Waste Site Reclassification Form

<u>Date Submitted:</u> 9/26/06 <u>Originator:</u> L. M. Dittmer <u>Phone:</u> 372-9664	<u>Operable Unit(s):</u> 100-FR-2 <u>Waste Site ID:</u> 128-F-3 <u>Type of Reclassification Action:</u> <div style="margin-left: 40px;"> Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐ </div>	<u>Control Number:</u> 2006-042 <u>Lead Agency:</u> EPA
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This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, interim closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List (NPL) of no action, interim closed-out, or closed-out sites will occur at a future date.

Description of current waste site condition:

The 128-F-3 waste site is a former burn pit associated with the 100-F Area experimental animal farm. The site was overlain by coal ash associated with the 126-F-1 waste site and could not be located during confirmatory site evaluation. Therefore, a housekeeping action was performed to remove the coal ash potentially obscuring residual burn pit features. During this housekeeping action, burn ash and a limited amount of wood debris was located and remediated concurrently. Confirmatory evaluation, 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 process information and confirmatory sample data, (2) remediating the site, (3) demonstrating through verification sampling that cleanup goals have been met, and (4) proposing the site for classification as interim closed out.

Basis for reclassification:

The 128-F-3 waste site has been remediated to meet the remedial action objectives specified in the Remaining Sites ROD. The results of verification sampling demonstrated 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 showed that residual contaminant concentrations are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 128-F-3 PNL Burn Pit* (attached).

 D. C. Smith
 DOE-RL Project Manager

 Signature

 10/4/06
 Date

 NA
 Ecology Project Manager

 Signature

 Date

 R. A. Lobos
 EPA Project Manager

 Signature

 10-20-06
 Date

**REMAINING SITES VERIFICATION PACKAGE FOR THE
128-F-3 PNL BURN PIT**

Attachment to Waste Site Reclassification Form 2006-042

October 2006

REMAINING SITES VERIFICATION PACKAGE FOR THE 128-F-3 PNL BURN PIT

EXECUTIVE SUMMARY

The 128-F-3 waste site, located within the 100-FR-2 Operable Unit, is the former Pacific National Laboratory Burn Pit, which is believed to have received waste from the 100-F Area Experimental Animal Farm. The site is immediately south of the 126-F-1 ash pit, and coal ash is present across the site and surrounding area.

The site was evaluated during April 2003 confirmatory sampling efforts to make a decision as to whether remedial action would be required at the site. Two test trenches were excavated, but conclusive evidence of a burn pit could not be located. Additionally, significant matrix interference problems were encountered during analysis of coal ash samples.

Because a no action decision could not be definitively made, housekeeping was performed to remove coal ash potentially obscuring site features. During removal of overlying coal ash, a small amount of burn ash and wood debris was also discovered and remediated concurrently. Approximately 690 metric tons (760 US tons) of material was removed from the 128-F-3 site and disposed at the Environmental Restoration Disposal Facility. Coal ash remains at the site and surrounding area, but historical analyses and leachate studies of similar coal ash from power plant operations at Hanford have concluded that this material is nonradioactive and nondangerous per *Washington Administrative Code* (WAC) 173-303 (DOE 1997, WHC 1987).

Following site remediation, verification soil sampling within the remediation footprint and remediation waste staging pile footprint was conducted on April 10 and 11, 2006. The results indicated that the waste removal action achieved compliance with the remedial action objectives for the 128-F-3 waste site. A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 128-F-3 waste site in accordance with the TPA-MP-14 (DOE-RL 1998) procedure.

In accordance with this evaluation, the 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 *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern, contaminants of potential concern, and other constituents. Screening levels were not exceeded for the site constituents, with the exception of barium, boron, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of vanadium does not pose a risk to ecological receptors as residual concentrations are below site background levels. The exceedances of soil screening values by residual barium and boron concentrations at the site will be evaluated in the context of additional lines of evidence for ecological effects. A baseline risk assessment for the river corridor portion of the Hanford Site began in 2004, which includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used to support the final closeout decision for the 128-F-3 waste site.

Table ES-1. Summary of Remedial Action Goals for the 128-F-3 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.	No radionuclides were identified as COCs/COPCs for verification sampling.	NA
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COC/COPC concentrations are below direct exposure RAGs.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	All individual hazard quotients are less than 1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (5.1×10^{-2}) is less than 1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	All individual excess carcinogenic risk values are less than 1×10^{-6} .	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess carcinogenic risk (2.6×10^{-8}) is less than 1×10^{-5} .	
Groundwater/River Protection – Radionuclides	Attain single-COPC groundwater and river protection RAGs.	No radionuclides were identified as COCs/COPCs for verification sampling.	NA
	Attain national primary drinking water standards: ^a 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.		
	Meet drinking water standards for alpha emitters: the most stringent of 15 pCi/L MCL or 1/25th of the derived concentration guides from DOE Order 5400.5. ^b	No alpha-emitting radionuclides were identified as COCs/COPCs for verification sampling.	
	Meet total uranium standard of 30 µg/L (21.2 pCi/L). ^c	Uranium was not identified as a COC/COPC for verification sampling.	NA

Table ES-1. Summary of Remedial Action Goals for the 128-F-3 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.	Residual concentrations of barium, chromium, and copper fail the WAC 173-340-740(7)(e) three-part test for groundwater and/or river protection. However, results of the <i>100 Area Analogous Sites RESRAD Calculations</i> (BHI 2005) indicate that these constituents will not reach groundwater (and therefore the Columbia River) within 1,000 years. Therefore, the residual concentrations achieve the RAOs for groundwater and river protection.	Yes

^a “National Primary Drinking Water Regulations” (40 *Code of Federal Regulations* 141).

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

^c Based on the isotopic distribution of uranium in the 100 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

NA = not applicable

RAG = remedial action goal

RAO = remedial action objective

REMAINING SITES VERIFICATION PACKAGE FOR THE 128-F-3 PNL BURN PIT

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 128-F-3 waste site meets the objectives for interim closure as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern, contaminants of potential concern, and other constituents. Screening levels were not exceeded for the site constituents, with the exception of barium, boron, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of vanadium does not pose a risk to ecological receptors as residual concentrations are below site background levels. The exceedances of soil screening values by residual barium and boron concentrations at the site will be evaluated in the context of additional lines of evidence for ecological effects. A baseline risk assessment for the river corridor portion of the Hanford Site began in 2004, which includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used to support the final closeout decision for the 128-F-3 waste site.

GENERAL SITE INFORMATION AND BACKGROUND

The 128-F-3 waste site, part of the 100-FR-2 Operable Unit, is the former location of the Pacific National Laboratory (PNL) Burn Pit. The site is located approximately 500 m (1,600 ft) southeast of the 105-F Reactor Building and immediately south of the 126-F-1 ash pit (Figure 1), and coal ash associated with the latter is present across the site. The site is believed to have received waste from the 100-F Area Experimental Animal Farm, but the exact nature of material burned or otherwise disposed is unknown. In 1988, as part of the U.S. Department of Energy Headquarters Environmental Survey program, exploratory excavation was conducted at the site, but no foreign material beyond the coal ash was located (DeFord 1994).

Due to matrix interference problems encountered during analysis of confirmatory coal ash samples collected from the site, a decision was made to perform additional housekeeping

Figure 1. Location of the 128-F-3 Waste Site.

action (BHI 2003b) to remove coal ash potentially obscuring the former burn pit. During excavation of the site in September 2005, a limited amount of wood debris and ash associated with burning was discovered and remediated by removal to the Environmental Restoration Disposal Facility (ERDF). A historic aerial photograph of the 128-F-3 waste site and surrounding area is provided in Appendix A.

CONFIRMATORY SAMPLING ACTIVITIES

The 128-F-3 waste site was evaluated during April 2003 confirmatory sampling efforts to make a decision as to whether remedial action would be required at the site. Based on site visit observations and the results of confirmatory sampling, a recommendation was made that housekeeping action be performed at the site (BHI 2003b). The following subsections provide additional discussion of the information used to develop the confirmatory sampling design. The results of confirmatory sampling are also summarized to provide support for development of the remedial action strategy and verification sample design.

Geophysical Investigation

A geophysical survey was performed at the 128-F-3 waste site in March 2003 using electromagnetic induction and magnetometry (Bergstrom and Mitchell 2003). The survey identified an anomalous area devoid of metallic debris, likely associated with the coal ash present at the site. The interpreted results of the geophysical survey are provided in Figure 2.

Contaminants of Potential Concern for Confirmatory Sampling

The contaminants of potential concern (COPCs) for the 128-F-3 waste site confirmatory sampling event were identified based on existing historical information for the site and consideration of potentially disposed materials. The confirmatory analysis list identified in the *Waste Site Evaluation for 128-F-3 Burn Pit* (ref rev 0) includes asbestos, arsenic, barium, cadmium, chromium (total and hexavalent), lead, selenium, silver, mercury, pesticides, polychlorinated biphenyls (PCBs), semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH), gamma energy analysis (GEA), gross alpha, and gross beta.

Confirmatory Sample Design

Historical data, process knowledge, geophysical survey results, and site visit information were used to develop a site-specific confirmatory sampling design with sampling of coal ash and underlying soils at the 128-F-3 site (BHI 2003b). Excavation and confirmatory sampling were performed on April 29, 2003, as described in the sampler's field logbook (BHI 2003a). Two test trenches were excavated in areas of coal ash, as shown in Figure 2. A uniform, approximately 0.5-m (1.5-ft) layer of coal ash was encountered at the site surface along the length of test trench 1. Excavation was extended to a depth of approximately 1.8 m (6 ft), revealing only undisturbed silt with gravel and cobbles beneath the coal ash layer. Samples were collected from the coal ash and underlying soils. Excavation at the northern end of test trench 2 encountered coal ash mixed

Figure 2. Interpreted Geophysical Survey Results and Confirmatory Sampling Locations at the 128-F-3 Waste Site.

with gravel to a depth of approximately 2.1 m (7 ft) for approximately 1.5 lateral m (5 lateral ft). The coal ash layer was restricted to the upper 0.5 m (1.5 ft) of the trench for the remainder of the excavation and underlain by undisturbed soil. Samples were collected from underlying soil. A test pit was also excavated at the 128-F-3 site at an area where no significant geophysical anomalies were noted as proof-of-concept on the geophysical investigation (Figure 2). A 0.2-m (0.5-ft)-thick surficial coal ash layer underlain by undisturbed silt with gravel and cobbles to a depth of 1.2 m (4 ft) was encountered during excavation of the test pit; no samples were collected at this location. No debris was encountered in any of the excavations. No volatile organic compounds were detected by field instrumentation, and no radioactivity was detected above background during sampling activities. A summary of the samples collected, and laboratory analyses performed, is provided in Table 1.

Table 1. Confirmatory Sample Summary for the 128-F-3 Burn Pit. (2 Pages)

Sample Location	Sample Media	Sample Number	Coordinate Locations	Depth (bgs)	Sample Analysis
Test trench 1	Coal ash	J00MR4	Trench from N 147365.5 E 580887.5 to N 147366.5 E 580897.0	0 – 0.5 m (0 – 1.5 ft)	GEA, gross alpha, gross beta, SVOA, pesticide, PCB, ICP metals, mercury, and TPH
		J00MR8			Asbestos
		J00MT2			Hexavalent chromium
	Coal ash (duplicate)	J00MR5			GEA, gross alpha, gross beta, SVOA, pesticide, PCB, ICP metals, mercury, and TPH
		J00MR9			Asbestos
		J00MT3			Hexavalent chromium
	Soil	J00MP4	Trench from N 147365.5 E 580887.5 to N 147366.0 E 580892.5	1.8 m (6 ft)	GEA, gross alpha, gross beta, SVOA, pesticide, PCB, ICP metals, mercury, hexavalent chromium, and TPH
		J00MP9			Asbestos
	Soil	J00MP5	Trench from N 147366.0 E 580892.5 to N 147366.5 E 580897.0	1.8 m (6 ft)	GEA, gross alpha, gross beta, SVOA, pesticide, PCB, ICP metals, mercury, hexavalent chromium, and TPH
		J00MR0			Asbestos
Test trench 2	Soil	J00MP6	Trench from N 147361.5 E 580891.0 to N 147356.5 E 580891.0	2.1 m (7 ft)	GEA, gross alpha, gross beta, SVOA, pesticide, PCB, ICP metals, mercury, hexavalent chromium, and TPH
		J00MR1			Asbestos
	Soil	J00MP7	Trench from N 147351.5 E 580891.0 to N 147356.5 E 580891.0	0.5 m (1.5 ft)	GEA, gross alpha, gross beta, SVOA, pesticide, PCB, ICP metals, mercury, hexavalent chromium, and TPH
		J00MR2			Asbestos

Table 1. Confirmatory Sample Summary for the 128-F-3 Burn Pit. (2 Pages)

Sample Location	Sample Media	Sample Number	Coordinate Locations	Depth (bgs)	Sample Analysis
Equipment blank	Silica sand	J00MP8	N/A	N/A	GEA, SVOA, ICP metals, and mercury

Source: *Remaining Sites Field Sampling*, Logbook EL-1577 (BHI 2003a).

bgs = below ground surface

GEA = gamma energy analysis

ICP = inductively coupled plasma

N/A = not applicable

PCB = polychlorinated biphenyl

SVOA = semivolatiles organic analysis

TPH = total petroleum hydrocarbons

Confirmatory Sample Results

Confirmatory samples were analyzed using analytical methods approved by the U.S. Environmental Protection Agency (DOE-RL 2005a), and the results were compared against the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b). The laboratory results were stored in the Environmental Restoration (ENRE) project-specific database prior to providing to the Hanford Environmental Information System (HEIS) and are provided in Appendix B.

Barium, chromium, lead, 4,4'-DDE, and 4,4'-DDT were detected above soil remedial action goals (RAGs) for groundwater and/or river protection in confirmatory samples, but are not predicted to migrate to groundwater (and, thus, the Columbia River) within 1,000 years based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005). Significant matrix interference problems occurred during the laboratory analysis of hexavalent chromium for the coal ash samples due to these samples containing large amounts of organic material. The hexavalent chromium analytical method (EPA Method 7196A) is a colorimetric method and is designed to handle water and soil matrices only. The method addresses digestion using sodium hydroxide and calcium carbonate which does little to eliminate the organic matrix from the material which may interfere with the final absorbance reading, leaving little confidence in the final outcome of the calculated concentrations. The analyst attempted a 1:20 dilution which still had too much "color" for a good absorbance reading. A 1:100 dilution was attempted which resulted in a final reported concentration of 17.3 mg/kg in the primary coal ash sample, while hexavalent chromium in the associated field duplicate sample was reported as nondetected. The hexavalent chromium results for the coal ash were believed to be suspect, however, because the quantified result exceeded RAG values, a decision for no action at the site could not be definitively made and, as such, additional housekeeping at the site was recommended (BHI 2003b).

REMEDIAL ACTION SUMMARY

Remediation of the 128-F-3 waste site was performed on September 20, 2005, and consisted of the removal of coal ash and surrounding soil associated with excavation of the geophysical anomaly. The excavation was also performed to assure no residual debris or ash associated with

historical burning was present at the site. During remediation, a limited amount of wood debris and ash associated with burning was found and removed. The excavation proceeded to a depth of approximately 1.1 m (3.5 ft) within the site boundary, which is inclusive of the geophysical anomalous area (Figure 2). Approximately 690 metric tons (760 US tons) of material was excavated and staged onsite before disposal at the Environmental Restoration Disposal Facility. Pre- and post-excavation topographic surveys of the 128-F-3 waste site are provided in Figures 3 and 4, respectively.

The surface coal ash present at the site is extensive and extends beyond the anomalous area identified by the geophysical survey. Historical analyses and leachate studies of similar coal ash from power plant operations at Hanford have concluded that it is nonradioactive and nondangerous per *Washington Administrative Code* (WAC) 173-303 (DOE 1997, WHC 1987). Rather than continue removal of this surface coal ash, in-process samples (also known as excavation guidance samples) were collected to determine if additional coal ash removal was necessary. The hexavalent chromium analysis for the in-process coal ash samples was performed without any significant data quality issues (unlike the confirmatory samples) and hexavalent chromium was not detected above applicable RAGs. Similar to the confirmatory sample results, barium, chromium (total), copper, and 4,4'-DDE were quantified slightly above the soil RAGs for the protection of groundwater and/or the Columbia River. However, based on the generic vertical migration within the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), and consistent with historical leachate studies performed on coal ash, none of these contaminants are predicted to migrate significantly within 1,000 years. The results of the in-process samples (provided in Table B-2 of Appendix B) and field observations of completion of excavation of the historical boundaries of the burn pit supported a decision to terminate remediation and initiate soil verification sampling.

VERIFICATION SAMPLING ACTIVITIES

Verification sampling at the 128-F-3 waste site was performed on April 10 and 11, 2006, to collect data to make a decision as to whether the remedial action objectives had been reached. Based on statistical evaluation of the resulting data, the residual contaminant concentrations meet the cleanup criteria specified in the RDR/RAWP (DOE-RL 2005b) and the Remaining Sites ROD (EPA 1999). The following subsections provide additional discussion of the information used to develop the verification sampling design. The results of verification sampling are also summarized to support interim closure of the site.

Contaminants of Potential Concern

The results of confirmatory and in-process sampling were used to determine the COPCs for verification sampling. Barium, chromium, and lead were previously detected above background levels and retained as site COPCs. Due to detections of 4,4'-DDT, 4,4'-DDE, endosulfan sulfate, and methoxychlor in confirmatory and in-process samples, chlorinated pesticides were also retained as COPCs for verification sampling. The VOC 1,1,2,2-tetrachloroethane was tentatively identified in one confirmatory soil sample (J00MP7) during semivolatile organic

Figure 3. Pre-Excavation Topographic Survey of the 128-F-3 Waste Site Vicinity.

Figure 4. Post-Excavation Topographic Survey of the 128-F-3 Waste Site and Statistical Verification Sampling Locations.

analysis; because of the carcinogenic risk associated with this compound, and its high potential mobility, VOCs were also included as COPCs for verification sampling.

Verification Sample Design

Statistical sampling was performed for the 128-F-3 remediation footprint because the spatial distribution of potential residual soil contamination over the study area was uncertain. The decision rule for demonstrating compliance with the cleanup criteria requires comparison of the true population mean of COPCs, as estimated by the 95% upper confidence limit on the sample mean, with the cleanup level. 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. Therefore, sampling locations were distributed over the entire remediation footprint on a grid basis in an effort to determine the residual presence of contamination.

Visual Sample Plan¹ (VSP) was used as a tool to develop the statistical sampling design for the 128-F-3 waste site. The remediation footprint was delineated in VSP and used as the basis for location of a systematic grid for verification soil sample collection. Ten soil sample locations were identified using a random-start triangular grid. Additional details concerning the use of VSP to develop the statistical sampling design are provided in the 128-F-3 waste site verification sampling work instruction (WCH 2006b).

Figure 4 provides a map of the 10 statistical soil sample locations that were determined for verification sampling, with coordinates shown in Table 2. The soil sample locations were surveyed and staked prior to sample collection (WCH 2006a). All sampling was performed in accordance with ENV-1, *Environmental Monitoring and Management* to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a). One soil sample was collected at each location by collecting 25 aliquots of surficial soils from within approximately 1 m (3 ft) of the staked location and combining the aliquots into 1 sample. Field quality control (QC) samples consisted of one field duplicate sample and one equipment blank. The duplicate soil sample was collected at location 6. All samples were requested for full protocol laboratory analysis.

Verification sampling was also performed at the 128-F-3 remediation waste staging pile footprint. As there was limited potential for contaminant migration into soils underlying the former staging pile, a sampling design based on professional judgment was used rather than a statistical sampling design (WCH 2006b). Sampling at the remediation waste staging pile footprint consisted of one sample composed of 30 aliquots of surficial soils collected from locations distributed across the entire staging area (WCH 2006a).

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

Table 2. 128-F-3 Verification Sample Location Coordinates.

Sample Location	Sample Number	Washington State Plane Coordinates
1	J11VV5	N 147352.6 E 580887.3
2	J11VV6	N 147353.7 E 580893.2
3	J11VV7	N 147357.2 E 580883.3
4	J11VV8	N 147358.3 E 580889.3
5	J11VV9	N 147359.4 E 580895.2
6 ^a	J11VW0/J11VW1 ^a	N 147362.9 E 580885.4
7	J11VW2	N 147364.0 E 580891.3
8	J11VW3	N 147365.1 E 580897.3
9	J11VW4	N 147368.6 E 580887.4
10	J11VW5	N 147369.7 E 580893.4
Remediation waste staging pile footprint ^b	J11VW6	N 147380.0 E 580819.8
Equipment blank	J11VV4	NA

Source: 100-F Area RAWD Sampling, Logbook EFL-1174-1 (WCH 2006a).

^a A field duplicate sample was collected at sample location 6.

^b Boundary survey information for the footprint is stored in the Washington Closure Hanford geographic information system database.

NA = not applicable

Verification Sampling Results

Verification samples were analyzed using U.S. Environmental Protection Agency-approved analytical methods. The 95% upper confidence limit (UCL) on the true population mean for residual concentrations of COPCs was calculated for the remediation footprint as specified by the RDR/RAWP (DOE-RL 2005b), with calculations provided in Appendix C. When a COPC was detected in fewer than 50% of the verification samples collected, the maximum detected value was used for comparison against RAGs, with the exception of beta-BHC. If no detections for a given COPC were reported in the data set, then no statistical evaluation or calculations were performed for that COPC. Evaluation of the verification data from the remediation waste staging pile footprint was performed by direct comparison of the sample result for each COPC against cleanup criteria.

The chlorinated pesticide beta-BHC was detected at a maximum concentration of 0.0054 mg/kg, slightly above the soil remedial action goal for protection of groundwater, in one sample from the data set. This constituent was not detected (i.e., was censored) in 70% of the sample data set, and, as described above, the statistical value is typically set equal to the maximum detected concentration under this scenario. However, doing so is a stringent test for compliance with a cleanup level, particularly since the maximum does not violate the compliance criteria of exceeding twice the cleanup level (WAC 173-340-740[7][e]). Handling censored data sets is problematic in calculating the 95% UCL, and both the Washington Department of Ecology and the EPA provide alternative guidance. For the 128-F-3 site, the 95% UCL value for beta-BHC was calculated using a method suggested in *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (EPA 2002), in which the censored data is set equal to the quantitation limit and the 95% UCL is calculated and reported as a value likely to be considerably higher than the true mean.

Comparisons of the statistical and maximum results for COPCs and the site RAGs for the remediation footprint and remediation waste staging pile footprint are summarized in Tables 3a and 3b, respectively. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Model Toxics Control Act Cleanup Levels and Risk Calculations database under *Washington Administrative Code* (WAC) 173-340-740(3) for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium; therefore, these constituents are not considered site COPCs. The laboratory-reported data results for all constituents are stored in the ENRE project-specific database prior to providing to HEIS and are presented in Appendix C.

Table 3a. Comparison of Statistical Contaminant Concentrations to Action Levels for the 128-F-3 Remediation Footprint Verification Sampling Event. (3 Pages)

Contaminant of Potential Concern	Statistical Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	2.5 (<BG)	20	20	20	No	--
Barium	261	5,600 ^b	132 ^{c,d}	224 ^c	Yes	Yes ^f
Beryllium	0.50 (<BG)	10.4 ^g	1.51 ^d	1.51 ^d	No	--
Boron ^h	42.4	16,000	320	-- ⁱ	No	--
Cadmium ^j	0.26 (<BG)	13.9	0.81 ^d	0.81 ^d	No	--
Chromium (total)	25.8	80,000 ^b	18.5 ^d	18.5 ^d	Yes	Yes ^f
Cobalt	6.3 (<BG)	1,600	32	-- ⁱ	No	--
Copper	21.1 (<BG)	2,960	59.2	22.0 ^d	Yes ^k	Yes ^f
Lead	4.5 (<BG)	353	10.2 ^d	10.2 ^d	No	--
Manganese	293 (<BG)	11,200	512 ^d	512 ^d	No	--
Mercury	0.03 (<BG)	24	0.33 ^d	0.33 ^d	No	--

Table 3a. Comparison of Statistical Contaminant Concentrations to Action Levels for the 128-F-3 Remediation Footprint Verification Sampling Event. (3 Pages)

Contaminant of Potential Concern	Statistical Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Statistical Data Set Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Nickel	10.9 (<BG)	1,600	19.1 ^d	27.4	No	--
Vanadium	41.7 (<BG)	560	85.1 ^d	-- ⁱ	No	--
Zinc	42.8 (<BG)	24,000	480	67.8 ^d	No	--
Aldrin	0.00056	0.0588	0.00165 ^l	0.00165 ^l	No	--
alpha-Chlordane	0.0028	2.86 ^m	0.025 ^m	0.0165 ^l	No	--
beta-BHC	0.003	0.556	0.00486	0.00554	No	--
4,4'-DDD	0.0043	4.17	0.0365	0.005 ^l	No	--
4,4'-DDE	0.0023	2.94	0.0257	0.005 ^l	No	--
4,4'-DDT	0.0016	2.94	0.0257	0.005 ^l	No	--
Endosulfan I	0.0016	480	9.6	0.0112	No	--
Endosulfan sulfate	0.0058	480	9.6	0.0112	No	--
Endrin ketone	0.0030	24	0.2	0.039	No	--
gamma-BHC (lindane)	0.0013	0.769	0.00673	0.0038	No	--
Heptachlor epoxide	0.00055	0.11	0.002 ^l	0.002 ^l	No	--
Methoxychlor	0.010	400	4	1.67	No	--
2-Butanone	0.005	48,000	480	-- ⁱ	No	--
2-Hexanone	0.008	3,200	64	-- ⁱ	No	--
4-Methyl-2-pentanone	0.008	6,400	64	-- ⁱ	No	--
Acetone	0.009	72,000	720	-- ⁱ	No	--
Chlorobenzene	0.008	1,600	10	136	No	--
Chloroform	0.005	164	0.71	1.14	No	--
Ethylbenzene	0.002	8,000	70	620	No	--
Methylene chloride	0.016	133	0.5	0.94	No	--
Styrene	0.004	33.3	0.15	-- ⁱ	No	--
Tetrachloroethene	0.001	1.85	0.008	0.078	No	--
Xylenes (total)	0.007	16,000	160	-- ⁱ	No	--

^a 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, 730, and 740, Method B, 1996, unless otherwise noted.

^b Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) (as presented in DOE-RL [2005b]). Updated oral reference dose values (as provided in IRIS) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and chromium, respectively.

Table 3a. Comparison of Statistical Contaminant Concentrations to Action Levels for the 128-F-3 Remediation Footprint Verification Sampling Event. (3 Pages)

- ^c Barium soil cleanup level for groundwater protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule") and WAC 173-340-720(3), 1996 (Method B for groundwater) is 112 mg/kg (as presented in DOE-RL [2005b]). The updated oral reference dose value (as provided in IRIS) yields a Method B groundwater cleanup criteria of 7 mg/L, as compared to the more restrictive maximum contaminant level of 2 mg/L (40 CFR 141). Per WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), the most restrictive updated soil cleanup level for groundwater protection would be 200 mg/kg.
- ^d Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).
- ^e Barium soil cleanup level for river protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), a dilution attenuation factor of 2, and WAC 173-340-720(3), 1996 (Method B for groundwater) is 224 mg/kg (as presented in DOE-RL [2005b]). No surface water bioconcentration factor is available for barium and no AWQC value exists separate from the previous drinking water standard; therefore no WAC 173-340-730(3), 1996 (Method B for surface waters) value can be determined.
- ^f Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), barium, chromium, and copper are not expected to migrate more than 3 m (10 ft) in 1,000 years. The vadose zone underlying the remediation footprint is approximately 6.5 m (21 ft) thick.
- ^g Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750[3], 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m³ (WDOH 1997).
- ^h No Hanford Site-specific or Washington State background value available.
- ⁱ No cleanup level is available from the Ecology Cleanup Levels and Risk Calculations database (Ecology 2005), and no bioconcentration factor or AWQC values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
- ^j Hanford Site-specific background value is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
- ^k The statistical verification data set for copper fails the third component of the WAC 173-340-740(7)(e) 3-part test (more than 10% of the data set exceeds the soil RAG for river protection).
- ^l Where cleanup levels are less than the RDL, cleanup levels default to the RDL (WAC 173-340-707[2], 1996 and DOE-RL 2005b).
- ^m Direct exposure and groundwater protection RAG values for chlordane were mistakenly calculated based on carcinogenicity data for lindane in DOE-RL (2005b). Corrected values are presented in this table.
- = not applicable
- AWQC = ambient water quality criteria
- BG = background
- CFR = Code of Federal Regulations
- IRIS = Integrated Risk Information System
- RAG = remedial action goal
- RDL = required detection limit
- RESRAD = RESidual RADioactivity (dose assessment model)
- WAC = Washington Administrative Code

Table 3b. Comparison of Detected Contaminant Concentrations to Action Levels for the 128-F-3 Remediation Waste Staging Pile Footprint Verification Sampling Event. (2 Pages)

Contaminant of Potential Concern	Analytical Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Analytical Result Exceed RAGs?	Does the Analytical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Barium	141	5,600 ^b	132 ^{c,d}	224 ^e	Yes	Yes ^f
Beryllium	0.58 (<BG)	10.4 ^g	1.51 ^d	1.51 ^d	No	--
Boron ^h	5.5	16,000	320	-- ⁱ	No	--
Cadmium ^j	0.27 (<BG)	13.9	0.81 ^d	0.81 ^d	No	--
Chromium (total)	9.8 (<BG)	80,000 ^b	18.5 ^d	18.5 ^d	No	--
Cobalt	6.6 (<BG)	1,600	32	-- ⁱ	No	--
Copper	11.6 (<BG)	2,960	59.2	22.0 ^d	No	--
Lead	8.3 (<BG)	353	10.2 ^d	10.2 ^d	No	--

Table 3b. Comparison of Detected Contaminant Concentrations to Action Levels for the 128-F-3 Remediation Waste Staging Pile Footprint Verification Sampling Event. (2 Pages)

Contaminant of Potential Concern	Analytical Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Analytical Result Exceed RAGs?	Does the Analytical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Manganese	331 (<BG)	11,200	512 ^d	512 ^d	No	--
Nickel	9.2 (<BG)	1,600	19.1 ^d	27.4	No	--
Vanadium	46.4 (<BG)	560	85.1 ^d	-- ⁱ	No	--
Zinc	44.8 (<BG)	24,000	480	67.8 ^d	No	--
4,4'-DDE	0.0031	2.94	0.0257	0.005 ^k	No	--
4,4'-DDT	0.00076	2.94	0.0257	0.005 ^k	No	--
Endosulfan II	0.00088	480	9.6	0.0112	No	--

^a 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, 730, and 740, Method B, 1996, unless otherwise noted.

^b Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), 1996 (Method B for soils) (as presented in DOE-RL [2005b]). Updated oral reference dose values (as provided in IRIS) yield Method B direct exposure RAG values of 16,000 mg/kg and 120,000 mg/kg for barium and chromium, respectively.

^c Barium soil cleanup level for groundwater protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule") and WAC 173-340-720(3), 1996 (Method B for groundwater) is 112 mg/kg (as presented in DOE-RL [2005b]). The updated oral reference dose value (as provided in IRIS) yields a Method B groundwater cleanup criteria of 7 mg/L, as compared to the more restrictive maximum contaminant level of 2 mg/L (40 CFR 141). Per WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), the most restrictive updated soil cleanup level for groundwater protection would be 200 mg/kg.

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

^e Barium soil cleanup level for river protection calculated from WAC 173-340-740(3)(a)(ii)(A), 1996 ("100 times rule"), a dilution attenuation factor of 2, and WAC 173-340-720(3), 1996 (Method B for groundwater) is 224 mg/kg (as presented in DOE-RL [2005b]). No surface water bioconcentration factor is available for barium and no AWQC value exists separate from the previous drinking water standard; therefore no WAC 173-340-730(3), 1996 (Method B for surface waters) value can be determined.

^f Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), barium is not expected to migrate more than 3 m (10 ft) in 1,000 years. The vadose zone underlying the remediation footprint is approximately 9.0 m (30 ft) thick.

^g Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750[3], 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m³ (WDOH 1997).

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

ⁱ No cleanup level is available from the Ecology Cleanup Levels and Risk Calculations database (Ecology 2005), and no bioconcentration factor or AWQC values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).

^j Hanford Site-specific background value is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

^k Where cleanup levels are less than the RDL, cleanup levels default to the RDL (WAC 173-340-707[2], 1996 and DOE-RL 2005b).

-- = not applicable

AWQC = ambient water quality criteria

BG = background

CFR = *Code of Federal Regulations*

IRIS = Integrated Risk Information System

RAG = remedial action goal

RDL = required detection limit

RESRAD = RESidual RADioactivity (dose assessment model)

WAC = *Washington Administrative Code*

DATA EVALUATION

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 128-F-3 waste site verification data sets is included in statistical calculations (Appendix C). The three-part test was not performed when statistical values defaulted to the maximum detected value due to data censorship, as direct evaluation of the maximum result against RAGs was used as the compliance basis.

All residual COPC concentrations for the 128-F-3 remediation footprint pass the three-part test in comparison against direct exposure RAGs. Residual concentrations of barium, chromium, and copper in the remediation footprint fail one or more parts of the three-part test in comparison against soil RAGs for the protection of groundwater and/or the Columbia River. Data were not collected on the vertical extent of residual contamination, but, given the soil-partitioning coefficients of the metals (>22 mL/g), these contaminants would not be expected to migrate more than 3 m (10 ft) vertically in 1,000 years (BHI 2005). The vadose zone beneath the 128-F-3 excavation is approximately 6.5 m (21 ft) thick. Therefore, residual concentrations of barium, chromium, and copper are protective of groundwater. The only pathway for contamination to reach the Columbia River is via groundwater migration, so these contaminant concentrations are also protective of river water.

Residual concentrations of barium within the waste staging pile footprint also slightly exceed the soil RAG for groundwater protection. As with the remediation footprint, data were not collected on the vertical extent of residual contamination, but, given the soil-partitioning coefficient of barium (25 mL/g), it would not be expected to migrate more than 3 m (10 ft) vertically in 1,000 years (BHI 2005). The vadose zone beneath the 128-F-3 waste staging pile footprint is approximately 9.0 m (30 ft) thick. Therefore, residual concentrations of barium are protective of groundwater.

Nonradionuclide risk requirements include a hazard quotient of less than 1.0 for all individual noncarcinogens, 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} . These risk values were conservatively calculated using the higher of the remediation footprint statistical value and the waste staging pile footprint maximum value for each constituent. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients were less than 1.0, and all individual excess carcinogenic risk values were less than 1×10^{-6} (Appendix D). The cumulative hazard quotient for the 128-F-3 waste site is 5.1×10^{-2} , and the cumulative excess carcinogenic risk value is 2.6×10^{-8} . Therefore, nonradionuclide risk requirements are met.

DATA QUALITY ASSESSMENT

Confirmatory Sampling

A data quality assessment (DQA) was performed to compare the confirmatory sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific work instruction (BHI 2003b). This DQA was performed in accordance with procedures detailed in ENV-1, *Environmental Monitoring and Management*. Specific data quality objectives for the site are found in the SAP (DOE-RL 2005a).

A review of the work instruction (BHI 2003b), the field logbook (BHI 2003a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected per the sample design. Where the sample design allowed for additional samples, if required to properly characterize the site, no additional data needs were identified at the time of field sampling. To ensure quality data, the 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., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process.

Data from confirmatory samples collected at the 128-F-3 waste site were provided by the laboratory in four sample delivery groups (SDGs): H2188, H2189, W04032, and 20030605. K0211 and SDG K0368.

H2188

SDG H2188 consists of four field samples (J00MP4 through J00MP7), analyzed for SVOCs, pesticides, PCBs, inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, TPH, gross alpha, gross beta, and by gamma energy analysis. This SDG also includes a field equipment blank (J00MP8), analyzed for SVOCs, ICP metals, mercury, and by GEA. Third-party validation was performed on this SDG, the results of which are included within the following discussion.

In the Pesticide analysis three of sixteen surrogate recoveries were above the acceptance criteria. The decachlorobiphenyl surrogate in the method blank (MB) recovered at 130%, and in samples J00MP4 and J00MP7 at 130% and 135%, respectively. However, the secondary acceptance criteria of "... no more than one outlier per sample" was met. High surrogate recoveries may indicate a high bias in the affected field data. High biased data are acceptable for decision making purposes.

In the PCB analysis, two of sixteen surrogate recoveries were above the laboratory acceptance criteria. The decachlorobiphenyl surrogate recovery in the MB and sample J00MP7 were 125% and 135%, respectively. However, the secondary acceptance criterion (no more than one outlier per sample) was met. High surrogate recoveries may indicate a high bias in the affected field data. High biased data are acceptable for decision-making purposes.

In the ICP metals analysis, the laboratory has commented that the relative percent difference (RPD) for selenium is above the acceptance criteria. Both the main sample and the duplicate sample were near the practical quantitation limit (PQL) with the main sample showing a non-detection. Calculation of RPDs near the PQL is always problematic. The PQL is, by definition, that region of concentrations where the quantitation becomes less reliable. RDLs are not usually calculated or reported when either the main sample or duplicate are non-detected. The data are unaffected by this result.

Contamination in the MB for the analyte chromium was only significant relative to the sample J00MP8. Third-party validation qualified the chromium result in sample J00MP8 as non-detected with a "U" flag. It should be noted that the remaining samples were not qualified because the low level MB contamination was not significant compared to the results in those samples. Sample J00MP8, the equipment blank, was the only sample with a low enough chromium result for the MB result to be considered relevant. However, both values are below the required quantitation limit (RQL), are not relevant compared to the RAG, and do not indicate any problems in the data.

The non-detected chromium results were reported above the 0.1 mg/kg RQL with a PQL of 0.41 mg/kg. The PQL is close enough to the RQL that chromium would have been detected at the RQL and reported with a "J" flag if it were present in the sample. The lowest RAG value is 18.5 mg/kg, which is well above the PQL.

H2189

SDG H2189 consists of field sample J00MR4 and the associated field duplicate sample J00MR5, analyzed for SVOCs, pesticides, PCBs, ICP metals, mercury, TPH, gross alpha, gross beta, and by GEA.

In the pesticide analysis, the decachlorobiphenyl surrogate in the MB was above the acceptance criteria at 130%. However, the secondary acceptance criterion (no more than one outlier per sample) was met. This result is limited to the MB there is no impact on the field sample results.

In the PCB analysis, seven of twelve surrogate results were above the acceptance criteria in the range of 125%-205%. These results may indicate a high bias in the field sample data. High biased field sample data are acceptable for decision-making purposes.

Also in the PCB analysis, the matrix spike (MS) recovery for aroclor-1016 and aroclor-1260 were above the acceptance criteria at 156% and 157%, respectively. These results may indicate a high bias in the field sample data. High biased field sample data are acceptable for decision-making purposes.

In the metals analysis the MS recoveries for mercury and barium were outside the acceptance criteria at 66% and 144%, respectively. It is common for some of the metals to be out of criteria due to spike concentrations that are not appropriate compared to the concentrations found in the sample from which the MS is prepared. This is difficult for the laboratory to avoid because the

analyte sample concentrations are unknown prior to analysis. The laboratory had performed serial dilutions, and in the case of barium a post-digestion spike (PDS), to confirm that acceptable quantitation of these analytes has been achieved.

W04032

SDG W04032 consists of field sample J00MT2 and the associated field duplicate sample J00MT3, analyzed for hexavalent chromium.

The hexavalent chromium analysis was compromised due to the presence of organics in the samples. The samples were diluted 100-fold. The laboratory has also indicated little confidence that the final readings represent the actual concentrations in the samples. The MS recovery was an unacceptable 1%. The project rejected the hexavalent chromium data in SDG W04032. Hexavalent chromium was retained for analysis of samples collected during verification sampling.

SDG 20030605

SDG 20030605 consists of five field samples (J00MR1, J00MR2, J00MR8, J00MR0, and J00MP9) and one field duplicate sample (J00MR9, duplicate of J00MR8), analyzed for asbestos.

No issues were identified with the asbestos data in SDG 20030605.

Summary

Limited, random, or sample matrix-specific influenced batch quality control (QC) issues such as these are a potential for any analysis. The number and types seen in these data sets were within expectations for the matrix types and analyses performed. The DQA review for the 128-F-3 confirmatory sampling data found the results to be accurate within the standard errors associated with the analytical methods, sampling, and sample handling, except as described above. The DQA review for the 128-F-3 site confirmatory data concludes that the data reviewed are of the right type, quality, and quantity to support the intended use, except as noted above. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of quality assurance (QA) and QC deficiencies. All analytical data, with the exception of hexavalent chromium in SDG W04032 were found acceptable for decision-making purposes. The verification sample analytical data are stored in the ENRE project-specific database prior to providing to HEIS and are summarized in Appendix B.

Verification Sampling

A DQA was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific work instruction (WCH 2006b). This DQA was performed in accordance with procedures detailed in ENV-1, *Environmental Monitoring and Management*. Specific data quality objectives for the site are found in the SAP (DOE-RL 2005a).

A review of the work instruction (WCH 2006b), the field logbook (WCH 2006a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected per the sample design. Where the sample design allowed for additional samples, if required to properly characterize the site, no additional data needs were identified at the time of field sampling. To ensure quality data, the 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., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process.

Data from verification samples collected at the 128-F-3 waste site were provided by the laboratory in two SDGs: K0310 and K0321.

K0310

SDG K0310 consists of five field samples (J11VV5 through J11VV9), analyzed for ICP metals, mercury, hexavalent chromium, pesticides, and by volatile organic analysis (VOA). This SDG also includes a field equipment blank (J11VV4), analyzed for ICP metals, mercury, and by VOA.

Several deficiencies are noted below for the VOA in SDG K0310. All of the deficiencies suggest a high bias in the data and, considered together, they confirm that there is a high bias in the SDG K0310 VOA data. High biased data are acceptable for decision-making purposes.

In the VOA, nineteen of fifty-one surrogate recoveries were above the acceptance criteria, in the range of 123%-191%. After the initial analysis, the samples were re-extracted, re-analyzed, and reported. Of the nineteen surrogate recoveries that were out of criteria, four were within the re-extraction analytical run. The initial analysis of the MS and matrix spiked duplicate (MSD) fulfills the reanalysis requirement for sample J11VV5. The high surrogate recoveries suggest a high bias in the data.

In the VOA, twenty-seven of seventy MS/MSD recoveries were above the acceptance criteria in the range of 132%-228%. This is another indication of the deficiency in the initial analysis of these samples as discussed above with the surrogate recoveries. The initial analysis of sample J11VV5 fulfills the reanalysis requirement for the MS and MSD. The high MS/MSD recoveries suggest a high bias in the data.

Also in the VOA, the common laboratory contaminant methylene chloride was found in the MB at less than three times the RQL. The analytes chloroform, 2-hexanone, 4-methyl-2-pentanone, styrene, and xylenes (total) were found in the MB at less than the RQL. Results for all of the detected analytes in the MB were less than the lowest applicable RAGs for those analytes. These analytes also were not detected in the field samples at concentrations above the RAGs.

Sample J11VV5 was also out of criteria for the internal standard. The MS and MSD fulfill the reanalysis requirement for sample J11VV5. The data have a high bias as noted above. This result is acceptable for decision-making purposes.

In the pesticide analysis, no MS, MSD, or laboratory control spike (LCS) analysis was run on the analyte toxaphene. Toxaphene is actually a mixture of compounds. While the overall concentration of toxaphene can be calculated using several unobstructed peaks, the inclusion of toxaphene in the spiking mixture would be problematic for the other pesticide analytes. The laboratory typically quantitates toxaphene but does not include toxaphene in the spiking mixtures. The toxaphene data is considered estimated but useable for decision-making purposes.

In the ICP metals analysis, four analytes (aluminum, iron, antimony, and silicon) were outside of the acceptance criteria. It is common for some of the metals to be out of criteria due to analyte spike concentrations that are not appropriate compared to the analyte concentrations found in the sample from which the MS is prepared. This is difficult for the laboratory to avoid because the analyte sample concentrations are unknown prior to analysis. The laboratory performs serial dilutions and PDSs to confirm that acceptable quantitation has been achieved. The PDS recoveries were all acceptable (90%-103%).

The LCS recovery for silicon was below acceptance criteria at 42.2%. Associated sample results for silicon may be biased low. Silicon is not a COPC for the 128-F-3 waste site. The silicon data is considered estimated but useable for decision-making purposes.

The RPD calculated for mercury was above the laboratory acceptance criteria at 29.8%, however, this is within the project-specified acceptance criteria. Elevated RPDs are attributed to natural heterogeneities in the sample matrix from which the duplicate and main samples were prepared. The data is useable for decision-making purposes.

K0321

SDG K0321 consists of seven field samples (J11VW0 through JJ11VW6), analyzed for ICP metals, mercury, hexavalent chromium, pesticides, and by VOA.

Several deficiencies are noted below for the VOA in SDG K0321. Most of the deficiencies suggest a high bias in the data and, considered together, they confirm that there is a high bias in the SDG K0321 VOA data. High biased data are acceptable for decision-making purposes.

In the VOA, twenty-four of fifty-four surrogate recoveries were above the acceptance criteria, in the range of 127%-164%. After the initial analysis, the samples were re-extracted and re-analyzed, with the exception of sample J11VW2. The initial analysis of the MS and MSD fulfills the reanalysis requirement for sample J11VW2. Of the twenty-four surrogate recoveries that were out of criteria, fourteen were within the re-extraction analytical run. The data for each sample has been selected from either the initial analysis or the reanalysis based the surrogate recoveries. The sample data selected for each sample had no more than one surrogate outlier per sample with the exception of sample J11VW0. Third-party validation qualified sample J11VW0 as estimated with a "J" flag. The high surrogate recoveries suggest a high bias in the data.

In the VOA, sixteen of seventy MS/MSD recoveries were above the acceptance criteria in the range of 131%-166%. This is another indication of the deficiency in the initial analysis of these samples as discussed above with the surrogate recoveries. The initial analysis of sample J11VW0 fulfills the reanalysis requirement for the MS and MSD. The high MS/MSD recoveries suggest a high bias in the data.

Also in the VOA, the common laboratory contaminants methylene chloride and acetone were found in the MB at less than three times the RQL. The analytes chloroform, 2-hexanone, 4-methyl-2-pentanone, chlorobenzene, styrene, and xylenes (total) were found in the MB at less than the RQL. Results for all of the detected analytes in the MB were less than the lowest applicable RAGs for those analytes. Third-party validation qualified all of the methylene chloride and chloroform results as non-detected with "U" flags. All of the acetone results in samples J11VW2 and J11VW5 were raised to the RQL and qualified as non-detected with "U" flags. All of the detected results for 4-methyl-2-pentanone, 2-hexanone, chlorobenzene, styrene, and xylenes (total) were raised to the RQLs and qualified as non-detected with "U" flags. The MB contamination described here suggests a high bias in the data for the analytes discussed.

The internal standard in samples J11VW0, J11VW1, J11VW4, and the re-extraction of sample J11VW4 were out of criteria. Data from the re-extraction of sample J11VW4 has not been used for evaluation of the 128-F-3 site because of the surrogate issues mentioned above. The reanalysis requirement for all of the samples has been met.

Data from the re-extraction of samples J11VW5 and J11VW6 were identified by third-party validation as lacking an associated MS or MSD. Third party validation qualified the re-extracted data for samples J11VW5 and J11VW6 VOA data in SDG K0321 as estimated with "J" flags. None of the data from the re-extraction of these samples were used in the evaluation of the 128-F-3 site because of the surrogate issues mentioned above.

In the pesticide analysis, the tetrachloro-m-xylene surrogate recoveries in the MS and samples J11VW2, J11VW3, and J11VW5 was above the laboratories acceptance criteria in the range of 120% to 127%. However, the secondary acceptance criterion (no more than one outlier per sample) was met for each sample. The initial recoveries are also acceptable under the project acceptance criteria of 70% - 130%.

In the ICP metals analysis, four analytes (aluminum, iron, antimony, silicon) were outside of the acceptance criteria. It is common for some of the metals to be out of criteria due to analyte spike concentrations that are not appropriate compared to the analyte concentrations found in the sample from which the MS is prepared. The laboratory has performed serial dilutions and PDSs, to confirm that acceptable quantitation has been achieved. The PDS recoveries were all acceptable, falling in the range of 85.9%-101.4%. Third-party validation qualified the antimony and silicon results as estimates with "J" flags due to their initial MS recoveries of 59.5% and 43.1%, respectively.

Silver detected in the MB (0.09 mg/kg) was insignificant compared to the silver results in all of the samples except sample J11VW5 (0.28 mg/kg) where silver was both detected and less than 5

times the MB concentration. Third-party validation qualified the silver result in sample J11VW5 as a non-detected estimate with "UJ" flags.

The LCS recovery for silicon was below acceptance criteria at 43.1%. Associated sample results for silicon may be biased low. Silicon is not a COPC for the 128-F-3 waste site. The silicon data is considered estimated but useable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as these are a potential for any analysis. The number and types seen in these data sets were within expectations for the matrix types and analyses performed. The DQA review of the 128-F-3 verification sampling data found the results to be accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for the 128-F-3 site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of QA and QC deficiencies. All analytical data were found acceptable for decision-making purposes. The verification sample analytical data are stored in the ENRE project-specific database prior to being submitted for inclusion in the HEIS database. The verification sample analytical data are also summarized in Appendix B.

SUMMARY FOR INTERIM CLOSURE

The 128-F-3 waste site has been evaluated and remediated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2005b). Approximately 690 metric tons (760 US tons) of coal ash, burn ash, debris, and soil was removed to ERDF. Statistical and judgmental sampling to verify the completeness of remediation was performed, and analytical results were shown to meet the cleanup objectives for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the verification sampling results support a reclassification of the 128-F-3 site to interim closed out. This site does not have a deep zone; therefore, no deep zone institutional controls are required.

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APPENDIX A
HISTORICAL PHOTOGRAPHY

Photograph 1. Aerial Photograph of the 128-F-3 Burn Pit and Surrounding Area (March 1962).

APPENDIX B

CONFIRMATORY AND IN-PROCESS SAMPLING ANALYTICAL RESULTS

Note: Verification sampling results and calculations to support site closeout are provided in Appendix C.

Table B-1. 128-F-3 Confirmatory Sampling Results. (6 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Area 1 Coal Ash	J00MR4	4/29/03	0.12	U	0.12	0.061		0.033	0.033	U	0.033	0.078	U	0.078	0.098	U	0.098	0.076	U	0.076
Duplicate of J00MR4	J00MR5	4/29/03	0.40	U	0.40	0.069	U	0.069	0.048	U	0.048	0.11	U	0.11	0.13	U	0.13	0.14	U	0.14
West Area 1 Soil	J00MP4	4/29/03	0.16	U	0.16	0.024	U	0.024	0.027	U	0.027	0.063	U	0.063	0.079	U	0.079	0.087	U	0.087
East Area 1 Soil	J00MP5	4/29/03	0.14	U	0.14	0.019	U	0.019	0.022	U	0.022	0.053	U	0.053	0.071	U	0.071	0.074	U	0.074
North Area 2 Soil	J00MP6	4/29/03	0.29	U	0.29	0.032	U	0.032	0.034	U	0.034	0.071	U	0.071	0.13	U	0.13	0.10	U	0.10
South Area 2 Soil	J00MP7	4/29/03	0.040	U	0.040	0.027	U	0.027	0.031	U	0.031	0.068	U	0.068	0.091	U	0.091	0.062	U	0.062
Equipment Blank	J00MP8	4/29/03	0.091	U	0.091	0.024	U	0.024	0.026	U	0.026	0.065	U	0.065	0.084	U	0.084	0.063	U	0.063

Sample Location	HEIS Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Thorium-232 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Area 1 Coal Ash	J00MR4	4/29/03	4.92		4.1	8.22		6.3	4.13		0.31	0.678		0.048	0.803		0.15	0.695		0.036
Duplicate of J00MR4	J00MR5	4/29/03	4.73		2.9	8.17		5.2	4.04		0.42	0.624		0.089	0.605		0.22	0.582		0.051
West Area 1 Soil	J00MP4	4/29/03	3.29	U	4.4	21.3		5.2	17.7		0.20	0.466		0.047	0.840		0.099	0.630		0.028
East Area 1 Soil	J00MP5	4/29/03	2.51	U	2.6	16.0		5.5	15.8		0.21	0.467		0.041	0.774		0.096	0.571		0.023
North Area 2 Soil	J00MP6	4/29/03	3.34	U	3.6	19.4		6.5	13.8		0.28	0.449		0.058	0.644		0.11	0.530		0.039
South Area 2 Soil	J00MP7	4/29/03	7.68		3.6	18.4		5.4	14.0		0.27	0.525		0.049	0.833		0.13	0.877		0.052
Equipment Blank	J00MP8	4/29/03							4.06		0.27	0.181		0.043	0.228		0.098	0.157		0.027

Sample Location	HEIS Number	Sample Date	Thorium-232 GEA			Uranium-235 GEA			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Area 1 Coal Ash	J00MR4	4/29/03	0.803		0.15	0.11	U	0.11	3.6	U	3.6
Duplicate of J00MR4	J00MR5	4/29/03	0.605		0.22	0.19	U	0.19	4.8	U	4.8
West Area 1 Soil	J00MP4	4/29/03	0.840		0.099	0.11	U	0.11	2.9	U	2.9
East Area 1 Soil	J00MP5	4/29/03	0.774		0.096	0.095	U	0.095	2.3	U	2.3
North Area 2 Soil	J00MP6	4/29/03	0.644		0.11	0.14	U	0.14	3.8	U	3.8
South Area 2 Soil	J00MP7	4/29/03	0.833		0.13	0.098	U	0.098	3.5	U	3.5
Equipment Blank	J00MP8	4/29/03	0.228		0.098	0.10	U	0.10	2.9	U	2.9

Acronyms and note apply to all tables in this appendix.

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

B = method blank contamination

BHC = hexachlorocyclohexane

C = method blank contamination

D = diluted

GEA = gamma energy analysis

HEIS = Hanford Environmental Information System

J = estimate

MDA = minimum detectable activity

PQL = practical quantitation limit

Q = qualifier

R = rejected

TPH = total petroleum hydrocarbons

U = undetected

Table B-1. 128-F-3 Confirmatory Sampling Results. (6 Pages)

Sample Location	HEIS Number	Sample Date	Arsenic			Barium			Cadmium			Chromium			Hexavalent Chromium			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1 Coal Ash	J00MR4	4/29/03	4.8		0.42	1050		0.01	0.43		0.05	34.4		0.07				10.4		0.32
Area 1 Coal Ash	J00MT2*	4/29/03													17.3	R	0.350			
Duplicate of J00MR4	J00MR5	4/29/03	4.7		0.43	952		0.01	0.26		0.05	27.7		0.07				8.0		0.32
Duplicate of J00MT2	J00MT3*	4/29/03													0.350	UR	0.350			
West Area 1 Soil	J00MP4	4/29/03	3.0		0.35	59.2		0.01	0.04	U	0.04	13.3		0.06	0.41	U	0.41	3.7		0.26
East Area 1 Soil	J00MP5	4/29/03	2.7		0.32	58.1		0.009	0.04	U	0.04	12.4		0.05	0.41	U	0.41	3.6		0.24
North Area 2 Soil	J00MP6	4/29/03	2.6		0.35	60.8		0.01	0.05		0.04	12.9		0.06	0.41	U	0.41	3.7		0.26
South Area 2 Soil	J00MP7	4/29/03	2.9		0.35	90.4		0.01	0.05		0.04	13.7		0.06	0.54		0.41	4.4		0.26
Equipment Blank	J00MP8	4/29/03	0.33	U	0.33	1.5		0.009	0.04	U	0.04	0.17		0.06				0.90		0.24

*Submitted for hexavalent chromium analysis only.

Sample Location	HEIS Number	Sample Date	Mercury			Selenium			Silver			TPH		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Area 1 Coal Ash	J00MR4	4/29/03	0.20		0.02	0.76		0.44	0.1	U	0.1	9.2		4.2
Duplicate of J00MR4	J00MR5	4/29/03	0.1		0.02	0.93		0.44	0.1	U	0.1	8.6		4.1
West Area 1 Soil	J00MP4	4/29/03	0.02	U	0.02	0.36	U	0.36	0.08	U	0.08	3.4	U	3.400
East Area 1 Soil	J00MP5	4/29/03	0.01	U	0.01	0.33	U	0.33	0.07	U	0.07	3.4	U	3.400
North Area 2 Soil	J00MP6	4/29/03	0.02	U	0.02	0.36	U	0.36	0.08	U	0.08	3.4	U	3.400
South Area 2 Soil	J00MP7	4/29/03	0.02	U	0.02	0.36	U	0.36	0.08	U	0.08	3.4	U	3.400
Equipment Blank	J00MP8	4/29/03	0.01	U	0.01	0.34	U	0.34	0.07	U	0.07			

Sample Location	HEIS Number	Sample Date	Asbestos Result
Area 1 Coal Ash	J00MR8	4/29/03	Obvious (<1%) Chrysotile Asbestos
Duplicate of J00MR8	J00MR9	4/29/03	Obvious (<1%) Chrysotile Asbestos
West Area 1 Soil	J00MP9	4/29/03	Trace (<1%) Chrysotile Asbestos
East Area 1 Soil	J00MR0	4/29/03	None
North Area 2 Soil	J00MR1	4/29/03	Trace (<1%) Chrysotile Asbestos
South Area 2 Soil	J00MR2	4/29/03	Trace (<1%) Chrysotile Asbestos

Table B-1. 128-F-3 Confirmatory Sampling Results. (6 Pages)

Constituent	J00MP4			J00MP5			J00MP6			J00MP7		
	West Area 1 Soil			East Area 1 Soil			North Area 2 Soil			South Area 2 Soil		
	Sample Date 4/29/03			Sample Date 4/29/03			Sample Date 4/29/03			Sample Date 4/29/03		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls												
Aroclor-1016	15	U	15	15	U	15	15	U	15	15	U	15
Aroclor-1221	15	U	15	15	U	15	15	U	15	15	U	15
Aroclor-1232	15	U	15	15	U	15	15	U	15	15	U	15
Aroclor-1242	15	U	15	15	U	15	15	U	15	15	U	15
Aroclor-1248	15	U	15	15	U	15	15	U	15	15	U	15
Aroclor-1254	15	U	15	15	U	15	15	U	15	15	U	15
Aroclor-1260	15	U	15	15	U	15	15	U	15	15	U	15
Pesticides												
Aldrin	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
alpha-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
alpha-Chlordane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
beta-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
delta-BHC	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Dichlorodiphenyldichloroethane	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4
Dichlorodiphenyldichloroethylene	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4
Dichlorodiphenyltrichloroethane	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4
Dieldrin	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4
Endosulfan I	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Endosulfan II	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4
Endosulfan sulfate	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4
Endrin	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4
Endrin aldehyde	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4
Endrin ketone	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4	3.4	U	3.4
gamma-BHC (Lindane)	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
gamma-Chlordane	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Heptachlor	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Heptachlor epoxide	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7	1.7	U	1.7
Methoxychlor	17	U	17	17	U	17	17	U	17	17	U	17
Toxaphene	170	U	170	170	U	170	170	U	170	170	U	170
Semivolatile Organic Analytes												
1,2,4-Trichlorobenzene	340	U	340	340	U	340	340	U	340	340	U	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	860	U	860	860	U	860	860	U	860
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	860	U	860	860	U	860	860	U	860
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	U	340	340	U	340	340	U	340	340	U	340
2-Methylphenol (cresol, o-)	340	U	340	340	U	340	340	U	340	340	U	340
2-Nitroaniline	860	U	860	860	U	860	860	U	860	860	U	860

Table B-1. 128-F-3 Confirmatory Sampling Results. (6 Pages)

Constituent	J00MP4 West Area 1 Soil Sample Date 4/29/03			J00MP5 East Area 1 Soil Sample Date 4/29/03			J00MP6 North Area 2 Soil Sample Date 4/29/03			J00MP7 South Area 2 Soil Sample Date 4/29/03		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (continued)												
2-Nitrophenol	340	U	340	340	U	340	340	U	340	340	U	340
3+4 Methylphenol (cresol, m+p)	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	860	U	860	860	U	860	860	U	860
4,6-Dinitro-2-methylphenol	860	U	860	860	U	860	860	U	860	860	U	860
4-Bromophenylphenyl ether	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	U	340	340	U	340	340	U	340	340	U	340
4-Chlorophenylphenyl ether	340	U	340	340	U	340	340	U	340	340	U	340
4-Nitroaniline	860	U	860	860	U	860	860	U	860	860	U	860
4-Nitrophenol	860	U	860	860	U	860	860	U	860	860	U	860
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	23	J	340	340	U	340	18	J	340	340	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
Dibenzo[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	59	J	340	52	J	340
Dimethyl phthalate	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	860	U	860	860	U	860	860	U	860
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 B-1. 128-F-3 Confirmatory Sampling Results. (6 Pages)

Constituent	J00MR4			J00MR5			J00MP8		
	Area 1 Coal Ash Sample Date 4/29/03			Duplicate of J00MR4 Sample Date 4/29/03			Equipment Blank Sample Date 4/29/03		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls									
Aroclor-1016	19	U	19	19	U	19			
Aroclor-1221	19	U	19	19	U	19			
Aroclor-1232	19	U	19	19	U	19			
Aroclor-1242	19	U	19	19	U	19			
Aroclor-1248	19	U	19	19	U	19			
Aroclor-1254	19	U	19	19	U	19			
Aroclor-1260	19	U	19	19	U	19			
Pesticides									
Aldrin	2.1	U	2.1	2.1	U	2.1			
alpha-BHC	2.1	U	2.1	2.1	U	2.1			
alpha-Chlordane	2.1	U	2.1	2.1	U	2.1			
beta--BHC	2.1	U	2.1	2.1	U	2.1			
delta-BHC	2.1	U	2.1	2.1	U	2.1			
Dichlorodiphenyldichloroethane	4.2	U	4.2	4.1	U	4.1			
Dichlorodiphenyldichloroethylene	6.3		4.2	23		4.1			
Dichlorodiphenyltrichloroethane	7.6		4.2	7.5		4.1			
Dieldrin	4.2	U	4.2	4.1	U	4.1			
Endosulfan I	2.1	U	2.1	2.1	U	2.1			
Endosulfan II	4.2	U	4.2	4.1	U	4.1			
Endosulfan sulfate	4.2	U	4.2	4.1	U	4.1			
Endrin	4.2	U	4.2	4.1	U	4.1			
Endrin aldehyde	4.2	U	4.2	4.1	U	4.1			
Endrin ketone	4.2	U	4.2	4.1	U	4.1			
gamma-BHC (Lindane)	2.1	U	2.1	2.1	U	2.1			
gamma-Chlordane	2.1	U	2.1	2.1	U	2.1			
Heptachlor	2.1	U	2.1	2.1	U	2.1			
Heptachlor epoxide	2.1	U	2.1	2.1	U	2.1			
Methoxychlor	21	U	21	21	U	21			
Toxaphene	210	U	210	210	U	210			
Semivolatile Organic Analytes									
1,2,4-Trichlorobenzene	420	U	420	410	U	410	330	U	330
1,2-Dichlorobenzene	420	U	420	410	U	410	330	U	330
1,3-Dichlorobenzene	420	U	420	410	U	410	330	U	330
1,4-Dichlorobenzene	420	U	420	410	U	410	330	U	330
2,4,5-Trichlorophenol	1000	U	1000	1000	U	1000	840	U	840
2,4,6-Trichlorophenol	420	U	420	410	U	410	330	U	330
2,4-Dichlorophenol	420	U	420	410	U	410	330	U	330
2,4-Dimethylphenol	420	U	420	410	U	410	330	U	330
2,4-Dinitrophenol	1000	U	1000	1000	U	1000	840	U	840
2,4-Dinitrotoluene	420	U	420	410	U	410	330	U	330
2,6-Dinitrotoluene	420	U	420	410	U	410	330	U	330
2-Chloronaphthalene	420	U	420	410	U	410	330	U	330
2-Chlorophenol	420	U	420	410	U	410	330	U	330
2-Methylnaphthalene	420	U	420	410	U	410	330	U	330
2-Methylphenol (cresol, o-)	420	U	420	410	U	410	330	U	330
2-Nitroaniline	1000	U	1000	1000	U	1000	840	U	840

Table B-1. 128-F-3 Confirmatory Sampling Results. (6 Pages)

Constituent	J00MR4 Area 1 Coal Ash Sample Date 4/29/03			J00MR5 Duplicate of J00MR4 Sample Date 4/29/03			J00MP8 Equipment Blank Sample Date 4/29/03		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes (continued)									
2-Nitrophenol	420	U	420	410	U	410	330	U	330
3+4 Methylphenol (cresol, m+p)	420	U	420	410	U	410	330	U	330
3,3'-Dichlorobenzidine	420	U	420	410	U	410	330	U	330
3-Nitroaniline	1000	U	1000	1000	U	1000	840	U	840
4,6-Dinitro-2-methylphenol	1000	U	1000	1000	U	1000	840	U	840
4-Bromophenylphenyl ether	420	U	420	410	U	410	330	U	330
4-Chloro-3-methylphenol	420	U	420	410	U	410	330	U	330
4-Chloroaniline	420	U	420	410	U	410	330	U	330
4-Chlorophenylphenyl ether	420	U	420	410	U	410	330	U	330
4-Nitroaniline	1000	U	1000	1000	U	1000	840	U	840
4-Nitrophenol	1000	U	1000	1000	U	1000	840	U	840
Acenaphthene	420	U	420	410	U	410	330	U	330
Acenaphthylene	420	U	420	410	U	410	330	U	330
Anthracene	420	U	420	410	U	410	330	U	330
Benzo(a)anthracene	420	U	420	410	U	410	330	U	330
Benzo(a)pyrene	420	U	420	410	U	410	330	U	330
Benzo(b)fluoranthene	420	U	420	410	U	410	330	U	330
Benzo(g,h,i)perylene	420	U	420	410	U	410	330	U	330
Benzo(k)fluoranthene	420	U	420	410	U	410	330	U	330
Bis(2-chloro-1-methylethyl)ether	420	U	420	410	U	410	330	U	330
Bis(2-Chloroethoxy)methane	420	U	420	410	U	410	330	U	330
Bis(2-chloroethyl) ether	420	U	420	410	U	410	330	U	330
Bis(2-ethylhexyl) phthalate	420	U	420	790		410	330	U	330
Butylbenzylphthalate	420	U	420	410	U	410	330	U	330
Carbazole	420	U	420	410	U	410	330	U	330
Chrysene	420	U	420	410	U	410	330	U	330
Di-n-butylphthalate	420	U	420	410	U	410	93	J	330
Di-n-octylphthalate	420	U	420	410	U	410	330	U	330
Dibenzo[a,h]anthracene	420	U	420	410	U	410	330	U	330
Dibenzofuran	420	U	420	410	U	410	330	U	330
Diethylphthalate	420	U	420	410	U	410	42	J	330
Dimethyl phthalate	420	U	420	410	U	410	330	U	330
Fluoranthene	420	U	420	410	U	410	330	U	330
Fluorene	420	U	420	410	U	410	330	U	330
Hexachlorobenzene	420	U	420	410	U	410	330	U	330
Hexachlorobutadiene	420	U	420	410	U	410	330	U	330
Hexachlorocyclopentadiene	420	U	420	410	U	410	330	U	330
Hexachloroethane	420	U	420	410	U	410	330	U	330
Indeno(1,2,3-cd)pyrene	420	U	420	410	U	410	330	U	330
Isophorone	420	U	420	410	U	410	330	U	330
N-Nitroso-di-n-dipropylamine	420	U	420	410	U	410	330	U	330
N-Nitrosodiphenylamine	420	U	420	410	U	410	330	U	330
Naphthalene	420	U	420	410	U	410	330	U	330
Nitrobenzene	420	U	420	410	U	410	330	U	330
Pentachlorophenol	1000	U	1000	1000	U	1000	840	U	840
Phenanthrene	420	U	420	410	U	410	330	U	330
Phenol	420	U	420	410	U	410	330	U	330
Pyrene	420	U	420	410	U	410	330	U	330

Table B-2. 128-F-3 In-Process Sampling Results. (4 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Black ash/soil	J107Y2	09/27/05	0.32	U	0.32	0.18	U	0.18	0.19	U	0.19	0.52	U	0.52	0.56	U	0.56	0.32	U	0.32
Black ash/soil	J107Y3	09/27/05	0.53	U	0.53	0.113		0.063	0.079	U	0.079	0.18	U	0.18	0.22	U	0.22	0.24	U	0.24

Sample Location	HEIS Number	Sample Date	Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-235 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Black ash/soil	J107Y2	09/27/05	6.75		1.8	0.583		0.28	0.89	U	0.89	0.986		0.26	0.89	U	0.89	0.54	U	0.54
Black ash/soil	J107Y3	09/27/05	10.7		0.65	0.704		0.15	1.09		0.29	1.1		0.13	1.09		0.29	0.25	U	0.25

Sample Location	HEIS Number	Sample Date	Uranium-238 GEA		
			pCi/g	Q	MDA
Black ash/soil	J107Y2	09/27/05	22.0	U	22.0
Black ash/soil	J107Y3	09/27/05	8.6	U	8.6

Table B-2. 128-F-3 In-Process Sampling Results. (4 Pages)

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Black ash/soil	J107Y2	09/27/05	10200		20.1	2.5		1.9	5.2		3	649	C	0.06	1		0.06	55.5	C	1.4
Black ash/soil	J107Y3	09/27/05	7640		22.1	2.08	U	2.1	5.5		3.3	414	C	0.07	0.889		0.07	20.0	C	1.6

Sample Location	HEIS 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
Black ash/soil	J107Y2	09/27/05	0.252	U	0.25	12400	C	4.5	45.3	C	0.44	6.9		0.44	58.1		0.82	0.225	U	0.22
Black ash/soil	J107Y3	09/27/05	0.278	U	0.28	7820	C	4.9	15.3	C	0.49	7.2		0.49	28.1		0.9	0.28		0.28

Sample Location	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Black ash/soil	J107Y2	09/27/05	12300		16.4	8.4		1.8	3790		4.1	220	C	0.13	0.074		0.02	1.13	U	1.1
Black ash/soil	J107Y3	09/27/05	16100		18.0	6.7		2.0	3640		4.5	301	C	0.14	0.019	U	0.02	1.7		1.2

Sample Location	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Black ash/soil	J107Y2	09/27/05	15.5		0.82	1370		18.1	2.71	U	2.7	1250		11.2	0.504	U	0.5	1010	C	1.3
Black ash/soil	J107Y3	09/27/05	14		0.9	865		20	2.99	U	3	873		12.4	0.555	U	0.56	321	C	1.5

Sample Location	HEIS Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
Black ash/soil	J107Y2	09/27/05	47.1		0.38	64.6		0.44
Black ash/soil	J107Y3	09/27/05	52.1		0.42	42.3		0.49

Table B-2. 128-F-3 In-Process Sampling Results. (4 Pages)

Constituents	J107Y2 Black Ash/Soil Sample Date 9/27/05			J107Y3 Black Ash/Soil Sample Date 9/27/05		
	µg/kg	Q	PQL	µg/kg	Q	PQL
	Pesticides					
Aldrin	1.9	U	1.9	2.1	U	2.1
alpha-BHC	1.9	U	1.9	2.1	U	2.1
alpha-Chlordane	1.9	U	1.9	2.1	U	2.1
beta--BHC	1.9	U	1.9	2.1	U	2.1
delta-BHC	1.9	U	1.9	2.1	U	2.1
Dichlorodiphenyldichloroethane	1.9	U	1.9	2.1	U	2.1
Dichlorodiphenyldichloroethylene	2.4		1.9	2.1	U	2.1
Dichlorodiphenyltrichloroethane	1.9	U	1.9	2.1	U	2.1
Dieldrin	1.9	U	1.9	2.1	U	2.1
Endosulfan I	1.9	U	1.9	2.1	U	2.1
Endosulfan II	1.9	U	1.9	2.1	U	2.1
Endosulfan sulfate	2.8		1.9	2.1	U	2.1
Endrin	1.9	U	1.9	2.1	U	2.1
Endrin aldehyde	1.9	U	1.9	2.1	U	2.1
Endrin ketone	1.9	U	1.9	2.1	U	2.1
gamma-BHC (Lindane)	1.9	U	1.9	2.1	U	2.1
gamma-Chlordane	1.9	U	1.9	2.1	U	2.1
Heptachlor	1.9	U	1.9	2.1	U	2.1
Heptachlor epoxide	1.9	U	1.9	2.1	U	2.1
Methoxychlor	1.9	U	1.9	5.9		2.1
Toxaphene	19	U	19	21	U	21
Semivolatile Organic Analytes						
1,2,4-Trichlorobenzene	750	UD	750	410	U	410
1,2-Dichlorobenzene	750	UD	750	410	U	410
1,3-Dichlorobenzene	750	UD	750	410	U	410
1,4-Dichlorobenzene	750	UD	750	410	U	410
2,4,5-Trichlorophenol	1900	UD	1900	1000	U	1000
2,4,6-Trichlorophenol	750	UD	750	410	U	410
2,4-Dichlorophenol	750	UD	750	410	U	410
2,4-Dimethylphenol	750	UD	750	410	U	410
2,4-Dinitrophenol	1900	UD	1900	1000	U	1000
2,4-Dinitrotoluene	750	UD	750	410	U	410
2,6-Dinitrotoluene	750	UD	750	410	U	410
2-Chloronaphthalene	750	UD	750	410	U	410
2-Chlorophenol	750	UD	750	410	U	410
2-Methylnaphthalene	78	JD	750	867		410
2-Methylphenol (cresol, o-)	750	UD	750	410	U	410
2-Nitroaniline	1900	UD	1900	1000	U	1000
2-Nitrophenol	750	UD	750	410	U	410
3+4 Methylphenol (cresol, m+p)	750	UD	750	410	U	410
3,3'-Dichlorobenzidine	750	UD	750	410	U	410
3-Nitroaniline	1900	UD	1900	1000	U	1000
4,6-Dinitro-2-methylphenol	1900	UD	1900	1000	U	1000
4-Bromophenylphenyl ether	750	UD	750	410	U	410
4-Chloro-3-methylphenol	750	UD	750	410	U	410
4-Chloroaniline	750	UD	750	410	U	410

Table B-2. 128-F-3 In-Process Sampling Results. (4 Pages)

Constituents	J107Y2 Black Ash/Soil Sample Date 9/27/05			J107Y3 Black Ash/Soil Sample Date 9/27/05		
	µg/kg	Q	PQL	µg/kg	Q	PQL
	Semivolatile Organic Analytes (continued)					
4-Chlorophenylphenyl ether	750	UD	750	410	U	410
4-Nitroaniline	1900	UD	1900	1000	U	1000
4-Nitrophenol	1900	UD	1900	1000	U	1000
Acenaphthene	750	UD	750	410	U	410
Acenaphthylene	750	UD	750	410	U	410
Anthracene	750	UD	750	23	J	410
Benzo(a)anthracene	750	UD	750	29	J	410
Benzo(a)pyrene	750	UD	750	410	U	410
Benzo(b)fluoranthene	750	UD	750	410	U	410
Benzo(g,h,i)perylene	750	UD	750	410	U	410
Benzo(k)fluoranthene	750	UD	750	410	U	410
Bis(2-chloro-1-methylethyl)ether	750	UD	750	410	U	410
Bis(2-Chloroethoxy)methane	750	UD	750	410	U	410
Bis(2-chloroethyl) ether	750	UD	750	410	U	410
Bis(2-ethylhexyl) phthalate	113	JBD	750	62	JB	410
Butylbenzylphthalate	750	UD	750	410	U	410
Carbazole	750	UD	750	28	J	410
Chrysene	750	UD	750	32	J	410
Di-n-butylphthalate	750	UD	750	53	JB	410
Di-n-octylphthalate	750	UD	750	410	U	410
Dibenzo[a,h]anthracene	750	UD	750	410	U	410
Dibenzofuran	750	UD	750	150	J	410
Diethylphthalate	750	UD	750	410	U	410
Dimethyl phthalate	750	UD	750	410	U	410
Fluoranthene	750	UD	750	410	U	410
Fluorene	750	UD	750	410	U	410
Hexachlorobenzene	750	UD	750	410	U	410
Hexachlorobutadiene	750	UD	750	410	U	410
Hexachlorocyclopentadiene	750	UD	750	410	U	410
Hexachloroethane	750	UD	750	410	U	410
Indeno(1,2,3-cd)pyrene	750	UD	750	410	U	410
Isophorone	750	UD	750	410	U	410
N-Nitroso-di-n-dipropylamine	750	UD	750	410	U	410
N-Nitrosodiphenylamine	750	UD	750	410	U	410
Naphthalene	52	JD	750	460		410
Nitrobenzene	750	UD	750	410	U	410
Pentachlorophenol	1900	UD	1900	1000	U	1000
Phenanthrene	750	UD	750	140	J	410
Phenol	750	UD	750	410	U	410
Pyrene	750	UD	750	31	J	410

APPENDIX C

**CALCULATION OF 95% UCL VALUES FOR
VERIFICATION DATA**

Project Title:	100-F Area Field Remediation	Job No.	14655
Area	100-F		
Discipline	Environmental	*Calc. No.	0100F-CA-V0258
Subject	128-F-3 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 Attn. 1 = 6 Total = 17	<i>J m g</i> 9/14/06 J. M. Capron	<i>T. M. Blakley</i> 9/18/06 T. M. Blakley	<i>L. M. Dittmer</i> 9/19/06 L. M. Dittmer	<i>S. W. Callison</i> 9-21-06 S. W. Callison	9-21-06
SUMMARY OF REVISIONS						

* Obtain Calc. No. from R&DC and Form from Intranet

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JmC* Date 09/14/06
 Project 100-F Area Field Remediation Job No. 14655
 Subject 128-F-3 Waste Site Cleanup Verification 95% UCL Calculations

Calc. No. 0100F-CA-V0258 Rev. No. 0
 Checked T. M. Blakley *TMB* Date 7/12/06
 Sheet No. 4 of 10

Summary

Purpose:

Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the remediation footprint of 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.

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Sheets 1 to 3 - Calculation Sheet Summary
 Sheets 4 to 5 - Calculation Sheet Remediation Footprint Verification Data
 Sheet 6 - Calculation Sheet Duplicate Analysis
 Sheets 7 to 10 - Ecology Software (MTCASat) Results
 Attachment 1 - 128-F-3 Verification Sampling Results (6 sheets)

Given/References:

- 1) Sample Results (Attachment 1).
- 2) Background values and remedial action goals (RAGs) are taken from DOE-RL (2005b), DOE-RL (2001), and Ecology (2005).
- 3) DOE-RL, 2001, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 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) EPA, 2002, *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*, Office of Solid Waste and Emergency Response, Publication 9285.6-10, U.S. Environmental Protection Agency, Washington, D.C.
- 11) 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 (with the exception of beta-BHC). 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 (with the exception of beta-BHC). The 95% UCL values were not calculated for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium, as no cleanup values are available in Ecology (2005) under WAC 173-340-740(3), and these constituents are thus not considered site COPCs.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC* Date 09/14/06
 Project 100-F Area Field Remediation Job No. 14655
 Subject 128-F-3 Waste Site Cleanup Verification 95% UCL Calculations

Calc. No. 0100F-CA-V0258 Rev. No. 0
 Checked T. M. Blakley *TMB* Date 9/14/06
 Sheet No. 2 of 10

Summary (continued)

All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics (Ecology 1993), with the exception of beta-BHC. In cases where third-party validation requalified detected results as nondetected due to method blank contamination, but did not change the laboratory quantitation limit (e.g., methylene chloride), ½ the reported value was used for calculation of the statistics. For radionuclide data, calculation of the statistics was done on 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.

The chlorinated pesticide beta-BHC was detected at a maximum concentration of 0.0054 mg/kg, slightly above the soil remedial action goal for protection of groundwater, in one sample from the data set. This constituent was not detected (i.e., was censored) in 70% of the sample data set, and, as described previously, the statistical value is typically set equal to the maximum detected concentration under this scenario. However, doing so is a stringent test for compliance with a cleanup level, particularly since the maximum does not violate the compliance criteria of exceeding twice the cleanup level, as described below. Therefore, for the 128-F-3 site, the 95% UCL value for beta-BHC was calculated using a method suggested in EPA (2002), in which the censored data is set equal to the detection limit and the 95% UCL calculated using the resulting data set.

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, as for the subject site, distributional testing and calculation of the 95% UCL is done using Ecology's MTCASat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2005b) and MTCASat coding and due to a limitation in the MTCASat 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 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). Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

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

where, M = main sample value S = split (or duplicate) sample value

For quality assurance/quality control (QA/QC) 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. As a matter of good practice, when an analyte is detected in the primary or duplicate sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate results exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. No split samples were collected for cleanup verification of the subject site. Additional discussion is provided in the data quality assessment section of the applicable RSVP, as necessary.

In addition to the statistical samples collected from the remediation footprint at the subject site, a multi-aliquot sample was collected from the remediation waste staging area. Statistical methodology is not applicable to non-statistical sampling, and direct evaluation of detected values within this decision unit will be used as the compliance basis. These maximum detected values are presented in the results summary for use in the RSVP.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC*

Date 09/14/06

Calc. No. 0100F-CA-V0258

Rev. No. 0

Project 100-F Area Field Remediation

Job No. 14655

Checked T. M. Blakley *TMB*

Date 7/18/06

Subject 128-F-3 Waste Site Cleanup Verification 95% UCL Calculations

Sheet No. 3 of 10

1 Summary (continued)

2 Results:

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

Results Summary - Remediation Footprint			
Analyte	95% UCL ^a	Maximum ^b	Units
7 Arsenic	2.5		mg/kg
8 Barium	261		mg/kg
9 Beryllium	0.50		mg/kg
10 Boron	42.4		mg/kg
11 Cadmium		0.26	mg/kg
12 Chromium	25.8		mg/kg
13 Cobalt	6.3		mg/kg
14 Copper	21.1		mg/kg
15 Lead	4.5		mg/kg
16 Manganese	293		mg/kg
17 Mercury		0.03	mg/kg
18 Nickel	10.9		mg/kg
19 Vanadium	41.7		mg/kg
20 Zinc	42.8		mg/kg
21 Aldrin		0.00056	mg/kg
22 alpha-Chlordane		0.0028	mg/kg
23 beta-BHC	0.003		mg/kg
24 4,4'-DDD		0.0043	mg/kg
25 4,4'-DDE		0.0023	mg/kg
26 4,4'-DDT		0.0016	mg/kg
27 Endosulfan I		0.0016	mg/kg
28 Endosulfan sulfate		0.0058	mg/kg
29 Endrin ketone		0.0030	mg/kg
30 gamma-BHC (lindane)		0.0013	mg/kg
31 Heptachlor epoxide		0.00055	mg/kg
32 Methoxychlor		0.010	mg/kg
33 2-Butanone		0.005	mg/kg
34 2-Hexanone		0.008	mg/kg
35 4-Methyl-2-Pentanone		0.008	mg/kg
36 Acetone		0.009	mg/kg
37 Chlorobenzene		0.008	mg/kg
38 Chloroform	0.005		mg/kg
39 Ethylbenzene		0.002	mg/kg
40 Methylene chloride	0.016		mg/kg
41 Styrene		0.004	mg/kg
41 Tetrachloroethene		0.001	mg/kg
42 Xylenes (total)		0.007	mg/kg

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

44	Because of the "yes" answers to the WAC 173-340 3-part test for barium, chromium, and copper, additional evaluation of the attainment of cleanup criteria will be performed.
45 WAC 173-340 3-Part Test for most stringent RAG:	
46 95% UCL > Cleanup Limit?	YES
47 > 10% above Cleanup Limit?	YES
48 Any sample > 2x Cleanup Limit?	YES

49 *For nonradionuclides, where ≤ 50% of a data set is censored (below detection limits),

50 the 95% UCL value is used for a given analyte.

51 *For nonradionuclides, where > 50% of a data set is censored, the statistical value defaults

52 to the maximum detected value in the data set (Attachment 1).

53 RAG = remedial action goal

54 UCL = upper confidence level

55 WAC = Washington Administrative Code

56

Relative Percent Difference Results ^a - QA/QC Analysis			
Analyte	Duplicate Analysis ^b	Analyte	Duplicate Analysis ^b
58 Aluminum	6.2%	Iron	0%
59 Barium	9.4%	Magnesium	1.1%
60 Boron	15%	Manganese	0.31%
61 Calcium	3.5%	Silicon	6.4%
62 Chromium	7.7%	Vanadium	3.1%
63 Copper	11%	Zinc	9.7%

65 *Relative percent difference evaluation was not required for analytes not included in this table.

66 *The significance of relative percent difference values are discussed within the RSVP for the subject site.

67 QA/QC = quality assurance/quality control

68 RSVP = remaining sites verification package

Results Summary - Waste Staging Area		
Analyte	Maximum ^a	Units
Barium	141	mg/kg
Beryllium	0.58	mg/kg
Boron	5.5	mg/kg
Cadmium	0.27	mg/kg
Chromium	9.8	mg/kg
Cobalt	6.6	mg/kg
Copper	11.6	mg/kg
Lead	8.3	mg/kg
Manganese	331	mg/kg
Nickel	9.2	mg/kg
Vanadium	46.4	mg/kg
Zinc	44.8	mg/kg
4,4'-DDE	0.0031	mg/kg
4,4'-DDT	0.00076	mg/kg
Endosulfan II	0.00088	mg/kg

^aVerification sampling at the waste staging area was based on multi-aliquot, rather than statistical, sampling.

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron
Project 100-F Area Field Remediation
Subject 128-F-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/14/06
Job No. 14655

Calc. No. 0100F-CA-V0258
Checked T. M. Blakley

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1 Remediation Footprint Verification Data (continued)

Sampling Area	HEIS Number	Sample Date	Manganese			Nickel			Vanadium			Zinc			Chloroform			Methylene Chloride			beta-BHC		
			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
6	J11VW0	4/11/2006	327		0.1	10.7		0.78	50.8		0.29	59.6	C	0.52	0.010	U	0.010	0.018	U	0.006	0.0033	D	0.0015
Duplicate of J11VW0	J11VW1	4/11/2006	326		0.1	10.9		0.79	52.4		0.30	54.1	C	0.53	0.010	U	0.010	0.016	U	0.006	0.0047	D	0.0015
1	J11VV5	4/10/2006	250		0.09	9.7		0.74	34.8		0.28	39.5		0.49	0.005	JB	0.006	0.033	B	0.006	0.0054	D	0.0015
2	J11VV6	4/10/2006	305		0.09	9.0		0.74	34.2		0.28	33.2		0.49	0.004	JB	0.006	0.009	B	0.006	0.0015	UD	0.0015
3	J11VV7	4/10/2006	350		0.09	8.4		0.70	44.3		0.26	40.2		0.47	0.003	JB	0.006	0.015	B	0.006	0.0014	UD	0.0014
4	J11VV8	4/10/2006	229		0.09	10.0		0.69	23.6		0.26	29.9		0.46	0.003	JB	0.005	0.012	B	0.005	0.0015	UD	0.0015
5	J11VV9	4/10/2006	218		0.09	8.8		0.73	22.5		0.27	27.7		0.48	0.003	JB	0.005	0.012	B	0.005	0.0015	UD	0.0015
7	J11VW2	4/11/2006	234		0.09	12.5		0.76	26.5		0.28	31.6	C	0.51	0.010	U	0.010	0.015	U	0.006	0.0014	UD	0.0014
8	J11VW3	4/11/2006	219		0.09	9.5		0.75	23.7		0.28	26.4	C	0.50	0.010	U	0.010	0.012	U	0.005	0.0014	UD	0.0014
9	J11VW4	4/11/2006	304		0.1	10.2		0.76	48.0		0.29	46.6	C	0.51	0.010	U	0.010	0.021	U	0.006	0.00095	JD	0.0015
10	J11VW5	4/11/2006	239		0.1	11.8		0.77	29.1		0.29	34.7	C	0.52	0.010	U	0.010	0.022	U	0.006	0.0015	UD	0.0015

15 Statistical Computation Input Data

Sampling Area	HEIS Number	Sample Date	Manganese mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg	Chloroform mg/kg	Methylene Chloride mg/kg	beta-BHC mg/kg
6	J11VW0/J11VW1	4/11/2006	327	10.8	51.6	56.9	0.005	0.009	0.004
1	J11VV5	4/10/2006	250	9.7	34.8	39.5	0.005	0.033	0.0054
2	J11VV6	4/10/2006	305	9.0	34.2	33.2	0.004	0.009	0.0015
3	J11VV7	4/10/2006	350	8.4	44.3	40.2	0.003	0.015	0.0014
4	J11VV8	4/10/2006	229	10.0	23.6	29.9	0.003	0.012	0.0015
5	J11VV9	4/10/2006	218	8.8	22.5	27.7	0.003	0.012	0.0015
7	J11VW2	4/11/2006	234	12.5	26.5	31.6	0.005	0.008	0.0014
8	J11VW3	4/11/2006	219	9.5	23.7	26.4	0.005	0.006	0.0014
9	J11VW4	4/11/2006	304	10.2	48.0	46.6	0.005	0.011	0.00095
10	J11VW5	4/11/2006	239	11.8	29.1	34.7	0.005	0.011	0.0015

28 Statistical Computations

	Manganese	Nickel	Vanadium	Zinc	Chloroform	Methylene Chloride	beta-BHC
95% UCL based on	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), use MTCASat lognormal distribution.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥ 10), lognormal and normal distribution rejected, use z-statistic.
N	10	10	10	10	10	10	10
% < Detection limit	0%	0%	0%	0%	50%	50%	70%
Mean	267	10.1	33.8	36.7	0.004	0.012	0.002
Standard deviation	49	1.3	10.7	9.4	0.001	0.008	0.001
95% UCL on mean	293	10.9	41.7	42.8	0.005	0.016	0.003
Maximum detected value	350	12.5	52.4	59.6	0.005	0.033	0.0054
Statistical value	293	10.9	41.7	42.8	0.005	0.016	0.003
Most Stringent Cleanup Limit for nonradionuclide and RAG type	512 BG/GW Protection	19.1 BG/GW Protection	85.1 BG/GW Protection	67.8 BG/River Protection	0.71 GW Protection	0.5 GW Protection	0.00486 GW Protection
WAC 173-340 3-PART TEST							
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NO	NO
> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NO	NO
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NO	NO
WAC 173-340 Compliance?	Yes	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.	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.

44 BG = background
45 B = blank contamination (inorganic contamination)
46 C = blank contamination (organic contamination)
47 D = diluted
GW = groundwater
HEIS = Hanford Environmental Information System
J = estimated
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

Project 100-F Area Field Remediation

Subject 128-F-3 Waste Site Cleanup Verification 95% UCL Calculations

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Sheet No. 6 of 10

1 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Boron			Cadmium			Calcium			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	mg/kg	Q	PQL	mg/kg	Q	PQL
6	J11VW0	4/11/2006	5980		9.3	2.0		2.0	214	C	0.06	0.50		0.06	11.4		0.78	0.25		0.23	5840	C	5.3	13.7	C	0.42
Duplicate of J11VW0	J11VW1	4/11/2006	6360		9.5	2.6		2.0	235	C	0.07	0.54		0.07	13.2		0.79	0.26		0.23	6050	C	5.4	14.8	C	0.43

6 Analysis:

Duplicate Analysis	TDL	5	10	2	0.5	2	0.2	100	1
	Both > PQL?	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)		Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)
	RPD	6.2%		9.4%		15%		3.5%	7.7%
	Difference >2xTDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable

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Sampling Area	HEIS Number	Sample Date	Cobalt			Copper			Iron			Lead			Magnesium			Manganese			Nickel			Potassium		
			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
6	J11VW0	4/11/2006	7.2		0.45	23.0		0.39	18400		11.3	5.2		1.0	3620		3.1	327		0.1	10.7		0.78	1120	C	7.4
Duplicate of J11VW0	J11VW1	4/11/2006	7.2		0.46	25.7		0.40	18400		11.5	5.7		1.0	3660		3.2	326		0.1	10.9		0.79	1110	C	7.5

17 Analysis:

Duplicate Analysis	TDL	2	1	5	5	75	5	4	400
	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)	No - evaluate difference	No - evaluate difference
	RPD		11%	0%		1.1%	0.31%		
	Difference >2xTDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable

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Sampling Area	HEIS Number	Sample Date	Silicon			Sodium			Vanadium			Zinc			Aldrin			alpha-Chlordane			beta-BHC			4,4'-DDD		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
6	J11VW0	4/11/2006	584	J	7.4	192		2.5	50.8		0.29	59.6	C	0.52	0.56	JD	1.5	0.89	JD	1.5	3.3	D	1.5	1.5	UD	1.5
Duplicate of J11VW0	J11VW1	4/11/2006	548	J	7.5	233		2.5	52.4		0.30	54.1	C	0.53	1.5	UD	1.5	2.8	D	1.5	4.7	D	1.5	4.3	D	1.5

28 Analysis:

Duplicate Analysis	TDL	2	50	2.5	1	1.65	1.65	1.65	3.3
	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No - evaluate difference	No - evaluate difference	Yes (continue)	No - evaluate difference
	Both >5xTDL?	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)			No - evaluate difference	
	RPD	6.4%		3.1%	9.7%				
	Difference >2xTDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

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Sampling Area	HEIS Number	Sample Date	4,4'-DDT			Endosulfan I			Endosulfan Sulfate			Endrin Ketone			Heptachlor Epoxide			Methoxychlor		
			µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
6	J11VW0	4/11/2006	1.6	JD	1.5	1.2	JD	1.5	1.3	JD	1.5	0.59	JD	1.5	0.41	JD	1.5	1.5	UD	1.5
Duplicate of J11VW0	J11VW1	4/11/2006	1.5	UD	1.5	1.5	UD	1.5	5.8	D	1.5	3.0	D	1.5	1.5	UD	1.5	9.8	D	1.5

38 Analysis:

Duplicate Analysis	TDL	3.3	1.65	3.3	3.3	1.65	16.5
	Both > PQL?	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference
	Both >5xTDL?						
	RPD						
	Difference >2xTDL?	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable

43 C = blank contamination

44 D = diluted

45 HEIS = Hanford Environmental Information System

46 J = estimated

PQL = practical quantitation limit

Q = qualifier

RPD = relative percent difference

TDL = target detection limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC*
 Project 100-F Area Field Remediation
 Subject 128-F-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/14/06
 Job No. 14655

Calc. No. 0100F-CA-V0258
 Checked T. M. Blakley *TMB*

Rev. No. 0
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Ecology Software (MTCASat) Results

DATA	ID	Arsenic 95% UCL Calculation				DATA	ID	Barium 95% UCL Calculation			
2.3	J11VW0/J11VW1					225	J11VW0/J11VW1				
3.2	J11VV5					288	J11VV5				
2.1	J11VV6	Number of samples	Uncensored values			79.8	J11VV6	Number of samples	Uncensored values		
2.0	J11VV7	Uncensored	10	Mean	2.4	79.5	J11VV7	Uncensored	10	Mean	124
2.3	J11VV8	Censored		Lognormal mean	2.4	45.9	J11VV8	Censored		Lognormal mean	127
2.0	J11VV9	Detection limit or PQL		Std. devn.	0.4	38.8	J11VV9	Detection limit or PQL		Std. devn.	102
2.3	J11VW2	Method detection limit		Median	2.3	60.7	J11VW2	Method detection limit		Median	80
2.3	J11VW3	TOTAL	10	Min.	2.0	36.7	J11VW3	TOTAL	10	Min.	36.7
2.4	J11VW4			Max.	3.2	290	J11VW4			Max.	290
2.6	J11VW5					98.2	J11VW5				
		Lognormal distribution?	Normal distribution?					Lognormal distribution?	Normal distribution?		
		r-squared is: 0.849	r-squared is: 0.800					r-squared is: 0.909	r-squared is: 0.796		
		Recommendations:						Recommendations:			
		Reject BOTH lognormal and normal distributions.						Use lognormal distribution.			
		UCL (based on Z-statistic) is	2.5					UCL (Land's method) is	261		
DATA	ID	Beryllium 95% UCL Calculation				DATA	ID	Boron 95% UCL Calculation			
0.52	J11VW0/J11VW1					12.3	J11VW0/J11VW1				
0.47	J11VV5					15.5	J11VV5				
0.44	J11VV6	Number of samples	Uncensored values			3.1	J11VV6	Number of samples	Uncensored values		
0.49	J11VV7	Uncensored	10	Mean	0.42	3.3	J11VV7	Uncensored	10	Mean	6.6
0.32	J11VV8	Censored		Lognormal mean	0.42	1.3	J11VV8	Censored		Lognormal mean	8.1
0.29	J11VV9	Detection limit or PQL		Std. devn.	0.11	0.37	J11VV9	Detection limit or PQL		Std. devn.	7.3
0.32	J11VW2	Method detection limit		Median	0.43	2.4	J11VW2	Method detection limit		Median	3.2
0.29	J11VW3	TOTAL	10	Min.	0.29	0.88	J11VW3	TOTAL	10	Min.	0.37
0.62	J11VW4			Max.	0.62	21.8	J11VW4			Max.	21.8
0.41	J11VW5					5.4	J11VW5				
		Lognormal distribution?	Normal distribution?					Lognormal distribution?	Normal distribution?		
		r-squared is: 0.938	r-squared is: 0.936					r-squared is: 0.979	r-squared is: 0.817		
		Recommendations:						Recommendations:			
		Use lognormal distribution.						Use lognormal distribution.			
		UCL (Land's method) is	0.50					UCL (Land's method) is	42.4		

41 PQL = practical quantitation limit

42 UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
 Project 100-F Area Field Remediation
 Subject 128-F-3 Waste Site Cleanup Verification 95% UCL Calculations

Date 09/14/06

Job No. 14655

Calc. No. 0100F-CA-V0258

Checked T. M. Blakley

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Ecology Software (MTCASat) Results

DATA	ID	Chromium 95% UCL Calculation				DATA	ID	Cobalt 95% UCL Calculation			
14.3	J11VW0/J11VW1					7.2	J11VW0/J11VW1				
69.3	J11VV5					5.5	J11VV5				
7.4	J11VV6	Number of samples	Uncensored values			6.4	J11VV6	Number of samples	Uncensored values		
6.8	J11VV7	Uncensored	10	Mean	16.0	6.5	J11VV7	Uncensored	10	Mean	5.7
9.0	J11VV8	Censored		Lognormal mean	14.9	4.8	J11VV8	Censored		Lognormal mean	5.7
8.5	J11VV9	Detection limit or PQL		Std. devn.	18.9	4.5	J11VV9	Detection limit or PQL		Std. devn.	0.9
12.6	J11VW2	Method detection limit		Median	9.6	5.2	J11VW2	Method detection limit		Median	5.5
8.9	J11VW3	TOTAL	10	Min.	6.8	4.7	J11VW3	TOTAL	10	Min.	4.5
10.2	J11VW4			Max.	69.3	6.6	J11VW4			Max.	7.2
13.1	J11VW5					5.5	J11VW5				
		Lognormal distribution?	Normal distribution?					Lognormal distribution?	Normal distribution?		
		r-squared is: 0.689	r-squared is: 0.457					r-squared is: 0.951	r-squared is: 0.945		
		Recommendations:						Recommendations:			
		Reject BOTH lognormal and normal distributions.						Use lognormal distribution.			
		UCL (based on Z-statistic) is	25.8					UCL (Land's method) is	6.3		
DATA	ID	Copper 95% UCL Calculation				DATA	ID	Lead 95% UCL Calculation			
24.4	J11VW0/J11VW1					5.5	J11VW0/J11VW1				
23.8	J11VV5					5.1	J11VV5				
12.8	J11VV6	Number of samples	Uncensored values			3.4	J11VV6	Number of samples	Uncensored values		
9.9	J11VV7	Uncensored	10	Mean	17.5	4.0	J11VV7	Uncensored	10	Mean	3.9
15.1	J11VV8	Censored		Lognormal mean	17.6	3.3	J11VV8	Censored		Lognormal mean	3.9
15.7	J11VV9	Detection limit or PQL		Std. devn.	4.6	2.8	J11VV9	Detection limit or PQL		Std. devn.	0.9
18.5	J11VW2	Method detection limit		Median	17.1	3.4	J11VW2	Method detection limit		Median	3.5
15.0	J11VW3	TOTAL	10	Min.	9.9	3.1	J11VW3	TOTAL	10	Min.	2.8
20.0	J11VW4			Max.	24.4	4.7	J11VW4			Max.	5.5
19.7	J11VW5					3.5	J11VW5				
		Lognormal distribution?	Normal distribution?					Lognormal distribution?	Normal distribution?		
		r-squared is: 0.959	r-squared is: 0.971					r-squared is: 0.929	r-squared is: 0.899		
		Recommendations:						Recommendations:			
		Use lognormal distribution.						Use lognormal distribution.			
		UCL (Land's method) is	21.1					UCL (Land's method) is	4.5		

41 PQL = practical quantitation limit

42 UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC*

Date 09/14/06

Calc. No. 0100F-CA-V0258

Rev. No. 0

Project 100-F Area Field Remediation

Job No. 14655

Checked T. M. Blakley *TMB*

Date 9/18/06

Subject 128-F-3 Waste Site Cleanup Verification 95% UCL Calculations

Sheet No. 9 of 10

Ecology Software (MTCASat) Results

DATA	ID	Manganese 95% UCL Calculation				DATA	ID	Nickel 95% UCL Calculation			
327	J11VW0/J11VW1					10.8	J11VW0/J11VW1				
250	J11VV5					9.7	J11VV5				
305	J11VV6	Number of samples		Uncensored values		9.0	J11VV6	Number of samples		Uncensored values	
350	J11VV7	Uncensored	10	Mean	267	8.4	J11VV7	Uncensored	10	Mean	10.1
229	J11VV8	Censored		Lognormal mean	268	10.0	J11VV8	Censored		Lognormal mean	10.1
218	J11VV9	Detection limit or PQL		Std. devn.	49	8.8	J11VV9	Detection limit or PQL		Std. devn.	1.3
234	J11VW2	Method detection limit		Median	245	12.5	J11VW2	Method detection limit		Median	9.9
219	J11VW3	TOTAL	10	Min.	218	9.5	J11VW3	TOTAL	10	Min.	8.4
304	J11VW4			Max.	350	10.2	J11VW4			Max.	12.5
239	J11VW5					11.8	J11VW5				
		Lognormal distribution?		Normal distribution?				Lognormal distribution?		Normal distribution?	
		r-squared is: 0.895		r-squared is: 0.883				r-squared is: 0.971		r-squared is: 0.952	
		Recommendations:						Recommendations:			
		Reject BOTH lognormal and normal distributions.						Use lognormal distribution.			
		UCL (based on Z-statistic) is		293				UCL (Land's method) is		10.9	
DATA	ID	Vanadium 95% UCL Calculation				DATA	ID	Zinc 95% UCL Calculation			
51.6	J11VW0/J11VW1					56.9	J11VW0/J11VW1				
34.8	J11VV5					39.5	J11VV5				
34.2	J11VV6	Number of samples		Uncensored values		33.2	J11VV6	Number of samples		Uncensored values	
44.3	J11VV7	Uncensored	10	Mean	33.8	40.2	J11VV7	Uncensored	10	Mean	36.7
23.6	J11VV8	Censored		Lognormal mean	34.0	29.9	J11VV8	Censored		Lognormal mean	36.7
22.5	J11VV9	Detection limit or PQL		Std. devn.	10.7	27.7	J11VV9	Detection limit or PQL		Std. devn.	9.4
26.5	J11VW2	Method detection limit		Median	31.7	31.6	J11VW2	Method detection limit		Median	34.0
23.7	J11VW3	TOTAL	10	Min.	22.5	26.4	J11VW3	TOTAL	10	Min.	26.4
48.0	J11VW4			Max.	51.6	46.6	J11VW4			Max.	56.9
29.1	J11VW5					34.7	J11VW5				
		Lognormal distribution?		Normal distribution?				Lognormal distribution?		Normal distribution?	
		r-squared is: 0.932		r-squared is: 0.908				r-squared is: 0.958		r-squared is: 0.905	
		Recommendations:						Recommendations:			
		Use lognormal distribution.						Use lognormal distribution.			
		UCL (Land's method) is		41.7				UCL (Land's method) is		42.8	

41 PQL = practical quantitation limit

42 UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC*

Date 09/14/06

Calc. No. 0100F-CA-V0258

Rev. No. 0

Project 100-F Area Field Remediation

Job No. 14655

Checked T. M. Blakley *TMB*

Date 9/15/06

Subject 128-F-3 Waste Site Cleanup Verification 95% UCL Calculations

Sheet No. 10 of 10

Ecology Software (MTCASat) Results

DATA	ID	Chloroform 95% UCL Calculation				DATA	ID	Methylene Chloride 95% UCL Calculation			
0.005	J11VW0/J11VW1					0.009	J11VW0/J11VW1				
0.005	J11VV5					0.033	J11VV5				
0.004	J11VV6	Number of samples		Uncensored values		0.009	J11VV6	Number of samples		Uncensored values	
0.003	J11VV7	Uncensored	10	Mean	0.004	0.015	J11VV7	Uncensored	10	Mean	0.012
0.003	J11VV8	Censored		Lognormal mean	0.004	0.012	J11VV8	Censored		Lognormal mean	0.012
0.003	J11VV9	Detection limit or PQL		Std. devn.	0.001	0.012	J11VV9	Detection limit or PQL		Std. devn.	0.008
0.005	J11VW2	Method detection limit		Median	0.005	0.008	J11VW2	Method detection limit		Median	0.011
0.005	J11VW3	TOTAL	10	Min.	0.003	0.006	J11VW3	TOTAL	10	Min.	0.006
0.005	J11VW4			Max.	0.005	0.011	J11VW4			Max.	0.033
0.005	J11VW5					0.011	J11VW5				
		Lognormal distribution?		Normal distribution?				Lognormal distribution?		Normal distribution?	
		r-squared is: 0.709		r-squared is: 0.713				r-squared is: 0.872		r-squared is: 0.661	
		Recommendations:						Recommendations:			
		Reject BOTH lognormal and normal distributions.						Reject BOTH lognormal and normal distributions.			
		UCL (based on Z-statistic) is		0.005				UCL (based on Z-statistic) is		0.016	
DATA	ID	beta-BHC 95% UCL Calculation									
0.004	J11VW0/J11VW1										
0.0054	J11VV5										
0.0015	J11VV6	Number of samples		Uncensored values							
0.0014	J11VV7	Uncensored	10	Mean	0.002						
0.0015	J11VV8	Censored		Lognormal mean	0.002						
0.0015	J11VV9	Detection limit or PQL		Std. devn.	0.001						
0.0014	J11VW2	Method detection limit		Median	0.002						
0.0014	J11VW3	TOTAL	10	Min.	0.00095						
0.00095	J11VW4			Max.	0.0054						
0.0015	J11VW5										
		Lognormal distribution?		Normal distribution?							
		r-squared is: 0.709		r-squared is: 0.617							
		Recommendations:									
		Reject BOTH lognormal and normal distributions.									
		UCL (based on Z-statistic) is		0.003							

41 PQL = practical quantitation limit

42 UCL = upper confidence limit

Attachment 1. 128-F3 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium		
			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
1	J11VV5	4/10/06	5860		8.9	1.4	U	1.4	3.2		1.9	288	C	0.06	0.47		0.06	15.5		0.74	0.22	U	0.22
2	J11VV6	4/10/06	4870		8.8	1.4	U	1.4	2.1		1.9	79.8	C	0.06	0.44		0.06	3.1		0.74	0.21	U	0.21
3	J11VV7	4/10/06	4940		8.4	1.3	U	1.3	2.0		1.8	79.5	C	0.06	0.49		0.06	3.3		0.70	0.20	U	0.20
4	J11VV8	4/10/06	5040		8.3	1.3	U	1.3	2.3		1.8	45.9	C	0.06	0.32		0.06	1.3		0.69	0.20	U	0.20
5	J11VV9	4/10/06	4660		8.7	1.3	U	1.3	2.0		1.8	38.8	C	0.06	0.29		0.06	0.73	U	0.73	0.21	U	0.21
6	J11VW0	4/11/06	5980		9.3	1.4	UJ	1.4	2.0		2.0	214	C	0.06	0.50		0.06	11.4		0.78	0.25		0.23
Duplicate of J11VW0	J11VW1	4/11/06	6360		9.5	1.5	UJ	1.5	2.6		2.0	235	C	0.07	0.54		0.07	13.2		0.79	0.26		0.23
7	J11VW2	4/11/06	5510		9.1	1.4	UJ	1.4	2.3		1.9	60.7	C	0.06	0.32		0.06	2.4		0.76	0.22	U	0.22
8	J11VW3	4/11/06	4540		87.9	1.4	UJ	1.4	2.3		1.9	36.7	C	0.06	0.29		0.06	0.88		0.75	0.22	U	0.22
9	J11VW4	4/11/06	7100		9.2	1.4	UJ	1.4	2.4		1.9	290	C	0.06	0.62		0.06	21.8		0.76	0.25		0.23
10	J11VW5	4/11/06	5770		9.3	1.4	UJ	1.4	2.6		2.0	98.2	C	0.06	0.41		0.06	5.4		0.77	0.23	U	0.23
Waste staging area	J11VW6	4/11/06	5930		9.5	1.5	UJ	1.5	2.0	U	2.0	141	C	0.07	0.58		0.07	5.5		0.79	0.27		0.23
Equipment blank	J11VV4	4/10/06	47.4		2.6	0.40	U	0.40	0.55	U	0.55	1.3	C	0.02	0.02	U	0.02	0.70		0.22	0.06	U	0.06

Sample Location	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead		
			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
1	J11VV5	4/10/06	6320	C	5.0	69.3		0.40	5.5		0.43	23.8		0.37	2.3	UD	2.3	12000	C	10.7	5.1		0.95
2	J11VV6	4/10/06	3160	C	5.0	7.4		0.40	6.4		0.43	12.8		0.37	0.22	U	0.22	14200	C	10.7	3.4		0.95
3	J11VV7	4/10/06	3190	C	4.8	6.8		0.38	6.5		0.41	9.9		0.35	0.22	U	0.22	17400	C	10.1	4.0		0.90
4	J11VV8	4/10/06	2550	C	4.7	9.0		0.38	4.8		0.41	15.1		0.35	0.22	U	0.22	11000	C	10.1	3.3		0.90
5	J11VV9	4/10/06	2320	C	5.0	8.5		0.39	4.5		0.42	15.7		0.36	2.2	UD	2.2	10400	C	10.6	2.8		0.94
6	J11VW0	4/11/06	5840	C	5.3	13.7	C	0.42	7.2		0.45	23.0		0.39	2.2	UD	2.2	18400		11.3	5.2		1.0
Duplicate of J11VW0	J11VW1	4/11/06	6050	C	5.4	14.8	C	0.43	7.2		0.46	25.7		0.40	0.23	U	0.23	18400		11.5	5.7		1.0
7	J11VW2	4/11/06	3070	C	5.2	12.6	C	0.41	5.2		0.44	18.5		0.38	0.22	U	0.22	12100		11.0	3.4		0.98
8	J11VW3	4/11/06	2420	C	5.1	8.9	C	0.40	4.7		0.43	15.0		0.37	0.21	U	0.21	10900		10.8	3.1		0.96
9	J11VW4	4/11/06	6140	C	5.2	10.2	C	0.41	6.6		0.45	20.0		0.38	0.22	U	0.22	17500		11.1	4.7		0.99
10	J11VW5	4/11/06	3390	C	5.3	13.1	C	0.42	5.5		0.45	19.7		0.39	0.22	U	0.22	12700		11.3	3.5		1.0
Waste staging area	J11VW6	4/11/06	3870	C	5.4	9.8	C	0.43	6.6		0.46	11.6		0.40	0.23	U	0.23	18300		11.5	8.3		1.0
Equipment blank	J11VV4	4/10/06	22.8	C	1.5	0.12	U	0.12	0.13		0.13	0.11	U	0.11				111	C	3.1	0.28	U	0.28

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

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

B = blank contamination (organic constituents)

J = estimated

C = blank contamination (inorganic constituents)

PQL = practical quantitation limit

D = diluted

Q = qualifier

HEIS = Hanford Environmental Information System

U = undetected

Attachment 1
 Originator J. M. Capron *JMC*
 Checked T. M. Blakley *TMB*
 Calc. No. 0100F-CA-V0258

Sheet No. 1 of 6
 Date 09/14/06
 Date 9/18/06
 Rev. No. 0

Attachment 1. 128-F3 Verification Sampling Results.

Sample Location	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J11VV5	4/10/06	3130		3.0	250		0.09	0.03		0.02	0.89	U	0.89	9.7		0.74	1140		7.0	1.4	U	1.4
2	J11VV6	4/10/06	3170		3.0	305		0.09	0.01	U	0.01	0.89	U	0.89	9.0		0.74	1140		7.0	1.4	U	1.4
3	J11VV7	4/10/06	3320		2.8	350		0.09	0.02	U	0.02	0.84	U	0.84	8.4		0.70	1140		6.6	1.4	U	1.4
4	J11VV8	4/10/06	3280		2.8	229		0.09	0.01	U	0.01	0.84	U	0.84	10.0		0.69	822		6.6	1.4	U	1.4
5	J11VV9	4/10/06	3060		2.9	218		0.09	0.02	U	0.02	0.88	U	0.88	8.8		0.73	797		6.9	1.4	U	1.4
6	J11VW0	4/11/06	3620		3.1	327		0.1	0.02	U	0.02	0.94	U	0.94	10.7		0.78	1120	C	7.4	1.5	U	1.5
Duplicate of J11VW0	J11VW1	4/11/06	3660		3.2	326		0.1	0.02		0.02	0.96	U	0.96	10.9		0.79	1110	C	7.5	1.6	U	1.6
7	J11VW2	4/11/06	3660		3.1	234		0.09	0.02	U	0.02	0.92	U	0.92	12.5		0.76	852	C	7.2	1.5	U	1.5
8	J11VW3	4/11/06	3100		3	219		0.09	0.02	U	0.02	0.90	U	0.90	9.5		0.75	676	C	7.0	1.5	U	1.5
9	J11VW4	4/11/06	3730		3.1	304		0.1	0.02		0.02	0.92	U	0.92	10.2		0.76	1290	C	7.2	1.5	U	1.5
10	J11VW5	4/11/06	3650		3.1	239		0.1	0.02	U	0.02	0.94	U	0.94	11.8		0.77	903	C	7.3	1.5	U	1.5
Waste staging area	J11VW6	4/11/06	3440		3.2	331		0.1	0.02	U	0.02	0.96	U	0.96	9.2		0.79	1340	C	7.5	1.5	U	1.5
Equipment blank	J11VV4	4/10/06	6.8		0.87	4.8		0.03	0.01	U	0.01	0.26	U	0.26	0.22	U	0.22	19.2		2.0	0.42	U	0.42

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
1	J11VV5	4/10/06	548	C	7.0	0.22	U	0.22	259		2.3	34.8		0.28	39.5		0.49
2	J11VV6	4/10/06	561	C	7.0	0.21	U	0.21	85.8		2.3	34.2		0.28	33.2		0.49
3	J11VV7	4/10/06	564	C	6.6	0.20	U	0.20	103		2.2	44.3		0.26	40.2		0.47
4	J11VV8	4/10/06	501	C	6.6	0.20	U	0.20	84.5		2.2	23.6		0.26	29.9		0.46
5	J11VV9	4/10/06	530	C	6.9	0.21	U	0.21	68.0		2.3	22.5		0.27	27.7		0.48
6	J11VW0	4/11/06	584	J	7.4	0.23	UC	0.23	192		2.5	50.8		0.29	59.6	C	0.52
Duplicate of J11VW0	J11VW1	4/11/06	548	J	7.5	0.23	UC	0.23	233		2.5	52.4		0.30	54.1	C	0.53
7	J11VW2	4/11/06	476	J	7.2	0.22	UC	0.22	96.2		2.4	26.5		0.28	31.6	C	0.51
8	J11VW3	4/11/06	442	J	7.0	0.22	UC	0.22	67.9		2.4	23.7		0.28	26.4	C	0.50
9	J11VW4	4/11/06	555	J	7.2	0.22	UC	0.22	301		2.4	48.0		0.29	46.6	C	0.51
10	J11VW5	4/11/06	552	J	7.3	0.28	UJ	0.23	201		2.5	29.1		0.29	34.7	C	0.52
Waste staging area	J11VW6	4/11/06	392	J	7.5	0.23	UC	0.23	120		2.5	46.4		0.30	44.8	C	0.53
Equipment blank	J11VV4	4/10/06	42.0	C	2.0	0.06	U	0.06	7.2		0.69	0.08	U	0.08	1.4		0.14

Attachment 1
 Originator J. M. Capron
 Checked T. M. Blakley
 Calc. No. 0100F-CA-V0258

Sheet No. 2 of 6
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Attachment 1. 128-F-3 Verification Sampling Results.

Constituents	J11VV5 Location 1			J11VV6 Location 2			J11VV7 Location 3			J11VV8 Location 4		
	Sample Date 4/10/06			Sample Date 4/10/06			Sample Date 4/10/06			Sample Date 4/10/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Pesticides												
Aldrin	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
alpha-BHC	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
alpha-Chlordane	1.1	JD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
beta-BHC	5.4	D	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
delta-BHC	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Dichlorodiphenyldichloroethane	1.6	D	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Dichlorodiphenyldichloroethylene	2.2	D	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Dichlorodiphenyltrichloroethane	1.2	JD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Dieldrin	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endosulfan I	1.6	D	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endosulfan II	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endosulfan sulfate	1.8	D	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endrin	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endrin aldehyde	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Endrin ketone	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
gamma-BHC (Lindane)	1.3	JD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
gamma-Chlordane	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Heptachlor	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Heptachlor epoxide	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Methoxychlor	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4	1.5	UD	1.5
Toxaphene	15	UD	15	15	UD	15	14	UD	14	15	UD	15
Volatile Organic Compounds												
1,1,1-Trichloroethane	6	U	6	6	U	6	6	U	6	5	U	5
1,1,2,2-Tetrachloroethane	6	U	6	6	U	6	6	U	6	5	U	5
1,1,2-Trichloroethane	6	U	6	6	U	6	6	U	6	5	U	5
1,1-Dichloroethane	6	U	6	6	U	6	6	U	6	5	U	5
1,1-Dichloroethene	6	U	6	6	U	6	6	U	6	5	U	5
1,2-Dichloroethane	6	U	6	6	U	6	6	U	6	5	U	5
1,2-Dichloroethene (total)	6	U	6	6	U	6	6	U	6	5	U	5
1,2-Dichloropropane	6	U	6	6	U	6	6	U	6	5	U	5
2-Butanone	5	J	11	11	U	11	11	U	11	10	U	10
2-Hexanone	8	JB	11	11	U	11	2	JB	11	10	U	10
4-Methyl-2-Pentanone	8	JB	11	11	U	11	11	U	11	2	JB	10
Acetone	6	JB	11	9	J	11	11	U	11	10	U	10
Benzene	6	U	6	6	U	6	6	U	6	5	U	5
Bromodichloromethane	6	U	6	6	U	6	6	U	6	5	U	5
Bromoform	6	U	6	6	U	6	6	U	6	5	U	5
Bromomethane	11	U	11	11	U	11	11	U	11	10	U	10
Carbon disulfide	6	U	6	6	U	6	6	U	6	5	U	5
Carbon tetrachloride	6	U	6	6	U	6	6	U	6	5	U	5
Chlorobenzene	8	B	6	6	U	6	2	JB	6	2	JB	5
Chloroethane	11	U	11	11	U	11	11	U	11	10	U	10
Chloroform	5	JB	6	4	JB	6	3	JB	6	3	JB	5
Chloromethane	11	U	11	11	U	11	11	U	11	10	U	10
cis-1,2-Dichloroethylene	6	U	6	6	U	6	6	U	6	5	U	5
cis-1,3-Dichloropropene	6	U	6	6	U	6	6	U	6	5	U	5
Dibromochloromethane	6	U	6	6	U	6	6	U	6	5	U	5
Ethylbenzene	2	J	6	6	U	6	6	U	6	5	U	5
Methylene chloride	33	B	6	9	B	6	15	B	6	12	B	5
Styrene	4	JB	6	6	U	6	6	U	6	5	U	5
Tetrachloroethene	1	J	6	6	U	6	6	U	6	5	U	5
Toluene	6	U	6	6	U	6	6	U	6	5	U	5
trans-1,2-Dichloroethylene	6	U	6	6	U	6	6	U	6	5	U	5
trans-1,3-Dichloropropene	6	U	5	6	U	5	6	U	5	5	U	5
Trichloroethene	6	U	6	6	U	6	6	U	6	5	U	5
Vinyl chloride	11	U	11	11	U	11	11	U	11	10	U	10
Xylenes (total)	7	B	6	6	U	6	6	U	6	5	U	5

Attachment 1
 Originator J. M. Capron
 Checked T. M. Blakley
 Calc. No. 0100F-CA-V0258

Sheet No. 3 of 6
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Attachment 1. 128-F-3 Verification Sampling Results.

Constituents	J11VV9 Location 5			J11VW0 Location 6			J11VW1 Duplicate of J11VW0			J11VW2 Location 7		
	Sample Date 4/10/06			Sample Date 4/11/06			Sample Date 4/11/06			Sample Date 4/11/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Pesticides												
Aldrin	1.5	UD	1.5	0.56	JD	1.5	1.5	UD	1.5	1.4	UD	1.4
alpha-BHC	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4
alpha-Chlordane	1.5	UD	1.5	0.89	JD	1.5	2.8	D	1.5	1.4	UD	1.4
beta-BHC	1.5	UD	1.5	3.3	D	1.5	4.7	D	1.5	1.4	UD	1.4
delta-BHC	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4
Dichlorodiphenyldichloroethane	1.5	UD	1.5	1.5	UD	1.5	4.3	D	1.5	1.4	UD	1.4
Dichlorodiphenyldichloroethylene	1.5	UD	1.5	2.3	D	1.5	1.5	UD	1.5	1.4	UD	1.4
Dichlorodiphenyltrichloroethane	1.5	UD	1.5	1.6	JD	1.5	1.5	UD	1.5	1.4	UD	1.4
Dieldrin	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4
Endosulfan I	1.5	UD	1.5	1.2	JD	1.5	1.5	UD	1.5	1.4	UD	1.4
Endosulfan II	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4
Endosulfan sulfate	1.5	UD	1.5	1.3	JD	1.5	5.8	D	1.5	1.4	UD	1.4
Endrin	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4
Endrin aldehyde	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4
Endrin ketone	1.5	UD	1.5	0.59	JD	1.5	3.0	D	1.5	1.4	UD	1.4
gamma-BHC (Lindane)	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4
gamma-Chlordane	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4
Heptachlor	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5	1.4	UD	1.4
Heptachlor epoxide	1.5	UD	1.5	0.41	JD	1.5	1.5	UD	1.5	1.4	UD	1.4
Methoxychlor	1.5	UD	1.5	1.5	UD	1.5	9.8	D	1.5	1.4	UD	1.4
Toxaphene	15	UD	15	15	UDJ	15	15	UDJ	15	14	UDJ	14
Volatile Organic Compounds												
1,1,1-Trichloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,1,2,2-Tetrachloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,1,2-Trichloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,1-Dichloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,1-Dichloroethene	5	U	5	6	U	6	6	U	6	6	U	6
1,2-Dichloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,2-Dichloroethene (total)	5	U	5	6	U	6	6	U	6	6	U	6
1,2-Dichloropropane	5	U	5	6	U	6	6	U	6	6	U	6
2-Butanone	10	U	10	11	U	11	11	U	11	11	U	11
2-Hexanone	10	U	10	10	UJ	11	10	U	11	11	U	11
4-Methyl-2-Pentanone	10	U	10	10	UJ	11	11	U	11	11	U	11
Acetone	10	U	10	11	U	11	11	U	11	10	U	11
Benzene	5	U	5	6	U	6	6	U	6	6	U	6
Bromodichloromethane	5	U	5	6	U	6	6	U	6	6	U	6
Bromoform	5	U	5	6	U	6	6	U	6	6	U	6
Bromomethane	10	U	10	11	U	11	11	U	11	11	U	11
Carbon disulfide	5	U	5	6	U	6	6	U	6	6	U	6
Carbon tetrachloride	5	U	5	6	U	6	6	U	6	6	U	6
Chlorobenzene	3	JB	5	10	U	10	10	U	10	10	U	10
Chloroethane	10	U	10	11	U	11	11	U	11	11	U	11
Chloroform	3	JB	5	10	U	10	10	U	10	10	U	10
Chloromethane	10	U	10	11	U	11	11	U	11	11	U	11
cis-1,2-Dichloroethylene	5	U	5	6	U	6	6	U	6	6	U	6
cis-1,3-Dichloropropene	5	U	5	6	U	6	6	U	6	6	U	6
Dibromochloromethane	5	U	5	6	U	6	6	U	6	6	U	6
Ethylbenzene	5	U	5	6	U	6	6	U	6	6	U	6
Methylene chloride	12	B	5	18	U	6	16	U	6	15	U	6
Styrene	5	U	5	10	U	10	6	U	6	6	U	6
Tetrachloroethene	5	U	5	6	U	6	6	U	6	6	U	6
Toluene	5	U	5	6	U	6	6	U	6	6	U	6
trans-1,2-Dichloroethylene	5	U	5	6	U	6	6	U	6	6	U	6
trans-1,3-Dichloropropene	5	U	5	6	U	5	6	U	5	6	U	5
Trichloroethene	5	U	5	6	U	6	6	U	6	6	U	6
Vinyl chloride	10	U	10	11	U	11	11	U	11	11	U	11
Xylenes (total)	5	U	5	10	U	10	6	U	6	6	U	6

Attachment 1
 Originator J. M. Capron
 Checked T. M. Blakley
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Attachment 1. 128-F-3 Verification Sampling Results.

Constituents	J11VW3 Location 8			J11VW4 Location 9			J11VW5 Location 10			J11VW6 Waste Staging Area		
	Sample Date 4/11/06			Sample Date 4/11/06			Sample Date 4/11/06			Sample Date 4/11/06		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Pesticides												
Aldrin	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
alpha-BHC	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
alpha-Chlordane	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
beta-BHC	1.4	UD	1.4	0.95	JD	1.5	1.5	UD	1.5	1.5	UD	1.5
delta-BHC	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Dichlorodiphenyldichloroethane	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Dichlorodiphenyldichloroethylene	1.4	UD	1.4	1.2	JD	1.5	1.5	UD	1.5	3.1	D	1.5
Dichlorodiphenyltrichloroethane	1.4	UD	1.4	0.95	JD	1.5	1.5	UD	1.5	0.76	JD	1.5
Dieldrin	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Endosulfan I	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Endosulfan II	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	0.88	JD	1.5
Endosulfan sulfate	1.4	UD	1.4	0.80	JD	1.5	1.5	UD	1.5	1.5	UD	1.5
Endrin	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Endrin aldehyde	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Endrin ketone	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
gamma-BHC (Lindane)	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
gamma-Chlordane	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Heptachlor	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Heptachlor epoxide	1.4	UD	1.4	0.55	JD	1.5	1.5	UD	1.5	1.5	UD	1.5
Methoxychlor	1.4	UD	1.4	1.5	UD	1.5	1.5	UD	1.5	1.5	UD	1.5
Toxaphene	14	UDJ	14	15	UDJ	15	15	UDJ	15	15	UDJ	15
Volatile Organic Compounds												
1,1,1-Trichloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,1,2,2-Tetrachloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,1,2-Trichloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,1-Dichloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,1-Dichloroethene	5	U	5	6	U	6	6	U	6	6	U	6
1,2-Dichloroethane	5	U	5	6	U	6	6	U	6	6	U	6
1,2-Dichloroethene (total)	5	U	5	6	U	6	6	U	6	6	U	6
1,2-Dichloropropane	5	U	5	6	U	6	6	U	6	6	U	6
2-Butanone	10	U	10	11	U	11	11	U	11	11	U	11
2-Hexanone	10	U	10	11	U	11	11	U	11	11	U	11
4-Methyl-2-Pentanone	10	U	10	11	U	11	11	U	11	11	U	11
Acetone	10	U	10	11	U	11	11	U	11	11	U	11
Benzene	5	U	5	6	U	6	6	U	6	6	U	6
Bromodichloromethane	5	U	5	6	U	6	6	U	6	6	U	6
Bromoform	5	U	5	6	U	6	6	U	6	6	U	6
Bromomethane	10	U	10	11	U	11	11	U	11	11	U	11
Carbon disulfide	5	U	5	6	U	6	6	U	6	6	U	6
Carbon tetrachloride	5	U	5	6	U	6	6	U	6	6	U	6
Chlorobenzene	10	U	10	10	U	10	10	U	10	10	U	10
Chloroethane	10	U	10	11	U	11	11	U	11	11	U	11
Chloroform	10	U	10	10	U	10	10	U	10	10	U	10
Chloromethane	10	U	10	11	U	11	11	U	11	11	U	11
cis-1,2-Dichloroethylene	5	U	5	6	U	6	6	U	6	6	U	6
cis-1,3-Dichloropropene	5	U	5	6	U	6	6	U	6	6	U	6
Dibromochloromethane	5	U	5	6	U	6	6	U	6	6	U	6
Ethylbenzene	5	U	5	6	U	6	6	U	6	6	U	6
Methylene chloride	12	U	5	21	U	6	22	U	6	22	U	6
Styrene	5	U	5	6	U	6	6	U	6	6	U	6
Tetrachloroethene	5	U	5	6	U	6	6	U	6	6	U	6
Toluene	5	U	5	6	U	6	6	U	6	6	U	6
trans-1,2-Dichloroethylene	5	U	5	6	U	6	6	U	6	6	U	6
trans-1,3-Dichloropropene	5	U	5	5	U	5	6	U	5	6	U	5
Trichloroethene	5	U	5	6	U	6	6	U	6	6	U	6
Vinyl chloride	10	U	10	11	U	11	11	U	11	11	U	11
Xylenes (total)	5	U	5	6	U	6	6	U	6	6	U	6

Attachment 1
 Originator J. M. Capron
 Checked T. M. Blakley
 Calc. No. 0100F-CA-V0258

Sheet No. 5 of 6
 Date 09/14/06
 Date
 Rev. No. 0

Attachment 1. 128-F-3 Verification Sampling Results.

Constituents	J11VV4 Equipment Blank Sample Date 4/10/06		
	$\mu\text{g/kg}$	Q	PQL
Volatile Organic Compounds			
1,1,1-Trichloroethane	5	U	5
1,1,2,2-Tetrachloroethane	5	U	5
1,1,2-Trichloroethane	5	U	5
1,1-Dichloroethane	5	U	5
1,1-Dichloroethene	5	U	5
1,2-Dichloroethane	5	U	5
1,2-Dichloroethene (total)	5	U	5
1,2-Dichloropropane	5	U	5
2-Butanone	3	J	10
2-Hexanone	4	BJ	10
4-Methyl-2-Pentanone	3	BJ	10
Acetone	8	J	10
Benzene	5	U	5
Bromodichloromethane	5	U	5
Bromoform	5	U	5
Bromomethane	10	U	10
Carbon disulfide	5	U	5
Carbon tetrachloride	5	U	5
Chlorobenzene	5	U	5
Chloroethane	10	U	10
Chloroform	3	BJ	5
Chloromethane	10	U	10
cis-1,2-Dichloroethylene	5	U	5
cis-1,3-Dichloropropene	5	U	5
Dibromochloromethane	5	U	5
Ethylbenzene	5	U	5
Methylene chloride	5	BJ	5
Styrene	5	U	5
Tetrachloroethene	5	U	5
Toluene	5	U	5
trans-1,2-Dichloroethylene	5	U	5
trans-1,3-Dichloropropene	5	U	5
Trichloroethene	5	U	5
Vinyl chloride	10	U	10
Xylenes (total)	5	U	5

Attachment 1
 Originator J. M. Capron
 Checked T. M. Blakley
 Calc. No. 0100F-CA-V0258

Sheet No. 6 of 6
 Date 09/14/06
 Date _____
 Rev. No. 0

APPENDIX D

**CALCULATION OF HAZARD QUOTIENTS AND
EXCESS CARCINOGENIC RISK VALUES**

CALCULATION COVER SHEET

Project Title 100-F Area Field Remediation Closure **Job No.** 14655
Area 100-F
Discipline Environmental ***Calc. No.** 0100F-CA-V0260
Subject 128-F-3 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 Summary = 3	J. M. Capron <i>J. M. Capron</i> 9/14/06	T. M. Blakley <i>T. M. Blakley</i> 9/14/06	L. M. Dittmer <i>L. M. Dittmer</i> 9/19/06	S. W. Callison <i>SW Callison</i> 9-21-06	9-21-06
	Total = 4					

SUMMARY OF REVISION

WCH-DE-018 (9/01/2006)

* Obtain Calc. No. from R&DC and Form from Intranet

Washington Closure Hanford		CALCULATION SHEET			
Originator:	J. M. Capron <i>JMC</i>	Date:	09/14/06	Calc. No.:	0100F-CA-V0260
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	T. M. Blakley <i>TMB</i>
Subject:	128-F-3 Waste Site Hazard Quotient and Carcinogenic Risk Calculations				Rev.: 0 Date: 9/14/06 Sheet No. 1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk values for the 128-F-3 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 x 10⁻⁶ for individual carcinogens
- 4) A cumulative excess carcinogenic risk of <1 x 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, 2006, Waste Site Reclassification Form 2006-042, and Attachment *Remaining Sites Verification Package for the 128-F-3 PNL Burn Pit*, 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 x 10⁻⁶ (DOE-RL 2005).
- 4) Sum the excess carcinogenic risk values and compare to the cumulative excess carcinogenic risk criterion of <1 x 10⁻⁵.

METHODOLOGY:

Hazard quotient and carcinogenic risk calculations were performed for the 128-F-3 waste site using the higher of the remediation footprint statistical value and waste staging area maximum value for each analyte detected above background. Of the contaminants of potential concern (COPCs) for the site, boron requires the HQ calculations because it was detected and a Washington State or Hanford Site

Washington Closure Hanford			CALCULATION SHEET			
Originator:	J. M. Capron <i>JMC</i>	Date:	09/14/06	Calc. No.:	0100F-CA-V0260	Rev.: 0
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	T. M. Blakley <i>TMB</i>	Date: 9/14/06
Subject:	128-F-3 Waste Site Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 3

background value is not available. Barium and chromium are included because they were quantified above their respective Hanford Site background values. Multiple chlorinated pesticides and volatile organic compounds (as identified in Table 1) are included because they were detected by laboratory analysis and cannot be attributed to natural occurrence. All other site nonradionuclide COPCs were not detected or were detected below background levels. An example of the HQ and risk calculations is presented below:

- 1) For example, the statistical value for boron is 42.4 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 2.7×10^{-3} . 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 5.1×10^{-2} . 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 aldrin is 0.00056 mg/kg; divided by 0.0588 mg/kg and multiplied as indicated is 9.5×10^{-9} . Comparing this value, and all other individual values, to the requirement of $<1 \times 10^{-6}$, this criterion is met.
- 4) After these calculations are completed for the carcinogenic analytes, the cumulative excess 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 2.6×10^{-8} . 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 128-F-3 waste site.

Washington Closure Hanford

CALCULATION SHEET

Originator:	J. M. Capron <i>JMC</i>	Date:	09/14/06	Calc. No.:	0100F-CA-V0260	Rev.:	0
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	T. M. Blakley <i>TMB</i>	Date:	9/14/06
Subject:	128-F-3 Waste Site Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 3

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 128-F-3 Waste Site.

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					
Barium	261	5,600	4.7E-02	--	--
Boron	42.4	16,000	2.7E-03	--	--
Chromium, total	25.8	80,000	3.2E-04		
Pesticides					
Aldrin	0.00056	2.40	2.3E-04	0.0588	9.5E-09
BHC, beta-	0.0030	--	--	0.556	5.4E-09
BHC, gamma- (Lindane)	0.0013	24	5.4E-05	0.769	1.7E-09
Chlordane (alpha and gamma)	0.0028	40	7.0E-05	2.86	9.8E-10
DDD, 4,4'-	0.0043	--	--	4.17	1.0E-09
DDE, 4,4'-	0.0031	--	--	2.94	1.1E-09
DDT, 4,4'-	0.0016	40	4.0E-05	2.94	5.4E-10
Endosulfan (I, II, sulfate)	0.0083	480	1.7E-05	--	--
Endrin (and ketone, aldehyde)	0.0030	24	1.3E-04	--	--
Heptachlor epoxide	0.00055	1.04	5.3E-04	0.11	5.0E-09
Methoxychlor	0.010	400	2.5E-05	--	--
Volatile Organic Compounds					
Acetone	0.009	72,000	1.3E-07	--	--
Butanone; 2-	0.005	48,000	1.0E-07	--	--
Chlorobenzene	0.008	1,600	5.0E-06	--	--
Chloroform	0.005	800	6.3E-06	164	3.0E-11
Ethylbenzene	0.002	8,000	2.5E-07	--	--
Hexanone; 2-	0.008	3,200	2.5E-06	--	--
Methyl-2-pentanone; 4-	0.008	6,400	1.3E-06	--	--
Methylene chloride	0.016	4,800	3.3E-06	133	1.2E-10
Styrene	0.004	16,000	2.5E-07	33.3	1.2E-10
Tetrachloroethene	0.001	800	1.3E-06	1.85	5.4E-10
Xylenes (total)	0.007	16,000	4.4E-07	--	--
Totals					
Cumulative Hazard Quotient:			5.1E-02		
Cumulative Excess Cancer Risk:					2.6E-08

Notes:

RAG = remedial action goal

-- = not applicable

^a = From WCH 2006.^b = Value obtained from *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996.^c = Value for the carcinogen RAG calculated based on the inhalation exposure pathway (WAC) 173-340-750(3), 1996.

CONCLUSION:

This calculation demonstrates that the 128-F-3 waste site meets the requirements for hazard quotient and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2005).