	39	U	39	41	U	41
Fluorene	19	U	19	20	U	20	20	U	20	21	U	21
Hexachlorobenzene	30	U	30	32	U	32	32	U	32	33	U	33
Hexachlorobutadiene	10	U	10	11	U	11	11	U	11	12	U	12
Hexachlorocyclopentadiene	52	U	52	55	U	55	55	U	55	58	U	58
Hexachloroethane	22	U	22	23	U	23	23	U	23	25	U	25
Indeno(1,2,3-cd)pyrene	23	U	23	24	U	24	24	U	24	25	U	25
Isophorone	18	U	18	19	U	19	19	U	19	20	U	20
N-Nitroso-di-n-dipropylamine	32	U	32	34	U	34	34	U	34	36	U	36
N-Nitrosodiphenylamine	22	U	22	23	U	23	23	U	23	24	U	24
Naphthalene	32	U	32	34	U	34	34	U	34	36	U	36
Nitrobenzene	23	U	23	24	U	24	24	U	24	25	U	25
Pentachlorophenol	340	U	340	360	U	360	360	U	360	380	U	380
Phenanthrene	18	U	18	19	U	19	19	U	19	20	U	20
Phenol	19	U	19	20	U	20	20	U	20	21	U	21
Pyrene	13	U	13	13	U	13	13	U	13	14	U	14

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6T7 (5)			J1M6T8 (6)			J1M6T9 (7)			J1M6V0 (8)		
	11/13/2011			11/13/2011			11/13/2011			11/13/2011		
	µg/kg	Q	PQL									
PAHs												
Acenaphthene	11	U	11	230	X	11	11	U	11	11	U	11
Acenaphthylene	9.6	U	9.6	10	U	10	9.7	U	9.7	9.5	U	9.5
Anthracene	3.2	U	3.2	3.4	U	3.4	3.3	U	3.3	3.2	U	3.2
Benzo(a)anthracene	3.4	U	3.4	3.6	U	3.6	3.4	U	3.4	3.4	U	3.4
Benzo(a)pyrene	6.8	U	6.8	7.2	U	7.2	6.9	U	6.9	6.8	U	6.8
Benzo(b)fluoranthene	4.5	U	4.5	4.7	U	4.7	4.5	U	4.5	4.4	U	4.4
Benzo(ghi)perylene	7.7	U	7.7	8.1	U	8.1	7.7	U	7.7	7.6	U	7.6
Benzo(k)fluoranthene	4.2	U	4.2	4.4	U	4.4	4.2	U	4.2	4.2	U	4.2
Chrysene	5.1	U	5.1	5.4	U	5.4	5.2	U	5.2	5.1	U	5.1
Dibenz[a,h]anthracene	12	U	12									
Fluoranthene	14	U	14	15	U	15	14	U	14	14	U	14
Fluorene	5.6	U	5.6	5.9	U	5.9	5.7	U	5.7	5.6	U	5.6
Indeno(1,2,3-cd)pyrene	13	U	13									
Naphthalene	13	U	13									
Phenanthrene	13	U	13									
Pyrene	13	U	13									
PCBs												
Aroclor-1016	2.9	U	2.9	3.1	U	3.1	2.9	U	2.9	3	U	3
Aroclor-1221	8.4	U	8.4	8.9	U	8.9	8.5	U	8.5	8.8	U	8.8
Aroclor-1232	2.1	U	2.1	2.2	U	2.2	2.1	U	2.1	2.2	U	2.2
Aroclor-1242	4.9	U	4.9	5.2	U	5.2	4.9	U	4.9	5.1	U	5.1
Aroclor-1248	4.9	U	4.9	5.2	U	5.2	4.9	U	4.9	5.1	U	5.1
Aroclor-1254	2.7	U	2.7	2.9	U	2.9	2.8	U	2.8	2.9	U	2.9
Aroclor-1260	2.7	U	2.7	2.9	U	2.9	2.8	U	2.8	2.9	U	2.9
Pesticides												
Aldrin	0.27	U	0.27	0.29	U	0.29	0.27	U	0.27	0.28	U	0.28
Alpha-BHC	0.23	U	0.23	0.24	U	0.24	0.23	U	0.23	0.24	U	0.24
alpha-Chlordane	0.34	U	0.34	0.37	U	0.37	0.35	U	0.35	0.36	U	0.36
beta-1,2,3,4,5,6-Hexachlorocyclohexane	0.7	U	0.7	0.76	U	0.76	0.72	U	0.72	0.74	U	0.74
Delta-BHC	0.42	U	0.42	0.46	U	0.46	0.44	U	0.44	0.45	U	0.45
Dichlorodiphenyldichloroethane	0.58	U	0.58	0.62	U	0.62	0.6	U	0.6	0.61	U	0.61
Dichlorodiphenyldichloroethylene	0.25	U	0.25	0.27	U	0.27	0.26	U	0.26	0.26	U	0.26
Dichlorodiphenyltrichloroethane	0.62	U	0.62	0.67	U	0.67	0.64	U	0.64	0.66	U	0.66
Dieledrin	0.22	U	0.22	0.24	U	0.24	0.23	U	0.23	0.23	U	0.23
Endosulfan I	0.19	U	0.19	0.2	U	0.2	0.19	U	0.19	0.2	U	0.2
Endosulfan II	0.3	U	0.3	0.33	U	0.33	0.31	U	0.31	0.32	U	0.32
Endosulfan sulfate	0.29	U	0.29	0.31	U	0.31	0.3	U	0.3	0.31	U	0.31
Endrin	0.32	U	0.32	0.35	U	0.35	0.33	U	0.33	0.34	U	0.34
Endrin aldehyde	0.18	U	0.18	0.2	U	0.2	0.19	U	0.19	0.19	U	0.19
Endrin ketone	0.52	U	0.52	0.56	U	0.56	0.53	U	0.53	0.54	U	0.54
Gamma-BHC (Lindane)	0.49	U	0.49	0.53	U	0.53	0.51	U	0.51	0.52	U	0.52
gamma-Chlordane	0.28	U	0.28	0.3	U	0.3	0.29	U	0.29	0.3	U	0.3
Heptachlor	0.23	U	0.23	0.24	U	0.24	0.23	U	0.23	0.24	U	0.24
Heptachlor epoxide	0.45	U	0.45	0.49	U	0.49	0.46	U	0.46	0.47	U	0.47
Methoxychlor	0.48	U	0.48	0.51	U	0.51	0.49	U	0.49	0.5	U	0.5
Toxaphene	17	U	17	18	U	18	17	U	17	18	U	18

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6T7 (5)			J1M6T8 (6)			J1M6T9 (7)			J1M6V0 (8)		
	11/13/2011			11/13/2011			11/13/2011			11/13/2011		
	µg/kg	Q	PQL									
	SVOAs											
1,2,4-Trichlorobenzene	29	U	29	30	U	30	29	U	29	30	U	30
1,2-Dichlorobenzene	23	U	23	24	U	24	23	U	23	24	U	24
1,3-Dichlorobenzene	13	U	13									
1,4-Dichlorobenzene	14	U	14	15	U	15	14	U	14	15	U	15
2,4,5-Trichlorophenol	10	U	10	11	U	11	10	U	10	11	U	11
2,4,6-Trichlorophenol	10	U	10	11	U	11	10	U	10	11	U	11
2,4-Dichlorophenol	10	U	10	11	U	11	10	U	10	11	U	11
2,4-Dimethylphenol	69	U	69	71	U	71	69	U	69	71	U	71
2,4-Dinitrophenol	350	U	350	360	U	360	350	U	350	360	U	360
2,4-Dinitrotoluene	69	U	69	71	U	71	69	U	69	71	U	71
2,6-Dinitrotoluene	29	U	29	30	U	30	29	U	29	30	U	30
2-Chloronaphthalene	10	U	10	11	U	11	10	U	10	11	U	11
2-Chlorophenol	22	U	22	23	U	23	22	U	22	22	U	22
2-Methylnaphthalene	20	U	20									
2-Methylphenol (cresol, o-)	14	U	14									
2-Nitroaniline	52	U	52	54	U	54	52	U	52	53	U	53
2-Nitrophenol	10	U	10	11	U	11	10	U	10	11	U	11
3+4 Methylphenol (cresol, m+p)	35	U	35	35	U	35	34	U	34	35	U	35
3,3'-Dichlorobenzidine	94	U	94	97	U	97	94	U	94	96	U	96
3-Nitroaniline	76	U	76	78	U	78	76	U	76	78	U	78
4,6-Dinitro-2-methylphenol	350	U	350	350	U	350	340	U	340	350	U	350
4-Bromophenylphenyl ether	20	U	20									
4-Chloro-3-methylphenol	69	U	69	71	U	71	69	U	69	71	U	71
4-Chloroaniline	86	U	86	88	U	88	85	U	85	88	U	88
4-Chlorophenylphenyl ether	22	U	22	23	U	23	22	U	22	22	U	22
4-Nitroaniline	76	U	76	78	U	78	76	U	76	78	U	78
4-Nitrophenol	100	U	100									
Acenaphthene	11	U	11									
Acenaphthylene	18	U	18									
Anthracene	18	U	18									
Benzo(a)anthracene	21	U	21									
Benzo(a)pyrene	21	U	21									
Benzo(b)fluoranthene	27	U	27	28	U	28	27	U	27	28	U	28
Benzo(ghi)perylene	17	U	17									
Benzo(k)fluoranthene	42	U	42	43	U	43	42	U	42	43	U	43
Bis(2-chloro-1-methylethyl)ether	24	U	24	25	U	25	24	U	24	25	U	25
Bis(2-Chloroethoxy)methane	24	U	24	25	U	25	24	U	24	25	U	25
Bis(2-chloroethyl) ether	17	U	17	18	U	18	17	U	17	18	U	18
Bis(2-ethylhexyl) phthalate	48	U	48	49	U	49	48	U	48	49	U	49
Butylbenzylphthalate	45	U	45	46	U	46	45	U	45	46	U	46
Carbazole	38	U	38	39	U	39	38	U	38	39	U	39
Chrysene	28	U	28	29	U	29	28	U	28	29	U	29
Di-n-butylphthalate	30	U	30	31	U	31	30	U	30	31	U	31
Di-n-octylphthalate	15	U	15									
Dibenz[a,h]anthracene	20	U	20									
Dibenzofuran	21	U	21									
Diethyl phthalate	27	U	27	28	U	28	27	U	27	28	U	28
Dimethyl phthalate	73	J	24	81	J	25	360		24	180	J	25
Fluoranthene	38	U	38	39	U	39	38	U	38	39	U	39

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6T7 (5)				J1M6T8 (6)				J1M6T9 (7)				J1M6V0 (8)			
	11/13/2011				11/13/2011				11/13/2011				11/13/2011			
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg
Fluorene	19	U	19	19	U	19	19	U	19	19	U	19	19	U	19	19
Hexachlorobenzene	30	U	30	31	U	31	30	U	30	30	U	30	31	U	31	31
Hexachlorobutadiene	10	U	10	11	U	11	10	U	10	11	U	11	11	U	11	11
Hexachlorocyclopentadiene	52	U	52	54	U	54	52	U	52	52	U	52	53	U	53	53
Hexachloroethane	22	U	22	23	U	23	22	U	22	22	U	22	23	U	23	23
Indeno(1,2,3-cd)pyrene	23	U	23	24	U	24	23	U	23	23	U	23	24	U	24	24
Isophorone	18	U	18	18	U	18	18	U	18	18	U	18	18	U	18	18
N-Nitroso-di-n-dipropylamine	32	U	32	33	U	33	32	U	32	32	U	32	33	U	33	33
N-Nitrosodiphenylamine	22	U	22	23	U	23	22	U	22	22	U	22	22	U	22	22
Naphthalene	32	U	32	33	U	33	32	U	32	32	U	32	33	U	33	33
Nitrobenzene	23	U	23	24	U	24	23	U	23	23	U	23	24	U	24	24
Pentachlorophenol	350	U	350	350	U	350	340	U	340	350	U	350	350	U	350	350
Phenanthrene	18	U	18	18	U	18	18	U	18	18	U	18	18	U	18	18
Phenol	19	U	19	19	U	19	19	U	19	19	U	19	19	U	19	19
Pyrene	13	U	13	13	U	13	13	U	13	13	U	13	13	U	13	13

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6V1 (9)			J1M6V2 (10)			J1M6V3 (11)			J1M6V4 (12)		
	11/13/2011			11/13/2011			11/13/2011			11/13/2011		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
	PAHs											
Acenaphthene	11	U	11	55	JX	11	11	U	11	22	JX	11
Acenaphthylene	9.6	U	9.6	9.8	U	9.8	9.8	U	9.8	10	U	10
Anthracene	3.3	U	3.3	3.3	U	3.3	3.3	U	3.3	8.3	J	3.4
Benzo(a)anthracene	3.4	U	3.4	3.5	U	3.5	3.5	U	3.5	5.9	JX	3.6
Benzo(a)pyrene	6.9	U	6.9	7	U	7	7	U	7	9.5	J	7.1
Benzo(b)fluoranthene	4.5	U	4.5	4.6	U	4.6	4.6	U	4.6	9.1	J	4.7
Benzo(ghi)perylene	7.7	U	7.7	7.9	U	7.9	7.8	U	7.8	8	U	8
Benzo(k)fluoranthene	4.2	U	4.2	4.3	U	4.3	4.3	U	4.3	8.9	J	4.4
Chrysene	5.2	U	5.2	5.3	U	5.3	5.3	U	5.3	9	J	5.4
Dibenz[a,h]anthracene	12	U	12	12	U	12	12	U	12	12	U	12
Fluoranthene	14	U	14	14	U	14	14	U	14	14	U	14
Fluorene	5.6	U	5.6	5.8	U	5.8	5.8	U	5.8	8.5	J	5.9
Indeno(1,2,3-cd)pyrene	13	U	13	13	U	13	13	U	13	13	U	13
Naphthalene	13	U	13	13	U	13	13	U	13	13	U	13
Phenanthrene	13	U	13	13	U	13	13	U	13	13	U	13
Pyrene	13	U	13	13	U	13	13	U	13	13	U	13
PCBs												
Aroclor-1016	2.9	U	2.9	3.1	U	3.1	3	U	3	3.1	U	3.1
Aroclor-1221	8.4	U	8.4	9	U	9	8.8	U	8.8	8.9	U	8.9
Aroclor-1232	2.1	U	2.1	2.2	U	2.2	2.2	U	2.2	2.2	U	2.2
Aroclor-1242	4.9	U	4.9	5.2	U	5.2	5.1	U	5.1	5.2	U	5.2
Aroclor-1248	4.9	U	4.9	5.2	U	5.2	5.1	U	5.1	5.2	U	5.2
Aroclor-1254	2.7	U	2.7	2.9	U	2.9	2.8	U	2.8	2.9	U	2.9
Aroclor-1260	2.7	U	2.7	2.9	U	2.9	2.8	U	2.8	2.9	U	2.9
Pesticides												
Aldrin	0.27	U	0.27	0.27	U	0.27	0.29	U	0.29	0.27	U	0.27
Alpha-BHC	0.23	U	0.23	0.23	U	0.23	0.24	U	0.24	0.23	U	0.23
alpha-Chlordane	0.34	U	0.34	0.34	U	0.34	0.37	U	0.37	0.35	U	0.35
beta-1,2,3,4,5,6-Hexachlorocyclohexane	0.7	U	0.7	0.71	U	0.71	0.76	U	0.76	0.72	U	0.72
Delta-BHC	0.42	U	0.42	0.43	U	0.43	0.46	U	0.46	0.43	U	0.43
Dichlorodiphenyldichloroethane	0.58	U	0.58	0.58	U	0.58	0.62	U	0.62	0.59	U	0.59
Dichlorodiphenyldichloroethylene	0.25	U	0.25	0.25	U	0.25	0.27	U	0.27	0.26	U	0.26
Dichlorodiphenyltrichloroethane	0.62	U	0.62	0.63	U	0.63	0.67	U	0.67	0.64	U	0.64
Dieldrin	0.22	U	0.22	0.22	U	0.22	0.24	U	0.24	0.23	U	0.23
Endosulfan I	0.19	U	0.19	0.19	U	0.19	0.2	U	0.2	0.19	U	0.19
Endosulfan II	0.3	U	0.3	0.31	U	0.31	0.33	U	0.33	0.31	U	0.31
Endosulfan sulfate	0.29	U	0.29	0.29	U	0.29	0.31	U	0.31	0.3	U	0.3
Endrin	0.32	U	0.32	0.33	U	0.33	0.35	U	0.35	0.33	U	0.33
Endrin aldehyde	0.18	U	0.18	0.18	U	0.18	0.19	U	0.19	0.18	U	0.18
Endrin ketone	0.52	U	0.52	0.52	U	0.52	0.56	U	0.56	0.53	U	0.53
Gamma-BHC (Lindane)	0.49	U	0.49	0.49	U	0.49	0.53	U	0.53	0.5	U	0.5
gamma-Chlordane	0.28	U	0.28	0.28	U	0.28	0.3	U	0.3	0.29	U	0.29
Heptachlor	0.23	U	0.23	0.23	U	0.23	0.24	U	0.24	0.23	U	0.23
Heptachlor epoxide	0.45	U	0.45	0.45	U	0.45	0.48	U	0.48	0.46	U	0.46
Methoxychlor	0.48	U	0.48	0.48	U	0.48	0.51	U	0.51	0.49	U	0.49
Toxaphene	17	U	17	17	U	17	18	U	18	17	U	17

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6V1 (9)			J1M6V2 (10)			J1M6V3 (11)			J1M6V4 (12)		
	11/13/2011			11/13/2011			11/13/2011			11/13/2011		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
SVOAs												
1,2,4-Trichlorobenzene	30	U	30	30	U	30	31	U	31	30	U	30
1,2-Dichlorobenzene	24	U	24	24	U	24	24	U	24	23	U	23
1,3-Dichlorobenzene	13	U	13	13	U	13	13	U	13	13	U	13
1,4-Dichlorobenzene	15	U	15	15	U	15	15	U	15	14	U	14
2,4,5-Trichlorophenol	11	U	11	11	U	11	11	U	11	11	U	11
2,4,6-Trichlorophenol	11	U	11	11	U	11	11	U	11	11	U	11
2,4-Dichlorophenol	11	U	11	11	U	11	11	U	11	11	U	11
2,4-Dimethylphenol	71	U	71	71	U	71	73	U	73	70	U	70
2,4-Dinitrophenol	360	U	360	360	U	360	370	U	370	350	U	350
2,4-Dinitrotoluene	71	U	71	71	U	71	73	U	73	70	U	70
2,6-Dinitrotoluene	30	U	30	30	U	30	31	U	31	30	U	30
2-Chloronaphthalene	11	U	11	11	U	11	11	U	11	11	U	11
2-Chlorophenol	23	U	23	23	U	23	23	U	23	22	U	22
2-Methylnaphthalene	20	U	20	20	U	20	21	U	21	20	U	20
2-Methylphenol (cresol, o-)	14	U	14	14	U	14	14	U	14	14	U	14
2-Nitroaniline	54	U	54	54	U	54	55	U	55	53	U	53
2-Nitrophenol	11	U	11	11	U	11	11	U	11	11	U	11
3+4 Methylphenol (cresol, m+p)	35	U	35	35	U	35	36	U	36	35	U	35
3,3'-Dichlorobenzidine	97	U	97	96	U	96	99	U	99	95	U	95
3-Nitroaniline	78	U	78	78	U	78	81	U	81	77	U	77
4,6-Dinitro-2-methylphenol	350	U	350	350	U	350	360	U	360	350	U	350
4-Bromophenylphenyl ether	20	U	20	20	U	20	21	U	21	20	U	20
4-Chloro-3-methylphenol	71	U	71	71	U	71	73	U	73	70	U	70
4-Chloroaniline	88	U	88	88	U	88	90	U	90	87	U	87
4-Chlorophenylphenyl ether	23	U	23	23	U	23	23	U	23	22	U	22
4-Nitroaniline	78	U	78	78	U	78	80	U	80	77	U	77
4-Nitrophenol	100	U	100	100	U	100	110	U	110	100	U	100
Acenaphthene	11	U	11	11	U	11	11	U	11	11	U	11
Acenaphthylene	18	U	18	18	U	18	19	U	19	18	U	18
Anthracene	18	U	18	18	U	18	19	U	19	18	U	18
Benzo(a)anthracene	21	U	21	21	U	21	22	U	22	21	U	21
Benzo(a)pyrene	21	U	21	21	U	21	22	U	22	21	U	21
Benzo(b)fluoranthene	28	U	28	28	U	28	29	U	29	28	U	28
Benzo(ghi)perylene	17	U	17	17	U	17	18	U	18	17	U	17
Benzo(k)fluoranthene	43	U	43	43	U	43	44	U	44	42	U	42
Bis(2-chloro-1-methylethyl)ether	25	U	25	25	U	25	25	U	25	24	U	24
Bis(2-Chlorooethoxy)methane	25	U	25	25	U	25	25	U	25	24	U	24
Bis(2-chloroethyl) ether	18	U	18	18	U	18	18	U	18	18	U	18
Bis(2-ethylhexyl) phthalate	49	U	49	49	U	49	51	U	51	49	U	49
Butylbenzylphthalate	46	U	46	46	U	46	47	U	47	46	U	46
Carbazole	39	U	39	39	U	39	40	U	40	38	U	38
Chrysene	29	U	29	29	U	29	30	U	30	29	U	29
Di-n-butylphthalate	31	U	31	31	U	31	32	U	32	31	U	31
Di-n-octylphthalate	15	U	15	15	U	15	16	U	16	15	U	15
Dibenz[a,h]anthracene	20	U	20	20	U	20	21	U	21	20	U	20
Dibenzofuran	21	U	21	21	U	21	22	U	22	21	U	21
Diethyl phthalate	28	U	28	28	U	28	29	U	29	28	U	28
Dimethyl phthalate	140	J	25	100	J	25	190	J	25	130	J	24
Fluoranthene	39	U	39	39	U	39	40	U	40	38	U	38
Fluorene	19	U	19	19	U	19	20	U	20	19	U	19

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6V1 (9)			J1M6V2 (10)			J1M6V3 (11)			J1M6V4 (12)		
	11/13/2011			11/13/2011			11/13/2011			11/13/2011		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Hexachlorobenzene	31	U	31	31	U	31	32	U	32	31	U	31
Hexachlorobutadiene	11	U	11	11	U	11	11	U	11	11	U	11
Hexachlorocyclopentadiene	54	U	54	54	U	54	55	U	55	53	U	53
Hexachloroethane	23	U	23	23	U	23	24	U	24	23	U	23
Indeno(1,2,3-cd)pyrene	24	U	24	24	U	24	24	U	24	23	U	23
Isophorone	18	U	18	18	U	18	19	U	19	18	U	18
N-Nitroso-di-n-dipropylamine	33	U	33	33	U	33	34	U	34	33	U	33
N-Nitrosodiphenylamine	23	U	23	23	U	23	23	U	23	22	U	22
Naphthalene	33	U	33	33	U	33	34	U	34	33	U	33
Nitrobenzene	24	U	24	24	U	24	24	U	24	23	U	23
Pentachlorophenol	350	U	350	350	U	350	360	U	360	350	U	350
Phenanthrene	18	U	18	24	J	18	19	U	19	18	U	18
Phenol	19	U	19	19	U	19	20	U	20	19	U	19
Pyrene	13	U	13	28	J	13	13	U	13	13	U	13

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent				J1MM46 (Concrete)		
	J1M6V5 (5)			11/13/2011		
	11/13/2011			11/13/2011		
	µg/kg	Q	PQL	µg/kg	Q	PQL
PAHs						
Acenaphthene	10	U	10	9.8	U	9.8
Acenaphthylene	9.4	U	9.4	8.9	U	8.9
Anthracene	3.2	U	3.2	3	U	3
Benzo(a)anthracene	3.3	U	3.3	3.1	U	3.1
Benzo(a)pyrene	6.7	U	6.7	6.3	U	6.3
Benzo(b)fluoranthene	4.4	U	4.4	4.1	U	4.1
Benzo(ghi)perylene	7.5	U	7.5	7.1	U	7.1
Benzo(k)fluoranthene	4.1	U	4.1	3.9	U	3.9
Chrysene	5	U	5	4.8	U	4.8
Dibenz[a,h]anthracene	11	U	11	11	U	11
Fluoranthene	14	U	14	13	U	13
Fluorene	5.5	U	5.5	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	13	U	13	12	U	12
Naphthalene	13	U	13	12	U	12
Phenanthrene	13	U	13	12	U	12
Pyrene	13	U	13	12	U	12
PCBs						
Aroclor-1016	2.9	U	2.9	2.8	U	2.8
Aroclor-1221	8.3	U	8.3	8.2	U	8.2
Aroclor-1232	2.1	U	2.1	2	U	2
Aroclor-1242	4.8	U	4.8	4.8	U	4.8
Aroclor-1248	4.8	U	4.8	4.8	U	4.8
Aroclor-1254	2.7	U	2.7	2.7	U	2.7
Aroclor-1260	2.7	U	2.7	2.7	U	2.7
Pesticides						
Aldrin	0.27	U	0.27	0.26	U	0.26
Alpha-BHC	0.23	U	0.23	0.22	U	0.22
alpha-Chlordane	0.34	U	0.34	0.33	U	0.33
beta-1,2,3,4,5,6-Hexachlorocyclohexane	0.71	U	0.71	0.68	U	0.68
Delta-BHC	0.43	U	0.43	0.41	U	0.41
Dichlorodiphenyldichloroethane	0.58	U	0.58	0.56	U	0.56
Dichlorodiphenyldichloroethylene	0.25	U	0.25	0.25	U	0.25
Dichlorodiphenyltrichloroethane	0.63	U	0.63	0.61	U	0.61
Die�drin	0.22	U	0.22	0.22	U	0.22
Endosulfan I	0.19	U	0.19	0.18	U	0.18
Endosulfan II	0.3	U	0.3	0.3	U	0.3
Endosulfan sulfate	0.29	U	0.29	0.28	U	0.28
Endrin	0.33	U	0.33	0.32	U	0.32
Endrin aldehyde	0.18	U	0.18	0.18	U	0.18
Endrin ketone	0.52	U	0.52	0.5	U	0.5
Gamma-BHC (Lindane)	0.49	U	0.49	0.48	U	0.48
gamma-Chlordane	0.28	U	0.28	0.27	U	0.27
Heptachlor	0.23	U	0.23	0.22	U	0.22
Heptachlor epoxide	0.45	U	0.45	0.44	U	0.44
Methoxychlor	0.48	U	0.48	0.46	U	0.46
Toxaphene	17	U	17	16	U	16

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1MM46 (Concrete)					
	J1M6V5 (5)			11/13/2011		
	11/13/2011		11/13/2011			
	µg/kg	Q	PQL	µg/kg	Q	PQL
SVOAs						
1,2,4-Trichlorobenzene	28	U	28	28	U	28
1,2-Dichlorobenzene	22	U	22	22	U	22
1,3-Dichlorobenzene	12	U	12	12	U	12
1,4-Dichlorobenzene	14	U	14	14	U	14
2,4,5-Trichlorophenol	9.9	U	9.9	10	U	10
2,4,6-Trichlorophenol	9.9	U	9.9	10	U	10
2,4-Dichlorophenol	9.9	U	9.9	10	U	10
2,4-Dimethylphenol	66	U	66	66	U	66
2,4-Dinitrophenol	330	U	330	340	U	340
2,4-Dinitrotoluene	66	U	66	66	U	66
2,6-Dinitrotoluene	28	U	28	28	U	28
2-Chloronaphthalene	9.9	U	9.9	10	U	10
2-Chlorophenol	21	U	21	21	U	21
2-Methylnaphthalene	19	U	19	19	U	19
2-Methylphenol (cresol, o-)	13	U	13	13	U	13
2-Nitroaniline	50	U	50	50	U	50
2-Nitrophenol	9.9	U	9.9	10	U	10
3+4 Methylphenol (cresol, m+p)	33	U	33	33	U	33
3,3'-Dichlorobenzidine	89	U	89	91	U	91
3-Nitroaniline	73	U	73	74	U	74
4,6-Dinitro-2-methylphenol	330	U	330	330	U	330
4-Bromophenylphenyl ether	19	U	19	19	U	19
4-Chloro-3-methylphenol	66	U	66	66	U	66
4-Chloroaniline	81	U	81	82	U	82
4-Chlorophenylphenyl ether	21	U	21	21	U	21
4-Nitroaniline	72	U	72	73	U	73
4-Nitrophenol	96	U	96	98	U	98
Acenaphthene	10	U	10	10	U	10
Acenaphthylene	17	U	17	17	U	17
Anthracene	17	U	17	17	U	17
Benzo(a)anthracene	20	U	20	20	U	20
Benzo(a)pyrene	20	U	20	20	U	20
Benzo(b)fluoranthene	26	U	26	26	U	26
Benzo(ghi)perylene	16	U	16	16	U	16
Benzo(k)fluoranthene	40	U	40	40	U	40
Bis(2-chloro-1-methylethyl)ether	23	U	23	23	U	23
Bis(2-Chloroethoxy)methane	23	U	23	23	U	23
Bis(2-chloroethyl) ether	16	U	16	17	U	17
Bis(2-ethylhexyl) phthalate	46	U	46	46	U	46
Butylbenzylphthalate	43	U	43	43	U	43
Carbazole	36	U	36	36	U	36
Chrysene	27	U	27	27	U	27
Di-n-butylphthalate	29	U	29	29	U	29
Di-n-octylphthalate	14	U	14	15	U	15
Dibenz[a,h]anthracene	19	U	19	19	U	19
Dibenzofuran	20	U	20	20	U	20
Diethyl phthalate	26	U	26	26	U	26
Dimethyl phthalate	100	J	23	23	U	23

Table E-3. 100-D-65 Shoreline Sample Results - Organics. (12 Pages)

Constituent	J1M6V5 (5)			J1MM46 (Concrete)		
	11/13/2011			11/13/2011		
	µg/kg	Q	PQL	µg/kg	Q	PQL
Fluoranthene	36	U	36	36	U	36
Fluorene	18	U	18	18	U	18
Hexachlorobenzene	29	U	29	29	U	29
Hexachlorobutadiene	9.9	U	9.9	10	U	10
Hexachlorocyclopentadiene	50	U	50	50	U	50
Hexachloroethane	21	U	21	21	U	21
Indeno(1,2,3-cd)pyrene	22	U	22	22	U	22
Isophorone	17	U	17	17	U	17
N-Nitroso-di-n-dipropylamine	31	U	31	31	U	31
N-Nitrosodiphenylamine	21	U	21	21	U	21
Naphthalene	31	U	31	31	U	31
Nitrobenzene	22	U	22	22	U	22
Pentachlorophenol	330	U	330	330	U	330
Phenanthrene	17	U	17	17	U	17
Phenol	18	U	18	18	U	18
Pyrene	12	U	12	12	U	12

APPENDIX F
DATA QUALITY ASSESSMENT

APPENDIX F

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample designs (WCH 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).

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).

A review of the sample design (WCH 2012b), the field logbook (WCH 2012a), and the applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the upland sample design (WCH 2012b).

Verification sample data collected at the 100-D-65 waste site were provided by the laboratory in one sample delivery group (SDG), SDG KP0114, which was submitted for third-party validation. Major deficiencies were identified in the 100-D-65 analytical data set. Major and minor deficiencies are discussed for the 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.

MAJOR DEFICIENCIES

Due to the holding time exceedances in the method 300.0 anion analysis of greater than twice the limit of 48 hours, third party validation qualified the undetected nitrate, nitrite, and orthophosphate results in SDG KP0114 as rejected with "R" flags. This result was anticipated, and EPA analytical method 353.2 was also requested to provide acceptable nitrate/nitrite data for decision making purposes. Therefore, the rejected data for nitrate and nitrite do not hinder the evaluation of the 100-D-65 waste site. Phosphate is not a regulated chemical under *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup." The resulting data set is sufficient for the intended purpose of site closure.

In the semivolatile organic compound (SVOC) analysis, surrogate recoveries in sample J1PVM5 are outside the quality control (QC) limits. Sample J1PVM5 is the equipment blank. Third-party validation qualified the nondetected results (2,4-dinitrophenol, 2,4,6-trichlorophenol, 2,4,5-trichlorophenol, pentachlorophenol, bis(2-chloroethyl)ether, bis(2-chloroisopropyl)ether,

bis(2-chloroethoxy)methane, 4-chlorophenyl phenyl ether, and 4-bromophenyl phenyl ether) from sample J1PVM5 as rejected with "UR" flags. This deficiency is limited to the equipment blank and does not impact the field sample results. Therefore, the evaluation of the 100-D-65 waste site is not hindered. The resulting data set is sufficient for the intended purpose of site closure.

MINOR DEFICIENCIES

SDG KP0114

This SDG comprises 13 statistical soil samples (J1PVL2 through J1PVL9, J1PVM0 through J1PVM4) collected from the upland portion of the 100-D-65 waste site. This SDG includes one field duplicate pair (J1PVL2/J1PVM4). These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), SVOCs, pesticides, ion chromatography (IC) anions, nitrate/nitrite, hydrogen ion concentration (pH), hexavalent chromium, tritium, carbon-14, nickel-63, strontium-90, isotopic plutonium, isotopic uranium, and gamma-emitting analytes. SDG KP0114 was submitted for third-party validation. In addition, one equipment blank (J1PVM5) was prepared and analyzed for ICP metals and mercury. Minor deficiencies are as follows:

In the isotopic uranium analysis, due to a lack of a laboratory control sample (LCS) for uranium-235, all uranium-235 results were qualified by third-party validation as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the tritium and carbon-14 analyses, due to a lack of matrix spikes (MSs), tritium and carbon-14 results were qualified by third-party validation as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the matrix spike (MS) recoveries for antimony (31.3%) and calcium (156%) are outside of QC limits. All antimony and calcium results were qualified by third-party validation as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recoveries for aluminum (165%) and silicon (165%) are outside QC limits. All detected aluminum and silicon results were qualified by third-party validation as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, calcium was detected in the method blank (MB) and in the field equipment blank (J1PVM5) at similar concentrations. Third-party validation qualified the calcium result in sample J1PVM5 as nondetected and estimated with "UJ" flags. Nondetected and estimated data are usable for decision-making purposes.

In the pesticide analysis, the MS recovery for endrin aldehyde (47.7%) is outside the QC limits. Third-party validation qualified all endrin aldehyde results in SDG KP0114 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the pesticide analysis, the relative percent differences (RPDs) calculated for endrin aldehyde (49.4%) and endosulfan sulfate (39.6%) are outside QC limits. Third-party validation qualified all endrin aldehyde and endosulfan sulfate results in SDG KP0114 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the pesticide analysis, the analyte toxaphene was not included in the MS or matrix spike duplicate (MSD) and was qualified as estimated by third-party validation. Toxaphene is actually a mixture of compounds rather than a discrete analyte. While the overall concentration of toxaphene can be calculated using several unobstructed peaks in the chromatography, the inclusion of toxaphene in the spiking mixture would be problematic for the other pesticide analytes. The laboratory typically quantitates toxaphene but does not include toxaphene in quality assurance (QA)/QC samples. The toxaphene data are therefore considered estimated but usable for decision making purposes.

In the PCB analysis, the surrogate recovery in sample J1PVL7 is outside QC limits. Third-party validation qualified all PCB results for sample J1PVL7 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the PAH analysis, the LCS recoveries for naphthalene (271%) and anthracene (21%) are outside QC limits. Additionally, the MS and MSD recoveries for naphthalene (241%, 244%) and anthracene (22%, 22%) are also outside QC limits. Third-party validation qualified all naphthalene and anthracene data in SDG KP0114 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, LCS recoveries for 2,4-dinitrophenol (10%), 4,6-dinitro-2-methylphenol (19%), hexachlorocyclopentadiene (40%) and pentachlorophenol (25%) are outside QC limits. Third-party validation qualified all results for these analytes in SDG KP0114 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the MS recoveries for 2,4,5-trichlorophenol (39%), 2,4,6-trichlorophenol (17%), 2,4-dinitrophenol (39%), 4-nitrophenol (42%), hexachlorocyclopentadiene (39%), and pentachlorophenol (34%) are outside QC limits. Third-party validation qualified all results for these analytes in SDG KP0114 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, the MSD recoveries for 2,4,6-trichlorophenol (48%), 2,4-dinitrophenol (21%), 4-nitrophenol (46%), 4,6-dinitro-2-methylphenol (38%), 4-chloraniline (47%), hexachlorocyclopentadiene (36%), and pentachlorophenol (26%) are outside QC limits. Third-party validation qualified all results for these analytes in SDG KP0114 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, due to surrogate recoveries outside of QC limits, in sample J1PVM3, 2,4-dichlorophenol, 2,4,6-trichlorophenol, 2,4,5-trichlorophenol, pentachlorophenol, bis(2-chloroethyl)ether, b(2-chloroisopropyl)ether, bis(2-chloroethoxy)methane, 4-chlorophenyl phenyl ether, and 4-bromophenyl phenyl ether were qualified by third-party validation as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the SVOC analysis, RPDs calculated for the method blank for 2,4,5-trichlorophenol (42%), 2,4,6-trichlorophenol (98%), 2,4-dinitrophenol (59%) and 4,6-dinitro-2-methylphenol (40%) are outside the QC limits. Third-party validation qualified all results in SDG KP0114 for these analytes as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the pH analysis, due to holding time exceedances greater than twice the QC limit, third-party validation qualified all pH results in SDG KP0114 as estimated with "J" flags. Estimated data are usable for decision-making purposes.

In the method 300.0 anions analysis, due to holding time exceedances greater than twice the QC limit, all detected nitrate, nitrite, and orthophosphate results in SDG KP0114 were qualified by third-party validation as estimated with "J" flags. 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 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 F-1. The main and QA/QC sample results are presented in Appendix D.

Table F-1. Field Quality Assurance/Quality Control Sample Summary Table.

Sample Area	Main Sample	Duplicate Sample
Excavation	J1PVL2	J1PVM4

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 D provides details on duplicate pair evaluation and RPD calculation.

None of the RPDs calculated for the field duplicate sample are above the acceptance criteria (30%). A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the TDL, including undetected analytes.

In these cases, a control limit of ± 2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. No sample results required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 100-D-65 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 100-D-65 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 D.

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.

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

WCH, 2012a, *100-D Field Sampling and Field Notes*, EL-1607-14, pp. 37 - 39, Washington Closure Hanford, Richland, Washington.

WCH, 2012b, *Work Instruction for Verification Sampling of the Upland Portion of the 100-D-65, Waste Site*, Work Instruction No. 0100D-WI-G0118, Rev. 0, Washington Closure Hanford, Richland, Washington.

