Date Submitted: 04/24/08 Originator: J. M. Capron Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 100-BC-1 Waste Site Code: 100-B-21:2 Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2008-003

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

Description of current waste site condition:

The 100-B-21:2 waste site consists of the immediate area of the DS-100BC-02 pipeline. Remediation and verification sampling of this site have been performed in accordance with remedial action objectives and goals established by the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100 DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. The selected action involved: (1) evaluating the site using available information, (2) remediating the site, (3) demonstrating through verification sampling that cleanup goals have been achieved, and (4) proposing the site for reclassification to Interim Closed Out.

Basis for reclassification:

In accordance with this evaluation, the confirmatory and verification sampling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the Remaining Sites ROD. The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow-zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The site does not have a deep zone or residual contaminant concentrations that would require any institutional controls. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-B-21:2, 100-B/C Discovery Pipeline DS-100BC-002* (attached).

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

R. F. Guercia DOE Federal Project Director (printed)	Signature	5/10/08 Date
N/A Ecology Project Manager (printed)	Signature	Date
L. C. Buelow EPA Project Manager (printed)	Signature	6/16/08 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-B-21:2 SUBSITE (100-B/C DISCOVERY PIPELINE DS-100BC-002)

Attachment to Waste Site Reclassification Form 2008-003

April 2008

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-B-21:2 SUBSITE (100-B/C DISCOVERY PIPELINE DS-100BC-002)

EXECUTIVE SUMMARY

The 100-B-21 site includes miscellaneous pipelines uncovered during the removal of the 100-B/C Reactor effluent pipelines and soils (Shea 2004). These miscellaneous pipelines that did not belong to a previously established waste site were grouped together into the 100-B-21 waste site. The 100-B-21 waste site has been maintained as a collection of pipelines based on the type of pipeline and potential closeout pathways for each. At one time, the Waste Information Data System listed 21 pipelines in 100-B-21. One of these pipelines, originally called discovery pipeline DS-100BC-002, and later designated as waste site 100-B-21:2, is addressed in this report.

When discovered, the 100-B-21:2 pipeline was described as 2.5 cm (1-in.) diameter asbestos-wrapped metal pipe protruding 1.5 m (5 ft) horizontally from the ground at the upper embankment of the Columbia River. This pipeline was determined to extend due south under the 100-BC Perimeter Road to the edge of the 116-B-11 Retention Basin excavation boundary. The pipeline, the soil in contact with the pipe, and soil 0.3 m (1 ft) below the pipeline were removed and disposed of at the Environmental Restoration Disposal Facility (ERDF).

Ten verification soil samples and one field duplicate were collected from the excavated area and three soil samples were collected from the overburden stockpiles. These samples were analyzed for all the contaminants of concern/contaminants of potential concern listed in the *Work Instruction for Verification Sampling of the 100-B-21:2, Discovery Pipeline* (WCH, 2007).

A reclassification of Interim Closed Out for the 100-B-21:2 waste site is supported based on site histories, process knowledge, field observations, and laboratory data. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). Residual concentrations at the 100-B-21:2 site support future unrestricted remaining sites land uses that can be represented (or bounded) by a rural-residential scenario and are considered protective of human health, groundwater, and the Columbia River. The site does not have a deep zone or residual contaminant concentrations that would require any institutional controls.

A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1.

A comparison against ecological risk screening levels has been made for the site contaminants of potential concern and other constituents. Screening levels were not exceeded for the site

constituents, with the exception of boron, manganese, molybdenum, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of these constituents does not pose a risk to ecological receptors because concentrations of manganese, vanadium and zinc are below site background levels; boron and molybdenum concentrations are consistent with those seen elsewhere at the Hanford Site (no established background value is available for boron or molybdenum).

Table ES-1. Summary of Remedial Action Goals for the 100-B-21:2 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure Radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years.	Cesium-137 was detected in verification samples, at activities below the single-radionuclide 15-mrem/yr dose-equivalence lookup value	Yes
Direct Exposure Nonradionuclides	Attain individual COC/COPC RAGs.	All individual nonradionuclide COC and COPC concentrations are below the direct exposure RAGs.	Yes
Risk Requirements Nonradionuclides	Attain hazard quotient of less than 1 for noncarcinogens.	The hazard quotients for individual nonradionuclide COCs/COPCs are less than 1.	Yes
	Attain cumulative hazard quotient of less than 1 for noncarcinogens.	The cumulative hazard quotient for all decision units (7.6×10^{-3}) is less than 1.	
	Attain excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	Excess cancer risk values for individual nonradionuclide COCs/COPCs are less than 1×10^{-6}.	
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess carcinogenic risk for all decision units (1.3×10^{-7}) is less than 1×10^{-5}.	
Groundwater/River Protection – Radionuclides	Attain single COC groundwater and river RAGs.	Only cesium-137 was detected in verification samples, at activities significantly below the single-radionuclide lookup values for protection of groundwater and the Columbia River.	Yes
	Attain National Primary Drinking Water Regulations:[a] 4 mrem/yr (beta/gamma) dose standard to target receptor/organ.	Only cesium-137 was detected in verification samples, at activities significantly below the single-radionuclide lookup values for protection of groundwater and the Columbia River.	
	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]	No alpha-emitting radionuclide COC/COPCs were detected in verification samples.	
	Meet total uranium standard of 21.2 pCi/L.[c]	Uranium was not identified as a COC/COPC. No uranium isotopes were detected in gamma energy analysis of verification soil samples.	

Table ES-1. Summary of Remedial Action Goals for the 100-B-21:2 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	All individual nonradiounclide COC/COPC concentrations are below the soil RAGs for protection of groundwater and the Columbia River.	Yes

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

COC = contaminant of concern
COPC = contaminant of potential concern
MCL = maximum contaminant level
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-B-21:2 SUBSITE (100-B/C DISCOVERY PIPELINE DS-100BC-002)

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 100-B-21:2 waste site meets the objectives for Interim Closed Out as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites Rod) (EPA 1999). The results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use and are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required.

A comparison against ecological risk screening levels has been made for the site contaminants of potential concern and other constituents. Screening levels were not exceeded for the site constituents, with the exception of boron, manganese, molybdenum, vanadium, and zinc. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of these constituents does not pose a risk to ecological receptors because concentrations of manganese, vanadium and zinc are below site background levels; boron and molybdenum concentrations are consistent with those seen elsewhere at the Hanford Site (no established background value is available for boron or molybdenum). A more complete quantitative ecological risk assessment will be presented in the baseline risk assessment for the river corridor portion of the Hanford Site and will be used to support the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

Pipelines comprising the 100-B-21 waste site are located in the 100-BC-1 Operable Unit, in the 100-B/C Area of the Hanford Site. The miscellaneous 100-B-21 pipelines were uncovered during the remediation of the 100-B/C reactor effluent pipelines and soils. According to the Waste Information Data System (WIDS) General Summary Report, the 100-B-21 site at one time contained 21 separate pipeline segments, but several of the segments have been deferred to the 118:B-8:3 (105-B Reactor Miscellaneous Pipeline Segments) site, or determined to be part of other waste sites.

The 100-B Area facilities were generally in operation from 1944 to 1968 and the 100-C Area facilities were generally in operation from 1952 to 1969 (Sharpe et al. 2000). Therefore, it is assumed that the operational lifetime of the 100-B-21:2 pipeline lies within the time period of 1944 to 1969.

The 100-B-21:2 waste site consists of the discovery pipeline originally designated DS-100BC-002 (Figure 1). When discovered, this pipeline was described as 2.5 cm (1-in.) diameter asbestos-wrapped metal pipe protruding 1.5 m (5 ft) horizontally from the ground (Figure 2).

The northern end of the 100-B-21:2 pipeline, originally discovered at N145362, E565307, was located west of the 116-B-7 outfall structure and north of the 100-BC perimeter road. The pipeline was determined to extend due south, under the 100-BC perimeter road to the edge of 116-B-11 Retention Basin excavation boundary (Figure 1).

The history of the 100-B-21:2 pipeline, prior to its discovery in 2003, is unknown. The pipeline does not appear on the historical construction drawings. The location and orientation of the pipeline suggests that it was associated with the 116-B-11 Retention Basin and discharged to the river embankment. It is smaller than most drain lines, suggesting it was a pressurized water pipe, though the exact purpose remains unknown.

Field screening, sampling, and geophysical investigations of several pipelines within the 100-B-21 waste site were conducted in June through September 2003 for characterization purposes (Shea 2004, BHI 2003). Additionally, a geophysical investigation of the 100-B-21:2 pipeline was conducted in March 2007.

The July 2003 geophysical survey of the pipeline was performed with a pipe and cable locator. The pipeline was traced due south to the excavation associated with the remediation of 116-B-11 Retention Basin where the signal became indeterminate.

An additional geophysical survey in March 2007 of the 100-B-21:2 pipeline was performed using ground penetrating radar with results similar to those found in 2003 (Mitchell 2007). The geophysical interpretation identified the pipeline and noted low amplitude anomalies (thought to be large boulders) in the subsurface.

A sampling design to confirm the need for remediation (confirmatory sampling) was not conducted at this waste site. However, screening sample results indicated that the pipe wrap contained 10% to 20% asbestos and the contents of the pipe contained elevated levels of arsenic, cadmium, chromium, lead, mercury, selenium, silver, and a number of semivolatile organic compounds (SVOCs). Based on these results it was determined that removal of the 100-B-21:2 pipeline was needed.

Figure 1. Waste Site 100-B-21:2 Location Map.

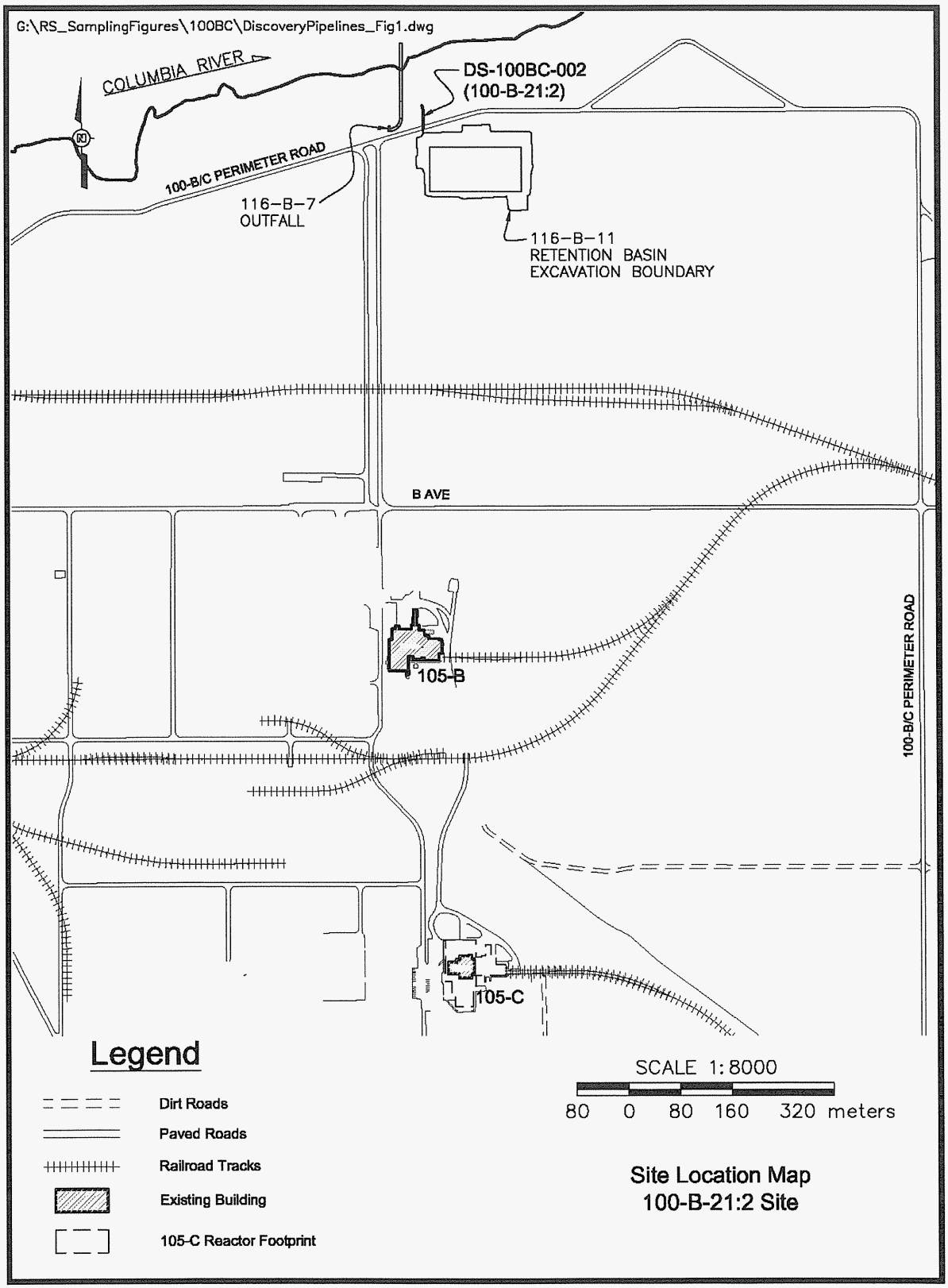


Figure 2. 100-B-21:2 Waste Site.

REMEDIAL ACTION SUMMARY

Remediation of the 100-B-21:2 waste site was performed from June 11 through June 18, 2007. The 100 B/C perimeter road was closed to allow remediation. Asphalt removed from the road surface was segregated into a stockpile on the adjacent road surface for disposal at the Environmental Restoration Disposal Facility (ERDF). Overburden soils were removed from above the pipeline and placed into two stockpiles on the west side of the excavation (WCH 2007a). The pipeline, soil in contact with the pipe, and soil 0.3 m (1 ft) below the pipeline were removed and disposed of at ERDF (Figures 3, 4, and 5).

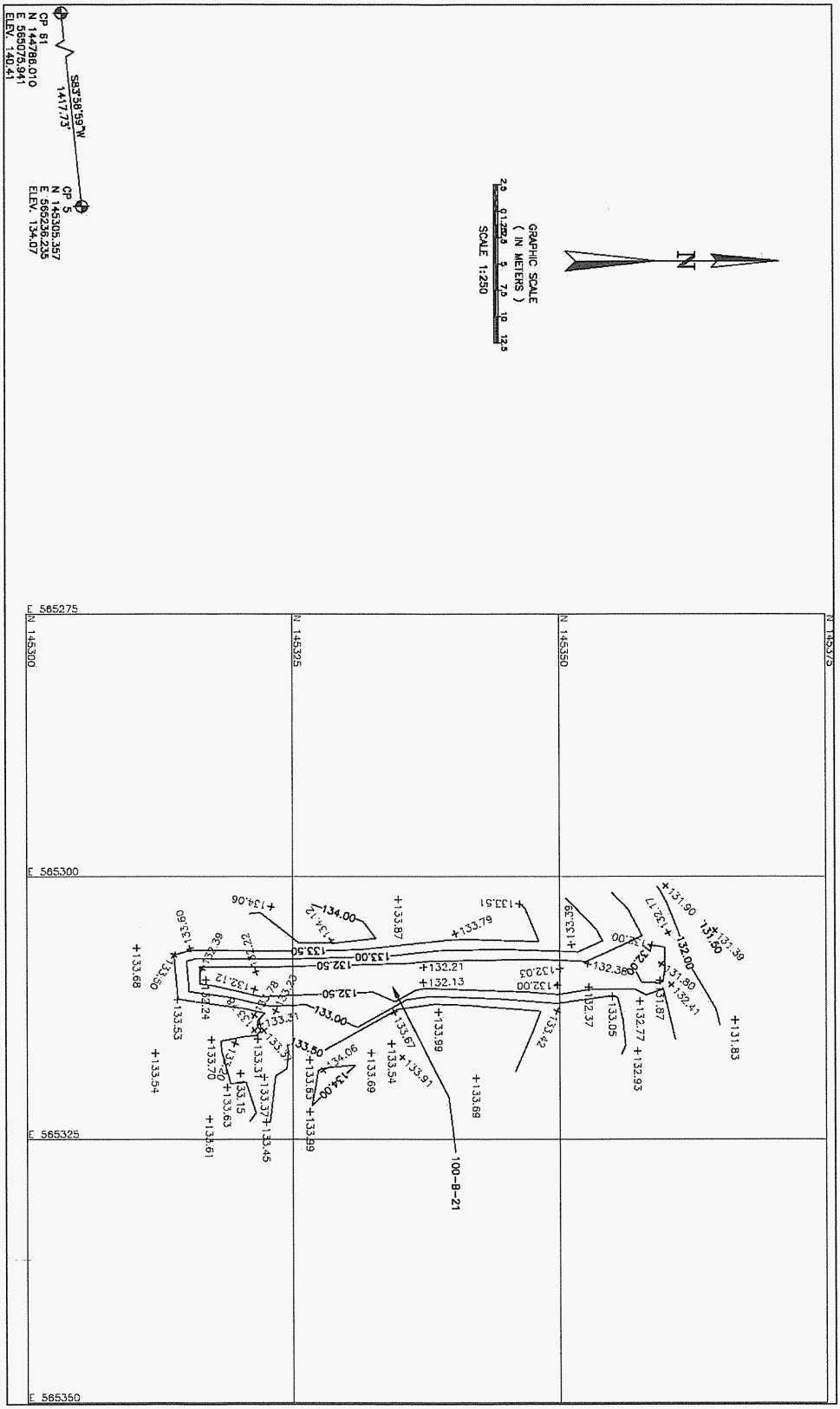
Approximately 91 metric tons (100 US tons) of material was disposed of at ERDF. No anomalies were discovered during the remedial action. Refer to Figure 6 for the post-excavation topography.

Figure 3. Remediation of the 100-B-21:2 Waste Site.

Figure 4. 100-B-21:2 Waste Site Remediation.

Figure 5. 100-B-21:2 Waste Site Excavation.

Figure 6. 100-B-21:2 Post-Excavation Topography.



VERIFICATION SAMPLING DESIGN

This section describes the basis for selection of an appropriate sample design and determination of the number of verification samples that were collected. The 100-B-21:2 waste site was divided into two decision units for the purpose of verification sampling. The first decision unit consisted of the excavation footprint of the pipeline, and the second decision unit consisted of the overburden and layback stockpiles. A summary of the samples collected and the analyses performed for the verification sampling event are presented in Table 1.

Verification Sampling – Excavation Footprint

The decision rule for demonstrating compliance with the cleanup criteria requires comparison of the true population mean, as estimated by the 95% upper confidence limit on the sample mean, with the cleanup level. Therefore, a statistical sampling design was selected as the verification sampling approach for the excavation footprint because the distribution of potential residual soil contamination over this area was uncertain. The Washington State Department of Ecology publication, *Guidance on Sampling and Data Analysis Methods* (Ecology 1995), recommends that systematic sampling with sample locations distributed over the entire study area be used. This sampling approach is referred to by the Washington State Department of Ecology as "area-wide sampling."

The excavated areas were delineated in Visual Sample Plan (VSP) and used as the basis for location of a random-start systematic grid for verification soil sample collection within the pipeline excavation. Ten soil samples were collected on a triangular grid as shown in Figure 7.

Verification Sampling – Overburden Stockpile

Two overburden stockpiles were accumulated west of the pipeline excavation. Professional judgment was used to develop a sampling design for these materials to determine if they could be used as backfill. Three verification samples were collected from the stockpiles. Two samples were collected from the larger northern stockpile with the pile stratified into two approximate equal areas and one sample collected from each area. The third sample was collected from the smaller southern stockpile. Each sample consisted of 25 aliquots distributed over the surface of the area being sampled. Aliquot locations were selected at the sampler's discretion to ensure that the surface soil of the area being sampled was represented by the sample.

Additional details concerning the use of VSP to develop the statistical sampling design and the sampling design for the overburden stockpiles can be found in the *Work Instruction for Verification Sampling of the 100-B-21:2, Discovery Pipeline* (WCH 2007a).

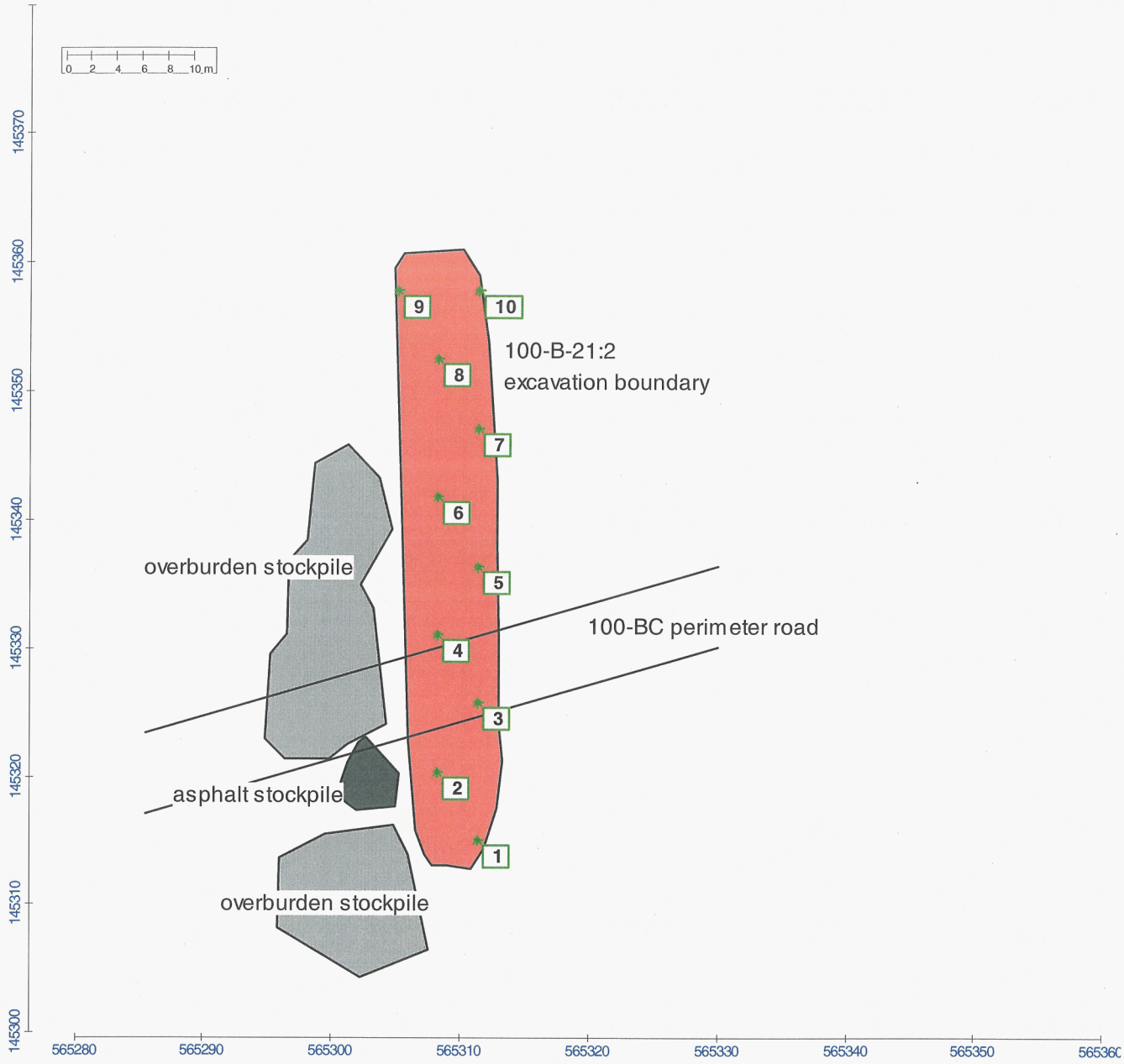
Table 1. 100-B-21:2 Verification Sample Summary Table.

Sample Location	Sample Number	Coordinate Locations	Sample Analysis
Staked location #1	J15W21	N 145315.0 E 565311.4	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA[a]
Staked location #2	J15W22	N 145320.4 E 565308.3	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
Staked location #3	J15W23	N 145325.7 E 565311.4	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
Duplicate of #3	J15W34	N 145325.7 E 565311.4	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
Staked location #4	J15W24	N 145331.1 E 565308.3	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
Staked location #5	J15W25	N 145336.5 E 565311.4	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
Staked location #6	J15W26	N 145341.8 E 565308.3	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
Staked location #7	J15W27	N 145347.2 E 565311.4	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
Staked location #8	J15W28	N 145352.6 E 565308.3	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
Staked location #9	J15W29	N 145357.9 E 565305.2	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
Staked location #10	J15W30	N 145357.9 E 565311.4	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
OB stockpile	J15W31	Southernmost stockpile	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
OB stockpile	J15W32	Northern portion of northern stockpile	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA
OB stockpile	J15W33	Southern portion of northern stockpile	GEA, gross alpha, gross beta, ICP metals, hexavalent Cr, SVOA

[a] *100B/C Burial Grounds/Remaining Sites Sampling and Field Activities*, Logbook EL-1173-14, pp 15-16, Washington Closure Hanford, Richland, Washington (WCH, 2007b).

ICP = inductively coupled plasma
GEA = gamma energy analysis
SVOA = semivolatile organic analysis

Figure 7. Statistical Verification Sampling Locations at the 100-B-21:2 Waste Site.



Contaminants of Concern (COCs) and Contaminants of Potential Concern (COPCs)

The *Work Instruction for Verification Sampling of the 100-B-21:2, Discovery Pipeline DS-100BC-002* (WCH 2007a) provides the basis for the COCs and COPCs listed in Table 2 below.

Table 2. COCs/COPCs for 100-B-21:2 Verification Sampling.

Radiological	Metals	Semivolatile organic analytes
Europium-154	Arsenic[a]	Acenaphthene[b]
	Barium[b]	Anthracene[b]
	Cadmium[a]	Bis(2-ethylhexyl)phthalate[b]
	Chromium[a]	Carbaxole[b]
	Lead[a]	Dibenzofuran[a]
	Mercury[a]	Fluorene[b]
	Selenium[b]	Indeno(1,2,3-cd)pyrene[a]
	Silver [a]	Phenanthrene[b]
	Hexavalent chromium[b]	Pyrene[b]

[a] Contaminant detected in pipe content samples at concentrations greater than cleanup criteria.
[b] Contaminant detected in pipe content samples, but less than the cleanup criteria.

Verification Sampling Results

Verification samples were analyzed using U.S. Environmental Protection Agency-approved analytical methods.

As noted earlier, the 100-B-21:2 waste site was divided into two decision units for verification sampling: (1) excavation footprint, and (2) overburden and layback stockpile.

(1) The 95% one-sided upper confidence limits (UCLs) on the true population means for residual concentrations of COCs and COPCs were calculated for the remediation footprint as specified by the RDR/RAWP (DOE-RL 2005), with calculations provided in Appendix C. When a nonradionuclide COC or COPC was detected in fewer than 50% of the verification samples collected for the area, the maximum detected value was used for comparison to the remedial action goals (RAGS). If no detections for a given COC/COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COC/COPC.

(2) Evaluation of the verification data from the overburden stockpiles was performed by direct comparison of the maximum sample results for each COC/COPC against cleanup criteria for each area.

Comparisons of the statistical and maximum results for COCs and COPCs and the site RAGs for each area are summarized in Tables 3 and 4. Contaminants that were not detected by laboratory analysis are excluded from these tables.

Table 3. Comparison of Statistical Containment Concentrations to Action Levels for the 100-B-21:2 Waste Site Statistical Verification Sampling Event.

COC/COPC	Statistical Result (pCi/g)	Generic Site Lookup Values (pCi/g)[a]			Does the Statistical Result Meet Lookup Values?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value	
Cesium-137	0.048	6.2	1,465[b]	1,465[b]	Yes
COC/COPC	**Statistical Result[bc] (mg/kg)**	**Remedial Action Goals (mg/kg)[a]**			**Does the Statistical Result Meet RAGs?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**	
Arsenic	5.9 (<BG)	20	20	20	Yes
Barium	89.4 (<BG)	5,600	132[c]	224	Yes
Beryllium	0.19 (<BG)	10.4[d]	1.51[c]	1.51[c]	Yes
Boron[e]	2.4	16,000	320	--[f]	Yes
Cadmium	0.31 (<BG)	13.9[d]	0.81[c]	0.81[c]	Yes
Chromium (total)	16.0 (<BG)	80,000	18.5[c]	18.5[c]	Yes
Chromium (hexavalent)	0.26	2.1	4.8[g]	2	Yes
Cobalt	7.9 (<BG)	1,600	32	--[f]	Yes
Copper	20.9 (<BG)	2,960	59.2	22.0[c]	Yes
Lead	6.3 (<BG)	353	10.2[c]	10.2[c]	Yes
Manganese	355 (<BG)	11,200	512[c]	512[c]	Yes
Molybdenum[e]	2.5	400	8	--[f]	Yes
Nickel	16.4 (<BG)	1,600	19.1[c]	27.4	Yes
Silver	0.39 (<BG)	400	8	0.73[c]	Yes
Vanadium	51.0 (<BG)	560	85.1[c]	--[f]	Yes
Zinc	43.6 (<BG)	67.8	480	67.8[c]	Yes
Di-n-butylphthalate	0.022	8,000	160	540	Yes
Pyrene	0.021	2,400	480	192	Yes

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) or calculated per WAC 173-340-720, WAC 173-340-730, and WAC 173-340-740, Method B, 1996, unless otherwise noted.

[b] Lookup value calculated per *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004).

[c] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d], 1996).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996) and an airborne particulate mass-loading rate of 0.0001 g/m^3 (WDOH 1997).

[e] No Hanford Site-specific or Washington State background value available.

[f] No cleanup level is available from the *Cleanup Levels and Risk Calculations (CLARC) Database* (Ecology 2005), and no bioconcentration factor or ambient water quality criteria values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).

[g] Calculated cleanup level presented is more restrictive than that presented in the RDR/RAWP (DOE-RL 2005b). Cleanup level presented is per (WAC 173-340-720(3), 1996 [Method B for groundwater] and WAC 173-340-740(3)(a)(ii)(A), 1996 ["100 times rule"]), based on updated oral reference dose value (as provided in the EPA's Integrated Risk Information System available on the internet at http://www.epa.gov/iris).

-- = not applicable
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
RAG = remedial action goal
WAC = *Washington Administrative Code*

Table 4. Comparison of Maximum Contaminant Concentrations to Action Levels for the 100-B-21:2 Overburden Stockpile Verification Sampling Event.

COC/COPC	Maximum Result (pCi/g)	Generic Site Lookup Values (pCi/g)[a]			Does the Maximum Result Meet Lookup Values?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value	
Cesium-137	0.048	6.2	1,465[b]	1,465[b]	Yes
COC/COPC	**Maximum Result[b] (mg/kg)**	**Remedial Action Goals (mg/kg)[a]**			**Does the Maximum Result Meet RAGs?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**	
Arsenic	4.8 (<BG)	20	20	20	Yes
Barium	89.8 (<BG)	5,600	132[c]	224	Yes
Beryllium	0.19 (<BG)	10.4[d]	1.51[c]	1.51[c]	Yes
Cadmium	0.33(<BG)	13.9[d]	0.81[c]	0.81[c]	Yes
Chromium (total)	15.8 (<BG)	80,000	18.5[c]	18.5[c]	Yes
Chromium (hexavalent)	0.26	2.1	4.8[e]	2	Yes
Cobalt	8.6 (<BG)	1,600	32	--[f]	Yes
Copper	20.6 (<BG)	2,960	59.2	22.0[c]	Yes
Lead	6.5 (<BG)	353	10.2[c]	10.2[c]	Yes
Manganese	363 (<BG)	11,200	512[c]	512[c]	Yes
Molybdenum[g]	0.83	400	8	--[f]	Yes
Nickel	17.8 (<BG)	1,600	19.1[c]	27.4	Yes
Vanadium	53.3 (<BG)	560	85.1[c]	--[f]	Yes
Zinc	48.7 (<BG)	24,000	480	67.8[c]	Yes

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) or calculated per WAC 173-340-720, WAC 173-340-730, and WAC 173-340-740, Method B, 1996, unless otherwise noted.

[b] Lookup value calculated per *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004).

[c] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d], 1996).

[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3], 1996) and an airborne particulate mass-loading rate of 0.0001 g/m^3 (WDOH 1997).

[e] Calculated cleanup level presented is more restrictive than that presented in the RDR/RAWP (DOE-RL 2005b). Cleanup level presented is per (WAC 173-340-720(3), 1996 [Method B for groundwater] and WAC 173-340-740(3)(a)(ii)(A), 1996 ["100 times rule"]), based on updated oral reference dose value (as provided in the EPA's Integrated Risk Information System available on the internet at http://www.epa.gov/iris).

[f] No cleanup level is available from the *Cleanup Levels and Risk Calculations (CLARC) Database* (Ecology 2005), and no bioconcentration factor or ambient water quality criteria values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).

[g] No Hanford Site-specific or Washington State background value available.

-- = not applicable
BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
RAG = remedial action goal
WAC = *Washington Administrative Code*

DATA EVALUATION

This section demonstrates that remedial actions at waste site 100-B-21:2 have achieved the applicable remedial action objectives by meeting the RAGs and determining that groundwater and the river are protected.

Evaluation of the results listed in Tables 3 and 4 indicates none of the contaminants exceed the soil RAGs for the protection of groundwater and/or the Columbia River in either of the decision units.

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. The application of the three-part test for the 100-B-21:2 remediation footprint is included in the statistical calculations (Appendix C). The three-part test is not applicable to the overburden and layback stockpile results because direct evaluation of nonstatistical sampling results was used as the compliance basis. All residual COC/COPC concentrations for the 100-B-21:2 remediation footprint pass the three-part test in comparison to the most stringent RAG value.

Assessment of the risk requirements for the 100-B-21:2 waste site is determined by calculation of the hazard quotient and excess carcinogenic risk values for nonradionuclides. These calculations are located in Appendix C. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. The hazard quotient and excess cancer risk calculations demonstrate that the 100-B-21:2 waste site meets the requirements as identified in the RDR/RAWP (DOE-RL 2005).

DATA QUALITY ASSESSEMENT

A DQA is performed to compare the verification sampling approach and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications. The DQA for waste site 100-B-21:2 waste site established that the data are of the right type, quality, and that the number of random samples specified in the work instruction have been correctly collected and analyzed. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The detailed DQA is presented in Appendix B.

SUMMARY FOR INTERIM CLOSE OUT

The 100-B-21:2 waste site has been remediated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2005). The site was remediated by removing approximately 91 metric tons (100 US tons) of material for disposal at the Environmental Restoration Disposal Facility. Statistical and judgmental sampling to verify the completeness of remediation was performed, and analytical results for the two decision units (excavation footprint and overburden stockpiles) were shown to meet the cleanup objectives for direct exposure, groundwater protection, and river protection. Accordingly, an interim closure reclassification is

supported for the 100-B-21:2 waste site. The site does not have a deep zone or residual contaminant concentrations that would require any institutional controls.

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APPENDIX A

VERIFICATION SAMPLING RESULTS

Table A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Sample Location	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
1	J15W21	10/22/07	0.045	U	0.045	0.051	U	0.051	0.029	U	0.029	0.075	U	0.075	0.090	U	0.090	0.068	U	0.068
2	J15W22	10/22/07	0.209	U	0.209	0.093		0.038	0.031	U	0.031	0.093	U	0.093	0.104	U	0.104	0.108	U	0.108
3	J15W23	10/22/07	0.075	U	0.075	0.045	U	0.045	0.041	U	0.041	0.112	U	0.112	0.139	U	0.139	0.175	U	0.175
Duplicate of J15W23	J15W34	10/22/07	0.070	U	0.070	0.040	U	0.040	0.038	U	0.038	0.100	U	0.100	0.123	U	0.123	0.129	U	0.129
4	J15W24	10/22/07	0.270	U	0.270	0.042	U	0.042	0.035	U	0.035	0.106	U	0.106	0.116	U	0.116	0.138	U	0.138
5	J15W25	10/22/07	0.414	U	0.414	0.057	U	0.057	0.048	U	0.048	0.132	U	0.132	0.182	U	0.182	0.155	U	0.155
6	J15W26	10/22/07	0.062	U	0.062	0.045	U	0.045	0.043	U	0.043	0.123	U	0.123	0.152	U	0.152	0.122	U	0.122
7	J15W27	10/22/07	0.060	U	0.060	0.067		0.026	0.035	U	0.035	0.116	U	0.116	0.121	U	0.121	0.101	U	0.101
8	J15W28	10/22/07	0.216	U	0.216	0.045	U	0.045	0.028	U	0.028	0.086	U	0.086	0.086	U	0.086	0.111	U	0.111
9	J15W29	10/22/07	0.403	U	0.403	0.052	U	0.052	0.049	U	0.049	0.123	U	0.123	0.178	U	0.178	0.145	U	0.145
10	J15W30	10/22/07	0.054	U	0.054	0.042	U	0.042	0.045	U	0.045	0.109	U	0.109	0.145	U	0.145	0.112	U	0.112
OB stockpile (south)	J15W31	10/22/07	0.058	U	0.058	0.078		0.040	0.033	U	0.033	0.123	U	0.123	0.112	U	0.112	0.137	U	0.137
OB stockpile (north)	J15W32	10/22/07	0.210	U	0.210	0.050		0.031	0.031	U	0.031	0.089	U	0.089	0.092	U	0.092	0.108	U	0.108
OB stockpile (center)	J15W33	10/22/07	0.055	U	0.055	0.062	U	0.062	0.043	U	0.043	0.109	U	0.109	0.139	U	0.139	0.186	U	0.186

Sample Location	Sample Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Silver-108m		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
1	J15W21	10/22/07	14.4		6.53	13.5		5.95	14.6		0.269	0.553		0.049	0.743		0.114	0.021	U	0.021
2	J15W22	10/22/07	14.3		8.21	19.8		6.30	15.8		0.349	0.729		0.044	0.971		0.137	0.024	U	0.024
3	J15W23	10/22/07	23.0		10.7	23.7		5.52	16.3		0.490	1.31		0.095	1.78		0.165	0.030	U	0.030
Duplicate of J15W23	J15W34	10/22/07	21.4		11.3	24.6		8.68	16.4		0.314	1.50		0.076	1.71		0.168	0.028	U	0.028
4	J15W24	10/22/07	31.9		8.79	23.8		5.54	17.0		0.373	1.06		0.077	1.32		0.167	0.030	U	0.030
5	J15W25	10/22/07	36.9		5.84	23.2		8.97	15.3		0.602	0.896		0.113	1.25		0.229	0.039	U	0.039
6	J15W26	10/22/07	30.1		6.36	20.4		5.93	15.4		0.482	1.69		0.078	1.90		0.185	0.034	U	0.034
7	J15W27	10/22/07	19.3		5.74	21.5		8.95	14.7		0.361	0.909		0.068	1.15		0.137	0.024	U	0.024
8	J15W28	10/22/07	16.2		9.82	21.9		5.68	16.2		0.295	0.781		0.061	1.12		0.117	0.023	U	0.023
9	J15W29	10/22/07	12.1		8.96	17.1		5.65	16.7		0.525	0.798		0.087	0.980		0.195	0.039	U	0.039
10	J15W30	10/22/07	15.4		8.99	22.2		5.54	15.4		0.396	0.697		0.077	1.12		0.161	0.031	U	0.031
OB stockpile (south)	J15W31	10/22/07	17.4		9.39	21.2		8.99	15.9		0.329	0.799		0.055	1.18		0.155	0.023	U	0.023
OB stockpile (north)	J15W32	10/22/07	17.0		11.6	16.3		8.70	15.9		0.286	0.771		0.045	1.08		0.126	0.023	U	0.023
OB stockpile (center)	J15W33	10/22/07	9.66		8.28	15.9		5.60	16.6		0.388	0.828		0.074	1.24		0.171	0.031	U	0.031

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

B = method blank contamination (organics)
C = method blank contamination (inorganics)
OB = overburden
J = estimate
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
U = undetected

Table A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Sample Location	Sample Number	Sample Date	Thorium-228			Thorium-232			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
1	J15W21	10/22/07	0.688		0.036	0.743		0.114	0.115	U	0.115	3.07	U	3.07
2	J15W22	10/22/07	0.964		0.044	0.971		0.137	0.156	U	0.156	3.74	U	3.74
3	J15W23	10/22/07	1.74		0.056	1.78		0.165	0.188	U	0.188	4.91	U	4.91
Duplicate of J15W23	J15W34	10/22/07	1.76		0.049	1.71		0.168	0.174	U	0.174	4.55	U	4.55
4	J15W24	10/22/07	1.41		0.055	1.32		0.167	0.186	U	0.186	4.26	U	4.26
5	J15W25	10/22/07	1.18		0.066	1.25		0.229	0.233	U	0.233	5.68	U	5.68
6	J15W26	10/22/07	1.99		0.057	1.90		0.185	0.187	U	0.187	5.10	U	5.10
7	J15W27	10/22/07	1.15		0.042	1.15		0.137	0.154	U	0.154	4.46	U	4.46
8	J15W28	10/22/07	1.10		0.044	1.12		0.117	0.185	U	0.185	3.44	U	3.44
9	J15W29	10/22/07	0.950		0.066	0.980		0.195	0.218	U	0.218	5.70	U	5.70
10	J15W30	10/22/07	1.02		0.052	1.12		0.161	0.164	U	0.164	5.20	U	5.20
OB stockpile (south)	J15W31	10/22/07	1.12		0.040	1.18		0.155	0.144	U	0.144	3.83	U	3.83
OB stockpile (north)	J15W32	10/22/07	1.05		0.039	1.08		0.126	0.146	U	0.146	3.69	U	3.69
OB stockpile (center)	J15W33	10/22/07	1.23		0.050	1.24		0.171	0.166	U	0.166	4.77	U	4.77

Sample Location	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	4910		12.0	0.90	U	0.90	1.8		1.5	49.4		0.30	0.15	U	0.15	1.6		1.5
2	J15W22	10/22/07	7780		11.6	0.87	U	0.87	4.1		1.5	83.2		0.29	0.15	U	0.15	2.4		1.5
3	J15W23	10/22/07	9310		11.6	0.87	U	0.87	6.9		1.4	80.0		0.29	0.19		0.14	1.7		1.4
Duplicate of J15W23	J15W34	10/22/07	8180		11.6	0.87	U	0.87	5.7		1.4	74.6		0.29	0.14	U	0.14	1.4	U	1.4
4	J15W24	10/22/07	9590		11.8	0.89	U	0.89	5.7		1.5	86.1		0.30	0.18		0.15	2.2		1.5
5	J15W25	10/22/07	8390		11.9	0.89	U	0.89	5.0		1.5	107		0.30	0.15	U	0.15	2.7		1.5
6	J15W26	10/22/07	8880		11.6	0.87	U	0.87	7.9		1.5	85.9		0.29	0.15	U	0.15	2.5		1.5
7	J15W27	10/22/07	7760		10.6	0.80	U	0.80	4.0		1.3	75.7		0.27	0.13	U	0.13	2.1		1.3
8	J15W28	10/22/07	7450		10.8	0.81	U	0.81	4.3		1.4	75.2		0.27	0.14	U	0.14	2.1		1.4
9	J15W29	10/22/07	10000		11.9	0.89	U	0.89	5.6		1.5	91.1		0.30	0.15	U	0.15	2.6		1.5
10	J15W30	10/22/07	9150		11.5	0.87	U	0.87	5.1		1.4	86.5		0.29	0.14	U	0.14	2.4		1.4
OB stockpile (south)	J15W31	10/22/07	6550		11.3	0.85	U	0.85	3.5		1.4	65.0		0.28	0.14	U	0.14	1.4	U	1.4
OB stockpile (north)	J15W32	10/22/07	9390		11.0	0.82	U	0.82	4.6		1.4	89.8		0.27	0.14	U	0.14	2.5		1.4
OB stockpile (center)	J15W33	10/22/07	8300		11.9	0.89	U	0.89	4.8		1.5	86.3		0.30	0.15	U	0.15	1.7		1.5
Equipment blank	J15W35	10/22/07	51.0		3.6	0.27	U	0.27	0.45	U	0.45	1.4		0.09	0.04	U	0.04	0.54		0.45

Table A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Sample Location	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	0.30	U	0.30	4880	C	12.0	6.9		0.6	5.3		0.60	17.4	C	0.60	0.20	U	0.20
2	J15W22	10/22/07	0.29	U	0.29	6130	C	11.6	10.8		0.58	7.9		0.58	20.6	C	0.58	0.21	U	0.21
3	J15W23	10/22/07	0.29	U	0.29	6340	C	11.6	19.7		0.58	8.0		0.58	21.1	C	0.58	0.23		0.21
Duplicate of J15W23	J15W34	10/22/07	0.31		0.29	5930	C	11.6	16.1		0.58	7.4		0.58	18.9	C	0.58	0.21	U	0.21
4	J15W24	10/22/07	0.30	U	0.30	8080	C	11.8	16.3		0.59	7.6		0.59	21.2	C	0.59	0.27		0.20
5	J15W25	10/22/07	0.30	U	0.30	6140	C	11.9	12.0		0.60	7.3		0.60	18.5	C	0.60	0.32		0.20
6	J15W26	10/22/07	0.29	U	0.29	10000	C	11.6	18.3		0.58	8.2		0.58	24.0	C	0.58	0.23		0.20
7	J15W27	10/22/07	0.27	U	0.27	4410	C	10.6	11.6		0.53	7.4		0.53	17.3	C	0.53	0.31		0.20
8	J15W28	10/22/07	0.27	U	0.27	4920	C	10.8	10.8		0.54	7.3		0.54	16.4	C	0.54	0.29		0.20
9	J15W29	10/22/07	0.30	U	0.30	5780	C	11.9	14.4		0.59	8.3		0.59	19.9	C	0.59	0.22		0.20
10	J15W30	10/22/07	0.29	U	0.29	5440	C	11.5	12.5		0.58	7.9		0.58	19.8	C	0.58	0.20	U	0.20
OB stockpile (south)	J15W31	10/22/07	0.28	U	0.28	4620	C	11.3	10.4		0.56	6.5		0.56	15.3	C	0.56	0.20	U	0.20
OB stockpile (north)	J15W32	10/22/07	0.33		0.27	5970	C	11.0	15.8		0.55	8.6		0.55	20.6	C	0.55	0.20	U	0.20
OB stockpile (center)	J15W33	10/22/07	0.31		0.30	10900	C	11.9	13.5		0.59	6.6		0.59	18.4	C	0.59	0.26		0.20
Equipment blank	J15W35	10/22/07	0.09	U	0.09	28.9	UJ	3.6	0.18	U	0.18	0.18	U	0.18	0.26	UJ	0.18			

Sample Location	Sample Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	14100	C	13.4	3.0		0.90	3490	C	7.5	250	C	0.12	0.02	U	0.02	0.90	U	0.90
2	J15W22	10/22/07	23800	C	13.1	6.8		0.87	4840	C	7.3	359	C	0.12	0.02	U	0.02	0.87	U	0.87
3	J15W23	10/22/07	23000	C	13.0	7.2		0.87	5080	C	7.2	371	C	0.12	0.01	U	0.01	0.87		0.87
Duplicate of J15W23	J15W34	10/22/07	21400	C	13.0	6.3		0.87	4870	C	7.2	339	C	0.12	0.02	U	0.02	1.0		0.87
4	J15W24	10/22/07	22400	C	13.3	6.5		0.89	5160	C	7.4	353	C	0.12	0.02	U	0.02	0.89	U	0.89
5	J15W25	10/22/07	24000	C	13.4	5.6		0.89	4070	C	7.4	346	C	0.12	0.02	U	0.02	2.5		0.89
6	J15W26	10/22/07	23200	C	13.1	5.9		0.87	4800	C	7.3	366	C	0.12	0.01	U	0.01	0.97		0.87
7	J15W27	10/22/07	21000	C	11.9	5.5		0.80	4200	C	6.6	324	C	0.11	0.01	U	0.01	0.80	U	0.80
8	J15W28	10/22/07	20400	C	12.2	6.0		0.81	4280	C	6.8	331	C	0.11	0.01	U	0.01	0.81	U	0.81
9	J15W29	10/22/07	24100	C	13.4	5.8		0.89	5800	C	7.4	352	C	0.12	0.01	U	0.01	0.89	U	0.89
10	J15W30	10/22/07	22600	C	13.0	5.9		0.87	5020	C	7.2	338	C	0.12	0.02	U	0.02	0.87	U	0.87
OB stockpile (south)	J15W31	10/22/07	18500	C	12.7	4.5		0.85	3660	C	7.1	297	C	0.11	0.02	U	0.02	0.85	U	0.85
OB stockpile (north)	J15W32	10/22/07	24800	C	12.4	6.3		0.82	5450	C	6.9	363	C	0.11	0.01	U	0.01	0.83		0.82
OB stockpile (center)	J15W33	10/22/07	20600	C	13.3	6.5		0.89	4930	C	7.4	287	C	0.12	0.01	U	0.01	0.89	U	0.89
Equipment blank	J15W35	10/22/07	94.7	C	4.0	0.35		0.27	7.3	UJ	2.2	3.3	C	0.04	0.01	U	0.01	0.27	U	0.27

Table A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Sample Location	Sample Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	8.7		0.60	704		12.0	1.8	U	1.8	2080		12.0	0.30	U	0.30	189	C	6.0
2	J15W22	10/22/07	13.6		0.58	1430		11.6	1.7	U	1.7	2510		11.6	0.29	U	0.29	281	C	5.8
3	J15W23	10/22/07	17.6		0.58	1280		11.6	1.7	U	1.7	1280		11.6	0.39		0.29	236	C	5.8
Duplicate of J15W23	J15W34	10/22/07	16.5		0.58	1170		11.6	1.7	U	1.7	1900		11.6	0.29	U	0.29	228	C	5.8
4	J15W24	10/22/07	15.8		0.59	1370		11.8	1.8	U	1.8	2090		11.8	0.30	U	0.30	308	C	5.9
5	J15W25	10/22/07	12.2		0.60	1480		11.9	1.8	U	1.8	1630		11.9	0.30	U	0.30	278	C	6.0
6	J15W26	10/22/07	18.3		0.58	1160		11.6	1.7	U	1.7	3030		11.6	0.29	U	0.29	434	C	5.8
7	J15W27	10/22/07	11.7		0.53	1490		10.6	1.6	U	1.6	1670		10.6	0.27	U	0.27	225	C	5.3
8	J15W28	10/22/07	11.2		0.54	1510		10.8	1.6	U	1.6	2690		10.8	0.27	U	0.27	232	C	5.4
9	J15W29	10/22/07	18.2		0.59	1800		11.9	1.8	U	1.8	1070		11.9	0.30	U	0.30	287	C	5.9
10	J15W30	10/22/07	13.2		0.58	2020		11.5	1.7	U	1.7	2210		11.5	0.29	U	0.29	212	C	5.8
OB stockpile (south)	J15W31	10/22/07	11.3		0.56	1010		11.3	1.7	U	1.7	2670		11.3	0.28	U	0.28	233	C	5.6
OB stockpile (north)	J15W32	10/22/07	17.8		0.55	1680		11.0	1.6	U	1.6	1120		11.0	0.27	U	0.27	247	C	5.5
OB stockpile (center)	J15W33	10/22/07	12.8		0.59	1250		11.9	1.8	U	1.8	2390		11.9	0.30	U	0.30	248	C	5.9
Equipment blank	J15W35	10/22/07	0.18	U	0.18	24.2		3.6	0.54	U	0.54	76.3		3.6	0.09	U	0.09	11.6	UJ	1.8

Sample Location	Sample Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	32.7		0.42	29.8	C	1.8
2	J15W22	10/22/07	44.5		0.41	46.0	C	1.7
3	J15W23	10/22/07	48.6		0.41	43.0	C	1.7
Duplicate of J15W23	J15W34	10/22/07	43.3		0.40	43.9	C	1.7
4	J15W24	10/22/07	49.5		0.41	42.9	C	1.8
5	J15W25	10/22/07	59.4		0.42	41.9	C	1.8
6	J15W26	10/22/07	52.7		0.41	38.6	C	1.7
7	J15W27	10/22/07	43.9		0.37	41.1	C	1.6
8	J15W28	10/22/07	38.0		0.38	41.9	C	1.6
9	J15W29	10/22/07	49.9		0.42	45.0	C	1.8
10	J15W30	10/22/07	42.2		0.40	42.0	C	1.7
OB stockpile (south)	J15W31	10/22/07	35.0		0.40	34.4	C	1.7
OB stockpile (north)	J15W32	10/22/07	53.3		0.38	48.7	C	1.6
OB stockpile (center)	J15W33	10/22/07	41.0		0.41	42.3	C	1.8
Equipment blank	J15W35	10/22/07	0.13	U	0.13	2.1	UJ	0.54

Table A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Constituents	J15W21 Location 1 Sample Date 10/22/07			J15W22 Location 2 Sample Date 10/22/07			J15W23 Location 3 Sample Date 10/22/07			J15W34 Duplicate of J15W23 Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	340	UJ	340	340	UJ	340	350	UJ	350	350	UJ	350
1,2-Dichlorobenzene	340	U	340	340	U	340	350	U	350	350	U	350
1,3-Dichlorobenzene	340	U	340	340	U	340	350	U	350	350	U	350
1,4-Dichlorobenzene	340	U	340	340	U	340	350	U	350	350	U	350
2,4,5-Trichlorophenol	850	U	850	860	U	860	870	U	870	870	U	870
2,4,6-Trichlorophenol	340	U	340	340	U	340	350	U	350	350	U	350
2,4-Dichlorophenol	340	U	340	340	U	340	350	U	350	350	U	350
2,4-Dimethylphenol	340	U	340	340	U	340	350	U	350	350	U	350
2,4-Dinitrophenol	850	U	850	860	U	860	870	U	870	870	U	870
2,4-Dinitrotoluene	340	U	340	340	U	340	350	U	350	350	U	350
2,6-Dinitrotoluene	340	U	340	340	U	340	350	U	350	350	U	350
2-Chloronaphthalene	340	U	340	340	U	340	350	U	350	350	U	350
2-Chlorophenol	340	U	340	340	U	340	350	U	350	350	U	350
2-Methylnaphthalene	340	UJ	340	340	UJ	340	350	UJ	350	350	UJ	350
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	350	U	350	350	U	350
2-Nitroaniline	850	U	850	860	U	860	870	U	870	870	U	870
2-Nitrophenol	340	U	340	340	U	340	350	U	350	350	U	350
3,3'-Dichlorobenzidine	340	U	340	340	U	340	350	U	350	350	U	350
3-Nitroaniline	850	U	850	860	U	860	870	U	870	870	U	870
4,6-Dinitro-2-methylphenol	850	U	850	860	U	860	870	U	870	870	U	870
4-Bromophenyl-phenylether	340	U	340	340	U	340	350	U	350	350	U	350
4-Chloro-3-methylphenol	340	U	340	340	U	340	350	U	350	350	U	350
4-Chloroaniline	340	UJ	340	340	UJ	340	350	UJ	350	350	UJ	350
4-Chlorophenyl-phenylether	340	U	340	340	U	340	350	U	350	350	U	350
4-Methylphenol (p-cresol)	340	U	340	340	U	340	350	U	350	350	U	350
4-Nitroaniline	850	U	850	860	U	860	870	U	870	870	U	870
4-Nitrophenol	850	U	850	860	U	860	870	U	870	870	U	870
Acenaphthene	340	U	340	340	U	340	350	U	350	350	U	350
Acenaphthylene	340	U	340	340	U	340	350	U	350	350	U	350
Anthracene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(a)anthracene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(a)pyrene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(b)fluoranthene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(g,h,i)perylene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(k)fluoranthene	340	U	340	340	U	340	350	U	350	350	U	350
bis(2-Chloro-1-methylethyl)ether	340	U	340	340	U	340	350	U	350	350	U	350
bis(2-Chloroethoxy)methane	340	U	340	340	U	340	350	U	350	350	U	350
bis(2-Chloroethyl)ether	340	U	340	340	U	340	350	U	350	350	U	350
bis(2-Ethylhexyl)phthalate	660	U	340	660	U	340	660	U	350	660	U	350
Butylbenzylphthalate	340	U	340	340	U	340	350	U	350	350	U	350
Carbazole	340	U	340	340	U	340	350	U	350	350	U	350
Chrysene	340	U	340	340	U	340	350	U	350	350	U	350
Di-n-butylphthalate	22	J	340	340	U	340	350	U	350	350	U	350
Di-n-octylphthalate	340	U	340	340	U	340	350	U	350	350	U	350
Dibenz(a,h)anthracene	340	U	340	340	U	340	350	U	350	350	U	350
Dibenzofuran	340	U	340	340	U	340	350	U	350	350	U	350
Diethylphthalate	340	U	340	340	U	340	350	U	350	350	U	350

Table A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Constituents	J15W21 Location 1 Sample Date 10/22/07			J15W22 Location 2 Sample Date 10/22/07			J15W23 Location 3 Sample Date 10/22/07			J15W34 Duplicate of J15W23 Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)												
Dimethylphthalate	340	U	340	340	U	340	350	U	350	350	U	350
Fluoranthene	340	U	340	340	U	340	350	U	350	350	U	350
Fluorene	340	U	340	340	U	340	350	U	350	350	U	350
Hexachlorobenzene	340	U	340	340	U	340	350	U	350	350	U	350
Hexachlorobutadiene	340	U	340	340	U	340	350	U	350	350	U	350
Hexachlorocyclopentadiene	340	U	340	340	U	340	350	U	350	350	U	350
Hexachloroethane	340	U	340	340	U	340	350	U	350	350	U	350
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	350	U	350	350	U	350
Isophorone	340	U	340	340	U	340	350	U	350	350	U	350
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	350	U	350	350	U	350
N-Nitrosodiphenylamine	340	U	340	340	U	340	350	U	350	350	U	350
Naphthalene	340	U	340	340	U	340	350	U	350	350	U	350
Nitrobenzene	340	U	340	340	U	340	350	U	350	350	U	350
Pentachlorophenol	850	U	850	860	U	860	870	U	870	870	U	870
Phenanthrene	340	U	340	340	U	340	350	U	350	350	U	350
Phenol	340	U	340	340	U	340	350	U	350	350	U	350
Pyrene	340	U	340	340	U	340	350	U	350	21	J	350

Constituents	J15W24 Location 4 Sample Date 10/22/07			J15W25 Location 5 Sample Date 10/22/07			J15W26 Location 6 Sample Date 10/22/07			J15W27 Location 7 Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
1,2-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
1,3-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
1,4-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
2,4,5-Trichlorophenol	860	U	860	850	U	850	850	U	850	850	U	850
2,4,6-Trichlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dichlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dimethylphenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dinitrophenol	860	U	860	850	U	850	850	U	850	850	U	850
2,4-Dinitrotoluene	340	U	340	340	U	340	340	U	340	340	U	340
2,6-Dinitrotoluene	340	U	340	340	U	340	340	U	340	340	U	340
2-Chloronaphthalene	340	U	340	340	U	340	340	U	340	340	U	340
2-Chlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2-Methylnaphthalene	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	340	U	340	340	U	340
2-Nitroaniline	860	U	860	850	U	850	850	U	850	850	U	850
2-Nitrophenol	340	U	340	340	U	340	340	U	340	340	U	340
3,3'-Dichlorobenzidine	340	U	340	340	U	340	340	U	340	340	U	340
3-Nitroaniline	860	U	860	850	U	850	850	U	850	850	U	850
4,6-Dinitro-2-methylphenol	860	U	860	850	U	850	850	U	850	850	U	850
4-Bromophenyl-phenylether	340	U	340	340	U	340	340	U	340	340	U	340
4-Chloro-3-methylphenol	340	U	340	340	U	340	340	U	340	340	U	340
4-Chloroaniline	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
4-Chlorophenyl-phenylether	340	U	340	340	U	340	340	U	340	340	U	340

Table A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Constituents	J15W24 Location 4 Sample Date 10/22/07			J15W25 Location 5 Sample Date 10/22/07			J15W26 Location 6 Sample Date 10/22/07			J15W27 Location 7 Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)												
4-Methylphenol (p-cresol)	340	U	340	340	U	340	340	U	340	340	U	340
4-Nitroaniline	860	U	860	850	U	850	850	U	850	850	U	850
4-Nitrophenol	860	U	860	850	U	850	850	U	850	850	U	850
Acenaphthene	340	U	340	340	U	340	340	U	340	340	U	340
Acenaphthylene	340	U	340	340	U	340	340	U	340	340	U	340
Anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(a)anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(a)pyrene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(b)fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(g,h,i)perylene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(k)fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloro-1-methylethyl)ether	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloroethoxy)methane	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloroethyl)ether	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Ethylhexyl)phthalate	660	U	340	660	U	340	660	U	340	660	U	340
Butylbenzylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Carbazole	340	U	340	340	U	340	340	U	340	340	U	340
Chrysene	340	U	340	340	U	340	340	U	340	340	U	340
Di-n-butylphthalate	17	J	340	340	U	340	340	U	340	340	U	340
Di-n-octylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Dibenz(a,h)anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Dibenzofuran	340	U	340	340	U	340	340	U	340	340	U	340
Diethylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Dimethylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
Fluorene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorobutadiene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorocyclopentadiene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachloroethane	340	U	340	340	U	340	340	U	340	340	U	340
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	340	U	340	340	U	340
Isophorone	340	U	340	340	U	340	340	U	340	340	U	340
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	340	U	340	340	U	340
N-Nitrosodiphenylamine	340	U	340	340	U	340	340	U	340	340	U	340
Naphthalene	340	U	340	340	U	340	340	U	340	340	U	340
Nitrobenzene	340	U	340	340	U	340	340	U	340	340	U	340
Pentachlorophenol	860	U	860	850	U	850	850	U	850	850	U	850
Phenanthrene	340	U	340	340	U	340	340	U	340	340	U	340
Phenol	340	U	340	340	U	340	340	U	340	340	U	340
Pyrene	340	U	340	340	U	340	340	U	340	340	U	340

Table A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Constituents	J15W28 Location 8 Sample Date 10/22/07			J15W29 Location 9 Sample Date 10/22/07			J15W30 Location 10 Sample Date 10/22/07			J15W31 OB stockpile (south) Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
1,2-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
1,3-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
1,4-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
2,4,5-Trichlorophenol	850	U	850	850	U	850	850	U	850	850	U	850
2,4,6-Trichlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dichlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dimethylphenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dinitrophenol	850	U	850	850	U	850	850	U	850	850	U	850
2,4-Dinitrotoluene	340	U	340	340	U	340	340	U	340	340	U	340
2,6-Dinitrotoluene	340	U	340	340	U	340	340	U	340	340	U	340
2-Chloronaphthalene	340	U	340	340	U	340	340	U	340	340	U	340
2-Chlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2-Methylnaphthalene	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	340	U	340	340	U	340
2-Nitroaniline	850	U	850	850	U	850	850	U	850	850	U	850
2-Nitrophenol	340	U	340	340	U	340	340	U	340	340	U	340
3,3'-Dichlorobenzidine	340	U	340	340	U	340	340	U	340	340	U	340
3-Nitroaniline	850	U	850	850	U	850	850	U	850	850	U	850
4,6-Dinitro-2-methylphenol	850	U	850	850	U	850	850	U	850	850	U	850
4-Bromophenyl-phenylether	340	U	340	340	U	340	340	U	340	340	U	340
4-Chloro-3-methylphenol	340	U	340	340	U	340	340	U	340	340	U	340
4-Chloroaniline	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
4-Chlorophenyl-phenylether	340	U	340	340	U	340	340	U	340	340	U	340
4-Methylphenol (p-cresol)	340	U	340	340	U	340	340	U	340	340	U	340
4-Nitroaniline	850	U	850	850	U	850	850	U	850	850	U	850
4-Nitrophenol	850	U	850	850	U	850	850	U	850	850	U	850
Acenaphthene	340	U	340	340	U	340	340	U	340	340	U	340
Acenaphthylene	340	U	340	340	U	340	340	U	340	340	U	340
Anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(a)anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(a)pyrene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(b)fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(g,h,i)perylene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(k)fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloro-1-methylethyl)ether	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloroethoxy)methane	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloroethyl)ether	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Ethylhexyl)phthalate	660	U	340	660	U	340	660	U	340	660	U	340
Butylbenzylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Carbazole	340	U	340	340	U	340	340	U	340	340	U	340
Chrysene	340	U	340	340	U	340	340	U	340	340	U	340
Di-n-butylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Di-n-octylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Dibenz(a,h)anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Dibenzofuran	340	U	340	340	U	340	340	U	340	340	U	340
Diethylphthalate	340	U	340	340	U	340	340	U	340	340	U	340

Talbe A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Constituents	J15W28 Location 8 Sample Date 10/22/07			J15W29 Location 9 Sample Date 10/22/07			J15W30 Location 10 Sample Date 10/22/07			J15W31 OB stockpile (south) Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)												
Dimethylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
Fluorene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorobutadiene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorocyclopentadiene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachloroethane	340	U	340	340	U	340	340	U	340	340	U	340
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	340	U	340	340	U	340
Isophorone	340	U	340	340	U	340	340	U	340	340	U	340
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	340	U	340	340	U	340
N-Nitrosodiphenylamine	340	U	340	340	U	340	340	U	340	340	U	340
Naphthalene	340	U	340	340	U	340	340	U	340	340	U	340
Nitrobenzene	340	U	340	340	U	340	340	U	340	340	U	340
Pentachlorophenol	850	U	850	850	U	850	850	U	850	850	U	850
Phenanthrene	340	U	340	340	U	340	340	U	340	340	U	340
Phenol	340	U	340	340	U	340	340	U	340	340	U	340
Pyrene	340	U	340	340	U	340	340	U	340	340	U	340

Constituents	J15W32 OB stockpile (north) Sample Date 10/22/07			J15W33 OB stockpile (center) Sample Date 10/22/07			J15W35 Equipment blank Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds									
1,2,4-Trichlorobenzene	340	UJ	340	340	UJ	340	330	UJ	330
1,2-Dichlorobenzene	340	U	340	340	U	340	330	U	330
1,3-Dichlorobenzene	340	U	340	340	U	340	330	U	330
1,4-Dichlorobenzene	340	U	340	340	U	340	330	U	330
2,4,5-Trichlorophenol	850	U	850	850	U	850	830	UJ	830
2,4,6-Trichlorophenol	340	U	340	340	U	340	330	UJ	330
2,4-Dichlorophenol	340	U	340	340	U	340	330	UJ	330
2,4-Dimethylphenol	340	U	340	340	U	340	330	U	330
2,4-Dinitrophenol	850	U	850	850	U	850	830	U	830
2,4-Dinitrotoluene	340	U	340	340	U	340	330	U	330
2,6-Dinitrotoluene	340	U	340	340	U	340	330	U	330
2-Chloronaphthalene	340	U	340	340	U	340	330	U	330
2-Chlorophenol	340	U	340	340	U	340	330	U	330
2-Methylnaphthalene	340	UJ	340	340	UJ	340	330	UJ	330
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	330	U	330
2-Nitroaniline	850	U	850	850	U	850	830	U	830
2-Nitrophenol	340	U	340	340	U	340	330	U	330
3,3'-Dichlorobenzidine	340	U	340	340	U	340	330	U	330
3-Nitroaniline	850	U	850	850	U	850	830	U	830
4,6-Dinitro-2-methylphenol	850	U	850	850	U	850	830	U	830
4-Bromophenyl-phenylether	340	U	340	340	U	340	330	UJ	330
4-Chloro-3-methylphenol	340	U	340	340	U	340	330	U	330
4-Chloroaniline	340	UJ	340	340	UJ	340	330	UJ	330
4-Chlorophenyl-phenylether	340	U	340	340	U	340	330	UJ	330

Table A-1. 100-B-21:2 Verification Sampling Results. (10 Pages)

Constituents	J15W32 OB stockpile (north) Sample Date 10/22/07			J15W33 OB stockpile (center) Sample Date 10/22/07			J15W35 Equipment blank Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)									
4-Methylphenol (p-cresol)	340	U	340	340	U	340	330	U	330
4-Nitroaniline	850	U	850	850	U	850	830	U	830
4-Nitrophenol	850	U	850	850	U	850	830	U	830
Acenaphthene	340	U	340	340	U	340	330	U	330
Acenaphthylene	340	U	340	340	U	340	330	U	330
Anthracene	340	U	340	340	U	340	330	U	330
Benzo(a)anthracene	340	U	340	340	U	340	330	U	330
Benzo(a)pyrene	340	U	340	340	U	340	330	U	330
Benzo(b)fluoranthene	340	U	340	340	U	340	330	U	330
Benzo(g,h,i)perylene	340	U	340	340	U	340	330	U	330
Benzo(k)fluoranthene	340	U	340	340	U	340	330	U	330
bis(2-Chloro-1-methylethyl)ether	340	U	340	340	U	340	330	U	330
bis(2-Chloroethoxy)methane	340	U	340	340	U	340	330	UJ	330
bis(2-Chloroethyl)ether	340	U	340	340	U	340	330	UJ	330
bis(2-Ethylhexyl)phthalate	660	U	340	660	U	340	660	U	330
Butylbenzylphthalate	340	U	340	340	U	340	330	U	330
Carbazole	340	U	340	340	U	340	330	U	330
Chrysene	340	U	340	340	U	340	330	U	330
Di-n-butylphthalate	340	U	340	340	U	340	32	J	330
Di-n-octylphthalate	340	U	340	340	U	340	330	U	330
Dibenz(a,h)anthracene	340	U	340	340	U	340	330	U	330
Dibenzofuran	340	U	340	340	U	340	330	U	330
Diethylphthalate	340	U	340	340	U	340	330	U	330
Dimethylphthalate	340	U	340	340	U	340	330	U	330
Fluoranthene	340	U	340	340	U	340	330	U	330
Fluorene	340	U	340	340	U	340	330	U	330
Hexachlorobenzene	340	U	340	340	U	340	330	U	330
Hexachlorobutadiene	340	U	340	340	U	340	330	U	330
Hexachlorocyclopentadiene	340	U	340	340	U	340	330	U	330
Hexachloroethane	340	U	340	340	U	340	330	U	330
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	330	U	330
Isophorone	340	U	340	340	U	340	330	U	330
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	330	U	330
N-Nitrosodiphenylamine	340	U	340	340	U	340	330	U	330
Naphthalene	340	U	340	340	U	340	330	U	330
Nitrobenzene	340	U	340	340	U	340	330	U	330
Pentachlorophenol	850	U	850	850	U	850	830	UJ	830
Phenanthrene	340	U	340	340	U	340	330	U	330
Phenol	340	U	340	340	U	340	330	U	330
Pyrene	340	U	340	340	U	340	330	U	330

APPENDIX B

VERIFICATION SAMPLING DATA QUALITY ASSESSMENT

APPENDIX B

VERIFICATION SAMPLING DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample designs (WCH 2007a, DOE-RL 2005a). This DQA was performed in accordance with site specific data quality objectives found in the SAP (DOE-RL 2005b).

To ensure quality data, the sampling and analysis plan (SAP) data assurance requirements and the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., evaluate against cleanup criteria to support a no action or remedial action decision). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2000).

A review of the sample design (WCH 2007a), the field logbook (WCH 2007b), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. The sample design included a statistical sampling approach. In order to calculate the number of samples needed in the statistical sampling plan, the standard deviation for each COC/COPC in the target population was assumed to be less than or equal to 25% of the corresponding decision threshold for each COC/COPC. Examination of the resulting data set shows that the sample standard deviations are consistent with those assumptions.

The verification sample data collected at the 100-B-21:2 waste site were provided by the laboratories in sample delivery group (SDG) K1005. SDG K1005 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed below.

SDG K1005

This SDG comprises 13 field samples (J15W21-J15W34) and an equipment blank (J15W35). A field duplicate pair (J15W23/J15W34) is included in this SDG. These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, semivolatile organic compounds (SVOCs), gross alpha and gross beta by proportional counting, and by gamma spectroscopy. SDG K1005 was submitted for formal third-party validation. Minor deficiencies found in SDG K1005 are as follows:

Reported analytical detection levels are compared against the required quantitation limits (RQLs) to ensure that laboratory detection levels meet the required criteria. In the radiochemical analysis, 37 analytes exceeded the RQL. Under the WCH statement of work, no qualification is required.

In the gross alpha analysis, 10 samples were reported with activities above the accepted background value for alpha activity. Elevated values such as these prompt an evaluation of the data to see if additional isotopic analyses of the samples are needed. Because all of the americium-241 results in these samples were undetected and the typical ratio of plutonium isotopes to americium-241 is approximately 5:1 it is unlikely that the elevated alpha activities are due to plutonium isotopes. Other man-made alpha emitting constituents account for only a small percentage of the overall alpha activity compared to plutonium. This suggests that the elevated gross alpha results are due to naturally occurring isotopes, probably of uranium. Careful analysis of the radium and thorium data from these samples supports the conclusion that the naturally occurring localized background value is higher than the overall site average (Weiss 2008). Because the overall site averages are used to set background values it is expected that some sites will naturally be above those average values. No additional isotopic analyses are indicated in this case. The data are useable for decision-making purposes.

In the SVOC analysis, the common laboratory contaminants bis(2-ethylhexyl)phthalate is detected in the method blank (MB). Third party validation raised the reported values for bis(2-ethylhexyl)phthalate in all samples to the required quantitation limit of 660 µg/kg and qualified them as undetected and flagged "U".

Also in the SVOC analysis, the matrix spike (MS) and the matrix spike duplicate (MSD) are outside quality control (QC) limits for 1,2,4-trichlorobenzene at 52% and 54%, respectively. The MS for 2-methylnaphthalene is also outside QC limits at 58%. Laboratory control sample (LCS) recovery was outside QC limits for 4-chloroanaline, at 43%. The results for these analytes were qualified as estimates and flagged "J" by third party validation. Estimated data are useable for decision-making purposes.

The surrogate recoveries for the following SVOCs were outside QC limits in sample J15W35: 2,4-dichlorophenol, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, pentachlorophenol, bis(2-chloroethyl)ether, bis(2-chloroethoxy)methane, 4-chlorophenyl phenyl ether, 4-bromophenyl phenyl ether. The sample J15W35 results for these SVOCs were qualified as estimates and flagged "J" by third party validation. Estimated data are useable for decision-making purposes.

In the SVOC analysis, 120 analytes exceeded the RQL. Under the WCH statement of work, no qualification is required.

In the ICP metals analysis, the calcium, copper, magnesium, sodium, and zinc results for sample J15W35 (the equipment blank) are of similar magnitude as the method blank results, and are qualified by third party validation as undetected estimates with "UJ" flags, due to method blank contamination. The data are useable 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/quality control (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 2007b), are the 100-B-21:2 sample primary and duplicate (J15W23/J15W34). The main and QA/QC sample results are presented in Appendix C.

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 comparison of the RPD of the duplicate samples for each contaminant of concern (COC). Only analytes with values above five times the detection limits for both the main and duplicate samples are compared. The 95% upper confidence limit (UCL) calculation brief in Appendix C provides details on duplicate pair evaluation and RPD calculation. The data are useable for decision making purposes.

Radionuclides

None of the RPD calculated for the field QA/QC samples radionuclide results exceeded the acceptance criteria of 30%. The data are useable for decision making purposes.

Nonradionuclides

The RPD calculated for silicon was 39%, which exceeded the acceptance criteria of 30%. An elevated RPD, such as this, in the analysis of environmental soil samples, is largely attributed to heterogeneities in the soil matrix and only in small part attributed to precision and accuracy issues at the laboratory. The data are useable for decision-making purposes.

RPDs for the remaining radionuclides and nonradionuclide analytes are not calculated because an evaluation of the data shows the analytes are not detected in both the main and duplicate sample at more than 5 times the target detection limit. RPDs of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The data are useable 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 5 times the target detection limit (TDL), including undetected analytes. In these cases, a control limit of ± 2 times the TDL is used (Appendix C) to indicate that a visual check of the data is required by the reviewer. For the 100-B-21:2 duplicate sample, the difference was less than 2 times the TDL (for all analytes with one or both of the samples less than 5 times the TDL), and did not required the visual check. However, a visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are useable for decision-making purposes.

SUMMARY

Limited, random, or sample matrix-specific influenced batch quality control (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-B-21:2 verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 100-B-21:2 waste site concludes that the data are of the right type, quality, and quantity to support the intended use. The verification sample analytical data are stored in the Environmental Restoration (ENRE) project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System (HEIS) database. The verification sample analytical data are also summarized in Appendix C.

REFERENCES

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

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

DOE-RL, 2005a, *Remedial Design Report/Remedial Action Work Plan for the 100 Area,* DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2005b, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 2000, *Guidance for Data Quality Assessment*, EPA QA/G-9, QA00 Update, U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

WCH, 2007a, *Work Instruction for Verification Sampling of the 100-B-21:2, Discovery Pipeline DS-100BC-002*, Work Instruction No. 0100B-WI-G0026, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2007b, *100B/C Burial Grounds/Remaining Sites Sampling and Field Activities*, Logbook EL-1173-14, pp 15-16, Washington Closure Hanford, Richland, Washington.

Weiss, R. L. 2008. *100-8-21:2 Verification Data alpha*, CCN 138292, e-mail correspondence with J. M. Capron, dated December 5, 2007, Washington Closure Hanford, Richland, Washington.

APPENDIX C

CALCULATION BRIEFS

APPENDIX C

CALCULATION BRIEFS

The following calculation briefs have been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculations," Washington Closure Hanford, Richland, Washington.

100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations, Calculation No. 0100B-CA-V00310, Rev. 1, Washington Closure Hanford, Richland, Washington.

100-B-21:2Waste Site Hazard Quotient and Carcinogenic Risk Calculations, Calculation No. 0100F-CA-V0311, Rev. 0, Washington Closure Hanford, Richland, Washington.

NOTE: The calculation briefs referenced in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the files will be stored in a U.S. Department of Energy, Richland Operations Office repository. Only excerpts of the calculation briefs are included in this appendix.

DISCLAIMER FOR CALCULATIONS

The calculations that are provided in the following 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.

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CALCULATION COVER SHEET

Project Title: 100-B/C Field Remediation **Job No. 14655**

Area: 100-B/C

Discipline: Environmental *Calculation No: 0100B-CA-V0310

Subject: 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 10 Attm. 1 = 10 Total = 21	J. M. Capron	M. J. Appel	N/A	D. N. Strom	12-20-07
1	Cover = 1 Sheets = 9 Attm. 1 = 10 Total = 20	J. M. Capron	M. J. Appel	N/A	D. N. Strom	1-31-08

SUMMARY OF REVISION

1	Revision to include results of third-party validation. Cover page replaced in entirety for convenience. Attachment 1 data tables revised per validation. Sheets 3, 5, and 10 revised to remove bis(2-ethylhexyl)phthalate results and associated calculations and acronyms, based on qualification of all associated data as non-detected. Sheet 9 removed entirely, as only calculations present were for bis(2-ethylhexyl)phthalate data.
WCH-DE-018 (05/08/2007)	*Obtain Calc. No. from Document Control and Form from Intranet

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron Date 12/16/07 Calc. No. 0100B-CA-V0310 Rev. No. 0
Project 100-B/C Field Remediation Job No. 14655 Checked M. J. Appel Date 12/17/07
Subject 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 1 of 109 mcy 1/31/08

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) 3-part test for each nonradioactive contaminant of concern (COC) and contaminant of potential concern (COPC) and calculate the relative percent difference (RPD) for primary-duplicate sample pairs, as necessary.

Table of Contents:

Given/References:
1) Sample Results (Attachment 1).
2) Background values and remedial action goals (RAGs) are taken from DOE-RL (1996, 2001, 2005b) and Ecology (2005).
3) DOE-RL, 2001b, Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2005a, 100 Area Remedial Action Sampling and Analysis Plan (SAP), DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) DOE-RL, 2005b, Remedial Design Report/Remedial Action Work Plan for the 100 Area (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
6) Ecology, 1992, Statistical Guidance for Ecology Site Managers, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
7) 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.
8) Ecology, 2005, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
9) EPA, 1994, USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013. U.S. Environmental Protection Agency, Washington, D.C.
10) 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 2005b). 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, as required. 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 data from soil verification samples from the subject waste site. The data were entered into an EXCEL 2003 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 2005b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:
For nonradioactive analytes with ≤50% of the data below detection limits and all detected radionuclide analytes, 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, the maximum detected value for the data set is used instead of the 95% UCL. The 95% UCL is not calculated for data sets with no reported detections. The evaluation of the portion of each analyte's data set below detection limits was performed by direct inspection of the attached sample results, and no further calculations were performed for those data sets where >50% of the data was below detection limits. Statistical values were not calculated for radium-226, radium-228, thorium-228, thorium-232, and potassium-40, as these isotopes are excluded from consideration as COCs based on natural occurrence and analogous site information. Statistical values were also not calculated for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium, as no parameters to calculate cleanup values under WAC 173-340-740(3) are available in Ecology (2005) or other reference databases, and these constituents are thus not considered site COCs/COPCs. Statistical values were also not calculated for gross alpha and beta analyses. These analyses were performed only as a screening-level analysis, and review of

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron Date 12/16/07 Calc. No. 0100B-CA-V0310 Rev. No. 0
Project 100-B/C Field Remediation Job No. 14655 Checked M. J. Appel Date 12/19/07
Subject 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 2 of 109

Summary (continued)

the results and the data for americium-241, radium-226, thorium-228, and thorium-232 concluded that all results were consistent with slightly elevated natural background levels. Therefore, no further isotope-specific analysis for alpha- and beta-emitting radionuclides was performed.

All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics (Ecology 1993). 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 ($n < 10$) and all radionuclide data sets, the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, distributional testing and calculation of the 95% UCL is done using Ecology's MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2005b) 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 input 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 WAC 173-340-740(7)(e) 3-part test is not performed for COPCs/COCs where the statistical value defaults to the maximum value in the data set. Instead, direct comparison of the maximum value against site RAGs (within the RSVP) is used as the compliance basis.

The RPD values are evaluated for analytes detected in a primary-duplicate or primary-split sample pair for the purposes of data quality assessment within the RSVP (where direct evaluation of the attached data showed that a given analyte was undetected in both the primary and duplicate sample or accepted data was not available for both samples in the pair, no further calculations were performed). The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method, listed in Table II-1 of the SAP (DOE-RL 2005a). 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) split and duplicate RPD calculations, a value less than 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. 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 results exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. Additional discussion is provided in the data quality assessment section of the RSVP, as necessary.

The results presented in the summary tables that follow are for use in risk analysis and the RSVP for this site. In addition to the statistical samples collected in the remediation footprint, non-statistical samples were collected from stockpiled overburden material. Statistical methodology is not applicable to non-statistical sampling, and direct evaluation of detected values will be used as the compliance basis. The maximum detected value for each analyte from all overburden samples collected is presented in the results summary for use in the RSVP and risk analysis.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron Date 01/22/08 Job No. 14655 Calc. No. 0100B-CA-V0310 Rev. No. 1
Project 100-B/C Field Remediation Checked M. J. Appel Date 1/29/08
Subject 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 3 of 109

mjc 4/31/08

Summary (continued)

Results:
The results presented in the summary tables that follow are for use in risk analysis and the RSVP for this site.

Results Summary[a]

Analyte	Remediation Footprint[b]	Overburden[c]	Units
Cesium-137	0.048	0.078	pCi/g
Arsenic	5.9	4.8	mg/kg
Barium	89.4	89.8	mg/kg
Beryllium	0.19	ND	mg/kg
Boron	2.4	2.5	mg/kg
Cadmium	0.31	0.33	mg/kg
Chromium	16.0	15.8	mg/kg
Cobalt	7.9	8.6	mg/kg
Copper	20.9	20.6	mg/kg
Hexavalent chromium	0.26	0.26	mg/kg
Lead	6.3	6.5	mg/kg
Manganese	355	363	mg/kg
Molybdenum	2.5	0.83	mg/kg
Nickel	16.4	17.8	mg/kg
Silver	0.39	ND	mg/kg
Vanadium	51.0	53.3	mg/kg
Zinc	43.6	48.7	mg/kg
Di-n-butylphthalate	0.022	ND	mg/kg
Pyrene	0.021	ND	mg/kg

WAC 173-340-740(7)(e) Evaluation

WAC 173-340 3-Part Test for most stringent RAG:		All data sets meet the 3-part test criteria when compared to the most stringent cleanup limit.
95% UCL > Cleanup Limit?	NO	
> 10% above Cleanup Limit?	NO	
Any sample > 2x Cleanup Limit?	NO	

[a]No detections were reported in any data set for COCs/COPCs not listed in this table.
[b]Maximum or 95% UCL result, depending on data censorship, as described in the calculation methodology.
[c]Maximum detected result from all overburden samples.
ND = not detected (for all samples in the data set)
UCL = upper confidence level
RAG = remedial action goal
WAC = *Washington Adminstrative Code*

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

Analyte	Duplicate Analysis[b]
Potassium-40	0.61%
Radium-226	14%
Radium-228	4.0%
Aluminum	13%
Barium	7.0%
Calcium	6.7%
Chromium (total)	20%
Copper	11%
Iron	7.2%
Magnesium	4.2%
Manganese	9.0%
Silicon	39%
Vanadium	12%
Zinc	2.1%

[a]Relative percent difference evaluation was not required for analytes not included in this table.
[b]The significance of relative percent difference values are discussed within the RSVP for the subject site.
QA/QC = quality assurance/quality control
RSVP = remaining sites verification package

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC Date 12/16/07 Calc. No. 0100B-CA-V0310 Rev. No. 0
Project 100-B/C Field Remediation Job No. 14655 Checked M. J. Appel MJA Date 12/19/07
Subject 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 4 of ~~109~~ rev 4/31/08

100-B-21:2 Remediation Footprint Statistical Calculations

Verification Data

Sample Location	Sample Number	Sample Date	Cesium-137 pCi/g	Q	Cesium-137 MDA	Arsenic mg/kg	Q	Arsenic PQL	Barium mg/kg	Q	Barium PQL	Boron mg/kg	Q	Boron PQL	Chromium mg/kg	Q	Chromium PQL	Cobalt mg/kg	Q	Cobalt PQL	Copper mg/kg	Q	Copper PQL
1	J15W21	10/22/07	0.051	U	0.051	1.8		1.5	49.4		0.30	1.6		1.5	6.9		0.6	5.3		0.60	17.4	C	0.60
2	J15W22	10/22/07	0.093		0.038	4.1		1.5	83.2		0.29	2.4		1.5	10.8		0.58	7.9		0.58	20.6	C	0.58
3	J15W23	10/22/07	0.045	U	0.045	6.9		1.4	80.0		0.29	1.7		1.4	19.7		0.58	8.0		0.58	21.1	C	0.58
Duplicate of J15W23	J15W34	10/22/07	0.040	U	0.040	5.7		1.4	74.6		0.29	1.4	U	1.4	16.1		0.58	7.4		0.58	18.9	C	0.58
4	J15W24	10/22/07	0.042	U	0.042	5.7		1.5	86.1		0.30	2.2		1.5	16.3		0.59	7.6		0.59	21.2	C	0.59
5	J15W25	10/22/07	0.057	U	0.057	5.0		1.5	107		0.30	2.7		1.5	12.0		0.60	7.3		0.60	18.5	C	0.60
6	J15W26	10/22/07	0.045	U	0.045	7.9		1.5	85.9		0.29	2.5		1.5	18.3		0.58	8.2		0.58	24.0	C	0.58
7	J15W27	10/22/07	0.067		0.026	4.0		1.3	75.7		0.27	2.1		1.3	11.6		0.53	7.4		0.53	17.3	C	0.53
8	J15W28	10/22/07	0.045	U	0.045	4.3		1.4	75.2		0.27	2.1		1.4	10.8		0.54	7.3		0.54	16.4	C	0.54
9	J15W29	10/22/07	0.052	U	0.052	5.6		1.5	91.1		0.30	2.6		1.5	14.4		0.59	8.3		0.59	19.9	C	0.59
10	J15W30	10/22/07	0.042	U	0.042	5.1		1.4	86.5		0.29	2.4		1.4	12.5		0.58	7.9		0.58	19.8	C	0.58

Statistical Computation Input Data

Sample Location	Sample Number	Sample Date	Cesium-137 pCi/g	Arsenic mg/kg	Barium mg/kg	Boron mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg
1	J15W21	10/22/2007	0.026	1.8	49.4	1.6	6.9	5.3	17.4
2	J15W22	10/22/2007	0.093	4.1	83.2	2.4	10.8	7.9	20.6
3	J15W23/J15W34	10/22/2007	0.021	6.3	77.3	1.2	17.9	7.7	20.0
4	J15W24	10/22/2007	0.021	5.7	86.1	2.2	16.3	7.6	21.2
5	J15W25	10/22/2007	0.029	5.0	107	2.7	12.0	7.3	18.5
6	J15W26	10/22/2007	0.023	7.9	85.9	2.5	18.3	8.2	24.0
7	J15W27	10/22/2007	0.067	4.0	75.7	2.1	11.6	7.4	17.3
8	J15W28	10/22/2007	0.023	4.3	75.2	2.1	10.8	7.3	16.4
9	J15W29	10/22/2007	0.026	5.6	91.1	2.6	14.4	8.3	19.9
10	J15W30	10/22/2007	0.021	5.1	86.5	2.4	12.5	7.9	19.8

Statistical Computations

	Cesium-137	Arsenic	Barium	Boron	Chromium	Cobalt	Copper
95% UCL value based on	Radionuclide data set. Use nonparametric z-stat.	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), 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	10	10	10	10	10	10	10
% < Detection limit	80%	0%	0%	0%	0%	0%	0%
Mean	0.035	5.0	81.7	2.2	13.2	7.5	19.5
Standard deviation	0.025	1.6	14.7	0.5	3.6	0.8	2.2
95% UCL on mean	0.048	5.9	89.4	2.4	16.0	7.9	20.9
Maximum detected value	0.093	7.9	107	2.7	19.7	8.3	24.0
Background	NA	6.5	132	NA	18.5	15.7	22.0
Statistical value above background*	0.048	5.9	89.4	2.4	16.0	7.9	20.9
Most Stringent Cleanup Limit for nonradionuclide and RAG type		20 Direct Exposure/GW & River Protection	132 BG/GW Protection	320 GW Protection	18.5 BG/GW & River Protection	32 GW Protection	22.0 BG/River Protection
WAC 173-340 3-PART TEST							
95% UCL > Cleanup Limit?		NO	NA	NO	NO	NA	NO
> 10% above Cleanup Limit?		NO	NA	NO	NO	NA	NO
Any sample > 2X Cleanup Limit?		NO	NA	NO	NO	NA	NO
WAC 173-340 Compliance? Yes		The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	Because all values are below background (132 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 cleanup limit.	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	Because all values are below background (15.7 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 cleanup limit.

*Background is not subtracted for nonradionuclides; consideration of background is given by direct comparison against background values.

BG = background GW = groundwater NA = not applicable Q = qualifier U = undetected WAC = *Washington Administrative Code*
C = method blank contamination MDA = minimum detectable activity PQL = practical quantitation limit RAG = remedial action goal UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC Date 01/22/08
Project 100-B/C Field Remediation Job No. 14655
Subject 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations

Calc. No. 0100B-CA-V0310 Rev. No. 1
Checked M. J. Appel MJA Date 1/29/08
Sheet No. 5 of 19 mje 1/31/08

100-B-21:2 Remediation Footprint Statistical Calculations (continued)

Verification Data

Sample Location	Sample Number	Sample Date	Hexavalent Chromium mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
1	J15W21	10/22/07	0.20	U	0.20	3.0		0.90	250	C	0.12	8.7		0.60	32.7		0.42	29.8	C	1.8
2	J15W22	10/22/07	0.21	U	0.21	6.8		0.87	359	C	0.12	13.6		0.58	44.5		0.41	46.0	C	1.7
3	J15W23	10/22/07	0.23		0.21	7.2		0.87	371	C	0.12	17.6		0.58	48.6		0.41	43.0	C	1.7
Duplicate of J15W23	J15W34	10/22/07	0.21	U	0.21	6.3		0.87	339	C	0.12	16.5		0.58	43.3		0.40	43.9	C	1.7
4	J15W24	10/22/07	0.27		0.20	6.5		0.89	353	C	0.12	15.8		0.59	49.5		0.41	42.9	C	1.8
5	J15W25	10/22/07	0.32		0.20	5.6		0.89	346	C	0.12	12.2		0.60	59.4		0.42	41.9	C	1.8
6	J15W26	10/22/07	0.23		0.20	5.9		0.87	366	C	0.12	18.3		0.58	52.7		0.41	38.6	C	1.7
7	J15W27	10/22/07	0.31		0.20	5.5		0.80	324	C	0.11	11.7		0.53	43.9		0.37	41.1	C	1.6
8	J15W28	10/22/07	0.29		0.20	6.0		0.81	331	C	0.11	11.2		0.54	38.0		0.38	41.9	C	1.6
9	J15W29	10/22/07	0.22		0.20	5.8		0.89	352	C	0.12	18.2		0.59	49.9		0.42	45.0	C	1.8
10	J15W30	10/22/07	0.20	U	0.20	5.9		0.87	338	C	0.12	13.2		0.58	42.2		0.40	42.0	C	1.7

Statistical Computation Input Data

Sample Location	Sample Number	Sample Date	Hexavalent Chromium mg/kg	Lead mg/kg	Manganese mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg
1	J15W21	10/22/2007	0.10	3.0	250	8.7	32.7	29.8
2	J15W22	10/22/2007	0.11	6.8	359	13.6	44.5	46.0
3	J15W23/J15W34	10/22/2007	0.17	6.8	355	17.1	46.0	43.5
4	J15W24	10/22/2007	0.27	6.5	353	15.8	49.5	42.9
5	J15W25	10/22/2007	0.32	5.6	346	12.2	59.4	41.9
6	J15W26	10/22/2007	0.23	5.9	366	18.3	52.7	38.6
7	J15W27	10/22/2007	0.31	5.5	324	11.7	43.9	41.1
8	J15W28	10/22/2007	0.29	6.0	331	11.2	38.0	41.9
9	J15W29	10/22/2007	0.22	5.8	352	18.2	49.9	45.0
10	J15W30	10/22/2007	0.10	5.9	338	13.2	42.2	42.0

Statistical Computations

	Hexavalent Chromium	Lead	Manganese	Nickel	Vanadium	Zinc
95% UCL value based on	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), 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.
N	10	10	10	10	10	10
% < Detection limit	30%	0%	0%	0%	0%	0%
Mean	0.21	5.8	337	14.0	45.9	41.3
Standard deviation	0.09	1.1	33	3.2	7.6	4.5
95% UCL on mean	0.26	6.3	355	16.4	51.0	43.6
Maximum detected value	0.32	7.2	371	18.3	59.4	46.0
Statistical value	0.26	6.3	355	16.4	51.0	43.6
Most Stringent Cleanup Limit for nonradionuclide and RAG type	2 River Protection	10.2 BG/GW & River Protection	512 BG/GW & River Protection	19.1 BG/GW Protection	85.1 BG/GW Protection	67.8 BG/River Protection
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	NO	NA	NA	NA	NA	NA
> 10% above Cleanup Limit?	NO	NA	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NO	NA	NA	NA	NA	NA
WAC 173-340 Compliance? Yes	The data set meets the 3-part test criteria when compared to the most stringent cleanup limit.	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 (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.

BG = background
C = method blank contamination (inorganics)
GW = groundwater
J = estimate
MDA = minimum detectable activity
NA = not applicable
PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
U = undetected
UCL = upper confidence limit
WAC = *Washington Administrative Code*

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC — Date 12/16/07 — Calc. No. 0100B-CA-V0310 — Rev. No. 0

Project 100-B/C Field Remediation — Job No. 14655 — Checked M. J. Appel MJA — Date 12/19/07

Subject 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations — Sheet No. 6 of 109 mle 4/3/08

Ecology Software (MTCAStat) Results

Arsenic 95% UCL Calculation

DATA	ID
1.8	J15W21
4.1	J15W22
6.3	J15W23/J15W34
5.7	J15W24
5.0	J15W25
7.9	J15W26
4.0	J15W27
4.3	J15W28
5.6	J15W29
5.1	J15W30

		Uncensored values	
Number of samples			
Uncensored	10	Mean	5.0
Censored		Lognormal mean	5.1
Detection limit or PQL		Std. devn.	1.6
Method detection limit		Median	5.1
TOTAL	10	Min.	1.8
		Max.	7.9

Lognormal distribution? — Normal distribution?

r-squared is: 0.836 — r-squared is: 0.944

Recommendations:

Use normal distribution.

UCL (based on t-statistic) is 5.9

Barium 95% UCL Calculation

DATA	ID
49.4	J15W21
83.2	J15W22
77.3	J15W23/J15W34
86.1	J15W24
107.0	J15W25
85.9	J15W26
75.7	J15W27
75.2	J15W28
91.1	J15W29
86.5	J15W30

		Uncensored values	
Number of samples			
Uncensored	10	Mean	81.7
Censored		Lognormal mean	82.0
Detection limit or PQL		Std. devn.	14.7
Method detection limit		Median	84.6
TOTAL	10	Min.	49.4
		Max.	107

Lognormal distribution? — Normal distribution?

r-squared is: 0.806 — r-squared is: 0.871

Recommendations:

Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 89.4

Boron 95% UCL Calculation

DATA	ID
1.6	J15W21
2.4	J15W22
1.2	J15W23/J15W34
2.2	J15W24
2.7	J15W25
2.5	J15W26
2.1	J15W27
2.1	J15W28
2.6	J15W29
2.4	J15W30

		Uncensored values	
Number of samples			
Uncensored	10	Mean	2.2
Censored		Lognormal mean	2.2
Detection limit or PQL		Std. devn.	0.5
Method detection limit		Median	2.3
TOTAL	10	Min.	1.2
		Max.	2.7

Lognormal distribution? — Normal distribution?

r-squared is: 0.819 — r-squared is: 0.889

Recommendations:

Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 2.4

Chromium 95% UCL Calculation

DATA	ID
6.9	J15W21
10.8	J15W22
17.9	J15W23/J15W34
16.3	J15W24
12.0	J15W25
18.3	J15W26
11.6	J15W27
10.8	J15W28
14.4	J15W29
12.5	J15W30

		Uncensored values	
Number of samples			
Uncensored	10	Mean	13.2
Censored		Lognormal mean	13.2
Detection limit or PQL		Std. devn.	3.6
Method detection limit		Median	12.3
TOTAL	10	Min.	6.9
		Max.	18.3

Lognormal distribution? — Normal distribution?

r-squared is: 0.922 — r-squared is: 0.949

Recommendations:

Use lognormal distribution.

UCL (Land's method) is 16.0

PQL = practical quantitation limit

UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford
Originator J. M. Capron JMC
Project 100-B/C Field Remediation
Subject 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations

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Ecology Software (MTCAStat) Results (continued)

Cobalt 95% UCL Calculation

DATA	ID
5.3	J15W21
7.9	J15W22
7.7	J15W23/J15W34
7.6	J15W24
7.3	J15W25
8.2	J15W26
7.4	J15W27
7.3	J15W28
8.3	J15W29
7.9	J15W30

Number of samples		Uncensored values	
Uncensored	10	Mean	7.5
Censored		Lognormal mean	7.5
Detection limit or PQL		Std. devn.	0.8
Method detection limit		Median	7.7
TOTAL	10	Min.	5.3
		Max.	8.3

Lognormal distribution? Normal distribution?
r-squared is: 0.679 r-squared is: 0.735
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 7.9

Copper 95% UCL Calculation

DATA	ID
17.4	J15W21
20.6	J15W22
20.0	J15W23/J15W34
21.2	J15W24
18.5	J15W25
24.0	J15W26
17.3	J15W27
16.4	J15W28
19.9	J15W29
19.8	J15W30

Number of samples		Uncensored values	
Uncensored	10	Mean	19.5
Censored		Lognormal mean	19.5
Detection limit or PQL		Std. devn.	2.2
Method detection limit		Median	19.9
TOTAL	10	Min.	16.4
		Max.	24.0

Lognormal distribution? Normal distribution?
r-squared is: 0.958 r-squared is: 0.944
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 20.9

Hexavalent Chromium 95% UCL Calculation

DATA	ID
0.10	J15W21
0.11	J15W22
0.17	J15W23/J15W34
0.27	J15W24
0.32	J15W25
0.23	J15W26
0.31	J15W27
0.29	J15W28
0.22	J15W29
0.10	J15W30

Number of samples		Uncensored values	
Uncensored	10	Mean	0.21
Censored		Lognormal mean	0.22
Detection limit or PQL		Std. devn.	0.09
Method detection limit		Median	0.23
TOTAL	10	Min.	0.10
		Max.	0.32

Lognormal distribution? Normal distribution?
r-squared is: 0.872 r-squared is: 0.913
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 0.26

Lead 95% UCL Calculation

DATA	ID
3.0	J15W21
6.8	J15W22
6.8	J15W23/J15W34
6.5	J15W24
5.6	J15W25
5.9	J15W26
5.5	J15W27
6.0	J15W28
5.8	J15W29
5.9	J15W30

Number of samples		Uncensored values	
Uncensored	10	Mean	5.8
Censored		Lognormal mean	5.8
Detection limit or PQL		Std. devn.	1.1
Method detection limit		Median	5.9
TOTAL	10	Min.	3.0
		Max.	6.8

Lognormal distribution? Normal distribution?
r-squared is: 0.634 r-squared is: 0.733
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 6.3

PQL = practical quantitation limit
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford
Originator J. M. Capron
Project 100-B/C Field Remediation
Subject 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations

Date 12/16/07 Calc. No. 0100B-CA-V0310 Rev. No. 0
Job No. 14655 Checked M. J. Appel Date 12/19/07
Sheet No. 8 of 109 mac 4/31/08

Ecology Software (MTCAStat) Results (continued)

Manganese 95% UCL Calculation

DATA	ID
250	J15W21
359	J15W22
355	J15W23/J15W34
353	J15W24
346	J15W25
366	J15W26
324	J15W27
331	J15W28
352	J15W29
338	J15W30

Number of samples		Uncensored values	
Uncensored	10	Mean	337
Censored		Lognormal mean	338
Detection limit or PQL		Std. devn.	33
Method detection limit		Median	349
TOTAL	10	Min.	250
		Max.	366

Lognormal distribution? Normal distribution?
r-squared is: 0.659 r-squared is: 0.704
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 355

Nickel 95% UCL Calculation

DATA	ID
8.7	J15W21
13.6	J15W22
17.1	J15W23/J15W34
15.8	J15W24
12.2	J15W25
18.3	J15W26
11.7	J15W27
11.2	J15W28
18.2	J15W29
13.2	J15W30

Number of samples		Uncensored values	
Uncensored	10	Mean	14.0
Censored		Lognormal mean	14.0
Detection limit or PQL		Std. devn.	3.2
Method detection limit		Median	13.4
TOTAL	10	Min.	8.7
		Max.	18.3

Lognormal distribution? Normal distribution?
r-squared is: 0.952 r-squared is: 0.958
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 16.4

Vanadium 95% UCL Calculation

DATA	ID
32.7	J15W21
44.5	J15W22
46.0	J15W23/J15W34
49.5	J15W24
59.4	J15W25
52.7	J15W26
43.9	J15W27
38.0	J15W28
49.9	J15W29
42.2	J15W30

Number of samples		Uncensored values	
Uncensored	10	Mean	45.9
Censored		Lognormal mean	46.0
Detection limit or PQL		Std. devn.	7.6
Method detection limit		Median	45.2
TOTAL	10	Min.	32.7
		Max.	59.4

Lognormal distribution? Normal distribution?
r-squared is: 0.970 r-squared is: 0.981
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 51.0

Zinc 95% UCL Calculation

DATA	ID
29.8	J15W21
46.0	J15W22
43.5	J15W23/J15W34
42.9	J15W24
41.9	J15W25
38.6	J15W26
41.1	J15W27
41.9	J15W28
45.0	J15W29
42.0	J15W30

Number of samples		Uncensored values	
Uncensored	10	Mean	41.3
Censored		Lognormal mean	41.3
Detection limit or PQL		Std. devn.	4.5
Method detection limit		Median	42.0
TOTAL	10	Min.	29.8
		Max.	46.0

Lognormal distribution? Normal distribution?
r-squared is: 0.709 r-squared is: 0.762
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 43.6

PQL = practical quantitation limit
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron Date 01/22/08 Calc. No. 0100B-CA-V0310 Rev. No. 1
Project 100-B/C Field Remediation Job No. 14655 Checked M. J. Appel Date 1/29/08
Subject 100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations Sheet No. 9 of 109

Duplicate Analysis

Sample Location	Sample Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Thorium-228			Thorium-232			Aluminum		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
3	J15W23	10/22/07	23.0		10.7	23.7		5.52	16.3		0.490	1.31		0.095	1.78		0.165	1.74		0.056	1.78		0.165	9310		11.6
Duplicate of J15W23	J15W34	10/22/07	21.4		11.3	24.6		8.68	16.4		0.314	1.50		0.076	1.71		0.168	1.76		0.049	1.71		0.168	8180		11.6

Analysis:

TDL		Gross alpha	Gross beta	Potassium-40	Radium-226	Radium-228	Thorium-228	Thorium-232	Aluminum
		10	15	0.5	0.1	0.2	1	1	5
Duplicate Analysis	Both > MDA/PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No - evaluate difference	No - evaluate difference	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	No - evaluate difference	No - evaluate difference	**Yes (calc RPD)**
	RPD			0.61%	14%	4.0%			13%
	Difference >2xTDL?	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable

Sample Location	Sample Number	Sample Date	Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			Chromium (total)			Cobalt		
			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
3	J15W23	10/22/07	6.9		1.4	80.0		0.29	0.19		0.14	1.7		1.4	0.29	U	0.29	6340	C	11.6	19.7		0.58	8.0		0.58
Duplicate of J15W23	J15W34	10/22/07	5.7		1.4	74.6		0.29	0.14	U	0.14	1.4	U	1.4	0.31		0.29	5930	C	11.6	16.1		0.58	7.4		0.58

Analysis:

TDL		Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium (total)	Cobalt
		10	2	0.5	2	0.2	100	1	2
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	No - evaluate difference	No - evaluate difference	No - evaluate difference	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No - evaluate difference	**Yes (calc RPD)**				**Yes (calc RPD)**	**Yes (calc RPD)**	No - evaluate difference
	RPD		7.0%				6.7%	20%	
	Difference >2xTDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Sample Location	Sample Number	Sample Date	Copper			Hexavalent Chromium			Iron			Lead			Magnesium			Manganese			Molybdenum			Nickel		
			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
3	J15W23	10/22/07	21.1	C	0.58	0.23		0.21	23000	C	13.0	7.2		0.87	5080	C	7.2	371	C	0.12	0.87		0.87	17.6		0.58
Duplicate of J15W23	J15W34	10/22/07	18.9	C	0.58	0.21	U	0.21	21400	C	13.0	6.3		0.87	4870	C	7.2	339	C	0.12	1.0		0.87	16.5		0.58

Analysis:

TDL		Copper	Hexavalent Chromium	Iron	Lead	Magnesium	Manganese	Molybdenum	Nickel
		1	0.5	5	5	75	5	2	4
Duplicate Analysis	Both > PQL?	**Yes (continue)**	No - evaluate difference	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	No - evaluate difference	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**		**Yes (calc RPD)**	No - evaluate difference	**Yes (calc RPD)**	**Yes (calc RPD)**		No - evaluate difference
	RPD	11%		7.2%		4.2%	9.0%		
	Difference >2xTDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

Sample Location	Sample Number	Sample Date	Potassium			Silicon			Silver			Sodium			Vanadium			Zinc			Pyrene		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	µg/kg	Q	PQL
3	J15W23	10/22/07	1280		11.6	1280		11.6	0.39		0.29	236	C	5.8	48.6		0.41	43.0	C	1.7	350	U	350
Duplicate of J15W23	J15W34	10/22/07	1170		11.6	1900		11.6	0.29	U	0.29	228	C	5.8	43.3		0.40	43.9	C	1.7	21	J	350

Analysis:

TDL		Potassium	Silicon	Silver	Sodium	Vanadium	Zinc	Pyrene
		400	2	0.2	50	2.5	1	330
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	No - evaluate difference	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	No - evaluate difference
	Both >5xTDL?	No - evaluate difference	**Yes (calc RPD)**		No - evaluate difference	**Yes (calc RPD)**	**Yes (calc RPD)**	
	RPD		***39%***			12%	2.1%	
	Difference >2xTDL?	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

C = method blank contamination (inorganics)
J = estimate
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
RPD = relative percent difference
TDL = target detection limit
U = undetected

Attachment 1. 100-B-21:2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
1	J15W21	10/22/07	0.045	U	0.045	0.051	U	0.051	0.029	U	0.029	0.075	U	0.075	0.090	U	0.090	0.068	U	0.068
2	J15W22	10/22/07	0.209	U	0.209	0.093		0.038	0.031	U	0.031	0.093	U	0.093	0.104	U	0.104	0.108	U	0.108
3	J15W23	10/22/07	0.075	U	0.075	0.045	U	0.045	0.041	U	0.041	0.112	U	0.112	0.139	U	0.139	0.175	U	0.175
Duplicate of J15W23	J15W34	10/22/07	0.070	U	0.070	0.040	U	0.040	0.038	U	0.038	0.100	U	0.100	0.123	U	0.123	0.129	U	0.129
4	J15W24	10/22/07	0.270	U	0.270	0.042	U	0.042	0.035	U	0.035	0.106	U	0.106	0.116	U	0.116	0.138	U	0.138
5	J15W25	10/22/07	0.414	U	0.414	0.057	U	0.057	0.048	U	0.048	0.132	U	0.132	0.182	U	0.182	0.155	U	0.155
6	J15W26	10/22/07	0.062	U	0.062	0.045	U	0.045	0.043	U	0.043	0.123	U	0.123	0.152	U	0.152	0.122	U	0.122
7	J15W27	10/22/07	0.060	U	0.060	0.067		0.026	0.035	U	0.035	0.116	U	0.116	0.121	U	0.121	0.101	U	0.101
8	J15W28	10/22/07	0.216	U	0.216	0.045	U	0.045	0.028	U	0.028	0.086	U	0.086	0.086	U	0.086	0.111	U	0.111
9	J15W29	10/22/07	0.403	U	0.403	0.052	U	0.052	0.049	U	0.049	0.123	U	0.123	0.178	U	0.178	0.145	U	0.145
10	J15W30	10/22/07	0.054	U	0.054	0.042	U	0.042	0.045	U	0.045	0.109	U	0.109	0.145	U	0.145	0.112	U	0.112
OB stockpile (south)	J15W31	10/22/07	0.058	U	0.058	0.078		0.040	0.033	U	0.033	0.123	U	0.123	0.112	U	0.112	0.137	U	0.137
OB stockpile (north)	J15W32	10/22/07	0.210	U	0.210	0.050		0.031	0.031	U	0.031	0.089	U	0.089	0.092	U	0.092	0.108	U	0.108
OB stockpile (center)	J15W33	10/22/07	0.055	U	0.055	0.062	U	0.062	0.043	U	0.043	0.109	U	0.109	0.139	U	0.139	0.186	U	0.186

Sample Location	Sample Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Silver-108m		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
1	J15W21	10/22/07	14.4		6.53	13.5		5.95	14.6		0.269	0.553		0.049	0.743		0.114	0.021	U	0.021
2	J15W22	10/22/07	14.3		8.21	19.8		6.30	15.8		0.349	0.729		0.044	0.971		0.137	0.024	U	0.024
3	J15W23	10/22/07	23.0		10.7	23.7		5.52	16.3		0.490	1.31		0.095	1.78		0.165	0.030	U	0.030
Duplicate of J15W23	J15W34	10/22/07	21.4		11.3	24.6		8.68	16.4		0.314	1.50		0.076	1.71		0.168	0.028	U	0.028
4	J15W24	10/22/07	31.9		8.79	23.8		5.54	17.0		0.373	1.06		0.077	1.32		0.167	0.030	U	0.030
5	J15W25	10/22/07	36.9		5.84	23.2		8.97	15.3		0.602	0.896		0.113	1.25		0.229	0.039	U	0.039
6	J15W26	10/22/07	30.1		6.36	20.4		5.93	15.4		0.482	1.69		0.078	1.90		0.185	0.034	U	0.034
7	J15W27	10/22/07	19.3		5.74	21.5		8.95	14.7		0.361	0.909		0.068	1.15		0.137	0.024	U	0.024
8	J15W28	10/22/07	16.2		9.82	21.9		5.68	16.2		0.295	0.781		0.061	1.12		0.117	0.023	U	0.023
9	J15W29	10/22/07	12.1		8.96	17.1		5.65	16.7		0.525	0.798		0.087	0.980		0.195	0.039	U	0.039
10	J15W30	10/22/07	15.4		8.99	22.2		5.54	15.4		0.396	0.697		0.077	1.12		0.161	0.031	U	0.031
OB stockpile (south)	J15W31	10/22/07	17.4		9.39	21.2		8.99	15.9		0.329	0.799		0.055	1.18		0.155	0.023	U	0.023
OB stockpile (north)	J15W32	10/22/07	17.0		11.6	16.3		8.70	15.9		0.286	0.771		0.045	1.08		0.126	0.023	U	0.023
OB stockpile (center)	J15W33	10/22/07	9.66		8.28	15.9		5.60	16.6		0.388	0.828		0.074	1.24		0.171	0.031	U	0.031

Note: The following abbreviations apply to all Attachment 1 tables.

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

B = method blank contamination (organics)
C = method blank contamination (inorganics)
OB = overburden
J = estimate
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
U = undetected

Attachment	1	Sheet No.	1 of 10
Originator	J. M. Capron	Date	12/16/07
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	0

Attachment 1. 100-B-21:2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Thorium-228			Thorium-232			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
1	J15W21	10/22/07	0.688		0.036	0.743		0.114	0.115	U	0.115	3.07	U	3.07
2	J15W22	10/22/07	0.964		0.044	0.971		0.137	0.156	U	0.156	3.74	U	3.74
3	J15W23	10/22/07	1.74		0.056	1.78		0.165	0.188	U	0.188	4.91	U	4.91
Duplicate of J15W23	J15W34	10/22/07	1.76		0.049	1.71		0.168	0.174	U	0.174	4.55	U	4.55
4	J15W24	10/22/07	1.41		0.055	1.32		0.167	0.186	U	0.186	4.26	U	4.26
5	J15W25	10/22/07	1.18		0.066	1.25		0.229	0.233	U	0.233	5.68	U	5.68
6	J15W26	10/22/07	1.99		0.057	1.90		0.185	0.187	U	0.187	5.10	U	5.10
7	J15W27	10/22/07	1.15		0.042	1.15		0.137	0.154	U	0.154	4.46	U	4.46
8	J15W28	10/22/07	1.10		0.044	1.12		0.117	0.185	U	0.185	3.44	U	3.44
9	J15W29	10/22/07	0.950		0.066	0.980		0.195	0.218	U	0.218	5.70	U	5.70
10	J15W30	10/22/07	1.02		0.052	1.12		0.161	0.164	U	0.164	5.20	U	5.20
OB stockpile (south)	J15W31	10/22/07	1.12		0.040	1.18		0.155	0.144	U	0.144	3.83	U	3.83
OB stockpile (north)	J15W32	10/22/07	1.05		0.039	1.08		0.126	0.146	U	0.146	3.69	U	3.69
OB stockpile (center)	J15W33	10/22/07	1.23		0.050	1.24		0.171	0.166	U	0.166	4.77	U	4.77

Sample Location	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	4910		12.0	0.90	U	0.90	1.8		1.5	49.4		0.30	0.15	U	0.15	1.6		1.5
2	J15W22	10/22/07	7780		11.6	0.87	U	0.87	4.1		1.5	83.2		0.29	0.15	U	0.15	2.4		1.5
3	J15W23	10/22/07	9310		11.6	0.87	U	0.87	6.9		1.4	80.0		0.29	0.19		0.14	1.7		1.4
Duplicate of J15W23	J15W34	10/22/07	8180		11.6	0.87	U	0.87	5.7		1.4	74.6		0.29	0.14	U	0.14	1.4	U	1.4
4	J15W24	10/22/07	9590		11.8	0.89	U	0.89	5.7		1.5	86.1		0.30	0.18		0.15	2.2		1.5
5	J15W25	10/22/07	8390		11.9	0.89	U	0.89	5.0		1.5	107		0.30	0.15	U	0.15	2.7		1.5
6	J15W26	10/22/07	8880		11.6	0.87	U	0.87	7.9		1.5	85.9		0.29	0.15	U	0.15	2.5		1.5
7	J15W27	10/22/07	7760		10.6	0.80	U	0.80	4.0		1.3	75.7		0.27	0.13	U	0.13	2.1		1.3
8	J15W28	10/22/07	7450		10.8	0.81	U	0.81	4.3		1.4	75.2		0.27	0.14	U	0.14	2.1		1.4
9	J15W29	10/22/07	10000		11.9	0.89	U	0.89	5.6		1.5	91.1		0.30	0.15	U	0.15	2.6		1.5
10	J15W30	10/22/07	9150		11.5	0.87	U	0.87	5.1		1.4	86.5		0.29	0.14	U	0.14	2.4		1.4
OB stockpile (south)	J15W31	10/22/07	6550		11.3	0.85	U	0.85	3.5		1.4	65.0		0.28	0.14	U	0.14	1.4	U	1.4
OB stockpile (north)	J15W32	10/22/07	9390		11.0	0.82	U	0.82	4.6		1.4	89.8		0.27	0.14	U	0.14	2.5		1.4
OB stockpile (center)	J15W33	10/22/07	8300		11.9	0.89	U	0.89	4.8		1.5	86.3		0.30	0.15	U	0.15	1.7		1.5
Equipment blank	J15W35	10/22/07	51.0		3.6	0.27	U	0.27	0.45	U	0.45	1.4		0.09	0.04	U	0.04	0.54		0.45

Attachment	1	Sheet No.	2 of 10
Originator	J. M. Capron	Date	12/16/07
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	0

Attachment 1. 100-B-21:2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	0.30	U	0.30	4880	C	12.0	6.9		0.6	5.3		0.60	17.4	C	0.60	0.20	U	0.20
2	J15W22	10/22/07	0.29	U	0.29	6130	C	11.6	10.8		0.58	7.9		0.58	20.6	C	0.58	0.21	U	0.21
3	J15W23	10/22/07	0.29	U	0.29	6340	C	11.6	19.7		0.58	8.0		0.58	21.1	C	0.58	0.23		0.21
Duplicate of J15W23	J15W34	10/22/07	0.31		0.29	5930	C	11.6	16.1		0.58	7.4		0.58	18.9	C	0.58	0.21	U	0.21
4	J15W24	10/22/07	0.30	U	0.30	8080	C	11.8	16.3		0.59	7.6		0.59	21.2	C	0.59	0.27		0.20
5	J15W25	10/22/07	0.30	U	0.30	6140	C	11.9	12.0		0.60	7.3		0.60	18.5	C	0.60	0.32		0.20
6	J15W26	10/22/07	0.29	U	0.29	10000	C	11.6	18.3		0.58	8.2		0.58	24.0	C	0.58	0.23		0.20
7	J15W27	10/22/07	0.27	U	0.27	4410	C	10.6	11.6		0.53	7.4		0.53	17.3	C	0.53	0.31		0.20
8	J15W28	10/22/07	0.27	U	0.27	4920	C	10.8	10.8		0.54	7.3		0.54	16.4	C	0.54	0.29		0.20
9	J15W29	10/22/07	0.30	U	0.30	5780	C	11.9	14.4		0.59	8.3		0.59	19.9	C	0.59	0.22		0.20
10	J15W30	10/22/07	0.29	U	0.29	5440	C	11.5	12.5		0.58	7.9		0.58	19.8	C	0.58	0.20	U	0.20
OB stockpile (south)	J15W31	10/22/07	0.28	U	0.28	4620	C	11.3	10.4		0.56	6.5		0.56	15.3	C	0.56	0.20	U	0.20
OB stockpile (north)	J15W32	10/22/07	0.33		0.27	5970	C	11.0	15.8		0.55	8.6		0.55	20.6	C	0.55	0.20	U	0.20
OB stockpile (center)	J15W33	10/22/07	0.31		0.30	10900	C	11.9	13.5		0.59	6.6		0.59	18.4	C	0.59	0.26		0.20
Equipment blank	J15W35	10/22/07	0.09	U	0.09	28.9	UJ	3.6	0.18	U	0.18	0.18	U	0.18	0.26	UJ	0.18			

Sample Location	Sample Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	14100	C	13.4	3.0		0.90	3490	C	7.5	250	C	0.12	0.02	U	0.02	0.90	U	0.90
2	J15W22	10/22/07	23800	C	13.1	6.8		0.87	4840	C	7.3	359	C	0.12	0.02	U	0.02	0.87	U	0.87
3	J15W23	10/22/07	23000	C	13.0	7.2		0.87	5080	C	7.2	371	C	0.12	0.01	U	0.01	0.87		0.87
Duplicate of J15W23	J15W34	10/22/07	21400	C	13.0	6.3		0.87	4870	C	7.2	339	C	0.12	0.02	U	0.02	1.0		0.87
4	J15W24	10/22/07	22400	C	13.3	6.5		0.89	5160	C	7.4	353	C	0.12	0.02	U	0.02	0.89	U	0.89
5	J15W25	10/22/07	24000	C	13.4	5.6		0.89	4070	C	7.4	346	C	0.12	0.02	U	0.02	2.5		0.89
6	J15W26	10/22/07	23200	C	13.1	5.9		0.87	4800	C	7.3	366	C	0.12	0.01	U	0.01	0.97		0.87
7	J15W27	10/22/07	21000	C	11.9	5.5		0.80	4200	C	6.6	324	C	0.11	0.01	U	0.01	0.80	U	0.80
8	J15W28	10/22/07	20400	C	12.2	6.0		0.81	4280	C	6.8	331	C	0.11	0.01	U	0.01	0.81	U	0.81
9	J15W29	10/22/07	24100	C	13.4	5.8		0.89	5800	C	7.4	352	C	0.12	0.01	U	0.01	0.89	U	0.89
10	J15W30	10/22/07	22600	C	13.0	5.9		0.87	5020	C	7.2	338	C	0.12	0.02	U	0.02	0.87	U	0.87
OB stockpile (south)	J15W31	10/22/07	18500	C	12.7	4.5		0.85	3660	C	7.1	297	C	0.11	0.02	U	0.02	0.85	U	0.85
OB stockpile (north)	J15W32	10/22/07	24800	C	12.4	6.3		0.82	5450	C	6.9	363	C	0.11	0.01	U	0.01	0.83		0.82
OB stockpile (center)	J15W33	10/22/07	20600	C	13.3	6.5		0.89	4930	C	7.4	287	C	0.12	0.01	U	0.01	0.89	U	0.89
Equipment blank	J15W35	10/22/07	94.7	C	4.0	0.35		0.27	7.3	UJ	2.2	3.3	C	0.04	0.01	U	0.01	0.27	U	0.27

Attachment	1	Sheet No.	3 of 10
Originator	J. M. Capron	Date	01/22/08
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	1

Attachment 1. 100-B-21:2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	8.7		0.60	704		12.0	1.8	U	1.8	2080		12.0	0.30	U	0.30	189	C	6.0
2	J15W22	10/22/07	13.6		0.58	1430		11.6	1.7	U	1.7	2510		11.6	0.29	U	0.29	281	C	5.8
3	J15W23	10/22/07	17.6		0.58	1280		11.6	1.7	U	1.7	1280		11.6	0.39		0.29	236	C	5.8
Duplicate of J15W23	J15W34	10/22/07	16.5		0.58	1170		11.6	1.7	U	1.7	1900		11.6	0.29	U	0.29	228	C	5.8
4	J15W24	10/22/07	15.8		0.59	1370		11.8	1.8	U	1.8	2090		11.8	0.30	U	0.30	308	C	5.9
5	J15W25	10/22/07	12.2		0.60	1480		11.9	1.8	U	1.8	1630		11.9	0.30	U	0.30	278	C	6.0
6	J15W26	10/22/07	18.3		0.58	1160		11.6	1.7	U	1.7	3030		11.6	0.29	U	0.29	434	C	5.8
7	J15W27	10/22/07	11.7		0.53	1490		10.6	1.6	U	1.6	1670		10.6	0.27	U	0.27	225	C	5.3
8	J15W28	10/22/07	11.2		0.54	1510		10.8	1.6	U	1.6	2690		10.8	0.27	U	0.27	232	C	5.4
9	J15W29	10/22/07	18.2		0.59	1800		11.9	1.8	U	1.8	1070		11.9	0.30	U	0.30	287	C	5.9
10	J15W30	10/22/07	13.2		0.58	2020		11.5	1.7	U	1.7	2210		11.5	0.29	U	0.29	212	C	5.8
OB stockpile (south)	J15W31	10/22/07	11.3		0.56	1010		11.3	1.7	U	1.7	2670		11.3	0.28	U	0.28	233	C	5.6
OB stockpile (north)	J15W32	10/22/07	17.8		0.55	1680		11.0	1.6	U	1.6	1120		11.0	0.27	U	0.27	247	C	5.5
OB stockpile (center)	J15W33	10/22/07	12.8		0.59	1250		11.9	1.8	U	1.8	2390		11.9	0.30	U	0.30	248	C	5.9
Equipment blank	J15W35	10/22/07	0.18	U	0.18	24.2		3.6	0.54	U	0.54	76.3		3.6	0.09	U	0.09	11.6	UJ	1.8

Sample Location	Sample Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
1	J15W21	10/22/07	32.7		0.42	29.8	C	1.8
2	J15W22	10/22/07	44.5		0.41	46.0	C	1.7
3	J15W23	10/22/07	48.6		0.41	43.0	C	1.7
Duplicate of J15W23	J15W34	10/22/07	43.3		0.40	43.9	C	1.7
4	J15W24	10/22/07	49.5		0.41	42.9	C	1.8
5	J15W25	10/22/07	59.4		0.42	41.9	C	1.8
6	J15W26	10/22/07	52.7		0.41	38.6	C	1.7
7	J15W27	10/22/07	43.9		0.37	41.1	C	1.6
8	J15W28	10/22/07	38.0		0.38	41.9	C	1.6
9	J15W29	10/22/07	49.9		0.42	45.0	C	1.8
10	J15W30	10/22/07	42.2		0.40	42.0	C	1.7
OB stockpile (south)	J15W31	10/22/07	35.0		0.40	34.4	C	1.7
OB stockpile (north)	J15W32	10/22/07	53.3		0.38	48.7	C	1.6
OB stockpile (center)	J15W33	10/22/07	41.0		0.41	42.3	C	1.8
Equipment blank	J15W35	10/22/07	0.13	U	0.13	2.1	UJ	0.54

Attachment	1	Sheet No.	4 of 10
Originator	J. M. Capron	Date	01/22/08
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	1

Attachment 1. 100-B-21:2 Verification Sampling Results.

Constituents	J15W21 Location 1 Sample Date 10/22/07			J15W22 Location 2 Sample Date 10/22/07			J15W23 Location 3 Sample Date 10/22/07			J15W34 Duplicate of J15W23 Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	340	UJ	340	340	UJ	340	350	UJ	350	350	UJ	350
1,2-Dichlorobenzene	340	U	340	340	U	340	350	U	350	350	U	350
1,3-Dichlorobenzene	340	U	340	340	U	340	350	U	350	350	U	350
1,4-Dichlorobenzene	340	U	340	340	U	340	350	U	350	350	U	350
2,4,5-Trichlorophenol	850	U	850	860	U	860	870	U	870	870	U	870
2,4,6-Trichlorophenol	340	U	340	340	U	340	350	U	350	350	U	350
2,4-Dichlorophenol	340	U	340	340	U	340	350	U	350	350	U	350
2,4-Dimethylphenol	340	U	340	340	U	340	350	U	350	350	U	350
2,4-Dinitrophenol	850	U	850	860	U	860	870	U	870	870	U	870
2,4-Dinitrotoluene	340	U	340	340	U	340	350	U	350	350	U	350
2,6-Dinitrotoluene	340	U	340	340	U	340	350	U	350	350	U	350
2-Chloronaphthalene	340	U	340	340	U	340	350	U	350	350	U	350
2-Chlorophenol	340	U	340	340	U	340	350	U	350	350	U	350
2-Methylnaphthalene	340	UJ	340	340	UJ	340	350	UJ	350	350	UJ	350
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	350	U	350	350	U	350
2-Nitroaniline	850	U	850	860	U	860	870	U	870	870	U	870
2-Nitrophenol	340	U	340	340	U	340	350	U	350	350	U	350
3,3'-Dichlorobenzidine	340	U	340	340	U	340	350	U	350	350	U	350
3-Nitroaniline	850	U	850	860	U	860	870	U	870	870	U	870
4,6-Dinitro-2-methylphenol	850	U	850	860	U	860	870	U	870	870	U	870
4-Bromophenyl-phenylether	340	U	340	340	U	340	350	U	350	350	U	350
4-Chloro-3-methylphenol	340	U	340	340	U	340	350	U	350	350	U	350
4-Chloroaniline	340	UJ	340	340	UJ	340	350	UJ	350	350	UJ	350
4-Chlorophenyl-phenylether	340	U	340	340	U	340	350	U	350	350	U	350
4-Methylphenol (p-cresol)	340	U	340	340	U	340	350	U	350	350	U	350
4-Nitroaniline	850	U	850	860	U	860	870	U	870	870	U	870
4-Nitrophenol	850	U	850	860	U	860	870	U	870	870	U	870
Acenaphthene	340	U	340	340	U	340	350	U	350	350	U	350
Acenaphthylene	340	U	340	340	U	340	350	U	350	350	U	350
Anthracene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(a)anthracene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(a)pyrene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(b)fluoranthene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(g,h,i)perylene	340	U	340	340	U	340	350	U	350	350	U	350
Benzo(k)fluoranthene	340	U	340	340	U	340	350	U	350	350	U	350
bis(2-Chloro-1-methylethyl)ether	340	U	340	340	U	340	350	U	350	350	U	350
bis(2-Chloroethoxy)methane	340	U	340	340	U	340	350	U	350	350	U	350
bis(2-Chloroethyl)ether	340	U	340	340	U	340	350	U	350	350	U	350
bis(2-Ethylhexyl)phthalate	660	U	340	660	U	340	660	U	350	660	U	350
Butylbenzylphthalate	340	U	340	340	U	340	350	U	350	350	U	350
Carbazole	340	U	340	340	U	340	350	U	350	350	U	350
Chrysene	340	U	340	340	U	340	350	U	350	350	U	350
Di-n-butylphthalate	22	J	340	340	U	340	350	U	350	350	U	350
Di-n-octylphthalate	340	U	340	340	U	340	350	U	350	350	U	350
Dibenz(a,h)anthracene	340	U	340	340	U	340	350	U	350	350	U	350
Dibenzofuran	340	U	340	340	U	340	350	U	350	350	U	350
Diethylphthalate	340	U	340	340	U	340	350	U	350	350	U	350

Attachment	1	Sheet No.	5 of 10
Originator	J. M. Capron	Date	01/22/08
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	1

Attachment 1. 100-B-21:2 Verification Sampling Results.

Constituents	J15W21 Location 1 Sample Date 10/22/07			J15W22 Location 2 Sample Date 10/22/07			J15W23 Location 3 Sample Date 10/22/07			J15W34 Duplicate of J15W23 Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)												
Dimethylphthalate	340	U	340	340	U	340	350	U	350	350	U	350
Fluoranthene	340	U	340	340	U	340	350	U	350	350	U	350
Fluorene	340	U	340	340	U	340	350	U	350	350	U	350
Hexachlorobenzene	340	U	340	340	U	340	350	U	350	350	U	350
Hexachlorobutadiene	340	U	340	340	U	340	350	U	350	350	U	350
Hexachlorocyclopentadiene	340	U	340	340	U	340	350	U	350	350	U	350
Hexachloroethane	340	U	340	340	U	340	350	U	350	350	U	350
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	350	U	350	350	U	350
Isophorone	340	U	340	340	U	340	350	U	350	350	U	350
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	350	U	350	350	U	350
N-Nitrosodiphenylamine	340	U	340	340	U	340	350	U	350	350	U	350
Naphthalene	340	U	340	340	U	340	350	U	350	350	U	350
Nitrobenzene	340	U	340	340	U	340	350	U	350	350	U	350
Pentachlorophenol	850	U	850	860	U	860	870	U	870	870	U	870
Phenanthrene	340	U	340	340	U	340	350	U	350	350	U	350
Phenol	340	U	340	340	U	340	350	U	350	350	U	350
Pyrene	340	U	340	340	U	340	350	U	350	21	J	350

Constituents	J15W24 Location 4 Sample Date 10/22/07			J15W25 Location 5 Sample Date 10/22/07			J15W26 Location 6 Sample Date 10/22/07			J15W27 Location 7 Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
1,2-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
1,3-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
1,4-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
2,4,5-Trichlorophenol	860	U	860	850	U	850	850	U	850	850	U	850
2,4,6-Trichlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dichlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dimethylphenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dinitrophenol	860	U	860	850	U	850	850	U	850	850	U	850
2,4-Dinitrotoluene	340	U	340	340	U	340	340	U	340	340	U	340
2,6-Dinitrotoluene	340	U	340	340	U	340	340	U	340	340	U	340
2-Chloronaphthalene	340	U	340	340	U	340	340	U	340	340	U	340
2-Chlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2-Methylnaphthalene	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	340	U	340	340	U	340
2-Nitroaniline	860	U	860	850	U	850	850	U	850	850	U	850
2-Nitrophenol	340	U	340	340	U	340	340	U	340	340	U	340
3,3'-Dichlorobenzidine	340	U	340	340	U	340	340	U	340	340	U	340
3-Nitroaniline	860	U	860	850	U	850	850	U	850	850	U	850
4,6-Dinitro-2-methylphenol	860	U	860	850	U	850	850	U	850	850	U	850
4-Bromophenyl-phenylether	340	U	340	340	U	340	340	U	340	340	U	340
4-Chloro-3-methylphenol	340	U	340	340	U	340	340	U	340	340	U	340
4-Chloroaniline	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
4-Chlorophenyl-phenylether	340	U	340	340	U	340	340	U	340	340	U	340

Attachment	1	Sheet No.	6 of 10
Originator	J. M. Capron	Date	01/22/08
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	1

Attachment 1. 100-B-21:2 Verification Sampling Results.

Constituents	J15W24 Location 4 Sample Date 10/22/07			J15W25 Location 5 Sample Date 10/22/07			J15W26 Location 6 Sample Date 10/22/07			J15W27 Location 7 Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)												
4-Methylphenol (p-cresol)	340	U	340	340	U	340	340	U	340	340	U	340
4-Nitroaniline	860	U	860	850	U	850	850	U	850	850	U	850
4-Nitrophenol	860	U	860	850	U	850	850	U	850	850	U	850
Acenaphthene	340	U	340	340	U	340	340	U	340	340	U	340
Acenaphthylene	340	U	340	340	U	340	340	U	340	340	U	340
Anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(a)anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(a)pyrene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(b)fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(g,h,i)perylene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(k)fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloro-1-methylethyl)ether	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloroethoxy)methane	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloroethyl)ether	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Ethylhexyl)phthalate	660	U	340	660	U	340	660	U	340	660	U	340
Butylbenzylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Carbazole	340	U	340	340	U	340	340	U	340	340	U	340
Chrysene	340	U	340	340	U	340	340	U	340	340	U	340
Di-n-butylphthalate	17	J	340	340	U	340	340	U	340	340	U	340
Di-n-octylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Dibenz(a,h)anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Dibenzofuran	340	U	340	340	U	340	340	U	340	340	U	340
Diethylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Dimethylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
Fluorene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorobutadiene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorocyclopentadiene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachloroethane	340	U	340	340	U	340	340	U	340	340	U	340
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	340	U	340	340	U	340
Isophorone	340	U	340	340	U	340	340	U	340	340	U	340
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	340	U	340	340	U	340
N-Nitrosodiphenylamine	340	U	340	340	U	340	340	U	340	340	U	340
Naphthalene	340	U	340	340	U	340	340	U	340	340	U	340
Nitrobenzene	340	U	340	340	U	340	340	U	340	340	U	340
Pentachlorophenol	860	U	860	850	U	850	850	U	850	850	U	850
Phenanthrene	340	U	340	340	U	340	340	U	340	340	U	340
Phenol	340	U	340	340	U	340	340	U	340	340	U	340
Pyrene	340	U	340	340	U	340	340	U	340	340	U	340

Attachment	1	Sheet No.	7 of 10
Originator	J. M. Capron	Date	01/22/08
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	1

Attachment 1. 100-B-21:2 Verification Sampling Results.

Constituents	J15W28 Location 8 Sample Date 10/22/07			J15W29 Location 9 Sample Date 10/22/07			J15W30 Location 10 Sample Date 10/22/07			J15W31 OB stockpile (south) Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
1,2-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
1,3-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
1,4-Dichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
2,4,5-Trichlorophenol	850	U	850	850	U	850	850	U	850	850	U	850
2,4,6-Trichlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dichlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dimethylphenol	340	U	340	340	U	340	340	U	340	340	U	340
2,4-Dinitrophenol	850	U	850	850	U	850	850	U	850	850	U	850
2,4-Dinitrotoluene	340	U	340	340	U	340	340	U	340	340	U	340
2,6-Dinitrotoluene	340	U	340	340	U	340	340	U	340	340	U	340
2-Chloronaphthalene	340	U	340	340	U	340	340	U	340	340	U	340
2-Chlorophenol	340	U	340	340	U	340	340	U	340	340	U	340
2-Methylnaphthalene	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	340	U	340	340	U	340
2-Nitroaniline	850	U	850	850	U	850	850	U	850	850	U	850
2-Nitrophenol	340	U	340	340	U	340	340	U	340	340	U	340
3,3'-Dichlorobenzidine	340	U	340	340	U	340	340	U	340	340	U	340
3-Nitroaniline	850	U	850	850	U	850	850	U	850	850	U	850
4,6-Dinitro-2-methylphenol	850	U	850	850	U	850	850	U	850	850	U	850
4-Bromophenyl-phenylether	340	U	340	340	U	340	340	U	340	340	U	340
4-Chloro-3-methylphenol	340	U	340	340	U	340	340	U	340	340	U	340
4-Chloroaniline	340	UJ	340	340	UJ	340	340	UJ	340	340	UJ	340
4-Chlorophenyl-phenylether	340	U	340	340	U	340	340	U	340	340	U	340
4-Methylphenol (p-cresol)	340	U	340	340	U	340	340	U	340	340	U	340
4-Nitroaniline	850	U	850	850	U	850	850	U	850	850	U	850
4-Nitrophenol	850	U	850	850	U	850	850	U	850	850	U	850
Acenaphthene	340	U	340	340	U	340	340	U	340	340	U	340
Acenaphthylene	340	U	340	340	U	340	340	U	340	340	U	340
Anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(a)anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(a)pyrene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(b)fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(g,h,i)perylene	340	U	340	340	U	340	340	U	340	340	U	340
Benzo(k)fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloro-1-methylethyl)ether	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloroethoxy)methane	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Chloroethyl)ether	340	U	340	340	U	340	340	U	340	340	U	340
bis(2-Ethylhexyl)phthalate	660	U	340	660	U	340	660	U	340	660	U	340
Butylbenzylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Carbazole	340	U	340	340	U	340	340	U	340	340	U	340
Chrysene	340	U	340	340	U	340	340	U	340	340	U	340
Di-n-butylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Di-n-octylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Dibenz(a,h)anthracene	340	U	340	340	U	340	340	U	340	340	U	340
Dibenzofuran	340	U	340	340	U	340	340	U	340	340	U	340
Diethylphthalate	340	U	340	340	U	340	340	U	340	340	U	340

Attachment	1	Sheet No.	8 of 10
Originator	J. M. Capron	Date	01/22/08
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	1

Attachment 1. 100-B-21:2 Verification Sampling Results.

Constituents	J15W28 Location 8 Sample Date 10/22/07			J15W29 Location 9 Sample Date 10/22/07			J15W30 Location 10 Sample Date 10/22/07			J15W31 OB stockpile (south) Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)												
Dimethylphthalate	340	U	340	340	U	340	340	U	340	340	U	340
Fluoranthene	340	U	340	340	U	340	340	U	340	340	U	340
Fluorene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorobenzene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorobutadiene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachlorocyclopentadiene	340	U	340	340	U	340	340	U	340	340	U	340
Hexachloroethane	340	U	340	340	U	340	340	U	340	340	U	340
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	340	U	340	340	U	340
Isophorone	340	U	340	340	U	340	340	U	340	340	U	340
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	340	U	340	340	U	340
N-Nitrosodiphenylamine	340	U	340	340	U	340	340	U	340	340	U	340
Naphthalene	340	U	340	340	U	340	340	U	340	340	U	340
Nitrobenzene	340	U	340	340	U	340	340	U	340	340	U	340
Pentachlorophenol	850	U	850	850	U	850	850	U	850	850	U	850
Phenanthrene	340	U	340	340	U	340	340	U	340	340	U	340
Phenol	340	U	340	340	U	340	340	U	340	340	U	340
Pyrene	340	U	340	340	U	340	340	U	340	340	U	340

Constituents	J15W32 OB stockpile (north) Sample Date 10/22/07			J15W33 OB stockpile (center) Sample Date 10/22/07			J15W35 Equipment blank Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds									
1,2,4-Trichlorobenzene	340	UJ	340	340	UJ	340	330	UJ	330
1,2-Dichlorobenzene	340	U	340	340	U	340	330	U	330
1,3-Dichlorobenzene	340	U	340	340	U	340	330	U	330
1,4-Dichlorobenzene	340	U	340	340	U	340	330	U	330
2,4,5-Trichlorophenol	850	U	850	850	U	850	830	UJ	830
2,4,6-Trichlorophenol	340	U	340	340	U	340	330	UJ	330
2,4-Dichlorophenol	340	U	340	340	U	340	330	UJ	330
2,4-Dimethylphenol	340	U	340	340	U	340	330	U	330
2,4-Dinitrophenol	850	U	850	850	U	850	830	U	830
2,4-Dinitrotoluene	340	U	340	340	U	340	330	U	330
2,6-Dinitrotoluene	340	U	340	340	U	340	330	U	330
2-Chloronaphthalene	340	U	340	340	U	340	330	U	330
2-Chlorophenol	340	U	340	340	U	340	330	U	330
2-Methylnaphthalene	340	UJ	340	340	UJ	340	330	UJ	330
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	330	U	330
2-Nitroaniline	850	U	850	850	U	850	830	U	830
2-Nitrophenol	340	U	340	340	U	340	330	U	330
3,3'-Dichlorobenzidine	340	U	340	340	U	340	330	U	330
3-Nitroaniline	850	U	850	850	U	850	830	U	830
4,6-Dinitro-2-methylphenol	850	U	850	850	U	850	830	U	830
4-Bromophenyl-phenylether	340	U	340	340	U	340	330	UJ	330
4-Chloro-3-methylphenol	340	U	340	340	U	340	330	U	330
4-Chloroaniline	340	UJ	340	340	UJ	340	330	UJ	330
4-Chlorophenyl-phenylether	340	U	340	340	U	340	330	UJ	330

Attachment	1	Sheet No.	9 of 10
Originator	J. M. Capron	Date	01/22/08
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	1

Attachment 1. 100-B-21:2 Verification Sampling Results.

Constituents	J15W32 OB stockpile (north) Sample Date 10/22/07			J15W33 OB stockpile (center) Sample Date 10/22/07			J15W35 Equipment blank Sample Date 10/22/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)									
4-Methylphenol (p-cresol)	340	U	340	340	U	340	330	U	330
4-Nitroaniline	850	U	850	850	U	850	830	U	830
4-Nitrophenol	850	U	850	850	U	850	830	U	830
Acenaphthene	340	U	340	340	U	340	330	U	330
Acenaphthylene	340	U	340	340	U	340	330	U	330
Anthracene	340	U	340	340	U	340	330	U	330
Benzo(a)anthracene	340	U	340	340	U	340	330	U	330
Benzo(a)pyrene	340	U	340	340	U	340	330	U	330
Benzo(b)fluoranthene	340	U	340	340	U	340	330	U	330
Benzo(g,h,i)perylene	340	U	340	340	U	340	330	U	330
Benzo(k)fluoranthene	340	U	340	340	U	340	330	U	330
bis(2-Chloro-1-methylethyl)ether	340	U	340	340	U	340	330	U	330
bis(2-Chloroethoxy)methane	340	U	340	340	U	340	330	UJ	330
bis(2-Chloroethyl)ether	340	U	340	340	U	340	330	UJ	330
bis(2-Ethylhexyl)phthalate	660	U	340	660	U	340	660	U	330
Butylbenzylphthalate	340	U	340	340	U	340	330	U	330
Carbazole	340	U	340	340	U	340	330	U	330
Chrysene	340	U	340	340	U	340	330	U	330
Di-n-butylphthalate	340	U	340	340	U	340	32	J	330
Di-n-octylphthalate	340	U	340	340	U	340	330	U	330
Dibenz(a,h)anthracene	340	U	340	340	U	340	330	U	330
Dibenzofuran	340	U	340	340	U	340	330	U	330
Diethylphthalate	340	U	340	340	U	340	330	U	330
Dimethylphthalate	340	U	340	340	U	340	330	U	330
Fluoranthene	340	U	340	340	U	340	330	U	330
Fluorene	340	U	340	340	U	340	330	U	330
Hexachlorobenzene	340	U	340	340	U	340	330	U	330
Hexachlorobutadiene	340	U	340	340	U	340	330	U	330
Hexachlorocyclopentadiene	340	U	340	340	U	340	330	U	330
Hexachloroethane	340	U	340	340	U	340	330	U	330
Indeno(1,2,3-cd)pyrene	340	U	340	340	U	340	330	U	330
Isophorone	340	U	340	340	U	340	330	U	330
N-Nitroso-di-n-dipropylamine	340	U	340	340	U	340	330	U	330
N-Nitrosodiphenylamine	340	U	340	340	U	340	330	U	330
Naphthalene	340	U	340	340	U	340	330	U	330
Nitrobenzene	340	U	340	340	U	340	330	U	330
Pentachlorophenol	850	U	850	850	U	850	830	UJ	830
Phenanthrene	340	U	340	340	U	340	330	U	330
Phenol	340	U	340	340	U	340	330	U	330
Pyrene	340	U	340	340	U	340	330	U	330

Attachment	1	Sheet No.	10 of 10
Originator	J. M. Capron	Date	01/22/08
Checked	M. J. Appel	Date	
Calc. No.	0100B-CA-V0310	Rev. No.	1

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-B/C Field Remediation **Job No. 14655**

Area: 100-B/C

Discipline: Environmental *Calculation No: 0100B-CA-V0311

Subject: 100-B-21:2 Waste Site Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 3 Total = 4	J. M. Capron	S. W. Clark	N/A	D. N. Strom	12-20-07

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. M. Capron	Date:	12/16/07	Calc. No.:	0100B-CA-V0311	Rev.:	1
Project:	100-B/C Field Remediation	Job No:	14655	Checked:	S. W. Clark	Date:	12/18/07
Subject:	100-B-21:2 Waste Site Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk values for the 100-B-21:2 waste site remediation verification sampling results. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2005), 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 carcinogenic risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess carcinogenic risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 2005, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas,* DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

3) WCH, 2007, *100-B-21:2 Waste Site Cleanup Verification 95% UCL Calculations*, Calculation No. 0100B-CA-V0310, Rev. 0, Washington Closure Hanford, Richland, Washington.

SOLUTION:

1) Calculate an HQ for each noncarcinogenic constituent detected above background and compare to the individual HQ of <1.0 (DOE-RL 2005).

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

3) Calculate an excess carcinogenic risk value for each carcinogenic constituent detected above background and compare to the individual excess carcinogenic risk criterion of $<1 \times 10^{-6}$ (DOE-RL 2005).

4) Sum the excess carcinogenic risk values and compare to the cumulative excess carcinogenic risk criterion of $<1 \times 10^{-5}$.

Washington Closure Hanford CALCULATION SHEET

Originator:	J. M. Capron	Date:	12/16/07	Calc. No.:	0100B-CA-V0311	Rev.:	1
Project:	100-B/C Field Remediation	Job No:	14655	Checked:	S. W. Clark	Date:	12/18/07
Subject:	100-B-21:2 Waste Site Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	2 of 3

METHODOLOGY:

Hazard quotient and carcinogenic risk calculations were performed for the 100-B-21:2 waste site using the highest of the remediation footprint statistical values and overburden stockpile samples for each analyte detected above background. Of the contaminants of concern (COCs) and contaminants of potential concern (COPCs) for the site, boron and molybdenum require the HQ calculations because they were detected and Washington State or Hanford Site background values are not available. Hexavalent chromium and multiple organic compounds (as identified in Table 1) are included in HQ and excess carcinogenic risk calculations because they were detected by laboratory analysis and cannot be attributed to natural occurrence. All other site nonradionuclide COCs and COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron is 2.5 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 1.6×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculations are completed for the appropriate analytes, the cumulative HQ is 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 7.6×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess carcinogenic risk, the 95% upper confidence limit or maximum value is divided by the carcinogenic RAG value, then multiplied by 1×10^{-6}. For example, the maximum value for hexavalent chromium is 0.26 mg/kg; divided by 2.1 mg/kg and multiplied as indicated is 1.2×10^{-7}. Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess carcinogenic risk is obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual values prior to rounding are used for this calculation.) The sum of the excess carcinogenic risk values is 1.3×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

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

Table 1 shows the results of the calculations for the 100-B-21:2 waste site.

Washington Closure Hanford CALCULATION SHEET

Originator:	J. M. Capron	Date:	12/16/07	Calc. No.:	0100B-CA-V0311	Rev.:	1
Project:	100-B/C Field Remediation	Job No:	14655	Checked:	S. W. Clark	Date:	12/18/07
Subject:	100-B-21:2 Waste Site Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 3

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 100-B-21:2 Waste Site.

Contaminants of Concern/ Contaminants of Potential Concern	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	2.5	16,000	1.6E-04	--	--
Chromium, hexavalent[c]	0.26	240	1.1E-03	2.1	1.2E-07
Molybdenum	2.5	400	6.3E-03	--	--
Semivolatiles					
bis(2-Ethylhexyl) phthalate	0.095	1,600	5.9E-05	71.4	1.3E-09
Di-n-butylphthalate	0.022	8,000	2.8E-06	--	--
Pyrene	0.021	2,400	8.8E-06	--	--
Totals					
Cumulative Hazard Quotient:			**7.6E-03**		
Cumulative Excess Cancer Risk:					**1.3E-07**

Notes:

[a] = From WCH (2007).

[b] = Value obtained from *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

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

-- = not applicable

RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that the 100-B-21:2 waste site meets the requirements for hazard quotient and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2005).