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

14-AMRP-0283

SEP 10 2014

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

Dear Ms. Hedges:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 100-N-84:2, 100-N AREA FUEL AND FOAM PIPELINES SUBSITE, REVISION 0

Attached for your use is the approved Waste Site Reclassification Form No. 2014-088 and supporting, "Remaining Sites Verification Package for the 100-N-84:2, 100-N Area Fuel and Foam Pipelines Subsite," Rev. 0. If you have questions, please contact me or your staff may contact Joanne Chance, of my staff, at (509) 376-0811.

Sincerely,

Mark S. French, Director
River Corridor Division

AMRP:JCC

Attachment

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

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

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-NR-1 **Control No.:** 2014-088

Waste Site Code(s)/Subsite Code(s): 100-N-84:2

Reclassification Category: Interim ☒ Final ☐

Reclassification Status: Closed Out ☒ No Action ☐ Rejected ☐
RCRA Post closure ☐ Consolidated ☐ None ☐

Approvals Needed: DOE ☒ Ecology ☒ EPA ☐

Description of current waste site condition:

The 100-N-84:2, 100-N Area Fuel and Foam Pipelines subsite is 1 of 10 subsites associated with the 100-N-84, 100-N Miscellaneous Pipelines waste site. The 100-N-84 waste site, part of the 100-NR-1 Operable Unit, was added to the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 1999), as a candidate site for confirmatory sampling via the *Explanation of Significant Differences for the 100-NR-1 and 100-NR-2 Operable Units Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2011). The 100-N-84:2 subsite was recommended for remove, treat, and dispose without confirmatory sampling based on the potential for the pipelines to contain residual petroleum product.

The 100-N-84:2 subsite consisted of pipelines used for diesel oil supply and return, ignition oil, ignition oil supply and return, fuel oil supply and return, waste oil, and fire-suppression foam. In addition to the pipelines, the subsite also included a fuel oil unloading facility that was used to unload both fuel oil (No. 6 fuel oil also known as Bunker C) and diesel oil (No. 2 fuel oil).

Remediation of the 100-N-84:2 subsite was initiated April 6, 2013, and completed in March 21, 2014. Incidental segments of 100-N-84:2 were removed with co-located waste sites and facilities as early as 2011. In general, pipeline excavations did not extend to a depth greater than 4.9 m (16 ft) below ground surface (bgs), consistent with the decision process for determining the extent of remediation specified in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (100-N Area RDR/RAWP), DOE/RL-2005-93, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington (DOE-RL 2013) for application of remedial action goals (RAGs) for shallow (less than or equal to 4.6 m [15 ft] bgs) versus deep petroleum (greater than 4.6 m [15 ft] bgs) contamination. The selected remedy for contaminated soil and debris above 4.6 m (15 ft) was to remove and perform ex situ bioremediation (if necessary) of the contaminated material. For contamination below 4.6 m (15 ft) or below the termination point of the potential ex situ bioremediation, the remedy was in situ bioremediation. Ex situ bioremediation was determined to not be feasible because of the amount of construction rubble, asphalt, and debris in the soil, and approximately 41,710 bank cubic meters (54,555 bank cubic yards) of petroleum-contaminated soil was removed for disposal at the Environmental Restoration Disposal Facility (ERDF). No overburden or waste staging pile areas were created. No anomalous material was found during remediation.

Cleanup verification sampling was conducted on March 24, May 21 and 27, and June 10, 2014. The sampling was performed to determine if the remediated subsite met the remedial action objectives (RAOs) and RAGs established by the100-N Area RDR/RAWP, (DOE-RL 2013), and the 100-N Area 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, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification of Interim Closed Out.

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-NR-1 **Control No.:** 2014-088

Waste Site Code(s)/Subsite Code(s): 100-N-84:2

Basis for reclassification:

The verification sampling and modeling results for the 100-N-84:2 subsite demonstrate that the site meets the RAOs and corresponding RAGs established in the 100-N Area RDR/RAWP (DOE-RL 2013) and the 100-N Area ROD (EPA 1999) and support a reclassification to Interim Closed Out. These sampling and modeling results established that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Contamination above direct exposure levels was present at several locations in the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-N-84:2, 100-N Area Fuel and Foam Pipelines Subsite* (attached).

Regulator comments:

Waste Site Controls:

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

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

Institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the 100-N-84:2 subsite are required because contamination above direct exposure cleanup levels was observed in deep zone soils. This requirement is per the remedial alternatives cited on page 37 of the 100-N Area ROD (EPA 1999) to meet the remedial action objectives of the ROD.

J. P. Neath	J P Neath	8/11/14
DOE Federal Project Director (printed)	Signature	Date
N. Menard KIM WELSCH FOR	KIM WELSCH FOR	8/13/14
Ecology Project Manager (printed)	Signature	Date
NA		
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-N-84:2, 100-N AREA FUEL AND FOAM PIPELINES SUBSITE

Attachment to Waste Site Reclassification Form 2014-088

August 2014

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-N-84:2, 100-N AREA FUEL AND FOAM PIPELINES SUBSITE

EXECUTIVE SUMMARY

The 100-N-84:2, 100-N Area Fuel and Foam Pipelines subsite, part of the 100-NR-1 Operable Unit, is 1 of 10 subsites associated with the 100-N-84, 100-N Miscellaneous Pipelines subsite. The 100-N-84:2 subsite consisted of pipelines used for diesel oil supply and return, ignition oil, ignition oil supply and return, fuel oil supply and return, waste oil, and fire-suppression foam. In addition to the pipelines, the subsite also included a fuel oil unloading facility that was used to unload both fuel oil (No. 6 fuel oil also known as Bunker C) and diesel oil (No. 2 fuel oil). The 100-N-84:2 subsite was added to the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD) (EPA 1999) via the *Explanation of Significant Differences for the 100-NR-1 and 100-NR-2 Operable Units Interim Remedial Action Record of Decision*, *Hanford Site, Benton County, Washington* (EPA 2011). The 100-N-84:2 subsite was recommended for remove, treat, and dispose without confirmatory sampling based on the potential for the pipelines to contain residual petroleum product (WCH 2010).

Remediation of the 100-N-84:2 subsite was initiated April 6, 2013, and completed in March 21, 2014. Incidental segments of 100-N-84:2 were removed with co-located waste sites and facilities as early as 2011. In general, pipeline excavations did not extend to a depth greater than 4.9 m (16 ft) below ground surface (bgs), consistent with the decision process for determining the extent of remediation specified in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (100-N Area RDR/RAWP), (DOE-RL 2013) for application of remedial action goals (RAGs) for shallow (less than or equal to 4.6 m [15 ft] bgs) versus deep petroleum (greater than 4.6 m [15 ft] bgs) contamination. The selected remedy for contaminated soil and debris above 4.6 m (15 ft) was to remove and perform ex situ bioremediation (if necessary) of the contaminated material. For contamination below 4.6 m (15 ft) or below the termination point of the potential ex situ bioremediation, the remedy was in situ bioremediation. Ex situ bioremediation was determined to not be feasible because of the amount of construction rubble, asphalt, and debris in the soil (WCH 2011a/2011c/2011d). Approximately 41,710 bank cubic meters (54,555 bank cubic yards) of petroleum-contaminated soil was removed for disposal at the Environmental Restoration Disposal Facility (ERDF). No overburden or waste staging pile areas were created. No anomalous material was found during remediation.

Cleanup verification sampling was conducted on March 24, May 21 and 27, and June 10, 2014. A summary of the cleanup evaluation for the soil sampling results against the applicable remedial action goals (RAGs) is presented in Table ES-1. The results of the verification sampling were used to make reclassification decisions for the 100-N-84:2 subsite in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

Table ES-1. Summary of Remedial Action Goals for the 100-N-84:2 Subsite. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15 mrem/yr above background over 1,000 years.	Radionuclides were not COPCs for the 100-N-84:2 subsite.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC direct exposure RAGs.	All individual COPC concentrations are below the direct exposure criteria. Benzo(a)pyrene exceeded direct exposure in two samples, but is attributed to asphalt and not contamination associated with the 100-N-84:2 pipeline subsite.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for the 100-N-84:2 subsite (3.2×10^{-1}) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for individual carcinogens is $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The cumulative excess cancer risk (3.0×10^{-6}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclides were not COPCs for the 100-N-84:2 site.	NA
	Attain National Primary Drinking Water Regulations [a] of <4 mrem/yr (beta/gamma) dose to target receptor/organ.		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].		
	Meet total uranium standard of 30 µg/L (21.2 pCi/L) [c].		

Table ES-1. Summary of Remedial Action Goals for the 100-N-84:2 Subsite. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Residual concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and aroclor-1254 exceed soil RAGs for groundwater and/or river protection. However, based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2013), it is predicted that these constituents will not reach groundwater (and thus the Columbia River) within 1,000 years [d].	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).
[d] Based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2013), the residual concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and aroclor-1254 are predicted to migrate less than 1 m (3.3 ft) vertically within 1,000 years (based on the lowest soil-partitioning coefficient of the contaminants [aroclor-1254] of 75.6 mL/g]). The vadose zone beneath the 100-N-84:2 subsite is approximately 16 m (53 ft) thick. Therefore, the residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.

COPC = contaminant of potential concern
MCL = maximum contaminant level
NA = not applicable
PCB = polychlorinated biphenyl
RAG = remedial action goal
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)

In accordance with this evaluation, the verification sampling results and modeling support a reclassification of this site to Interim Closed Out. The current site conditions achieve the remedial action objectives (RAOs) and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (DOE-RL 2013) and the 100-N Area ROD (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The sampling and modeling results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft] deep), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River.

Contamination above direct exposure levels was present at several locations in the deep zone soils. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are required.

Soil cleanup levels were established in the 100-N Area ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the 100-N Area ROD, a comparison against ecological risk screening levels has been made for the 100-N-84:2 subsite contaminants of potential concern and other constituents (Appendix A). Ecological screening levels from the *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were exceeded for boron and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, manganese, vanadium, zinc, and high molecular weight polycyclic aromatic hydrocarbons. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because the concentrations of antimony, manganese, vanadium, and zinc are below the Hanford Site background values, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-N-84:2, 100-N AREA FUEL AND FOAM PIPELINES SUBSITE

STATEMENT OF PROTECTIVENESS

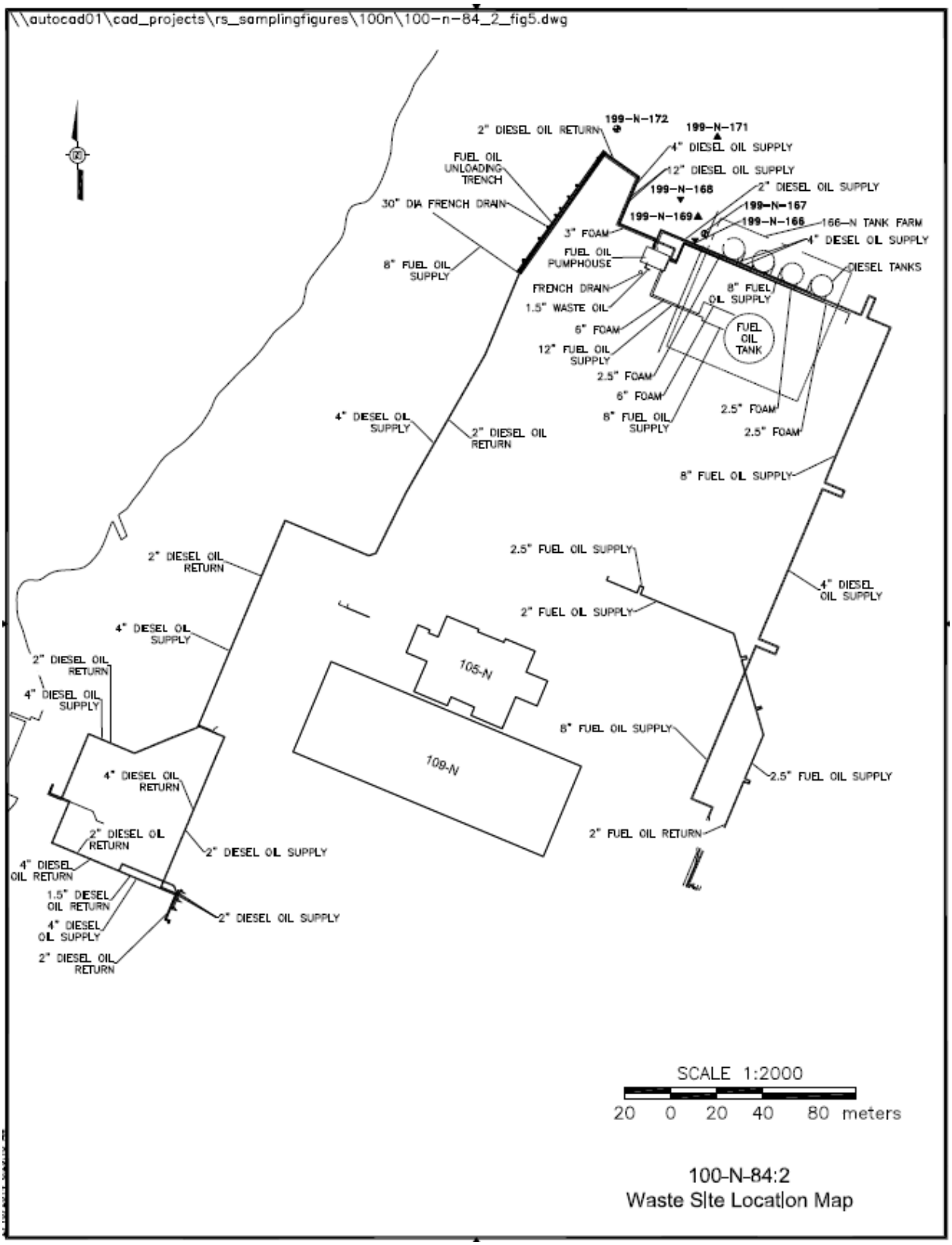
The 100-N-84:2 subsite cleanup verification sampling data, site evaluations, and supporting documentation demonstrate that this site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100-N Area* (100-N Area RDR/RAWP) (DOE-RL 2013) and the *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (100-N Area ROD) (EPA 1999). The results of verification sampling and modeling show that residual soil concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Contamination above direct exposure levels was present at several locations in the deep zone soils. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are required.

Soil cleanup levels were established in the 100-N Area ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the 100-N Area ROD, a comparison against ecological risk screening levels has been made for the 100-N-84:2 subsite contaminants of potential concern and other constituents (Appendix A). Ecological screening levels from the *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," were exceeded for boron and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, manganese, vanadium, zinc, and high molecular weight polycyclic aromatic hydrocarbons (PAH). Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because the concentrations of antimony, manganese, vanadium, and zinc are below the Hanford Site background values, it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-N-84:2, 100-N Area Fuel and Foam Pipelines subsite consisted of pipelines used for diesel oil supply and return, ignition oil, ignition oil supply and return, fuel oil supply and return, waste oil, and fire-suppression foam (Figure 1). In addition to the pipelines, the subsite also included a fuel oil unloading facility that was used to unload both fuel oil (No. 6 fuel oil also known as Bunker C) and diesel oil (No. 2 fuel oil).

Figure 1. 100-N-84:2 Subsite Location Map.



The 105-N Reactor operated between 1963 and 1987. Bulk quantities of Bunker C fuel oil (Grade No. 6) (5,469,903 L [1,445,000 gal]) and diesel oil (Grade No. 2) (1,786,709 L [472,000 gal]) were stored at the 100-N Area. Bunker C was used as fuel for the 184-N boilers. Diesel oil was used to fire the igniters in the boilers and to fuel the diesel-driven emergency low-lift, high-lift, and fog spray pumps (UNI 1985). During operation, multiple releases of petroleum occurred through mechanisms of corrosion failure of pipelines used to transport diesel and Bunker C fuel oil, overfilling of storage facilities, and spills during fuel transfers. Figure 2 provides a map showing the locations of the 100-N petroleum-contaminated waste sites including the 100-N-84:2 pipelines.

Bunker C Fuel Oil

Bunker C fuel oil was unloaded at the 1900-N unloading station and transferred through pumps in the 166-N Building to the appropriate storage tank. Figure 3 provides a photograph of the 166-N Tank Farm during the early operational years. Bunker C fuel oil was stored in a 5,204,925-L (1,375,000-gal) capacity above-ground storage tank and transferred through underground lines to the two 184-N fuel oil day tanks. Each of these tanks had a capacity of 132,489 L (35,000 gal). The two tanks were surrounded by a cement retaining wall. Figure 4 shows the historical layout and location of Bunker C fuel oil tanks and pipelines.

Diesel Oil

Diesel oil was unloaded at the 166-N unloading station and transferred through pumps in the 166-N pump house building to the appropriate storage tank. The diesel oil was stored in four above-ground storage tanks, each with a capacity of 397,467 L (105,000 gal) (Figure 3). The four storage tanks were located within an earthen berm capable of holding approximately 2,763,342 L (730,000 gal). Diesel oil was pumped or gravity fed through a 10-cm (4-in.) underground supply line from the 166-N storage tanks to a 26,498-L (7,000-gal) capacity day tank outside of the 184-N Building. The day tank was located adjacent to the fuel oil day tanks within the concrete retaining walls. Diesel oil from the 166-N storage tanks was also transferred by gravity flow through 5-cm (2-in.) and 10-cm (4-in.) underground supply lines to three day tanks located outside of the 182-N Building. Each 182-N underground day tank had a capacity of 56,781 L (15,000 gal) and supplied both the 182-N and 181-N diesel oil systems. Foam fire-suppression lines to support the diesel oil tanks and pipelines were co-located with the diesel oil pipelines near the 166-N Tank Farm.

Emergency cooling requirements required that a minimum of 378,540 L (100,000 gal) of diesel oil be available to the 182-N day tanks. To accomplish this, the day tanks were maintained at levels near capacity and two 166-N diesel storage tanks were continuously kept on line to the day tanks. Figure 5 shows the historical layout and location of diesel oil tanks and pipelines.

Figure 2. Map Showing the Location of the 100-N Petroleum Waste Sites.

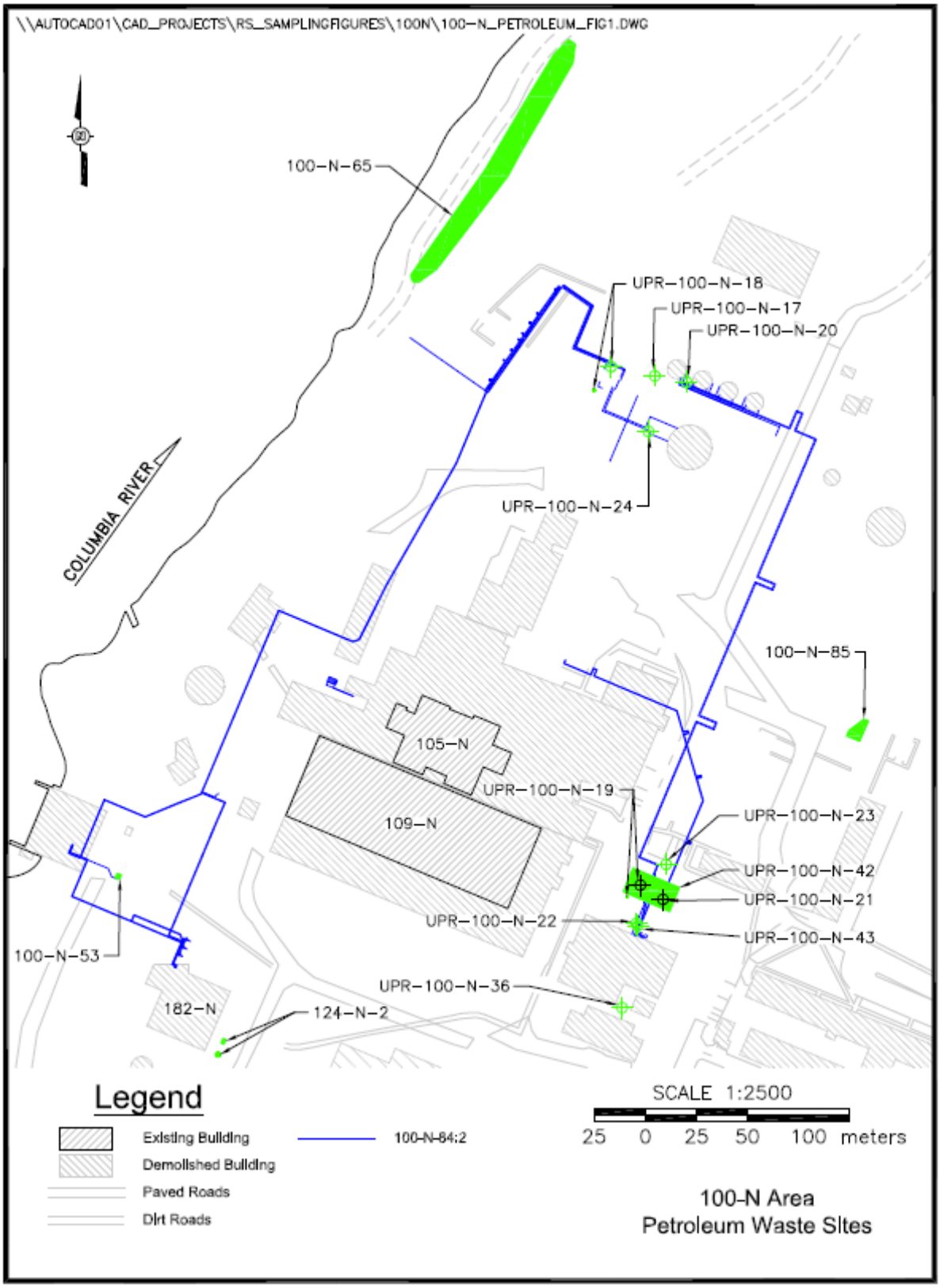


Figure 3. Photograph of 166-N Tank Farm Facility (Early 1960s).

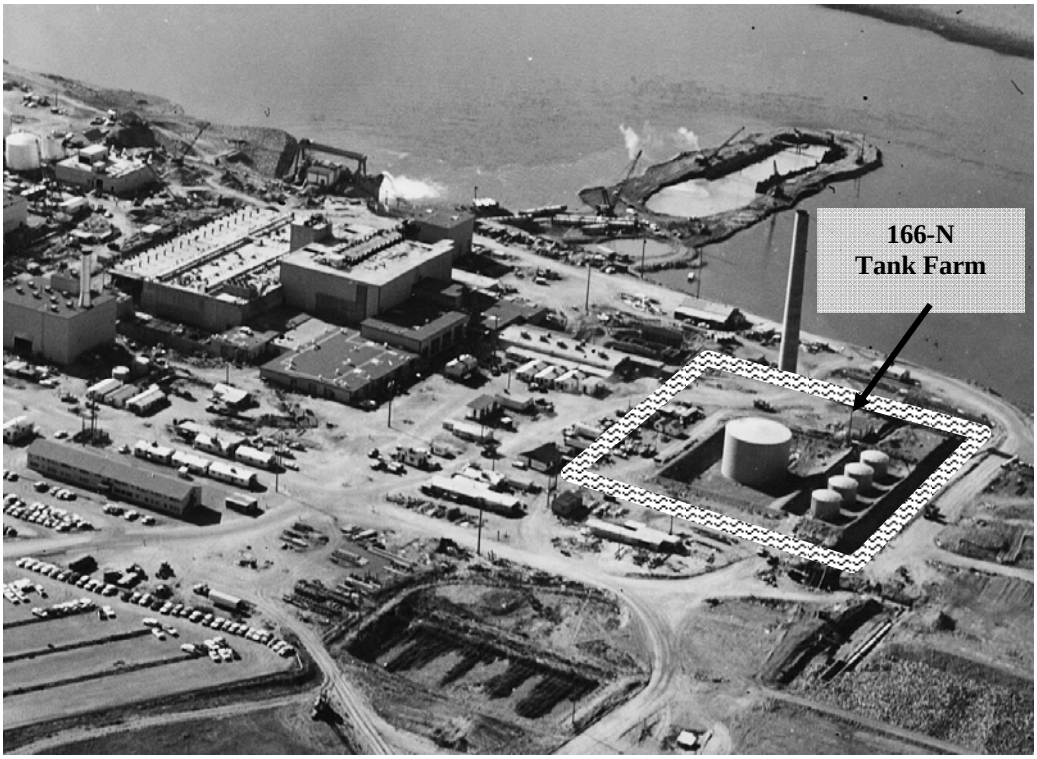


Figure 4. Historical Locations of Fuel Oil (Bunker C) Storage Tanks, Day Tanks, and Transfer Piping.

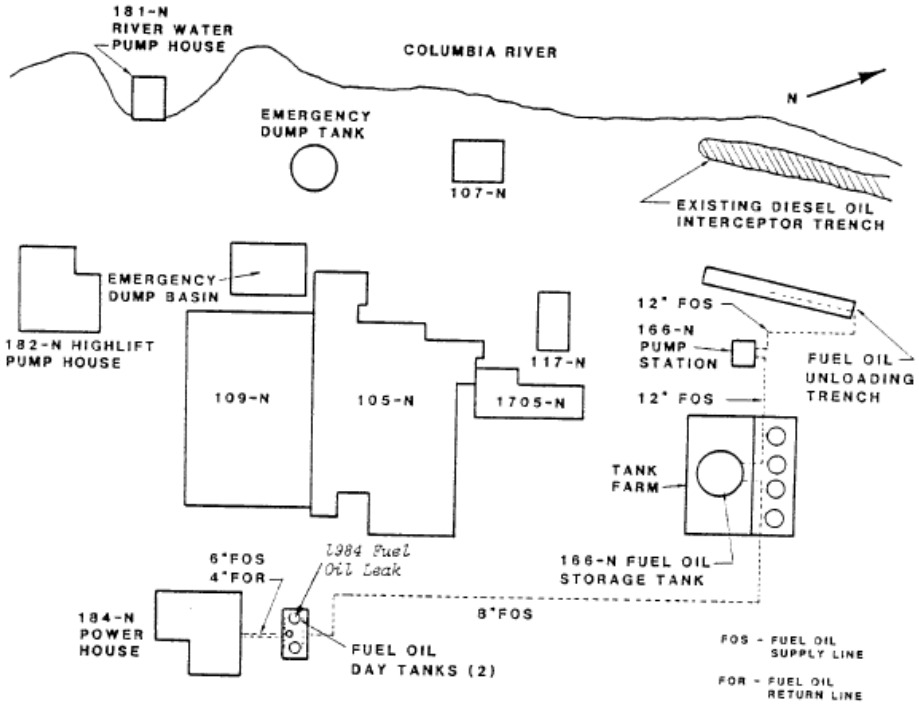
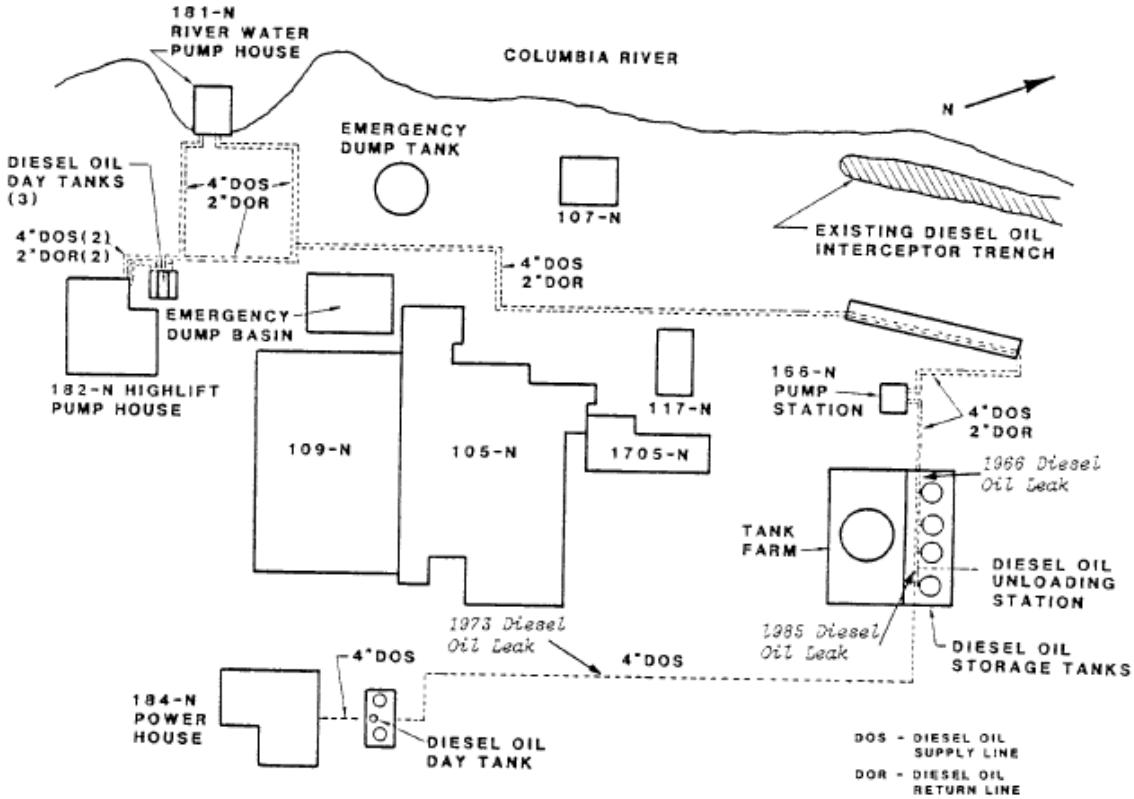


Figure 5. Historical Locations of Diesel Oil Storage Tanks, Day Tanks, and Transfer Piping.



Historical Petroleum Pipeline Releases

Corrosion of the transfer pipelines connecting the large storage tanks and day-use tanks resulted in several incidents that released approximately 303,000 L (80,000 gal) of diesel fuel between 1965 and 1985. Occasional releases of petroleum products due to corrosion of piping systems, overfilling of tanks, and spills during transfers have been documented over time and descriptions are provided in the Waste Information Data System (WIDS) database. Figure 2 shows the location of these releases. A brief discussion of selected events is provided as follows:

In August 1966, an estimated 303,000 L (80,000 gal) of diesel oil leaked from an oil transfer line near the 166-N facility. This release is identified in WIDS as UPR-100-N-17. The line was excavated and repaired in September 1966. Sometime later, diesel oil was observed entering the river at the shoreline. To alleviate this problem, a trench (the 100-N-65 Interceptor Trench) was excavated (in 1967) along the shoreline to intercept and accumulate the migrating diesel oil (GE 1967). The trench was approximately 12.2 m (40 ft) in width, 27.4 m (90 ft) long, and was excavated approximately 9.1 m (30 ft) deep to a point beneath the prevailing water table. The completed trench contained water at approximately river level. Periodically, the diesel oil accumulated in the trench was ignited and allowed to burn to remove as much of the diesel oil as possible before it could enter the river. The UPR-100-N-17 release was substantial, extending through the deep vadose zone at depths greater than 4.6 m (15 ft) below ground surface (bgs) to groundwater. Based on estimates from reports during that time period of 100-N Area operation,

the release may have resulted in as much as 39,000 m^3 (1,377,272 ft^3) of soil being contaminated with petroleum hydrocarbons. A bioventing system is currently operating at UPR-100-N-17 for in situ bioremediation of petroleum hydrocarbon contamination located in the deep vadose zone (DOE-RL 2013).

A number of smaller releases of diesel oil and fuel oil between 1973 and 1987 totaling less than approximately 18,927 L (5,000 gal) are identified in WIDS as waste sites UPR-100-N-18, UPR-100-N-19, UPR-100-N-20, UPR-100-N-21, UPR-100-N-22, UPR-100-N-23, UPR-100-N-36, UPR-100-N-42, and UPR-100-N-43.

Demolition and Removal Activities

Demolition of the 166-N facilities included removal of the fuel oil (Bunker C) tank in January 2006 and removal of the 166-N Pump House and the 166-N Unloading Station in April 2006 (WCH 2006b). The four 1715-N diesel tanks were removed during prior demolition work approximately 10 years earlier, leaving the tank foundations to be removed during the 2006 demolition. The Washington Closure Hanford Deactivation, Decontamination, Decommissioning, and Demolition (D4) Closure Project deferred soil associated with the 166-N facilities to the Field Remediation (FR) Closure Project (WCH 2006a) for remediation.

REMEDIAL ACTION SUMMARY

The D4 Closure Project removed many of the 100-N-84:2 pipelines during facility demolition work that began in 2006 and continued through 2012. In some instances, the pipelines were removed at locations where they entered buildings and tanks. Elsewhere, field remediation of co-located waste sites removed portions of the pipelines during excavation. Prior to removal, the pipelines were drained and the oil collected for waste disposition. It is estimated that over the past 7 years, approximately 3,030 L (800 gal) each of diesel and Bunker C have been drained from the pipelines. Figures 6 and 7 show photographs of the pipelines during removal.

Remediation of the 100-N-84:2 subsite was initiated April 6, 2013, and completed in March 21, 2014. Incidental segments of 100-N-84:2 were removed with co-located waste sites and facilities as early as 2011. During excavation, in-process soil samples (Appendix B) were collected and visual observations were used to guide the excavation and support waste management decisions. The depth of the excavation after removal of the pipelines varied based upon the amount of excavation necessary to remove soil staining and petroleum contamination.

Figure 6. 100-N-84:2 Pipelines During Removal (January 2012).

Figure 7. 100-N-84:2 Pipelines During Removal (November 2012).

In general, the pipeline excavations did not extend to a depth greater than 4.9 m (16 ft) below surface grade, consistent with the decision process for determining the extent of remediation specified in the 100-N Area RDR/RAWP (DOE-RL 2013) for application of remedial action goals (RAGs) for shallow (less than or equal to 4.6 m [15 ft] bgs) versus deep petroleum (greater than 4.6 m [15 ft] bgs) contamination. The selected remedy for contaminated soil and debris above 4.6 m (15 ft) was to remove and perform ex situ bioremediation (if necessary) of the contaminated material. For contamination below 4.6 m (15 ft) or below the termination point of the potential ex situ bioremediation, the remedy was in situ bioremediation. Ex situ bioremediation was determined to not be feasible because of the amount of construction rubble, asphalt, and debris in the soil (WCH 2011a/2011c/2011d). Approximately 41,710 bank cubic meters (54,555 bank cubic yards) of petroleum-contaminated soil was removed for disposal at the Environmental Restoration Disposal Facility (ERDF).

Based upon field information and observations during excavation, the following conditions were noted regarding the pipeline remediation and were used for development of the verification sampling strategy for the 100-N-84:2 subsite:

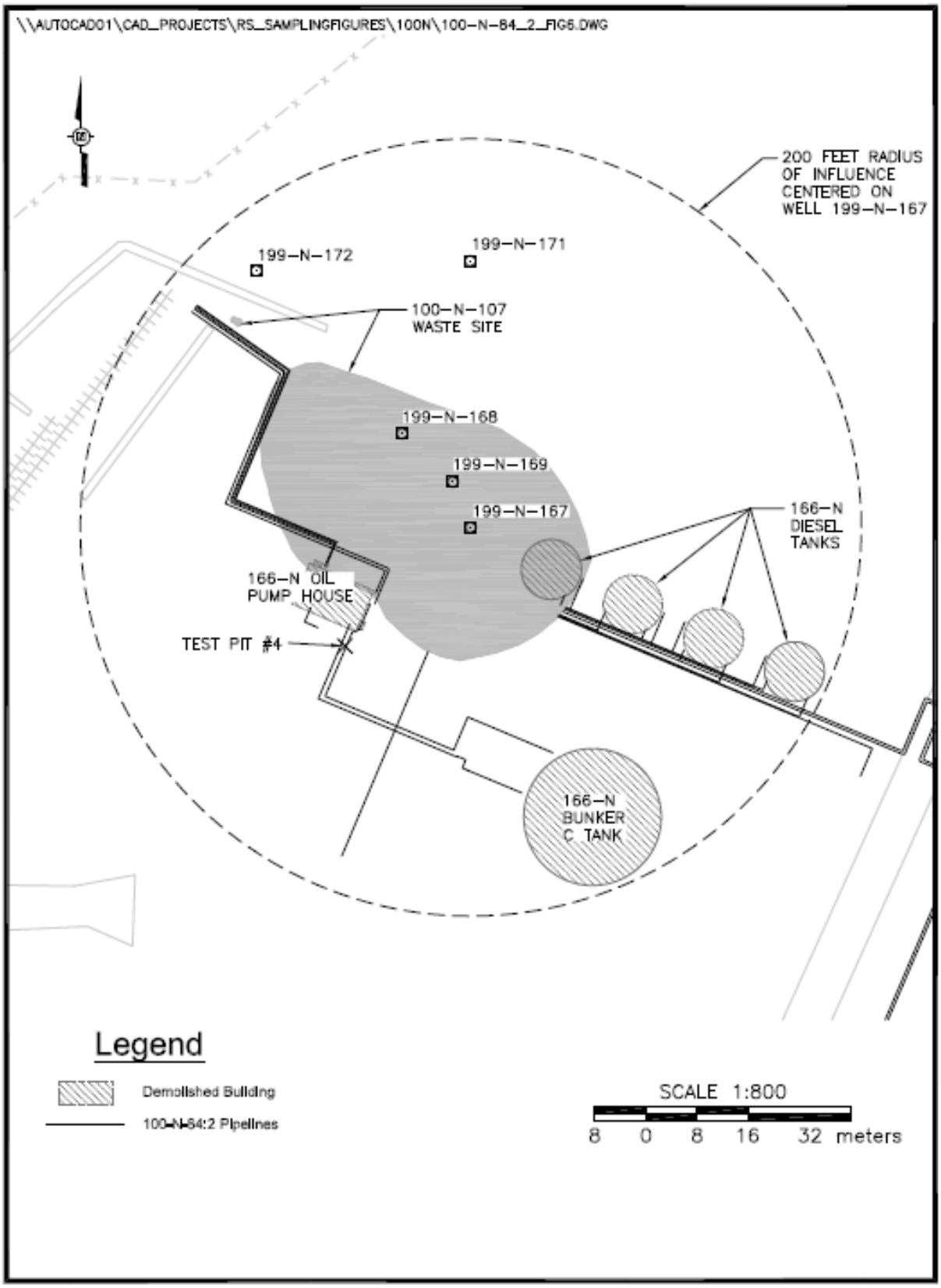
Remediation Observation #1

No petroleum contamination or evidence of any release of petroleum was observed in soil associated with the 100-N-84:2 pipelines that ran from the fuel unloading station to the 181-N and 182-N facilities (Figure 5). In agreement with the Washington State Department of Ecology (Ecology) and the U.S. Department of Energy, the excavation associated with the pipelines in this area can be backfilled and no verification sampling is needed (WCH 2014c).

Remediation Observation #2

Significant petroleum-stained soil is present below 4.6 m (15 ft) depth at the location where the 100-N-84:2 Bunker C and diesel pipelines entered the 166-N pump house and the Bunker C storage tank (Figures 4 and 5). A test pit was excavated and sampled on November 20, 2013, to a depth of approximately 9.4 m (31 ft) bgs at the location exhibiting the worst staining to evaluate the vertical extent of petroleum contamination and to support decisions concerning the need for additional remediation. Heavily stained petroleum-contaminated soil was noted in the material that was excavated from this test pit, and contamination continued to be present at the base of the test pit (9.4 m [31 ft]). This petroleum contamination is suspected to be mostly Bunker C and may include weathered, aged diesel. Appendix C provides a summary of the results of this test pit investigation. This information was used to support assignment of this portion of the 100-N-84:2 subsite, located below 4.6 m (15 ft), to the UPR-100-N-17 waste site for in situ bioremediation. This soil contamination (Test Pit #4) is located near the UPR-100-N-17 bioventing wells and is within the air injection radius of influence for the bioremediation system (Figure 8).

Figure 8. Location of Deep Vadose Contaminated Soil (Test Pit #4) and Radius of Influence for the UPR-100-N-17 Bioventing System.



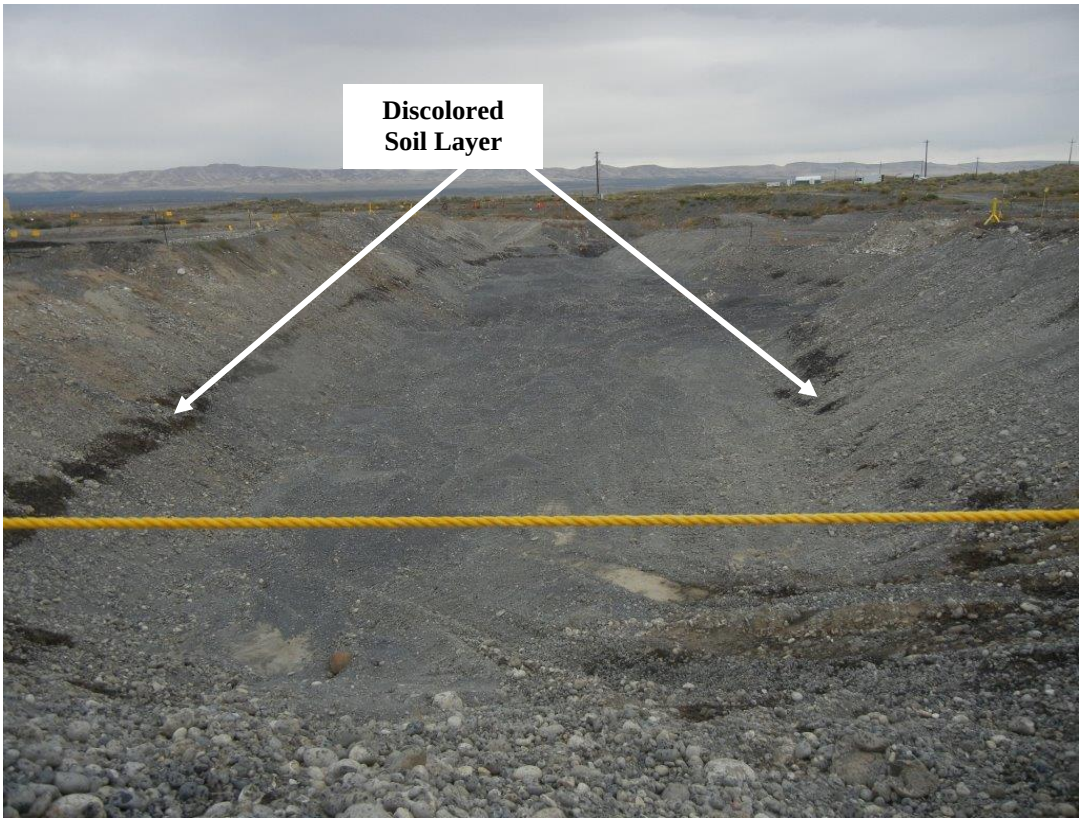
Remediation Observation #3

Petroleum contamination was found in soil below the pipelines that ran from the 166-N Tank Farm to the 184-N Day Tank facility. This contamination was likely Bunker C and was found below locations where expansion loops were present in the pipelines (Figure 9). The excavation of these pipelines removed soil to a depth of between 4.6 m (15 ft) to 4.9 m (16 ft) bgs. Petroleum-contaminated soil above 4.6 m (15 ft) was removed laterally until in-process soil samples indicated contamination was adequately removed. During this excavation process, a band of discolored, moist soil was noted to be laterally present in the excavation sidewalls at a depth of between 3.4 to 4.6 m (11 to 15 ft) bgs and was initially suspected to be petroleum contamination. Due to uncertainties concerning the nature of this soil discoloration, an extensive in-process sampling campaign was performed at multiple locations within the excavation sidewalls to evaluate this soil. Discrete soil samples were collected from immediately above the discoloration, within the discoloration, and below the discoloration. At all locations and in all samples, no contamination was identified that would indicate the discoloration to be associated with petroleum releases and none of these samples had petroleum contamination that exceeded soil cleanup criteria.

Figure 9. Photograph Showing Contaminated Soil Located Below an Expansion Loop in the 100-N-84:2 Pipeline (May 2013).

Figure 10 is a photograph that shows the soil discoloration layer in one of the excavation sidewalls.

Figure 10. Photograph Showing Discolored Soil Layer Located Within Excavation Sidewall (October 2013).



This discoloration is associated with excess moisture contained within a soil horizon associated with a change in lithology. It is likely that excess dust-suppression water had accumulated over time within this lateral soil layer, resulting in a darker appearance. A field test was performed on October 9, 2013, to allow soil removed from the discolored layer to dry out during the day. After drying, the soil was noted to no longer exhibit discoloration. Appendix D provides a summary of the results of the discolored soil layer investigation.

Remediation Observation #4

Petroleum stained soil was observed at a depth of approximately 4.6 m (15 ft) bgs at the base of the pipeline excavation at several locations that coincided with the location of the pipeline expansion loops. Test pits were excavated at three locations that exhibited the worst staining. The test pits were excavated to a depth of approximately 9.1 m (30 ft) bgs to evaluate the vertical extent of petroleum contamination and to support decisions concerning the need for additional remediation. For each of these three test pits, soil samples were collected at approximately 0.9 m (3 ft) depth intervals and submitted for laboratory analysis of diesel, motor oil, and polycyclic aromatic hydrocarbons (PAH). Additionally, Ecology collected samples for testing, including analysis of extractable petroleum hydrocarbons (EPH). The results of this sampling are presented in Appendix C. Samples from each of these test pits identified contamination at 4.6 m (15 ft) and 5.5 m (18 ft) bgs that exceeded soil cleanup criteria. However, samples collected below 5.5 m (18 ft) (at approximately 6.4 m [21 ft], 7.3 m [24 ft], 8.2 m [27 ft], and

9.1 m [30 ft] bgs) were all well below soil cleanup criteria for total petroleum hydrocarbons. Furthermore, laboratory test results indicate this residual petroleum contamination below 4.6 m (15 ft) to be weathered and aged, consisting mostly of heavy motor oil range diesel likely associated with releases of Bunker C from the pipeline expansion loops. The results of Ecology's EPH testing were used in the Ecology Model Toxics Control Act (MTCA) four-phase partitioning model to support an evaluation of groundwater protection and to support a determination that no further excavation to remove soil below 4.6 m (15 ft) is needed. Because four-phase partition modeling supports a conclusion that no further migration of residual petroleum is predicted to occur within this area and test pit samples indicate that contamination has not continued to migrate, a decision for no further excavation of soil below 4.6 m (15 ft) for this area can be supported because residual contaminant concentrations are demonstrated to be protective of groundwater. Furthermore, it was determined that no verification sampling below 4.6 m (15 ft) depth was necessary to support closeout of this portion of the pipeline waste site because the test pits were excavated at three locations exhibiting the highest residual petroleum concentrations. Appendix C provides a summary of the test pit sampling, including a summary of the groundwater protection evaluation using the Ecology four-phase partitioning model (*Washington Administrative Code* [WAC] 173-340-747[3][c]).

Remediation Observation #5

The barge-unloading pipeline located on the shoreline was removed during January and February 2014. This pipeline was never used; however, some petroleum that had likely resulted from leakage past an upper valve at the petroleum unloading station was present inside the pipeline. This petroleum was drained and collected for disposition. Some soil staining was observed near the top of the pipeline at the unloading facility and was removed.

Remediation Observation #6

The verification sample results for the RR-5 location identified in the "100-N FR South River Road Agreement" (WCH 2011b) were reviewed. Sample RR-5 was taken where the co-located 100-N-84:2, 100-N-84:3, and 100-N-84:7 pipelines were removed (Figure 11). A soil sample (J1J4J5) and a duplicate sample (J1J4J6) were collected on June 8, 2011, at the RR-5 location. The results of this sampling indicated the presence of PAH and polychlorinated biphenyls (PCBs) above cleanup criteria. Polychlorinated biphenyls and PAH in the duplicate sample exceeded direct exposure RAGs. At the time, no additional remediation was performed at this location and the site was backfilled to support access for decommissioning of the river intake structures (181-N and 181-NE) (WCH 2011b). Figure 12 shows the river road pipelines during the 2011 remediation.

Figure 11. "River Road Agreement" Sample Location for RR-5 Collected in 2011.

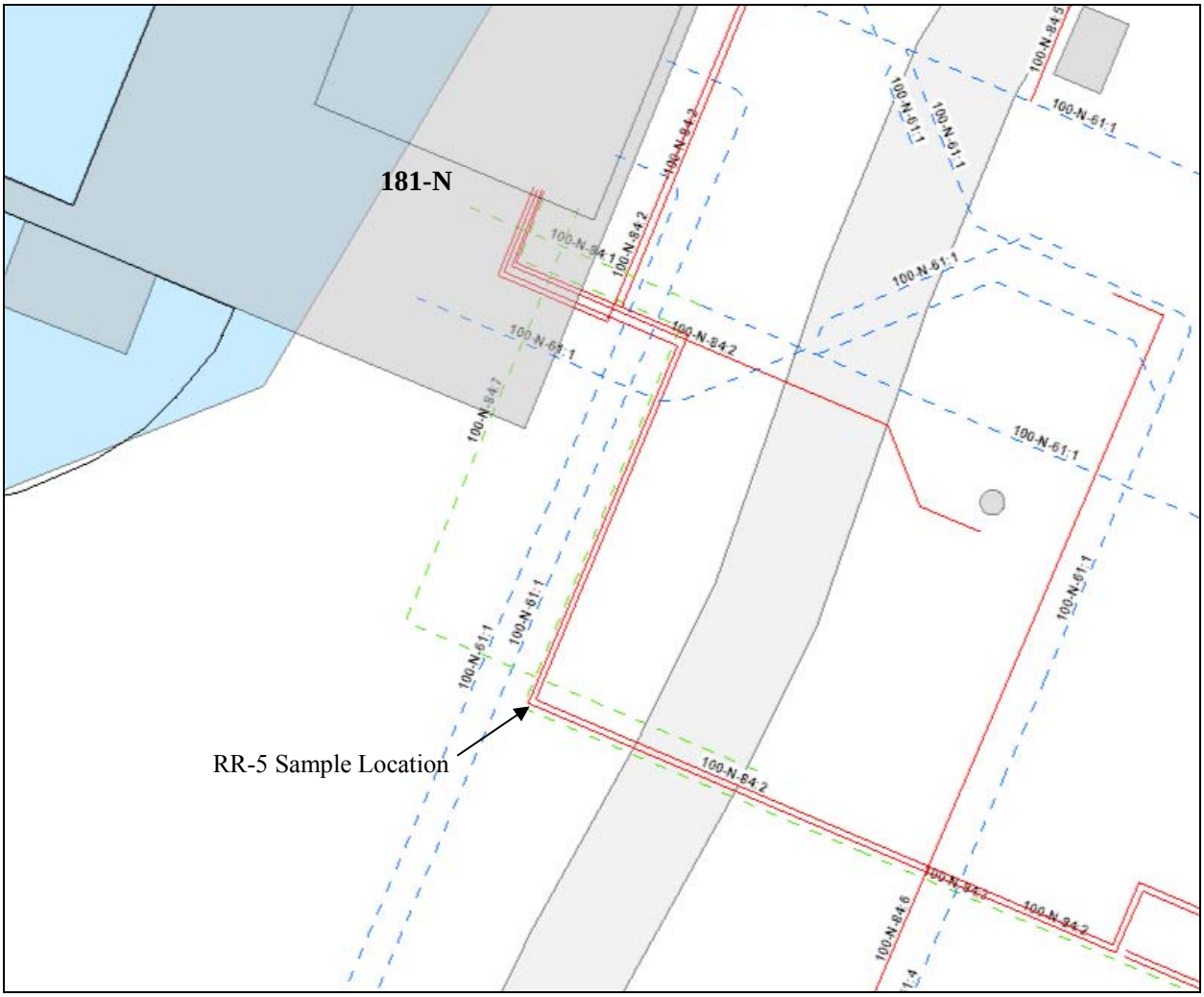


Figure 12. Photograph Showing Pipelines Exposed in River Road Area During 2011 Remediation.

In March 2014, additional excavation and soil removal was performed at the RR-5 sample location (WCH 2014a). Follow-up verification sampling was then performed as specified in the "100-N FR South River Road Agreement" (WCH 2011b). Additionally, the March 2014 excavation provided verification that the 100-N-84:2 pipelines had been removed below the river road during the 2011 remediation.

During the March 2014 excavation a small, localized soil stain was discovered in the north sidewall, approximately 10.7 m (35 ft) to the north of the RR-5 sample location (Figure 13). Additional excavation to remove this stain was performed; an additional 1.8 m (6 ft) of soil was removed from the north sidewall of the excavation and no further staining was observed. Figure 14 shows the approximate boundary of the March 2014 excavation, the soil stain location, and the RR-5 sample location. Because the stain was small and localized, and because it was completely removed , it was agreed with Ecology that a focused verification sample was not needed to verify adequacy of the stained soil removal (WCH 2014b).

Figure 13. Stained Soil Located in March 2014 Excavation at the River Road Area.

Figure 14. March 2014 Aerial Photograph Showing Approximate Location of Additional Soil Removal and Sample Location RR-5.

After the additional remediation, a replacement sample (J1TFW4/J1TFW6) and a duplicate soil sample (J1TFW5/J1TFW7) were collected on March 24, 2014, at the RR-5 location and analyzed for all pipeline (100-N-84:2, 100-N-84:3, and 100-N-84:7) contaminants of potential concern (COPCs) identified in the "100-N FR South River Road Agreement" (WCH 2011b). The sample results detected PAH exceeding soil cleanup criteria and exhibited a large variation in the PAH results, both between the main and duplicate samples and between the analysis obtained from the PAH analytical method (EPA Method 8310) and the semivolatile organic analyte (SVOA) method (EPA Method 8270). This variation in results reflected sample heterogeneity and was likely due to the presence of asphaltic material associated with pipe coatings that would have been present on the 100-N-84:7 pipelines. In agreement with Ecology, no further remediation to remove PAH associated with this sample is necessary since the PAH were associated with asphaltic pipe coatings (WCH 2014b). The RR-5 sample results are provided in Appendix F.

Figure 15 provides a 2012 aerial photograph of the 100-N Area with the 100-N-84:2 pipelines overlain.

Figure 15. Aerial Photograph of the 100-N Area Showing 100-N-84:2 Pipeline Locations (2012).

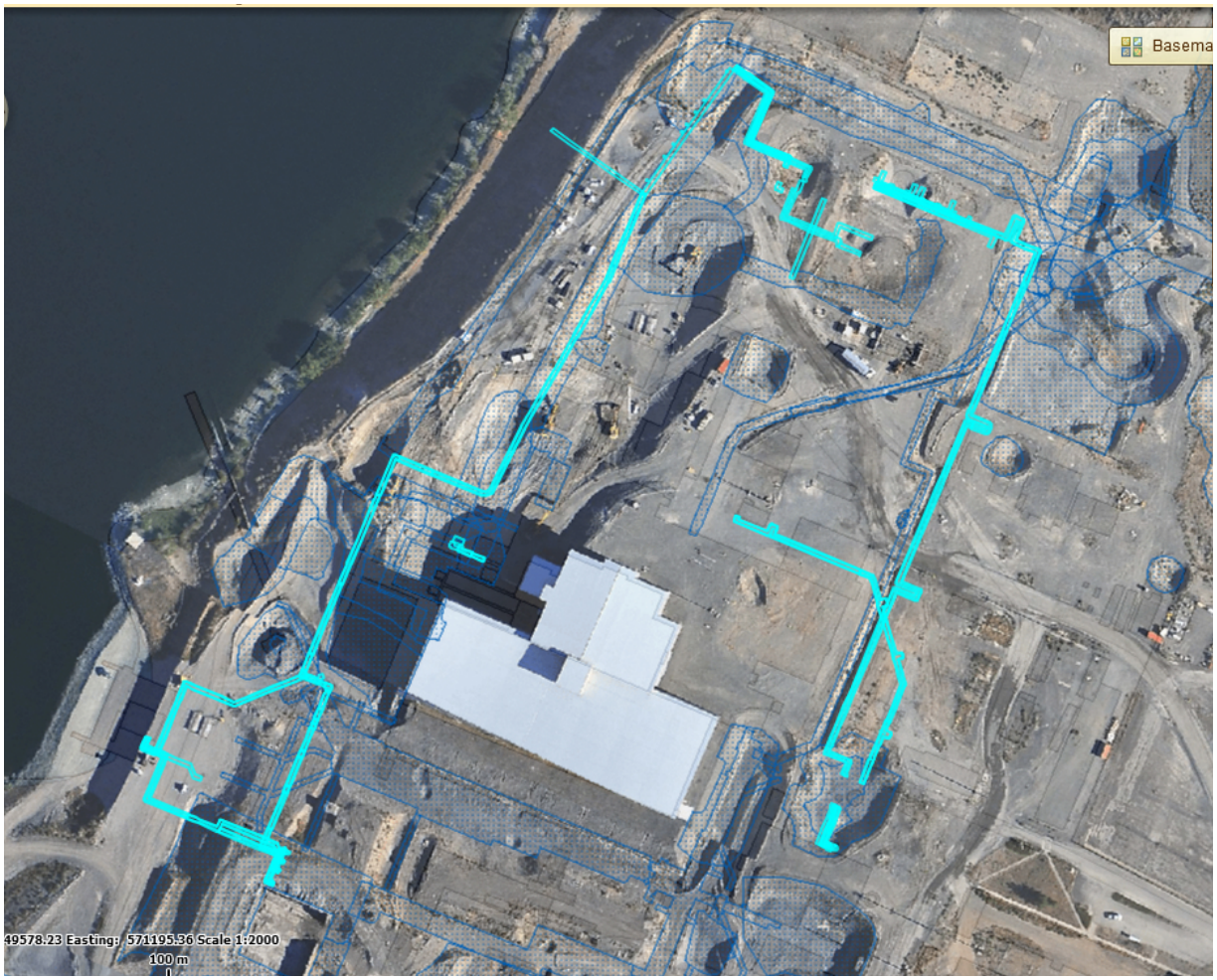


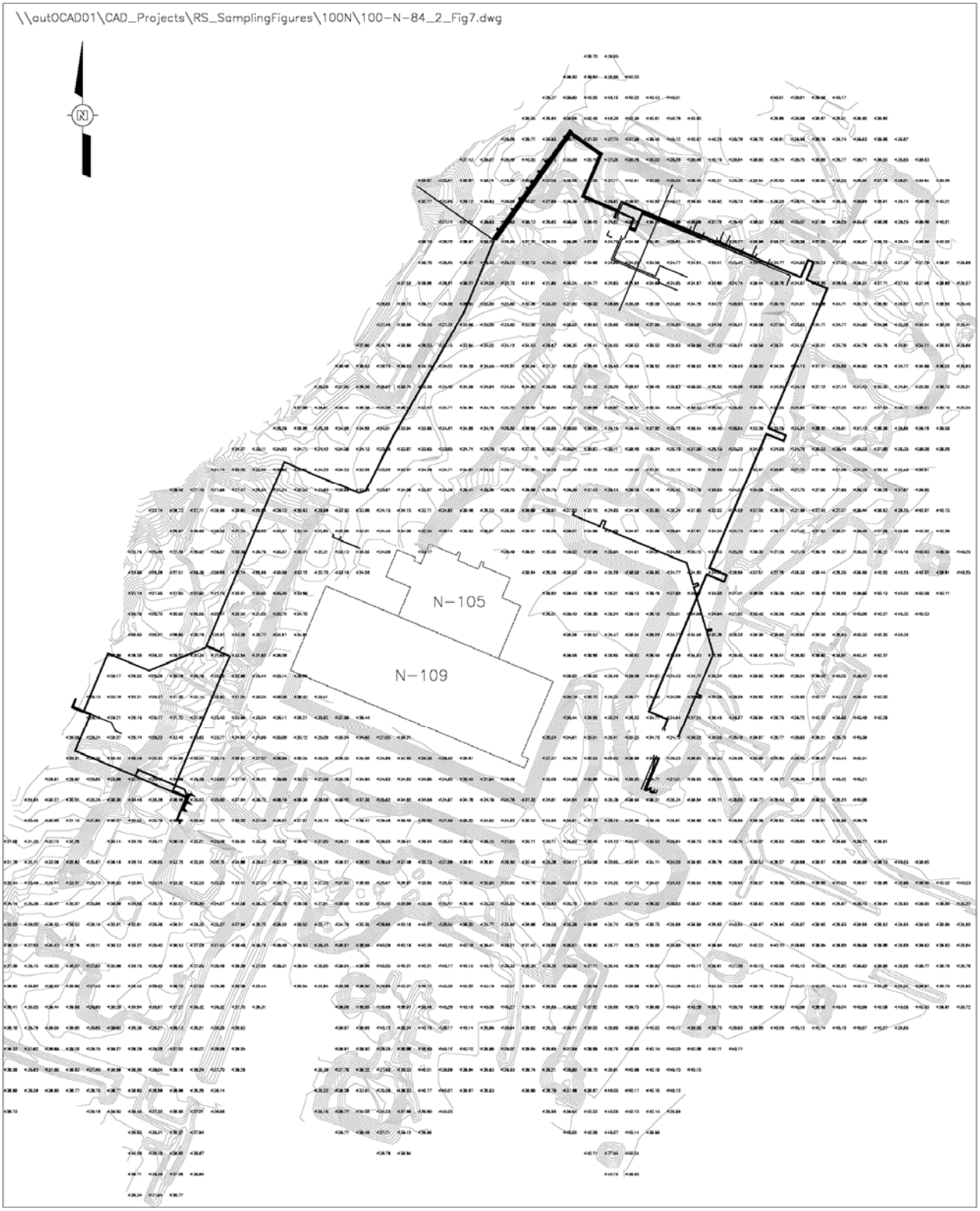
Figure 16 is an aerial photograph taken in January 2014 showing the extent of excavation associated with field remediation activities. A post-remediation civil survey for the site is provided in Figure 17. Appendix B provides a summary of the in-process sample results associated with remediation of the 100-N-84:2 pipelines.

Global Positioning Radiological Surveys

Although radionuclides are not associated with the 100-N-84:2 pipelines, global positioning environmental radiological surveys (GPERS) of the excavation were performed in December 2013 and January 2014 to evaluate potential radiological contamination that might be associated with other waste sites in the vicinity. Some residual radiological contamination was detected in soil, likely associated with the 1310-N golf ball remediation; this contamination was subsequently removed and radiological surveys of the area using GPERS were repeated. The results of these final surveys showing no radiological contamination above site background are provided in Appendix E.

Figure 16. Aerial Photograph of the 100-N Area Showing Extent of Remediation (January 2014).

Figure 17. 100-N-84:2 Post-Excavation Civil Survey.



VERIFICATION SAMPLING ACTIVITIES

Verification soil sampling was conducted on May 21 and 27, and June 6, 2014, per the *Work Instruction for Verification Sampling of the 100-N-84:2, 100-N Area Fuel and Foam Pipelines Waste Site* (WCH 2014d). Additionally, one focus verification soil sample and a duplicate soil sample were collected on March 24, 2014 as specified in the *100-N FR South River Road Agreement* (WCH 2011b). Sampling was conducted to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the 100-N Area RDR/RAWP (DOE-RL 2013) and 100-N Area ROD (EPA 1999).

The verification sample results are provided in Appendix F and indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs) for the 100-N-84:2 subsite. The following subsections provide additional discussion of the information used to develop the verification sampling design. The statistical results of verification sampling are also summarized to support interim closure of the site.

Contaminants of Potential Concern

The COPCs for verification sampling of the 100-N-84:2 subsite were determined in consideration of process knowledge, historical sampling information, and in-process sampling results collected during remediation and are identified in Table 1 with the analytical methods that were performed to evaluate the site COPCs.

Table 1. Laboratory Analytical Methods.

Analytical Method	Contaminant of Potential Concern
TPH – EPA Method NWTPH-D	Total petroleum hydrocarbons – diesel range
TPH – EPA Method NWTPH-Dx	Total petroleum hydrocarbons – heavy oil range
TPH-NWTPH-G	Total petroleum hydrocarbons – gasoline range
PAH – EPA Method 8310	Polycyclic aromatic hydrocarbons
PCB – EPA Method 8082	Polychlorinated biphenyls
ICP metals [a] – EPA Method 6010	ICP metals
Mercury – EPA Method 7471	Mercury

[a] The expanded list of ICP metals was performed and included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

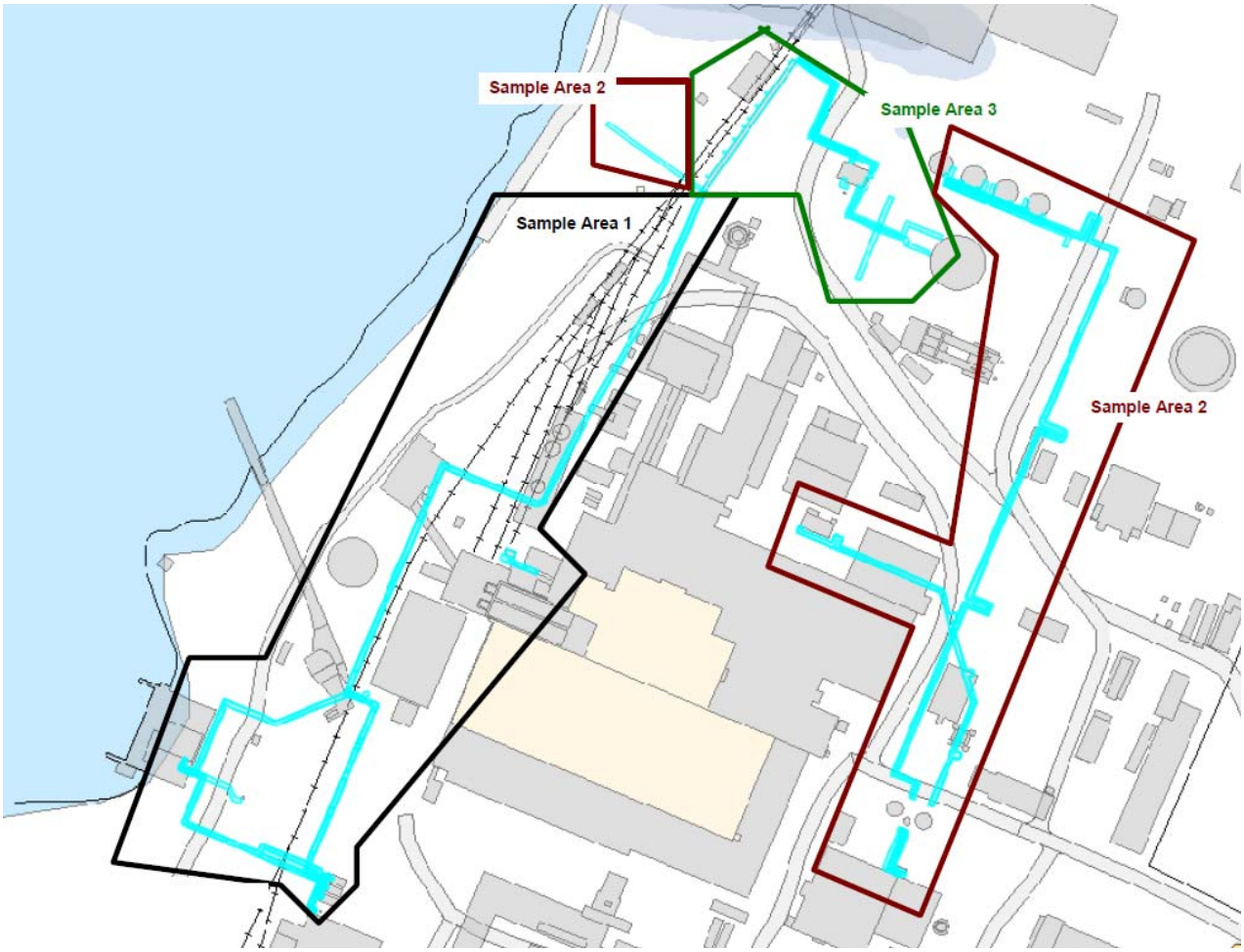
EPA = U.S. Environmental Protection Agency
ICP = inductively coupled plasma
NWTPH-D = Northwest total petroleum hydrocarbons – diesel
NWTPH-Dx = Northwest total petroleum hydrocarbons – heavy oil range
NWTPH-G = Northwest total petroleum hydrocarbons – gasoline
PAH = polycyclic aromatic hydrocarbons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

Hexavalent chromium, anions, pesticides, SVOCs, and radionuclides were additional COPCs associated with the 100-N-84:3 and 100-N-84:7 subsites that were analyzed for in the focused soil sample that was collected as part of the "100-N FR South River Road Agreement" (WCH 2011b). These COPCs were not associated with the 100-N-84:2 subsite.

Verification Sample Design

Process knowledge, field observations, investigative work, and the results of remedial excavation were used to stratify the 100-N-84:2 subsite into three areas for evaluation (Figure 18). These areas are discussed below.

Figure 18. Map Showing Location of Verification Sampling Areas for the 100-N-84:2 Pipeline.



Area 1

Area 1 was defined using the previous excavation and removal information and consisted of only diesel oil pipelines. Pipelines located in Area 1 were removed concurrent with the WCH D4 Closure Project facility removal actions (e.g., 181-N River Pump House, 1908-N Outfall, 107-N Basin Recirculation Facility, 1303-N Spacer Silos, and 117-N Air Filter Building) and during FR Closure Project waste site remediation (including UPR-100-N-30, UPR-100-N-57, 118-N-1, and 116-N-4). The Area 1 pipeline segments were shallow subsurface pipelines that

were located where large-scale facility removal and waste site remediation was performed to depths greater than 4.6 m (15 ft) bgs and in some locations as deep as 9.1 m (30 ft) bgs.

Figure 19 shows the 100-N-84:2 pipeline exposed during excavation and removal of the 100-N-63:2 pipeline. The 100-N-84:2 pipelines were drained prior to removal. No pipeline releases were noted or petroleum-stained soil observed during removal and remediation work performed for the pipeline segments located in Area 1. Therefore, no verification sampling was performed for Area 1 (WCH 2014c) with the exception of a focused verification sample and duplicate sample that were previously identified as part of the "100-N FR South River Road Agreement" (WCH 2011b).

Figure 19. 100-N-84:2 Diesel Oil Pipeline Removed During 100-N-63:2 Pipeline Removal.

Area 2

Area 2 was defined as the diesel oil and Bunker C pipelines that ran from the 166-N Tank Farm to the 184:4-N Day Tanks. Several historical petroleum releases were documented in this area. During pipeline removal, Bunker C was drained from the pipelines and it was observed as product in the soil at locations where expansion loops (Figure 9) were present. Contaminated soil was removed to a minimum depth of 4.6 m (15 ft) bgs. Test pits excavated to a depth of approximately 9.1 m (30 ft) bgs at three locations exhibiting the most soil staining detected

contamination to a depth of 5.5 m (18 ft) bgs, with no contamination detected above soil cleanup criteria below that depth. Appendix C provides a summary of the test pit sampling investigation. Extractable petroleum hydrocarbon analysis indicates this contamination is heavy oil (Bunker C); the MTCA four-phase partitioning model predicts no migration to groundwater. Groundwater monitoring does not indicate the presence of a petroleum groundwater plume below this area. Soils in this area are not contiguous with the diesel plume that is identified in the smear zone below Area 3. Statistical soil sampling of Area 2 was performed to evaluate the excavation sidewalls above a depth of 4.6 m (15 ft) bgs. The test pit data and groundwater protection modeling results (Appendix C) were used to support a decision that no further soil removal is required below 4.6 m (15 ft) in Area 2. Therefore, no verification sampling of Area 2 below 4.6 m (15 ft) was performed.

Area 2 also included the 166-N petroleum unloading facility and the barge-unloading pipeline that was located on the shoreline. The petroleum unloading facility was removed by the D4 Closure Project in 2006 (WCH 2006b) with additional soil removal performed by the FR Closure Project (WCH 2006a). The barge-unloading pipeline was removed by the FR Closure Project in March 2014. This pipeline was never used; however, some petroleum was present inside the pipeline in the upper portion above a closed valve, apparently due to leakage past an upper valve at the petroleum unloading facility. This petroleum was drained and collected for disposition. Some soil staining was observed near the top of the pipeline at the unloading facility and was removed. Therefore, one focused verification soil sample was collected at the location where the stained soil was identified and removed.

Area 3

Area 3 was delineated based on petroleum-affected soils associated with the 166-N Tank Farm, the petroleum unloading facility, the petroleum pump house, and the pipelines that connected these facilities. Multiple releases of Bunker C and diesel oil are documented in this area. With the exception of the bioventing well island, soil has been removed to a minimum depth of 4.6 m (15 ft) bgs and in some locations deeper due to nonpetroleum waste site remediation (e.g., 100-N-63:2). Bunker C stained soil is noted at a depth of 4.9 m (16 ft) at the base of a portion of the excavation. Microbial testing of heavily stained soil samples from this location indicates that biodegradation is occurring (WCH 2014e). The diesel groundwater plume underlies this area. A smear zone of petroleum-contaminated soil resides near the water table. The smear zone resulted from the movement of free-phase petroleum floating on the water table in the direction of groundwater flow. As the petroleum moves along the groundwater flow path, some of the free-phase product adheres to the soil particles and fills soil pore spaces. As seasonal water level fluctuates, the available free product is smeared vertically and laterally through the soil profile. The smear zone extends from the 166-N Tank Farm west to the Columbia River and ranges in thickness from approximately 4.6 m (15 ft) at well 199-N-169 (upland) to 2.7 m (9 ft) at well 199-N-173 (shoreline). Residual petroleum contamination remains in Area 3, and therefore this area was assigned to the UPR-100-N-17 waste site for further evaluation. No verification sampling of this area was performed.

Area 2 Verification Sampling Design

Visual Sample Plan[1] (VSP) was used to develop a statistical sampling design for Area 2 and identify verification sample locations as provided for in the 100-N Area SAP (DOE-RL 2006). Area 2 was divided into north and south decision units for verification sampling. Area 2 consisted of the excavation sidewalls from ground surface to a depth of 4.6 m (15 ft) bgs. Twelve statistical samples were collected from each decision unit using a systematic grid. Additionally, one focused soil sample was collected from the barge unloading pipeline segment at a location that exhibited soil staining that was removed during remediation.

All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites* (DOE-RL 2006). All samples were collected as discrete grab samples at the identified sample coordinates. The samples were submitted for full protocol laboratory analyses for the COPCs identified in Table 1.

Additional information related to the verification samples can be found in the field sampling logbooks (WCH 2014g, 2014h). Table 2 provides a summary of the verification samples that were collected. Figure 20 shows the statistical verification sample locations for Area 2 pipeline excavation and the location of the focused sample for the barge unloading pipeline segment.

Table 2. 100-N-84:2 Excavation Verification Sample Summary. (2 Pages)

Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
100-N-84:2 River Road Agreement Focused Samples				
RR-5	J1TFW4	571013.9	149433.5	Gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, ICP metals [a], mercury, hexavalent chromium, anions, nitrate/nitrite, pesticides, SVOA, GEA, strontium-90
Duplicate of J1TFW4	J1TFW5	571013.9	149433.5	
RR-5	J1TFW6	571013.9	149433.5	Asbestos
Duplicate of J1TFW6	J1TFW7	571013.9	149433.5	
North Decision Unit Statistical Samples				
N-1	J1TPV1	571360.7	149579.6	Gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, ICP metals [a], and mercury
N-2	J1TPV2	571328.8	149590.7	
N-3	J1TPV3	571335.2	149601.7	
N-4	J1TPV4	571360.7	149601.7	
N-5	J1TPV5	571341.5	149612.8	
N-6	J1TPV6	571347.9	149623.8	
N-7	J1TPV7	571354.3	149634.9	
N-8	J1TPV8	571354.3	149656.9	
N-9	J1TPV9	571373.4	149668.0	
N-10	J1TPW0	571341.5	149679.0	

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

Table 2. 100-N-84:2 Excavation Verification Sample Summary. (2 Pages)

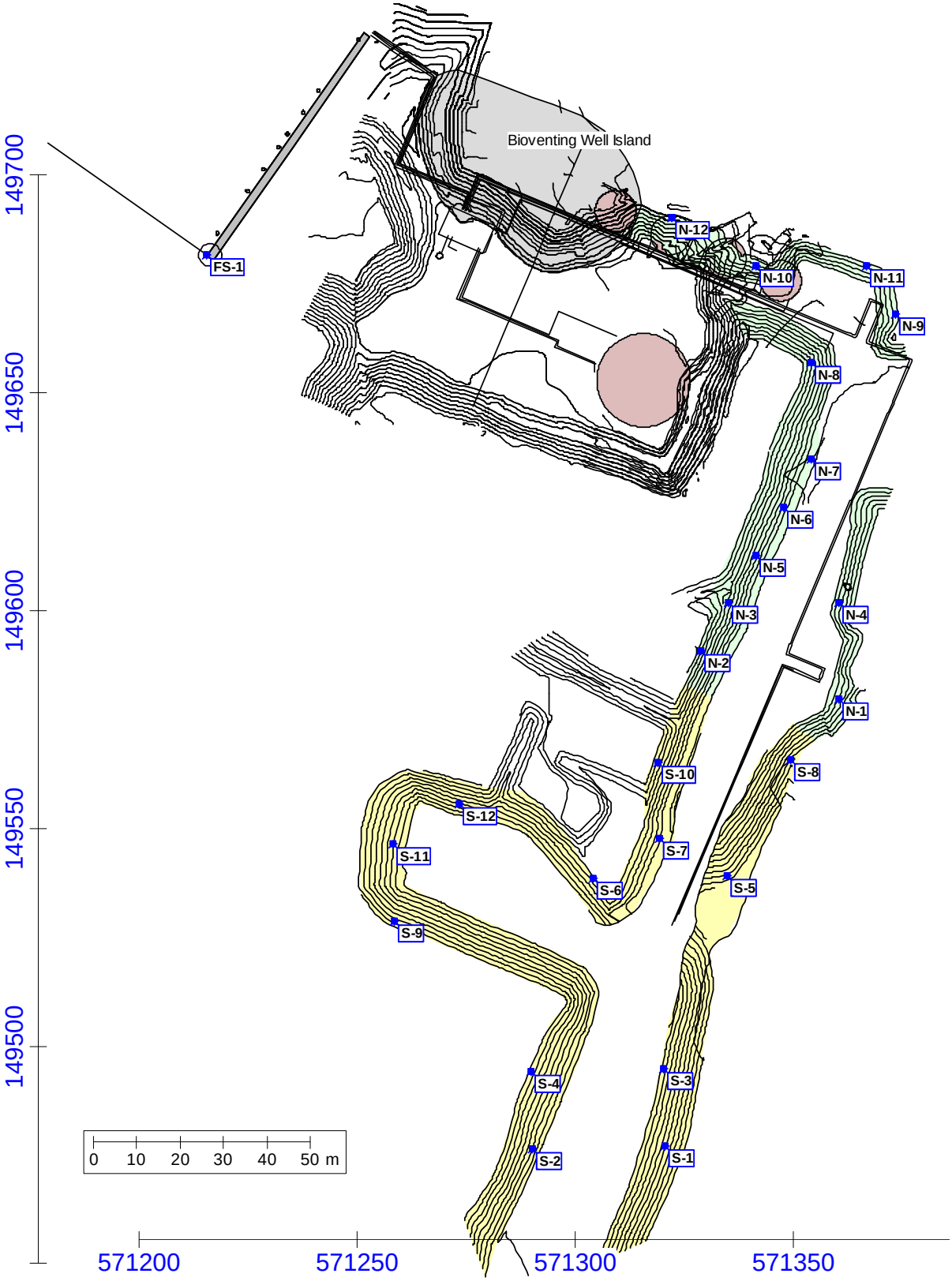
Sample Location	HEIS Sample Number	Washington State Plane Coordinates (m)		Sample Analysis
		Easting	Northing	
N-11	J1TPW1	571367.0	149679.0	Gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, ICP metals [a], and mercury
N-12	J1TPW2	571322.4	149690.1	
South Decision Unit Statistical Samples				
S-1	J1TPX5	571320.6	149477.1	Gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, ICP metals [a], and mercury
S-2	J1TPX6	571290.1	149476.5	
S-3	J1TPX7	571320.3	149494.7	
S-4	J1TPX8	571289.8	149494.2	
S-5	J1TPX9	571334.8	149539.0	
S-6	J1TR00	571304.3	149538.5	
S-7	J1TR01	571319.4	149547.6	
S-8	J1TR02	571349.6	149565.7	
S-9	J1TR03	571258.7	149528.9	
S-10	J1TR04	571319.1	149565.2	
S-11	J1TR05	571258.3	149546.5	
S-12	J1TR06	571273.5	149555.6	
Barge Unloading Pipeline Focused Sample				
FS-1	J1TR29	571215.5	149681.7	Gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, ICP metals [a], and mercury
Field QC Samples				
Duplicate (north) [b]	J1TPW3	571322.4	149690.1	Gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, ICP metals, and mercury
Split (north) [b]	J1TPX2	571322.4	149690.1	
Duplicate (south) [b]	J1TR07	571290.1	149476.5	
Split (south) [b]	J1TR08	571290.1	149476.5	
Equipment blank	J1TPW4	NA	NA	ICP metals [a] and mercury

[a] The expanded list of ICP metals was requested and included antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

[b] The duplicate and split soil samples were collected at the same location as the primary sample; the locations were selected at the project analytical lead's discretion.

GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
QC = quality control
SVOA= semivolatile organic analysis

Figure 20. Verification Sample Locations for the 100-N-84:2 Excavation (Area 2 and Barge Unloading Pipeline Segment).



Verification Sample Results

All verification samples were collected for full protocol laboratory analysis and analyzed using EPA-approved analytical methods. Evaluation of the verification data from the 100-N-84:2 subsite was performed by direct comparison of the statistical or maximum sample results for each COPC against the cleanup criteria.

The primary statistical calculation to evaluate compliance with cleanup standards is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. The 95% UCL values for each detected COPC are computed for the 100-N-84:2 subsite decision unit as specified by the 100-N Area RDR/RAWP (DOE-RL 2013). The calculations are provided in Appendix F. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for the decision unit, the maximum detected value was used for comparison to the RAGs. If no detections for a given COPC were reported in the data set, then no statistical calculation or evaluation was performed for that COPC.

Comparisons of the results for each COPC from the 100-N-84:2 subsite against the RAGs are summarized in Tables 3 through 6. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2014) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in the table.

The complete laboratory results for all constituents are stored in a Washington Closure Hanford (WCH) project-specific database prior to archival in the Hanford Environmental Information System (HEIS) and are presented in Attachment 1 of the 95% UCL calculations (Appendix F).

DATA EVALUATION

This section demonstrates that contaminant concentrations at the 100-N-84:2 subsite achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the 100-N Area ROD (EPA 1999) and documented in the 100-N Area RDR/RAWP (DOE-RL 2013).

Table 3. Comparison of Contaminant Concentrations to Remedial Action Goals for the North Decision Unit of the 100-N-84:2 Subsite Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.40 (<BG)	32	5 [c]	5 [c]	No	--
Arsenic	4.0 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	55.9 (<BG)	16,000 [d]	200	400	No	--
Beryllium	0.098 (<BG)	10.4 [e]	1.51 [c]	1.51 [c]	No	--
Boron [f]	1.6	16,000 [d]	320	-- [g]	No	--
Cadmium [h]	0.18 (<BG)	13.9 [e]	0.81 [c]	0.81 [c]	No	--
Chromium	10.3 (<BG)	120,000 [d]	18.5 [c]	18.5 [c]	No	--
Cobalt	8.7 (<BG)	1,600 [d]	32	-- [g]	No	--
Copper	16.6 (<BG)	2,960 [d]	59.2	22.0 [c]	No	--
Lead	6.8 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	325 (<BG)	11,200 [d]	512 [c]	-- [g]	No	--
Mercury	0.010 (<BG)	24 [d]	0.33 [c]	0.33 [c]	No	--
Molybdenum [f]	0.34	400 [d]	8	-- [g]	No	--
Nickel	12.3 (<BG)	1,600 [d]	19.1 [c]	27.4	No	--
Vanadium	60.6 (<BG)	560 [d]	85.1 [c]	-- [g]	No	--
Zinc	49.4 (<BG)	24,000 [d]	480	67.8 [c]	No	--
TPH - diesel range EXT	111	200	200	200	No	--
TPH - diesel range	61	200	200	200	No	--
Acenaphthene	0.120	4,800 [d]	96	129	No	--
Anthracene	0.110	24,000 [d]	240	1,920	No	--
Benzo(a)anthracene [i]	0.620	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Benzo(a)pyrene [i]	0.640	0.137 [j]	0.015 [k]	0.015 [k]	Yes	-- [l, m]
Benzo(b)fluoranthene [i]	0.480	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Benzo(ghi)perylene [n]	0.400	2,400 [d]	48	192	No	--
Benzo(k)fluoranthene [i]	0.220	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Chrysene [i]	0.700	13.7 [j]	0.12	0.1 [k]	Yes	Yes [l]
Dibenz[a,h]anthracene [i]	0.085	1.37 [j]	0.03 [j]	0.03 [j]	Yes	Yes [l]
Fluoranthene	0.820	3,200 [d]	64	18.0	No	--
Fluorene	0.095	3,200 [d]	64	260	No	--
Indeno(1,2,3-cd)pyrene [i]	0.400	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Phenanthrene [n]	0.210	24,000 [d]	240	1,920	No	--
Pyrene	1.2	2,400 [d]	48	192	No	--

Table 3. Comparison of Contaminant Concentrations to Remedial Action Goals for the North Decision Unit of the 100-N-84:2 Subsite Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Aroclor-1254	0.500	0.5 [J]	0.017 [k]	0.017 [k]	Yes	Yes [l]

[a] RAGs obtained from the 100-N Area RDR/RAWP (DOE-RL 2013), unless indicated otherwise.
[b] Maximum or 95% UCL, depending on data censorship, as described in the *100-N-84:2 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix F).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 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-N Area RDR/RAWP (DOE-RL 2013).
[d] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, Ecology 1996.
[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[f] No Hanford Site-specific or Washington State background value available.
[g] No parameters (bioconcentration factors or AWQC values) are available from the Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).
[h] Hanford Site-specific background 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).
[i] Remedial action goals obtained from the 100 Area RDR/RAWP (DOE-RL 2009).
[j] Carcinogenic cleanup level calculated per WAC 173-340-740(3), Method B, 1996.
[k] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).
[l] Based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2013), the residual concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and aroclor-1254 are predicted to migrate less than 1 m (3.3 ft) vertically within 1,000 years (based on the lowest soil-partitioning coefficient of the contaminants [aroclor-1254] of 75.6 mL/g]). The vadose zone beneath the 100-N-84:2 subsite is approximately 16 m (53 ft) thick. Therefore, the residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.
[m] The benzo(a)pyrene result is associated with a single sample located within 0.6 m (2 ft) of ground surface. The detection of benzo(a)pyrene in this sample is attributed to road asphalt and not contamination associated with the 100-N-84:2 pipelines (WCH 2014f).
[n] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:
Contaminant: benzo(g,h,i)perylene; surrogate: pyrene
Contaminant: phenathrene; surrogate: anthracene

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
Ecology = Washington State Department of Ecology
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 4. Comparison of Contaminant Concentrations to Remedial Action Goals for the South Decision Unit of the 100-N-84:2 Subsite Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.2 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	67.4 (<BG)	16,000 [d]	200	400	No	--
Beryllium	0.22 (<BG)	10.4 [e]	1.51 [c]	1.51 [c]	No	--
Boron [f]	1.5	16,000 [d]	320	-- [g]	No	--
Cadmium [h]	0.075 (<BG)	13.9 [e]	0.81 [c]	0.81 [c]	No	--
Chromium	7.9 (<BG)	120,000 [d]	18.5 [c]	18.5 [c]	No	--
Cobalt	9.7 (<BG)	1,600 [d]	32	-- [g]	No	--
Copper	16.3 (<BG)	2,960 [d]	59.2	22.0 [c]	No	--
Lead	5.3 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	341 (<BG)	11,200 [d]	512 [c]	-- [g]	No	--
Mercury	0.013 (<BG)	24 [d]	0.33 [c]	0.33 [c]	No	--
Molybdenum [f]	0.29	400 [d]	8	-- [g]	No	--
Nickel	10.7 (<BG)	1,600 [d]	19.1 [c]	27.4	No	--
Vanadium	63.9 (<BG)	560 [d]	85.1 [c]	-- [g]	No	--
Zinc	50.1 (<BG)	24,000 [d]	480	67.8 [c]	No	--
TPH - diesel range EXT	97	200	200	200	No	--
TPH - diesel range	51	200	200	200	No	--
Acenaphthene	0.028	4,800 [d]	96	129	No	--
Anthracene	0.024	24,000 [d]	240	1,920	No	--
Benzo(a)anthracene [i]	0.049	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Benzo(a)pyrene [i]	0.008	0.137 [j]	0.015 [k]	0.015 [k]	No	--
Benzo(b)fluoranthene [i]	0.067	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Benzo(ghi)perylene [m]	0.068	2,400 [d]	48	192	No	--
Benzo(k)fluoranthene [i]	0.110	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Chrysene [i]	0.071	13.7 [j]	0.12	0.1 [k]	No	--
Fluoranthene	0.041	3,200 [d]	64	18.0	No	--
Fluorene	0.017	3,200 [d]	64	260	No	--
Indeno(1,2,3-cd)pyrene [i]	0.060	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Phenanthrene [m]	0.076	24,000 [d]	240	1,920	No	--
Pyrene	0.073	2,400 [d]	48	192	No	--

Table 4. Comparison of Contaminant Concentrations to Remedial Action Goals for the South Decision Unit of the 100-N-84:2 Subsite Statistical Verification Samples. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Aroclor-1254	0.011	0.5 [J]	0.017 [k]	0.017 [k]	No	--

[a] RAGs obtained from the 100-N Area RDR/RAWP (DOE-RL 2013), unless otherwise indicated.
[b] Maximum or 95% UCL, depending on data censorship, as described in the *100-N-84:2 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix F).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 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-N Area RDR/RAWP (DOE-RL 2013).
[d] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, Ecology 1996.
[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[f] No Hanford Site-specific or Washington State background value available.
[g] No parameters (bioconcentration factors or AWQC values) are available from the Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).
[h] Hanford Site-specific background 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).
[i] Remedial action goals obtained from the 100 Area RDR/RAWP (DOE-RL 2009).
[j] Carcinogenic cleanup level calculated per WAC 173-340-740(3), Method B, 1996.
[k] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).
[l] Based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2013), the residual concentrations of benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene are predicted not to migrate vertically within 1,000 years (based on the lowest soil-partitioning coefficient of the contaminants [benzo(a)anthracene] of 360 mL/g]). The vadose zone beneath the 100-N-84:2 subsite is approximately 16 m (53 ft) thick. Therefore, the residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.
[m] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:
Contaminant: benzo(g,h,i)perylene; surrogate: pyrene
Contaminant: phenathrene; surrogate: anthracene

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
Ecology = Washington State Department of Ecology
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 5. Comparison of Contaminant Concentrations to Remedial Action Goals for the 100-N-84:2 Subsite Focused Verification Sample (Area 2).

COPC	Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.0 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	60.1 (<BG)	16,000 [d]	200	400	No	--
Cadmium [e]	0.19 (<BG)	13.9 [f]	0.81 [c]	0.81 [c]	No	--
Chromium	12.6 (<BG)	120,000 [d]	18.5 [c]	18.5 [c]	No	--
Cobalt	7.5 (<BG)	1,600 [d]	32	-- [g]	No	--
Copper	19.0 (<BG)	2,960 [d]	59.2	22.0 [c]	No	--
Lead	3.8 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	310 (<BG)	11,200 [d]	512 [c]	-- [g]	No	--
Nickel	11.4 (<BG)	1,600	19.1 [c]	27.4	No	--
Vanadium	44.0 (<BG)	560 [d]	85.1 [d]	-- [g]	No	--
Zinc	38.8 (<BG)	24,000 [d]	480 [d]	67.8 [d]	No	--
TPH - diesel range EXT	6.5	200	200	200	No	--
TPH - diesel range	4.0	200	200	200	No	--
Benzo(a)anthracene [h]	0.007	1.37 [i]	0.015 [j]	0.015 [j]	No	--
Benzo(a)pyrene [h]	0.011	0.137 [i]	0.015 [j]	0.015 [j]	No	--
Benzo(k)fluoranthene [h]	0.009	1.37 [i]	0.015 [j]	0.015 [j]	No	--
Chrysene [h]	0.013	13.7 [i]	0.12	0.1 [j]	No	--
Fluoranthene	0.022	3,200 [d]	64	18.0	No	--
Pyrene	0.024	2,400 [d]	48	192	No	--
Aroclor-1254	0.0038	0.5 [1]	0.017 [j]	0.017 [j]	No	--

[a] RAGs obtained from the 100-N Area RDR/RAWP (DOE-RL 2013), unless otherwise indicated.
[b] Maximum result as described in the *100-N-84:2 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix F).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 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-N Area RDR/RAWP (DOE-RL 2013).
[d] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, Ecology 1996.
[e] 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).
[f] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[g] No parameters (bioconcentration factors or AWQC values) are available from the Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).
[h] Remedial action goals obtained from the 100 Area RDR/RAWP (DOE-RL 2009).
[i] Carcinogenic cleanup level calculated per WAC 173-340-740(3), Method B, 1996.
[j] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
Ecology = Washington State Department of Ecology
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 6. Comparison of Contaminant Concentrations to Remedial Action Goals for the River Road Portion of the 100-N-84:2 Subsite Focused Verification Sample. (2 Pages)

COPC	Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.1 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	61.2 (<BG)	16,000 [d]	200	400	No	--
Cadmium [e]	0.12 (<BG)	13.9 [f]	0.81 [c]	0.81 [c]	No	--
Chromium	7.4 (<BG)	120,000 [d]	18.5 [c]	18.5 [c]	No	--
Cobalt	9.4 (<BG)	1,600 [d]	32	-- [g]	No	--
Copper	15.1 (<BG)	2,960 [d]	59.2	22.0 [c]	No	--
Hexavalent chromium [h]	0.408	2.1 [f]	4.8	2	No	--
Lead	5.6 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	349 (<BG)	11,200 [d]	512 [c]	-- [g]	No	--
Nickel	9.7 (<BG)	1,600 [d]	19.1 [c]	27.4	No	--
Vanadium	50.3 (<BG)	560 [d]	85.1 [c]	-- [g]	No	--
Zinc	46.3 (<BG)	24,000 [d]	480	67.8 [c]	No	--
TPH - diesel range EXT	83	200	200	200	No	--
TPH - diesel range	29	200	200	200	No	--
Chloride [i]	9.4 (<BG)	--	25,000	-- [g]	No	--
Fluoride [i]	1.0 (<BG)	4,800	96	400	No	--
Nitrogen in nitrate [i]	1.9 (<BG)	128,000 [d]	1,000	2,000	No	--
Nitrogen in nitrate and nitrite [i]	0.98	128,000 [d]	1,000	2,000	No	--
Sulfate [i]	121(<BG)	--	25,000	-- [g]	No	--
Acenapthene	0.058	4,800 [d]	96	129	No	--
Anthracene	0.056	24,000 [d]	240	1,920	No	--
Benzo(a)anthracene [l]	0.660	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Benzo(a)pyrene [l]	0.490	0.137 [j]	0.015 [k]	0.015 [k]	Yes	-- [m]
Benzo(b)fluoranthene [l]	0.400	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Benzo(ghi)perylene [n]	0.230	2,400 [d]	48	192	No	--
Benzo(k)fluoranthene [l]	0.180	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Carbozole	0.230	50 [j]	0.437	-- [g]	No	--
Chrysene [l]	0.730	13.7 [j]	0.12	0.1 [k]	Yes	Yes [l]
Dibenz[a,h]anthracene [l]	0.024	1.37 [j]	0.03 [k]	0.03 [k]	No	--
Dibenzofuran	0.110	160 [d]	3.20	-- [g]	No	--
Dimethyl phthalate	0.033	80,000 [d]	1,600	14,400	No	--
Fluoranthene	0.290	3,200 [d]	64	18.0	No	--
Fluorene	0.069	3,200 [d]	64	260	No	--
Indeno(1,2,3-cd)pyrene [l]	0.200	1.37 [j]	0.015 [k]	0.015 [k]	Yes	Yes [l]
Phenanthrene [n]	0.028	24,000 [d]	240	1,920	No	--
Pyrene	0.590	2,400 [d]	48	192	No	--

Table 6. Comparison of Contaminant Concentrations to Remedial Action Goals for the River Road Portion of the 100-N-84:2 Subsite Focused Verification Sample. (2 Pages)

COPC	Maximum Result [b] (mg/kg)	Remedial Action Goals (mg/kg) [a]			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Aroclor-1254	0.010	0.5 [j]	0.017 [k]	0.017 [k]	No	--

[a] RAGs obtained from the 100-N Area RDR/RAWP (DOE-RL 2013), unless otherwise indicated.
[b] Maximum result as described in the *100-N-84:2 Waste Site Cleanup Verification 95% UCL Calculations* (Appendix F).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 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-N Area RDR/RAWP (DOE-RL 2013).
[d] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, Ecology 1996.
[e] 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).
[f] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], Ecology 1996).
[g] No parameters (bioconcentration factors or AWQC values) are available from the Ecology Cleanup Levels and Risk Calculations database or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], 1996 [Method B for surface waters]).
[h] No Hanford Site-specific or Washington State background value available.
[i] Remedial action goals obtained from the 100 Area RDR/RAWP (DOE-RL 2009).
[j] Carcinogenic cleanup level calculated per WAC 173-340-740(3), Method B, 1996.
[k] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996).
[l] Based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2013), the residual concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene are predicted not to migrate vertically within 1,000 years (based on the lowest soil-partitioning coefficient of the contaminants [aroclor-1254] of 75.6 mL/g]). The vadose zone beneath the 100-N-84:2 subsite is approximately 16 m (53 ft) thick. Therefore, the residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.
[m] The benzo(a)pyrene in this sample is attributed to asphaltic pipeline coatings that were present on the co-located 100-N-84:7 pipeline and not associated with the 100-N-84:2 pipelines (WCH 2014b).
[n] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals:
Contaminant: benzo(g,h,i)perylene; surrogate: pyrene
Contaminant: phenathrene; surrogate: anthracene

-- = not applicable
AWQC = ambient water quality criteria
BG = background
COPC = contaminant of potential concern
Ecology = Washington State Department of Ecology
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = Remedial Design Report/Remedial Action Work Plan
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Attainment of Nonradionuclide RAGs

Tables 3 through 6 compare the shallow zone (above 4.6 m [15 ft] depth) cleanup verification sample values for the 100-N-84:2 subsite excavation to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. All COPCs were quantified below groundwater and/or river protection soil RAGs with the exception of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and aroclor-1254. However, given the lowest soil-partitioning coefficient (K_d) of these contaminants (aroclor-1254) of 75.6 mL/g, none would be expected to migrate more than 1 m (3.3 ft) vertically in 1,000 years based on RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2013). The vadose zone beneath the 100-N-84:2 subsite is approximately

16 m (53 ft) thick. Therefore, residual concentrations of all contaminants are predicted to be protective of groundwater (and thus the Columbia River).

RAGs for Direct Exposure and GW & River Protection Exceeded

As previously stated, diesel and motor oil range petroleum hydrocarbons and polycyclic aromatic hydrocarbon contamination exceeding direct exposure, groundwater protection, and river protection RAGs remain in the deep vadose zone soil (below 4.6 m [15 ft] depth) at the base of the Area 2 and Area 3 excavations. Test pits were excavated to an approximate depth of 9.1 m (30 ft) bgs at four locations exhibiting the most soil staining to further evaluate this contamination (Appendix C). Extractable petroleum hydrocarbon analysis of the test pit soil samples indicates this contamination is heavy oil (Bunker C).

Test pit soil samples and the MTCA four-phase partitioning model (Appendix C) indicate that residual contaminant concentrations in Area 2 are protective of groundwater and the Columbia River (e.g., no migration to groundwater is predicted) and no further soil removal in Area 2 is required. However, focused sample concentrations in Area 2 exceed direct exposure RAGs; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are required.

Soil samples collected from the test pit located in Area 3 showed contamination throughout the tested soil column and the MTCA four-phase partitioning model indicates contamination concentrations in Area 3 are not protective of groundwater (and thus the Columbia River) (Appendix C). Therefore, residual contamination remaining in Area 3 will be assigned to the UPR-100-N-17 waste site for in situ bioremediation and further evaluation.

Sample J1TPV2 in the Area 2 north decision unit had benzo(a)pyrene detected at 0.640 mg/kg. Because only 4 of the 12 samples in the north decision unit had detectable benzo(a)pyrene, the data set defaulted to the maximum value of 0.640 mg/kg (Appendix F) which exceeds the direct exposure RAG of 0.137 mg/kg. However, for two reasons it is believed that the observed concentration of benzo(a)pyrene is associated with road asphalt and is not associated with the petroleum pipelines: (1) Sample J1TPV2 is located at sampling node N-2, within 0.6 m (2 ft) of the ground surface and within 4.6 m (15 ft) of a roadway in an area where surface soil has been highly disturbed over the years of N-Area operation and by subsequent D4 removal activities and FR remediation activities. (2) Sample J1TPV2 also had a detection of Aroclor-1254 and PCBs have not previously been detected in samples associated with diesel or Bunker C oil at 100-N but are a roadway contaminant. The laboratory rechecked the results and also reran the sample. The reran result for benzo(a)pyrene was similar to the original result. Also, note that benzo(a)pyrene was not detected in sample J1TR05 (which had the highest TPH value [390 mg/kg]). Total petroleum hydrocarbon (TPH) was detected at 58 mg/kg in sample J1TPV2. Therefore, it is believed that the detection of benzo(a)pyrene in sample J1TPV2 is due to road asphalt and is not associated with the petroleum pipelines. Based on this determination, it was decided that no further remediation at this location will be performed (WCH 2014f).

Three-Part Test for Nonradionuclides

A RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test, which consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection shall 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-N-84:2 subsite is included in the *100-N-84:2 Waste Site Cleanup Verification 95% UCL Calculation* in Appendix F of this remaining sites verification package for shallow zone samples (above 4.6 m [15 ft] depth), where half or more of the data set was detected. The results of this evaluation indicate that all residual COPC concentrations pass the three-part test in comparison against applicable RAGs.

An additional application of the three-part test is included for the statistical data sets that default to the maximum because less than half of the data set was detected. The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs with the exception of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and aroclor-1254 which fail one or more of the three-part test. However, based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2013), the residual concentrations of these constituents are predicted to migrate less than 1 m (3.3 ft) vertically within 1,000 years (based on the lowest K_d of the contaminants [aroclor-1254] of 75.6 mL/g). As stated above, the vadose zone beneath the 100-N-84:2 subsite is approximately 16 m (53 ft) thick. Therefore, the residual concentrations of these contaminants are predicted to be protective of groundwater and the Columbia River.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. For the 100-N-84:2 subsite, these risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background. All individual hazard quotients for noncarcinogenic constituents in shallow zone samples (above 4.6 m [15 ft] depth) were less than 1.0. The cumulative hazard quotient for those noncarcinogenic constituents above background or detected levels is 3.2×10^{-1}, which is less than 1.0. The individual carcinogenic risk values for the carcinogenic constituents detected above background in shallow zone samples (above 4.6 m [15 ft] depth) are less than 1×10^{-6}, and the cumulative carcinogenic risk value was 3.0×10^{-6}, which is less than 1×10^{-5}. The 100-N-84:2 subsite meets the requirements for the direct contact hazard quotient and excess carcinogenic risk as identified in the 100-N Area RDR/RAWP (DOE-RL 2013).

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 100-N-84:2 subsite included a calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides in shallow zone samples (above 4.6 m [15 ft] depth). The requirements include

an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than 1 x 10^{-6}, and a cumulative excess carcinogenic risk of less than 1 x 10^{-5}. 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 soil-partitioning coefficients for these contaminants must be less than that necessary to show no migration to groundwater in 1,000 years based on RESRAD modeling discussed in Appendix C of the 100-N Area RDR/RAWP (DOE-RL 2013). Based on this model and a vadose zone of approximately 16.0 m (53 ft) in thickness, a K_d of 4.6 or greater is required to show no predicted migration to groundwater in 1,000 years. All individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the 100-N-84:2 subsite is 9.0 x 10^{-2}, which is less than 1.0. No carcinogenic constituents met the criteria for groundwater protection evaluation at the 100-N-84:2 subsite; therefore, no calculations of excess carcinogenic risk were performed. Therefore, nonradionuclide risk requirements related to groundwater are met.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach (WCH 2014d), the field logbooks (WCH 2014g, 2014h), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 100-N-84:2 subsite established that the data are of the right type, quality, and quantity to support site closeout decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in a WCH project-specific database for data evaluation prior to archival in HEIS and are summarized in Appendix F. The detailed DQA is presented in Appendix G.

SUMMARY FOR INTERIM CLOSURE

The 100-N-84:2 subsite has been evaluated in accordance with the 100-N Area ROD (EPA 1999) and the 100-N Area RDR/RAWP (DOE-RL 2013). Verification sampling was performed, and the analytical results indicate that the residual concentrations of COPCs in shallow zone samples at the site meet the RAOs for direct exposure, groundwater protection, and river protection. However, diesel and motor oil range petroleum hydrocarbons and polycyclic aromatic hydrocarbon contamination exceeding direct exposure, groundwater protection, and river protection RAGs remain in the deep vadose zone soil in some areas.

While the shallow zone verification sampling results support a reclassification of the 100-N-84:2 subsite to Interim Closed Out, contamination above direct exposure levels remains at several locations in the deep zone soils. Therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are required. Residual contamination in Area 3 will be assigned to the UPR-100-N-17 waste site for in situ bioremediation and further evaluation.

REFERENCES

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

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

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

DOE-RL, 2006, *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites,* DOE/RL-2005-92, Rev. 0, 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.

DOE-RL, 2013, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area,* DOE/RL-2005-93, Rev. 1, 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, 2014, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.

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

EPA, 1989, *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A; Interim Final*, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1999, *Interim Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2011, *Explanation of Significant Differences for the 100-NR-1 and 100-NR-2 Operable Units Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

GE, 1967, *Oil Leak – 100-N Area*, letter from R. L. Dickeman, General Electric Company, to W. Devine, U.S. Atomic Energy Commission, dated June 27, 1967, 0036669, General Electric Company, Richland, Washington.

UNI, 1985, *Oil Spill Prevention, Control, and Countermeasures Plan*, UNI-228, Rev. 4, United Nuclear Industries, Richland, Washington.

WAC 173-340, 2007, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, as amended.

WCH, 2006a, *D-4 Project Soils or Below Grade Structures Deferral Form for the 166-N, 1715-N,* D4-100N-0004, Washington Closure Hanford, Richland, Washington.

WCH, 2006b, *Post-Demolition Summary Report for the 166-N Fuel Oil Pump House, 166-N Fuel Oil Unloading Station, and 1715-N Fuel Oil Storage Tanks 1-5*, CCN 128258, Washington Closure Hanford, Richland, Washington.

WCH, 2010, "100-N-84:2 Remaining Site for Remedial Action," CCN 152843 to S. W. Callison, from M. L. Proctor, Washington Closure Hanford, Richland, Washington, August 12.

WCH, 2011a, "Ecology Approved Ex-Situ Bioremediation Plan For 100-N," CCN 157653 to M. Buckmaster, et al., from D. G. Saueressig, Washington Closure Hanford, Richland, Washington, March 29.

WCH, 2011b, "100-N FR South River Road Agreement," CCN 158653 to R. Varljen, Washington State Department of Ecology, from T. L. Faust, Washington Closure Hanford, Richland, Washington, May 19.

WCH, 2011c, "UPR-100-N-19, UPR-100-N-21, UPR-100-N-22, UPR-100-N-23, and UPR-100-N-43 Bio-Situ Evaluation," CCN 160246 to M. Buckmaster, et al., from T. L. Faust, Washington Closure Hanford, Richland, Washington, August 2.

WCH, 2011d, "100-N Bioremediation Ex-situ Phase 1 Plan Update," CCN 162100 to R. Varljen, Washington State Department of Ecology, from T. L. Faust, Washington Closure Hanford, Richland, Washington, October 20.

WCH, 2014a, "100-N-84:2 Remaining Pipe Agreement," CCN 174952, to W. Elliott, Washington State Department of Ecology, and J. C. Chance, U.S. Department of Energy, from D. G. Saueressig, Washington Closure Hanford, Richland, Washington, March 5.

WCH, 2014b, "100-N-84:2 and River Road Agreement," CCN 175488, to W. Elliott, Washington State Department of Ecology, and J. C. Chance, U.S. Department of Energy, from W. S. Thompson, Washington Closure Hanford, Richland, Washington, April 7.

WCH, 2014c, "Request to Backfill 100-N-84 Pipeline Segments," CCN 174313, to W. Elliott, Washington State Department of Ecology, and J. C. Chance, U.S. Department of Energy, from D. G. Saueressig, Washington Closure Hanford, Richland, Washington, January 13.

WCH, 2014d, *Work Instruction for Verification Sampling of the 100-N-84:2, 100-N Area Fuel and Foam Pipelines Waste Site,* 0100N-WI-G0083, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014e, Annual Operations and Monitoring Report for UPR-100-N-17: November 2012 – February 2014, WCH-600, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014f, "100-N-84:2 Status," CCN 176376, to W. Elliott, Washington State Department of Ecology, and J. C. Chance, U.S. Department of Energy, from W. S. Thompson, Washington Closure Hanford, Richland, Washington, June 17.

WCH, 2014g, *100N Field Remediation and Sampling*, Logbook EL-1652-11, pp. 74-75, Washington Closure Hanford, Richland, Washington.

WCH, 2014h, *100N Field Remediation and Sampling*, Logbook EL-1652-12, pp. 15-21, 24-19, 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 Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-N-84:2 Subsite [a].

Hazardous Substance		2001 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]				Statistical or Maximum Result
		Plants	Soil Biota	Wildlife	Plants	Soil Biota	Avian [c]	Mammalian [c]	
	Background	Metals (mg/kg)							
Antimony	5	5	NA	NA	NA	78	NA	0.27	0.40 (<BG)
Boron	NA	0.5	NA	NA	NA	NA	NA	NA	1.6
Manganese	512	1,100 [d]	NA	1,500	220	450	4,300	4,000	349 (<BG)
Vanadium	85.1	2	NA	NA	NA	NA	7.8	280	63.9 (<BG)
Zinc	67.8	86 [d]	200	360	160	120	46	79	50.1 (<BG)
Other Nonchlorinated Organics									
High molecular weight PAH [e]		--	--	--	--	18	--	1.1	4.745

NOTE: Shaded cells indicate screening values that are exceeded.

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

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

[c] Wildlife.

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

[e] High Molecular Weight Polynuclear Aromatic Hydrocarbons (HMW-PAH), e.g., *Benzo(a)anthracene,* Benzo(a)pyrene, *Benzo(g,h,i)perylene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz[a,h]anthracene, Indeno(1,2,3-cd)pyrene, and pyrene.*

-- = no value exists
BG = background
EPA = U.S. Environmental Protection Agency
NA = not available
PAH = polycyclic aromatic hydrocarbons
WAC= *Washington Administrative Code*

APPENDIX B

IN-PROCESS SAMPLE RESULTS

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	TPH - Diesel Ext.			TPH - Diesel			Oil and grease			TPH - gasoline		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1FHX1	3/23/2011	149650	571374	140,000	N	270	110,000	N	190						
J1J4J5	6/8/2011	149433.5	571014	10		1	7.9		0.69						
J1J4J6	6/8/2011	149433.5	571014	22		1	18		0.7						
J1RRD0	7/2/2013	149676.3	571342	85	B	1	78	B	0.7	290	BNC	88	0.34	U	0.34
J1RRD1	7/2/2013	149669.1	571351	3200	BD	9.2	2100	BD	6.3	8670		85.1	0.33	U	0.33
J1RRD2	7/2/2013	149675.5	571369	4.3	B	0.98	2,8	JB	0.67	146	BC	82.4	0.32	U	0.32
J1RRD3	7/2/2013	149681.1	571355	3.2	JB	0.99	2.6	JB	0.67				0.34	U	0.34
J1RRD4	7/2/2013	149677.1	571363	3.1	JB	0.98	2.3	JB	0.67				0.33	U	0.33
J1RRD5	7/2/2013	149658.3	571365	28	B	1	15	B	0.68				0.33	U	0.33
J1RRD6	7/2/2013	149662.8	571350	53	B	0.96	43	B	0.65	284	BC	86.1	0.33	U	0.33
J1RTP5	7/17/2013	149550.9	571331	5.8		1	3.8	J	0.68	3950		84	0.33	U	0.33
J1RTP6	7/17/2013	149565.2	571337	4100	D	20	2800	D	14	4410		84.7	0.32	U	0.32
J1RTP7	7/17/2013	149579.4	571345	8100	D	20	5500	D	13	9060		85.2	0.33	U	0.33
J1RTP8	7/17/2013	149585.9	571357	21000	D	47	17000	D	32	4100		86.6	0.82	J	0.33
J1RTP9	7/17/2013	149611.5	571360	1400	D	5	1300	D	3.4				0.32	U	0.32
J1RTR0	7/17/2013	149585.5	571354	7.1		0.98	4.1		0.67						
J1RV86	7/17/2013	149590.5	571348	24000	D	40	20000	D	27						
J1RV87	7/17/2013	149547.9	571265	0.99	U	0.99	0.67	U	0.67						
J1RV88	7/17/2013	149547.8	571263	2.6	J	1	1.3	J	0.68						
J1RV89	7/17/2013	149542.4	571268	1900		4	1200		2.7						
J1RV90	7/17/2013	149540.2	571262	5.1		0.98	2.9	J	0.67						
J1RV91	7/17/2013	149546.3	571257	270		0.95	160		0.65						
J1RVK8	7/29/2013	149539.5	571273	8300	DB	19	5600	DB	13	20900		85.9	1.2		0.33
J1RVK9	7/29/2013	149535.1	571287	6100	DB	19	3000	DB	13	15400		83.2	0.32	U	0.32
J1RVP3	7/29/2013	149536.9	571277	6400	DB	20	4200	DB	13	13900	N	83.4			
J1RVP4	7/29/2013	149540.4	571288	15	B	1	6.6	B	0.69	425	BC	87.8			
J1RVP5	7/29/2013	149543.8	571285	550	B	0.92	320	B	0.62	1350	C	85.3			
J1RVP6	7/29/2013	149547.4	571276	7000	DB	20	3500	DB	13	27700		83.4			
J1RVP7	7/29/2013	149528.7	571292	6200	DB	20	3400	DB	13	17600		81.2			
J1RVP8	7/29/2013	149531.2	571283	1400	DB	4.8	840	DB	3.3	5000		83.7			
J1RVP9	7/29/2013	149526.4	571301	38	B	0.98	21	B	0.66	1270	C	83.2			
J1RVR0	7/29/2013	149550.6	571286	130	B	1	61	B	0.69	6580		89.1			
J1RWH0	8/13/2013	149468.6	571298	1600	BN	15	930	N	9.9	3510		84.7			
J1RWH1	8/13/2013	149493.7	571307	82	B	0.99	77		0.68	284	BC	80.2			
J1RWH2	8/13/2013	149483.1	571304	60	B	1	49		0.7	342	BC	85.3			
J1RWT6	8/14/2013	149514.1	571324	1	U	1	0.7	U	0.7	213	BC	86.1			
J1RWT7	8/14/2013	149514.5	571323	1.1	U	1.1	0.74	U	0.74	613	C	89.7			
J1RWT8	8/14/2013	149515.2	571323	1	U	1	0.68	U	0.68	146	BC	82.4			
J1RXN1	8/22/2013	149681.1	571355							190	BC	84.9			
J1RXN2	8/22/2013	149677.1	571363							129	BC	84.3			
J1RXN3	8/22/2013	149658.3	571365							234	BC	82.7			
J1RXN4	8/22/2013	149662.8	571350							226	BC	83.2			
J1T085	9/5/2013	149602.6	571338	1.2	JB	1	1.2	JB	0.68	387	BC	88.6			
J1T086	9/5/2013	149602.1	571339	1.1	U	1.1	0.76	U	0.76	208	BC	92.9			
J1T087	9/5/2013	149602.1	571340	2.9	JB	1	2.4	JB	0.68	229	BC	84.4			
J1T088	9/5/2013	149641.8	571358	8	B	0.98	5.4	B	0.66	425	BC	82			
J1T089	9/5/2013	149641.3	571358	310	B	1.1	220	B	0.77	4480		91.3			
J1T090	9/5/2013	149641.2	571359	19	B	1	12	B	0.69	457	BC	86.2			
J1T091	9/5/2013	149591.6	571362	3.4	JB	1	2.8	JB	0.68	329	BC	84.5			
J1T092	9/5/2013	149591.3	571362	1.1	U	1.1	0.73	U	0.73	435	BC	90			

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	TPH - Diesel Ext.			TPH - Diesel			Oil and grease			TPH - gasoline		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1T093	9/5/2013	149591.2	571363	1.5	JB	0.98	1.3	JB	0.67	483	BC	85.3			
J1T094	9/5/2013	149607.9	571341	1.1	U	1.1	0.77	U	0.77	447	BC	97.1			
J1T097	9/5/2013	149585.5	571355	4.9	B	5.2	2.9	B	3.5	2020	N	89.2			
J1T098	9/5/2013	149585.5	571355	2.1	B	5.2	1.4	B	3.5	891	C	86.8			
J1T099	9/5/2013	149585.5	571355	52	B	1	35	B	0.7	327	BC	86.7			
J1T0C0	9/5/2013	149585.5	571355	3.7	JB	1	2.5	JB	0.68	256	BC	86.8			
J1T0C1	9/5/2013	149585.5	571355	29	B	1	19	B	0.71	414	BC	87.8			
J1T0C2	9/5/2013	149585.5	571355	2.3	JB	0.96	1.6	JB	0.65	282	BC	88.5			
J1T0C3	9/5/2013	149652.6	571366	25000	DB	150	18	DB	100	3890		86.1			
J1T0C4	9/5/2013	149652.6	571366	2300	B	4.9	1300	B	3.3	728	C	88.2			
J1T0C5	9/5/2013	149652.6	571366	25	B	1	16	B	0.68	508	BC	87.9			
J1T0C6	9/5/2013	149652.6	571366	38	B	1	23	B	0.68	401	BC	87.1			
J1T0C7	9/5/2013	149652.6	571366	1	U	1	0.85	JB	0.69	310	BC	87.6			
J1T0C8	9/5/2013	149652.6	571366	8	B	1	5.6	B	0.69	198	BC	88.4			
J1T1P8	9/17/2013	149551.1	571338	2.8	JB	1	2.2	JB	0.71	248	BC	87.6			
J1T1P9	9/17/2013	149551.6	571337	3.2	JB	1.1	2.4	JB	0.74	300	BC	87.8			
J1T1R0	9/17/2013	149552.2	571336	18	B	1	8.4	B	0.7	374	BC	85.6			
J1T1R2	9/17/2013	149462.5	571289	15	B	0.98	7.3	B	0.67	406	BC	86.1			
J1T1R3	9/17/2013	149461.1	571290	1.1	U	1.1	0.72	U	0.72	393	BC	90			
J1T1R4	9/17/2013	149460	571291	5.8	B	0.99	4.5	B	0.67	332	BC	82.7			
J1T462	10/23/2013	149682.2	571336	10	B	1	7.6	B	0.68						
J1T463	10/23/2013	149682.8	571325	3.7	JB	0.96	2.7	JB	0.65						
J1T464	10/23/2013	149686.3	571324	13	B	1	9.1	B	0.68						
J1T465	10/23/2013	149686.8	571318	3.7	JB	0.98	2.7	JB	0.67						
J1T4M7	10/29/2013	149569.4	571349	4.5	B	1.1	3.7	JB	0.73						
J1T4M8	10/29/2013	149557.8	571323	5.6	B	1	4.2	B	0.7						
J1T4P9	10/31/2013	149459.1	571280	3.7	JB	1	2.6	JB	0.68						
J1T4R0	10/31/2013	149471.1	571285	15	B	1.1	8.7	B	0.72						
J1T4R1	10/31/2013	149483.9	571291	2.4	JB	1.1	1.6	JB	0.72						
J1T4R2	10/31/2013	149497.7	571297	4.1	JB	1	2.4	JB	0.7						
J1T4R3	10/31/2013	149522.9	571319	2.1	JB	1	1.6	JB	0.71						
J1T4R4	10/31/2013	149512.2	571326	4	JB	1	2.3	JB	0.69						
J1T4R5	10/31/2013	149502.4	571324	9.4	B	1	5.7	B	0.69						
J1T4R6	10/31/2013	149488	571321	17	B	1	11	B	0.71						
J1T4R7	10/31/2013	149476.9	571320	3.9	JB	1	3.2	JB	0.71						
J1T4R8	10/31/2013	149460.4	571311	4.3	B	0.98	3	JB	0.67						
J1T599	11/14/2013	149407.9	571066	7.9		1.1	5.9		0.72						
J1T5C0	11/14/2013	149413.7	571070	20		1	17		0.7						
J1T5C1	11/14/2013	149421.6	571054	3.9	JX	1	3.3	JX	0.68						
J1T630	11/20/2013	149534.2	571287	2200	D	10	1300	D	6.8						
J1T631	11/20/2013	149534.2	571287	2600	D	10	1900	D	7						
J1T632	11/20/2013	149534.2	571287	2.8	J	0.96	2.2	J	0.65						
J1T633	11/20/2013	149534.2	571287	2.1	J	1	1.6	J	0.69						
J1T634	11/20/2013	149534.2	571287	2.7	J	1	2.1	J	0.69						
J1T635	11/20/2013	149534.2	571287	5.4		1	3.4	J	0.69						
J1T636	11/20/2013	149679.7	571277	7800	D	100	5600	D	69						
J1T637	11/20/2013	149679.7	571277	21000	D	13	17000	D	86						
J1T638	11/20/2013	149679.7	571277	3000	D	10	2300	D	6.8						
J1T639	11/20/2013	149679.7	571277	1800	D	11	1200	D	7.2						
J1T640	11/20/2013	149679.7	571277	2100	D	10	1500	D	7						

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	TPH - Diesel Ext.			TPH - Diesel			Oil and grease			TPH - gasoline		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1T641	11/20/2013	149679.7	571277	3300	D	10	2300	D	7.1						
J1T685	11/20/2013	149516.9	571301	2.2	JB	1.1	1.6	JB	0.77						
J1T686	11/20/2013	149521.3	571289	2.6	JB	1.1	2.1	JB	0.76						
J1T687	11/20/2013	149526.2	571272	1	U	1	0.7	U	0.7						
J1T688	11/20/2013	149530.5	571259	0.97	U	0.97	0.66	U	0.66						
J1T689	11/20/2013	149537.6	571255	12	B	1	8.2	B	0.69						
J1T690	11/20/2013	149549.8	571254	670	DB	10	380	DB	7						
J1T691	11/20/2013	149558.2	571271	11	B	1	7	B	0.7						
J1T692	11/20/2013	149554.2	571289	17	B	1.1	9	B	0.72						
J1T693	11/20/2013	149543.5	571299	160	B	1.1	110	B	0.73						
J1T694	11/20/2013	149536.7	571308	14	B	1.1	7.4	B	0.74						
J1T695	11/20/2013	149531.2	571315	130	B	1	58	B	0.7						
J1T696	11/20/2013	149637.7	571353	2.9	JB	1.1	2.1	JB	0.72						
J1T786	1/13/2014	149549.8	571255	110		1	56		0.7						
J1T787	1/13/2014	149539.9	571332	4.5	J	1.2	3.1	J	0.79						
J1T788	1/13/2014	149538.1	571316	5.3		1.1	3.4	J	0.72						
J1TF24	2/24/2014	149681.7	571216	5.9	B	1	4.1	JB	0.71						
J1TF25	2/24/2014	149694	571202	5	B	1	3.4	JB	0.71						
J1TF26	2/24/2014	149701.5	571191	5.1	B	1	3.5	JB	0.71						
J1TF27	2/24/2014	149706.8	571180	2.9	JB	1	2.3	JB	0.69						

HEIS Number	Date	Bromide			Chloride			Fluoride			Nitrogen in Nitrate			Nitrogen in Nitrite and		
		mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
J1FHX1	3/23/2011															
J1J4J5	6/8/2011	0.4	U	0.4	179		2.1	0.86	U	0.86	0.98	B	0.33	0.79	BM	0.32
J1J4J6	6/8/2011	0.4	U	0.4	225		2	0.85	U	0.85	1	B	0.32	0.93		0.32
J1RV00	7/16/2013															
J1RV01	7/16/2013															

HEIS Number	Date	Nitrogen in			Phosphorous in			Sulfate			Total halogens			pH Measurement		
		mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	pH	Q	PQL
J1FHX1	3/23/2011															
J1J4J5	6/8/2011	0.35	U	0.35	1.3	U	1.3	4.6	B	1.8				8.23		0.01
J1J4J6	6/8/2011	0.35	U	0.35	1.3	U	1.3	5	B	1.8				7.35		0.01
J1RV00	7/16/2013															
J1RV01	7/16/2013										765		38.9			

HEIS Number	Date	Ignitability		
		Deg F	Q	PQL
J1FHX1	3/23/2011			
J1J4J5	6/8/2011			
J1J4J6	6/8/2011			
J1RV00	7/16/2013	160	U	1
J1RV01	7/16/2013	160	U	1

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Total beta radiostrontium			Americium-241			Cesium-137		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
J1FHX1	3/23/2011	149650	571374				0.155	U	0.347	-0.005	U	0.033
J1J3R8	5/10/2011	149575.7	571013.9				-0.043	U	0.269	-0.019	U	0.039
J1J4J5	6/8/2011	149433.5	571013.9	0.0104	U	0.177	0.072	U	0.152	0.005	U	0.024
J1J4J6	6/8/2011	149433.5	571013.9	0.018	U	0.146	-0.08	U	0.249	-0.005	U	0.028

HEIS Number	Date	Northing	Easting	Cobalt-60			Europium-152			Europium-154		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
J1FHX1	3/23/2011	149650	571374	0.0166	U	0.0361	-0.005	U	0.085	-0.038	U	0.104
J1J3R8	5/10/2011	149575.7	571013.9	-0.012	U	0.043	-0.016	U	0.1	0.014	U	0.117
J1J4J5	6/8/2011	149433.5	571013.9	-0.003	U	0.0237	-0.015	U	0.051	-0.011	U	0.075
J1J4J6	6/8/2011	149433.5	571013.9	0.0032	U	0.0316	0.019	U	0.073	-0.009	U	0.091

HEIS Number	Date	Northing	Easting	Europium-155			Radium-226		
				pCi/g	Q	MDA	pCi/g	Q	MDA
J1FHX1	3/23/2011	149650	571374	0.0239	U	0.105	0.6		0.057
J1J3R8	5/10/2011	149575.7	571013.9	-0.001	U	0.0972	0.008	U	0.109
J1J4J5	6/8/2011	149433.5	571013.9	0.0249	U	0.0649	0.433		0.039
J1J4J6	6/8/2011	149433.5	571013.9	0.0233	U	0.0853	0.385		0.051

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Acenaphthene			Acenaphthylene			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1FHX1	3/23/2011	149650	571374	220	UD	220	200	UDN	200	53000	XDN	68	71	UDN	71	140	UDN	140	110000	XDN	94
J1J3R8	5/10/2011	149575.7	571013.9																		
J1J4J5	6/8/2011	149433.5	571013.9	52	UD	52	47	UD	47	16	UD	16	7400	DX	17	34	UD	34	22	UD	22
J1J4J6	6/8/2011	149433.5	571013.9	10	U	10	9.3	U	9.3	36		3.2	230	X	3.3	170		6.6	170		4.3
J1L2K4	8/31/2011	NA	NA																		
J1RRD0	7/2/2013	149676.3	571341.8	9.8	U	9.8	8.8	U	8.8	3	U	3	3.1	U	3.1	6.3	U	6.3	4.1	U	4.1
J1RRD1	7/2/2013	149669.1	571350.9	50	UD	50	45	UD	45	15	UD	15	16	UD	16	430	DX	32	21	UD	21
J1RRD2	7/2/2013	149675.5	571369.3	24	U	24	22	U	22	7.4	U	7.4	7.7	U	7.7	15	U	15	10	U	10
J1RRD3	7/2/2013	149681.1	571355.4	9.8	U	9.8	8.9	U	8.9	3	U	3	3.1	U	3.1	6.3	U	6.3	4.1	U	4.1
J1RRD4	7/2/2013	149677.1	571362.9	10	U	10	9.1	U	9.1	3.1	U	3.1	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
J1RRD5	7/2/2013	149658.3	571364.9	10	U	10	9.1	U	9.1	3.1	U	3.1	3.2	U	3.2	46		6.5	4.3	U	4.3
J1RRD6	7/2/2013	149662.8	571350.1	13	JX	10	9	U	9	3.1	U	3.1	440	X	3.2	110		6.4	4.2	U	4.2
J1RTP5	7/17/2013	149550.9	571330.6	9.5	U	9.5	8.5	U	8.5	2.9	U	2.9	3	U	3	6.4	JX	6.1	4	U	4
J1RTP6	7/17/2013	149565.2	571337.4	50	JX	9.9	94	JX	8.9	3	U	3	1300	X	3.2	1500	X	6.3	4.2	U	4.2
J1RTP7	7/17/2013	149579.4	571344.7	10	U	10	9	U	9	3.1	U	3.1	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
J1RTP8	7/17/2013	149585.9	571356.8	100	UD	100	90	UD	90	30	UD	30	32	UD	32	64	UD	64	42	UD	42
J1RTP9	7/17/2013	149611.5	571360.2	49	UD	49	44	UD	44	15	UD	15	16	UD	16	32	UD	32	21	UD	21
J1RV00	7/16/2013	NA	NA																		
J1RVK8	7/29/2013	149539.5	571272.8	170	JDX	98	88	UDX	88	30	UD	30	31	UD	31	3800	DX	63	41	UD	41
J1RVK9	7/29/2013	149535.1	571286.6	95	UD	95	85	UD	85	29	UD	29	30	UD	30	450	DX	61	40	UD	40
J1RWT6	8/14/2013	149514.1	571323.9	10	U	10	9.3	U	9.3	3.1	U	3.1	3.3	U	3.3	6.6	U	6.6	4.3	U	4.3
J1RWT7	8/14/2013	149514.5	571323.1	11	U	11	9.8	U	9.8	3.3	U	3.3	3.5	U	3.5	7	U	7	4.6	U	4.6
J1RWT8	8/14/2013	149515.2	571322.6	9.9	U	9.9	8.9	U	8.9	3	U	3	3.2	U	3.2	6.3	U	6.3	4.2	U	4.2
J1T085	9/5/2013	149602.6	571337.9	10	U	10	9.4	U	9.4	3.2	U	3.2	3.3	U	3.3	6.7	U	6.7	4.4	U	4.4
J1T086	9/5/2013	149602.1	571338.8	11	U	11	9.7	U	9.7	3.3	U	3.3	3.5	U	3.5	6.9	U	6.9	4.5	U	4.5
J1T087	9/5/2013	149602.1	571339.7	10	U	10	9	U	9	3	U	3	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
J1T088	9/5/2013	149641.8	571357.8	9.5	U	9.5	8.5	U	8.5	2.9	U	2.9	3	U	3	6.1	U	6.1	4	U	4
J1T089	9/5/2013	149641.3	571358.2	11	U	11	35	JX	9.5	3.2	U	3.2	3.4	U	3.4	2700		6.8	4.4	U	4.4
J1T090	9/5/2013	149641.2	571358.8	11	U	11	9.5	U	9.5	3.2	U	3.2	3.4	U	3.4	38		6.8	4.4	U	4.4
J1T091	9/5/2013	149591.6	571361.5	9.7	U	9.7	8.7	U	8.7	3	U	3	3.1	U	3.1	6.2	U	6.2	4.1	U	4.1
J1T092	9/5/2013	149591.3	571362.2	11	U	11	9.6	U	9.6	3.3	U	3.3	3.4	U	3.4	6.8	U	6.8	4.5	U	4.5
J1T093	9/5/2013	149591.2	571363	9.8	U	9.8	8.8	U	8.8	3	U	3	3.1	U	3.1	6.3	U	6.3	4.1	U	4.1
J1T094	9/5/2013	149607.9	571340.6	11	U	11	10	U	10	3.5	U	3.5	3.7	U	3.7	7.4	U	7.4	4.8	U	4.8
J1T097	9/5/2013	149585.5	571354.9	10	U	10	9.4	U	9.4	3.2	U	3.2	3.3	U	3.3	6.7	U	6.7	4.4	U	4.4
J1T098	9/5/2013	149585.5	571354.9	100	X	9.9	160	X	8.9	3	U	3	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
J1T099	9/5/2013	149585.5	571354.9	10	U	10	9.2	U	9.2	3.1	U	3.1	3.2	U	3.2	46		6.5	4.3	U	4.3
J1T0C0	9/5/2013	149585.5	571354.9	10	U	10	9.3	U	9.3	3.1	U	3.1	3.3	U	3.3	6.6	U	6.6	4.3	U	4.3

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Acenaphthene			Acenaphthylene			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1T0C1	9/5/2013	149585.5	571354.9	10	U	10	9.1	U	9.1	3.1	U	3.1	3.2	U	3.2	110		6.4	4.2	U	4.2
J1T0C2	9/5/2013	149585.5	571354.9	10	U	10	9.2	U	9.2	3.1	U	3.1	3.3	U	3.3	6.5	U	6.5	4.3	U	4.3
J1T0C3	9/5/2013	149652.6	571366.1	400	X	29	26	U	26	8.9	U	8.9	11000	X	9.3	19	U	19	420	X	12
J1T0C4	9/5/2013	149652.6	571366.1	9.6	U	9.6	8.7	U	8.7	2.9	U	2.9	3.1	U	3.1	810		6.2	4	U	4
J1T0C5	9/5/2013	149652.6	571366.1	10	U	10	9	U	9	3.1	U	3.1	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
J1T0C6	9/5/2013	149652.6	571366.1	10	U	10	9.2	U	9.2	3.1	U	3.1	3.3	U	3.3	6.5	U	6.5	4.3	U	4.3
J1T0C7	9/5/2013	149652.6	571366.1	10	U	10	9.1	U	9.1	3.1	U	3.1	3.2	U	3.2	6.5	U	6.5	4.3	U	4.3
J1T0C8	9/5/2013	149652.6	571366.1	10	U	10	9.1	U	9.1	3.1	U	3.1	3.2	U	3.2	6.5	U	6.5	4.3	U	4.3
J1T1P8	9/17/2013	149551.1	571338	10	U	10	9.4	U	9.4	3.2	U	3.2	3.3	U	3.3	6.7	U	6.7	4.4	U	4.4
J1T1P9	9/17/2013	149551.6	571337	10	U	10	9.3	U	9.3	3.2	U	3.2	3.3	U	3.3	6.6	U	6.6	4.4	U	4.4
J1T1R0	9/17/2013	149552.2	571336	10	U	10	9	U	9	3	U	3	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2
J1T1R2	9/17/2013	149462.5	571289.2	9.8	U	9.8	8.9	U	8.9	3	U	3	8.7	JX	3.1	18		6.3	15	X	4.1
J1T1R3	9/17/2013	149461.1	571290	11	U	11	9.9	U	9.9	3.4	U	3.4	3.5	U	3.5	7.1	U	7.1	4.6	U	4.6
J1T1R4	9/17/2013	149460	571291.3	10	U	10	9.1	U	9.1	3.1	U	3.1	3.2	U	3.2	6.5	U	6.5	4.3	U	4.3
J1TF24	2/24/2014	149681.7	571215.5	10	U	10	9.4	U	9.4	3.2	U	3.2	3.3	U	3.3	6.7	U	6.7	4.4	U	4.4
J1TF25	2/24/2014	149694.02	571202.1	10	U	10	9.2	U	9.2	3.1	U	3.1	3.3	U	3.3	6.6	U	6.6	4.3	U	4.3
J1TF26	2/24/2014	149701.48	571190.9	11	U	11	9.5	U	9.5	6.6	JX	3.2	16	X	3.4	20		6.7	12	JX	4.4
J1TF27	2/24/2014	149706.84	571179.7	10	U	10	9.1	U	9.1	3.1	U	3.1	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Benzo(ghi)perylene			Benzo(k)fluoranthene			Chrysene			Dibenz[a,h]anthracen			Fluoranthene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1FHX1	3/23/2011	149650	571374	160	UDN	160	88	UDN	88	280000	XDN	110	250	UDN	250	290	UDN	290
J1J3R8	5/10/2011	149575.7	571013.9															
J1J4J5	6/8/2011	149433.5	571013.9	410	XD	38	1800	D	21	5500	D	25	440	DX	58	13000	D	68
J1J4J6	6/8/2011	149433.5	571013.9	17	JX	7.5	62	X	4.1	220		5	18	JX	11	250		13
J1L2K4	8/31/2011	NA	NA															
J1RRD0	7/2/2013	149676.3	571341.8	7.1	U	7.1	7.3	JX	3.9	4.8	U	4.8	11	U	11	29	J	13
J1RRD1	7/2/2013	149669.1	571350.9	36	UD	36	360	DX	20	24	UD	24	55	UD	55	65	UD	65
J1RRD2	7/2/2013	149675.5	571369.3	17	U	17	9.5	U	9.5	12	U	12	27	U	27	31	U	31
J1RRD3	7/2/2013	149681.1	571355.4	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13
J1RRD4	7/2/2013	149677.1	571362.9	7.2	U	7.2	4	U	4	4.9	U	4.9	11	U	11	13	U	13
J1RRD5	7/2/2013	149658.3	571364.9	7.3	U	7.3	4	U	4	42		4.9	11	U	11	13	U	13
J1RRD6	7/2/2013	149662.8	571350.1	7.2	U	7.2	34	X	3.9	270	X	4.8	11	U	11	370		13
J1RTP5	7/17/2013	149550.9	571330.6	6.8	U	6.8	3.7	U	3.7	20	J	4.6	10	U	10	12	U	12
J1RTP6	7/17/2013	149565.2	571337.4	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13
J1RTP7	7/17/2013	149579.4	571344.7	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13
J1RTP8	7/17/2013	149585.9	571356.8	72	UD	72	39	UD	39	25000	D	48	110	UD	110	12000	DX	130
J1RTP9	7/17/2013	149611.5	571360.2	36	UD	36	19	UD	19	2500	DX	24	54	UD	54	64	UD	64
J1RV00	7/16/2013	NA	NA															
J1RVK8	7/29/2013	149539.5	571272.8	70	UD	70	3900	DX	38	16000	D	47	110	UD	110	130	UD	130
J1RVK9	7/29/2013	149535.1	571286.6	68	UD	68	37	UD	37	46	UD	46	100	UD	100	120	UD	120
J1RWT6	8/14/2013	149514.1	571323.9	7.4	U	7.4	4.1	U	4.1	5	U	5	11	U	11	13	U	13
J1RWT7	8/14/2013	149514.5	571323.1	7.9	U	7.9	4.3	U	4.3	5.3	U	5.3	12	U	12	14	U	14
J1RWT8	8/14/2013	149515.2	571322.6	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13
J1T085	9/5/2013	149602.6	571337.9	7.5	U	7.5	4.1	U	4.1	5	U	5	11	U	11	14	U	14
J1T086	9/5/2013	149602.1	571338.8	7.8	U	7.8	4.3	U	4.3	5.2	U	5.2	12	U	12	14	U	14
J1T087	9/5/2013	149602.1	571339.7	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13
J1T088	9/5/2013	149641.8	571357.8	6.8	U	6.8	3.7	U	3.7	4.6	U	4.6	10	U	10	12	U	12
J1T089	9/5/2013	149641.3	571358.2	7.6	U	7.6	4.2	U	4.2	5.1	U	5.1	12	U	12	14	U	14
J1T090	9/5/2013	149641.2	571358.8	7.6	U	7.6	4.2	U	4.2	5.1	U	5.1	12	U	12	14	U	14
J1T091	9/5/2013	149591.6	571361.5	7	U	7	3.8	U	3.8	4.7	U	4.7	11	U	11	13	U	13
J1T092	9/5/2013	149591.3	571362.2	7.7	U	7.7	4.2	U	4.2	5.2	U	5.2	12	U	12	14	U	14
J1T093	9/5/2013	149591.2	571363	7	U	7	3.8	U	3.8	4.7	U	4.7	11	U	11	13	U	13
J1T094	9/5/2013	149607.9	571340.6	8.3	U	8.3	4.5	U	4.5	5.6	U	5.6	13	U	13	15	U	15
J1T097	9/5/2013	149585.5	571354.9	7.5	U	7.5	4.1	U	4.1	5.1	U	5.1	11	U	11	14	U	14
J1T098	9/5/2013	149585.5	571354.9	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13
J1T099	9/5/2013	149585.5	571354.9	7.3	U	7.3	4	U	4	4.9	U	4.9	11	U	11	13	U	13
J1T0C0	9/5/2013	149585.5	571354.9	7.4	U	7.4	4.1	U	4.1	5	U	5	11	U	11	13	U	13

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Benzo(ghi)perylene			Benzo(k)fluoranthene			Chrysene			Dibenz[a,h]anthracen			Fluoranthene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1T0C1	9/5/2013	149585.5	571354.9	7.2	U	7.2	8	JX	4	4.9	U	4.9	11	U	11	13	U	13
J1T0C2	9/5/2013	149585.5	571354.9	7.4	U	7.4	4	U	4	4.9	U	4.9	11	U	11	13	U	13
J1T0C3	9/5/2013	149652.6	571366.1	21	U	21	12	U	12	8800	X	14	32	U	32	38	U	38
J1T0C4	9/5/2013	149652.6	571366.1	6.9	U	6.9	3.8	U	3.8	4.7	U	4.7	11	U	11	13	U	13
J1T0C5	9/5/2013	149652.6	571366.1	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13
J1T0C6	9/5/2013	149652.6	571366.1	7.3	U	7.3	4	U	4	4.9	U	4.9	11	U	11	13	U	13
J1T0C7	9/5/2013	149652.6	571366.1	7.3	U	7.3	4	U	4	4.9	U	4.9	11	U	11	13	U	13
J1T0C8	9/5/2013	149652.6	571366.1	7.3	U	7.3	4	U	4	4.9	U	4.9	11	U	11	13	U	13
J1T1P8	9/17/2013	149551.1	571338	7.6	U	7.6	4.1	U	4.1	5.1	U	5.1	12	U	12	14	U	14
J1T1P9	9/17/2013	149551.6	571337	7.5	U	7.5	4.1	U	4.1	5	U	5	11	U	11	13	U	13
J1T1R0	9/17/2013	149552.2	571336	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13
J1T1R2	9/17/2013	149462.5	571289.2	7.2	JX	7.1	4.5	J	3.9	28	J	4.8	11	U	11	36	J	13
J1T1R3	9/17/2013	149461.1	571290	7.9	U	7.9	4.3	U	4.3	5.3	U	5.3	12	U	12	14	U	14
J1T1R4	9/17/2013	149460	571291.3	7.3	U	7.3	4	U	4	4.9	U	4.9	11	U	11	13	U	13
J1TF24	2/24/2014	149681.7	571215.5	7.5	U	7.5	4.1	U	4.1	5	U	5	11	U	11	14	U	14
J1TF25	2/24/2014	149694.02	571202.1	7.4	U	7.4	4	U	4	6.1	J	5	11	U	11	13	U	13
J1TF26	2/24/2014	149701.48	571190.9	7.6	U	7.6	4.1	U	4.1	26	J	5.1	12	U	12	44		14
J1TF27	2/24/2014	149706.84	571179.7	7.2	U	7.2	4	U	4	4.9	U	4.9	11	U	11	13	U	13

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Fluorene			Indeno(1,2,3-			Naphthalene			Phenanthrene			Pyrene			Aroclor-1248		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1FHX1	3/23/2011	149650	571374	13000	DX	120	14000	DX	270	110000	DN	270	270	UDN	270	270	UDN	270			
J1J3R8	5/10/2011	149575.7	571013.9																330	UD	330
J1J4J5	6/8/2011	149433.5	571013.9	1300	D	28	1700	D	63	63	UD	63	7600	D	63	9700	DX	63	510	D	49
J1J4J6	6/8/2011	149433.5	571013.9	5.5	U	5.5	70		12	12	U	12	73		12	220	X	12	580	D	49
J1L2K4	8/31/2011	NA	NA																997	U	997
J1RRD0	7/2/2013	149676.3	571341.8	5.2	U	5.2	12	U	12	12	U	12	12	U	12	36	J	12	4.5	U	4.5
J1RRD1	7/2/2013	149669.1	571350.9	26	UD	26	60	UD	60	60	UD	60	60	UD	60	60	UD	60	4.5	U	4.5
J1RRD2	7/2/2013	149675.5	571369.3	13	U	13	29	U	29	29	U	29	29	U	29	29	U	29	4.5	U	4.5
J1RRD3	7/2/2013	149681.1	571355.4	5.2	U	5.2	12	U	12	12	U	12	12	U	12	12	U	12			
J1RRD4	7/2/2013	149677.1	571362.9	5.3	U	5.3	12	U	12	12	U	12	12	U	12	12	U	12			
J1RRD5	7/2/2013	149658.3	571364.9	5.4	U	5.4	12	U	12	12	U	12	12	U	12	12	U	12			
J1RRD6	7/2/2013	149662.8	571350.1	28	JX	5.3	12	JX	12	12	U	12	100		12	350		12			
J1RTP5	7/17/2013	149550.9	571330.6	5	U	5	11	U	11	11	U	11	11	U	11	11	U	11	4.8	U	4.8
J1RTP6	7/17/2013	149565.2	571337.4	5.2	U	5.2	12	U	12	12	U	12	12	U	12	1900		12	47	UD	47
J1RTP7	7/17/2013	149579.4	571344.7	5.3	U	5.3	12	U	12	12	U	12	12	U	12	390		12	46	UD	46
J1RTP8	7/17/2013	149585.9	571356.8	6000	D	53	120	UD	120	120	UD	120	37000	D	120	9900	DX	120	46	UD	46
J1RTP9	7/17/2013	149611.5	571360.2	800	DX	26	59	UD	59	59	UD	59	11000	D	59	1600	DX	59	4.8	U	4.8
J1RV00	7/16/2013	NA	NA																1700	UD	1700
J1RVK8	7/29/2013	149539.5	571272.8	52	UD	52	120	UD	120	120	UD	120	120	UD	120	6500	DX	120	460	UD	460
J1RVK9	7/29/2013	149535.1	571286.6	50	UD	50	110	UD	110	110	UD	110	110	UD	110	110	UD	110	450	UD	450
J1RWT6	8/14/2013	149514.1	571323.9	5.5	U	5.5	12	U	12	12	U	12	12	U	12	12	U	12			
J1RWT7	8/14/2013	149514.5	571323.1	5.8	U	5.8	13	U	13	13	U	13	13	U	13	13	U	13			
J1RWT8	8/14/2013	149515.2	571322.6	5.2	U	5.2	12	U	12	12	U	12	12	U	12	12	U	12			
J1T085	9/5/2013	149602.6	571337.9	5.5	U	5.5	12	U	12	12	U	12	12	U	12	12	U	12	4.6	U	4.6
J1T086	9/5/2013	149602.1	571338.8	5.7	U	5.7	13	U	13	13	U	13	13	U	13	13	U	13	5	U	5
J1T087	9/5/2013	149602.1	571339.7	5.3	U	5.3	12	U	12	12	U	12	12	U	12	12	U	12	4.7	U	4.7
J1T088	9/5/2013	149641.8	571357.8	5	U	5	11	U	11	11	U	11	11	U	11	11	U	11	4.4	U	4.4
J1T089	9/5/2013	149641.3	571358.2	5.6	U	5.6	13	U	13	13	U	13	13	U	13	13	U	13	5.2	U	5.2
J1T090	9/5/2013	149641.2	571358.8	5.6	U	5.6	13	U	13	13	U	13	13	U	13	13	U	13	4.6	U	4.6
J1T091	9/5/2013	149591.6	571361.5	5.1	U	5.1	12	U	12	12	U	12	12	U	12	12	U	12	4.6	U	4.6
J1T092	9/5/2013	149591.3	571362.2	5.6	U	5.6	13	U	13	13	U	13	13	U	13	13	U	13	4.7	U	4.7
J1T093	9/5/2013	149591.2	571363	5.2	U	5.2	12	U	12	12	U	12	12	U	12	12	U	12	4.9	U	4.9
J1T094	9/5/2013	149607.9	571340.6	6.1	U	6.1	14	U	14	14	U	14	14	U	14	14	U	14	5.4	U	5.4
J1T097	9/5/2013	149585.5	571354.9	5.5	U	5.5	13	U	13	13	U	13	13	U	13	24	JX	13	4.7	U	4.7
J1T098	9/5/2013	149585.5	571354.9	5.2	U	5.2	12	U	12	12	U	12	12	U	12	12	U	12	4.7	U	4.7
J1T099	9/5/2013	149585.5	571354.9	5.4	U	5.4	12	U	12	12	U	12	12	U	12	44		12	4.7	U	4.7
J1T0C0	9/5/2013	149585.5	571354.9	5.4	U	5.4	12	U	12	12	U	12	12	U	12	12	U	12	4.6	U	4.6

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Fluorene			Indeno(1,2,3-			Naphthalene			Phenanthrene			Pyrene			Aroclor-1248		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1T0C1	9/5/2013	149585.5	571354.9	5.3	U	5.3	12	U	12	12	U	12	12	U	12	12	U	12	4.6	U	4.6
J1T0C2	9/5/2013	149585.5	571354.9	5.4	U	5.4	12	U	12	12	U	12	12	U	12	12	U	12	4.7	U	4.7
J1T0C3	9/5/2013	149652.6	571366.1	15	U	15	35	U	35	35	U	35	35	U	35	8900		35	4.6	U	4.6
J1T0C4	9/5/2013	149652.6	571366.1	5.1	U	5.1	46	X	12	15	JX	12	12	U	12	14	J	12	4.5	U	4.5
J1T0C5	9/5/2013	149652.6	571366.1	5.3	U	5.3	12	U	12	12	U	12	12	U	12	12	U	12	4.5	U	4.5
J1T0C6	9/5/2013	149652.6	571366.1	5.4	U	5.4	12	U	12	12	U	12	12	U	12	12	U	12	4.7	U	4.7
J1T0C7	9/5/2013	149652.6	571366.1	5.4	U	5.4	12	U	12	12	U	12	12	U	12	12	U	12	4.7	U	4.7
J1T0C8	9/5/2013	149652.6	571366.1	5.4	U	5.4	12	U	12	12	U	12	12	U	12	12	U	12	4.8	U	4.8
J1T1P8	9/17/2013	149551.1	571338	5.5	U	5.5	13	U	13	13	U	13	13	U	13	13	U	13	4.9	U	4.9
J1T1P9	9/17/2013	149551.6	571337	5.5	U	5.5	12	U	12	12	U	12	12	U	12	12	U	12	5.1	U	5.1
J1T1R0	9/17/2013	149552.2	571336	5.3	U	5.3	12	U	12	12	U	12	12	U	12	12	U	12	4.9	U	4.9
J1T1R2	9/17/2013	149462.5	571289.2	5.2	U	5.2	12	U	12	12	U	12	12	U	12	42		12	4.7	U	4.7
J1T1R3	9/17/2013	149461.1	571290	5.8	U	5.8	13	U	13	13	U	13	13	U	13	13	U	13	5	U	5
J1T1R4	9/17/2013	149460	571291.3	5.4	U	5.4	12	U	12	12	U	12	12	U	12	12	U	12	4.7	U	4.7
J1TF24	2/24/2014	149681.7	571215.5	5.5	U	5.5	13	U	13	13	U	13	13	U	13	13	U	13			
J1TF25	2/24/2014	149694.02	571202.1	5.4	U	5.4	12	U	12	12	U	12	12	U	12	12	U	12			
J1TF26	2/24/2014	149701.48	571190.9	5.6	U	5.6	13	U	13	13	U	13	19	J	13	49		13			
J1TF27	2/24/2014	149706.84	571179.7	5.3	U	5.3	12	U	12	12	U	12	12	U	12	12	U	12			

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Aroclor-1254			Aroclor-1260			Dichlorodiphenyl-trichloroethane			Dieldrin			Heptachlor epoxide			Acenaphthene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1FHX1	3/23/2011	149650	571374																		
J1J3R8	5/10/2011	149575.7	571013.9	320	UD	320	150	UDN	150										29000	UD	29000
J1J4J5	6/8/2011	149433.5	571013.9	27	UD	27	27	UD	27	1.3	JX	0.62	1	JY	0.22	0.99	JX	0.45	11	U	11
J1J4J6	6/8/2011	149433.5	571013.9	27	UD	27	27	UD	27	0.88	JXN	0.61	0.86	JYN	0.22	0.83	JX	0.44	10	U	10
J1L2K4	8/31/2011	NA	NA	997	U	997	997	U	997												
J1RRD0	7/2/2013	149676.3	571341.8	2.5	U	2.5	2.5	U	2.5												
J1RRD1	7/2/2013	149669.1	571350.9	15	P	2.5	2.5	U	2.5												
J1RRD2	7/2/2013	149675.5	571369.3	2.5	U	2.5	2.5	U	2.5												
J1RRD3	7/2/2013	149681.1	571355.4																		
J1RRD4	7/2/2013	149677.1	571362.9																		
J1RRD5	7/2/2013	149658.3	571364.9																		
J1RRD6	7/2/2013	149662.8	571350.1																		
J1RTP5	7/17/2013	149550.9	571330.6	2.8	J	2.7	2.7	U	2.7												
J1RTP6	7/17/2013	149565.2	571337.4	26	UD	26	26	UD	26												
J1RTP7	7/17/2013	149579.4	571344.7	31	JD	26	26	UD	26												
J1RTP8	7/17/2013	149585.9	571356.8	26	UD	26	26	UD	26												
J1RTP9	7/17/2013	149611.5	571360.2	39		2.7	2.7	U	2.7												
J1RV00	7/16/2013	NA	NA	1600	UD	1600	780	UD	780												
J1RVK8	7/29/2013	149539.5	571272.8	260	UD	260	260	UD	260												
J1RVK9	7/29/2013	149535.1	571286.6	250	UD	250	250	UD	250												
J1RWT6	8/14/2013	149514.1	571323.9																		
J1RWT7	8/14/2013	149514.5	571323.1																		
J1RWT8	8/14/2013	149515.2	571322.6																		
J1T085	9/5/2013	149602.6	571337.9	2.6	U	2.6	2.6	UN	2.6										11	U	11
J1T086	9/5/2013	149602.1	571338.8	2.8	U	2.8	2.8	U	2.8										11	U	11
J1T087	9/5/2013	149602.1	571339.7	2.6	U	2.6	2.6	U	2.6										10	U	10
J1T088	9/5/2013	149641.8	571357.8	2.4	U	2.4	2.4	U	2.4										10	U	10
J1T089	9/5/2013	149641.3	571358.2	2.9	U	2.9	2.9	U	2.9										11	U	11
J1T090	9/5/2013	149641.2	571358.8	2.6	U	2.6	2.6	U	2.6										11	U	11
J1T091	9/5/2013	149591.6	571361.5	2.6	U	2.6	2.6	U	2.6										10	U	10
J1T092	9/5/2013	149591.3	571362.2	2.6	U	2.6	2.6	U	2.6										11	U	11
J1T093	9/5/2013	149591.2	571363	2.7	U	2.7	2.7	U	2.7										11	U	11
J1T094	9/5/2013	149607.9	571340.6	3	U	3	3	U	3										11	U	11
J1T097	9/5/2013	149585.5	571354.9	2.6	U	2.6	2.6	U	2.6										210	UD	210
J1T098	9/5/2013	149585.5	571354.9	2.6	U	2.6	2.6	UN	2.6										100	UD	100
J1T099	9/5/2013	149585.5	571354.9	2.6	U	2.6	2.6	U	2.6										10	U	10
J1T0C0	9/5/2013	149585.5	571354.9	2.5	U	2.5	2.5	U	2.5										10	U	10

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Aroclor-1254			Aroclor-1260			Dichlorodiphenyl-trichloroethane			Dieldrin			Heptachlor epoxide			Acenaphthene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1T0C1	9/5/2013	149585.5	571354.9	2.6	U	2.6	2.6	U	2.6										10	U	10
J1T0C2	9/5/2013	149585.5	571354.9	2.6	U	2.6	2.6	U	2.6										10	U	10
J1T0C3	9/5/2013	149652.6	571366.1	2.6	U	2.6	2.6	U	2.6										620	UD	620
J1T0C4	9/5/2013	149652.6	571366.1	2.5	U	2.5	2.5	U	2.5										100	UD	100
J1T0C5	9/5/2013	149652.6	571366.1	2.5	U	2.5	2.5	U	2.5										10	U	10
J1T0C6	9/5/2013	149652.6	571366.1	2.6	U	2.6	2.6	U	2.6										9.7	U	9.7
J1T0C7	9/5/2013	149652.6	571366.1	2.6	U	2.6	2.6	U	2.6										10	U	10
J1T0C8	9/5/2013	149652.6	571366.1	2.7	U	2.7	2.7	U	2.7										10	U	10
J1T1P8	9/17/2013	149551.1	571338	2.7	U	2.7	2.7	U	2.7										11	U	11
J1T1P9	9/17/2013	149551.6	571337	2.8	U	2.8	2.8	U	2.8										11	U	11
J1T1R0	9/17/2013	149552.2	571336	2.7	U	2.7	2.7	U	2.7										11	U	11
J1T1R2	9/17/2013	149462.5	571289.2	2.6	U	2.6	5.2	J	2.6										10	U	10
J1T1R3	9/17/2013	149461.1	571290	2.8	U	2.8	2.8	U	2.8										10	U	10
J1T1R4	9/17/2013	149460	571291.3	2.6	JP	2.6	2.6	U	2.6										9.8	U	9.8
J1TF24	2/24/2014	149681.7	571215.5																		
J1TF25	2/24/2014	149694.02	571202.1																		
J1TF26	2/24/2014	149701.48	571190.9																		
J1TF27	2/24/2014	149706.84	571179.7																		

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Acenaphthylene			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)-fluoranthene			Benzo(ghi)-perylene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1FHX1	3/23/2011	149650	571374																		
J1J3R8	5/10/2011	149575.7	571013.9	50000	UD	50000	50000	UD	50000	58000	UD	58000	58000	UD	58000	77000	UD	77000	47000	UD	47000
J1J4J5	6/8/2011	149433.5	571013.9	17	U	17	17	U	17	85	J	21	69	J	21	120	JX	27	27	J	16
J1J4J6	6/8/2011	149433.5	571013.9	17	U	17	17	U	17	54	J	20	46	J	20	76	JX	26	20	J	16
J1L2K4	8/31/2011	NA	NA																		
J1RRD0	7/2/2013	149676.3	571341.8																		
J1RRD1	7/2/2013	149669.1	571350.9																		
J1RRD2	7/2/2013	149675.5	571369.3																		
J1RRD3	7/2/2013	149681.1	571355.4																		
J1RRD4	7/2/2013	149677.1	571362.9																		
J1RRD5	7/2/2013	149658.3	571364.9																		
J1RRD6	7/2/2013	149662.8	571350.1																		
J1RTP5	7/17/2013	149550.9	571330.6																		
J1RTP6	7/17/2013	149565.2	571337.4																		
J1RTP7	7/17/2013	149579.4	571344.7																		
J1RTP8	7/17/2013	149585.9	571356.8																		
J1RTP9	7/17/2013	149611.5	571360.2																		
J1RV00	7/16/2013	NA	NA																		
J1RVK8	7/29/2013	149539.5	571272.8																		
J1RVK9	7/29/2013	149535.1	571286.6																		
J1RWT6	8/14/2013	149514.1	571323.9																		
J1RWT7	8/14/2013	149514.5	571323.1																		
J1RWT8	8/14/2013	149515.2	571322.6																		
J1T085	9/5/2013	149602.6	571337.9	18	U	18	18	U	18	21	U	21	21	U	21	27	U	27	17	U	17
J1T086	9/5/2013	149602.1	571338.8	19	U	19	19	U	19	22	U	22	22	U	22	29	U	29	18	U	18
J1T087	9/5/2013	149602.1	571339.7	17	U	17	17	U	17	20	U	20	20	U	20	26	U	26	16	U	16
J1T088	9/5/2013	149641.8	571357.8	17	U	17	17	U	17	20	U	20	20	U	20	26	U	26	16	U	16
J1T089	9/5/2013	149641.3	571358.2	19	U	19	19	U	19	22	U	22	180	J	22	130	J	29	90	J	18
J1T090	9/5/2013	149641.2	571358.8	18	U	18	18	U	18	21	U	21	21	U	21	27	U	27	16	U	16
J1T091	9/5/2013	149591.6	571361.5	17	U	17	17	U	17	20	U	20	20	U	20	26	U	26	16	U	16
J1T092	9/5/2013	149591.3	571362.2	18	U	18	18	U	18	22	U	22	22	U	22	28	U	28	17	U	17
J1T093	9/5/2013	149591.2	571363	18	U	18	18	U	18	21	U	21	21	U	21	28	U	28	17	U	17
J1T094	9/5/2013	149607.9	571340.6	19	U	19	19	U	19	22	U	22	22	U	22	29	U	29	18	U	18
J1T097	9/5/2013	149585.5	571354.9	350	UD	350	350	UD	350	410	UD	410	410	UD	410	540	UD	540	1000	JD	330
J1T098	9/5/2013	149585.5	571354.9	170	UD	170	170	UD	170	280	JD	200	410	JD	200	260	JD	260	170	JD	160
J1T099	9/5/2013	149585.5	571354.9	17	U	17	17	U	17	20	U	20	20	U	20	26	U	26	16	U	16
J1T0C0	9/5/2013	149585.5	571354.9	17	U	17	17	U	17	19	U	19	19	U	19	26	U	26	16	U	16

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Acenaphthylene			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)-fluoranthene			Benzo(ghi)-perylene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1T0C1	9/5/2013	149585.5	571354.9	17	U	17	17	U	17	19	U	19	19	U	19	25	U	25	16	U	16
J1T0C2	9/5/2013	149585.5	571354.9	17	U	17	17	U	17	20	U	20	20	U	20	26	U	26	16	U	16
J1T0C3	9/5/2013	149652.6	571366.1	1000	UD	1000	1000	UD	1000	8700	JD	1200	13000	JD	1200	8000	JD	1600	5700	JD	960
J1T0C4	9/5/2013	149652.6	571366.1	170	UD	170	170	UD	170	190	UD	190	190	UD	190	250	UD	250	350	JD	160
J1T0C5	9/5/2013	149652.6	571366.1	17	U	17	17	U	17	20	U	20	20	U	20	26	U	26	16	U	16
J1T0C6	9/5/2013	149652.6	571366.1	16	U	16	16	U	16	19	U	19	19	U	19	25	U	25	15	U	15
J1T0C7	9/5/2013	149652.6	571366.1	17	U	17	17	U	17	20	U	20	20	U	20	26	U	26	16	U	16
J1T0C8	9/5/2013	149652.6	571366.1	17	U	17	17	U	17	20	U	20	29	J	20	27	U	27	16	U	16
J1T1P8	9/17/2013	149551.1	571338	18	U	18	18	U	18	21	U	21	21	U	21	28	U	28	17	U	17
J1T1P9	9/17/2013	149551.6	571337	18	U	18	18	U	18	21	U	21	21	U	21	27	U	27	17	U	17
J1T1R0	9/17/2013	149552.2	571336	18	U	18	18	U	18	21	U	21	21	U	21	27	U	27	17	U	17
J1T1R2	9/17/2013	149462.5	571289.2	17	U	17	17	U	17	19	U	19	19	U	19	26	U	26	16	U	16
J1T1R3	9/17/2013	149461.1	571290	17	U	17	17	U	17	20	U	20	20	U	20	26	U	26	16	U	16
J1T1R4	9/17/2013	149460	571291.3	16	U	16	16	U	16	19	U	19	19	U	19	25	U	25	15	U	15
J1TF24	2/24/2014	149681.7	571215.5																		
J1TF25	2/24/2014	149694.02	571202.1																		
J1TF26	2/24/2014	149701.48	571190.9																		
J1TF27	2/24/2014	149706.84	571179.7																		

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Benzo(k) fluoranthene			Bis(2-ethylhexyl) phthalate			Chrysene			Di-n-octylphthalate			Dibenz[a,h] anthracene			Dimethyl phthalate		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1FHX1	3/23/2011	149650	571374																		
J1J3R8	5/10/2011	149575.7	571013.9	120000	UD	120000	140000	UD	140000	79000	UD	79000	42000	UD	42000	55000	UD	55000	67000	UD	67000
J1J4J5	6/8/2011	149433.5	571013.9	41	UX	41	100	JB	47	110	J	28	15	U	15	20	U	20	24	U	24
J1J4J6	6/8/2011	149433.5	571013.9	40	UX	40	98	JB	46	67	J	27	180	J	14	19	U	19	23	U	23
J1L2K4	8/31/2011	NA	NA																		
J1RRD0	7/2/2013	149676.3	571341.8																		
J1RRD1	7/2/2013	149669.1	571350.9																		
J1RRD2	7/2/2013	149675.5	571369.3																		
J1RRD3	7/2/2013	149681.1	571355.4																		
J1RRD4	7/2/2013	149677.1	571362.9																		
J1RRD5	7/2/2013	149658.3	571364.9																		
J1RRD6	7/2/2013	149662.8	571350.1																		
J1RTP5	7/17/2013	149550.9	571330.6																		
J1RTP6	7/17/2013	149565.2	571337.4																		
J1RTP7	7/17/2013	149579.4	571344.7																		
J1RTP8	7/17/2013	149585.9	571356.8																		
J1RTP9	7/17/2013	149611.5	571360.2																		
J1RV00	7/16/2013	NA	NA																		
J1RVK8	7/29/2013	149539.5	571272.8																		
J1RVK9	7/29/2013	149535.1	571286.6																		
J1RWT6	8/14/2013	149514.1	571323.9																		
J1RWT7	8/14/2013	149514.5	571323.1																		
J1RWT8	8/14/2013	149515.2	571322.6																		
J1T085	9/5/2013	149602.6	571337.9	42	U	42	48	U	48	28	U	28	15	U	15	20	U	20	180	JB	24
J1T086	9/5/2013	149602.1	571338.8	44	U	44	51	U	51	30	U	30	16	U	16	21	U	21	130	JB	25
J1T087	9/5/2013	149602.1	571339.7	40	U	40	46	U	46	27	U	27	14	U	14	19	U	19	69	JB	23
J1T088	9/5/2013	149641.8	571357.8	40	U	40	46	U	46	27	U	27	15	U	15	19	U	19	160	JB	23
J1T089	9/5/2013	149641.3	571358.2	45	U	45	51	U	51	320	J	30	16	U	16	49	J	21	78	JB	26
J1T090	9/5/2013	149641.2	571358.8	41	U	41	47	U	47	28	U	28	15	U	15	20	U	20	49	JB	24
J1T091	9/5/2013	149591.6	571361.5	40	U	40	46	U	46	27	U	27	14	U	14	19	U	19	75	JB	23
J1T092	9/5/2013	149591.3	571362.2	43	U	43	50	U	50	29	U	29	16	U	16	21	U	21	170	JB	25
J1T093	9/5/2013	149591.2	571363	42	U	42	48	U	48	28	U	28	15	U	15	20	U	20	110	JB	24
J1T094	9/5/2013	149607.9	571340.6	44	U	44	50	U	50	30	U	30	16	U	16	21	U	21	200	JB	25
J1T097	9/5/2013	149585.5	571354.9	830	UD	830	950	UD	950	560	UD	560	300	UD	300	390	UD	390	470	UD	470
J1T098	9/5/2013	149585.5	571354.9	400	UD	400	460	UD	460	1200	JD	270	140	UD	140	190	UD	190	230	UD	230
J1T099	9/5/2013	149585.5	571354.9	40	U	40	47	U	47	27	U	27	15	U	15	19	U	19	110	JB	23
J1T0C0	9/5/2013	149585.5	571354.9	39	U	39	45	U	45	26	U	26	14	U	14	19	U	19	22	U	22

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Benzo(k) fluoranthene			Bis(2-ethylhexyl) phthalate			Chrysene			Di-n-octylphthalate			Dibenz[a,h] anthracene			Dimethyl phthalate		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1T0C1	9/5/2013	149585.5	571354.9	39	U	39	45	U	45	26	U	26	14	U	14	18	U	18	170	JB	22
J1T0C2	9/5/2013	149585.5	571354.9	40	U	40	46	U	46	27	U	27	14	U	14	19	U	19	170	JB	23
J1T0C3	9/5/2013	149652.6	571366.1	2400	UD	2400	2800	UD	2800	27000	D	1600	870	UD	870	5700	JD	1100	1400	UD	1400
J1T0C4	9/5/2013	149652.6	571366.1	390	UD	390	450	UD	450	260	UD	260	140	UD	140	180	UD	180	220	UD	220
J1T0C5	9/5/2013	149652.6	571366.1	40	U	40	46	U	46	27	U	27	14	U	14	19	U	19	150	JB	23
J1T0C6	9/5/2013	149652.6	571366.1	38	U	38	43	U	43	26	U	26	14	U	14	18	U	18	72	JB	22
J1T0C7	9/5/2013	149652.6	571366.1	39	U	39	45	U	45	27	U	27	14	U	14	19	U	19	260	JB	23
J1T0C8	9/5/2013	149652.6	571366.1	41	U	41	47	U	47	36	J	27	15	U	15	19	U	19	85	JB	23
J1T1P8	9/17/2013	149551.1	571338	42	U	42	48	U	48	28	U	28	15	U	15	20	U	20	120	JBX	24
J1T1P9	9/17/2013	149551.6	571337	41	U	41	48	U	48	28	U	28	15	U	15	20	U	20	310	JB	24
J1T1R0	9/17/2013	149552.2	571336	41	U	41	48	U	48	28	U	28	15	U	15	20	U	20	310	JBX	24
J1T1R2	9/17/2013	149462.5	571289.2	39	U	39	45	U	45	26	U	26	14	U	14	19	U	19	80	JB	22
J1T1R3	9/17/2013	149461.1	571290	40	U	40	47	U	47	27	U	27	15	U	15	19	U	19	430	B	23
J1T1R4	9/17/2013	149460	571291.3	38	U	38	44	U	44	26	U	26	14	U	14	18	U	18	200	JB	22
J1TF24	2/24/2014	149681.7	571215.5																		
J1TF25	2/24/2014	149694.02	571202.1																		
J1TF26	2/24/2014	149701.48	571190.9																		
J1TF27	2/24/2014	149706.84	571179.7																		

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Fluoranthene			Fluorene			Indeno(1,2,3-cd)pyrene			Naphthalene			Phenanthrene			Pyrene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1FHX1	3/23/2011	149650	571374																		
J1J3R8	5/10/2011	149575.7	571013.9	110000	UD	110000	52000	UD	52000	64000	UD	64000	90000	UD	90000	50000	UD	50000	35000	UD	35000
J1J4J5	6/8/2011	149433.5	571013.9	130	J	37	18	U	18	25	J	23	32	U	32	35	J	17	130	J	12
J1J4J6	6/8/2011	149433.5	571013.9	70	J	36	18	U	18	22	U	22	31	U	31	23	J	17	72	J	12
J1L2K4	8/31/2011	NA	NA																		
J1RRD0	7/2/2013	149676.3	571341.8																		
J1RRD1	7/2/2013	149669.1	571350.9																		
J1RRD2	7/2/2013	149675.5	571369.3																		
J1RRD3	7/2/2013	149681.1	571355.4																		
J1RRD4	7/2/2013	149677.1	571362.9																		
J1RRD5	7/2/2013	149658.3	571364.9																		
J1RRD6	7/2/2013	149662.8	571350.1																		
J1RTP5	7/17/2013	149550.9	571330.6																		
J1RTP6	7/17/2013	149565.2	571337.4																		
J1RTP7	7/17/2013	149579.4	571344.7																		
J1RTP8	7/17/2013	149585.9	571356.8																		
J1RTP9	7/17/2013	149611.5	571360.2																		
J1RV00	7/16/2013	NA	NA																		
J1RVK8	7/29/2013	149539.5	571272.8																		
J1RVK9	7/29/2013	149535.1	571286.6																		
J1RWT6	8/14/2013	149514.1	571323.9																		
J1RWT7	8/14/2013	149514.5	571323.1																		
J1RWT8	8/14/2013	149515.2	571322.6																		
J1T085	9/5/2013	149602.6	571337.9	37	U	37	19	U	19	23	U	23	32	U	32	18	U	18	13	U	13
J1T086	9/5/2013	149602.1	571338.8	40	U	40	20	U	20	24	U	24	34	U	34	19	U	19	13	U	13
J1T087	9/5/2013	149602.1	571339.7	36	U	36	18	U	18	22	U	22	31	U	31	17	U	17	12	U	12
J1T088	9/5/2013	149641.8	571357.8	36	U	36	18	U	18	22	U	22	31	U	31	17	U	17	12	U	12
J1T089	9/5/2013	149641.3	571358.2	40	U	40	20	U	20	25	U	25	35	U	35	19	U	19	320	J	13
J1T090	9/5/2013	149641.2	571358.8	37	U	37	19	U	19	23	U	23	32	U	32	18	U	18	12	U	12
J1T091	9/5/2013	149591.6	571361.5	36	U	36	18	U	18	22	U	22	31	U	31	17	U	17	12	U	12
J1T092	9/5/2013	149591.3	571362.2	39	U	39	20	U	20	24	U	24	34	U	34	18	U	18	13	U	13
J1T093	9/5/2013	149591.2	571363	38	U	38	19	U	19	23	U	23	33	U	33	18	U	18	13	U	13
J1T094	9/5/2013	149607.9	571340.6	39	U	39	20	U	20	24	U	24	34	U	34	19	U	19	13	U	13
J1T097	9/5/2013	149585.5	571354.9	740	UD	740	370	UD	370	450	UD	450	640	UD	640	350	UD	350	250	UD	250
J1T098	9/5/2013	149585.5	571354.9	360	UD	360	180	UD	180	220	UD	220	310	UD	310	170	UD	170	870	JD	120
J1T099	9/5/2013	149585.5	571354.9	36	U	36	18	U	18	22	U	22	31	U	31	17	U	17	28	J	12
J1T0C0	9/5/2013	149585.5	571354.9	35	U	35	18	U	18	21	U	21	30	U	30	17	U	17	12	U	12

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	Fluoranthene			Fluorene			Indeno(1,2,3-cd)pyrene			Naphthalene			Phenanthrene			Pyrene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1T0C1	9/5/2013	149585.5	571354.9	35	U	35	17	U	17	21	U	21	30	U	30	17	U	17	12	U	12
J1T0C2	9/5/2013	149585.5	571354.9	36	U	36	18	U	18	22	U	22	31	U	31	17	U	17	12	U	12
J1T0C3	9/5/2013	149652.6	571366.1	2200	UD	2200	1100	UD	1100	1300	UD	1300	1900	UD	1900	1000	UD	1000	26000	D	730
J1T0C4	9/5/2013	149652.6	571366.1	350	UD	350	180	UD	180	210	UD	210	300	UD	300	170	UD	170	120	UD	120
J1T0C5	9/5/2013	149652.6	571366.1	36	U	36	18	U	18	22	U	22	31	U	31	17	U	17	12	U	12
J1T0C6	9/5/2013	149652.6	571366.1	34	U	34	17	U	17	21	U	21	29	U	29	16	U	16	11	U	11
J1T0C7	9/5/2013	149652.6	571366.1	35	U	35	18	U	18	22	U	22	31	U	31	17	U	17	12	U	12
J1T0C8	9/5/2013	149652.6	571366.1	37	U	37	18	U	18	22	U	22	32	U	32	17	U	17	51	J	12
J1T1P8	9/17/2013	149551.1	571338	38	U	38	19	U	19	23	U	23	33	U	33	18	U	18	13	U	13
J1T1P9	9/17/2013	149551.6	571337	37	U	37	19	U	19	23	U	23	32	U	32	18	U	18	12	U	12
J1T1R0	9/17/2013	149552.2	571336	37	U	37	19	U	19	23	U	23	32	U	32	18	U	18	13	U	13
J1T1R2	9/17/2013	149462.5	571289.2	35	U	35	18	U	18	21	U	21	30	U	30	17	U	17	12	U	12
J1T1R3	9/17/2013	149461.1	571290	36	U	36	18	U	18	22	U	22	31	U	31	17	U	17	12	U	12
J1T1R4	9/17/2013	149460	571291.3	34	U	34	17	U	17	21	U	21	30	U	30	16	U	16	12	U	12
J1TF24	2/24/2014	149681.7	571215.5																		
J1TF25	2/24/2014	149694.02	571202.1																		
J1TF26	2/24/2014	149701.48	571190.9																		
J1TF27	2/24/2014	149706.84	571179.7																		

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	1,1-Dichloroethene			2-Butanone			Acetone			Chloroform			Methylenechloride			Tetrachloroethene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1FHX1	3/23/2011	149650	571374																		
J1J3R8	5/10/2011	149575.7	571014																		
J1J4J5	6/8/2011	149433.5	571014																		
J1J4J6	6/8/2011	149433.5	571014																		
J1L2K4	8/31/2011	NA	NA																		
J1RRD0	7/2/2013	149676.3	571342																		
J1RRD1	7/2/2013	149669.1	571351																		
J1RRD2	7/2/2013	149675.5	571369																		
J1RRD3	7/2/2013	149681.1	571355																		
J1RRD4	7/2/2013	149677.1	571363																		
J1RRD5	7/2/2013	149658.3	571365																		
J1RRD6	7/2/2013	149662.8	571350																		
J1RTP5	7/17/2013	149550.9	571331																		
J1RTP6	7/17/2013	149565.2	571337																		
J1RTP7	7/17/2013	149579.4	571345																		
J1RTP8	7/17/2013	149585.9	571357																		
J1RTP9	7/17/2013	149611.5	571360																		
J1RV00	7/16/2013	NA	NA																		
J1VK8	7/29/2013	149539.5	571273																		
J1VK9	7/29/2013	149535.1	571287																		
J1RWT6	8/14/2013	149514.1	571324																		
J1RWT7	8/14/2013	149514.5	571323																		
J1RWT8	8/14/2013	149515.2	571323																		
J1T085	9/5/2013	149602.6	571338	0.74	U	0.74	2.3	U	2.3	6.8	U	6.8	0.39	J	0.37	2	U	2	0.74	U	0.74
J1T086	9/5/2013	149602.1	571339	0.69	U	0.69	2.2	U	2.2	6.3	U	6.3	0.42	J	0.34	1.9	U	1.9	0.69	U	0.69
J1T087	9/5/2013	149602.1	571340	0.8	U	0.8	2.5	U	2.5	7.3	U	7.3	0.39	U	0.39	2.2	U	2.2	0.8	U	0.8
J1T088	9/5/2013	149641.8	571358	1.1	U	1.1	3.3	U	3.3	9.8	U	9.8	0.69	J	0.53	2.9	JB	2.9	1.1	U	1.1
J1T089	9/5/2013	149641.3	571358	0.88	U	0.88	2.7	U	2.7	8	U	8	0.64	J	0.43	2.4	U	2.4	0.88	U	0.88
J1T090	9/5/2013	149641.2	571359	0.63	U	0.63	2.3	J	1.9	5.7	U	5.7	0.31	U	0.31	1.9	JB	1.7	0.63	U	0.63
J1T091	9/5/2013	149591.6	571362	0.69	U	0.69	2.1	U	2.1	6.3	U	6.3	0.45	J	0.34	1.9	U	1.9	0.69	U	0.69
J1T092	9/5/2013	149591.3	571362	0.72	U	0.72	2.2	U	2.2	6.6	U	6.6	0.4	J	0.35	1.9	U	1.9	0.72	U	0.72
J1T093	9/5/2013	149591.2	571363	0.69	U	0.69	2.2	U	2.2	6.3	U	6.3	0.41	J	0.34	2	JB	1.9	0.69	U	0.69
J1T094	9/5/2013	149607.9	571341	0.6	U	0.6	1.9	U	1.9	5.4	U	5.4	0.29	U	0.29	1.6	U	1.6	0.6	U	0.6
J1T097	9/5/2013	149585.5	571355	0.82	U	0.82	2.6	J	2.5	12	J	7.5	0.55	J	0.4	2.2	U	2.2	2.9	J	0.82
J1T098	9/5/2013	149585.5	571355	0.66	U	0.66	2.1	U	2.1	6	U	6	0.39	J	0.33	1.8	U	1.8	0.66	U	0.66
J1T099	9/5/2013	149585.5	571355	0.65	U	0.65	2	U	2	5.9	U	5.9	0.47	J	0.32	1.8	U	1.8	0.65	U	0.65
J1T0C0	9/5/2013	149585.5	571355	0.86	U	0.86	2.7	U	2.7	7.8	U	7.8	0.68	J	0.42	2.3	U	2.3	0.86	U	0.86

Table B-1. In-Process Sample Results for 100-N-84:2. (20 Pages)

HEIS Number	Date	Northing	Easting	1,1-Dichloroethene			2-Butanone			Acetone			Chloroform			Methylenechloride			Tetrachloroethene		
				ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
J1T0C1	9/5/2013	149585.5	571354.9	0.8	U	0.8	2.5	U	2.5	7.3	U	7.3	0.53	J	0.39	2.2	U	2.2	0.8	U	0.8
J1T0C2	9/5/2013	149585.5	571354.9	0.66	U	0.66	2	U	2	6	U	6	0.32	U	0.32	1.8	U	1.8	0.66	U	0.66
J1T0C3	9/5/2013	149652.6	571366.1	0.58	U	0.58	5.8	J	1.8	29		5.3	0.28	U	0.28	1.8	JB	1.6	0.63	J	0.58
J1T0C4	9/5/2013	149652.6	571366.1	0.65	U	0.65	2.1	J	2	5.9	U	5.9	0.99	J	0.32	1.8	U	1.8	2.7	J	0.65
J1T0C5	9/5/2013	149652.6	571366.1	0.78	U	0.78	2.4	U	2.4	7.1	U	7.1	0.45	J	0.38	2.1	U	2.1	0.78	U	0.78
J1T0C6	9/5/2013	149652.6	571366.1	0.65	U	0.65	2	U	2	6	U	6	0.39	J	0.32	1.8	U	1.8	0.65	U	0.65
J1T0C7	9/5/2013	149652.6	571366.1	0.61	U	0.61	1.9	U	1.9	5.5	U	5.5	0.4	J	0.3	1.7	U	1.7	0.61	U	0.61
J1T0C8	9/5/2013	149652.6	571366.1	0.7	U	0.7	2.2	U	2.2	6.3	U	6.3	0.39	J	0.34	1.9	U	1.9	0.7	U	0.7
J1T1P8	9/17/2013	149551.1	571338	0.38	J	0.32	1	U	1	3.8	J	3	1.4	J	0.16	0.91	JB	0.88	0.32	U	0.32
J1T1P9	9/17/2013	149551.6	571337	0.31	U	0.31	0.96	U	0.96	2.8	U	2.8	1.6	J	0.15	0.84	U	0.84	0.31	U	0.31
J1T1R0	9/17/2013	149552.2	571336	0.31	U	0.31	0.95	U	0.95	2.8	U	2.8	1.4	J	0.15	0.91	JB	0.83	0.31	U	0.31
J1T1R2	9/17/2013	149462.5	571289.2	0.36	U	0.36	1.1	U	1.1	3.3	U	3.3	1.5	J	0.18	0.97	U	0.97	0.36	U	0.36
J1T1R3	9/17/2013	149461.1	571290	0.33	U	0.33	1	U	1	3	U	3	0.96	J	0.16	1.1	JB	0.89	0.33	U	0.33
J1T1R4	9/17/2013	149460	571291.3	0.31	U	0.31	0.96	U	0.96	2.8	U	2.8	1.3	J	0.15	0.96	JB	0.84	0.31	U	0.31
J1TF24	2/24/2014	149681.7	571215.5																		
J1TF25	2/24/2014	149694.02	571202.1																		
J1TF26	2/24/2014	149701.48	571190.9																		
J1TF27	2/24/2014	149706.84	571179.7																		

B	= estimated result
C	= analyte detected in both the sample and the associated quality control blank, and the sample concentration was </= 5 times the blank concentration
D	= dilution
HEIS	= Hanford Environmental Information System
J	= estimate
M	= sample duplicate precision not met
MDA	= minimum detected activity
N	= recovery exceeds upper or lower control limits
P	= there is greater than 25% difference for detected concentrations between the two gas chromatogram columns
PQL	= practical quantitation limit
Q	= qualifier
U	= undetected
X(metals)	= serial dilution in the analytical batch indicates that physical and chemical interferences are present
X(organics)	= more than 40% difference between columns, lower result reported

APPENDIX C

TEST PIT INVESTIGATION RESULTS

APPENDIX C

TEST PIT INVESTIGATION RESULTS

Test Pit Locations

This appendix provides information concerning the results of four test pits that were excavated at the base of the 100-N-84:2 pipeline excavation. Test pits #1 through #3 were excavated within Area 2 where the highest concentrations and staining of petroleum was observed at the base of the excavation. Test pit #4 was excavated in Area 3 where heavily stained petroleum-contaminated soil was observed on the floor of the excavation. Figure C-1 shows the location of these four test pits. Table C-1 provides a summary of the test pit locations, sample collection depths, and petroleum concentrations. As can be seen in these results, petroleum contamination remained present with depth in soil samples collected from test pit #4. However, petroleum contamination was not detected above cleanup criteria in soil samples below a depth of approximately 6.7 m (22 ft) in test pits #1, #2, and #3. The Washington State Department of Ecology four-phase partitioning model predicts that residual concentrations of petroleum detected in test pits #1 through #3 are protective of groundwater. Furthermore, considering that petroleum has not migrated deeper than 6.7 m (22 ft) below ground surface at test pits #1, #2, and #3; that petroleum is not present in groundwater at these test pit locations; and the fact that these petroleum releases are over 30 years old, it can be concluded that current soil concentrations are not above residual saturation. The output of the four-phase modeling predictions is provided in Tables C-2 through C-11.

Figure C-1. Map of Test Pit Locations.

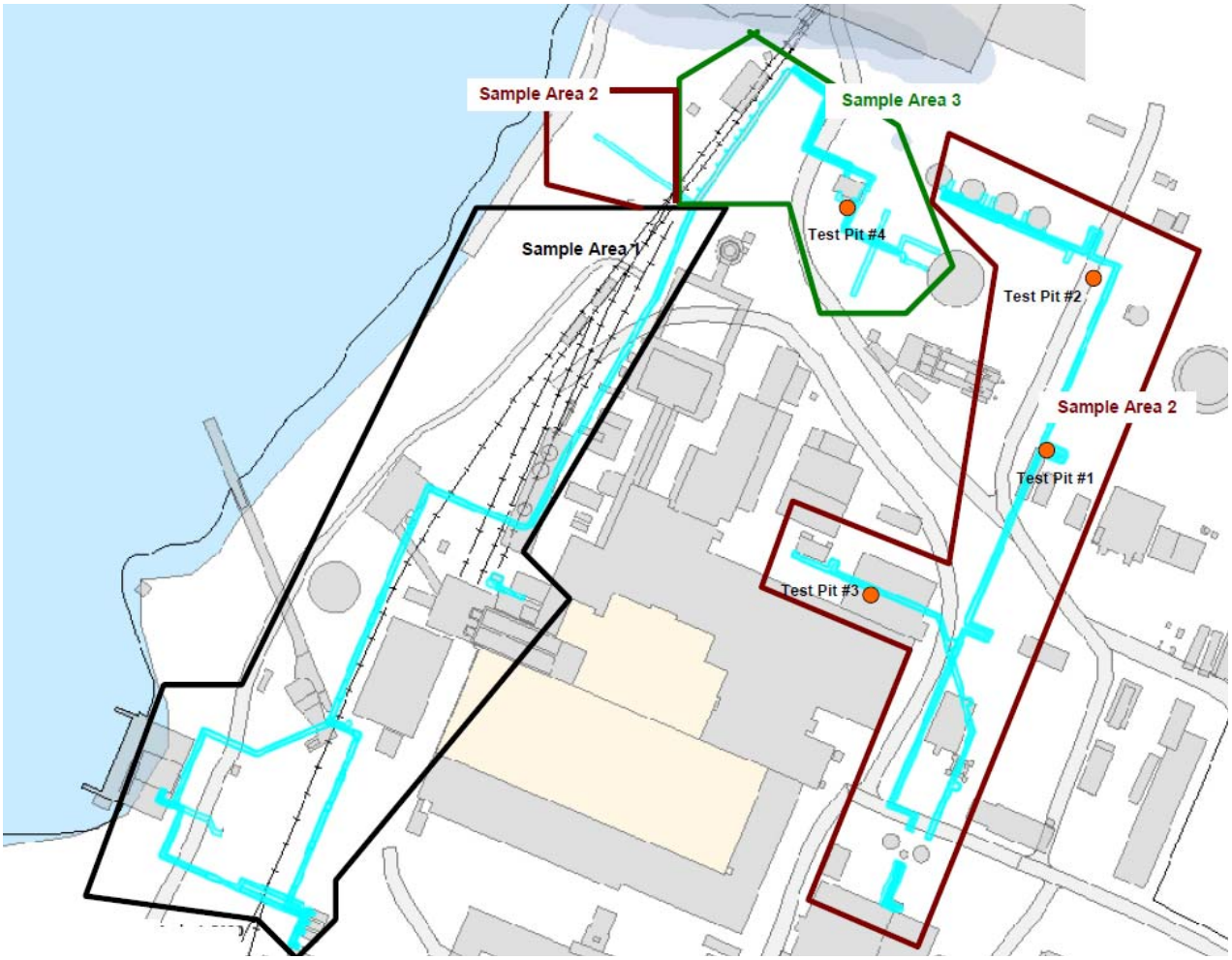


Table C-1. Test Pit Summary Information.

Test Pit Number	Date	Location		Sample Number	Depth (ft)	Sample Results (mg/kg) [a]		Ecology Sample Number	EPH Sum [b] (mg/kg)	θ_{NAPL}	% NAPL Saturation [c] ($\theta_{NAPL/n}$)	100% NAPL [d] (mg/kg)
		Northing	Easting			Diesel Range (C10-C28)	Motor Oil Range (C10-C36)					
1	9/5/13	149585.5	571354.9	J1T097	15	2,900	4,900	NA	--	--	--	--
				J1T098	18	1,400	2,100	NA	--	--	--	--
				J1T099	21	35	52	NA	--	--	--	--
				J1T0C0	24	2.5	3.7	NA	--	--	--	--
				J1T0C1	27	19	29	NA	--	--	--	--
				J1T0C2	30	1.6	2.3	TP1-15	--	--	--	--
2	9/5/13	149652.6	571366.1	J1T0C3	15	18,000	25,000	TP2-00	18,804	0.028	6.59	86,242
				J1T0C4	18	1,300	2,300	TP2-03	1,581	0.0024	0.55	85,662
				J150C5	21	16	25	TP2-06	--	--	--	--
				J1T0C6	24	23	38	TP2-09	--	--	--	--
				J150C7	27	0.85	<0.1	TP2-12	--	--	--	--
				J1T0C8	30	5.6	8.0	TP2-15	--	--	--	--
3	11/20/13	149534.2	571286.8	J1T630	16	1,300	2,200	TP1-1	3,017	0.0046	1.10	77,825
				J1T631	19	1,900	2,600	TP1-2	5,212	0.0077	1.79	87,944
				J1T632	22	2.2	2.8	TP1-3	0	--	--	--
				J1T633	25	2.1	1.6	TP1-4	0	--	--	--
				J1T634	28	2.1	2.7	TP1-5	0	--	--	--
				J1T635	31	3.4	5.4	TP1-6	0	--	--	--
4	11/20/13	149679.7	571277.1	J1T636	16	5,600	7,800	TP2-1	7,966	0.012	2.89	83,275
				J1T637	19	17,000	21,000	TP2-2	106,974	0.17	38.45	e
				J1T638	22	2,300	3,000	TP2-3	5,753	0.0091	2.11	82,517
				J1T639	25	1,200	1,800	TP2-4	3,476	0.0055	1.28	82,004
				J1T640	28	1,500	2,100	TP2-5	3,496	0.0055	1.28	82,571
				J1T641	31	2,300	3,300	TP2-6	3,775	0.006	1.39	82,188

[a] Northwest total petroleum hydrocarbon results for samples collected by Washington Closure Hanford.
[b] Extractable petroleum hydrocarbon results provided by Washington State Department of Ecology.
[c] Percentage NAPL in soil predicted by four-phase partitioning model using EPH sample results.
[d] Concentration predicted by four-phase partitioning model for 100% NAPL in soil using EPH data.
[e] Super saturation in soil predicted by four-phase partitioning model using EPH data.

-- = not analyzed
EPH = extractable petroleum hydrocarbons
NA = not applicable
n = total soil porosity (0.42)
NAPL = nonaqueous phase liquid
θ_{NAPL} = volumetric NAPL content

Table C-2. Four-Phase Partitioning Model Results for Test Pit #2 at 15-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: Refer to WAC 173-340-720, 740,745, 747, 750

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #2 @ 15 ft depth (J1T0C3)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10	25	0.13%
AL_EC >10-12	25	0.13%
AL_EC >12-16	650	3.46%
AL_EC >16-21	1700	9.04%
AL_EC >21-34	6000	31.91%
AR_EC >8-10	25	0.13%
AR_EC >10-12	25	0.13%
AR_EC >12-16	92	0.49%
AR_EC >16-21	1800	9.57%
AR_EC >21-34	8400	44.67%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene	0.75	0.00%
1-Methyl Naphthalene	0.75	0.00%
2-Methyl Naphthalene	0.75	0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	15	0.08%
Benzo(b)fluoranthene	9.5	0.05%
Benzo(k)fluoranthene	2.4	0.01%
Benzo(a)pyrene	15	0.08%
Chrysene	11	0.06%
Dibenz(a,h)anthracene	4.5	0.02%
Indeno(1,2,3-cd)pyrene	1.9	0.01%
Sum	18803.55	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here:	500	ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 9/5/2013 at a depth of approximately 15 ft below surface grade at Hanford coordinates N149652.6, E571366.1. Ecology sample number TP200. This sample was split with WCH sample J1T0C3.

Table C-2. Four-Phase Partitioning Model Results for Test Pit #2 at 15-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 10/22/2013
Site Name: 100-N-84:2
Sample Name: Test Pit #2 @ 15 ft depth (J1T0C3)
Measured Soil TPH Concentration, mg/kg **18,803.550**

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	106	1.78E-04	5.40E+00	Fail
	Method C	4,258	4.42E-05	4.48E-01	Fail
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	1.00E-08	4.76E-02	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	105.72	4,257.58
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	3.48E+03	3.29E-05	1.00E+00	*NO*	4.19E+04	9.85E-05	1.00E+00
Total Risk=1E-5	*NO*	1.06E+03	1.00E-05	3.04E-01	YES	4.26E+03	1.00E-05	1.02E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	1.06E+02	1.00E-06	3.04E-02				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	1.94E+01	1.00E-08	4.79E-02	100% NAPL
Total Risk = 1E-5	YES	1.94E+01	1.00E-08	4.79E-02	100% NAPL
Total Risk = 1E-6	YES	1.94E+01	1.00E-08	4.79E-02	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	1.94E+01	1.00E-08	4.79E-02	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 86000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	1.94E+01	1.00E-08	4.79E-02	**100% NAPL**

Table C-2. Four-Phase Partitioning Model Results for Test Pit #2 at 15-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Level for the Protection of Ground Water Quality (Leaching Pathway)

WAC 173-340-740 and 747

Date: 3/19/2014

Site Name: 100-N-84:2

Sample Name: Test Pit #2 @ 15 ft depth (J1T0C3)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition				
			Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	25		2.50E+01	5.85E-02	2.44E-04		
AL_EC >10-12	25		2.50E+01	3.76E-03	1.57E-05		
AL_EC >12-16	650		6.50E+02	1.75E-03	3.64E-06		
AL_EC >16-21	1700		1.70E+03	5.79E-06	1.81E-10		
AL_EC >21-34	6000		6.00E+03	1.59E-10	4.98E-15		
AR_EC >8-10	25		2.50E+01	9.46E+00	1.18E-02		
AR_EC >10-12	25		2.50E+01	3.38E+00	2.11E-02		
AR_EC >12-16	92		9.20E+01	2.51E+00	3.14E-03		
AR_EC >16-21	1800		1.80E+03	3.42E+00	7.12E-03		
AR_EC >21-34	8400		8.40E+03	1.64E-01	2.56E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0.75	160	7.50E-01	1.28E-01	8.00E-04		
1-Methyl Naphthalene	0.75		7.50E-01	9.26E-02	2.32E-04		
2-Methyl Naphthalene	0.75		7.50E-01	9.12E-02	2.85E-03		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	15	for	1.50E+01	4.37E-04		3.65E-09	for
Benzo(b)fluoranthene	9.5	all	9.50E+00	4.00E-05		3.34E-10	all
Benzo(k)fluoranthene	2.4	cPAHs	2.40E+00	5.39E-06		4.50E-11	cPAHs
Benzo(a)pyrene	15	Risk=	1.50E+01	6.82E-05		5.69E-09	
Chrysene	11	1E-05	1.10E+01	5.46E-05		4.55E-11	
Dibenz(a,h)anthracene	4.5		4.50E+00	2.85E-05		2.38E-10	Σ Risk=
Indeno(1,2,3-cd)pyrene	1.9		1.90E+00	1.07E-07		8.94E-13	1.00E-08
Sum	18803.55		1.88E+04	1.93E+01	4.76E-02	1.00E-08	Pass

Site-Specific Hydrogeological Properties previously entered:

Item	Symbol	Value	Units
Total soil porosity:	n	0.43	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.13	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.001	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:

Target Ground Water TPH Conc, ug/L ⇒ 500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION Calculate or Test

TPH Test button used.

Pass or Fail? Pass

Tested TPH Soil Conc, mg/kg = 18803.55

Predicted TPH GW Conc, ug/L = 1.93E+01

RISK @ Well = 1.00E-08

HI @Well = 4.76E-02

DEDAILED MODEL RESULTS TPH Range Test

Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	266.2
Equilibrated Weighted Average MW of NAPL, g/mol:	266.2
Initial Weighted Average Density of NAPL, kg/L:	0.995
Volumetric NAPL Content, Θ_{NAPL} :	2.8E-02
NAPL Saturation (%), Θ_{NAPL}/n :	6.59%
100% NAPL, mg/kg	86241.7
Mass Distribution Pattern @ 4-phase in soil pore system:	Mass Balance Pattern
Total Mass distributed in Water Phase: 0.00%	in Solid: 0.02%
Total Mass distributed in Air Phase: 0.00%	in NAPL: 99.98%

Please Check Soil Residual Saturation TPH Levels: Refer to Table 747-5!

Table C-3. Four-Phase Partitioning Model Results for Test Pit #2 at 18-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: Refer to WAC 173-340-720, 740,745, 747, 750

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #2 @ 18 ft depth (J1T0C4)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10	25	1.58%
AL_EC >10-12	25	1.58%
AL_EC >12-16	25	1.58%
AL_EC >16-21	130	8.22%
AL_EC >21-34	480	30.37%
AR_EC >8-10	25	1.58%
AR_EC >10-12	25	1.58%
AR_EC >12-16	25	1.58%
AR_EC >16-21	130	8.22%
AR_EC >21-34	690	43.65%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene	0.017	0.00%
1-Methyl Naphthalene	0.017	0.00%
2-Methyl Naphthalene	0.017	0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	0.059	0.00%
Benzo(b)fluoranthene	0.081	0.01%
Benzo(k)fluoranthene	0.031	0.00%
Benzo(a)pyrene	0.23	0.01%
Chrysene	0.034	0.00%
Dibenz(a,h)anthracene	0.065	0.00%
Indeno(1,2,3-cd)pyrene	0.024	0.00%
Sum	1580.575	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here: 500 ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 9/5/2013 at a depth of approximately 18 ft below surface grade at Hanford coordinates N149652.6, E 571366.1. Ecology sample number TP203. This sample was a split with WCH sample J1T0C4.

Table C-3. Four-Phase Partitioning Model Results for Test Pit #2 at 18-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 10/22/2013
Site Name: 100-N-84:2
Sample Name: Test Pit #2 @ 18 ft.
Measured Soil TPH Concentration, mg/kg **1,580.575**

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	639	2.47E-06	4.61E-01	Fail
	Method C	25,744	6.14E-07	3.70E-02	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	1.25E-09	3.12E-01	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	639.23	25,744.41
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	3.43E+03	5.36E-06	1.00E+00	*NO*	4.27E+04	1.66E-05	1.00E+00
Total Risk=1E-5	*NO*	6.39E+03	1.00E-05	1.86E+00	YES	2.57E+04	1.00E-05	6.03E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	6.39E+02	1.00E-06	1.86E-01				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	1.56E+02	1.22E-09	3.91E-01	100% NAPL
Total Risk = 1E-5	YES	1.56E+02	1.22E-09	3.91E-01	100% NAPL
Total Risk = 1E-6	YES	1.56E+02	1.22E-09	3.91E-01	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	1.56E+02	1.22E-09	3.91E-01	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 85000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	1.56E+02	1.22E-09	3.91E-01	100% NAPL

Table C-3. Four-Phase Partitioning Model Results for Test Pit #2 at 18-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Levels for the Protection of Ground Water Quality (Leaching Pathway)

Ecology's Model Toxics Control Act Cleanup Levels and Risk Calculations (CLARC) Version 3.1 Ground Water

WAC 173-340-740 and 747

Date: 3/19/2014

Site Name: 100-N-84:2

Sample Name: Test Pit #2 @ 18 ft depth (J1T0C4)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition				
			Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	25		2.50E+01	6.52E-01	2.72E-03		
AL_EC >10-12	25		2.50E+01	4.24E-02	1.76E-04		
AL_EC >12-16	25		2.50E+01	7.61E-04	1.59E-06		
AL_EC >16-21	130		1.30E+02	5.00E-06	1.56E-10		
AL_EC >21-34	480		4.80E+02	1.45E-10	4.52E-15		
AR_EC >8-10	25		2.50E+01	9.40E+01	1.17E-01		
AR_EC >10-12	25		2.50E+01	3.57E+01	2.23E-01		
AR_EC >12-16	25		2.50E+01	7.53E+00	9.41E-03		
AR_EC >16-21	130		1.30E+02	2.79E+00	5.80E-03		
AR_EC >21-34	690		6.90E+02	1.52E-01	2.38E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0.017	160	1.70E-02	3.14E-02	1.96E-04		
1-Methyl Naphthalene	0.017		1.70E-02	2.20E-02	5.50E-05		
2-Methyl Naphthalene	0.017		1.70E-02	2.17E-02	6.79E-04		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0.059	for	5.90E-02	1.95E-05		1.63E-10	for
Benzo(b)fluoranthene	0.081	all	8.10E-02	3.87E-06		3.23E-11	all
Benzo(k)fluoranthene	0.031	cPAHs	3.10E-02	7.90E-07		6.59E-12	cPAHs
Benzo(a)pyrene	0.23	Risk=	2.30E-01	1.19E-05		9.90E-10	
Chrysene	0.034	1E-05	3.40E-02	1.91E-06		1.60E-12	
Dibenz(a,h)anthracene	0.065		6.50E-02	4.67E-06		3.89E-11	Σ Risk=
Indeno(1,2,3-cd)pyrene	0.024		2.40E-02	1.54E-08		1.28E-13	1.23E-09
Sum	1580.575		1.58E+03	1.41E+02	3.60E-01	1.23E-09	Pass

Site-Specific Hydrogeological Properties previously entered:

Item	Symbol	Value	Units
Total soil porosity:	n	0.43	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.13	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.001	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:

Target Ground Water TPH Conc, ug/L ⇒ 500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION — Calculate or Test

TPH Test button used.

Pass or Fail? Pass

Tested TPH Soil Conc, mg/kg = **1581.00**

Predicted TPH GW Conc, ug/L = 1.41E+02

RISK @ Well = 1.23E-09

HI @Well = 3.60E-01

DEDAILED MODEL RESULTS — TPH Range Test

Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	251.5
Equilibrated Weighted Average MW of NAPL, g/mol:	252.7
Initial Weighted Average Density of NAPL, kg/L:	0.988
Volumetric NAPL Content, Θ_{NAPL} :	2.4E-03
NAPL Saturation (%), Θ_{NAPL}/n :	0.55%
100% NAPL, mg/kg	85661.8
Mass Distribution Pattern @ 4-phase in soil pore system:	Mass Balance Pattern
Total Mass distributed in Water Phase: 0.04%	in Solid: 0.53%
Total Mass distributed in Air Phase: 0.01%	in NAPL: 99.42%

Please Check Soil Residual Saturation TPH Levels; Refer to Table 747-5!

3/19/2014: 3_19_14_J1T0C4.xls

Table C-4. Four-Phase Partitioning Model Results for Test Pit #3 at 16-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: **Refer to WAC 173-340-720, 740,745, 747, 750**

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #3 @ 16 ft depth (J1T630)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10		0.00%
AL_EC >10-12		0.00%
AL_EC >12-16	85	2.82%
AL_EC >16-21	330	10.94%
AL_EC >21-34	1100	36.45%
AR_EC >8-10		0.00%
AR_EC >10-12		0.00%
AR_EC >12-16	11	0.36%
AR_EC >16-21	190	6.30%
AR_EC >21-34	1300	43.08%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene		0.00%
1-Methyl Naphthalene		0.00%
2-Methyl Naphthalene		0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	0.11	0.00%
Benzo(b)fluoranthene	0.19	0.01%
Benzo(k)fluoranthene	0.059	0.00%
Benzo(a)pyrene	0.69	0.02%
Chrysene	0.11	0.00%
Dibenz(a,h)anthracene	0.16	0.01%
Indeno(1,2,3-cd)pyrene	0.11	0.00%
Sum	3017.429	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.42	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.12	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.003	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here: 500 ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 11/20/13 at a depth of approximately 16 ft below surface grade at Hanford coordinates N149534.2, E571286.8. The sample was a split with WCH sample # J1T630.

Table C-4. Four-Phase Partitioning Model Results for Test Pit #3 at 16-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 3/18/2014
Site Name: 100-N-84:2
Sample Name: Ecology TP1-1
Measured Soil TPH Concentration, mg/kg **3,017.429**

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	415	7.27E-06	7.67E-01	Fail
	Method C	16,709	1.81E-06	6.39E-02	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	1.98E-09	7.42E-03	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	414.88	16,708.98
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	3.93E+03	9.48E-06	1.00E+00	*NO*	4.72E+04	2.83E-05	1.00E+00
Total Risk=1E-5	*NO*	4.15E+03	1.00E-05	1.05E+00	YES	1.67E+04	1.00E-05	3.54E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	4.15E+02	1.00E-06	1.05E-01				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	4.45E+00	1.98E-09	7.57E-03	100% NAPL
Total Risk = 1E-5	YES	4.45E+00	1.98E-09	7.57E-03	100% NAPL
Total Risk = 1E-6	YES	4.45E+00	1.98E-09	7.57E-03	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	4.45E+00	1.98E-09	7.57E-03	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 77000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	4.45E+00	1.98E-09	7.57E-03	100% NAPL

Table C-4. Four-Phase Partitioning Model Results for Test Pit #3 at 16-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Levels for the Protection of Ground Water Quality (Leaching Pathway)

Ground Water

WAC 173-340-740 and 747

Date: 3/19/2014

Site Name: 100-N-84:2

Sample Name: Test Pit #3 @ 16 ft depth (J1T630)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition				
			Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >12-16	85		8.50E+01	1.48E-03	3.08E-06		
AL_EC >16-21	330		3.30E+02	7.23E-06	2.26E-10		
AL_EC >21-34	1100		1.10E+03	1.90E-10	5.94E-15		
AR_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >12-16	11		1.10E+01	1.86E+00	2.32E-03		
AR_EC >16-21	190		1.90E+02	2.32E+00	4.84E-03		
AR_EC >21-34	1300		1.30E+03	1.65E-01	2.57E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0	160	0.00E+00	0.00E+00	0.00E+00		
1-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
2-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0.11	for	1.10E-01	2.08E-05		1.73E-10	for
Benzo(b)fluoranthene	0.19	all	1.90E-01	5.19E-06		4.33E-11	all
Benzo(k)fluoranthene	0.059	cPAHs	5.90E-02	8.61E-07		7.18E-12	cPAHs
Benzo(a)pyrene	0.69	Risk=	6.90E-01	2.04E-05		1.70E-09	
Chrysene	0.11	1E-05	1.10E-01	3.55E-06		2.96E-12	
Dibenz(a,h)anthracene	0.16		1.60E-01	6.57E-06		5.48E-11	Σ Risk=
Indeno(1,2,3-cd)pyrene	0.11		1.10E-01	4.03E-08		3.37E-13	1.98E-09
Sum	3017.429		3.02E+03	4.35E+00	7.42E-03	1.98E-09	Pass

Site-Specific Hydrogeological Properties previously entered:

Item	Symbol	Value	Units
Total soil porosity:	n	0.42	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.12	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.003	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:

Target Ground Water TPH Conc, ug/L ⇒ 500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION Calculate or Test

TPH Test button used.

Pass or Fail? Pass

Tested TPH Soil Conc, mg/kg = 3017.00

Predicted TPH GW Conc, ug/L = 4.35E+00

RISK @ Well = 1.98E-09

HI @Well = 7.42E-03

DEDAILED MODEL RESULTS TPH Range Test

Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	277.0
Equilibrated Weighted Average MW of NAPL, g/mol:	277.2
Initial Weighted Average Density of NAPL, kg/L:	0.973
Volumetric NAPL Content, Θ_{NAPL} :	4.6E-03
NAPL Saturation (%), Θ_{NAPL}/n :	1.10%
100% NAPL, mg/kg	77824.7

Mass Distribution Pattern @ 4-phase in soil pore system: Mass Balance Pattern

Total Mass distributed in Water Phase: 0.00% in Solid: 0.29%

Total Mass distributed in Air Phase: 0.00% in NAPL: 99.71%

Please Check Soil Residual Saturation TPH Levels: Refer to Table 747-5!

Table C-5. Four-Phase Partitioning Model Results for Test Pit #3 at 19-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: **Refer to WAC 173-340-720, 740,745, 747, 750**

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #3 @ 19 ft depth (J1T631)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10		0.00%
AL_EC >10-12		0.00%
AL_EC >12-16	330	6.33%
AL_EC >16-21	530	10.17%
AL_EC >21-34	1200	23.02%
AR_EC >8-10		0.00%
AR_EC >10-12		0.00%
AR_EC >12-16	45	0.86%
AR_EC >16-21	800	15.35%
AR_EC >21-34	2300	44.13%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene		0.00%
1-Methyl Naphthalene		0.00%
2-Methyl Naphthalene		0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	0.99	0.02%
Benzo(b)fluoranthene	1.1	0.02%
Benzo(k)fluoranthene	0.43	0.01%
Benzo(a)pyrene	2.4	0.05%
Chrysene	1.7	0.03%
Dibenz(a,h)anthracene	0.39	0.01%
Indeno(1,2,3-cd)pyrene	0.26	0.00%
Sum	5212.27	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here:	500	ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 11/20/13 at a depth of approximately 19 ft below surface grade at Hanford coordiantes N149534.2, E571286.8. The sample was a split with WCH sample #J1T631.

Table C-5. Four-Phase Partitioning Model Results for Test Pit #3 at 19-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 3/18/2014
Site Name: 100-N-84:2
Sample Name: Test Pit #2/Ecology Sample TP1-2
Measured Soil TPH Concentration, mg/kg 5,212.270

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	198	2.64E-05	1.74E+00	Fail
	Method C	7,960	6.55E-06	1.45E-01	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	4.18E-09	1.61E-02	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through -7494).
Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	197.65	7,959.99
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	2.99E+03	1.51E-05	1.00E+00	*NO*	3.58E+04	4.50E-05	1.00E+00
Total Risk=1E-5	*NO*	1.98E+03	1.00E-05	6.62E-01	YES	7.96E+03	1.00E-05	2.22E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	1.98E+02	1.00E-06	6.62E-02				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	9.52E+00	4.17E-09	1.63E-02	100% NAPL
Total Risk = 1E-5	YES	9.52E+00	4.17E-09	1.63E-02	100% NAPL
Total Risk = 1E-6	YES	9.52E+00	4.17E-09	1.63E-02	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	9.52E+00	4.17E-09	1.63E-02	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 87000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	9.52E+00	4.17E-09	1.63E-02	100% NAPL

Table C-5. Four-Phase Partitioning Model Results for Test Pit #3 at 19-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Level for the Protection of Ground Water Quality (Leaching Pathway) Ground Water
WAC 173-340-740 and 747

Date: 3/19/2014
Site Name: 100-N-84:2
Sample Name: Test Pit #3 @ 19 ft depth (J1T631)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition: Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >12-16	330		3.30E+02	3.02E-03	6.30E-06		
AL_EC >16-21	530		5.30E+02	6.15E-06	1.92E-10		
AL_EC >21-34	1200		1.20E+03	1.09E-10	3.39E-15		
AR_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >12-16	45		4.50E+01	4.16E+00	5.20E-03		
AR_EC >16-21	800		8.00E+02	5.17E+00	1.08E-02		
AR_EC >21-34	2300		2.30E+03	1.53E-01	2.38E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0	160	0.00E+00	0.00E+00	0.00E+00		
1-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
2-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0.99	for	9.90E-01	9.83E-05		8.20E-10	for
Benzo(b)fluoranthene	1.1	all	1.10E+00	1.58E-05		1.32E-10	all
Benzo(k)fluoranthene	0.43	cPAHs	4.30E-01	3.29E-06		2.74E-11	cPAHs
Benzo(a)pyrene	2.4	Risk=	2.40E+00	3.72E-05		3.10E-09	
Chrysene	1.7	1E-05	1.70E+00	2.88E-05		2.40E-11	
Dibenz(a,h)anthracene	0.39		3.90E-01	8.42E-06		7.03E-11	Σ Risk=
Indeno(1,2,3-cd)pyrene	0.26		2.60E-01	5.00E-08		4.17E-13	4.18E-09
Sum	5212.27		5.21E+03	9.49E+00	1.62E-02	4.18E-09	Pass

Site-Specific Hydrogeological Properties previously entered:

Item	Symbol	Value	Units
Total soil porosity:	n	0.43	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.13	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.001	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:

Target Ground Water TPH Conc, ug/L ⇒ 500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION — Calculate or Test

TPH Test button used.
Pass or Fail? Pass

Tested TPH Soil Conc, mg/kg = **5212.00**
Predicted TPH GW Conc, ug/L = 9.49E+00
RISK @ Well = 4.18E-09
HI @Well = 1.62E-02

DEDAILED MODEL RESULTS — TPH Range Test

Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	251.4
Equilibrated Weighted Average MW of NAPL, g/mol:	251.4
Initial Weighted Average Density of NAPL, kg/L:	1.015
Volumetric NAPL Content, Θ_{NAPL} :	7.7E-03
NAPL Saturation (%), Θ_{NAPL}/n :	1.79%
100% NAPL, mg/kg	87943.8
Mass Distribution Pattern @ 4-phase in soil pore system:	Mass Balance Pattern
Total Mass distributed in Water Phase: 0.00%	in Solid: 0.08%
Total Mass distributed in Air Phase: 0.00%	in NAPL: 99.92%

Please Check Soil Residual Saturation TPH Levels: Refer to Table 747-5!

3/19/2014: 3_18_14_J1T631.xls

Table C-6. Four-Phase Partitioning Model Results for Test Pit #4 at 16-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: **Refer to WAC 173-340-720, 740,745, 747, 750**

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 16 ft depth (J1T636)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10		0.00%
AL_EC >10-12		0.00%
AL_EC >12-16	82	1.03%
AL_EC >16-21	940	11.80%
AL_EC >21-34	3100	38.91%
AR_EC >8-10		0.00%
AR_EC >10-12		0.00%
AR_EC >12-16	21	0.26%
AR_EC >16-21	1000	12.55%
AR_EC >21-34	2800	35.15%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene		0.00%
1-Methyl Naphthalene		0.00%
2-Methyl Naphthalene		0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	5.8	0.07%
Benzo(b)fluoranthene	2.6	0.03%
Benzo(k)fluoranthene	0.63	0.01%
Benzo(a)pyrene	2.8	0.04%
Chrysene	9.7	0.12%
Dibenz(a,h)anthracene	1.1	0.01%
Indeno(1,2,3-cd)pyrene	0.86	0.01%
Sum	7966.49	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here: 500 ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 11/20/13 at a depth of approximately 16 ft below surface grade at Hanford coordinates N149679.7, E571277.1. The sample was a split with WCH sample #J1T636.

Table C-6. Four-Phase Partitioning Model Results for Test Pit #4 at 16-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 3/19/2014
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 16 ft depth (J1T636)
Measured Soil TPH Concentration, mg/kg **7,966.490**

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	207	3.85E-05	1.95E+00	Fail
	Method C	8,324	9.57E-06	1.63E-01	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	6.56E-09	1.17E-02	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	206.68	8,323.88
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	4.08E+03	1.97E-05	1.00E+00	*NO*	4.89E+04	5.88E-05	1.00E+00
Total Risk=1E-5	*NO*	2.07E+03	1.00E-05	5.07E-01	YES	8.32E+03	1.00E-05	1.70E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	2.07E+02	1.00E-06	5.07E-02				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	6.20E+00	6.56E-09	1.17E-02	100% NAPL
Total Risk = 1E-5	YES	6.20E+00	6.56E-09	1.17E-02	100% NAPL
Total Risk = 1E-6	YES	6.20E+00	6.56E-09	1.17E-02	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	6.20E+00	6.56E-09	1.17E-02	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 83000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	6.20E+00	6.56E-09	1.17E-02	**100% NAPL**

Table C-6. Four-Phase Partitioning Model Results for Test Pit #4 at 16-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Levels for the Protection of Ground Water Quality (Leaching Pathway)

WAC 173-340-740 and 747

Date: 3/19/2014

Site Name: 100-N-84:2

Sample Name: Test Pit #4 @ 16 ft depth (J1T636)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition				
			Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >12-16	82		8.20E+01	5.41E-04	1.13E-06		
AL_EC >16-21	940		9.40E+02	7.85E-06	2.45E-10		
AL_EC >21-34	3100		3.10E+03	2.02E-10	6.31E-15		
AR_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >12-16	21		2.10E+01	1.40E+00	1.75E-03		
AR_EC >16-21	1000		1.00E+03	4.65E+00	9.70E-03		
AR_EC >21-34	2800		2.80E+03	1.34E-01	2.09E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0	160	0.00E+00	0.00E+00	0.00E+00		
1-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
2-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	5.8	for	5.80E+00	4.14E-04		3.46E-09	for
Benzo(b)fluoranthene	2.6	all	2.60E+00	2.68E-05		2.24E-10	all
Benzo(k)fluoranthene	0.63	cPAHs	6.30E-01	3.47E-06		2.89E-11	cPAHs
Benzo(a)pyrene	2.8	Risk=	2.80E+00	3.12E-05		2.60E-09	
Chrysene	9.7	1E-05	9.70E+00	1.18E-04		9.85E-11	
Dibenz(a,h)anthracene	1.1		1.10E+00	1.71E-05		1.43E-10	Σ Risk=
Indeno(1,2,3-cd)pyrene	0.86		8.60E-01	1.19E-07		9.92E-13	6.56E-09
Sum	7966.49		7.97E+03	6.19E+00	1.17E-02	6.56E-09	Pass

Site-Specific Hydrogeological Properties previously entered:

Item	Symbol	Value	Units
Total soil porosity:	n	0.43	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.13	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.001	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:

Target Ground Water TPH Conc, ug/L ⇒ 500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION Calculate or Test

TPH Test button used.

Pass or Fail? Pass

Tested TPH Soil Conc, mg/kg = **7966.00**

Predicted TPH GW Conc, ug/L = 6.19E+00

RISK @ Well = 6.56E-09

HI @Well = 1.17E-02

DEDAILED MODEL RESULTS TPH Range Test

Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	276.5
Equilibrated Weighted Average MW of NAPL, g/mol:	276.6
Initial Weighted Average Density of NAPL, kg/L:	0.961
Volumetric NAPL Content, Θ_{NAPL} :	1.2E-02
NAPL Saturation (%), Θ_{NAPL}/n :	2.89%
100% NAPL, mg/kg	83275.3

Mass Distribution Pattern @ 4-phase in soil pore system: Mass Balance Pattern

Total Mass distributed in Water Phase: 0.00% in Solid: 0.04%

Total Mass distributed in Air Phase: 0.00% in NAPL: 99.96%

Please Check Soil Residual Saturation TPH Levels: Refer to Table 747-5!

3/19/2014: 3_19_14_J1T636.xls

Table C-7. Four-Phase Partitioning Model Results for Test Pit #4 at 19-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: **Refer to WAC 173-340-720, 740,745, 747, 750**

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 19 ft depth (J1T637)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10		0.00%
AL_EC >10-12	670	0.63%
AL_EC >12-16	8400	7.85%
AL_EC >16-21	14000	13.09%
AL_EC >21-34	27000	25.24%
AR_EC >8-10		0.00%
AR_EC >10-12	150	0.14%
AR_EC >12-16	2700	2.52%
AR_EC >16-21	20000	18.70%
AR_EC >21-34	34000	31.78%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene		0.00%
1-Methyl Naphthalene		0.00%
2-Methyl Naphthalene		0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	14	0.01%
Benzo(b)fluoranthene	4.6	0.00%
Benzo(k)fluoranthene	1.4	0.00%
Benzo(a)pyrene	10	0.01%
Chrysene	20	0.02%
Dibenz(a,h)anthracene	2.1	0.00%
Indeno(1,2,3-cd)pyrene	2	0.00%
Sum	106974.1	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here:	500	ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 11/20/2013 at a depth of approximately 19 ft below surface grade at Hanford coordinates N149679.7, E571277.1. The sample was a split with WCH sample # J1T637.

Table C-7. Four-Phase Partitioning Model Results for Test Pit #4 at 19-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 3/19/2014
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 19 ft depth (J1T637)
Measured Soil TPH Concentration, mg/kg **106,974.100**

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	879	1.22E-04	3.41E+01	Fail
	Method C	35,420	3.02E-05	2.83E+00	Fail
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	1.24E-09	4.92E-02	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	879.47	35,419.94
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	3.14E+03	3.57E-06	1.00E+00	*NO*	3.78E+04	1.07E-05	1.00E+00
Total Risk=1E-5	*NO*	8.79E+03	1.00E-05	2.80E+00	YES	3.54E+04	1.00E-05	9.36E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	8.79E+02	1.00E-06	2.80E-01				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	2.18E+01	1.24E-09	4.92E-02	100% NAPL
Total Risk = 1E-5	YES	2.18E+01	1.24E-09	4.92E-02	100% NAPL
Total Risk = 1E-6	YES	2.18E+01	1.24E-09	4.92E-02	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	2.18E+01	1.24E-09	4.92E-02	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 84000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	2.18E+01	1.24E-09	4.92E-02	**100% NAPL**

Table C-7. Four-Phase Partitioning Model Results for Test Pit #4 at 19-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Levels for the Protection of Ground Water Quality (Leaching Pathway)

WAC 173-340-740 and 747

Date: 3/19/2014

Site Name: 100-N-84:2

Sample Name: Test Pit #4 @ 19 ft depth (J1T637)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition				
			Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >10-12	670		6.70E+02	1.65E-02	6.87E-05		
AL_EC >12-16	8400		8.40E+03	3.70E-03	7.70E-06		
AL_EC >16-21	14000		1.40E+04	7.80E-06	2.44E-10		
AL_EC >21-34	27000		2.70E+04	1.17E-10	3.66E-15		
AR_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >10-12	150		1.50E+02	3.34E+00	2.09E-02		
AR_EC >12-16	2700		2.70E+03	1.21E+01	1.51E-02		
AR_EC >16-21	20000		2.00E+04	6.22E+00	1.29E-02		
AR_EC >21-34	34000		3.40E+04	1.08E-01	1.69E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0	160	0.00E+00	0.00E+00	0.00E+00		
1-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
2-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	14	for	1.40E+01	6.67E-05		5.57E-10	for
Benzo(b)fluoranthene	4.6	all	4.60E+00	3.17E-06		2.64E-11	all
Benzo(k)fluoranthene	1.4	cPAHs	1.40E+00	5.14E-07		4.29E-12	cPAHs
Benzo(a)pyrene	10	Risk=	1.00E+01	7.43E-06		6.20E-10	
Chrysene	20	1E-05	2.00E+01	1.62E-05		1.35E-11	
Dibenz(a,h)anthracene	2.1		2.10E+00	2.18E-06		1.82E-11	Σ Risk=
Indeno(1,2,3-cd)pyrene	2		2.00E+00	1.84E-08		1.54E-13	1.24E-09
Sum	106974.1		1.07E+05	2.18E+01	4.91E-02	1.24E-09	Pass

Site-Specific Hydrogeological Properties previously entered:

Item	Symbol	Value	Units
Total soil porosity:	n	0.43	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.13	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.001	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:

Target Ground Water TPH Conc, ug/L ⇒ 500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION Calculate or Test

TPH Test button used.

Pass or Fail? Pass

Tested TPH Soil Conc, mg/kg = 106974.00

Predicted TPH GW Conc, ug/L = 2.18E+01

RISK @ Well = 1.24E-09

HI @Well = 4.91E-02

DEDAILED MODEL RESULTS TPH Range Test

Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	247.7
Equilibrated Weighted Average MW of NAPL, g/mol:	247.7
Initial Weighted Average Density of NAPL, kg/L:	0.970
Volumetric NAPL Content, Θ_{NAPL} :	1.7E-01
NAPL Saturation (%), Θ_{NAPL}/n :	38.45%
100% NAPL, mg/kg	84104.9

Mass Distribution Pattern @ 4-phase in soil pore system: Mass Balance Pattern

Total Mass distributed in Water Phase: 0.00% in Solid: 0.01%

Total Mass distributed in Air Phase: 0.00% in NAPL: 99.99%

NAPL is supersaturated, Computation is not Correct!

Please Check Soil Residual Saturation TPH Levels: Refer to Table 747-5!

3/19/2014: 3_18_14_J1T637.xls

Table C-8. Four-Phase Partitioning Model Results for Test Pit #4 at 22-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: **Refer to WAC 173-340-720, 740,745, 747, 750**

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 22 ft depth (J1T638)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10		0.00%
AL_EC >10-12	47	0.82%
AL_EC >12-16	500	8.69%
AL_EC >16-21	760	13.21%
AL_EC >21-34	1700	29.55%
AR_EC >8-10		0.00%
AR_EC >10-12		0.00%
AR_EC >12-16	100	1.74%
AR_EC >16-21	740	12.86%
AR_EC >21-34	1900	33.02%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene		0.00%
1-Methyl Naphthalene	0.099	0.00%
2-Methyl Naphthalene	0.074	0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	1.4	0.02%
Benzo(b)fluoranthene	0.72	0.01%
Benzo(k)fluoranthene	0.18	0.00%
Benzo(a)pyrene	1.7	0.03%
Chrysene	1.8	0.03%
Dibenz(a,h)anthracene	0.32	0.01%
Indeno(1,2,3-cd)pyrene	0.18	0.00%
Sum	5753.473	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentration (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here:	500	ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 11/20/2013 at a depth of approximately 22 ft below surface grade at Hanford coordinates N149679.7, E571277.1. The sample was a split with WCH sample # J1T638.

Table C-8. Four-Phase Partitioning Model Results for Test Pit #4 at 22-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 3/19/2014
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 22 ft depth (J1T638)
Measured Soil TPH Concentration, mg/kg 5,753.473

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	299	1.93E-05	1.68E+00	Fail
	Method C	12,023	4.79E-06	1.39E-01	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	3.28E-09	2.12E-02	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	298.53	12,023.17
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	3.42E+03	1.15E-05	9.99E-01	*NO*	4.13E+04	3.44E-05	1.00E+00
Total Risk=1E-5	*NO*	2.99E+03	1.00E-05	8.71E-01	YES	1.20E+04	1.00E-05	2.91E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	2.99E+02	1.00E-06	8.71E-02				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	1.33E+01	3.28E-09	2.13E-02	100% NAPL
Total Risk = 1E-5	YES	1.33E+01	3.28E-09	2.13E-02	100% NAPL
Total Risk = 1E-6	YES	1.33E+01	3.28E-09	2.13E-02	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	1.33E+01	3.28E-09	2.13E-02	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 82000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	1.33E+01	3.28E-09	2.13E-02	100% NAPL

Table C-8. Four-Phase Partitioning Model Results for Test Pit #4 at 22-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Levels for the Protection of Ground Water Quality (Leaching Pathway)

WAC 173-340-740 and 747

Date: 3/19/2014

Site Name: 100-N-84:2

Sample Name: Test Pit #4 @ 22 ft depth (J1T638)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition				
			Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >10-12	47		4.70E+01	2.23E-02	9.29E-05		
AL_EC >12-16	500		5.00E+02	4.25E-03	8.85E-06		
AL_EC >16-21	760		7.60E+02	8.17E-06	2.55E-10		
AL_EC >21-34	1700		1.70E+03	1.43E-10	4.46E-15		
AR_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >12-16	100		1.00E+02	8.58E+00	1.07E-02		
AR_EC >16-21	740		7.40E+02	4.44E+00	9.24E-03		
AR_EC >21-34	1900		1.90E+03	1.17E-01	1.83E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0	160	0.00E+00	0.00E+00	0.00E+00		
1-Methyl Naphthalene	0.099		9.90E-02	3.80E-02	9.50E-05		
2-Methyl Naphthalene	0.074		7.40E-02	2.80E-02	8.74E-04		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	1.4	for	1.40E+00	1.29E-04		1.08E-09	for
Benzo(b)fluoranthene	0.72	all	7.20E-01	9.58E-06		7.99E-11	all
Benzo(k)fluoranthene	0.18	cPAHs	1.80E-01	1.28E-06		1.07E-11	cPAHs
Benzo(a)pyrene	1.7	Risk=	1.70E+00	2.44E-05		2.04E-09	
Chrysene	1.8	1E-05	1.80E+00	2.82E-05		2.36E-11	
Dibenz(a,h)anthracene	0.32		3.20E-01	6.41E-06		5.35E-11	Σ Risk=
Indeno(1,2,3-cd)pyrene	0.18		1.80E-01	3.21E-08		2.68E-13	3.28E-09
Sum	5753.473		5.75E+03	1.32E+01	2.12E-02	3.28E-09	Pass

Site-Specific Hydrogeological Properties previously entered:			
Item	Symbol	Value	Units
Total soil porosity:	n	0.43	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.13	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.001	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:	
Target Ground Water TPH Conc, ug/L ⇒	500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION	Calculate or Test
TPH Test button used.	
Pass or Fail? Pass	
Tested TPH Soil Conc, mg/kg = 5753.00	
Predicted TPH GW Conc, ug/L = 1.32E+01	
RISK @ Well = 3.28E-09	
HI @Well = 2.12E-02	

DEDAILED MODEL RESULTS	TPH Range Test
Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	257.3
Equilibrated Weighted Average MW of NAPL, g/mol:	257.3
Initial Weighted Average Density of NAPL, kg/L:	0.952
Volumetric NAPL Content, Θ_{NAPL} :	9.1E-03
NAPL Saturation (%), Θ_{NAPL}/n :	2.11%
100% NAPL, mg/kg	82516.8
Mass Distribution Pattern @ 4-phase in soil pore system:	Mass Balance Pattern
Total Mass distributed in Water Phase: 0.00%	in Solid: 0.08%
Total Mass distributed in Air Phase: 0.00%	in NAPL: 99.92%
Please Check Soil Residual Saturation TPH Levels: Refer to Table 747-5!	

3/19/2014: 3_18_14_J1T638.xls

Table C-9. Four-Phase Partitioning Model Results for Test Pit #4 at 25-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: Refer to WAC 173-340-720, 740,745, 747, 750

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 25 ft depth (J1T639)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10		0.00%
AL_EC >10-12		0.00%
AL_EC >12-16	140	4.03%
AL_EC >16-21	500	14.38%
AL_EC >21-34	1300	37.40%
AR_EC >8-10		0.00%
AR_EC >10-12		0.00%
AR_EC >12-16	14	0.40%
AR_EC >16-21	220	6.33%
AR_EC >21-34	1300	37.40%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene		0.00%
1-Methyl Naphthalene		0.00%
2-Methyl Naphthalene		0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	0.2	0.01%
Benzo(b)fluoranthene	0.4	0.01%
Benzo(k)fluoranthene	0.082	0.00%
Benzo(a)pyrene	0.69	0.02%
Chrysene	0.17	0.00%
Dibenz(a,h)anthracene	0.2	0.01%
Indeno(1,2,3-cd)pyrene	0.17	0.00%
Sum	3475.912	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentration (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here:	500	ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 11/20/2013 at a depth of approximately 25 ft below surface grade at Hanford coordinates N149679.7, E571277.1. The sample was a split with WCH sample # J1T639.

Table C-9. Four-Phase Partitioning Model Results for Test Pit #4 at 25-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 3/19/2014
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 25 ft depth (J1T639)
Measured Soil TPH Concentration, mg/kg 3,475.912

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	452	7.69E-06	8.22E-01	Fail
	Method C	18,212	1.91E-06	6.85E-02	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	1.91E-09	7.82E-03	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	452.19	18,211.65
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	4.23E+03	9.35E-06	1.00E+00	*NO*	5.07E+04	2.79E-05	1.00E+00
Total Risk=1E-5	*NO*	4.52E+03	1.00E-05	1.07E+00	YES	1.82E+04	1.00E-05	3.59E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	4.52E+02	1.00E-06	1.07E-01				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	4.68E+00	1.91E-09	7.87E-03	100% NAPL
Total Risk = 1E-5	YES	4.68E+00	1.91E-09	7.87E-03	100% NAPL
Total Risk = 1E-6	YES	4.68E+00	1.91E-09	7.87E-03	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	4.68E+00	1.91E-09	7.87E-03	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 82000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	4.68E+00	1.91E-09	7.87E-03	100% NAPL

Table C-9. Four-Phase Partitioning Model Results for Test Pit #4 at 25-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Level for the Protection of Ground Water Quality (Leaching Pathway)

WAC 173-340-740 and 747

Date: 3/19/2014

Site Name: 100-N-84:2

Sample Name: Test Pit #4 @ 25 ft depth (J1T639)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition: Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >12-16	140		1.40E+02	2.13E-03	4.44E-06		
AL_EC >16-21	500		5.00E+02	9.62E-06	3.01E-10		
AL_EC >21-34	1300		1.30E+03	1.96E-10	6.11E-15		
AR_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >12-16	14		1.40E+01	2.14E+00	2.67E-03		
AR_EC >16-21	220		2.20E+02	2.36E+00	4.92E-03		
AR_EC >21-34	1300		1.30E+03	1.43E-01	2.24E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0	160	0.00E+00	0.00E+00	0.00E+00		
1-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
2-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0.2	for	2.00E-01	3.30E-05		2.75E-10	for
Benzo(b)fluoranthene	0.4	all	4.00E-01	9.54E-06		7.96E-11	all
Benzo(k)fluoranthene	0.082	cPAHs	8.20E-02	1.04E-06		8.70E-12	cPAHs
Benzo(a)pyrene	0.69	Risk=	6.90E-01	1.78E-05		1.48E-09	
Chrysene	0.17	1E-05	1.70E-01	4.78E-06		3.99E-12	
Dibenz(a,h)anthracene	0.2		2.00E-01	7.18E-06		5.99E-11	Σ Risk=
Indeno(1,2,3-cd)pyrene	0.17		1.70E-01	5.43E-08		4.53E-13	1.91E-09
Sum	3475.912		3.48E+03	4.64E+00	7.82E-03	1.91E-09	Pass

Site-Specific Hydrogeological Properties previously entered:

Item	Symbol	Value	Units
Total soil porosity:	n	0.43	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.13	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.001	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:

Target Ground Water TPH Conc, ug/L ⇒ 500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION — Calculate or Test

TPH Test button used.

Pass or Fail? Pass

Tested TPH Soil Conc, mg/kg = 3476.00

Predicted TPH GW Conc, ug/L = 4.64E+00

RISK @ Well = 1.91E-09

HI @Well = 7.82E-03

DEDAILED MODEL RESULTS — TPH Range Test

Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	278.6
Equilibrated Weighted Average MW of NAPL, g/mol:	278.6
Initial Weighted Average Density of NAPL, kg/L:	0.946
Volumetric NAPL Content, Θ_{NAPL} :	5.5E-03
NAPL Saturation (%), Θ_{NAPL}/n :	1.28%
100% NAPL, mg/kg	82004.0
Mass Distribution Pattern @ 4-phase in soil pore system:	Mass Balance Pattern
Total Mass distributed in Water Phase: 0.00%	in Solid: 0.10%
Total Mass distributed in Air Phase: 0.00%	in NAPL: 99.90%

Please Check Soil Residual Saturation TPH Levels: Refer to Table 747-5!

3/19/2014: 3_18_14_J1T639.xls

Table C-10. Four-Phase Partitioning Model Results for Test Pit #4 at 28-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: **Refer to WAC 173-340-720, 740,745, 747, 750**

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 28 ft depth (J1T640)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10		0.00%
AL_EC >10-12		0.00%
AL_EC >12-16	190	5.44%
AL_EC >16-21	490	14.02%
AL_EC >21-34	1200	34.33%
AR_EC >8-10		0.00%
AR_EC >10-12		0.00%
AR_EC >12-16	23	0.66%
AR_EC >16-21	290	8.30%
AR_EC >21-34	1300	37.19%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene		0.00%
1-Methyl Naphthalene		0.00%
2-Methyl Naphthalene	0.051	0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	0.31	0.01%
Benzo(b)fluoranthene	0.58	0.02%
Benzo(k)fluoranthene	0.14	0.00%
Benzo(a)pyrene	0.76	0.02%
Chrysene	0.33	0.01%
Dibenz(a,h)anthracene	0.18	0.01%
Indeno(1,2,3-cd)pyrene	0.16	0.00%
Sum	3495.511	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here: 500 ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 11/20/2013 at a depth of approximately 28 ft below surface grade at Hanford coordinates N149679.7, E571277.1. The sample was a split with WCH sample # J1T640.

Table C-10. Four-Phase Partitioning Model Results for Test Pit #4 at 28-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 3/19/2014
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 28 ft depth (J1T640)
Measured Soil TPH Concentration, mg/kg **3,495.511**

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	403	8.68E-06	8.97E-01	Fail
	Method C	16,211	2.16E-06	7.47E-02	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	2.18E-09	1.18E-02	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	402.52	16,210.92
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	3.90E+03	9.69E-06	1.00E+00	*NO*	4.68E+04	2.89E-05	1.00E+00
Total Risk=1E-5	*NO*	4.03E+03	1.00E-05	1.03E+00	YES	1.62E+04	1.00E-05	3.46E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	4.03E+02	1.00E-06	1.03E-01				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	6.65E+00	2.18E-09	1.19E-02	100% NAPL
Total Risk = 1E-5	YES	6.65E+00	2.18E-09	1.19E-02	100% NAPL
Total Risk = 1E-6	YES	6.65E+00	2.18E-09	1.19E-02	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	6.65E+00	2.18E-09	1.19E-02	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 82000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	6.65E+00	2.18E-09	1.19E-02	100% NAPL

Table C-10. Four-Phase Partitioning Model Results for Test Pit #4 at 28-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Levels for the Protection of Ground Water Quality (Leaching Pathway)

WAC 173-340-740 and 747

Date: 3/19/2014

Site Name: 100-N-84:2

Sample Name: Test Pit #4 @ 28 ft depth (J1T640)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition				
			Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >12-16	190		1.90E+02	2.80E-03	5.84E-06		
AL_EC >16-21	490		4.90E+02	9.14E-06	2.86E-10		
AL_EC >21-34	1200		1.20E+03	1.75E-10	5.47E-15		
AR_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >12-16	23		2.30E+01	3.41E+00	4.26E-03		
AR_EC >16-21	290		2.90E+02	3.02E+00	6.29E-03		
AR_EC >21-34	1300		1.30E+03	1.39E-01	2.17E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0	160	0.00E+00	0.00E+00	0.00E+00		
1-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
2-Methyl Naphthalene	0.051		5.10E-02	3.29E-02	1.03E-03		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0.31	for	3.10E-01	4.96E-05		4.14E-10	for
Benzo(b)fluoranthene	0.58	all	5.80E-01	1.34E-05		1.12E-10	all
Benzo(k)fluoranthene	0.14	cPAHs	1.40E-01	1.73E-06		1.44E-11	cPAHs
Benzo(a)pyrene	0.76	Risk=	7.60E-01	1.90E-05		1.58E-09	
Chrysene	0.33	1E-05	3.30E-01	8.99E-06		7.50E-12	
Dibenz(a,h)anthracene	0.18		1.80E-01	6.26E-06		5.23E-11	Σ Risk=
Indeno(1,2,3-cd)pyrene	0.16		1.60E-01	4.96E-08		4.13E-13	2.18E-09
Sum	3495.511		3.50E+03	6.60E+00	1.18E-02	2.18E-09	Pass

Site-Specific Hydrogeological Properties previously entered:

Item	Symbol	Value	Units
Total soil porosity:	n	0.43	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.13	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.001	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:

Target Ground Water TPH Conc, ug/L ⇒ 500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION — Calculate or Test

TPH Test button used.

Pass or Fail? Pass

Tested TPH Soil Conc, mg/kg = 3496.00

Predicted TPH GW Conc, ug/L = 6.60E+00

RISK @ Well = 2.18E-09

HI @Well = 1.18E-02

DEDAILED MODEL RESULTS — TPH Range Test

Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	271.6
Equilibrated Weighted Average MW of NAPL, g/mol:	271.6
Initial Weighted Average Density of NAPL, kg/L:	0.953
Volumetric NAPL Content, Θ_{NAPL} :	5.5E-03
NAPL Saturation (%), Θ_{NAPL}/n :	1.28%
100% NAPL, mg/kg	82570.8

Mass Distribution Pattern @ 4-phase in soil pore system: Mass Balance Pattern

Total Mass distributed in Water Phase: 0.00% in Solid: 0.11%

Total Mass distributed in Air Phase: 0.00% in NAPL: 99.89%

Please Check Soil Residual Saturation TPH Levels: Refer to Table 747-5!

3/19/2014: 3_19_14_J1T640.xls

Table C-11. Four-Phase Partitioning Model Results for Test Pit #4 at 31-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: Refer to WAC 173-340-720, 740,745, 747, 750

1. Enter Site Information

Date: 03/19/14
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 31 ft depth (J1T641)

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6		0.00%
AL_EC >6-8		0.00%
AL_EC >8-10		0.00%
AL_EC >10-12		0.00%
AL_EC >12-16	160	4.24%
AL_EC >16-21	520	13.78%
AL_EC >21-34	1400	37.09%
AR_EC >8-10		0.00%
AR_EC >10-12		0.00%
AR_EC >12-16	22	0.58%
AR_EC >16-21	270	7.15%
AR_EC >21-34	1400	37.09%
Benzene		0.00%
Toluene		0.00%
Ethylbenzene		0.00%
Total Xylenes		0.00%
Naphthalene		0.00%
1-Methyl Naphthalene		0.00%
2-Methyl Naphthalene		0.00%
n-Hexane		0.00%
MTBE		0.00%
Ethylene Dibromide (EDB)		0.00%
1,2 Dichloroethane (EDC)		0.00%
Benzo(a)anthracene	0.22	0.01%
Benzo(b)fluoranthene	0.54	0.01%
Benzo(k)fluoranthene	0.14	0.00%
Benzo(a)pyrene	0.88	0.02%
Chrysene	0.26	0.01%
Dibenz(a,h)anthracene	0.33	0.01%
Indeno(1,2,3-cd)pyrene	0.29	0.01%
Sum	3774.66	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here:	500	ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:
This sample was collected on 11/20/2013 at a depth of approximately 31 ft below surface grade at Hanford coordinates N149679.7, E571277.1. The sample was a split with WCH sample # J1T641.

Table C-11. Four-Phase Partitioning Model Results for Test Pit #4 at 31-ft Depth. (3 Pages)

Washington State Department of Ecology, Toxics Cleanup Program: Soil Cleanup Level for TPH Sites - Main Data Entry Form and Calculation Summary

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 3/19/2014
Site Name: 100-N-84:2
Sample Name: Test Pit #4 @ 31 ft depth (J1T641)
Measured Soil TPH Concentration, mg/kg **3,774.660**

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	378	9.98E-06	9.13E-01	Fail
	Method C	15,233	2.48E-06	7.61E-02	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	100% NAPL	2.22E-09	9.60E-03	Pass
	Target TPH GW Conc. @ 500 ug/L	100% NAPL	NA	NA	Pass

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	378.24	15,233.15
Most Stringent Criterion	Risk of cPAHs mixture= 1E-6	Total Risk=1E-5

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	*NO*	4.13E+03	1.09E-05	1.00E+00	*NO*	4.96E+04	3.26E-05	1.00E+00
Total Risk=1E-5	*NO*	3.78E+03	1.00E-05	9.15E-01	YES	1.52E+04	1.00E-05	3.07E-01
Risk of Benzene= 1E-6	NA	NA	NA	NA	NA			
Risk of cPAHs mixture= 1E-6	YES	3.78E+02	1.00E-06	9.15E-02				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	NA
Protective Ground Water Concentration, ug/L	NA
Protective Soil Concentration, mg/kg	Soil-to-Ground Water is not a critical pathway!

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	5.92E+00	2.21E-09	9.66E-03	100% NAPL
Total Risk = 1E-5	YES	5.92E+00	2.21E-09	9.66E-03	100% NAPL
Total Risk = 1E-6	YES	5.92E+00	2.21E-09	9.66E-03	100% NAPL
Risk of cPAHs mixture= 1E-5	YES	5.92E+00	2.21E-09	9.66E-03	100% NAPL
Benzene MCL = 5 ug/L	NA	NA	NA	NA	NA
MTBE = 20 ug/L	NA	NA	NA	NA	NA

Note: 100% NAPL is 82000 mg/kg TPH.

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 500 ug/L	5.92E+00	2.21E-09	9.66E-03	100% NAPL

Table C-11. Four-Phase Partitioning Model Results for Test Pit #4 at 31-ft Depth. (3 Pages)

A2. 2 Worksheet for Calculating Soil Cleanup Levels for the Protection of Ground Water Quality (Leaching Pathway)

WAC 173-340-740 and 747

Date: 3/19/2014

Site Name: 100-N-84:2

Sample Name: Test Pit #4 @ 31 ft depth (J1T641)

Chemical of Concern or EC Group	Measured Soil Conc @dry basis	GW Cleanup Level	Adjusted Condition				
			Soil Conc being tested	Predicted Conc @Well	HQ @ Well	RISK @ Well	Pass or Fail?
	mg/kg	ug/L	mg/kg	ug/L	unitless	unitless	
Petroleum EC Fraction							
AL_EC >5-6	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >6-8	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AL_EC >12-16	160		1.60E+02	2.23E-03	4.64E-06		
AL_EC >16-21	520		5.20E+02	9.16E-06	2.86E-10		
AL_EC >21-34	1400		1.40E+03	1.93E-10	6.02E-15		
AR_EC >8-10	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >10-12	0		0.00E+00	0.00E+00	0.00E+00		
AR_EC >12-16	22		2.20E+01	3.08E+00	3.85E-03		
AR_EC >16-21	270		2.70E+02	2.65E+00	5.52E-03		
AR_EC >21-34	1400		1.40E+03	1.41E-01	2.21E-04		
Benzene	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Toluene	0	1000	0.00E+00	0.00E+00	0.00E+00		
Ethylbenzene	0	700	0.00E+00	0.00E+00	0.00E+00		
Total Xylenes	0	1000	0.00E+00	0.00E+00	0.00E+00		
Naphthalene	0	160	0.00E+00	0.00E+00	0.00E+00		
1-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
2-Methyl Naphthalene	0		0.00E+00	0.00E+00	0.00E+00		
n-Hexane	0		0.00E+00	0.00E+00	0.00E+00		
MTBE	0	20	0.00E+00	0.00E+00	0.00E+00		
Ethylene Dibromide (EDB)	0	0.01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0	5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0.22	for	2.20E-01	3.32E-05		2.77E-10	for
Benzo(b)fluoranthene	0.54	all	5.40E-01	1.18E-05		9.83E-11	all
Benzo(k)fluoranthene	0.14	cPAHs	1.40E-01	1.63E-06		1.36E-11	cPAHs
Benzo(a)pyrene	0.88	Risk=	8.80E-01	2.07E-05		1.73E-09	
Chrysene	0.26	1E-05	2.60E-01	6.69E-06		5.58E-12	
Dibenz(a,h)anthracene	0.33		3.30E-01	1.08E-05		9.04E-11	Σ Risk=
Indeno(1,2,3-cd)pyrene	0.29		2.90E-01	8.48E-08		7.07E-13	2.22E-09
Sum	3774.66		3.78E+03	5.87E+00	9.60E-03	2.22E-09	Pass

Site-Specific Hydrogeological Properties previously entered:

Item	Symbol	Value	Units
Total soil porosity:	n	0.43	unitless
Volumetric water content:	Θ_w	0.3	unitless
Volumetric air content:	Θ_a	0.13	unitless
Soil bulk density measured:	ρ_b	1.5	kg/L
Fraction Organic Carbon:	f_{oc}	0.001	unitless
Dilution Factor:	DF	20	unitless

Target Ground Water TPH conc adjusted previously if any:

Target Ground Water TPH Conc, ug/L⇒ 500

CALCULATE PROTECTIVE CONDITION OR TEST ADJUSTED CONDITION Calculate or Test

TPH Test button used.

Pass or Fail? Pass

Tested TPH Soil Conc, mg/kg = 3775.00

Predicted TPH GW Conc, ug/L = 5.87E+00

RISK @ Well = 2.22E-09

HI @Well = 9.60E-03

DEDAILED MODEL RESULTS TPH Range Test

Type of model used for computation:	4-Phase Model
Computation completed?	Yes!
Initial Weighted Average MW of NAPL, g/mol:	276.8
Equilibrated Weighted Average MW of NAPL, g/mol:	276.9
Initial Weighted Average Density of NAPL, kg/L:	0.948
Volumetric NAPL Content, Θ_{NAPL} :	6.0E-03
NAPL Saturation (%), Θ_{NAPL}/n :	1.39%
100% NAPL, mg/kg	82188.0
Mass Distribution Pattern @ 4-phase in soil pore system:	Mass Balance Pattern
Total Mass distributed in Water Phase: 0.00%	in Solid: 0.09%
Total Mass distributed in Air Phase: 0.00%	in NAPL: 99.91%

Please Check Soil Residual Saturation TPH Levels: Refer to Table 747-5!

3/19/2014: 3_19_14_J1T641.xls

APPENDIX D

DISCOLORED SOIL INVESTIGATION

Table D-1. Summary of Sample Results for Soil Discoloration Investigation.

HEIS Number	Date	WSP Location		Depth (ft)	TPH (mg/kg)[a]	Comments
		Northing	Easting			
J1T085	9/5/2013	149602.6	571337.9	10	1.2	Above stained soil
J1T086	9/5/2013	149602.1	571338.8	12	1.1	Within stained soil
J1T087	9/5/2013	149602.1	571339.7	14	2.9	Below stained soil
J1T088	9/5/2013	149641.8	571357.8	11	8	Above stained soil
J1T089	9/5/2013	149641.3	571358.2	13	310	Within stained soil; subsequently excavated
J1T090	9/5/2013	149641.2	571358.8	15	19	Below stained soil
J1T093	9/5/2013	149591.2	571363.0	8	1.5	Above stained soil layer
J1T092	9/5/2013	149591.3	571362.2	10	1.1 (ND)	Within stained soil layer
J1T091	9/5/2013	149591.6	571361.5	12	3.4	Below stained layer
J1T1P8	9/17/2013	149652.6	571366.1	8	2.8	Above stained soil
J1T1P9	9/17/2013	149551.6	571337.0	11	3.2	Within stained soil
J1T1R0	9/17/2013	149552.2	571336.0	13	18	Below stained soil
J1T1R2	9/17/2013	571289.2	149462.5	6	15	Above stained soil
J1T1R3	9/17/2013	571290.0	149461.1	9	1.1 (ND)	Within stained soil
J1T1R4	9/17/2013	571291.3	149460.0	11	5.8	Below stained soil

[a] Value is total petroleum hydrocarbons measured through diesel extended range.

HEIS = Hanford Environmental Information System
ND = not detected
TPH = total petroleum hydrocarbons
WSP = Washington State Plane (m)

Field Investigation of Discolored Soil (October 9, 2013).

Band of staining in 100-N-84:2 (north of N Avenue).

Stain as it appears on sidewall of 100-N-84:2 (north of N Avenue). This is the location material was removed from for our observations.

Material was removed from stain (shown above) at 1030 hours. Picture taken at time of collection.

Material collected at 1030 hours was visibly lighter in color when observed at 1430 hours.

Material collected at 1430 hours (left) and material collected at 1030 hours (right). Both samples were collected from exact same location within stain at 100-N-84:2 sidewall. After 4 hours the material on the right is visibly lighter in color.

Material collected at 1430 (left) and material collected 1030 (right). Material collected at 1030 was visibly darker in color in the center of the pile than was observed on the surface of the pile.

APPENDIX E

GLOBAL POSITIONING ENVIRONMENTAL RADIOLOGICAL SURVEYOR SURVEYS

Figure E-1. Beta Radiological Survey Map.

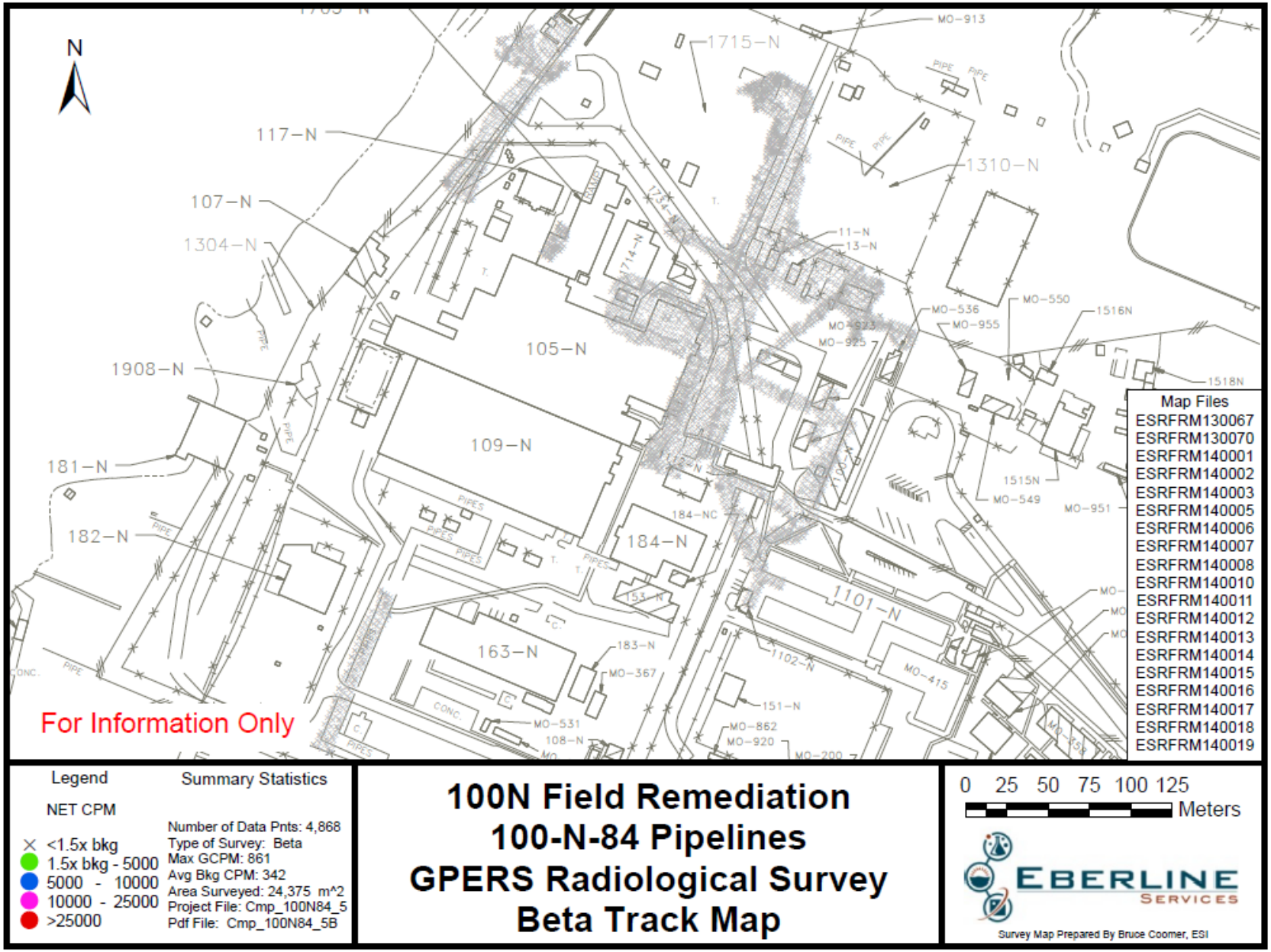
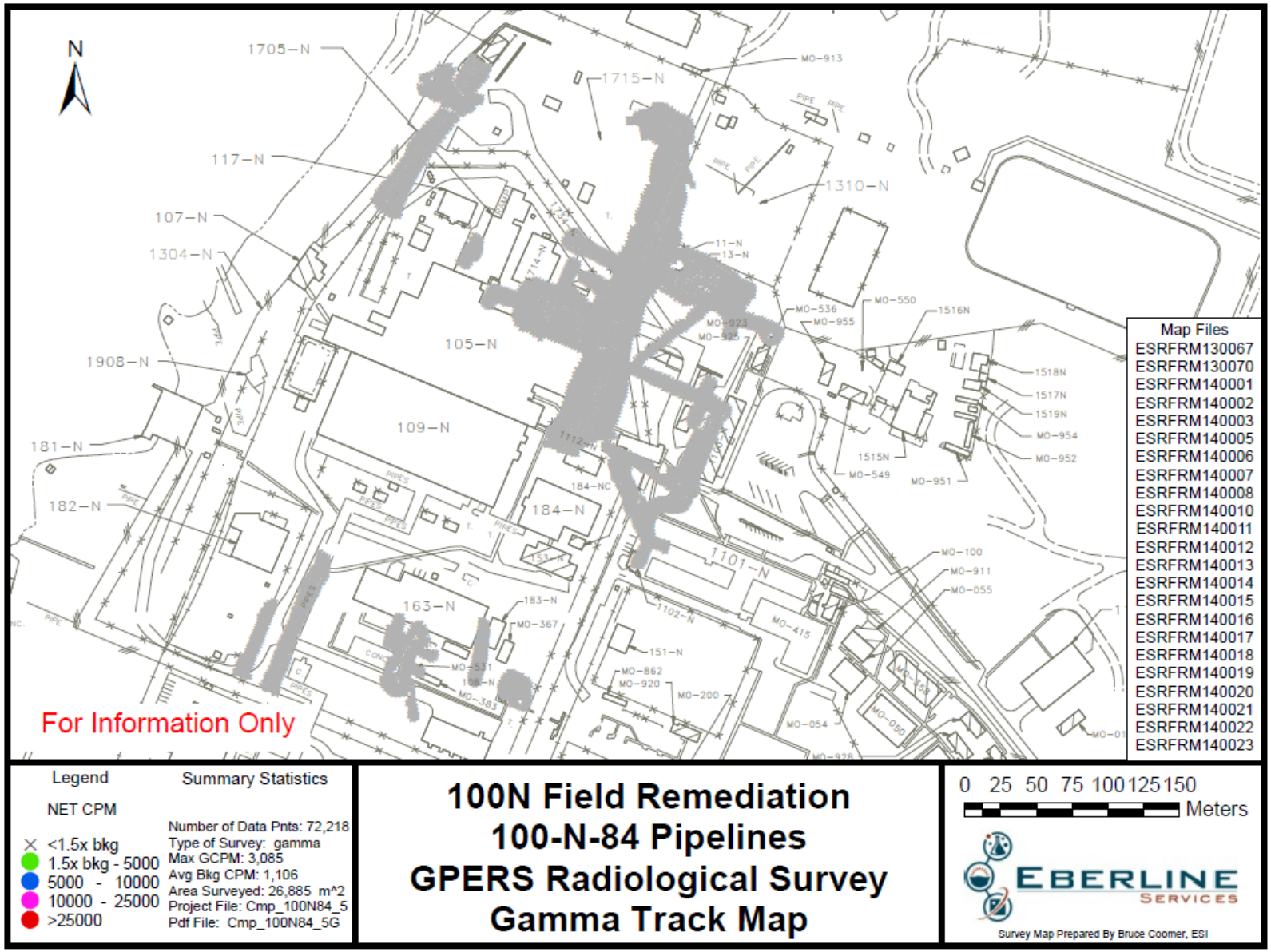


Figure E-2. Gamma Radiological Survey Map.



APPENDIX F

CALCULATIONS

APPENDIX F

CALCULATION BRIEF

The calculations provided in this appendix are copies of originals that 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 Calculations," Washington Closure Hanford, Richland, Washington. The calculations provided in this appendix include:

100-N-84:2 Subsite Cleanup Verification 95% UCL Calculation, 0100N-CA-V0287, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-N-82:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100N-CA-V0288, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-N-84:2 Subsite Hazard Quotient and Carcinogenic Risk Calculations for Protection of Groundwater, 0100N-CA-V0289, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

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

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-N

Discipline: Environmental *Calculation No: 0100N-CA-V0287

Subject: 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculation

Computer Program: Excel Program No: Excel 2010

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 = 19 Attm. 1 = 12 Total = 32	J. D. Skoglie	I. B. Berezovskiy	T. Q. Howell	S. G. Wilkinson	8/20/14

SUMMARY OF REVISION

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

CALCULATION SHEET

Washington Closure Hanford

Originator	J. D. Skoglie	Date	07/01/14	Calc. No. 0100N-CA-V0287	Rev. No. 0
Project	100-N Field Remediation	Job No.	14655	Checked I. B. Berezovskiy	Date 07/01/14
Subject	100-N-84:2 Subsite Cleanup Verification 95% UCL				Sheet No. 1 of 19

Summary

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

Table of Contents:
Sheets 1 to 5 - Calculation Sheet Summary
Sheets 6 to 12 - Calculation Sheet Verification Data - Excavation Statistical and Maximum Calculations
Sheets 13 to 16 - Ecology Software (MTCAStat) Results
Sheet 17 to 19 - Calculation Sheet Duplicate-Split Analysis
Attachment 1 - 100-N-84:2, Verification Sampling Results (12 sheets)

Given/References:
1) Sample Results (Attachment 1).
2) DOE-RL, 2006, 100-N Area Sampling and Analysis Plan for CERCLA Waste Sites, DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
3) DOE-RL, 2013, Remedial Design Report/Remedial Action Work Plan for the 100-N Area, DOE/RL-2005-93, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) Ecology, 1992, Statistical Guidance for Ecology Site Managers, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
5) Ecology, 1993, Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets), Publication #92-54, Washington Department of Ecology, Olympia, Washington.
6) Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
7) EPA, 1989, Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual, Part A; Interim Final, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D. C.
8) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," Washington Administrative Code.

Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2013). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).

Calculation Description:
The subject calculations were performed on statistical and focused data from soil verification samples (Attachment 1) from the 100-N-84:2 subsite. The data were entered into an EXCEL 2010 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2013) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:
The 100-N-84:2 subsite underwent statistical and focused sampling. The 100-N-84:2 is comprised of two decision units; north excavation (N) and south excavation (S), with associated focused samples FS-1 and river road (RR).

Analytical results for all sampling locations are summarized in the tables provided on sheet 4 and 5. Further information of the sample data quality is presented in the data quality assessment section of the associated RSVP.

Summary (continued)

Methodology, continued:

For nonradioactive analytes with ≤50% of the data below detection limits, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with >50% of the data below detection limits, as determined by direct inspection of the sample results (Attachment 1), the maximum detected value for the data set (which includes primary and duplicate samples) is used instead of the 95% UCL, and no further calculations are performed for those data sets. For convenience, these maximum detected values are included in the summary tables that follow. The 95% UCL was not calculated for data sets with no reported detections. Calculated cleanup levels are not available in (Ecology 2011) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment 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 COCs/COPCs and are also not included in these calculations.

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

For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets ($n < 10$), the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2013) and MTCAStat coding and due to a limitation in the MTCAStat coding (no direct capability to address variable quantitation limits within a data set), substitutions for censored data are performed before software input and the resulting data set treated as uncensored.

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

The RPD is calculated when both the primary value and either the duplicate or split value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed in Table 2-1 of the SAP (DOE-RL 2006) for certain constituents. All other constituents will have their own pre-determined TDL's based on the laboratory and method used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

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

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

Washington Closure Hanford CALCULATION SHEET

Originator J. D. Skoglie	**Date** 07/01/14	**Calc. No.** 0100N-CA-V0287		**Rev. No.** 0
Project 100-N Field Remediation	**Job No.** 14655	**Checked** I. B. Berezovskiy		**Date** 07/01/14
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations				**Sheet No.** 3 of 19

Summary (continued)

QUALIFIER LIST

Grey cells indicate rejected data and will not be used in the calcualtion.
B = estimated result. Result is less than the RL, but greater than MDL.
D = reported from a dilution.
J = estimate
M = sample duplicate precision not met
N = recovery exceeds upper or lower control limits.
U = undetected
X = serial dilution in the analytical batch indicates that physical and chemical interferences are present (metals).

ACRONYM LIST

-- = not applicable
DE = direct exposure
EXC = excavation
FS = focused sample
GW = groundwater
MTCA = *Model Toxics Control Act*
PQL = practical quantitation limit
Q = qualifier
QA/QC = quality assurance/quality control
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
RSVP = remaining sites verification package
SAP = sampling and analysis plan
TDL = target detection limit
UCL = upper confidence limit
WAC = Washington Administrative Code

Washington Closure Hanford CALCULATION SHEET

Originator J. D. Skoglie Date 07/02/14 Calc. No. 0100N-CA-V0287 Rev. No. 0
Project 100-N Field Remediation Job No. 14655 Checked I. B. Berezovskiy Date 07/02/14
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations Sheet No. 4 of 19

Summary (continued)

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

Results Summary - Excavation, Focused Sample, and River Road Sample [a]

Analyte	North (N) - Excavation		South (S) - Excavation		Focused Sample	River Road (RR)	Units
	95% UCL Result	Maximum Result	95% UCL Result	Maximum Result	Maximum Result	Maximum Result	
Antimony	--	0.40	--	--	--	--	mg/kg
Arsenic	4.0	--	3.2	--	3.0	2.1	mg/kg
Barium	55.9	--	67.4	--	60.1	61.2	mg/kg
Beryllium	0.098	--	--	0.22	--	--	mg/kg
Boron	--	1.6	--	1.5	--	--	mg/kg
Cadmium	--	0.18	0.075	--	0.19	0.12	mg/kg
Chromium	10.3	--	7.9	--	12.6	7.4	mg/kg
Cobalt	8.7	--	9.7	--	7.5	9.4	mg/kg
Copper	16.6	--	16.3	--	19.0	15.1	mg/kg
Hexavalent chromium	--	--	--	--	--	0.408	mg/kg
Lead	6.8	--	5.3	--	3.8	5.6	mg/kg
Manganese	325	--	341	--	310	349	mg/kg
Mercury	0.010	--	0.013	--	--	--	mg/kg
Molybdenum	--	0.34	--	0.29	--	--	mg/kg
Nickel	12.3	--	10.7	--	11.4	9.7	mg/kg
Vanadium	60.6	--	63.9	--	44.0	50.3	mg/kg
Zinc	49.4	--	50.1	--	38.8	46.3	mg/kg
Chloride	--	--	--	--	--	9.4	mg/kg
Fluoride	--	--	--	--	--	1.0	mg/kg
Nitrogen in nitrate	--	--	--	--	--	1.9	mg/kg
Nitrogen in nitrate and nitrite	--	--	--	--	--	0.98	mg/kg
Sulfate	--	--	--	--	--	121	mg/kg
TPH - Diesel Range EXT	111	--	97	--	6.5	83	mg/kg
TPH - Diesel Range	61	--	51	--	4.0	29	mg/kg
Acenaphthene (Method 8310)	--	0.120	--	0.028	--	0.058	mg/kg
Acenaphthene (Method 8270)	--	--	--	--	--	0.130	mg/kg
Anthracene (Method 8310)	--	0.110	--	0.024	--	0.056	mg/kg
Anthracene (Method 8270)	--	--	--	--	--	0.390	mg/kg
Benzo(a)anthracene (Method 8310)	--	0.620	--	0.049	0.0070	0.660	mg/kg
Benzo(a)anthracene (Method 8270)	--	--	--	--	--	0.470	mg/kg
Benzo(a)pyrene (Method 8310)	--	0.640	0.0080	--	0.011	0.490	mg/kg
Benzo(a)pyrene (Method 8270)	--	--	--	--	--	0.310	mg/kg
Benzo(b)fluoranthene (Method 8310)	--	0.480	--	0.067	--	0.400	mg/kg
Benzo(b)fluoranthene (Method 8270)	--	--	--	--	--	0.430	mg/kg
Benzo(ghi)perylene (Method 8310)	--	0.400	--	0.068	--	0.230	mg/kg
Benzo(ghi)perylene (Method 8270)	--	--	--	--	--	0.130	mg/kg
Benzo(k)fluoranthene (Method 8310)	--	0.220	--	0.110	0.0090	0.180	mg/kg
Benzo(k)fluoranthene (Method 8270)	--	--	--	--	--	0.140	mg/kg
Carbazole	--	--	--	--	--	0.230	mg/kg
Chrysene (Method 8310)	--	0.700	--	0.071	0.013	0.730	mg/kg
Chrysene (Method 8270)	--	--	--	--	--	0.440	mg/kg
Dibenz[a,h]anthracene (Method 8310)	--	0.085	--	--	--	0.024	mg/kg
Dibenz[a,h]anthracene (Method 8270)	--	--	--	--	--	0.029	mg/kg
Dibenzofuran	--	--	--	--	--	0.110	mg/kg
Dimethyl phthalate	--	--	--	--	--	0.033	mg/kg
Fluoranthene (Method 8310)	--	0.820	0.041	--	0.022	0.290	mg/kg
Fluoranthene (Method 8270)	--	--	--	--	--	1.2	mg/kg
Fluorene (Method 8310)	--	0.095	--	0.017	--	0.069	mg/kg
Fluorene (Method 8270)	--	--	--	--	--	0.180	mg/kg
Indeno(1,2,3-cd)pyrene (Method 8310)	--	0.400	--	0.060	--	0.200	mg/kg
Indeno(1,2,3-cd)pyrene (Method 8270)	--	--	--	--	--	0.130	mg/kg
Phenanthrene (Method 8310)	--	0.210	--	0.076	--	0.028	mg/kg
Phenanthrene (Method 8270)	--	--	--	--	--	1.3	mg/kg
Pyrene (Method 8310)	--	1.2	0.073	--	0.024	0.590	mg/kg
Pyrene (Method 8270)	--	--	--	--	--	1.0	mg/kg
Aroclor-1254	--	0.500	--	0.011	0.0038	0.010	mg/kg

3-Part Test Evaluation:

95% UCL or maximum [a] > Cleanup	N		S	
Limit?	NO	YES	NO	NO
> 10% above Cleanup Limit?	NO	YES	NO	NO
Any sample > 2x Cleanup Limit?	NO	YES	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 J. D. Skoglie Date 07/01/14 Calc. No. 0100N-CA-V0287 Rev. No. 0
Project 100-N Field Remediation Job No. 14655 Checked I. B. Berezovskiy Date 07/01/14
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations Sheet No. 5 of 19

Summary (continued)

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

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

Analyte	North EXC		South EXC		River Road (RR)
	Duplicate	Split	Duplicate	Split	Duplicate
Potassium-40	--	--	--	--	9.0%
Aluminum	22.5%	11.9%	17.8%	28.6%	15.1%
Barium	7.4%	5.0%	***39.6%***	***58.2%***	13.1%
Calcium	5.8%	4.5%	16.9%	0.9%	15.6%
Chromium	***39.3%***	29.8%	--	--	9.9%
Cobalt	--	--	3.8%	1.0%	--
Copper	5.9%	12.0%	11.1%	12.4%	2.7%
Iron	3.4%	3.2%	6.6%	3.9%	10.8%
Magnesium	15.4%	25.1%	4.1%	1.9%	15.7%
Manganese	8.4%	23.5%	6.5%	1.3%	27.4%
Silicon	11.2%	***65.9%***	11.4%	***85.2%***	25.7%
Sodium	***30.3%***	--	--	--	15.0%
Vanadium	9.7%	14.3%	14.3%	26.4%	7.6%
Zinc	***38.2%***	9.0%	6.8%	17.4%	15.1%
Sulfate	--	--	--	--	17.0%
Benzo(a)anthracene	***66.7%***	--	--	--	--
Benzo(b)fluoranthene	***43.9%***	--	--	--	--
Chrysene	***88.4%***	--	--	--	--
Fluoranthene	***51.4%***	***124.1%***	--	--	--
Phenanthrene	19.4%		--	--	--
Pyrene	***63.3%***	***141.9%***	--	--	--

[a]RPD listed where result produced, based on criteria. If RPD not required, no value is listed. The significance of the reported RPD values, including values greater than 30%, and greater than 35% for splits, is addressed in the data quality assessment section of the RSVP.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 6 of 19

100-N-84:2 Subsite Statistical Calculations

Verification Data - North Excavation (N)

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Arsenic Q	Arsenic PQL	Barium mg/kg	Barium Q	Barium PQL	Beryllium mg/kg	Beryllium Q	Beryllium PQL	Chromium mg/kg	Chromium Q	Chromium PQL	Cobalt mg/kg	Cobalt Q	Cobalt PQL	Copper mg/kg	Copper Q	Copper PQL	Lead mg/kg	Lead Q	Lead PQL	Manganese mg/kg	Manganese Q	Manganese PQL
N-12	J1TPW2	5/27/14	2.5		0.63	57.7		0.073	0.041	B	0.032	14.0		0.056	7.4	X	0.096	15.7	X	0.21	8.9		0.26	274		0.096
Duplicate of J1TPW2	J1TPW3	5/27/14	2.6		0.64	53.6		0.074	0.039	B	0.032	9.4		0.056	6.9	X	0.097	14.8	X	0.21	5.6		0.26	252		0.097
N-1	J1TPV1	5/21/14	3.3	JN	0.64	62.0	JNXM	0.074	0.032	UJN	0.032	11.6	JNXM	0.056	10.4	JNXM	0.097	16.1	JNXM	0.21	5.5	JNM	0.26	379	JXM	0.097
N-2	J1TPV2	5/21/14	3.1	J	0.62	64.2	JX	0.071	0.031	UJ	0.031	15.8	JX	0.054	8.4	JX	0.094	16.0	JX	0.20	8.1	J	0.25	322	JX	0.094
N-3	J1TPV3	5/27/14	2.8		0.61	50.8		0.070	0.030	U	0.030	4.7		0.053	8.6	X	0.092	13.7	X	0.20	3.9		0.25	323		0.092
N-4	J1TPV4	5/27/14	1.7		0.60	38.9		0.069	0.030	U	0.030	1.8		0.053	9.2	X	0.091	13.0	X	0.20	2.0		0.25	311		0.091
N-5	J1TPV5	5/27/14	2.2		0.61	50.5		0.071	0.031	U	0.031	4.3		0.054	8.6	X	0.093	14.1	X	0.20	3.0		0.25	306		0.093
N-6	J1TPV6	5/27/14	4.4		0.66	42.0		0.076	0.16	B	0.033	9.3		0.058	7.0	X	0.10	15.6	X	0.22	4.4		0.27	288		0.10
N-7	J1TPV7	5/27/14	3.4		0.57	47.9		0.066	0.079	B	0.028	7.8		0.050	7.3	X	0.086	16.1	X	0.19	3.2		0.23	261		0.086
N-8	J1TPV8	5/27/14	3.6		0.62	57.6		0.071	0.11	B	0.031	8.0		0.054	7.7	X	0.094	16.8	X	0.20	4.5		0.25	300		0.094
N-9	J1TPV9	5/27/14	5.3		0.62	51.3		0.071	0.20		0.031	10.9		0.054	8.0	X	0.094	19.3	X	0.20	6.2		0.25	333		0.094
N-10	J1TPW0	5/27/14	3.5		0.57	52.3		0.066	0.098	B	0.028	7.8		0.050	8.1	X	0.086	16.5	X	0.19	8.9		0.23	305		0.086
N-11	J1TPW1	5/27/14	4.2		0.58	39.3		0.067	0.055	B	0.029	6.7		0.051	8.3	X	0.089	15.7	X	0.19	4.1		0.24	309		0.089

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Lead mg/kg	Manganese mg/kg
N-12	J1TPW2/ J1TPW3	5/27/14	2.6	55.7	0.040	11.7	7.2	15.3	7.3	263
N-1	J1TPV1	5/21/14	3.3	62.0	0.016	11.6	10.4	16.1	5.5	379
N-2	J1TPV2	5/21/14	3.1	64.2	0.016	15.8	8.4	16.0	8.1	322
N-3	J1TPV3	5/27/14	2.8	50.8	0.015	4.7	8.6	13.7	3.9	323
N-4	J1TPV4	5/27/14	1.7	38.9	0.015	1.8	9.2	13.0	2.0	311
N-5	J1TPV5	5/27/14	2.2	50.5	0.016	4.3	8.6	14.1	3.0	306
N-6	J1TPV6	5/27/14	4.4	42.0	0.16	9.3	7.0	15.6	4.4	288
N-7	J1TPV7	5/27/14	3.4	47.9	0.079	7.8	7.3	16.1	3.2	261
N-8	J1TPV8	5/27/14	3.6	57.6	0.11	8.0	7.7	16.8	4.5	300
N-9	J1TPV9	5/27/14	5.3	51.3	0.20	10.9	8.0	19.3	6.2	333
N-10	J1TPW0	5/27/14	3.5	52.3	0.098	7.8	8.1	16.5	8.9	305
N-11	J1TPW1	5/27/14	4.2	39.3	0.055	6.7	8.3	15.7	4.1	309

Statistical Computations

	Arsenic	Barium	Beryllium	Chromium	Cobalt	Copper	Lead	Manganese
95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat normal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat normal distribution.
N	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	42%	0%	0%	0%	0%	0%
mean	3.3	51.0	0.068	8.4	8.2	15.7	5.1	308
st. dev.	1.0	8.2	0.063	3.8	0.95	1.6	2.1	31.3
95% UCL on mean	4.0	55.9	0.098	10.3	8.7	16.6	6.8	325
max value	5.3	64.2	0.20	15.8	10.4	19.3	8.9	379
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	18.5 GW & River Protection	32 GW Protection	22.0 River Protection	10.2 GW & River Protection	512 GW Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA
> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA
WAC 173-340 Compliance?	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 7 of 19

100-N-84:2 Subsite Statistical Calculations

Verification Data - North Excavation (N)

Sample Area	Sample Number	Sample Date	Mercury mg/kg	Mercury Q	Mercury PQL	Nickel mg/kg	Nickel Q	Nickel PQL	Vanadium mg/kg	Vanadium Q	Vanadium PQL	Zinc mg/kg	Zinc Q	Zinc PQL	TPH - Diesel Range EXT ug/kg	TPH - Diesel Range EXT Q	TPH - Diesel Range EXT PQL	TPH - Diesel Range ug/kg	TPH - Diesel Range Q	TPH - Diesel Range PQL
N-12	J1TPW2	5/27/14	0.0054	B	0.0052	10.4	X	0.12	51.9		0.090	59.5		0.38	9000		920	5900		620
Duplicate of J1TPW2	J1TPW3	5/27/14	0.0052	U	0.0052	8.4	X	0.12	47.1		0.091	40.4		0.39	13000		990	7900		680
N-1	J1TPV1	5/21/14	0.0087	JB	0.0051	14.9	JNXM	0.12	61.9	JNM	0.091	47.5	JNXM	0.39	3700	J	990	2600	J	670
N-2	J1TPV2	5/21/14	0.0094	JB	0.0058	12.6	JX	0.12	45.5	J	0.088	46.5	JX	0.37	58000		1000	34000		690
N-3	J1TPV3	5/27/14	0.0049	U	0.0049	8.9	X	0.11	64.9		0.086	44.9		0.37	5500		1000	3100	J	680
N-4	J1TPV4	5/27/14	0.0056	U	0.0056	7.7	X	0.11	71.4		0.085	44.5		0.36	970	U	970	660	U	660
N-5	J1TPV5	5/27/14	0.0052	U	0.0052	8.1	X	0.11	69.8		0.088	44.5		0.37	3400	J	970	2100	J	660
N-6	J1TPV6	5/27/14	0.0087	B	0.0058	11.7	X	0.12	36.2		0.095	34.5		0.40	17000		990	9100		670
N-7	J1TPV7	5/27/14	0.0066	B	0.0056	10.1	X	0.11	41.9		0.081	33.3		0.34	58000		990	34000		670
N-8	J1TPV8	5/27/14	0.0084	B	0.0053	10.8	X	0.12	49.7		0.088	40.3		0.37	970	J	970	760	J	660
N-9	J1TPV9	5/27/14	0.016		0.0053	13.8	X	0.12	48.4		0.088	43.1		0.37	8300		940	5300		640
N-10	J1TPW0	5/27/14	0.0064	B	0.0061	11.2	X	0.11	48.9		0.081	69.6		0.34	19000		960	16000		650
N-11	J1TPW1	5/27/14	0.0057	B	0.0055	11.9	X	0.11	57.1		0.083	41.4		0.35	2500	J	1000	1500	J	680

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Mercury mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	TPH - Diesel Range EXT ug/kg	TPH - Diesel Range ug/kg
N-12	J1TPW2/ J1TPW3	5/27/14	0.0040	9.4	49.5	50.0	11000	6900
N-1	J1TPV1	5/21/14	0.0087	14.9	61.9	47.5	3700	2600
N-2	J1TPV2	5/21/14	0.0094	12.6	45.5	46.5	58000	34000
N-3	J1TPV3	5/27/14	0.0025	8.9	64.9	44.9	5500	3100
N-4	J1TPV4	5/27/14	0.0028	7.7	71.4	44.5	485	330
N-5	J1TPV5	5/27/14	0.0026	8.1	69.8	44.5	3400	2100
N-6	J1TPV6	5/27/14	0.0087	11.7	36.2	34.5	17000	9100
N-7	J1TPV7	5/27/14	0.0066	10.1	41.9	33.3	58000	34000
N-8	J1TPV8	5/27/14	0.0084	10.8	49.7	40.3	970	760
N-9	J1TPV9	5/27/14	0.016	13.8	48.4	43.1	8300	5300
N-10	J1TPW0	5/27/14	0.0064	11.2	48.9	69.6	19000	16000
N-11	J1TPW1	5/27/14	0.0057	11.9	57.1	41.4	2500	1500

Statistical Computations

	Mercury	Nickel	Vanadium	Zinc	TPH - Diesel Range EXT	TPH - Diesel Range
95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12
% < Detection limit	25%	0%	0%	0%	8%	8%
mean	0.0068	10.9	53.8	45.0	15655	9641
st. dev.	0.0038	2.2	11.2	9.2	20649	12191
95% UCL on mean	0.010	12.3	60.6	49.4	110822	61488
max value	0.016	14.9	71.4	69.6	58000	34000
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless noted otherwise	0.33 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200000 ug/kg GW & River Protection	200000 ug/kg GW & River Protection
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	NA	NA	NA	NO	NO	NO
> 10% above Cleanup Limit?	NA	NA	NA	NO	NO	NO
Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NO	NO
WAC 173-340 Compliance?	Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. D. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 8 of 19

100-N-84:2 Subsite Maximum Calculations
Verification Data - North Excavation (N)

Sample Area	Sample Number	Sample Date	Antimony mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Acenaphthene ug/kg	Q	PQL	Anthracene ug/kg	Q	PQL	Benzo(a)anthracene ug/kg	Q	PQL	Benzo(a)pyrene ug/kg	Q	PQL
N-12	J1TPW2	5/27/14	0.37	U	0.37	0.94	U	0.94	0.039	U	0.039	0.25	U	0.25	56	JX	9.7	68		3	300	X	3.1	6.2	U	6.2
Duplicate of J1TPW2	J1TPW3	5/27/14	0.37	U	0.37	0.95	U	0.95	0.040	U	0.040	0.25	U	0.25	26	JX	9.4	54	X	2.9	150		3.0	9.4	JX	6.0
N-1	J1TPV1	5/21/14	0.40	JB	0.37	0.96	JBN	0.95	0.13	JBNM	0.040	0.25	UJN	0.25	10	U	10	3.0	U	3.0	3.2	U	3.2	6.4	U	6.4
N-2	J1TPV2	5/21/14	0.36	UR	0.36	1.6	JB	0.92	0.18	JBN	0.038	0.28	JB	0.24	120	X	9.6	110		2.9	620		3.1	640		6.2
N-3	J1TPV3	5/27/14	0.35	U	0.35	0.90	UN	0.90	0.038	U	0.038	0.31	B	0.24	10	U	10	3.1	U	3.1	3.2	U	3.2	9.2	J	6.4
N-4	J1TPV4	5/27/14	0.34	U	0.34	0.89	U	0.89	0.037	U	0.037	0.34	B	0.24	9.7	U	9.7	3.0	U	3.0	3.1	U	3.1	6.2	U	6.2
N-5	J1TPV5	5/27/14	0.35	U	0.35	0.91	U	0.91	0.038	U	0.038	0.30	B	0.24	9.3	U	9.3	2.8	U	2.8	3.0	U	3.0	6.0	U	6.0
N-6	J1TPV6	5/27/14	0.38	U	0.38	0.99	U	0.99	0.041	U	0.041	0.26	U	0.26	9.8	U	9.8	3.0	U	3.0	3.1	U	3.1	7.0	JX	6.3
N-7	J1TPV7	5/27/14	0.33	U	0.33	0.85	U	0.85	0.035	U	0.035	0.22	U	0.22	9.4	U	9.4	2.9	U	2.9	3.0	U	3.0	16	X	6.1
N-8	J1TPV8	5/27/14	0.36	U	0.36	1.0	B	0.92	0.038	U	0.038	0.24	U	0.24	9.9	U	9.9	3.0	U	3.0	3.2	U	3.2	6.4	U	6.4
N-9	J1TPV9	5/27/14	0.36	U	0.36	1.3	B	0.92	0.038	U	0.038	0.25	B	0.24	10	U	10	3.0	U	3.0	3.2	U	3.2	6.4	U	6.4
N-10	J1TPW0	5/27/14	0.33	U	0.33	0.85	U	0.85	0.035	U	0.035	0.22	U	0.22	9.4	U	9.4	2.9	U	2.9	3.0	U	3.0	6.0	U	6.0
N-11	J1TPW1	5/27/14	0.34	U	0.34	0.87	U	0.87	0.036	U	0.036	0.23	U	0.23	9.4	U	9.4	2.9	U	2.9	3.0	U	3.0	6.0	U	6.0

Statistical Computations

	Antimony			Boron			Cadmium			Molybdenum			Acenaphthene			Anthracene			Benzo(a)anthracene			Benzo(a)pyrene		
% < Detection limit	92%			67%			83%			58%			83%			83%			83%			58%		
Maximum value	0.40			1.6			0.18			0.34			120			110			620			640		
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)unless otherwise noted	5	GW & River Protection		320	GW Protection		0.81	GW & River Protection		8	GW Protection		96000 ug/kg	GW Protection		240000 ug/kg	GW Protection		15 ug/kg	GW & River Protection		15 ug/kg	GW & River Protection	
3-PART TEST																								
Maximum > Cleanup Limit?	NA			NO			NA			NO			NO			NO			YES			YES		
> 10% above Cleanup Limit?	NA			NO			NA			NO			NO			NO			YES			YES		
Any sample > 2X Cleanup Limit?	NA			NO			NA			NO			NO			NO			YES			YES		
3-Part Test Compliance?	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.			A detailed assessment will be performed. The data set does NOT meet the 3-part test criteria when compared to the direct exposure RAG.		

100-N-84:2 Subsite Maximum Calculations
Verification Data - North Excavation (N)

Sample Area	Sample Number	Sample Date	Benzo(b)fluoranthene ug/kg	Q	PQL	Benzo(ghi)perylene ug/kg	Q	PQL	Benzo(k)fluoranthene ug/kg	Q	PQL	Chrysene ug/kg	Q	PQL	Dibenz[a,h]anthracene ug/kg	Q	PQL	Fluoranthene ug/kg	Q	PQL	Fluorene ug/kg	Q	PQL	Indeno(1,2,3-cd)pyrene ug/kg	Q	PQL
N-12	J1TPW2	5/27/14	150	X	4.1	100		7.0	59		3.8	310		4.7	11	U	11	440	X	13	42	X	5.1	73		12
Duplicate of J1TPW2	J1TPW3	5/27/14	96		3.9	55		6.7	34		3.7	120		4.5	10	U	10	260	X	12	19	JX	4.9	53		11
N-1	J1TPV1	5/21/14	4.2	U	4.2	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13	5.3	U	5.3	12	U	12
N-2	J1TPV2	5/21/14	480	NX	4.0	400		6.9	220		3.8	700		4.7	85	X	11	820		12	95		5.1	400		12
N-3	J1TPV3	5/27/14	7.9	JX	4.2	7.2	U	7.2	4.0	U	4.0	6.7	J	4.9	11	U	11	13	U	13	5.3	U	5.3	12	U	12
N-4	J1TPV4	5/27/14	4.1	U	4.1	7.0	U	7.0	3.8	U	3.8	4.7	U	4.7	11	U	11	13	U	13	5.1	U	5.1	12	U	12
N-5	J1TPV5	5/27/14	3.9	U	3.9	6.7	U	6.7	3.7	U	3.7	4.5	U	4.5	10	U	10	12	U	12	4.9	U	4.9	11	U	11
N-6	J1TPV6	5/27/14	4.1	U	4.1	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13	5.2	U	5.2	12	U	12
N-7	J1TPV7	5/27/14	4.0	U	4.0	8.4	JX	6.8	3.7	U	3.7	4.6	U	4.6	10	U	10	12	U	12	5.0	U	5.0	11	U	11
N-8	J1TPV8	5/27/14	4.2	U	4.2	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13	5.2	U	5.2	12	U	12
N-9	J1TPV9	5/27/14	4.2	U	4.2	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	11	U	11	13	U	13	5.3	U	5.3	12	U	12
N-10	J1TPW0	5/27/14	4.0	U	4.0	6.8	U	6.8	3.7	U	3.7	5.0	J	4.6	10	U	10	12	U	12	5.0	U	5.0	11	U	11
N-11	J1TPW1	5/27/14	3.9	U	3.9	6.7	U	6.7	3.7	U	3.7	4.5	U	4.5	10	U	10	12	U	12	4.9	U	4.9	11	U	11

Statistical Computations

	Benzo(b)fluoranthene			Benzo(ghi)perylene			Benzo(k)fluoranthene			Chrysene			Dibenz[a,h]anthracene			Fluoranthene			Fluorene			Indeno(1,2,3-cd)pyrene		
% < Detection limit	75%			75%			83%			67%			92%			83%			83%			83%		
Maximum value	480			400			220			700			85			820			95			400		
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)unless otherwise noted	15 ug/kg	GW & River Protection		48000 ug/kg	GW Protection		15 ug/kg	River Protection		100 ug/kg	River Protection		30 ug/kg	GW & River Protection		18000 ug/kg	River Protection		64000 ug/kg	GW Protection		15 ug/kg	GW & River Protection	
3-PART TEST																								
Maximum > Cleanup Limit?	YES			NO			YES			YES			YES			NO			NO			YES		
> 10% above Cleanup Limit?	YES			NO			YES			YES			NO			NO			NO			YES		
Any sample > 2X Cleanup Limit?	YES			NO			YES			YES			YES			NO			NO			YES		
3-Part Test Compliance?	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.			A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.			A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.		

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 9 of 19

1 **100-N-84:2 Subsite Maximum Calculations**
2 **Verification Data - North Excavation (N)**

3	Sample	Sample	Sample	Phenanthrene			Pyrene			Aroclor-1254		
4	Area	Number	Date	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
5	N-12	J1TPW2	5/27/14	170		12	520		12	6.7	J	2.5
6	Duplicate of J1TPW2	J1TPW3	5/27/14	140		11	270		11	18		2.6
7	N-1	J1TPV1	5/21/14	12	U	12	12	U	12	2.6	U	2.6
8	N-2	J1TPV2	5/21/14	210		12	1200		12	500	D	13
9	N-3	J1TPV3	5/27/14	12	U	12	12	J	12	2.6	U	2.6
10	N-4	J1TPV4	5/27/14	12	U	12	12	U	12	2.6	U	2.6
11	N-5	J1TPV5	5/27/14	11	U	11	11	U	11	22		2.5
12	N-6	J1TPV6	5/27/14	12	U	12	12	U	12	2.6	U	2.6
13	N-7	J1TPV7	5/27/14	11	U	11	11	U	11	2.6	U	2.6
14	N-8	J1TPV8	5/27/14	12	U	12	12	U	12	2.5	U	2.5
15	N-9	J1TPV9	5/27/14	12	U	12	12	U	12	2.6	U	2.6
16	N-10	J1TPW0	5/27/14	11	U	11	11	U	11	2.6	U	2.6
17	N-11	J1TPW1	5/27/14	11	U	11	11	U	11	2.6	U	2.6

18
19 **Statistical Computations**

20		Phenanthrene			Pyrene			Aroclor-1254		
21	% < Detection limit	83%			75%			75%		
22	Maximum value	210			1200			500		
23	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)unless otherwise noted**	240000 ug/kg	GW Protection		48000 ug/kg	GW Protection		17 ug/kg	GW & River Protection	
24	**3-PART TEST**									
25	Maximum > Cleanup Limit?	NO			NO			YES		
26	> 10% above Cleanup Limit?	NO			NO			YES		
27	Any sample > 2X Cleanup Limit?	NO			NO			YES		
28	**3-Part Test Compliance?**	The data set meets the 3-part test criteria when compared to the most stringent RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.		

29

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 10 of 19

100-N-84:2 Subsite Statistical Calculations

Verification Data - South Excavation (S)

Sample Area	Sample Number	Sample Date	Arsenic			Barium			Cadmium			Chromium			Cobalt			Copper			Lead			Manganese			Mercury		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
S-2	J1TPX6	5/21/14	1.8	J	0.67	56.6	JX	0.077	0.052	JBN	0.041	3.3	JX	0.059	10.3	JX	0.10	14.4	JX	0.22	3.7	J	0.27	299	JX	0.10	0.0062	UJ	0.0062
Duplicate of J1TPX6	J1TR07	5/21/14	2.1	J	0.61	37.9	JX	0.071	0.092	JBN	0.038	3.8	JX	0.054	10.7	JX	0.46	16.1	JX	1.0	4.2	J	1.3	319	JX	0.093	0.0055	UJ	0.0055
S-1	J1TPX5	5/21/14	1.8	J	0.65	26.6	JX	0.075	0.050	JBN	0.041	4.0	JX	0.057	4.7	JX	0.099	8.2	JX	0.21	3.0	J	0.27	160	JX	0.099	0.0093	JB	0.0057
S-3	J1TPX7	5/21/14	2.7	J	0.58	49.7	JX	0.067	0.11	JBN	0.036	7.1	JX	0.051	9.3	JX	0.088	14.4	JX	0.19	4.6	J	0.24	307	JX	0.088	0.019	J	0.0053
S-4	J1TPX8	5/21/14	2.1	J	0.63	87.5	JX	0.073	0.047	JBN	0.039	4.7	JX	0.056	10.6	JX	0.096	14.7	JX	0.21	3.8	J	0.26	429	JX	0.096	0.0063	JB	0.0060
S-5	J1TPX9	5/21/14	3.5	J	0.63	66.6	JX	0.072	0.13	JBN	0.039	10.7	JX	0.055	9.3	JX	0.095	18.1	JX	0.21	6.1	J	0.26	342	JX	0.095	0.011	JB	0.0059
S-6	J1TR00	5/27/14	3.4		0.66	66.1		0.075	0.041	U	0.041	6.1		0.058	7.9	X	0.099	15.2	X	0.22	3.9		0.27	293		0.099	0.0078	B	0.0054
S-7	J1TR01	5/21/14	1.9	J	0.63	41.7	JX	0.073	0.067	JBN	0.039	4.0	JX	0.056	11.2	JX	0.48	18.0	JX	1.0	5.4	J	1.3	318	JX	0.096	0.0061	JB	0.0051
S-8	J1TR02	5/21/14	2.0	J	0.67	35.2	JX	0.077	0.042	UJN	0.042	4.9	JX	0.059	6.9	JX	0.10	10.4	JX	0.22	3.4	J	0.27	222	JX	0.10	0.0078	JB	0.0050
S-9	J1TR03	5/27/14	2.4		0.65	56.1		0.075	0.040	U	0.040	4.9		0.057	8.8	X	0.098	15.5	X	0.21	4.2		0.26	316		0.098	0.0055	U	0.0055
S-10	J1TR04	5/21/14	3.2	J	0.60	75.1	JX	0.069	0.099	JBN	0.037	12.1	JX	0.053	8.9	JX	0.091	16.0	JX	0.20	5.6	J	0.25	351	JX	0.091	0.011	JB	0.0058
S-11	J1TR05	5/27/14	3.4		0.67	51.1		0.077	0.041	U	0.041	5.3		0.059	8.5	X	0.10	16.9	X	0.22	5.2		0.27	319		0.10	0.0091	B	0.0054
S-12	J1TR06	5/27/14	4.3		0.66	58.0		0.076	0.041	U	0.041	7.8		0.058	8.7	X	0.10	16.8	X	0.22	6.2		0.27	350		0.10	0.0096	B	0.0055

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg	Lead mg/kg	Manganese mg/kg	Mercury mg/kg
S-2	J1TPX6/ J1TR07	5/27/14	2.0	47.3	0.072	3.6	10.5	15.3	4.0	309	0.0029
S-1	J1TPX5	5/21/14	1.8	26.6	0.050	4.0	4.7	8.2	3.0	160	0.0093
S-3	J1TPX7	5/21/14	2.7	49.7	0.11	7.1	9.3	14.4	4.6	307	0.019
S-4	J1TPX8	5/21/14	2.1	87.5	0.047	4.7	10.6	14.7	3.8	429	0.0063
S-5	J1TPX9	5/21/14	3.5	66.6	0.13	10.7	9.3	18.1	6.1	342	0.011
S-6	J1TR00	5/27/14	3.4	66.1	0.021	6.1	7.9	15.2	3.9	293	0.0078
S-7	J1TR01	5/21/14	1.9	41.7	0.067	4.0	11.2	18.0	5.4	318	0.0061
S-8	J1TR02	5/21/14	2.0	35.2	0.021	4.9	6.9	10.4	3.4	222	0.0078
S-9	J1TR03	5/27/14	2.4	56.1	0.020	4.9	8.8	15.5	4.2	316	0.0028
S-10	J1TR04	5/21/14	3.2	75.1	0.099	12.1	8.9	16.0	5.6	351	0.011
S-11	J1TR05	5/27/14	3.4	51.1	0.021	5.3	8.5	16.9	5.2	319	0.0091
S-12	J1TR06	5/27/14	4.3	58.0	0.021	7.8	8.7	16.8	6.2	350	0.0096

Statistical Computations

	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury
95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat normal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	42%	0%	0%	0%	0%	0%	17%
mean	2.7	55.1	0.056	6.3	8.8	15.0	4.6	310	0.0086
st. dev.	0.82	17.1	0.039	2.7	1.8	2.9	1.1	66.9	0.0043
95% UCL on mean	3.2	67.4	0.075	7.9	9.7	16.3	5.3	341	0.013
max value	4.3	87.5	0.13	12.1	11.2	18.1	6.2	429	0.019
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW & River Protection	200 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	32 GW Protection	22.0 River Protection	10.2 GW & River Protection	512 GW Protection	0.33 GW & River Protection
WAC 173-340 3-PART TEST									
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA	NA
> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA	NA
WAC 173-340 Compliance?	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (10.2 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.

CALCULATION SHEET

Washington Closure Hanford
Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 11 of 19

100-N-84:2 Subsite Statistical Calculations
Verification Data - South Excavation (S)

Sample Area	Sample Number	Sample Date	Nickel mg/kg	Nickel Q	Nickel PQL	Vanadium mg/kg	Vanadium Q	Vanadium PQL	Zinc mg/kg	Zinc Q	Zinc PQL	TPH - Diesel Range EXT ug/kg	TPH - Diesel Range EXT Q	TPH - Diesel Range EXT PQL	TPH - Diesel Range ug/kg	TPH - Diesel Range Q	TPH - Diesel Range PQL	Benzo(a)pyrene ug/kg	Benzo(a)pyrene Q	Benzo(a)pyrene PQL	Fluoranthene ug/kg	Fluoranthene Q	Fluoranthene PQL	Pyrene ug/kg	Pyrene Q	Pyrene PQL
S-2	J1TPX6	5/21/14	6.6	JX	0.12	63.8	J	0.095	42.6	JX	0.40	7600		1000	6000		680	19		6.2	53	X	13	53		12
Duplicate of J1TPX6	J1TR07	5/21/14	6.9	JX	0.11	73.6	J	0.44	45.6	JX	0.37	4400		1000	3100	J	690	6.2	U	6.2	13	U	13	12	U	12
S-1	J1TPX5	5/21/14	6.0	JX	0.12	24.4	J	0.093	21.9	JX	0.39	31000		1000	26000		700	7.7	J	6.4	14	J	13	18	J	12
S-3	J1TPX7	5/21/14	9.9	JX	0.11	53.7	J	0.083	47.6	JX	0.35	11000		1000	7300		680	13	J	6.1	26	J	12	26	J	11
S-4	J1TPX8	5/21/14	7.6	JX	0.12	64.5	J	0.090	44.0	JX	0.38	4200		930	3100	J	630	7.4	J	6.3	19	J	13	19	J	12
S-5	J1TPX9	5/21/14	12.4	JX	0.12	50.2	J	0.089	61.3	JX	0.38	19000		1000	6500		690	9.9	J	6.6	13	U	13	12	U	12
S-6	J1TR00	5/27/14	10.1	X	0.12	41.8		0.093	36.2		0.40	42000		980	22000		670	6.0	U	6.0	12	U	12	24	J	11
S-7	J1TR01	5/21/14	8.5	JX	0.12	81.2	J	0.45	48.6	JX	0.38	3400	J	990	2600	J	670	6.4	U	6.4	13	U	13	12	U	12
S-8	J1TR02	5/21/14	7.0	JX	0.12	40.7	J	0.095	31.7	JX	0.40	5900		980	4400		660	6.2	U	6.2	13	U	13	12	U	12
S-9	J1TR03	5/27/14	8.6	X	0.12	63.2		0.092	62.7		0.39	14000		1000	8500		690	7.5	JX	6.0	140		12	160		11
S-10	J1TR04	5/21/14	12.4	JX	0.11	45.7	J	0.085	44.1	JX	0.36	3900		940	2600	J	640	6.3	U	6.3	13	U	13	12	U	12
S-11	J1TR05	5/27/14	9.8	X	0.12	55.9		0.095	47.1		0.40	390000		930	200000		630	6.4	U	6.4	15	JX	13	200		12
S-12	J1TR06	5/27/14	12.0	X	0.12	42.2		0.094	42.1		0.40	4100		940	2500	J	640	6.0	U	6.0	12	U	12	11	U	11

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	TPH - Diesel Range EXT ug/kg	TPH - Diesel Range ug/kg	Benzo(a)pyrene ug/kg	Fluoranthene ug/kg	Pyrene ug/kg
S-2	J1TPX6/ J1TR07	5/27/14	6.8	68.7	44.1	6000	4550	11	30	30
S-1	J1TPX5	5/21/14	6.0	24.4	21.9	31000	26000	7.7	14	18
S-3	J1TPX7	5/21/14	9.9	53.7	47.6	11000	7300	13	26	26
S-4	J1TPX8	5/21/14	7.6	64.5	44.0	4200	3100	7.4	19	19
S-5	J1TPX9	5/21/14	12.4	50.2	61.3	19000	6500	9.9	6.5	6.0
S-6	J1TR00	5/27/14	10.1	41.8	36.2	42000	22000	3.0	6.0	24
S-7	J1TR01	5/21/14	8.5	81.2	48.6	3400	2600	3.2	6.5	6.0
S-8	J1TR02	5/21/14	7.0	40.7	31.7	5900	4400	3.1	6.5	6.0
S-9	J1TR03	5/27/14	8.6	63.2	62.7	14000	8500	7.5	140	160
S-10	J1TR04	5/21/14	12.4	45.7	44.1	3900	2600	3.2	6.5	6.0
S-11	J1TR05	5/27/14	9.8	55.9	47.1	390000	200000	3.2	15	200
S-12	J1TR06	5/27/14	12.0	42.2	42.1	4100	2500	3.0	6.0	5.5

Statistical Computations

	Nickel	Vanadium	Zinc	TPH - Diesel Range EXT	TPH - Diesel Range	Benzo(a)pyrene	Fluoranthene	Pyrene
95% UCL based on	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat lognormal distribution.	Large data set (n ≥ 10), use MTCAStat normal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	50%	50%	42%
mean	9.3	52.7	44.3	44542	24171	6.3	23	42
st. dev.	2.2	15.2	11.3	109473	55911	3.6	38	66
95% UCL on mean	10.7	63.9	50.1	96527	50721	8.0	41	73
max value	12.4	81.2	62.7	390000	200000	19	140	200
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)unless otherwise noted	19.1 GW Protection	85.1 GW Protection	67.8 River Protection	200000 ug/kg GW & River Protection	200000 ug/kg GW & River Protection	330 ug/kg DE, GW & River Protection	18000 ug/kg River Protection	48000 ug/kg GW Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NA	NA	NO	NO	NO	NO	NO
> 10% above Cleanup Limit?	NA	NA	NA	NO	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NO	NO	NO	NO
WAC 173-340 Compliance?	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 12 of 19

100-N-84:2 Subsite Maximum Calculations
Verification Data - South Excavation (S)

Sample Area	Sample Number	Sample Date	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Acenaphthene ug/kg	Q	PQL	Anthracene ug/kg	Q	PQL	Benzo(a)anthracene ug/kg	Q	PQL	Benzo(b)fluoranthene ug/kg	Q	PQL	Benzo(ghi)perylene ug/kg	Q	PQL
S-2	J1TPX6	5/21/14	0.033	UJ	0.033	0.99	UJ	0.99	0.26	UJ	0.26	9.7	U	9.7	5.8	J	3.0	3.1	U	3.1	4.1	U	4.1	7.0	U	7.0
Duplicate of J1TPX6	J1TR07	5/21/14	0.15	UJ	0.15	0.91	UJ	0.91	0.24	UJ	0.24	9.7	U	9.7	3.0	U	3.0	3.1	U	3.1	4.1	U	4.1	7.0	U	7.0
S-1	J1TPX5	5/21/14	0.033	UJ	0.033	0.97	UJ	0.97	0.26	UJ	0.26	9.9	U	9.9	3.0	U	3.0	3.2	U	3.2	4.2	U	4.2	7.1	U	7.1
S-3	J1TPX7	5/21/14	0.029	UJ	0.029	0.87	UJ	0.87	0.23	UJ	0.23	9.5	U	9.5	2.9	U	2.9	13	J	3.0	4.0	U	4.0	17	J	6.9
S-4	J1TPX8	5/21/14	0.032	UJ	0.032	0.94	UJ	0.94	0.25	UJ	0.25	9.8	U	9.8	3.0	U	3.0	3.1	U	3.1	5.8	JX	4.1	7.1	U	7.1
S-5	J1TPX9	5/21/14	0.031	UJ	0.031	1.2	JB	0.93	0.25	UJ	0.25	10	U	10	3.2	U	3.2	3.3	U	3.3	4.3	U	4.3	7.5	U	7.5
S-6	J1TR00	5/27/14	0.11	B	0.033	0.97	U	0.97	0.26	U	0.26	9.3	U	9.3	2.8	U	2.8	3.0	U	3.0	3.9	U	3.9	6.7	U	6.7
S-7	J1TR01	5/21/14	0.16	UJ	0.16	0.94	UJ	0.94	0.25	UJ	0.25	9.9	U	9.9	3.0	U	3.0	3.2	U	3.2	4.2	U	4.2	7.2	U	7.2
S-8	J1TR02	5/21/14	0.033	UJ	0.033	0.99	UJ	0.99	0.26	UJ	0.26	9.7	U	9.7	3.0	U	3.0	3.1	U	3.1	4.1	U	4.1	7.0	U	7.0
S-9	J1TR03	5/27/14	0.032	U	0.032	0.96	U	0.96	0.29	B	0.26	28	JX	9.4	24		2.9	49	X	3.0	67		4.0	68		6.8
S-10	J1TR04	5/21/14	0.046	JB	0.030	1.5	JB	0.89	0.24	UJ	0.24	9.9	U	9.9	3.0	U	3.0	3.2	U	3.2	4.2	U	4.2	7.1	U	7.1
S-11	J1TR05	5/27/14	0.13	B	0.033	0.99	U	0.99	0.26	U	0.26	10	U	10	3.1	U	3.1	3.2	U	3.2	4.2	U	4.2	7.2	U	7.2
S-12	J1TR06	5/27/14	0.22		0.033	0.98	U	0.98	0.26	U	0.26	9.4	U	9.4	2.9	U	2.9	3.0	U	3.0	4.0	U	4.0	6.8	U	6.8

Statistical Computations

	Beryllium			Boron			Molybdenum			Acenaphthene			Anthracene			Benzo(a)anthracene			Benzo(b)fluoranthene			Benzo(ghi)perylene		
% < Detection limit	67%			83%			92%			92%			83%			83%			83%			83%		
Maximum value	0.22			1.5			0.29			28			24			49			67			68		
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)unless otherwise noted	1.51	GW & River Protection		320	GW Protection		8	GW Protection		96000 ug/kg	GW Protection		240000 ug/kg	GW Protection		15 ug/kg	GW & River Protection		15 ug/kg	GW & River Protection		48000 ug/kg	GW Protection	
3-PART TEST																								
Maximum > Cleanup Limit?	NA			NO			NO			NO			NO			YES			YES			NO		
> 10% above Cleanup Limit?	NA			NO			NO			NO			NO			NO			NO			NO		
Any sample > 2X Cleanup Limit?	NA			NO			NO			NO			NO			YES			YES			NO		
3-Part Test Compliance?	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.			A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.		

100-N-84:2 Subsite Maximum Calculations
Verification Data - South Excavation (S)

Sample Area	Sample Number	Sample Date	Benzo(k)fluoranthene ug/kg	Q	PQL	Chrysene ug/kg	Q	PQL	Fluorene ug/kg	Q	PQL	Indeno(1,2,3-cd)pyrene ug/kg	Q	PQL	Phenanthrene ug/kg	Q	PQL	Aroclor-1254 ug/kg	Q	PQL
S-2	J1TPX6	5/21/14	7.5	J	3.8	24	JX	4.7	5.1	U	5.1	12	JX	12	18	J	12	2.6	U	2.6
Duplicate of J1TPX6	J1TR07	5/21/14	3.8	U	3.8	4.7	U	4.7	5.1	U	5.1	12	U	12	12	U	12	2.6	U	2.6
S-1	J1TPX5	5/21/14	3.9	U	3.9	4.8	U	4.8	5.2	U	5.2	12	U	12	12	U	12	2.5	U	2.5
S-3	J1TPX7	5/21/14	6.4	JX	3.8	15	JX	4.6	5.0	U	5.0	12	J	11	14	J	11	2.6	U	2.6
S-4	J1TPX8	5/21/14	3.9	U	3.9	9.6	JX	4.8	5.2	U	5.2	12	U	12	12	U	12	2.6	U	2.6
S-5	J1TPX9	5/21/14	4.1	U	4.1	7.0	J	5.0	5.5	U	5.5	12	U	12	12	U	12	6.3	J	2.6
S-6	J1TR00	5/27/14	16		3.7	4.5	U	4.5	4.9	U	4.9	11	U	11	11	U	11	2.5	U	2.5
S-7	J1TR01	5/21/14	3.9	U	3.9	4.8	U	4.8	5.2	U	5.2	12	U	12	12	U	12	2.5	U	2.5
S-8	J1TR02	5/21/14	3.8	U	3.8	4.7	U	4.7	5.1	U	5.1	12	U	12	12	U	12	2.5	U	2.5
S-9	J1TR03	5/27/14	26		3.7	71	X	4.6	17	J	5.0	60		11	76		11	11		2.6
S-10	J1TR04	5/21/14	3.9	U	3.9	4.8	U	4.8	5.2	U	5.2	12	U	12	12	U	12	2.6	U	2.6
S-11	J1TR05	5/27/14	110	X	3.9	4.8	U	4.8	5.3	U	5.3	12	U	12	12	U	12	2.4	U	2.4
S-12	J1TR06	5/27/14	3.7	U	3.7	4.6	U	4.6	5.0	U	5.0	11	U	11	11	U	11	2.4	U	2.4

Statistical Computations

	Benzo(k)fluoranthene			Chrysene			Fluorene			Indeno(1,2,3-cd)pyrene			Phenanthrene			Aroclor-1254		
% < Detection limit	58%			58%			92%			75%			75%			83%		
Maximum value	110			71			17			60			76			11		
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)unless otherwise noted	15 ug/kg	River Protection		100 ug/kg	River Protection		64000 ug/kg	GW Protection		15 ug/kg	GW & River Protection		240000 ug/kg	GW Protection		17 ug/kg	GW & River Protection	
3-PART TEST																		
Maximum > Cleanup Limit?	YES			NO			NO			YES			NO			NO		
> 10% above Cleanup Limit?	YES			NO			NO			NO			NO			NO		
Any sample > 2X Cleanup Limit?	YES			NO			NO			YES			NO			NO		
3-Part Test Compliance?	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.			The data set meets the 3-part test criteria when compared to the most stringent RAG.		

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 13 of 19

Ecology Software (MTCAStat) Results, 100-N-84:2 Subsite North Excavation (N)

Arsenic 95% UCL Calculation

DATA	ID
2.6	J1TPW2/ J1TPW3
3.3	J1TPV1
3.1	J1TPV2
2.8	J1TPV3
1.7	J1TPV4
2.2	J1TPV5
4.4	J1TPV6
3.4	J1TPV7
3.6	J1TPV8
5.3	J1TPV9
3.5	J1TPW0
4.2	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	3.3
Censored		Lognormal mean	3.4
Detection limit or PQL		Std. devn.	0.99
Method detection limit		Median	3.4
TOTAL	12	Min.	1.7
		Max.	5.3

Lognormal distribution? r-squared is: 0.973
Normal distribution? r-squared is: 0.980
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 4.0

Barium 95% UCL Calculation

DATA	ID
55.7	J1TPW2/ J1TPW3
62.0	J1TPV1
64.2	J1TPV2
50.8	J1TPV3
38.9	J1TPV4
50.5	J1TPV5
42.0	J1TPV6
47.9	J1TPV7
57.6	J1TPV8
51.3	J1TPV9
52.3	J1TPW0
39.3	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	51.0
Censored		Lognormal mean	51.1
Detection limit or PQL		Std. devn.	8.2
Method detection limit		Median	51.1
TOTAL	12	Min.	38.9
		Max.	64.2

Lognormal distribution? r-squared is: 0.955
Normal distribution? r-squared is: 0.965
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 55.9

Beryllium 95% UCL Calculation

DATA	ID
0.040	J1TPW2/ J1TPW3
0.016	J1TPV1
0.016	J1TPV2
0.015	J1TPV3
0.015	J1TPV4
0.016	J1TPV5
0.16	J1TPV6
0.079	J1TPV7
0.11	J1TPV8
0.20	J1TPV9
0.098	J1TPW0
0.055	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	0.068
Censored		Lognormal mean	0.074
Detection limit or PQL		Std. devn.	0.063
Method detection limit		Median	0.048
TOTAL	12	Min.	0.015
		Max.	0.20

Lognormal distribution? r-squared is: 0.882
Normal distribution? r-squared is: 0.851
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 0.098

Chromium 95% UCL Calculation

DATA	ID
11.7	J1TPW2/ J1TPW3
11.6	J1TPV1
15.8	J1TPV2
4.7	J1TPV3
1.8	J1TPV4
4.3	J1TPV5
9.3	J1TPV6
7.8	J1TPV7
8.0	J1TPV8
10.9	J1TPV9
7.8	J1TPW0
6.7	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	8.4
Censored		Lognormal mean	8.7
Detection limit or PQL		Std. devn.	3.8
Method detection limit		Median	7.9
TOTAL	12	Min.	1.8
		Max.	15.8

Lognormal distribution? r-squared is: 0.887
Normal distribution? r-squared is: 0.975
Recommendations:
Use normal distribution.

UCL (Land's method) is 10.3

Cobalt 95% UCL Calculation

DATA	ID
7.2	J1TPW2/ J1TPW3
10.4	J1TPV1
8.4	J1TPV2
8.6	J1TPV3
9.2	J1TPV4
8.6	J1TPV5
7.0	J1TPV6
7.3	J1TPV7
7.7	J1TPV8
8.0	J1TPV9
8.1	J1TPW0
8.3	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	8.2
Censored		Lognormal mean	8.2
Detection limit or PQL		Std. devn.	0.95
Method detection limit		Median	8.2
TOTAL	12	Min.	7.0
		Max.	10.4

Lognormal distribution? r-squared is: 0.952
Normal distribution? r-squared is: 0.928
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.7

Copper 95% UCL Calculation

DATA	ID
15.3	J1TPW2/ J1TPW3
16.1	J1TPV1
16.0	J1TPV2
13.7	J1TPV3
13.0	J1TPV4
14.1	J1TPV5
15.6	J1TPV6
16.1	J1TPV7
16.8	J1TPV8
19.3	J1TPV9
16.5	J1TPW0
15.7	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	15.7
Censored		Lognormal mean	15.7
Detection limit or PQL		Std. devn.	1.6
Method detection limit		Median	15.9
TOTAL	12	Min.	13.0
		Max.	19.3

Lognormal distribution? r-squared is: 0.930
Normal distribution? r-squared is: 0.919
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 16.6

Lead 95% UCL Calculation

DATA	ID
7.3	J1TPW2/ J1TPW3
5.5	J1TPV1
8.1	J1TPV2
3.9	J1TPV3
2.0	J1TPV4
3.0	J1TPV5
4.4	J1TPV6
3.2	J1TPV7
4.5	J1TPV8
6.2	J1TPV9
8.9	J1TPW0
4.1	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	5.1
Censored		Lognormal mean	5.1
Detection limit or PQL		Std. devn.	2.1
Method detection limit		Median	4.5
TOTAL	12	Min.	2.0
		Max.	8.9

Lognormal distribution? r-squared is: 0.978
Normal distribution? r-squared is: 0.960
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 6.8

Manganese 95% UCL Calculation

DATA	ID
263	J1TPW2/ J1TPW3
379	J1TPV1
322	J1TPV2
323	J1TPV3
311	J1TPV4
306	J1TPV5
288	J1TPV6
261	J1TPV7
300	J1TPV8
333	J1TPV9
305	J1TPW0
309	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	308
Censored		Lognormal mean	308
Detection limit or PQL		Std. devn.	31
Method detection limit		Median	308
TOTAL	12	Min.	261
		Max.	379

Lognormal distribution? r-squared is: 0.928
Normal distribution? r-squared is: 0.916
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 325

Mercury 95% UCL Calculation

DATA	ID
0.0040	J1TPW2/ J1TPW3
0.0087	J1TPV1
0.0094	J1TPV2
0.0025	J1TPV3
0.0028	J1TPV4
0.0026	J1TPV5
0.0087	J1TPV6
0.0066	J1TPV7
0.0084	J1TPV8
0.016	J1TPV9
0.0064	J1TPW0
0.0057	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	0.0068
Censored		Lognormal mean	0.0070
Detection limit or PQL		Std. devn.	0.0038
Method detection limit		Median	0.0065
TOTAL	12	Min.	0.0025
		Max.	0.016

Lognormal distribution? r-squared is: 0.938
Normal distribution? r-squared is: 0.887
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.010

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 14 of 19

Ecology Software (MTCAStat) Results, 100-N-84:2 Subsite North Excavation (N)

Nickel 95% UCL Calculation

DATA	ID
9.4	J1TPW2/ J1TPW3
14.9	J1TPV1
12.6	J1TPV2
8.9	J1TPV3
7.7	J1TPV4
8.1	J1TPV5
11.7	J1TPV6
10.1	J1TPV7
10.8	J1TPV8
13.8	J1TPV9
11.2	J1TPW0
11.9	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	10.9
Censored		Lognormal mean	10.9
Detection limit or PQL		Std. devn.	2.2
Method detection limit		Median	11.0
TOTAL	12	Min.	7.7
		Max.	14.9

Lognormal distribution? r-squared is: 0.989
Normal distribution? r-squared is: 0.986
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 12.3

Vanadium 95% UCL Calculation

DATA	ID
49.5	J1TPW2/ J1TPW3
61.9	J1TPV1
45.5	J1TPV2
64.9	J1TPV3
71.4	J1TPV4
69.8	J1TPV5
36.2	J1TPV6
41.9	J1TPV7
49.7	J1TPV8
48.4	J1TPV9
48.9	J1TPW0
57.1	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	53.8
Censored		Lognormal mean	53.9
Detection limit or PQL		Std. devn.	11.2
Method detection limit		Median	49.6
TOTAL	12	Min.	36.2
		Max.	71.4

Lognormal distribution? r-squared is: 0.963
Normal distribution? r-squared is: 0.955
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 60.6

Zinc 95% UCL Calculation

DATA	ID
50.0	J1TPW2/ J1TPW3
47.5	J1TPV1
46.5	J1TPV2
44.9	J1TPV3
44.5	J1TPV4
44.5	J1TPV5
34.5	J1TPV6
33.3	J1TPV7
40.3	J1TPV8
43.1	J1TPV9
69.6	J1TPW0
41.4	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	45.0
Censored		Lognormal mean	45.0
Detection limit or PQL		Std. devn.	9.2
Method detection limit		Median	44.5
TOTAL	12	Min.	33.3
		Max.	69.6

Lognormal distribution? r-squared is: 0.876
Normal distribution? r-squared is: 0.802
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 49.4

TPH Diesel Range EXT 95% UCL Calculation

DATA	ID
11000	J1TPW2/ J1TPW3
3700	J1TPV1
58000	J1TPV2
5500	J1TPV3
485	J1TPV4
3400	J1TPV5
17000	J1TPV6
58000	J1TPV7
970	J1TPV8
8300	J1TPV9
19000	J1TPW0
2500	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	15655
Censored		Lognormal mean	19936
Detection limit or PQL		Std. devn.	20649
Method detection limit		Median	6900
TOTAL	12	Min.	485
		Max.	58000

Lognormal distribution? r-squared is: 0.978
Normal distribution? r-squared is: 0.704
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 110822

TPH Diesel Range 95% UCL Calculation

DATA	ID
6900	J1TPW2/ J1TPW3
2600	J1TPV1
34000	J1TPV2
3100	J1TPV3
330	J1TPV4
2100	J1TPV5
9100	J1TPV6
34000	J1TPV7
760	J1TPV8
5300	J1TPV9
16000	J1TPW0
1500	J1TPW1

Number of samples		Uncensored values	
Uncensored	12	Mean	9641
Censored		Lognormal mean	12038
Detection limit or PQL		Std. devn.	12191
Method detection limit		Median	4200
TOTAL	12	Min.	330
		Max.	34000

Lognormal distribution? r-squared is: 0.982
Normal distribution? r-squared is: 0.734
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 61488

CALCULATION SHEET

Washington Closure Hanford			
Originator	J. D. Skoglie	Date 06/30/14	Calc. No. 0100N-CA-V0287
Project	100-N Field Remediation	Job No. 14655	Checked I. B. Berezovskiy
Subject	100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations		

Rev. No. 0
Date 06/30/14
Sheet No. 15 of 19

Ecology Software (MTCAStat) Results, 100-N-84:2 Subsite South Excavation (S)

Arsenic 95% UCL Calculation

DATA	ID
2.0	J1TPX6/ J1TR07
1.8	J1TPX5
2.7	J1TPX7
2.1	J1TPX8
3.5	J1TPX9
3.4	J1TR00
1.9	J1TR01
2.0	J1TR02
2.4	J1TR03
3.2	J1TR04
3.4	J1TR05
4.3	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	2.7
Censored		Lognormal mean	2.7
Detection limit or PQL		Std. devn.	0.82
Method detection limit		Median	2.6
TOTAL	12	Min.	1.8
		Max.	4.3

Lognormal distribution? r-squared is: 0.926
Normal distribution? r-squared is: 0.910
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 3.2

Barium 95% UCL Calculation

DATA	ID
47.3	J1TPX6/ J1TR07
26.6	J1TPX5
49.7	J1TPX7
87.5	J1TPX8
66.6	J1TPX9
66.1	J1TR00
41.7	J1TR01
35.2	J1TR02
56.1	J1TR03
75.1	J1TR04
51.1	J1TR05
58.0	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	55.1
Censored		Lognormal mean	55.5
Detection limit or PQL		Std. devn.	17.1
Method detection limit		Median	53.6
TOTAL	12	Min.	26.6
		Max.	87.5

Lognormal distribution? r-squared is: 0.973
Normal distribution? r-squared is: 0.989
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 67.4

Cadmium 95% UCL Calculation

DATA	ID
0.072	J1TPX6/ J1TR07
0.050	J1TPX5
0.11	J1TPX7
0.047	J1TPX8
0.13	J1TPX9
0.021	J1TR00
0.067	J1TR01
0.021	J1TR02
0.020	J1TR03
0.099	J1TR04
0.021	J1TR05
0.021	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	0.056
Censored		Lognormal mean	0.058
Detection limit or PQL		Std. devn.	0.039
Method detection limit		Median	0.049
TOTAL	12	Min.	0.020
		Max.	0.13

Lognormal distribution? r-squared is: 0.876
Normal distribution? r-squared is: 0.877
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 0.075

Chromium 95% UCL Calculation

DATA	ID
3.6	J1TPX6/ J1TR07
4.0	J1TPX5
7.1	J1TPX7
4.7	J1TPX8
10.7	J1TPX9
6.1	J1TR00
4.0	J1TR01
4.9	J1TR02
4.9	J1TR03
12.1	J1TR04
5.3	J1TR05
7.8	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	6.3
Censored		Lognormal mean	6.3
Detection limit or PQL		Std. devn.	2.7
Method detection limit		Median	5.1
TOTAL	12	Min.	3.6
		Max.	12.1

Lognormal distribution? r-squared is: 0.934
Normal distribution? r-squared is: 0.850
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 7.9

Cobalt 95% UCL Calculation

DATA	ID
10.5	J1TPX6/ J1TR07
4.7	J1TPX5
9.3	J1TPX7
10.6	J1TPX8
9.3	J1TPX9
7.9	J1TR00
11.2	J1TR01
6.9	J1TR02
8.8	J1TR03
8.9	J1TR04
8.5	J1TR05
8.7	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	8.8
Censored		Lognormal mean	8.8
Detection limit or PQL		Std. devn.	1.8
Method detection limit		Median	8.9
TOTAL	12	Min.	4.7
		Max.	11.2

Lognormal distribution? r-squared is: 0.828
Normal distribution? r-squared is: 0.913
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 9.7

Copper 95% UCL Calculation

DATA	ID
15.3	J1TPX6/ J1TR07
8.2	J1TPX5
14.4	J1TPX7
14.7	J1TPX8
18.1	J1TPX9
15.2	J1TR00
18.0	J1TR01
10.4	J1TR02
15.5	J1TR03
16.0	J1TR04
16.9	J1TR05
16.8	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	15.0
Censored		Lognormal mean	15.0
Detection limit or PQL		Std. devn.	2.9
Method detection limit		Median	15.4
TOTAL	12	Min.	8.2
		Max.	18.1

Lognormal distribution? r-squared is: 0.767
Normal distribution? r-squared is: 0.841
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 16.3

Lead 95% UCL Calculation

DATA	ID
4.0	J1TPX6/ J1TR07
3.0	J1TPX5
4.6	J1TPX7
3.8	J1TPX8
6.1	J1TPX9
3.9	J1TR00
5.4	J1TR01
3.4	J1TR02
4.2	J1TR03
5.6	J1TR04
5.2	J1TR05
6.2	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	4.6
Censored		Lognormal mean	4.6
Detection limit or PQL		Std. devn.	1.1
Method detection limit		Median	4.4
TOTAL	12	Min.	3.0
		Max.	6.2

Lognormal distribution? r-squared is: 0.966
Normal distribution? r-squared is: 0.961
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 5.3

Manganese 95% UCL Calculation

DATA	ID
309	J1TPX6/ J1TR07
160	J1TPX5
307	J1TPX7
429	J1TPX8
342	J1TPX9
293	J1TR00
318	J1TR01
222	J1TR02
316	J1TR03
351	J1TR04
319	J1TR05
350	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	310
Censored		Lognormal mean	311
Detection limit or PQL		Std. devn.	67
Method detection limit		Median	317
TOTAL	12	Min.	160
		Max.	429

Lognormal distribution? r-squared is: 0.798
Normal distribution? r-squared is: 0.872
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 341

Mercury 95% UCL Calculation

DATA	ID
0.0029	J1TPX6/ J1TR07
0.0093	J1TPX5
0.019	J1TPX7
0.0063	J1TPX8
0.011	J1TPX9
0.0078	J1TR00
0.0061	J1TR01
0.0078	J1TR02
0.0028	J1TR03
0.011	J1TR04
0.0091	J1TR05
0.0096	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	0.0086
Censored		Lognormal mean	0.0088
Detection limit or PQL		Std. devn.	0.0043
Method detection limit		Median	0.0085
TOTAL	12	Min.	0.0028
		Max.	0.019

Lognormal distribution? r-squared is: 0.903
Normal distribution? r-squared is: 0.883
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.013

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 16 of 19

Ecology Software (MTCAStat) Results, 100-N-84:2 Subsite South Excavation (S)

Nickel 95% UCL Calculation

DATA	ID
6.8	J1TPX6/ J1TR07
6.0	J1TPX5
9.9	J1TPX7
7.6	J1TPX8
12.4	J1TPX9
10.1	J1TR00
8.5	J1TR01
7.0	J1TR02
8.6	J1TR03
12.4	J1TR04
9.8	J1TR05
12.0	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	9.3
Censored		Lognormal mean	9.3
Detection limit or PQL		Std. devn.	2.2
Method detection limit		Median	9.2
TOTAL	12	Min.	6.0
		Max.	12.4

Lognormal distribution? r-squared is: 0.960
Normal distribution? r-squared is: 0.952
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.7

Vanadium 95% UCL Calculation

DATA	ID
68.7	J1TPX6/ J1TR07
24.4	J1TPX5
53.7	J1TPX7
64.5	J1TPX8
50.2	J1TPX9
41.8	J1TR00
81.2	J1TR01
40.7	J1TR02
63.2	J1TR03
45.7	J1TR04
55.9	J1TR05
42.2	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	52.7
Censored		Lognormal mean	53.1
Detection limit or PQL		Std. devn.	15.2
Method detection limit		Median	52.0
TOTAL	12	Min.	24.4
		Max.	81.2

Lognormal distribution? r-squared is: 0.932
Normal distribution? r-squared is: 0.974
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 63.9

Zinc 95% UCL Calculation

DATA	ID
44.1	J1TPX6/ J1TR07
21.9	J1TPX5
47.6	J1TPX7
44.0	J1TPX8
61.3	J1TPX9
36.2	J1TR00
48.6	J1TR01
31.7	J1TR02
62.7	J1TR03
44.1	J1TR04
47.1	J1TR05
42.1	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	44.3
Censored		Lognormal mean	44.6
Detection limit or PQL		Std. devn.	11.3
Method detection limit		Median	44.1
TOTAL	12	Min.	21.9
		Max.	62.7

Lognormal distribution? r-squared is: 0.885
Normal distribution? r-squared is: 0.933
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 50.1

TPH Diesel Range EXT 95% UCL Calculation

DATA	ID
6000	J1TPX6/ J1TR07
31000	J1TPX5
11000	J1TPX7
4200	J1TPX8
19000	J1TPX9
42000	J1TR00
3400	J1TR01
5900	J1TR02
14000	J1TR03
3900	J1TR04
390000	J1TR05
4100	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	44542
Censored		Lognormal mean	31834
Detection limit or PQL		Std. devn.	109473
Method detection limit		Median	8500
TOTAL	12	Min.	3400
		Max.	390000

Lognormal distribution? r-squared is: 0.837
Normal distribution? r-squared is: 0.384
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 96527

TPH Diesel Range 95% UCL Calculation

DATA	ID
4550	J1TPX6/ J1TR07
26000	J1TPX5
7300	J1TPX7
3100	J1TPX8
6500	J1TPX9
22000	J1TR00
2600	J1TR01
4400	J1TR02
8500	J1TR03
2600	J1TR04
200000	J1TR05
2500	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	24171
Censored		Lognormal mean	17828
Detection limit or PQL		Std. devn.	55911
Method detection limit		Median	5525
TOTAL	12	Min.	2500
		Max.	200000

Lognormal distribution? r-squared is: 0.819
Normal distribution? r-squared is: 0.400
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 50721

Benzo(a)pyrene 95% UCL Calculation

DATA	ID
11.1	J1TPX6/ J1TR07
7.7	J1TPX5
13.0	J1TPX7
7.4	J1TPX8
9.9	J1TPX9
3.0	J1TR00
3.2	J1TR01
3.1	J1TR02
7.5	J1TR03
3.2	J1TR04
3.2	J1TR05
3.0	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	6.3
Censored		Lognormal mean	6.4
Detection limit or PQL		Std. devn.	3.6
Method detection limit		Median	5.3
TOTAL	12	Min.	3.0
		Max.	13

Lognormal distribution? r-squared is: 0.831
Normal distribution? r-squared is: 0.845
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 8.0

Fluoranthene 95% UCL Calculation

DATA	ID
30	J1TPX6/ J1TR07
14	J1TPX5
26	J1TPX7
19	J1TPX8
6.5	J1TPX9
6.0	J1TR00
6.5	J1TR01
6.5	J1TR02
140	J1TR03
6.5	J1TR04
15	J1TR05
6.0	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	23
Censored		Lognormal mean	21
Detection limit or PQL		Std. devn.	38
Method detection limit		Median	10
TOTAL	12	Min.	6.0
		Max.	140

Lognormal distribution? r-squared is: 0.803
Normal distribution? r-squared is: 0.478
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 41

Pyrene 95% UCL Calculation

DATA	ID
30	J1TPX6/ J1TR07
18	J1TPX5
26	J1TPX7
19	J1TPX8
6.0	J1TPX9
24	J1TR00
6.0	J1TR01
6.0	J1TR02
160	J1TR03
6.0	J1TR04
200	J1TR05
5.5	J1TR06

Number of samples		Uncensored values	
Uncensored	12	Mean	42
Censored		Lognormal mean	40
Detection limit or PQL		Std. devn.	66
Method detection limit		Median	19
TOTAL	12	Min.	5.5
		Max.	200

Lognormal distribution? r-squared is: 0.847
Normal distribution? r-squared is: 0.590
Recommendations:
Reject BOTH lognormal and normal distributions

UCL (based on Z-statistic) is 73

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 17 of 19

Duplicate/Split Analysis - 100-N-84:2 Subsite North Excavation (N)

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
N-12	J1TPW2	5/27/14	6930		1.5	2.5		0.63	57.7		0.073	0.041	B	0.032	7830		13.6	14.0		0.056	7.4	X	0.096	15.7	X	0.21	21200		3.7
Duplicate of J1TPW2	J1TPW3	5/27/14	5530		1.5	2.6		0.64	53.6		0.074	0.039	B	0.032	7390		13.7	9.4		0.056	6.9	X	0.097	14.8	X	0.21	20500		3.7
Split of J1TPW2	J1TPX2	5/27/14	6150		6.7	3.66		0.493	54.9		0.0985	0.695		0.0985	8190		7.88	18.9		0.148	8.22	D	0.739	17.7		0.296	21900		7.88

Analysis:

TDL		5	10	2	0.2	100	1	2	1	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD	22.5%		7.4%		5.8%	*39.3%*		5.9%	3.4%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable
Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD	11.9%		5.0%		4.5%	29.8%		12.0%	3.2%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Yes - assess further	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable

Duplicate/Split Analysis - 100-N-84:2 Subsite North Excavation (N)

Sampling Area	Sample Number	Sample Date	Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
N-12	J1TPW2	5/27/14	8.9		0.26	4330		3.6	274		0.096	10.4	X	0.12	1080		39.4	397	X	5.4	342		56.7	51.9		0.090	59.5		0.38
Duplicate of J1TPW2	J1TPW3	5/27/14	5.6		0.26	3710		3.6	252		0.097	8.4	X	0.12	901		39.8	355	X	5.5	252		57.3	47.1		0.091	40.4		0.39
Split of J1TPW2	J1TPX2	5/27/14	2.42	BCD	1.63	5570		8.38	347		0.197	17.7	*	0.148	1060		6.31	787	*MN	1.48	194		6.90	59.9	D	0.493	54.4	D	1.97

Analysis:

TDL		5	75	5	4	400	2	50	2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD		15.4%	8.4%			11.2%	*30.3%*	9.7%	*38.2%*
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable
Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD		25.1%	23.5%			*65.9%*		14.3%	9.0%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	Yes - assess further	Not applicable	Not applicable

Duplicate/Split Analysis - 100-N-84:2 Subsite North Excavation (N)

Sampling Area	Sample Number	Sample Date	TPH - Diesel Range EXT			TPH - Diesel Range			Acenaphthene			Anthracene			Benzo(a)anthracene			Benzo(b)fluoranthene			Benzo(ghi)perylene			Benzo(k)fluoranthene			Chrysene		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
N-12	J1TPW2	5/27/14	9000		920	5900		620	56	JX	9.7	68		3.0	300	X	3.1	150	X	4.1	100		7.0	59		3.8	310		4.7
Duplicate of J1TPW2	J1TPW3	5/27/14	13000		990	7900		680	26	JX	9.4	54	X	2.9	150		3.0	96		3.9	55		6.7	34		3.7	120		4.5
Split of J1TPW2	J1TPX2	5/27/14				2160	U	2160	5.02	U	5.02	16.0	J	1.67	63.2		0.536	55.7		0.536	22.7		0.536	30.0		0.268	40.9		0.536

Analysis:

TDL		5000	5000	15	15	15	15	15	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD					*66.7%*	*43.9%*			*88.4%*
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	Yes - assess further	No - acceptable	Not applicable
Split Analysis	Both > PQL?		No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?				No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD									
	Difference > 2 TDL?		No - acceptable	Yes - assess further	Yes - assess further	Yes - assess further	Yes - assess further	Yes - assess further	No - acceptable	Yes - assess further

Duplicate/Split Analysis - 100-N-84:2 Subsite North Excavation (N)

Sampling Area	Sample Number	Sample Date	Fluoranthene			Fluorene			Indeno(1,2,3-cd)pyrene			Phenanthrene			Pyrene			Aroclor-1254		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
N-12	J1TPW2	5/27/14	440	X	13	42	X	5.1	73		12	170		12	520		12	6.7	J	2.5
Duplicate of J1TPW2	J1TPW3	5/27/14	260	X	12	19	JX	4.9	53		11	140		11	270		11	18		2.6
Split of J1TPW2	J1TPX2	5/27/14	103		0.536	5.02	U	5.02	0.536	U	0.536	64.7		5.02	88.3		0.536	1.11	U	1.11

Analysis:

TDL		15	15	15	15	15	20
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	*51.4%*			19.4%	*63.3%*	
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable
Split Analysis	Both > PQL?	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	No-Stop (acceptable)
	Both >5xTDL?	Yes (calc RPD)			No-Stop (acceptable)	Yes (calc RPD)	
	RPD	*124.1%*				*141.9%*	
	Difference > 2 TDL?	Not applicable	Yes - assess further	Yes - assess further	Yes - assess further	Not applicable	No - acceptable

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 18 of 19

Duplicate/Split Analysis - 100-N-84:2 Subsite South Excavation (S)

Sampling Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Cadmium			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
S-2	J1TPX6	5/21/14	4600	JX	1.6	1.8	J	0.67	56.6	JX	0.077	0.052	JBN	0.041	5400	JX	14.3	3.3	JX	0.059	10.3	JX	0.10	14.4	JX	0.22	25000	JX	3.8
Duplicate of J1TPX6	J1TR07	5/21/14	3850	JX	1.4	2.1	J	0.61	37.9	JX	0.071	0.092	JBN	0.038	6400	JX	13.1	3.8	JX	0.054	10.7	JX	0.46	16.1	JX	1.0	26700	JX	3.5
Split of J1TPX6	J1TR08	5/21/14	3450	J	6.07	2.66	JBC	0.446	31.1	J	0.0893	0.718	J	0.0893	5350	J	7.14	3.48	J	0.134	10.4	JD	0.67	16.3	J	0.268	26000	J	7.14

Analysis:

	TDL	5	10	2	0.2	100	1	2	1	5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	17.8%		39.6%		16.9%		3.8%	11.1%	6.6%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable
Split Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD	28.6%		58.2%		0.9%		1.0%	12.4%	3.9%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Yes - assess further	Not applicable	No - acceptable	Not applicable	Not applicable	Not applicable

Duplicate/Split Analysis - 100-N-84:2 Subsite South Excavation (S)

Sampling Area	Sample Number	Sample Date	Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
S-2	J1TPX6	5/21/14	3.7	J	0.27	4270	JX	3.7	299	JX	0.10	6.6	JX	0.12	626	J	41.5	149	J	5.7	349	J	59.7	63.8	J	0.095	42.6	JX	0.40
Duplicate of J1TPX6	J1TR07	5/21/14	4.2	J	1.3	4450	JX	3.4	319	JX	0.093	6.9	JX	0.11	611	J	38.1	167	J	26.3	238	J	54.8	73.6	J	0.44	45.6	JX	0.37
Split of J1TPX6	J1TR08	5/21/14	2.95	JDU	2.95	4350	J	7.59	295	J	0.179	6.61	J	0.134	515	J	5.71	370	JN	1.34	204	J	6.25	83.2	JD	0.446	50.7	JD	1.79

Analysis:

	TDL	5	75	5	4	400	2	50	2.5	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD		4.1%	6.5%			11.4%		14.3%	6.8%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	Yes - assess further	Not applicable	Not applicable
Split Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?		Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)
	RPD		1.9%	1.3%			85.2%		26.4%	17.4%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable	Yes - assess further	Not applicable	Not applicable

Duplicate/Split Analysis - 100-N-84:2 Subsite South Excavation (S)

Sampling Area	Sample Number	Sample Date	TPH - Diesel Range EXT			TPH - Diesel Range			Benzo(a)pyrene			Benzo(k)fluoranthene			Chrysene			Fluoranthene			Pyrene		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
S-2	J1TPX6	5/21/14	7600		1000	6000		680	19		6.2	7.5	J	3.8	24	JX	4.7	53	X	13	53		12
Duplicate of J1TPX6	J1TR07	5/21/14	4400		1000	3100	J	690	6.2	U	6.2	3.8	U	3.8	4.7	U	4.7	13	U	13	12	U	12
Split of J1TPX6	J1TR08	5/21/14							2.50		0.539	1.81		0.270	2.97		0.539	4.69		0.539	4.2		0.539

Analysis:

	TDL	5000	5000	15	15	15	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)					
	RPD							
	Difference > 2 TDL?	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Yes - assess further	Yes - assess further
Split Analysis	Both > PQL?			Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?			No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD							
	Difference > 2 TDL?			No - acceptable	No - acceptable	No - acceptable	Yes - assess further	Yes - assess further

CALCULATION SHEET

Washington Closure Hanford

Originator J. D. Skoglie
Project 100-N Field Remediation
Subject 100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations

Date 06/30/14
Job No. 14655

Calc. No. 0100N-CA-V0287
Checked I. B. Berezovskiy

Rev. No. 0
Date 06/30/14
Sheet No. 19 of 19

Duplicate Analysis - 100-N-84:2 Subsite River Road (RR)

Sampling Area	Sample Number	Sample Date	Potassium-40			Radium-226			Chloride			Fluoride			Nitrogen in Nitrate			Sulfate			Aluminum			Arsenic			Barium		
			pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
RR-5	J1TFW4	3/24/14	10.6		0.169	0.344		0.0298	9.4		2.1	1.0	B	0.87	1.7	B	0.33	102		1.8	6200		1.6	2.1	M	0.66	61.2		0.076
Dupicate of J1TFW4	J1TFW5	3/24/14	9.69		0.147	0.350		0.0299	6.4		2.1	0.98	B	0.85	1.9	B	0.33	121		1.8	5330		1.4	1.8		0.60	53.7		0.069

Analysis:

	TDL	0.5	0.1	2	5	0.75	5	5	10	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	9.0%					17.0%	15.1%		13.1%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - 100-N-84:2 Subsite River Road (RR)

Sampling Area	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
RR-5	J1TFW4	3/24/14	0.12	B	0.041	6420		14.1	7.4		0.058	9.4	X	0.10	14.7	X	0.22	0.408		0.155	22500		3.8	5.6		0.27	4670	X	3.7
Dupicate of J1TFW4	J1TFW5	3/24/14	0.092	B	0.037	5490		12.9	6.7		0.053	8.3	X	0.091	15.1	X	0.20	0.344		0.155	20200		3.5	4.0		0.25	3990	X	3.4

Analysis:

	TDL	0.2	100	1	2	1	0.5	5	5	75
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		15.6%	9.9%		2.7%		10.8%		15.7%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - 100-N-84:2 Subsite River Road (RR)

Sampling Area	Sample Number	Sample Date	Manganese			Nickel			Potassium			Silicon			Sodium			Vanadium			Zinc			TPH - Diesel Range EXT (C10 - C36)			TPH - Diesel Range (C10 - C28)		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
RR-5	J1TFW4	3/24/14	349		0.10	9.7	X	0.12	1050		41.0	281		5.7	351		59.0	50.3		0.094	46.3	X	0.40	83000	BN	1000	29000	B	680
Dupicate of J1TFW4	J1TFW5	3/24/14	265		0.091	8.2	X	0.11	922		37.4	217		5.2	302		53.9	46.6		0.086	39.8	X	0.36	13000	B	1000	6000	B	710

Analysis:

	TDL	5	4	400	2	50	2.5	1	5000	5000
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	27.4%			25.7%	15.0%	7.6%	15.1%		
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable	Yes - assess further	Yes - assess further

Duplicate Analysis - 100-N-84:2 Subsite River Road (RR)

Sampling Area	Sample Number	Sample Date	Benzo(a)anthracene (Method 8310)			Benzo(a)anthracene (Method 8270)			Benzo(a)pyrene (Method 8310)			Benzo(a)pyrene (Method 8270)			Benzo(b)fluoranthene (Method 8310)			Benzo(b)fluoranthene (Method 8270)			Benzo(ghi)perylene (Method 8310)			Benzo(k)fluoranthene (Method 8310)			Chrysene (Method 8310)		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
RR-5	J1TFW4	3/24/14	660		3.3	39	J	20	490		6.5	32	J	20	400	X	4.3	45	J	26	230		7.3	180		4.0	730		4.9
Dupicate of J1TFW4	J1TFW5	3/24/14	11	JX	3.3	470		21	48	N	6.7	310	J	21	37	X	4.4	430		27	12	JNX	7.5	14	J	4.1	55	X	5.0

Analysis:

	TDL	15	660	15	660	15	660	15	15	15
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD									
	Difference > 2 TDL?	Yes - assess further	No - acceptable	Yes - assess further	No - acceptable	Yes - assess further	No - acceptable	Yes - assess further	Yes - assess further	Yes - assess further

Duplicate Analysis - 100-N-84:2 Subsite River Road (RR)

Sampling Area	Sample Number	Sample Date	Chrysene (Method 8270)			Fluoranthene (Method 8310)			Fluoranthene (Method 8270)			Indeno (1,2,3-cd)pyrene (Method 8310)			Pyrene (Method 8310)			Pyrene (Method 8270)			Aroclor-1254		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
RR-5	J1TFW4	3/24/14	47	J	26	290	X	13	39	J	35	200		12	590		12	54	J	12	8.2	J	2.8
Dupicate of J1TFW4	J1TFW5	3/24/14	440		28	29	JX	14	1200	X	37	26	J	12	37	J	12	1000	X	13	10	J	2.7

Analysis:

	TDL	660	15	660	15	15	660	20
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD							
	Difference > 2 TDL?	No - acceptable	Yes - assess further	No - acceptable	Yes - assess further	Yes - assess further	No - acceptable	No - acceptable

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Radionuclides, Anions, and Asbestos).

Sample Location	HEIS Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
RR-5	J1TFW4	3/24/14	-0.00207	U	0.0229	0.00512	U	0.0180	-0.0103	U	0.0187	0.00289	U	0.0381	0.00910	U	0.0624
Dupicate of J1TFW4	J1TFW5	3/24/14	-0.000704	U	0.0211	-0.000828	U	0.0170	0.00649	U	0.0205	-0.0165	U	0.0362	-0.0146	U	0.0628

Sample Location	HEIS Number	Sample Date	Europium-155			Potassium-40			Radium-226			Total Beta Radiostrontium		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
RR-5	J1TFW4	3/24/14	0.0265	U	0.0383	10.6		0.169	0.344		0.0298	0.152	U	0.363
Dupicate of J1TFW4	J1TFW5	3/24/14	0.0173	U	0.0342	9.69		0.147	0.350		0.0299	0.0600	U	0.364

Sample Location	HEIS Number	Sample Date	Bromide			Chloride			Fluoride			Nitrogen in Nitrate			Nitrogen in Nitrite and Nitrate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
RR-5	J1TFW4	3/24/14	0.41	U	0.41	9.4		2.1	1.0	B	0.87	1.7	B	0.33	0.38	U	0.38
Dupicate of J1TFW4	J1TFW5	3/24/14	0.40	U	0.40	6.4		2.1	0.98	B	0.85	1.9	B	0.33	0.98		0.38

Sample Location	HEIS Number	Sample Date	Nitrogen in Nitrite			Phosphorous in phosphate			Sulfate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
RR-5	J1TFW4	3/24/14	0.35	U	0.35	1.3	U	1.3	102		1.8
Dupicate of J1TFW4	J1TFW5	3/24/14	0.35	U	0.35	1.3	U	1.3	121		1.8

Sample Location	HEIS Number	Sample Date	Chrysotile			Amosite			Crocidolite			Tremolite			Actinolite		
			%	Q	RDL	%	Q	RDL	%	Q	RDL	%	Q	RDL	%	Q	RDL
RR-5	J1TFW6	3/24/14	ND	U	ND	ND	U	ND	ND	U	ND	ND	U	ND	ND	U	ND
Dupicate of J1TFW6	J1TFW7	3/24/14	ND	U	ND	ND	U	ND	ND	U	ND	ND	U	ND	ND	U	ND

Sample Location	HEIS Number	Sample Date	Anthophyllite		
			%	Q	RDL
RR-5	J1TFW6	3/24/14	ND	U	ND
Dupicate of J1TFW6	J1TFW7	3/24/14	ND	U	ND

Attachment	1	Sheet No.	1 of 12
Originator	J. D. Skoglie	Date	7/2/14
Checked	I. B. Berezovskiy	Date	7/2/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

B = blank contamination (inorganic constituents)
C = </= 5x blank concentration
D = reported from a dilution.
EXC = excavation
FS = focused sample
HEIS = Hanford Environmental Information System
J = estimate
M = duplicate precision not met.
N = recovery outside control limits
PQL = practical quantitation limit
Q = qualifier
R = rejected
U = undetected
X = >40% difference between primary and confirmation dector results.

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Metals).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
N-12	J1TPW2	5/27/14	6930		1.5	0.37	U	0.37	2.5		0.63	57.7		0.073	0.041	B	0.032
Duplicate of J1TPW2	J1TPW3	5/27/14	5530		1.5	0.37	U	0.37	2.6		0.64	53.6		0.074	0.039	B	0.032
N-1	J1TPV1	5/21/14	7980	JXM	1.5	0.40	JB	0.37	3.3	JN	0.64	62.0	JNXM	0.074	0.032	UJN	0.032
N-2	J1TPV2	5/21/14	7470	JX	1.5	0.36	UR	0.36	3.1	J	0.62	64.2	JX	0.071	0.031	UJ	0.031
N-3	J1TPV3	5/27/14	5730		1.4	0.35	U	0.35	2.8		0.61	50.8		0.070	0.030	U	0.030
N-4	J1TPV4	5/27/14	3850		1.4	0.34	U	0.34	1.7		0.60	38.9		0.069	0.030	U	0.030
N-5	J1TPV5	5/27/14	5220		1.4	0.35	U	0.35	2.2		0.61	50.5		0.071	0.031	U	0.031
N-6	J1TPV6	5/27/14	8050		1.6	0.38	U	0.38	4.4		0.66	42.0		0.076	0.16	B	0.033
N-7	J1TPV7	5/27/14	5770		1.3	0.33	U	0.33	3.4		0.57	47.9		0.066	0.079	B	0.028
N-8	J1TPV8	5/27/14	8040		1.5	0.36	U	0.36	3.6		0.62	57.6		0.071	0.11	B	0.031
N-9	J1TPV9	5/27/14	9430		1.5	0.36	U	0.36	5.3		0.62	51.3		0.071	0.20		0.031
N-10	J1TPW0	5/27/14	7430		1.3	0.33	U	0.33	3.5		0.57	52.3		0.066	0.098	B	0.028
N-11	J1TPW1	5/27/14	7490		1.4	0.34	U	0.34	4.2		0.58	39.3		0.067	0.055	B	0.029
Split of J1TPW2	J1TPX2	5/27/14	6150		6.7	1.63	DU	1.63	3.66		0.493	54.9		0.0985	0.695		0.0985
S-2	J1TPX6	5/21/14	4600	JX	1.6	0.38	UR	0.38	1.8	J	0.67	56.6	JX	0.077	0.033	UJ	0.033
Duplicate of J1TPX6	J1TR07	5/21/14	3850	JX	1.4	1.8	UR	1.8	2.1	J	0.61	37.9	JX	0.071	0.15	UJ	0.15
S-1	J1TPX5	5/21/14	3430	JX	1.5	0.38	UR	0.38	1.8	J	0.65	26.6	JX	0.075	0.033	UJ	0.033
S-3	J1TPX7	5/21/14	6090	JX	1.4	0.34	UR	0.34	2.7	J	0.58	49.7	JX	0.067	0.029	UJ	0.029
S-4	J1TPX8	5/21/14	4850	JX	1.5	0.36	UR	0.36	2.1	J	0.63	87.5	JX	0.073	0.032	UJ	0.032
S-5	J1TPX9	5/21/14	8630	JX	1.5	0.36	UR	0.36	3.5	J	0.63	66.6	JX	0.072	0.031	UJ	0.031
S-6	J1TR00	5/27/14	6370		1.5	0.38	U	0.38	3.4		0.66	66.1		0.075	0.11	B	0.033
S-7	J1TR01	5/21/14	4650	JX	1.5	1.8	UR	1.8	1.9	J	0.63	41.7	JX	0.073	0.16	UJ	0.16
S-8	J1TR02	5/21/14	4110	JX	1.6	0.39	UR	0.39	2.0	J	0.67	35.2	JX	0.077	0.033	UJ	0.033
S-9	J1TR03	5/27/14	6500		1.5	0.37	U	0.37	2.4		0.65	56.1		0.075	0.032	U	0.032
S-10	J1TR04	5/21/14	9050	JX	1.4	0.34	UR	0.34	3.2	J	0.60	75.1	JX	0.069	0.046	JB	0.030
S-11	J1TR05	5/27/14	7240		1.6	0.38	U	0.38	3.4		0.67	51.1		0.077	0.13	B	0.033
S-12	J1TR06	5/27/14	8830		1.6	0.38	U	0.38	4.3		0.66	58.0		0.076	0.22		0.033
Split of J1TPX6	J1TR08	5/21/14	3450		6.07	1.47	DU	1.47	2.66	BC	0.446	31.1		0.0893	1.02		0.0893
FS-1	J1TR29	6/10/14	7120		1.6	0.38	U	0.38	3.0		0.66	60.1		0.076	0.033	U	0.033
RR-5	J1TFW4	3/24/14	6200		1.6	0.38	U	0.38	2.1	M	0.66	61.2		0.076	0.033	U	0.033
Dupicate of J1TFW4	J1TFW5	3/24/14	5330		1.4	0.35	U	0.35	1.8		0.60	53.7		0.069	0.030	U	0.030
Equipment Blank	J1TPW4	5/21/14	98.4	JX	1.4	0.35	UR	0.35	0.60	UJ	0.60	1.2	JX	0.069	0.030	UJ	0.030

Sample Location	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
N-12	J1TPW2	5/27/14	0.94	U	0.94	0.039	U	0.039	7830		13.6	14.0		0.056	7.4	X	0.096
Duplicate of J1TPW2	J1TPW3	5/27/14	0.95	U	0.95	0.040	U	0.040	7390		13.7	9.4		0.056	6.9	X	0.097
N-1	J1TPV1	5/21/14	0.96	JBN	0.95	0.13	JBNM	0.040	7990	JNXM	13.7	11.6	JNXM	0.056	10.4	JNXM	0.097
N-2	J1TPV2	5/21/14	1.6	JB	0.92	0.18	JBN	0.038	5790	JX	13.2	15.8	JX	0.054	8.4	JX	0.094
N-3	J1TPV3	5/27/14	0.90	UN	0.90	0.038	U	0.038	6870		12.9	4.7		0.053	8.6	X	0.092
N-4	J1TPV4	5/27/14	0.89	U	0.89	0.037	U	0.037	5590		12.8	1.8		0.053	9.2	X	0.091
N-5	J1TPV5	5/27/14	0.91	U	0.91	0.038	U	0.038	7120		13.1	4.3		0.054	8.6	X	0.093
N-6	J1TPV6	5/27/14	0.99	U	0.99	0.041	U	0.041	10700		14.2	9.3		0.058	7.0	X	0.10
N-7	J1TPV7	5/27/14	0.85	U	0.85	0.035	U	0.035	7150		12.2	7.8		0.05	7.3	X	0.086
N-8	J1TPV8	5/27/14	1.0	B	0.92	0.038	U	0.038	9410		13.2	8.0		0.054	7.7	X	0.094
N-9	J1TPV9	5/27/14	1.3	B	0.92	0.038	U	0.038	17900		13.2	10.9		0.054	8.0	X	0.094
N-10	J1TPW0	5/27/14	0.85	U	0.85	0.035	U	0.035	9280		12.2	7.8		0.05	8.1	X	0.086
N-11	J1TPW1	5/27/14	0.87	U	0.87	0.036	U	0.036	10500		12.5	6.7		0.051	8.3	X	0.089
Split of J1TPW2	J1TPX2	5/27/14	0.985	U	0.985	0.534		0.0985	8190		7.88	18.9		0.148	8.22	D	0.739
S-2	J1TPX6	5/21/14	0.99	UJ	0.99	0.052	JBN	0.041	5400	JX	14.3	3.3	JX	0.059	10.3	JX	0.10
Duplicate of J1TPX6	J1TR07	5/21/14	0.91	UJ	0.91	0.092	JBN	0.038	6400	JX	13.1	3.8	JX	0.054	10.7	JX	0.46
S-1	J1TPX5	5/21/14	0.97	UJ	0.97	0.050	JBN	0.041	4200	JX	14.0	4.0	JX	0.057	4.7	JX	0.099
S-3	J1TPX7	5/21/14	0.87	UJ	0.87	0.11	JBN	0.036	5950	JX	12.5	7.1	JX	0.051	9.3	JX	0.088
S-4	J1TPX8	5/21/14	0.94	UJ	0.94	0.047	JBN	0.039	5880	JX	13.5	4.7	JX	0.056	10.6	JX	0.096
S-5	J1TPX9	5/21/14	1.2	JB	0.93	0.13	JBN	0.039	9300	JX	13.4	10.7	JX	0.055	9.3	JX	0.095
S-6	J1TR00	5/27/14	0.97	U	0.97	0.041	U	0.041	5890		14.0	6.1		0.058	7.9	X	0.099
S-7	J1TR01	5/21/14	0.94	UJ	0.94	0.067	JBN	0.039	6630	JX	13.5	4.0	JX	0.056	11.2	JX	0.48
S-8	J1TR02	5/21/14	0.99	UJ	0.99	0.042	UJN	0.042	4850	JX	14.3	4.9	JX	0.059	6.9	JX	0.10
S-9	J1TR03	5/27/14	0.96	U	0.96	0.040	U	0.040	6220		13.8	4.9		0.057	8.8	X	0.098
S-10	J1TR04	5/21/14	1.5	JB	0.89	0.099	JBN	0.037	4790	JX	12.8	12.1	JX	0.053	8.9	JX	0.091
S-11	J1TR05	5/27/14	0.99	U	0.99	0.041	U	0.041	6940		14.3	5.3		0.059	8.5	X	0.10
S-12	J1TR06	5/27/14	0.98	U	0.98	0.041	U	0.041	8110		14.1	7.8		0.058	8.7	X	0.10
Split of J1TPX6	J1TR08	5/21/14	0.893	U	0.893	0.718		0.0893	5350		7.14	3.48		0.134	10.4	D	0.670
FS-1	J1TR29	6/10/14	0.98	U	0.98	0.19	B	0.041	6770		14.1	12.6		0.058	7.5	X	0.10
RR-5	J1TFW4	3/24/14	0.98	U	0.98	0.12	B	0.041	6420		14.1	7.4		0.058	9.4	X	0.10
Dupicate of J1TFW4	J1TFW5	3/24/14	0.89	U	0.89	0.092	B	0.037	5490		12.9	6.7		0.053	8.3	X	0.091
Equipment Blank	J1TPW4	5/21/14	0.89	UJ	0.89	0.037	UJN	0.037	21.7	JBX	12.8	0.14	JBX	0.053	0.091	UJX	0.091

Attachment	1	Sheet No.	2 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Metals).

Sample Location	HEIS Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
N-12	J1TPW2	5/27/14	15.7	X	0.21				21200		3.7	8.9		0.26	4330		3.6
Duplicate of J1TPW2	J1TPW3	5/27/14	14.8	X	0.21				20500		3.7	5.6		0.26	3710		3.6
N-1	J1TPV1	5/21/14	16.1	JNXM	0.21				24800	JXM	3.7	5.5	JNM	0.26	6140	JNXM	3.6
N-2	J1TPV2	5/21/14	16.0	JX	0.20				20800	JX	3.6	8.1	J	0.25	4310	JX	3.5
N-3	J1TPV3	5/27/14	13.7	X	0.20				26300		3.5	3.9		0.25	4610		3.4
N-4	J1TPV4	5/27/14	13.0	X	0.20				28200		3.4	2.0		0.25	4240		3.4
N-5	J1TPV5	5/27/14	14.1	X	0.20				26400		3.5	3.0		0.25	4520		3.4
N-6	J1TPV6	5/27/14	15.6	X	0.22				17900		3.8	4.4		0.27	5140		3.7
N-7	J1TPV7	5/27/14	16.1	X	0.19				18700		3.3	3.2		0.23	3960		3.2
N-8	J1TPV8	5/27/14	16.8	X	0.20				22400		3.6	4.5		0.25	4700		3.5
N-9	J1TPV9	5/27/14	19.3	X	0.20				21900		3.6	6.2		0.25	6340		3.5
N-10	J1TPW0	5/27/14	16.5	X	0.19				22100		3.3	8.9		0.23	4860		3.2
N-11	J1TPW1	5/27/14	15.7	X	0.19				23200		3.4	4.1		0.24	5370		3.3
Split of J1TPW2	J1TPX2	5/27/14	17.7		0.296				21900		7.88	2.42	BCD	1.63	5570		8.38
S-2	J1TPX6	5/21/14	14.4	JX	0.22				25000	JX	3.8	3.7	J	0.27	4270	JX	3.7
Duplicate of J1TPX6	J1TR07	5/21/14	16.1	JX	1.0				26700	JX	3.5	4.2	J	1.3	4450	JX	3.4
S-1	J1TPX5	5/21/14	8.2	JX	0.21				10800	JX	3.8	3.0	J	0.27	2410	JX	3.7
S-3	J1TPX7	5/21/14	14.4	JX	0.19				22400	JX	3.4	4.6	J	0.24	4570	JX	3.3
S-4	J1TPX8	5/21/14	14.7	JX	0.21				26500	JX	3.6	3.8	J	0.26	4690	JX	3.5
S-5	J1TPX9	5/21/14	18.1	JX	0.21				22400	JX	3.6	6.1	J	0.26	5250	JX	3.5
S-6	J1TR00	5/27/14	15.2	X	0.22				21000		3.8	3.9		0.27	4110		3.7
S-7	J1TR01	5/21/14	18.0	JX	1.0				28000	JX	3.6	5.4	J	1.3	4840	JX	3.6
S-8	J1TR02	5/21/14	10.4	JX	0.22				16500	JX	3.9	3.4	J	0.27	3320	JX	3.8
S-9	J1TR03	5/27/14	15.5	X	0.21				25200		3.7	4.2		0.26	4250		3.6
S-10	J1TR04	5/21/14	16.0	JX	0.20				22100	JX	3.4	5.6	J	0.25	4890	JX	3.4
S-11	J1TR05	5/27/14	16.9	X	0.22				23900		3.8	5.2		0.27	4860		3.7
S-12	J1TR06	5/27/14	16.8	X	0.22				22400		3.8	6.2		0.27	5940		3.7
Split of J1TPX6	J1TR08	5/21/14	16.3		0.268				26000		7.14	2.95	DU	2.95	4350		7.59
FS-1	J1TR29	6/10/14	19.0		0.22				19800		3.8	3.8		0.27	5540		3.7
RR-5	J1TFW4	3/24/14	14.7	X	0.22	0.408		0.155	22500		3.8	5.6		0.27	4670	X	3.7
Dupicate of J1TFW4	J1TFW5	3/24/14	15.1	X	0.20	0.344		0.155	20200		3.5	4.0		0.25	3990	X	3.4
Equipment Blank	J1TPW4	5/21/14	0.59	JBX	0.20				159	JX	3.5	0.40	JB	0.25	11.8	JBX	3.4

Sample Location	HEIS Number	Sample Date	Manganese			Mercury			Molybdenum			Nickel			Potassium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
N-12	J1TPW2	5/27/14	274		0.096	0.0054	B	0.0052	0.25	U	0.25	10.4	X	0.12	1080		39.4
Duplicate of J1TPW2	J1TPW3	5/27/14	252		0.097	0.0052	U	0.0052	0.25	U	0.25	8.4	X	0.12	901		39.8
N-1	J1TPV1	5/21/14	379	JXM	0.097	0.0087	B	0.0051	0.25	UJN	0.25	14.9	JNXM	0.12	1290	JNM	39.8
N-2	J1TPV2	5/21/14	322	JX	0.094	0.0094	B	0.0058	0.28	JB	0.24	12.6	JX	0.12	1460	J	38.4
N-3	J1TPV3	5/27/14	323		0.092	0.0049	U	0.0049	0.31	B	0.24	8.9	X	0.11	908		37.6
N-4	J1TPV4	5/27/14	311		0.091	0.0056	U	0.0056	0.34	B	0.24	7.7	X	0.11	542		37.2
N-5	J1TPV5	5/27/14	306		0.093	0.0052	U	0.0052	0.30	B	0.24	8.1	X	0.11	816		38.2
N-6	J1TPV6	5/27/14	288		0.10	0.0087	B	0.0058	0.26	U	0.26	11.7	X	0.12	1390		41.2
N-7	J1TPV7	5/27/14	261		0.086	0.0066	B	0.0056	0.22	U	0.22	10.1	X	0.11	932		35.4
N-8	J1TPV8	5/27/14	300		0.094	0.0084	B	0.0053	0.24	U	0.24	10.8	X	0.12	1360		38.4
N-9	J1TPV9	5/27/14	333		0.094	0.016		0.0053	0.25	B	0.24	13.8	X	0.12	1450		38.4
N-10	J1TPW0	5/27/14	305		0.086	0.0064	B	0.0061	0.22	U	0.22	11.2	X	0.11	1240		35.4
N-11	J1TPW1	5/27/14	309		0.089	0.0057	B	0.0055	0.23	U	0.23	11.9	X	0.11	1100		36.3
Split of J1TPW2	J1TPX2	5/27/14	347		0.197	0.0055	B	0.0040	0.283	B	0.197	17.7	*	0.148	1060		6.31
S-2	J1TPX6	5/21/14	299	JX	0.10	0.0062	U	0.0062	0.26	UJ	0.26	6.6	JX	0.12	626	J	41.5
Duplicate of J1TPX6	J1TR07	5/21/14	319	JX	0.093	0.0055	U	0.0055	0.24	UJ	0.24	6.9	JX	0.11	611	J	38.1
S-1	J1TPX5	5/21/14	160	JX	0.099	0.0093	B	0.0057	0.26	UJ	0.26	6.0	JX	0.12	576	J	40.6
S-3	J1TPX7	5/21/14	307	JX	0.088	0.019		0.0053	0.23	UJ	0.23	9.9	JX	0.11	955	J	36.2
S-4	J1TPX8	5/21/14	429	JX	0.096	0.0063	B	0.0060	0.25	UJ	0.25	7.6	JX	0.12	715	J	39.3
S-5	J1TPX9	5/21/14	342	JX	0.095	0.011	B	0.0059	0.25	UJ	0.25	12.4	JX	0.12	1520	J	38.9
S-6	J1TR00	5/27/14	293		0.099	0.0078	B	0.0054	0.26	U	0.26	10.1	X	0.12	1090		40.7
S-7	J1TR01	5/21/14	318	JX	0.096	0.0061	B	0.0051	0.25	UJ	0.25	8.5	JX	0.12	614	J	39.3
S-8	J1TR02	5/21/14	222	JX	0.10	0.0078	B	0.0050	0.26	UJ	0.26	7.0	JX	0.12	687	J	41.6
S-9	J1TR03	5/27/14	316		0.098	0.0055	U	0.0055	0.29	B	0.26	8.6	X	0.12	972		40.2
S-10	J1TR04	5/21/14	351	JX	0.091	0.011	B	0.0058	0.24	UJ	0.24	12.4	JX	0.11	1920	J	37.2
S-11	J1TR05	5/27/14	319		0.10	0.0091	B	0.0054	0.26	U	0.26	9.8	X	0.12	1250		41.4
S-12	J1TR06	5/27/14	350		0.10	0.0096	B	0.0055	0.26	U	0.26	12.0	X	0.12	1520		41.1
Split of J1TPX6	J1TR08	5/21/14	295		0.179	0.0040	U	0.0040	0.642	B	0.179	6.61		0.134	515		5.71
FS-1	J1TR29	6/10/14	310		0.10	0.0052	U	0.0052	0.26	U	0.26	11.4	X	0.12	1030		41.0
RR-5	J1TFW4	3/24/14	349		0.10	0.0057	U	0.0057	0.26	U	0.26	9.7	X	0.12	1050		41.0
Dupicate of J1TFW4	J1TFW5	3/24/14	265		0.091	0.0053	U	0.0053	0.24	U	0.24	8.2	X	0.11	922		37.4
Equipment Blank	J1TPW4	5/21/14	2.9	JX	0.091	0.0052	U	0.0052	0.24	UJ	0.24	0.11	UJX	0.11	37.3	UJ	37.3

Attachment	1	Sheet No.	3 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Metals).

Sample Location	HEIS Number	Sample Date	Selenium			Silicon			Silver			Sodium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
N-12	J1TPW2	5/27/14	0.83	U	0.83	397	X	5.4	0.15	U	0.15	342		56.7	51.9		0.090
Duplicate of J1TPW2	J1TPW3	5/27/14	0.83	U	0.83	355	X	5.5	0.16	U	0.16	252		57.3	47.1		0.091
N-1	J1TPV1	5/21/14	0.83	UJN	0.83	274	JNM	5.5	0.16	UJN	0.16	280	JNM	57.2	61.9	JNM	0.091
N-2	J1TPV2	5/21/14	0.81	UJ	0.81	224	J	5.3	0.15	UJ	0.15	292	J	55.3	45.5	J	0.088
N-3	J1TPV3	5/27/14	0.79	U	0.79	308	X	5.2	0.15	U	0.15	325		54.2	64.9		0.086
N-4	J1TPV4	5/27/14	0.78	U	0.78	191	X	5.1	0.15	U	0.15	284		53.6	71.4		0.085
N-5	J1TPV5	5/27/14	0.80	U	0.80	338	X	5.3	0.15	U	0.15	311		54.9	69.8		0.088
N-6	J1TPV6	5/27/14	0.86	U	0.86	513	X	5.7	0.16	U	0.16	313		59.3	36.2		0.095
N-7	J1TPV7	5/27/14	0.74	U	0.74	301	X	4.9	0.14	U	0.14	271		50.9	41.9		0.081
N-8	J1TPV8	5/27/14	0.81	U	0.81	421	X	5.3	0.15	U	0.15	244		55.3	49.7		0.088
N-9	J1TPV9	5/27/14	0.81	U	0.81	349	X	5.3	0.15	U	0.15	292		55.3	48.4		0.088
N-10	J1TPW0	5/27/14	0.74	U	0.74	395	X	4.9	0.14	U	0.14	299		50.9	48.9		0.081
N-11	J1TPW1	5/27/14	0.76	U	0.76	281	X	5.0	0.14	U	0.14	333		52.2	57.1		0.083
Split of J1TPW2	J1TPX2	5/27/14	0.330	DU	0.330	787	*MN	1.48	0.228	B	0.0985	194		6.9	59.9	D	0.493
S-2	J1TPX6	5/21/14	0.87	UJ	0.87	149	J	5.7	0.16	UJ	0.16	349	J	59.7	63.8	J	0.095
Duplicate of J1TPX6	J1TR07	5/21/14	0.80	UJ	0.80	167	J	26.3	0.15	UJ	0.15	238	J	54.8	73.6	J	0.44
S-1	J1TPX5	5/21/14	0.85	UJ	0.85	112	J	5.6	0.16	UJ	0.16	218	J	58.4	24.4	J	0.093
S-3	J1TPX7	5/21/14	0.76	UJ	0.76	171	J	5.0	0.14	UJ	0.14	300	J	52.1	53.7	J	0.083
S-4	J1TPX8	5/21/14	0.82	UJ	0.82	219	J	5.4	0.15	UJ	0.15	361	J	56.5	64.5	J	0.090
S-5	J1TPX9	5/21/14	0.82	UJ	0.82	277	J	5.4	0.15	UJ	0.15	408	J	56.0	50.2	J	0.089
S-6	J1TR00	5/27/14	0.85	U	0.85	473	X	5.6	0.16	U	0.16	235		58.6	41.8		0.093
S-7	J1TR01	5/21/14	0.83	UJ	0.83	185	J	27.2	0.15	UJ	0.15	314	J	56.6	81.2	J	0.45
S-8	J1TR02	5/21/14	0.87	UJ	0.87	150	J	5.7	0.16	UJ	0.16	201	J	59.9	40.7	J	0.095
S-9	J1TR03	5/27/14	0.84	U	0.84	331	X	5.6	0.16	U	0.16	462		57.9	63.2		0.092
S-10	J1TR04	5/21/14	0.78	UJ	0.78	295	J	5.1	0.15	UJ	0.15	276	J	53.5	45.7	J	0.085
S-11	J1TR05	5/27/14	0.87	U	0.87	401	X	5.7	0.16	U	0.16	293		59.6	55.9		0.095
S-12	J1TR06	5/27/14	0.86	U	0.86	414	X	5.7	0.16	U	0.16	269		59.1	42.2		0.094
Split of J1TPX6	J1TR08	5/21/14	0.332	DU	0.332	370	N	1.34	0.446	DU	0.446	204		6.25	83.2	D	0.446
FS-1	J1TR29	6/10/14	0.86	U	0.86	131	N	5.7	0.16	U	0.16	239		59.0	44.0		0.094
RR-5	J1TFW4	3/24/14	0.86	U	0.86	281		5.7	0.16	U	0.16	351		59.0	50.3		0.094
Dupicate of J1TFW4	J1TFW5	3/24/14	0.79	U	0.79	217		5.2	0.15	U	0.15	302		53.9	46.6		0.086
Equipment Blank	J1TPW4	5/21/14	0.78	UJ	0.78	87.6	J	5.1	0.15	UJ	0.15	53.7	UJ	53.7	0.26	JB	0.086

Sample Location	HEIS Number	Sample Date	Zinc		
			mg/kg	Q	PQL
N-12	J1TPW2	5/27/14	59.5		0.38
Duplicate of J1TPW2	J1TPW3	5/27/14	40.4		0.39
N-1	J1TPV1	5/21/14	47.5	JNXM	0.39
N-2	J1TPV2	5/21/14	46.5	JX	0.37
N-3	J1TPV3	5/27/14	44.9		0.37
N-4	J1TPV4	5/27/14	44.5		0.36
N-5	J1TPV5	5/27/14	44.5		0.37
N-6	J1TPV6	5/27/14	34.5		0.40
N-7	J1TPV7	5/27/14	33.3		0.34
N-8	J1TPV8	5/27/14	40.3		0.37
N-9	J1TPV9	5/27/14	43.1		0.37
N-10	J1TPW0	5/27/14	69.6		0.34
N-11	J1TPW1	5/27/14	41.4		0.35
Split of J1TPW2	J1TPX2	5/27/14	54.4	D	1.97
S-2	J1TPX6	5/21/14	42.6	JX	0.40
Duplicate of J1TPX6	J1TR07	5/21/14	45.6	JX	0.37
S-1	J1TPX5	5/21/14	21.9	JX	0.39
S-3	J1TPX7	5/21/14	47.6	JX	0.35
S-4	J1TPX8	5/21/14	44.0	JX	0.38
S-5	J1TPX9	5/21/14	61.3	JX	0.38
S-6	J1TR00	5/27/14	36.2		0.40
S-7	J1TR01	5/21/14	48.6	JX	0.38
S-8	J1TR02	5/21/14	31.7	JX	0.40
S-9	J1TR03	5/27/14	62.7		0.39
S-10	J1TR04	5/21/14	44.1	JX	0.36
S-11	J1TR05	5/27/14	47.1		0.40
S-12	J1TR06	5/27/14	42.1		0.40
Split of J1TPX6	J1TR08	5/21/14	50.7	D	1.79
FS-1	J1TR29	6/10/14	38.8	X	0.40
RR-5	J1TFW4	3/24/14	46.3	X	0.40
Dupicate of J1TFW4	J1TFW5	3/24/14	39.8	X	0.36
Equipment Blank	J1TPW4	5/21/14	0.62	JBX	0.36

Attachment	1	Sheet No.	4 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (TPH and Physical).

Sample Location	HEIS Number	Sample Date	TPH - Diesel Range EXT (C10 - C36)			TPH - Diesel Range (C10 - C28)			TPH - Diesel Range (C10 - C20)			TPH - Gasoline (Gasoline)			TPH - Gasoline (C6 - C10)		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
N-12	J1TPW2	5/27/14	9000		920	5900		620				330	U	330			
Duplicate of J1TPW2	J1TPW3	5/27/14	13000		990	7900		680				320	U	320			
N-1	J1TPV1	5/21/14	3700	J	990	2600	J	670				330	U	330			
N-2	J1TPV2	5/21/14	58000		1000	34000		690				320	U	320			
N-3	J1TPV3	5/27/14	5500		1000	3100	J	680				340	U	340			
N-4	J1TPV4	5/27/14	970	U	970	660	U	660				320	U	320			
N-5	J1TPV5	5/27/14	3400	J	970	2100	J	660				320	U	320			
N-6	J1TPV6	5/27/14	17000		990	9100		670				340	U	340			
N-7	J1TPV7	5/27/14	58000		990	34000		670				320	U	320			
N-8	J1TPV8	5/27/14	970	J	970	760	J	660				340	U	340			
N-9	J1TPV9	5/27/14	8300		940	5300		640				340	U	340			
N-10	J1TPW0	5/27/14	19000		960	16000		650				320	U	320			
N-11	J1TPW1	5/27/14	2500	J	1000	1500	J	680				320	U	320			
Split of J1TPW2	J1TPX2	5/27/14							2160	U	2160				1670	DU	5010
S-2	J1TPX6	5/21/14	7600		1000	6000		680				320	U	320			
Duplicate of J1TPX6	J1TR07	5/21/14	4400		1000	3100	J	690				320	U	320			
S-1	J1TPX5	5/21/14	31000		1000	26000		700				330	U	330			
S-3	J1TPX7	5/21/14	11000		1000	7300		680				330	U	330			
S-4	J1TPX8	5/21/14	4200		930	3100	J	630				330	U	330			
S-5	J1TPX9	5/21/14	19000		1000	6500		690				320	U	320			
S-6	J1TR00	5/27/14	42000		980	22000		670				320	U	320			
S-7	J1TR01	5/21/14	3400	J	990	2600	J	670				320	U	320			
S-8	J1TR02	5/21/14	5900		980	4400		660				330	U	330			
S-9	J1TR03	5/27/14	14000		1000	8500		690				330	U	330			
S-10	J1TR04	5/21/14	3900		940	2600	J	640				330	U	330			
S-11	J1TR05	5/27/14	390000		930	200000		630				320	U	320			
S-12	J1TR06	5/27/14	4100		940	2500	J	640				340	U	340			
Split of J1TPX6	J1TR08	5/21/14							2200	U	2200				1650	DU	4940
FS-1	J1TR29	6/10/14	6500	B	980	4000	B	670				330	U	330			
RR-5	J1TFW4	3/24/14	83000	BN	1000	29000	B	680				340	U	340			
Duplicate of J1TFW4	J1TFW5	3/24/14	13000	B	1000	6000	B	710				340	U	340			
Equipment Blank	J1TPW4	5/21/14															

Attachment	1	Sheet No.	5 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (TPH and Physical).

Sample Location	HEIS Number	Sample Date	TPH - motor oil (high boiling) (C20 - C36)			% moisture (wet sample)		
			ug/kg	Q	PQL	%	Q	PQL
N-12	J1TPW2	5/27/14				0.98		0.10
Duplicate of J1TPW2	J1TPW3	5/27/14				0.91		0.10
N-1	J1TPV1	5/21/14				2.8		0.10
N-2	J1TPV2	5/21/14				1.2		0.10
N-3	J1TPV3	5/27/14				1.9		0.10
N-4	J1TPV4	5/27/14				1.7		0.10
N-5	J1TPV5	5/27/14				1.5		0.10
N-6	J1TPV6	5/27/14				1.5		0.10
N-7	J1TPV7	5/27/14				0.98		0.10
N-8	J1TPV8	5/27/14				1.3		0.10
N-9	J1TPV9	5/27/14				2.1		0.10
N-10	J1TPW0	5/27/14				0.92		0.10
N-11	J1TPW1	5/27/14				1.8		0.10
Split of J1TPW2	J1TPX2	5/27/14	3210	J	2160			
S-2	J1TPX6	5/21/14				1.1		0.10
Duplicate of J1TPX6	J1TR07	5/21/14				1.3		0.10
S-1	J1TPX5	5/21/14				2.8		0.10
S-3	J1TPX7	5/21/14				1.6		0.10
S-4	J1TPX8	5/21/14				1.5		0.10
S-5	J1TPX9	5/21/14				3.4		0.10
S-6	J1TR00	5/27/14				1.3		0.10
S-7	J1TR01	5/21/14				1.7		0.10
S-8	J1TR02	5/21/14				1.5		0.10
S-9	J1TR03	5/27/14				2.0		0.10
S-10	J1TR04	5/21/14				1.6		0.10
S-11	J1TR05	5/27/14				2.0		0.10
S-12	J1TR06	5/27/14				2.1		0.10
Split of J1TPX6	J1TR08	5/21/14	2200	U	2200			
FS-1	J1TR29	6/10/14				1.1		0.10
Equipment Blank	J1TPW4	5/21/14				0.10	U	0.10

Attachment	1	Sheet No.	6 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Organics).

CONSTITUENT	CLASS	N-12 - J1TPW2			Duplicate of J1TPW2 - J1TPW3			N-1 - J1TPV1			N-2 - J1TPV2			N-3 - J1TPV3		
		5/27/14			5/27/14			5/21/14			5/21/14			5/27/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	56	JX	9.7	26	JX	9.4	10	U	10	120	X	9.6	10	U	10
Acenaphthylene	PAH	8.7	U	8.7	8.4	U	8.4	9.0	U	9.0	8.6	U	8.6	9.0	U	9.0
Anthracene	PAH	68		3.0	54	X	2.9	3.0	U	3.0	110		2.9	3.1	U	3.1
Benzo(a)anthracene	PAH	300	X	3.1	150		3.0	3.2	U	3.2	620		3.1	3.2	U	3.2
Benzo(a)pyrene	PAH	6.2	U	6.2	9.4	JX	6.0	6.4	U	6.4	640		6.2	9.2	J	6.4
Benzo(b)fluoranthene	PAH	150	X	4.1	96		3.9	4.2	U	4.2	480	NX	4.0	7.9	JX	4.2
Benzo(ghi)perylene	PAH	100		7.0	55		6.7	7.2	U	7.2	400		6.9	7.2	U	7.2
Benzo(k)fluoranthene	PAH	59		3.8	34		3.7	3.9	U	3.9	220		3.8	4.0	U	4.0
Chrysene	PAH	310		4.7	120		4.5	4.8	U	4.8	700		4.7	6.7	J	4.9
Dibenz[a,h]anthracene	PAH	11	U	11	10	U	10	11	U	11	85	X	11	11	U	11
Fluoranthene	PAH	440	X	13	260	X	12	13	U	13	820		12	13	U	13
Fluorene	PAH	42	X	5.1	19	JX	4.9	5.3	U	5.3	95		5.1	5.3	U	5.3
Indeno(1,2,3-cd)pyrene	PAH	73		12	53		11	12	U	12	400		12	12	U	12
Naphthalene	PAH	12	U	12	11	U	11	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	170		12	140		11	12	U	12	210		12	12	U	12
Pyrene	PAH	520		12	270		11	12	U	12	1200		12	12	J	12
Aroclor-1016	PCB	2.6	U	2.6	2.7	U	2.7	2.8	U	2.8	13	UD	13	2.8	U	2.8
Aroclor-1221	PCB	7.7	U	7.7	8.0	U	8.0	8.1	U	8.1	39	UD	39	8.0	U	8.0
Aroclor-1232	PCB	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0	9.7	UD	9.7	2.0	U	2.0
Aroclor-1242	PCB	4.5	U	4.5	4.6	U	4.6	4.7	U	4.7	23	UD	23	4.7	U	4.7
Aroclor-1248	PCB	4.5	U	4.5	4.6	U	4.6	4.7	U	4.7	23	UD	23	4.7	U	4.7
Aroclor-1254	PCB	6.7	J	2.5	18		2.6	2.6	U	2.6	500	D	13	2.6	U	2.6
Aroclor-1260	PCB	2.5	U	2.5	2.6	U	2.6	2.6	U	2.6	13	UD	13	2.6	U	2.6

CONSTITUENT	CLASS	N-4 - J1TPV4			N-5 - J1TPV5			N-6 - J1TPV6			N-7 - J1TPV7			N-8 - J1TPV8		
		5/27/14			5/27/14			5/27/14			5/27/14			5/27/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.7	U	9.7	9.3	U	9.3	9.8	U	9.8	9.4	U	9.4	9.9	U	9.9
Acenaphthylene	PAH	8.7	U	8.7	8.4	U	8.4	8.8	U	8.8	8.5	U	8.5	8.9	U	8.9
Anthracene	PAH	3.0	U	3.0	2.8	U	2.8	3.0	U	3.0	2.9	U	2.9	3.0	U	3.0
Benzo(a)anthracene	PAH	3.1	U	3.1	3.0	U	3.0	3.1	U	3.1	3.0	U	3.0	3.2	U	3.2
Benzo(a)pyrene	PAH	6.2	U	6.2	6.0	U	6.0	7.0	JX	6.3	16	X	6.1	6.4	U	6.4
Benzo(b)fluoranthene	PAH	4.1	U	4.1	3.9	U	3.9	4.1	U	4.1	4.0	U	4.0	4.2	U	4.2
Benzo(ghi)perylene	PAH	7.0	U	7.0	6.7	U	6.7	7.1	U	7.1	8.4	JX	6.8	7.1	U	7.1
Benzo(k)fluoranthene	PAH	3.8	U	3.8	3.7	U	3.7	3.9	U	3.9	3.7	U	3.7	3.9	U	3.9
Chrysene	PAH	4.7	U	4.7	4.5	U	4.5	4.8	U	4.8	4.6	U	4.6	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	10	U	10	11	U	11	10	U	10	11	U	11
Fluoranthene	PAH	13	U	13	12	U	12	13	U	13	12	U	12	13	U	13
Fluorene	PAH	5.1	U	5.1	4.9	U	4.9	5.2	U	5.2	5.0	U	5.0	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	11	U	11	12	U	12	11	U	11	12	U	12
Naphthalene	PAH	12	U	12	11	U	11	12	U	12	11	U	11	12	U	12
Phenanthrene	PAH	12	U	12	11	U	11	12	U	12	11	U	11	12	U	12
Pyrene	PAH	12	U	12	11	U	11	12	U	12	11	U	11	12	U	12
Aroclor-1016	PCB	2.8	U	2.8	2.7	U	2.7	2.7	U	2.7	2.8	U	2.8	2.7	U	2.7
Aroclor-1221	PCB	8.0	U	8.0	7.8	U	7.8	7.9	U	7.9	8.0	U	8.0	7.8	U	7.8
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.6	U	4.6	4.5	U	4.5	4.6	U	4.6	4.6	U	4.6	4.6	U	4.6
Aroclor-1248	PCB	4.6	U	4.6	4.5	U	4.5	4.6	U	4.6	4.6	U	4.6	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6	22		2.5	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5
Aroclor-1260	PCB	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5

Attachment	1	Sheet No.	7 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Organics).

CONSTITUENT	CLASS	N-9 - J1TPV9			N-10 - J1TPW0			N-11 - J1TPW1			Split of J1TPW2 - J1TPX2			S-2 - J1TPX6		
		5/27/14			5/27/14			5/27/14			5/27/14			5/21/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	9.4	U	9.4	9.4	U	9.4	5.02	U	5.02	9.7	U	9.7
Acenaphthylene	PAH	9.0	U	9.0	8.5	U	8.5	8.4	U	8.4	5.02	U	5.02	8.7	U	8.7
Anthracene	PAH	3.0	U	3.0	2.9	U	2.9	2.9	U	2.9	16.0	J	1.67	5.8	J	3.0
Benzo(a)anthracene	PAH	3.2	U	3.2	3.0	U	3.0	3.0	U	3.0	63.2		0.54	3.1	U	3.1
Benzo(a)pyrene	PAH	6.4	U	6.4	6.0	U	6.0	6.0	U	6.0	39.9		0.54	19		6.2
Benzo(b)fluoranthene	PAH	4.2	U	4.2	4.0	U	4.0	3.9	U	3.9	55.7		0.54	4.1	U	4.1
Benzo(ghi)perylene	PAH	7.2	U	7.2	6.8	U	6.8	6.7	U	6.7	22.7		0.54	7.0	U	7.0
Benzo(k)fluoranthene	PAH	3.9	U	3.9	3.7	U	3.7	3.7	U	3.7	30.0		0.27	7.5	J	3.8
Chrysene	PAH	4.8	U	4.8	5.0	J	4.6	4.5	U	4.5	40.9		0.54	24	JX	4.7
Dibenz[a,h]anthracene	PAH	11	U	11	10	U	10	10	U	10	2.87	P	0.54	11	U	11
Fluoranthene	PAH	13	U	13	12	U	12	12	U	12	103		0.54	53	X	13
Fluorene	PAH	5.3	U	5.3	5.0	U	5.0	4.9	U	4.9	5.02	U	5.02	5.1	U	5.1
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	11	U	11	11	U	11	0.536	U	0.54	12	JX	12
Naphthalene	PAH	12	U	12	11	U	11	11	U	11	5.02	U	5.02	12	U	12
Phenanthrene	PAH	12	U	12	11	U	11	11	U	11	64.7		5.02	18	J	12
Pyrene	PAH	12	U	12	11	U	11	11	U	11	88.3		0.54	53		12
Aroclor-1016	PCB	2.8	U	2.8	2.8	U	2.8	2.7	U	2.7	1.11	U	1.11	2.8	U	2.8
Aroclor-1221	PCB	8.0	U	8.0	8.1	U	8.1	7.9	U	7.9	1.11	U	1.11	8.0	U	8.0
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0	1.11	U	1.11	2.0	U	2.0
Aroclor-1242	PCB	4.7	U	4.7	4.7	U	4.7	4.6	U	4.6	1.11	U	1.11	4.6	U	4.6
Aroclor-1248	PCB	4.7	U	4.7	4.7	U	4.7	4.6	U	4.6	1.11	U	1.11	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.6	U	2.6	1.11	U	1.11	2.6	U	2.6
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	2.6	U	2.6	1.11	U	1.11	2.6	U	2.6

CONSTITUENT	CLASS	Duplicate of J1TPX6 - J1TR07			S-1 - J1TPX5			S-3 - J1TPX7			S-4 - J1TPX8			S-5 - J1TPX9		
		5/21/14			5/21/14			5/21/14			5/21/14			5/21/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.7	U	9.7	9.9	U	9.9	9.5	U	9.5	9.8	U	9.8	10	U	10
Acenaphthylene	PAH	8.8	U	8.8	8.9	U	8.9	8.6	U	8.6	8.8	U	8.8	9.3	U	9.3
Anthracene	PAH	3.0	U	3.0	3.0	U	3.0	2.9	U	2.9	3.0	U	3.0	3.2	U	3.2
Benzo(a)anthracene	PAH	3.1	U	3.1	3.2	U	3.2	13	J	3.0	3.1	U	3.1	3.3	U	3.3
Benzo(a)pyrene	PAH	6.2	U	6.2	7.7	J	6.4	13	J	6.1	7.4	J	6.3	9.9	J	6.6
Benzo(b)fluoranthene	PAH	4.1	U	4.1	4.2	U	4.2	4.0	U	4.0	5.8	JX	4.1	4.3	U	4.3
Benzo(ghi)perylene	PAH	7.0	U	7.0	7.1	U	7.1	17	J	6.9	7.1	U	7.1	7.5	U	7.5
Benzo(k)fluoranthene	PAH	3.8	U	3.8	3.9	U	3.9	6.4	JX	3.8	3.9	U	3.9	4.1	U	4.1
Chrysene	PAH	4.7	U	4.7	4.8	U	4.8	15	JX	4.6	9.6	JX	4.8	7.0	J	5.0
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	10	U	10	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	14	J	13	26	J	12	19	J	13	13	U	13
Fluorene	PAH	5.1	U	5.1	5.2	U	5.2	5.0	U	5.0	5.2	U	5.2	5.5	U	5.5
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	J	11	12	U	12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	11	U	11	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	14	J	11	12	U	12	12	U	12
Pyrene	PAH	12	U	12	18	J	12	26	J	11	19	J	12	12	U	12
Aroclor-1016	PCB	2.7	U	2.7	2.7	U	2.7	2.8	U	2.8	2.7	U	2.7	2.8	U	2.8
Aroclor-1221	PCB	7.9	U	7.9	7.8	U	7.8	8.0	U	8.0	7.9	U	7.9	8.2	U	8.2
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.6	U	4.6	4.6	U	4.6	4.7	U	4.7	4.6	U	4.6	4.7	U	4.7
Aroclor-1248	PCB	4.6	U	4.6	4.6	U	4.6	4.7	U	4.7	4.6	U	4.6	4.7	U	4.7
Aroclor-1254	PCB	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6	2.6	U	2.6	6.3	J	2.6
Aroclor-1260	PCB	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6	2.6	U	2.6	2.6	U	2.6

Attachment	1	Sheet No.	8 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Organics).

CONSTITUENT	CLASS	S-6 - J1TR00			S-7 - J1TR01			S-8 - J1TR02			S-9 - J1TR03			S-10 - J1TR04		
		5/27/14			5/21/14			5/21/14			5/27/14			5/21/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.3	U	9.3	9.9	U	9.9	9.7	U	9.7	28	JX	9.4	9.9	U	9.9
Acenaphthylene	PAH	8.4	U	8.4	8.9	U	8.9	8.7	U	8.7	8.5	U	8.5	8.9	U	8.9
Anthracene	PAH	2.8	U	2.8	3.0	U	3.0	3.0	U	3.0	24		2.9	3.0	U	3.0
Benzo(a)anthracene	PAH	3.0	U	3.0	3.2	U	3.2	3.1	U	3.1	49	X	3.0	3.2	U	3.2
Benzo(a)pyrene	PAH	6.0	U	6.0	6.4	U	6.4	6.2	U	6.2	7.5	JX	6.0	6.3	U	6.3
Benzo(b)fluoranthene	PAH	3.9	U	3.9	4.2	U	4.2	4.1	U	4.1	67		4.0	4.2	U	4.2
Benzo(ghi)perylene	PAH	6.7	U	6.7	7.2	U	7.2	7.0	U	7.0	68		6.8	7.1	U	7.1
Benzo(k)fluoranthene	PAH	16		3.7	3.9	U	3.9	3.8	U	3.8	26		3.7	3.9	U	3.9
Chrysene	PAH	4.5	U	4.5	4.8	U	4.8	4.7	U	4.7	71	X	4.6	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	10	U	10	11	U	11	11	U	11	10	U	10	11	U	11
Fluoranthene	PAH	12	U	12	13	U	13	13	U	13	140		12	13	U	13
Fluorene	PAH	4.9	U	4.9	5.2	U	5.2	5.1	U	5.1	17	J	5.0	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	11	U	11	12	U	12	12	U	12	60		11	12	U	12
Naphthalene	PAH	11	U	11	12	U	12	12	U	12	11	U	11	12	U	12
Phenanthrene	PAH	11	U	11	12	U	12	12	U	12	76		11	12	U	12
Pyrene	PAH	24	J	11	12	U	12	12	U	12	160		11	12	U	12
Aroclor-1016	PCB	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.8	U	2.8	2.8	U	2.8
Aroclor-1221	PCB	7.8	U	7.8	7.8	U	7.8	7.8	U	7.8	8.1	U	8.1	8.1	U	8.1
Aroclor-1232	PCB	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.5	U	4.5	4.5	U	4.5	4.5	U	4.5	4.7	U	4.7	4.7	U	4.7
Aroclor-1248	PCB	4.5	U	4.5	4.5	U	4.5	4.5	U	4.5	4.7	U	4.7	4.7	U	4.7
Aroclor-1254	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	11		2.6	2.6	U	2.6
Aroclor-1260	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.6	U	2.6

CONSTITUENT	CLASS	S-11 - J1TR05			S-12 - J1TR06			Split of J1TPX6 - J1TR08			FS-1 - J1TR29			RR-5 - J1TFW4		
		5/27/14			5/27/14			5/21/14			6/10/14			3/24/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	9.4	U	9.4	5.06	U	5.06	9.3	U	9.3	58	JX	10
Acenaphthylene	PAH	9.0	U	9.0	8.5	U	8.5	5.06	U	5.06	8.4	U	8.4	9.2	U	9.2
Anthracene	PAH	3.1	U	3.1	2.9	U	2.9	1.69	U	1.69	2.8	U	2.8	56	X	3.1
Benzo(a)anthracene	PAH	3.2	U	3.2	3.0	U	3.0	2.98		0.539	7.0	JX	3.0	660		3.3
Benzo(a)pyrene	PAH	6.4	U	6.4	6.0	U	6.0	2.50		0.539	11	J	6.0	490		6.5
Benzo(b)fluoranthene	PAH	4.2	U	4.2	4.0	U	4.0	3.03		0.539	3.9	U	3.9	400	X	4.3
Benzo(ghi)perylene	PAH	7.2	U	7.2	6.8	U	6.8	0.539	U	0.539	6.7	U	6.7	230		7.3
Benzo(k)fluoranthene	PAH	110	X	3.9	3.7	U	3.7	1.81		0.270	9.0	J	3.7	180		4.0
Chrysene	PAH	4.8	U	4.8	4.6	U	4.6	2.97		0.539	13	J	4.5	730		4.9
Dibenz[a,h]anthracene	PAH	11	U	11	10	U	10	0.539	U	0.539	10	U	10	24	JX	11
Fluoranthene	PAH	15	JX	13	12	U	12	4.69		0.539	22	J	12	290	X	13
Fluorene	PAH	5.3	U	5.3	5.0	U	5.0	5.06	U	5.06	4.9	U	4.9	69	X	5.4
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	11	U	11	0.539	U	0.539	11	U	11	200		12
Naphthalene	PAH	12	U	12	11	U	11	5.06	U	5.06	11	U	11	12	U	12
Phenanthrene	PAH	12	U	12	11	U	11	5.06	U	5.06	11	U	11	28	JX	12
Pyrene	PAH	200		12	11	U	11	4.20		0.539	24	J	11	590		12
Aroclor-1016	PCB	2.6	U	2.6	2.6	U	2.6	1.12	U	1.12	2.6	U	2.6	3.0	UN	3.0
Aroclor-1221	PCB	7.5	U	7.5	7.5	U	7.5	1.12	U	1.12	7.6	U	7.6	8.6	U	8.6
Aroclor-1232	PCB	1.9	U	1.9	1.9	U	1.9	1.12	U	1.12	1.9	U	1.9	2.1	U	2.1
Aroclor-1242	PCB	4.4	U	4.4	4.4	U	4.4	1.12	U	1.12	4.4	U	4.4	5.0	U	5.0
Aroclor-1248	PCB	4.4	U	4.4	4.4	U	4.4	1.12	U	1.12	4.4	U	4.4	5.0	U	5.0
Aroclor-1254	PCB	2.4	U	2.4	2.4	U	2.4	1.12	U	1.12	3.8	J	2.5	8.2	J	2.8
Aroclor-1260	PCB	2.4	U	2.4	2.4	U	2.4	1.12	U	1.12	2.5	U	2.5	2.8	UN	2.8

Attachment	1	Sheet No.	9 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Organics).

CONSTITUENT	CLASS	Duplicate of J1TFW4 - J1TFW5 3/24/14		
		ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10
Acenaphthylene	PAH	9.4	U	9.4
Anthracene	PAH	3.2	U	3.2
Benzo(a)anthracene	PAH	11	JX	3.3
Benzo(a)pyrene	PAH	48	N	6.7
Benzo(b)fluoranthene	PAH	37	X	4.4
Benzo(ghi)perylene	PAH	12	JNX	7.5
Benzo(k)fluoranthene	PAH	14	J	4.1
Chrysene	PAH	55	X	5.0
Dibenz[a,h]anthracene	PAH	11	U	11
Fluoranthene	PAH	29	JX	14
Fluorene	PAH	5.5	U	5.5
Indeno(1,2,3-cd)pyrene	PAH	26	J	12
Naphthalene	PAH	12	U	12
Phenanthrene	PAH	12	U	12
Pyrene	PAH	37	J	12
Aroclor-1016	PCB	2.9	U	2.9
Aroclor-1221	PCB	8.5	U	8.5
Aroclor-1232	PCB	2.1	U	2.1
Aroclor-1242	PCB	4.9	U	4.9
Aroclor-1248	PCB	4.9	U	4.9
Aroclor-1254	PCB	10	J	2.7
Aroclor-1260	PCB	2.7	U	2.7

Attachment	1	Sheet No.	10 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Organics).

CONSTITUENT	Class	RR-5 - J1TFW4			Duplicate of J1TFW4 - J1TFW5		
		3/24/14			3/24/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL
Aldrin	SVOA	0.27	U	0.27	0.26	U	0.26
Alpha-BHC	SVOA	0.23	U	0.23	0.22	U	0.22
alpha-Chlordane	SVOA	0.34	U	0.34	0.33	U	0.33
beta-BHC	SVOA	0.71	U	0.71	0.68	U	0.68
Delta-BHC	SVOA	0.43	U	0.43	0.41	U	0.41
4-4'-DDD	SVOA	0.58	U	0.58	0.56	U	0.56
4-4'-DDE	SVOA	0.25	U	0.25	0.25	U	0.25
4-4'-DDT	SVOA	0.63	U	0.63	0.61	U	0.61
Dieldrin	SVOA	0.22	U	0.22	0.22	U	0.22
Endosulfan I	SVOA	0.19	U	0.19	0.18	U	0.18
Endosulfan II	SVOA	0.31	U	0.31	0.30	U	0.30
Endosulfan sulfate	SVOA	0.29	U	0.29	0.28	U	0.28
Endrin	SVOA	0.33	U	0.33	0.32	U	0.32
Endrin aldehyde	SVOA	0.18	U	0.18	0.18	U	0.18
Endrin ketone	SVOA	0.52	U	0.52	0.50	U	0.50
Gamma-BHC (Lindane)	SVOA	0.49	U	0.49	0.48	U	0.48
gamma-Chlordane	SVOA	0.28	U	0.28	0.27	U	0.27
Heptachlor	SVOA	0.23	U	0.23	0.22	U	0.22
Heptachlor epoxide	SVOA	0.45	U	0.45	0.44	U	0.44
Methoxychlor	SVOA	0.48	U	0.48	0.46	U	0.46
Toxaphene	SVOA	17	U	17	16	U	16
1,2,4-Trichlorobenzene	SVOA	27	U	27	29	U	29
1,2-Dichlorobenzene	SVOA	21	U	21	23	U	23
1,3-Dichlorobenzene	SVOA	12	U	12	12	U	12
1,4-Dichlorobenzene	SVOA	13	U	13	14	U	14
2,4,5-Trichlorophenol	SVOA	9.8	U	9.8	10	U	10
2,4,6-Trichlorophenol	SVOA	9.8	U	9.8	10	U	10
2,4-Dichlorophenol	SVOA	9.8	U	9.8	10	U	10
2,4-Dimethylphenol	SVOA	64	U	64	69	U	69
2,4-Dinitrophenol	SVOA	330	U	330	350	U	350
2,4-Dinitrotoluene	SVOA	64	U	64	69	U	69
2,6-Dinitrotoluene	SVOA	27	U	27	29	U	29
2-Chloronaphthalene	SVOA	9.8	U	9.8	10	U	10
2-Chlorophenol	SVOA	20	U	20	22	U	22
2-Methylnaphthalene	SVOA	19	U	19	20	U	20
2-Methylphenol (cresol, o-)	SVOA	13	U	13	14	U	14
2-Nitroaniline	SVOA	49	U	49	52	U	52
2-Nitrophenol	SVOA	9.8	U	9.8	10	U	10
3,3'-Dichlorobenzidine	SVOA	88	U	88	94	U	94
3+4 Methylphenol (cresol, m+p)	SVOA	32	U	32	34	U	34
3-Nitroaniline	SVOA	71	U	71	76	U	76

Attachment	1	Sheet No.	11 of 12
Originator	J. D. Skoglie	Date	7/1/14
Checked	I. B. Berezovskiy	Date	7/1/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Attachment 1. 100-N-84:2 Subsite Verification Sampling Data (Organics).

CONSTITUENT	Class	RR-5 - J1TFW4			Duplicate of J1TFW4 - J1TFW5		
		3/24/14			3/24/14		
		ug/kg	Q	PQL	ug/kg	Q	PQL
4,6-Dinitro-2-methylphenol	SVOA	320	U	320	340	U	340
4-Bromophenylphenyl ether	SVOA	19	U	19	20	U	20
4-Chloro-3-methylphenol	SVOA	64	U	64	69	U	69
4-Chloroaniline	SVOA	80	U	80	85	U	85
4-Chlorophenylphenyl ether	SVOA	20	U	20	22	U	22
4-Nitroaniline	SVOA	71	U	71	75	U	75
4-Nitrophenol	SVOA	95	U	95	100	U	100
Acenaphthene	SVOA	10	U	10	130	J	11
Acenaphthylene	SVOA	17	U	17	18	U	18
Anthracene	SVOA	17	U	17	390		18
Benzo(a)anthracene	SVOA	39	J	20	470		21
Benzo(a)pyrene	SVOA	32	J	20	310	J	21
Benzo(b)fluoranthene	SVOA	45	J	26	430		27
Benzo(ghi)perylene	SVOA	16	U	16	130	J	17
Benzo(k)fluoranthene	SVOA	39	U	39	140	J	42
Bis(2-chloro-1-methylethyl)ether	SVOA	22	U	22	24	U	24
Bis(2-Chloroethoxy)methane	SVOA	22	U	22	24	U	24
Bis(2-chloroethyl) ether	SVOA	16	U	16	17	U	17
Bis(2-ethylhexyl) phthalate	SVOA	45	U	45	48	U	48
Butylbenzylphthalate	SVOA	42	U	42	45	U	45
Carbazole	SVOA	35	U	35	230	J	37
Chrysene	SVOA	47	J	26	440		28
Dibenz[a,h]anthracene	SVOA	19	U	19	29	J	20
Dibenzofuran	SVOA	20	U	20	110	J	21
Diethyl phthalate	SVOA	25	U	25	27	U	27
Dimethyl phthalate	SVOA	22	U	22	33	J	24
Di-n-butylphthalate	SVOA	28	U	28	30	U	30
Di-n-octylphthalate	SVOA	14	U	14	15	U	15
Fluoranthene	SVOA	39	J	35	1200	X	37
Fluorene	SVOA	18	U	18	180	J	19
Hexachlorobenzene	SVOA	28	U	28	30	U	30
Hexachlorobutadiene	SVOA	9.8	U	9.8	10	U	10
Hexachlorocyclopentadiene	SVOA	49	U	49	52	U	52
Hexachloroethane	SVOA	21	U	21	22	U	22
Indeno(1,2,3-cd)pyrene	SVOA	21	U	21	130	J	23
Isophorone	SVOA	17	U	17	18	U	18
Naphthalene	SVOA	30	U	30	32	U	32
Nitrobenzene	SVOA	21	U	21	23	U	23
N-Nitroso-di-n-dipropylamine	SVOA	30	U	30	32	U	32
N-Nitrosodiphenylamine	SVOA	20	U	20	22	U	22
Pentachlorophenol	SVOA	320	U	320	340	U	340
Phenanthrene	SVOA	17	U	17	1300	X	18
Phenol	SVOA	18	U	18	19	U	19
Pyrene	SVOA	54	J	12	1000	X	13

Attachment	1	Sheet No.	12 of 12
Originator	J. D. Skoglie	Date	6/30/14
Checked	I. B. Berezovskiy	Date	6/30/14
Calc. No.	0100N-CA-V0287	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-N

Discipline: Environmental *Calculation No: 0100N-CA-V0288

Subject: 100-N-84:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2010

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 4 Total = 5	J. D. Skoglie	T. Q. Howell	L. B. Berezovskiy	S. G. Wilkinson	8/20/14

SUMMARY OF REVISION

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

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	7/24/2014	Calc. No.:	0100N-CA-V0288	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	T. Q. Howell	Date:	7/24/2014
Subject:	100-N-84:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 4

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for the 100-N-84:2 subsite. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2013), 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 x 10^{-6} for individual carcinogens
4) A cumulative excess cancer risk of ≤1 x 10^{-5} for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 2006, *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites*, DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2013, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area*, DOE/RL-2005-93, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

3) DOE-RL, 2014a, *"100-N-84:2 and River Road Agreement"*, CCN 175488 to W. S. Thompson from J. C. Chance, Washington Closure Hanford, Richland, Washington, April 7.

4) DOE-RL, 2014b, *"100-N-84:2 Status"*, CCN 176376 to W. S. Thompson from J. C. Chance, Washington Closure Hanford, Richland, Washington, June 25.

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

6) WCH, 2014a, *100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations,* 0100N-CA-V0287, Washington Closure Hanford, Inc., Richland, Washington.

7) WCH, 2014b, *Remaining Sites Verification Package for the 100-N-84:2, 100-N Area Fuel and Foam Pipelines Waste Site*, Attachment to Waste Site Reclassification Form 2014-088, Washington Closure Hanford, Richland, Washington.

SOLUTION:

1) Generate an HQ for each noncarcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the individual HQ of ≤1.0 (DOE-RL 2013).

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

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	7/24/2014	Calc. No.:	0100N-CA-V0288	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	T. Q. Howell	Date:	7/24/2014
Subject:	100-N-84:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 4	

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the excess cancer risk of $\leq 1 \times 10^{-6}$ (DOE-RL 2013).

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

METHODOLOGY:

The 100-N-84:2 subsite is comprised of two decision units for verification sampling consisting of the north excavation and south excavation areas. Two focused samples (FS-1 and RR-5) were also taken. The direct contact hazard quotient and carcinogenic risk calculations for the 100-N-84:2 subsite were conservatively calculated for the entire waste site using the greater of the maximum or statistical verification soil sample results (WCH 2014a). Of the contaminants of potential concern (COPCs) for this site, boron, hexavalent chromium, molybdenum, the detected semivolatile organic compounds (SVOCs), the detected polycyclic aromatic hydrocarbons (PAHs), and aroclor-1254 require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Although total petroleum hydrocarbons (diesel range extended) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the statistical value for boron is 1.6 mg/kg, divided by the noncarcinogenic RAG value of 16,000 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 1.0×10^{-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 3.2×10^{-1}. Comparing this value to the requirement of ≤ 1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, then multiplied by 1.0×10^{-6}. For example, the maximum value for aroclor-1254 is 0.500 mg/kg, divided by 0.5 mg/kg, and multiplied as indicated, is 1.0×10^{-6}. Comparing this value, and all other individual values, to the requirement of $\leq 1 \times 10^{-6}$, 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 3.0×10^{-6}. Comparing this value to the requirement of $\leq 1 \times 10^{-5}$, this criterion is met.

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	7/24/2014	Calc. No.:	0100N-CA-V0288	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	T. Q. Howell	Date:	7/24/2014
Subject:	100-N-84:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 4	

RESULTS:

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

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

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-N-84:2 Subsite (2 Pages).

Contaminants of Potential Concern [a]	Maximum or Statistical Value [b] (mg/kg)	Noncarcinogen RAG [c] (mg/kg)	Hazard Quotient	Carcinogen RAG [c] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.6	16,000	1.0E-04	--	--
Chromium, hexavalent [d]	0.408	240	1.7E-03	2.1	1.9E-07
Molybdenum	0.34	400	8.5E-04	--	--
Semivolatiles					
Carbazole	0.230	--	--	50	4.6E-09
Dibenzofuran	0.110	160	6.9E-04	--	--
Dimethylphthalate	0.033	80,000	4.1E-07	--	--
Total Petroleum Hydrocarbons					
TPH - Diesel Range EXT [e]	111	--	--	--	--
Polycyclic Aromatic Hydrocarbons [f]					
Acenaphthene	0.120	4,800	2.5E-05	--	--
Anthracene	0.110	24,000	4.6E-06	--	--
Benzo(a)anthracene	0.660	--	--	1.37	4.8E-07
Benzo(a)pyrene	0.011	--	--	0.137	8.0E-08
Benzo(b)fluoranthene	0.480	--	--	1.37	3.5E-07
Benzo(ghi)perylene [g]	0.400	2,400	1.7E-04	--	--
Benzo(k)fluoranthene	0.220	--	--	13.7	1.6E-08
Chrysene	0.730	--	--	137	5.3E-09
Dibenz(a,h)anthracene	0.085	--	--	0.137	6.2E-07
Fluoranthene	0.820	3,200	2.6E-04	--	--
Fluorene	0.095	3,200	3.0E-05	--	--
Indeno(1,2,3-cd)pyrene	0.400	--	--	1.37	2.9E-07
Phenanthrene [g]	0.210	24,000	8.8E-06	--	--
Pyrene	1.2	2,400	5.0E-04	--	--

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	7/28/2014	Calc. No.:	0100N-CA-V0288	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	T. Q. Howell	Date:	7/28/2014
Subject:	100-N-84:2 Subsite Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	4 of 4

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-N-84:2 Subsite (2 Pages).

Contaminants of Potential Concern [a]	Maximum or Statistical Value [b] (mg/kg)	Noncarcinogen RAG [c] (mg/kg)	Hazard Quotient	Carcinogen RAG [c] (mg/kg)	Carcinogen Risk
Polychlorinated Biphenyls					
Aroclor-1254	0.500	1.6	3.1E-01	0.5	1.0E-06
Totals					
Cumulative Hazard Quotient:			**3.2E-01**		
Cumulative Excess Cancer Risk:					**3.0E-06**

Notes:

[a] = Method 8310 (polycyclic aromatic hydrocarbons) is specifically meant to analyze for PAHs; therefore, data from this method was used preferentially over the method 8270 data for site evaluation of the PAH analytes.

[b] = From WCH (2014a).

[c] = Value obtained from the 100-N Area RDR/RAWP (DOE-RL 2013) or *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

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

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

[f] = Benzo(a)pyrene is attributed to road asphalt and/or asphaltic pipeline coatings within the Northern Excavation decision unit and the River Road decision unit (DOE-RL 2014a, DOE-RL 2014b). Therefore, data will not be used for benzo(a)pyrene within these two decision units. However, benzo(a)pyrene data will be used from the South Excavation and focused samples. This is discussed in the RSVP for this site (WCH 2014b).

[g] = Toxicity data for this chemical is not available. The cleanup levels are based on use of surrogate chemicals.
benzo(g,h,i)perylene surrogate:
phenanthrene surrogate: anthracene
-- = not applicable
RAG = remedial action goal

CONCLUSION:

The calculations in Table 1 demonstrate that the 100-N-84:2 subsite meets the requirements for the direct contact hazard quotient and carcinogenic (excess cancer) risk as identified in the RDR/RAWP (DOE-RL 2013) and SAP (DOE-RL 2006). The direct contact hazard quotient and carcinogenic (excess cancer) risk calculations are for use in the RSVP for the 100-N-84:2 subsite.

Acrobat 8.0

CALCULATION COVER SHEET

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

Area: 100-N

Discipline: Environmental *Calculation No: 0100N-CA-V0289

Subject: 100-N-84:2 Subsite Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater

Computer Program: Excel Program No: Excel 2010

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	J. D. Skoglie	I. B. Berezovskiy	T. Q. Howell	S. G. Wilkinson	8/20/14

SUMMARY OF REVISION

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

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	06/30/14	Calc. No.:	0100N-CA-V0287	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	06/30/14
Subject:	100-N-84:2 Subsite Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					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-N-84:2 subsite. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) for the 100-N Area (DOE-RL 2013), 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 x 10^{-6} for individual carcinogens
4) A cumulative excess cancer risk of ≤1 x 10^{-5} for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 2013, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area*, DOE/RL-2005-93, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2014a, *"100-N-84:2 and River Road Agreement"*, CCN 175488 to W. S. Thompson from J. C. Chance, Washington Closure Hanford, Richland, Washington, April 7.

3) DOE-RL, 2014b, *"100-N-84:2 Status"*, CCN 176376 to W. S. Thompson from J. C. Chance, Washington Closure Hanford, Richland, Washington, June 25.

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

5) WCH, 2014a, *100-N-84:2 Subsite Cleanup Verification 95% UCL Calculations,* 0100N-CA-V0287, Washington Closure Hanford, Inc., Richland, Washington.

6) WCH, 2014b, *Remaining Sites Verification Package for the 100-N-84:2, 100-N Area Fuel and Foam Pipelines Waste Site*, Attachment to Waste Site Reclassification Form 2014-088, Washington Closure Hanford, 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 (DOE-RL 2013).

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

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	06/30/14	Calc. No.:	0100N-CA-V0289	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	06/30/14
Subject:	100-N-84:2 Subsite Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 2 of 3	

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 (DOE-RL 2013).

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

METHODOLOGY:

The 100-N-84:2 subsite is comprised of two decision units for verification sampling, consisting of the north excavation (N) and south excavation (S). In addition, two focused samples were collected; FS-1 and RR-5. The protection of groundwater hazard quotient and carcinogenic risk calculations for the 100-N-84:2 subsite were conservatively calculated for the entire subsite using the statistical or maximum value for each analyte (WCH 2014a). Based on the generic site RESRAD model (DOE-RL 2013) and a vadose zone of approximately 16 m (53 ft) thickness, a K_d of 4.6 or greater is required to show no predicted migration to groundwater in 1,000 years. Boron, hexavalent chromium, and dimethyl phthalate were included because they have a K_d of less than 4.6, and no Hanford Site background value has been established. All other site nonradionuclide COPCs were undetected, quantified below background levels, or have a K_d greater than or equal to 4.6. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (µg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720 (3)(a)(ii)(A), (1996) x 100 x 1 mg/1000 µg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii) (A) (1996). For example, the maximum value for boron of 1.6 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg is 5.0×10^{-3}. Comparing this value to the requirement of ≤1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The cumulative HQ for the 100-N-84:2 subsite is 9.0×10^{-2}. Comparing this value to the requirement of ≤1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, and then multiplied by 1×10^{-6}. There were not any constituents in this calculation that had a carcinogenic RAG associated with it. Therefore, the requirement of $\leq 1 \times 10^{-6}$ is met. Furthermore, the criterion for cumulative excess cancer risk for carcinogens is also met.

4) The soil cleanup RAGs for protection of groundwater are based on the "100 times" provision in WAC 173-340-740(3)(a)(ii)(A). WAC 173-340-740(3)(a)(ii)(A) (1996) provides the "100 times rule" but also states "unless it can be demonstrated that a higher soil concentration is protective of

Washington Closure Hanford CALCULATION SHEET

Originator:	J. D. Skoglie	Date:	06/30/14	Calc. No.:	0100N-CA-V0289	Rev.:	0
Project:	100-N Field Remediation	Job No:	14655	Checked:	I. B. Berezovskiy	Date:	06/30/14
Subject:	100-N-84:2 Subsite Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 3 of 3	

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.

RESULTS:

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

Table 1 shows the results of the calculations.

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 100-N-84:2 Subsite.

Contaminants of Potential Concern [a]	Maximum or Statistical Value [b] (mg/kg)	Noncarcinogen RAG [c] (mg/kg)	Hazard Quotient	Carcinogen RAG [c] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.6	320	5.0E-03	--	--
Chromium, hexavalent	0.408	4.8	8.5E-02	--	--
Semivolatiles					
Dimethylphthalate	0.033	80,000	4.1E-07	--	--
Totals					
Cumulative Hazard Quotient:			**9.0E-02**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:

[a] = Because polycyclic aromatic hydrocarbons (PAHs) are associated with road asphalt they will not be included in the direct contact hazard quotient as discussed in the RSVP for this site and documented in agreements CCN 176376 and 175488 (WCH 2014b, DOE-RL 2014a, and DOE-RL 2014b).

[b] = From WCH (2014a).

[c] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the 100 times model.

-- = not applicable

RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 100-N-84:2 subsite meets the requirements for the hazard quotient and excess carcinogenic risk for protection of groundwater as identified in the RDR/RAWP (DOE-RL 2013).

APPENDIX G

DATA QUALITY ASSESSMENT

APPENDIX G

DATA QUALITY ASSESSMENT

VERIFICATION SAMPLING

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2014c). This DQA was performed in accordance with site-specific data quality objectives found in the *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites* (100-N Area SAP) (DOE-RL 2006).

A review of the sample design (WCH 2014c), field logbooks (WCH 2014a, 2014b), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical analysis (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).

Verification sample data collected at the 100-N-84:2 waste subsite were provided by the laboratories in sample delivery groups (SDGs): JP0807, XP0094, JP0810, and XP0096. SDG JP0807 was submitted for third-party validation.

The data for the river road agreement samples were provided in SDGs MA08104 and JP0767. Major deficiencies were identified in this data set and are discussed in the Major Deficiencies section below. Minor deficiencies identified in the analytical data sets are discussed in the minor deficiencies section. 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

SDG JP0807

In the ICP metals analysis, MS recoveries are outside the QC limits for antimony (28%), calcium (-9%), copper (24%), magnesium (2%), silicon (-0.5%), vanadium (-0.3%), and zinc (12%). Third-party validation qualified the detected results for these analytes as estimated with “J” flags and qualified the non-detected results as rejected with “UR” flags. This resulted in the rejection of 11 antimony results in SDG JP0807. The driver for the 100-N-84:2 pipelines remediation is petroleum hydrocarbons. Antimony is incidental to the evaluation of that remediation. The resulting data set is sufficient and usable for decision-making purposes.

MINOR DEFICIENCIES

SDG JP0807

This SDG is comprised of 11 statistical verification soil samples (J1TPV1, J1TPV2, J1TPX5 through J1TPX9, J1TR01, J1TR02, J1TR04, and J1TR07) from the 100-N-84:2 excavation. Samples J1TPX6 and J1TR07 comprise a field duplicate pair. These samples were collected on April 21, 2014. All samples were analyzed for gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), ICP metals, and mercury. Additionally, one equipment blank (J1TPW4) is included in this SDG and was analyzed for ICP metals and mercury. SDG JP0807 was submitted for third-party validation. Minor deficiencies are as follows:

In the ICP metals analysis, matrix spike (MS) recoveries were outside the QC limits for arsenic (50%), barium (37%), beryllium (48%), boron (50%), cadmium (58%), chromium (30%), cobalt (41%), lead (46%), molybdenum (51%), nickel (37%), potassium (41%), selenium (52%), silver (59%) and sodium 51%). Third-party validation qualified all results in SDG JP0807 as estimated with “J” flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, MS recoveries were outside the QC limits for antimony (28%), calcium (-9%), copper (24%), magnesium (2%), silicon (-0.5%), vanadium (-0.3%), and zinc (12%). Undetected results for these analytes are discussed above in the Major Deficiencies section. Detected results for these analytes 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 laboratory control sample (LCS) recovery for silicon (13%) is outside the QC limits. Third-party validation qualified all silicon results in SDG JP0807 as estimated with “J” flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, relative percent differences (RPDs) calculated for aluminum (50%), barium (54%), calcium (49%), chromium (46%), copper (46%), iron (49%), magnesium (47%), manganese (50%), silicon (54%), sodium (50%), vanadium (51%), and zinc (46%) are above the QC range (less than 30%). Third-party validation qualified all associated data in SDG JP0807 as estimated with “J” flags. Estimated data are usable for decision-making purposes.

In the PCB analysis, RPDs calculated by the laboratory between the primary and confirmatory columns exceeded the laboratories QC limit of 40%. The laboratory has qualified the associated data with “X” flags. Matrix interference has been attributed to these deficiencies. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, chromatographic peaks in samples J1TPV2 and J1TPX9 did not resolve aroclor-1254 from aroclor-1260 and appeared to contain both analytes. The peaks were quantified together and reported as the predominant analyte. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, the RPD calculated on the MS/MSD pair for aroclor-1016 exceeded the QC limit. However, and acceptable LCS recovery for aroclor-1016 indicates that the analytical system was operating within control. These data are usable for decision-making purposes.

In the PAH analysis, RPDs calculated by the laboratory between the primary and confirmatory columns exceeded the laboratories QC limit of 40%. The laboratory has qualified the associated data with "X" flags. Matrix interference has been attributed to these deficiencies. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, the MSD the surrogate terphenyl-d14 was recovered outside QC limits and biased high. Additionally, the MSD recovery for benzo(b)fluoranthene was outside the QC limits and biased low. The laboratory has qualified the associated benzo(b)fluoranthene results with "N" flags. Acceptable LCS results indicate that the analytical system was operating within control and suggest matrix interference. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, serial dilutions indicate physical and chemical matrix interference for several analytes. The laboratory has qualified the associated data with "X" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, barium was detected in the method blank (MB). However, the concentration detected is less than half of the reporting limit and will have no substantial impact on the field sample data. The data are usable for decision-making purposes.

In the ICP metals analysis, iron was detected in the MB at a concentration greater than half of the reporting limit. However, the associated field sample concentrations are more than twenty times the MB concentration and will not be substantially impacted. It should be noted that iron is a common laboratory contaminant in the ICP metals analysis. The data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for cadmium is outside the QC limits, suggesting a high bias in the field sample results. The laboratory has qualified the associated cadmium data with "N" flags. However, all of the associated field sample data for cadmium is below the reporting limits. The high biased data will have no impact on the evaluation of the 100-N-84:2 waste site. The data are usable for decision-making purposes.

SDG XP0094

This SDG is comprised of one split sample (J1TR08) collected from the south sampling unit of the 100-N-84:2 excavation. Samples J1TPX6 and J1TR07 comprise the associated field duplicate pair which is part of SDG JP0807. This sample was collected on April 21, 2014. This sample was analyzed for gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, PAH, PCBs, ICP metals, and mercury. Minor deficiencies are as follows:

In the PCB analysis, a poor surrogate recovery was reported for one of the continuing calibration verification (CCV) standards. However, the CCV target analyte results were within the QC

range and all of the field sample results had surrogate recoveries within the QC limits. There is no perceived impact on the field sample data. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery for silicon (40.8%) is outside the QC limits. A post digestion spike was prepared and analyzed for silicon (138%) which is also outside the QC limits. Silicon is not a regulated compound and is incidental to the ICP metals analysis. Irregularities in the analysis silicon will not impact the evaluation of the 100-N-84:2 waste site. The data are usable for decision-making purposes.

SDG JP0810

This SDG is comprised of 15 statistical verification soil samples (J1TPV3 through J1TPV9, J1TPW0 through J1TPW3, J1TR00, J1TR03, J1TR05, and J1TR06) from the 100-N-84:2 excavation. Samples J1TPW2 and J1TPW3 comprise a field duplicate pair. These samples were collected on April 27, 2014. All samples were analyzed for gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, PAH, PCBs, ICP metals, and mercury. Minor deficiencies are as follows:

In the PCB analysis, due to matrix interferences and additional sulfuric acid cleanup was performed. This action was taken to improve analytical accuracy and should have no negative impact on the sample data. The data are usable for decision-making purposes.

In the PCB analysis, chromatographic peaks in samples J1TPV5, J1TPW2, J1TPW3, and J1TR03 did not resolve aroclor-1254 from aroclor-1260 and appeared to contain both analytes. The peaks were quantified together and reported as the predominant analyte. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, RPDs calculated by the laboratory between the primary and confirmatory columns exceeded the laboratories QC limit of 40%. The laboratory has qualified the associated data with “X” flags. Matrix interference has been attributed to these deficiencies. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, serial dilutions indicate physical and chemical matrix interference for several analytes. The laboratory has qualified the associated data with “X” flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, copper was detected in the method blank (MB). However, the concentration detected is less than half of the reporting limit and there is no substantial impact on the field sample data. The data are usable for decision-making purposes.

In the ICP metals analysis, iron was detected in the MB at a concentration greater than half of the reporting limit. However, the associated field sample concentrations are more than twenty times the MB concentration and will not be substantially impacted. It should be noted that iron is a common laboratory contaminant in the ICP metals analysis. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery for boron (79%) is outside the laboratory QC limits but within the project QC limits. There is no other indication that the analytical system was out of control. This result may be due to natural heterogeneities in the sample matrix. Acceptable results in the LCS confirm quantitation. The laboratory has qualified the associated boron data with "N" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

SDG XP0096

This SDG is comprised of one split sample (J1TPX2) collected from the north sampling unit of the 100-N-84:2 excavation. Samples J1TPW2 and J1TPW3 comprise the associated field duplicate pair which is part of SDG JP0810. This sample was collected on April 27, 2014. This sample was analyzed for gasoline range petroleum, diesel range petroleum, heavy oil range petroleum, PAH, PCBs, ICP metals, and mercury. Minor deficiencies are as follows:

In the total petroleum hydrocarbon (TPH) analysis, MS recoveries for diesel range organics (DRO) (69.2%) and motor oil (MO) (67.4%) are outside the QC range. These deficiencies are most probably due to natural heterogeneities in the sample matrix used. The data are usable for decision-making purposes.

In the TPH analysis, the RPD for MO (22%) is above the laboratories QC range but within the projects QC range. This result was obtained from the MS/MSD data and is most probably due to natural heterogeneities in the sample matrix. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recovery for silicon (19.8%) and the laboratories RPD calculated for silicon (27.8%) are both outside the QC limits. Additionally, a post digestion spike and a serial dilution was prepared and analyzed for silicon which are also outside the laboratory QC limits. These results indicate matrix interference and the field sample data for silicon may be considered estimated. Silicon is not a regulated compound, therefore, deficiencies in the sample data for silicon has no impact on the evaluation of the 100-N-84:2 waste site. The data are usable for the intended purpose.

In the ICP metals analysis, the RPD calculated for nickel (45.1%) is outside the QC limits. Elevated RPDs in environmental soil samples are generally attributed to natural heterogeneities in the sample matrix. The data are usable for decision-making purposes.

SDG MA08104

This SDG comprises two focused soil samples (J1TFW4, J1TFW5) collected per the river road agreement on March 24, 2014. These samples were analyzed for asbestos. No major or minor deficiencies were noted in the dataset. Asbestos was not detected. The data are usable for decision-making purposes.

SDG JP0767

This SDG comprises two focused soil samples (J1TFW6, J1TFW7) collected per the river road agreement on March 24, 2014. Samples J1TFW6 and J1TFW7 were analyzed for SVOA, gasoline range petroleum (GRO), DRO, nitrate, nitrite, pesticides, PCBs, PAH, ICP metals, and mercury. Minor deficiencies are as follows:

In the SVOA, the MS/MSD recoveries for fluoranthene, phenanthrene, and pyrene are outside the QC limits. Acceptable LCS results indicate that the analytical system was operating in control. The deficient MS/MSD results are most probably due to natural heterogeneities in the sample matrix. The laboratory has qualified the associated sample results with "T" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, chromatographic peaks in samples J1TFW4 and J1TFW5 did not resolve aroclor-1254 from aroclor-1260 and appeared to contain both analytes. The peaks were quantified together and reported as the predominant analyte. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, the MS recoveries for aroclor-1016 and aroclor-1260 are outside the QC limits. Additionally, the RPDs for these compounds between the MS and MSD were above the QC limits. The laboratory has qualified the associated sample data with "N" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the TPH DRO analysis, also known as the NWTPH-Dx analysis, low levels of DRO were detected in the MB. Because the detected concentrations are less than ½ of the reporting limit the laboratory determined that no corrective action was needed. For sample results with detected concentrations of DRO the laboratory has qualified the data with "B" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the NWTPH-Dx analysis, the MS recovery for the extended range DRO is outside the QC limits. The laboratory has qualified the associated data with "N" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, RPD's calculated between the primary and confirmatory columns exceeded 40% for some analytes in samples J1TFW4 and J1TFW5. The laboratory determined these results are due to matrix interference and has qualified the associated data with "X" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, the MS recoveries for benzo(a)pyrene and benzo(g,h,i)perylene are outside the QC limits. Additionally, the RPD limits for these compounds were exceeded. The laboratory has qualified the associated sample data with "N" flags. Acceptable LCS recoveries indicate the analytical system was operating within control and that the MS results are due to matrix interference. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, serial dilutions indicate physical and chemical (matrix) interference for several analytes. The laboratory has qualified the associated data with "X" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, low levels of zinc were detected in the MB. However, the concentration is less than half of the reporting limit and will not significantly impact the field sample data. The data are usable for decision-making purposes.

In the ICP metals analysis, concentrations of iron, a common laboratory contaminant, were detected in the MB at concentrations above the reporting limit. However, all of the field sample results for iron are more than twenty times the MB concentration. The data are usable for decision-making purposes.

In the ICP metals analysis, the RPD calculated for arsenic using the laboratory duplicate is outside the QC limits. Acceptable LCS data for arsenic indicate that the analytical system was operating within control. The laboratory has qualified the associated arsenic data with "M" flags. These data may be considered estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

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

Field quality assurance (QA)/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2014a, 2014b), are shown in Table G-1. The main and QA/QC sample results are presented in Appendix F.

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

Sample Area	Main Sample	Duplicate Sample	Split Sample
100-N-84:2 North Excavation	J1TPW2	J1TPW3	J1TPX2
100-N-84:2 South Excavation	J1TPX6	J1TR07	J1TR08
River Road	J1TFW4	J1TFW5	--

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. 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 F provides details on duplicate pair evaluation and RPD calculation.

Split samples are collected to provide a relative measure of the variability in the sampling, sample handling, and analytical techniques used by commercial laboratories. The field main and split samples are evaluated by computing the RPD of the split samples for each COPC to determine the usability of the verification data. The U.S. Environmental Protection Agency Contract Laboratory Program duplicate sample comparison methodology, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004), is used as an initial test of the data from the splits. Only analytes that had values above five times the CRQL for both the main and split sample were compared. The calculation brief in Appendix F provides details on split pair RPD calculation. The RPD acceptance criteria for project-split samples is ≤ 35% (less than or equal to 35%).

Northern excavation sampling data RPD calculations for the field duplicate pair are above the acceptance criteria (≤30%) for chromium (39.3%), sodium (30.3%), zinc (38.2%), benzo(a)anthracene (66.7%), benzo(b)fluoranthene (43.9%), and chrysene (88.4%). The split sample RPD calculated for silicon (65.9%) is also above the acceptance criteria (≤35%).

Southern excavation sampling data calculations for the field duplicate pair found that the RPD calculated for barium (39.6%) is above the acceptance criteria. Additionally, the split sample RPDs for barium (58.2%) and silicon (85.2%) are above the acceptance criteria.

None of the River Road field duplicate pair RPDs were above the acceptance criteria.

Elevated RPDs such as those observed in the northern and southern field duplicate and split samples are generally attributed to natural heterogeneities in the sample matrix. The data are usable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the target detection limit (TDL), including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix F) to indicate that a visual check of the data is required by the reviewer. Additionally, 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-N-84:2 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 the 100-N-84:2 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 Washington Closure Hanford 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 F.

REFERENCES

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

DOE-RL, 2006, *100-N Area Sampling and Analysis Plan for CERCLA Waste Sites,* DOE/RL-2005-92, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Final*, OSWER 9240.1-45/EPA 540-R-04-004, U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, Washington, D.C.

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

WCH, 2014a, *100N Field Remediation and Sampling*, Logbook EL-1652-11, pp. 74-75, Washington Closure Hanford, Richland, Washington.

WCH, 2014b, *100-N Field Remediation Sampling*, Logbook EL-1652-12, pp. 15-18, Washington Closure Hanford, Richland, Washington.

WCH, 2014c, *Work Instruction for Verification Sampling of the 100-N-84:2, 100-N Area Fuel and Foam Pipelines Waste Site,* 0100N-WI-G0083, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2014c, *100N Field Remediation and Sampling*, Logbook EL-1652-12, pp. 15-21, 24-19, Washington Closure Hanford, Richland, Washington.