Waste Site Reclassification Form

Date Submitted: 4/12/06 **Originator:** R. A. Carlson **Phone:** 373-1440	**Operable Unit(s):** 100-FR-1 **Waste Site ID:** 126-F-2 **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number:** 2006-017 **Lead Agency:** EPA

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 126-F-2 site is the clearwell facility formerly used as part of the reactor cooling water treatment at the 183-F facility. During demolition operations in the 1970s, potentially contaminated debris was disposed in the eastern clearwell structure. The site has been remediated by removing all debris in the clearwell structure to the Environmental Restoration Disposal Facility. 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, (2) remediating the site, (3) demonstrating through radiological surveys, visual inspection, and verification sampling that cleanup goals have been met, and (4) proposing the site for classification as interim closed out.

Basis for reclassification:

The 126-F-2 waste site has been remediated to meet the remedial action objectives specified in the Remaining Sites ROD. The results of radiological surveys and visual inspection of the remediated clearwell structure show neither residual contamination nor the potential for contaminant migration beyond the clearwell boundaries. The results of verification sampling at the remediation waste staging area 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. The deep zone portion of the site has been shown to meet direct exposure criteria; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 126-F-2, 183-F Clearwells* (attached).

D. C. Smith DOE-RL Project Manager	Signature	5/4/06 Date
NA Ecology Project Manager	Signature	Date
R. A. Lobos EPA Project Manager	Signature	5-4-06 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 126-F-2, 183-F CLEARWELLS

Attachment to Waste Site Reclassification Form 2006-017

May 2006

REMAINING SITES VERIFICATION PACKAGE FOR THE 126-F-2, 183-F CLEARWELLS

EXECUTIVE SUMMARY

The 126-F-2 waste site, located within the 100-FR-1 Operable Unit, consists of the clearwells and co-located pumphouse that were formerly part of the 183-F water treatment facility. In the late 1970s, the eastern clearwell was used for the disposal of inert debris generated in the demolition of various 100-F Area buildings. Because of the history of materials disposed, including records of radiological release, and the difficulties and high cost associated with obtaining adequate characterization data, the eastern clearwell at the 126-F-2 waste site was recommended for remedial action without confirmatory sampling.

Site remediation was performed from July to September 2005 and consisted of the removal of debris within the eastern clearwell structure down to the concrete floor. Excavated material was staged onsite before disposal at the Environmental Restoration Disposal Facility. Radiological surveys and visual inspection of the remediated clearwell structure revealed no residual contamination on the concrete floor or sidewalls and no indication of possible contaminant migration beyond the boundaries of the clearwells. No remediation or investigation was performed at the western clearwell, as no waste materials were disposed there, and the roof of the facility remains intact.

Verification sampling was performed at the remediation waste staging area on December 14, 2005, to confirm that no residual contamination associated with excavated materials existed in surficial soils. Evaluation of the results indicated that the waste removal action achieved compliance with the remedial action objectives for the 126-F-2 site. A summary of the verification sampling evaluation for the soil results compared against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 126-F-2 site in accordance with the TPA-MP-14 (DOE-RL 1998) process.

In accordance with this evaluation, the verification sampling results, radiological surveys, and visual inspection 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 in soil do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The deep zone portion of the eastern clearwell structure has been shown to meet direct exposure criteria; therefore, no deep zone institutional controls are required.

Soil cleanup levels were established in the interim action 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 potential concern and other constituents. Screening levels were not exceeded for the site constituents, with the exception of 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 these constituents does not pose a risk to ecological receptors as vanadium concentrations are below background levels and boron concentrations are consistent with levels seen elsewhere at the Hanford Site (no established background value exists). A baseline risk assessment for the river corridor portion of Hanford 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 126-F-2 waste site.

Table ES-1. Summary of Remedial Action Goals for the 126-F-2 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain 15-mrem/yr dose rate above background over 1,000 years.	Only cesium-137 was detected above background in verification sampling, at a concentration below the direct exposure dose-equivalence lookup value.	Yes
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	Benzo(a)pyrene was detected above the direct exposure RAG in verification sampling, but determined to be the result of asphalt cross-contamination. Asphalt that has been used for structural and construction purposes is excluded from consideration as a dangerous waste, is listed as an inert solid waste, and does not present a significant health risk for this waste site. All other individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	All individual hazard quotients associated with soil are less than 1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for soil (1.0×10^{-1}) is less than 1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The individual excess cancer risk for aroclor-1254 (the sole carcinogen associated with soil contamination) is less than 1×10^{-6}.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk (1.5×10^{-7}) is less than 1×10^{-5}.	

Table ES-1. Summary of Remedial Action Goals for the 126-F-2 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Radionuclides	Attain single-COPC groundwater and river protection RAGs.	Only cesium-137 was detected above background in verification sampling, at a concentration below the lookup value for protection of groundwater and the Columbia River.	Yes
	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 detected above statistical background levels.	
Groundwater/River Protection – Radionuclides (continued)	Meet total uranium standard of 30 μg/L (21.2 pCi/L).	Uranium was not detected above statistical background levels.	Yes
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Total petroleum hydrocarbons and multiple polyaromatic hydrocarbons were quantified at concentrations exceeding soil RAGs for groundwater and/or river protection, but determined to be the result of asphalt cross-contamination. Asphalt that has been used for structural and construction purposes is excluded from consideration as a dangerous waste, is listed as an inert solid waste, and does not present a significant health risk for this waste site. Maximum detected results for lead, zinc, and aroclor-1254 are above soil RAGs for groundwater and/or river protection. However, results of the *100 Area Analogous Sites RESRAD Calculations* (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] *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b).
COPC = contaminant of potential concern
MCL = maximum contaminant level
RAG = remedial action goal
RAO = remedial action objective
RESRAD = RESidual RADioactivity (dose model)

REMAINING SITES VERIFICATION PACKAGE FOR THE 126-F-2, 183-F CLEARWELLS

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 126-F-2 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). Process knowledge, radiological surveys, and the results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. The deep zone portion of the eastern clearwell structure has been shown to meet direct exposure criteria; therefore, no deep zone institutional controls are required.

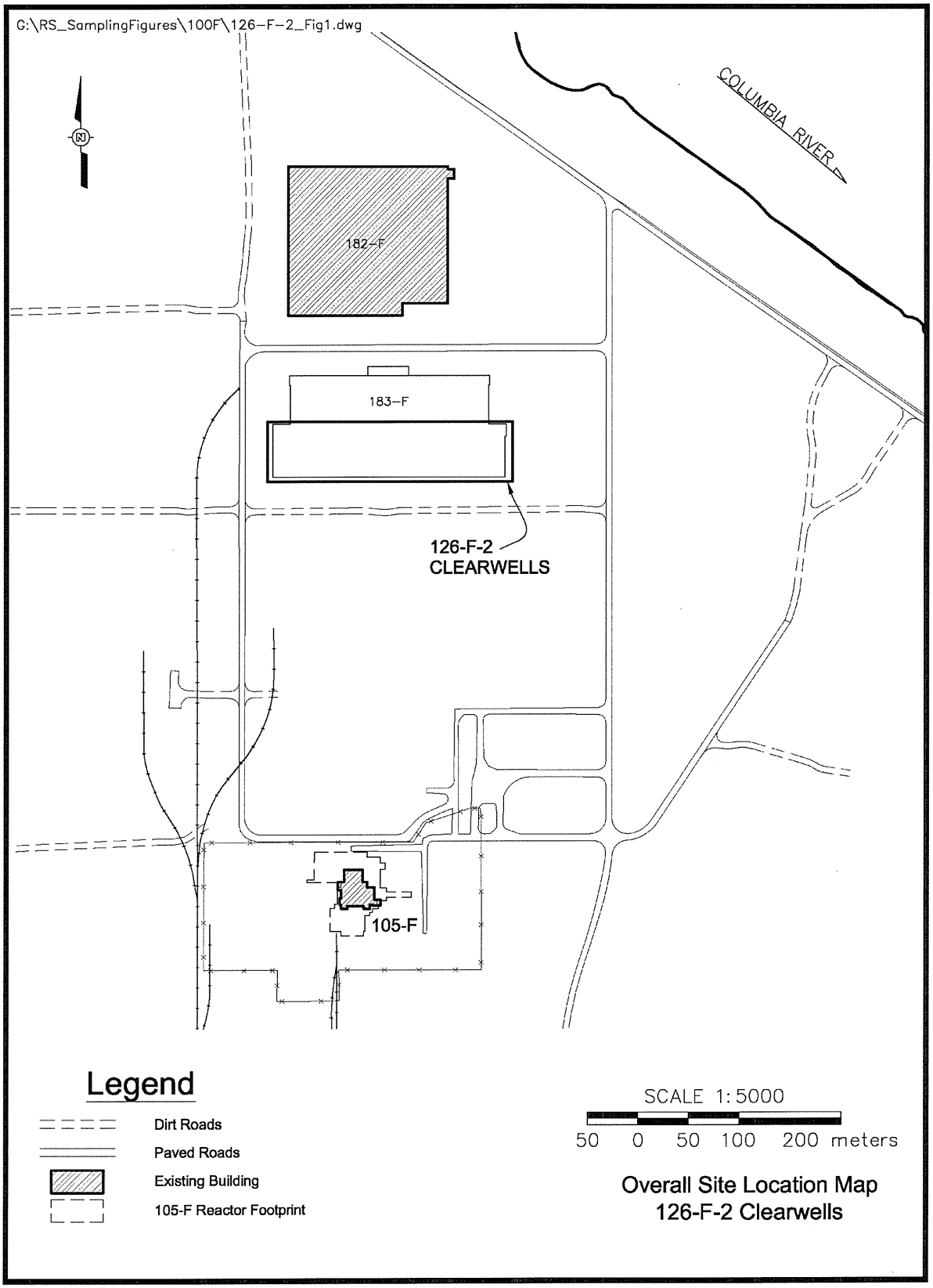
Soil cleanup levels were established in the interim action Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of potential concern and other constituents. Screening levels were not exceeded for the site constituents, with the exception of 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 these constituents does not pose a risk to ecological receptors as vanadium concentrations are below background levels and boron concentrations are consistent with levels seen elsewhere at the Hanford Site (no established background value exists). A baseline risk assessment for the river corridor portion of Hanford 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 126-F-2 waste site.

GENERAL SITE INFORMATION AND BACKGROUND

The 126-F-2 waste site, located within the 100-FR-1 Operable Unit, consists of the clearwells and co-located pumphouse that were formerly part of the 183-F water treatment facility. Located north of the 105-F Reactor Building and south of the former 182-F reservoir (Figure 1), these units were used as part of the cooling water treatment train for the 105-F Reactor from 1944 to 1965. Chemical addition to this point in the treatment train was limited to coagulants (alum and hydrated calcium oxide), pH adjustment (sulfuric acid), and chlorination (DOE-RL 1992).

The clearwells were composed of two separate, covered, predominantly below-grade structures with a combined capacity of approximately 34 million L (9 million gal) (Gerber 1993). In the late 1970s, the cover for the eastern clearwell structure was demolished and the basin partially

Figure 1. Location of the 126-F-2 Waste Site.



filled with demolition debris (from facilities identified in Table 1) that has since been removed as part of remedial activities. The cover for the western clearwell structure remains intact, and the facility is believed to be a bat-roosting site. The pumphouse was partially demolished and buried in place (WHC 1993). The site presently appears as an open, empty basin (eastern clearwell) and a structure covered with a near-grade roof (western clearwell). Modern photographs are included in Appendix A.

Table 1. Demolished Building Rubble Disposed at the 126-F-2 Waste Site.

Building Name	Hanford Era Building Use
183-F	Water treatment facilities
185-F	Dearation plant
189-F	Refrigeration building
190-F	Process pumphouse
Unidentified 1700 series building	Unidentified; potentially could have been paint or oil storage, first aid station, animal experiments, or pathology laboratory
115-F	Uncontaminated portions of cover gas recirculation building
Unidentified experimental animal building(s)	Unidentified experimental animal building(s)
108-F	Biology laboratory

Source: WHC (1993).

BASIS FOR REMEDIAL ACTION

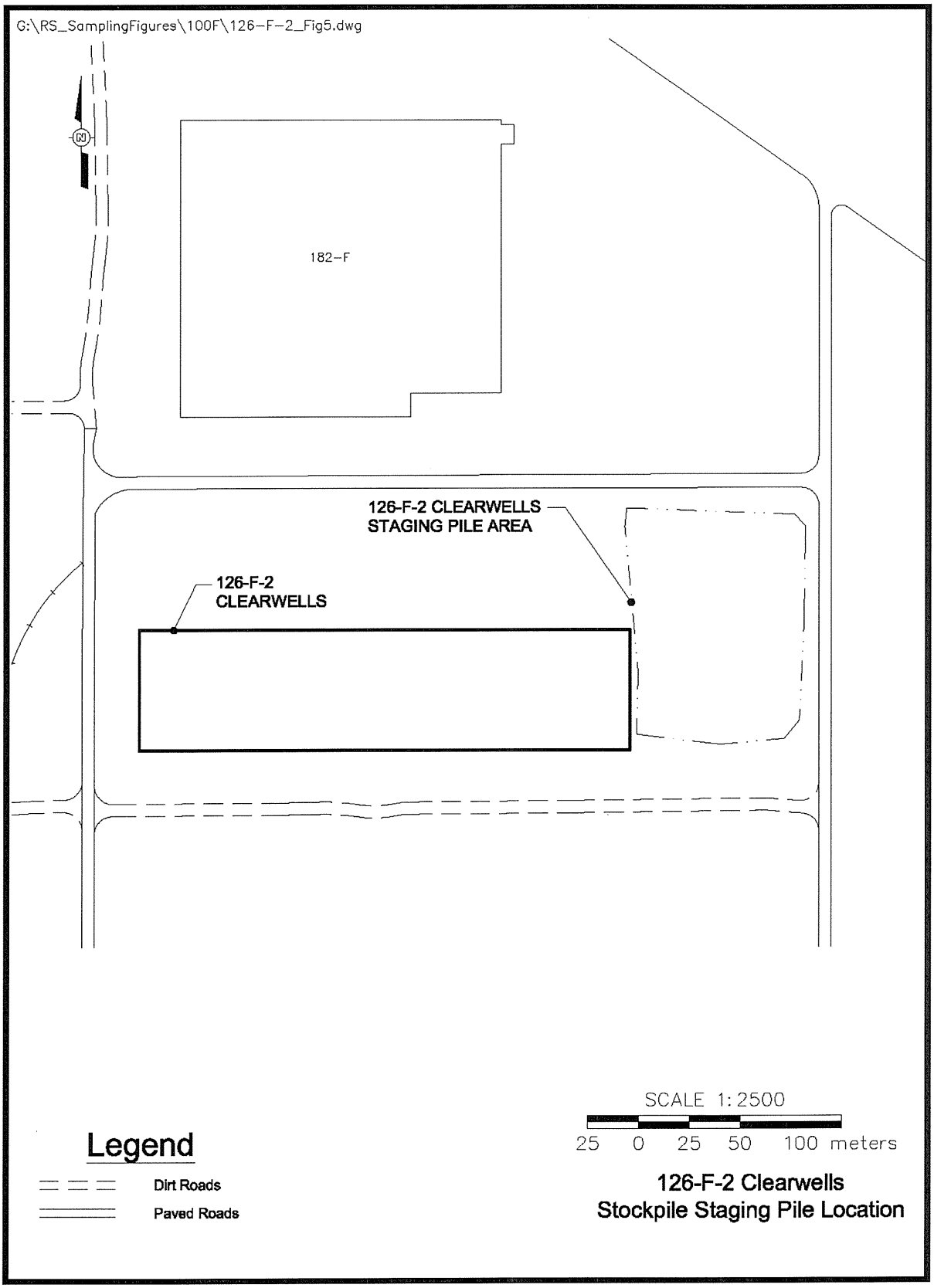
The 126-F-2 site was included in the Remaining Sites ROD (EPA 1999) as a candidate site because of possible contamination from metals, polychlorinated biphenyls (PCBs), and low-level radioactive waste. The site was recommended for remedial action without confirmatory sampling based on a review of historical process information (for the demolition debris disposed in the eastern clearwell structure) and concerns over sampling logistics and strategy (Feist 2004).

A geophysical survey was performed in the vicinity of the 126-F-2 waste site in April 2004 using electromagnetic induction and magnetometry (Bergstrom et al. 2004). Because the boundaries of the clearwells were readily identified by the above-grade portions of the residual basin walls, the geophysical survey focused on mapping subsurface pipelines and anomalies at the upstream portion of the former 183-F facility. No geophysical information was collected at the clearwells.

REMEDIAL ACTION SUMMARY

Remediation of the 126-F-2 waste site was performed from July to September 2005 and consisted of the removal of debris within the eastern clearwell structure down to the concrete floor. No staining or other visual evidence of residual contamination was observed at the floor. Approximately 28,986 metric tons (31,952 U.S. tons) of material was removed and staged at an area adjacent to the clearwells (Figure 2) before disposal at the Environmental Restoration

Figure 2. Boundaries of Staging Area at the 126-F-2 Waste Site.



Disposal Facility. Samples of excavated material were collected during remediation to support waste characterization, with analytical results provided in Appendix B.

Following the completion of remedial activities, radiological surveys were performed within the eastern clearwell structure and at the waste staging area using a sodium iodide detector, with results shown in Figures 3 through 5. No remedial activities were performed at the western clearwells, because the roof is intact and the facility is not known to have been used for the disposal of any demolition debris or other potentially hazardous substances.

VERIFICATION SAMPLING ACTIVITIES

Verification sampling at the 126-F-2 site was performed on December 14, 2005, to collect data to make a decision as to whether the remedial action objectives had been reached. The data were compared against 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 contaminants of potential concern (COPCs) for the 126-F-2 waste site were identified based on existing historical information for the site. The COPC list identified in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a) includes carbon-14, cobalt-60, cesium-137, europium-152, europium-154, europium-155, tritium, plutonium-238, plutonium-239/240, strontium-90, uranium-238, silver, cadmium, chromium (total), hexavalent chromium, mercury, lead, selenium, and PCBs. Based on further consideration of the possible nature of materials disposed at the site, semivolatile organic compounds (SVOCs), petroleum hydrocarbons, asbestos, arsenic, and barium have also been included as COPCs. The presence of antimony, beryllium, boron, cobalt, copper, manganese, molybdenum, nickel, vanadium, and zinc were also evaluated by performing the expanded inductively coupled plasma (ICP) metals analysis.

No volatile organic compounds were field detected by organic vapor monitoring during remedial activities; volatile organic compounds were, therefore, excluded from consideration as COPCs for verification sampling.

Verification Sample Design

Verification sampling at the 126-F-2 waste site was performed on December 14, 2005. Because no residual radiological contamination was identified and no evidence (e.g., staining) existed to suggest residual contamination at the concrete floor of the clearwells or migration of contamination beyond the clearwells, no sampling of the actual concrete clearwell structure was performed and verification sampling was targeted to the waste staging area. Per the *Work Instruction for Verification Sampling of the 126-F-2 Waste Site* (WCH 2005b), verification sampling consisted of the collection of 25 aliquots of surficial soils from locations distributed

Figure 3. Radiological Survey Results for the Eastern 126-F-2 Clearwells Floor.

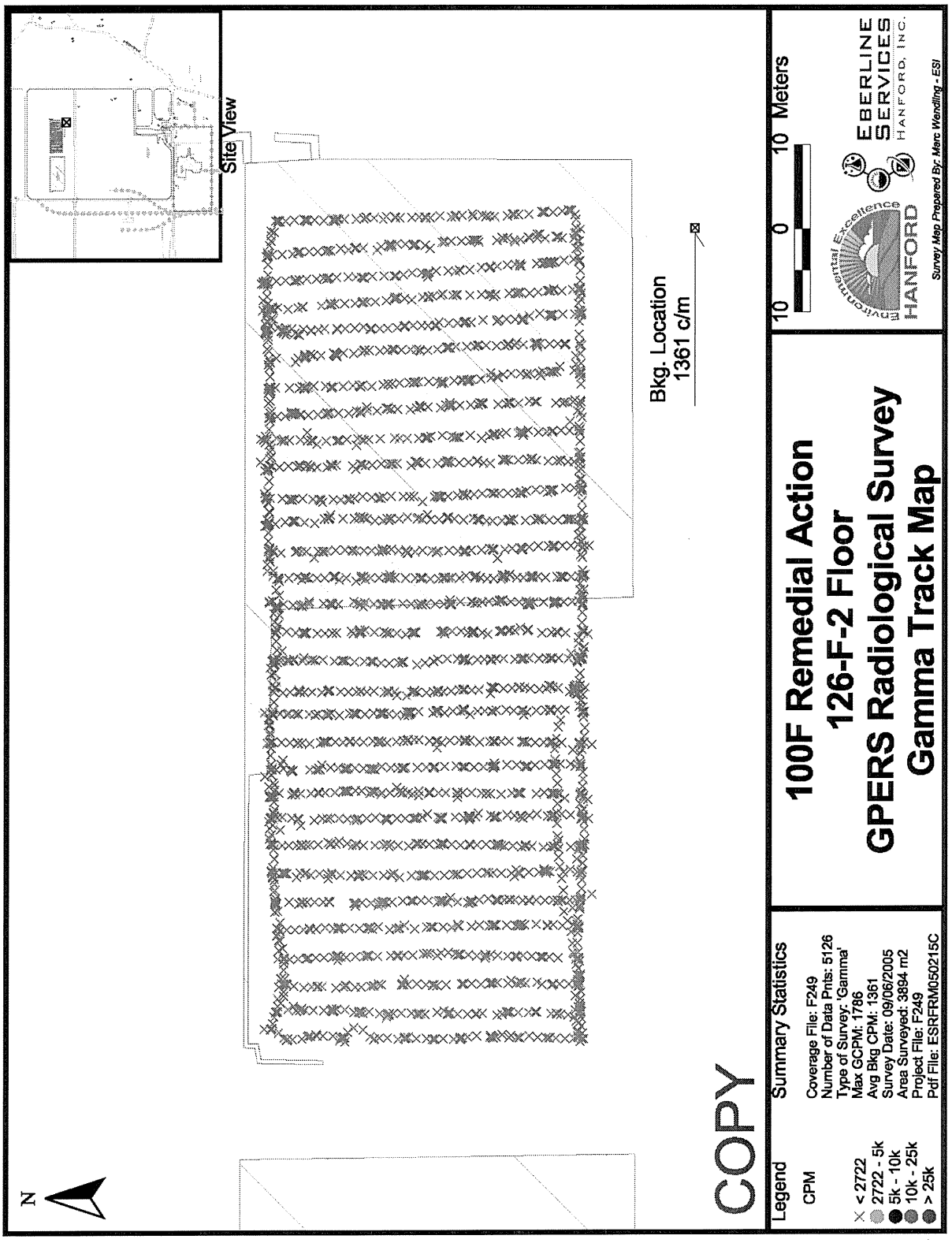


Figure 4. Radiological Survey Results for the Eastern 126-F-2 Clearwells Sloped Walls.

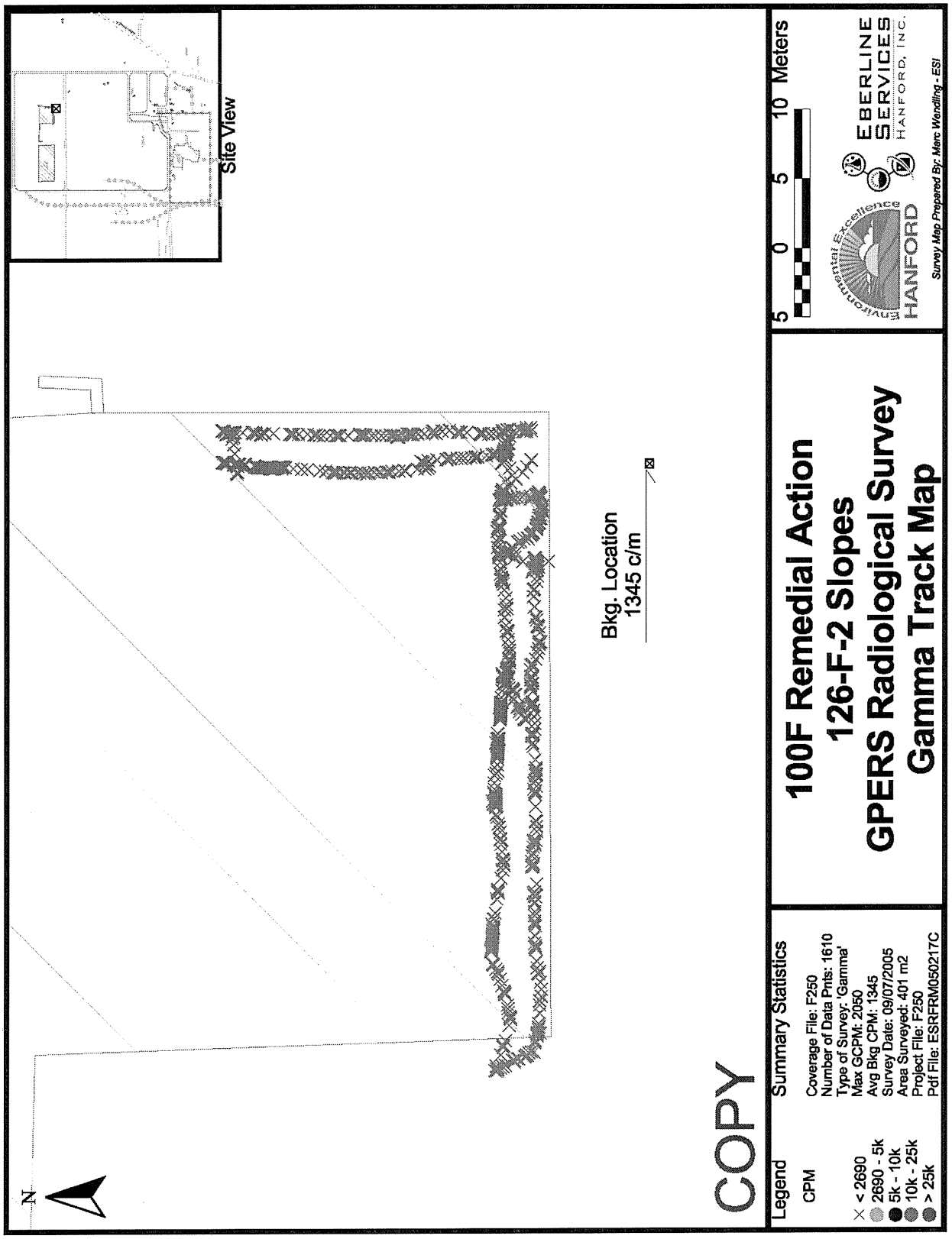
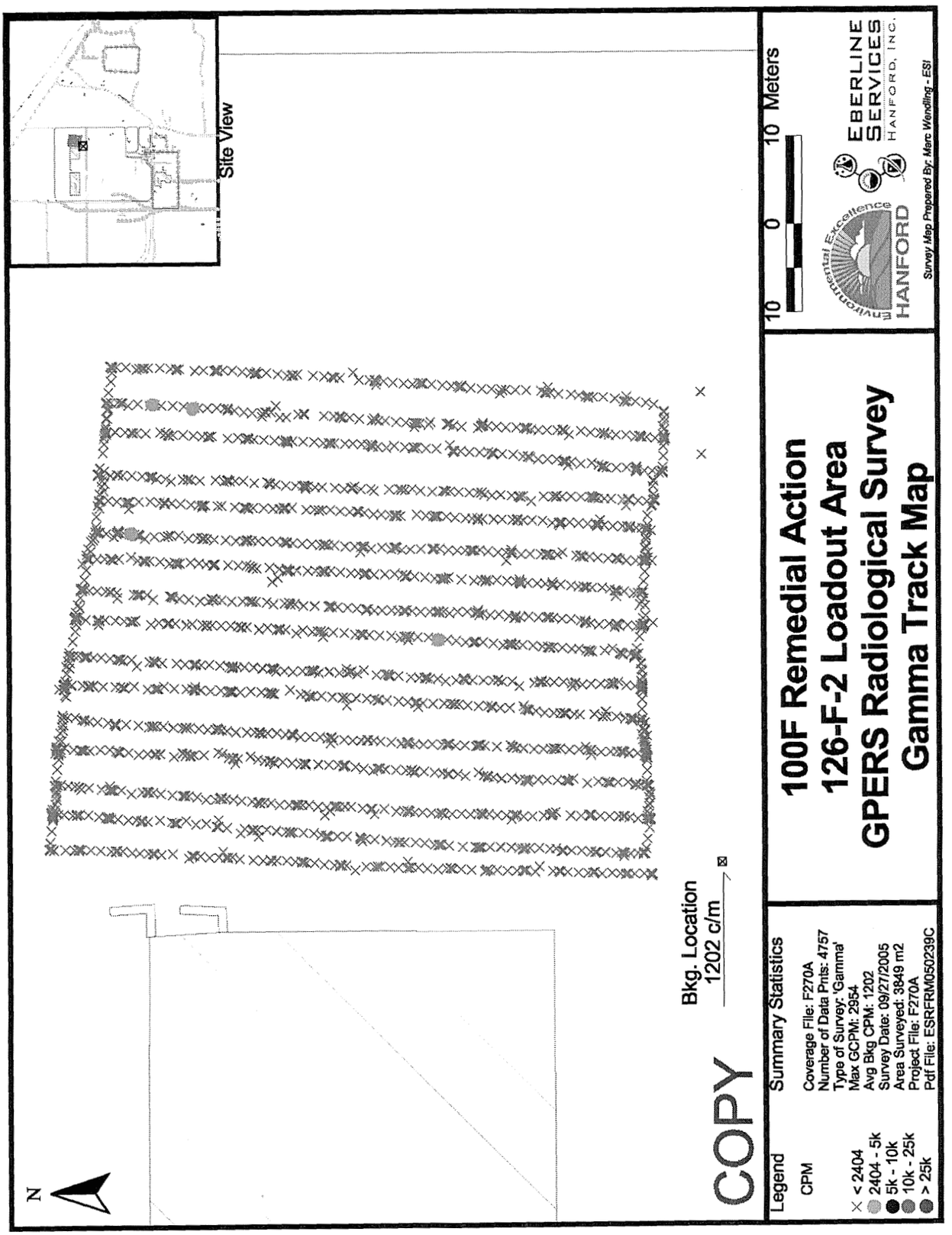


Figure 5. Radiological Survey Results for the 126-F-2 Waste Staging Area.



across the entire staging area, homogenizing the material, and dividing into one primary sample and one field duplicate sample. One equipment blank sample consisting of clean silica sand poured over sampling equipment was also collected. A summary of the samples collected during verification sampling and the analyses performed is presented in Table 2. All sampling was performed in accordance with WCH-EE-01, *Environmental Investigations Procedures* to fulfill the requirements of the SAP (DOE-RL 2005a).

Table 2. 126-F-2 Verification Sample Summary Table.

Sample Location	Sample Media	HEIS Number	Depth	Sample Analyses
Waste staging area footprint	Soil	J10VC1	Surficial	ICP metals, mercury, hexavalent chromium, PCB, SVOA, TPH, gross alpha, gross beta, GEA, carbon-14, tritium, isotopic plutonium, and isotopic uranium
		J10VC4		Asbestos
Duplicate of J10VC1/J10VC4	Soil	J10VC2	Surficial	ICP metals, mercury, hexavalent chromium, PCB, SVOA, TPH, gross alpha, gross beta, GEA, carbon-14, tritium, isotopic plutonium, and isotopic uranium
		J10VC7		Asbestos
Equipment blank	Silica sand	J10VC3	N/A	ICP metals, mercury, and SVOA

Source: *Remaining Sites Field Sampling*, Logbook EFL-1174 (WCH 2005a).
GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
N/A = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbon

Verification Sampling Results

Verification samples were analyzed using U.S. Environmental Protection Agency-approved analytical methods. Comparisons of the maximum detected result for each analyte and the site RAGs are summarized in Table 3. Contaminants that were not detected by laboratory analysis are excluded from Table 3. 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. Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the site, but are not considered within Table 3. These isotopes are not related to the operational history of the site, and all were detected at levels below statistical background activities (based on an assumption of secular equilibrium, the background activities for radium-228 and thorium-228 are equal to the statistical background activity of 1.32 pCi/g for thorium-232 provided in DOE-RL [1996]).

Table 3. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 126-F-2 Staging Area Verification Sampling Event.[a] (2 Pages)

COC/COPC	Maximum Result (pCi/g)	Generic Site Lookup Values (pCi/g)			Does the Maximum Result Exceed Lookup Values?	Does the Maximum Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value[b]	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.071	6.2	1,465	1,465	No	--
Uranium-233/234	0.532 (<BG)	1.1[c]	1.1[c]	1.1[c]	No	--
Uranium-238	0.761 (<BG)	1.1[c]	1.1[c]	1.1[c]	No	--
COC/COPC	**Maximum Result (mg/kg)**	**Remedial Action Goals (mg/kg)**			**Does the Maximum Result Exceed RAGs?**	**Does the Maximum Result Pass RESRAD Modeling?**
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony[d]	0.48 (<BG)	32[e]	5[f]	5[f]	No	--
Arsenic	3.0 (<BG)	20[g]	20[g]	20[g]	No	--
Barium	82.4 (<BG)	16,000[e]	132[f]	400	No	--
Beryllium	0.30 (<BG)	10.4[h]	1.51[f]	1.51[f]	No	--
Boron[i]	5.6	16,000[e]	320	--[j]	No	--
Chromium (total)	10.9 (<BG)	120,000[e]	18.5[f]	18.5[f]	No	--
Cobalt	6.2 (<BG)	1,600[e]	32	--[j]	No	--
Copper	17.4 (<BG)	2,960[e]	59.2	22[f]	No	--
Lead	17.2	353[k]	10.2[f]	10.2[f]	Yes	Yes[l]
Manganese	274 (<BG)	11,200[e]	512[f]	--[j]	No	--
Molybdenum[i]	0.39	400[e]	8	--[j]	No	--
Nickel	10.3 (<BG)	1,600[e]	19.1[f]	27.4	No	--
Selenium	0.37 (<BG)	400[e]	5	1	No	--
Vanadium	41.6 (<BG)	560[e]	85.1[f]	--[j]	No	--
Zinc	76.9	24,000[e]	480	67.8[f]	Yes	Yes[l]
Aroclor-1254	0.074	0.5[m]	0.017[n]	0.017[n]	Yes	Yes[l]
Acenaphthene	0.17	4,800[e]	96	129	No	--
Anthracene	0.41	24,000[e]	240	1,920	No	--
Benzo(a)anthracene	0.76	1.37[m]	0.33[n]	0.33[n]	Yes[o]	--[o]
Benzo(a)pyrene	0.70	0.33[n]	0.33[n]	0.33[n]	Yes[o]	--[o]
Benzo(b)fluoranthene	0.56	1.37[m]	0.33[n]	0.33[n]	Yes[o]	--[o]
Benzo(g,h,i)perylene[p]	0.27	2,400[e]	48	192	No	--

Table 3. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 126-F-2 Staging Area Verification Sampling Event.[a] (2 Pages)

COC/COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg)			Does the Maximum Result Exceed RAGs?	Does the Maximum Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Benzo(k)fluoranthene	0.76	13.7[m]	0.33[n]	0.33[n]	Yes[o]	--[o]
Chrysene	0.84	137[m]	1.2	0.33[n]	Yes[o]	--[o]
Dibenzo(a,h) anthracene	0.20	0.33[n]	0.33[n]	0.33[n]	No	--
Fluoranthene	1.8	3,200[e]	64	18	No	--
Fluorene	0.21	3,200[e]	64	260	No	--
Indeno(1,2,3-cd) pyrene	0.26	1.37[m]	0.33[n]	0.33[n]	No	--
Phenanthrene[p]	1.6	24,000[e]	240	1,920	No	--
Pyrene	1.8	2,400[e]	48	192	No	--
Total petroleum hydrocarbons	1650	--[j]	200	200	Yes[o]	--[o]

[a] RAG values have been updated since the most recent revision of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) to reflect changes to toxicity/carcinogenicity data and analytical performance requirements.
[b] Activity corresponding to a single-radionuclide 15 mrem/yr exposure as calculated using a generic RESRAD model (DOE-RL 2005b).
[c] The calculated lookup value is below the Hanford-specific statistical soil background activity. The value presented is the Hanford-specific statistical soil background activity.
[d] Hanford Site-specific background is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[e] Noncarcinogenic cleanup level calculated from WAC 173-340-740(3), Method B, 1996.
[f] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).
[g] The cleanup value of 20 mg/kg has been agreed to by Tri-Party project managers. The basis for 20 mg/kg is provided in Section 2.1.2.1 of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b).
[h] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3]) (1996).
[i] No Hanford Site-specific or Washington State background value available.
[j] No cleanup level is available from the Ecology Cleanup Levels and Risk Calculations tables, and no toxicity values are available to calculate cleanup levels (Ecology 2005).
[k] A WAC 173-340-740(3) (1996) value for lead is not available. This value is based on the *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children* (EPA 1994).
[l] Based on *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), with a groundwater table elevation of 114 m (374 ft) and a clean zone extending from groundwater to an elevation of 126.5 m (415 ft).
[m] Carcinogenic cleanup level calculated per WAC 173-340-740(3), Method B, 1996.
[n] Where cleanup levels are less than the RDL, cleanup levels default to the RDL (WAC 173-340-707[2], 1996 and DOE-RL 2005b).
[o] Constituent is the result of asphalt cross-contamination of the sample matrix. Asphalt that has been used for structural and construction purposes is excluded from consideration as a dangerous waste in WAC 173-303-071(3)(e), is listed as an inert waste in WAC 173-350-990(2)(b), and does not present a significant risk to human health or the environment. These values are thus not considered in attainment of soil RAGs.
[p] Toxicity data for this chemical are not available. RAGs for benzo(g,h,i)perylene and phenanthrene are based on the surrogate chemicals pyrene and anthracene, respectively.

BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)
RDL = required detection limit
WAC = *Washington Administrative Code*

The laboratory-reported data results for all constituents are stored in the Environmental Restoration (ENRE) project-specific database prior to archiving in Hanford Environmental Information System (HEIS) and are presented in Appendix C.

DATA EVALUATION

Lead, zinc, aroclor-1254, TPH, and multiple polyaromatic hydrocarbons (PAHs) (as identified in Table 3) were quantified at concentrations exceeding direct exposure RAGs and/or soil RAGs for groundwater and/or river protection in the verification samples collected from the 126-F-2 staging area footprint.

Based on the soil-partitioning coefficient (K_d) values for lead and zinc (both 30 mL/g), the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005) predict that these constituents will not reach groundwater at an elevation of 114 m (374 ft) within 1,000 years; residual concentrations of these contaminants are, therefore, 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. This evaluation is based on an assumption that the lower vertical boundary of contamination presently exists at an elevation of 126.5 m (415 ft) above mean sea level, 3 m (10 ft) below the present elevation of the former staging area. This elevation was selected based on test pit and borehole data presented in the *116-F-14 Characterization Test Pit Results* (BHI 2002) and the *Limited Field Investigation Report for the 100-FR-1 Operable Unit* (DOE-RL 1995), which show that concentrations of metals with a K_d value of 30 mL/g will decrease to levels below background within less than 3 m (10 ft) below the point at which contamination occurred. Similarly, while no data on the vertical extent of aroclor-1254 contamination at the 126-F-2 site exists, the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005) predict that this contaminant will not migrate more than 1 m (3 ft) vertically within 1,000 years based on the contaminant's K_d value of 75.6 mL/g. Residual concentrations of aroclor-1254 are, therefore, protective of groundwater and the river.

Portions of the 126-F-2 waste staging area were historically paved with asphaltic materials, and residual fragments of this paving can still be seen at the surface of this area. Asphaltic fragments within the verification samples collected at the former staging area would result in elevated detections of PAHs and TPH. A comparison of the detected PAHs in the verification data set to a known asphalt sample (BHI 2004) shows a good correlation (Table 4), as indicated by the Ratio Column. Asphalt that has been used for structural and construction purposes is excluded from consideration as a dangerous waste in WAC 173-303-071(3)(e), is listed as an inert waste in WAC 173-350-990(2)(b), and does not present a significant risk to human health or the environment. The verification data set for the 126-F-2 staging area is, therefore, considered to achieve soil RAGs for PAHs and TPH.

Table 4. Comparison of 126-F-2 Polyaromatic Hydrocarbon Verification Data to Asphalt Data. (2 Pages)

Analyte	Asphalt Sample Result (mg/kg)	Maximum 126-F-2 Staging Area Result (mg/kg)	Ratio[a] ($X 10^{-4}$)
2-Methylnaphthalene	394	ND	--
Acenaphthene	1,783	0.17	0.95
Anthracene	3,699	0.41	1.11
Benzo(a)anthracene	5,792	0.76	1.31
Benzo(a)pyrene	5,533	0.70	1.27
Benzo(b)fluoranthene	4,619	0.56	1.21
Benzo(g,h,i)perylene	2,839	0.27	0.95
Benzo(k)fluoranthene	4,527	0.76	1.68
Carbazole	2,049	ND	--
Chrysene	5,580	0.84	1.51
Dibenzo(a,h)anthracene	1,531	0.20	1.31
Dibenzofuran	1,135	ND	--
Fluoranthene	10,665	1.8	1.69
Fluorene	1,756	0.21	1.20
Indeno(1,2,3-cd) pyrene	2,751	0.26	0.95
Naphthalene	1,917	ND	--
Phenanthrene	10,975	1.6	1.46
Pyrene	10,205	1.8	1.76

[a] Determined by dividing the maximum 126-F-2 staging area result by the asphalt sample result.
ND = not detected (in any verification sample)
-- = not applicable

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 not calculated for constituents that were not detected, were detected at concentrations below Hanford Site or Washington State background values, or were the result of asphalt cross-contamination of the sample matrix. All individual hazard quotients for noncarcinogenic constituents were less than 1.0 (Appendix D). The cumulative hazard quotient for the former staging area is 1.0×10^{-1}. Aroclor-1254 is the sole carcinogenic constituent considered within the calculation of excess carcinogenic risk, contributing to a carcinogenic risk of 1.5×10^{-7}. The individual and cumulative excess carcinogenic risk requirements of 1.0×10^{-6} and 1.0×10^{-5}, respectively, are thus achieved.

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. However, this test is not applicable to this focused sampling approach because maximum detected concentration data are used as the compliance basis.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach and the resulting field and analytical data with the sampling and data requirements specified by the project objectives and performance specifications. This review involves evaluation of the data to determine if it is the right type, quality, and quantity to support the intended use and completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objective process.

This DQA was performed in accordance with WCH-EE-01, *Environmental Investigations Procedures*. Specific data quality objectives for the site are found in the SAP (DOE-RL 2005a). To ensure quality data sets, the SAP data quality assurance requirements as well as the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) are followed, where appropriate.

A review of the work instruction (WCH 2005b), the field logbook (WCH 2005a), and applicable analytical data packages has been performed as part of this DQA. All samples were collected per the sample design. The following 2 sample delivery groups (SDGs) were created during the verification sampling effort:

- SDG K0146 (inorganic, organic, and radiochemical analyses as identified in Table 2)
- SDG 05-A-6877 (asbestos analysis).

SDG K0146 was submitted for third-party validation (WCH 2006). No major deficiencies were found in the data. Minor data deficiency qualifications from third-party validation have been applied to the data in Appendix C and are presented in the following discussion of data quality issues in the verification data of 126-F-2.

SDG K0146

SDG K0146 consists of three field samples, J10VC1, J10VC2, and J10VC3, which correspond to the staging pile footprint sample, its duplicate, and an equipment blank. The samples were analyzed by the methods indicated in Table 2.

The common laboratory contaminant bis(2-ethylhexyl)phthalate was found in the SVOC analysis method blank (MB). Third-party validation has requalified the bis(2-ethylhexyl)phthalate result in samples J10VC1 and J10VC3 as non-detected at the required quantitation limit (660 μg/Kg U).

Also in the SVOC analysis, quality assurance/quality control (QA/QC) samples did not meet acceptance criteria for the analytes listed in Table 5. The specific QA/QC results that did not

meet acceptance criteria are also indicated in Table 5. Analytical results for the analytes listed in Table 5 were qualified "J" (or "UJ" if non-detected), as estimates, for all samples in SDG K0146.

Table 5. QA/QC of Semivolatile Compounds Resulting in Estimated or "J"-Qualified Data in SDG K0146.

Analyte	MS Recovery	MSD Recovery	Duplicate Sample RPDs	LCS Recovery
4-Chloro-3-methylphenol	--	53%	--	--
Hexachlorocyclopentadiene	8%	--	138%	--
3-Nitroanaline	--	39%	70%	--
2,4-Dinitrophenol	Diluted out	--	Diluted out	--
4-Nitroanaline	--	34%	82%	--
4,6-Dinitro-2-methylphenol	27%	--	73%	--
N-Nitrosodiphenylamine	--	49%	--	--
Butylbenzylphthalate	--	48%	--	--
3,3-Dichlorobenzidine	--	Diluted out	Diluted out	--
Chrysene	--	40%	64%	--
bis(2-Ethylhexyl)phthalate	--	40%	52%	--
Nitrobenzene	--	--	--	47%
Isophorone	--	--	--	53%
2-Nitrophenol	--	--	--	48%
2,4-Dimethylphenol	--	--	--	45%
1,2,4-Trichlorobenzene	--	--	--	46%
4-Chloro-3-methylphenol	--	--	46%	53%
2-Methylnaphthalene	--	--	--	52%
Butylbenzylphthalate	--	--	49%	--
Benzene(a)anthracene	--	--	45%	--

Note: QA/QC data that meets acceptance criteria is not listed.
LCS = laboratory control sample
MS = matrix spike
MSD = matrix spike duplicate
QA/QC = quality assurance/quality control
RPD = relative percent difference

In the radiochemical analysis of carbon-14 and tritium, no matrix spikes were run due to feasibility restrictions for the associated analytical methods. However, sample duplicates and laboratory control samples were run, with acceptable results. Per the validation procedures, third-party validation has assigned "J" qualifiers to the carbon-14 and tritium results for all samples in SDG K0146.

In the TPH analysis, the matrix spike had a percent recovery of negative 110 % (-110%), while the matrix spike duplicate had a recovery of 100.5%. The matrix spike result is due to an error at the laboratory, likely a poor integration by the analytical system computer. The relative percent difference values for the TPH analysis were also out of criteria. Third party validation has assigned "J" qualifiers to the TPH results for all samples in SDG K0146.

In the ICP metals analysis of SDG K0146, the analytes copper and antimony were qualified "J," for all samples in the SDG due to matrix spike recoveries outside of the acceptance criteria at 136.8% and 40.2%, respectively. The analytes lead and silicon were also qualified "J" for all samples in the SDG due to relative percent difference values that were outside of the acceptance criteria at 70.9% and 36.7%, respectively.

None of the SDG K0146 data is rejected and all remains useable for decision-making purposes.

SDG 05-A-6877

SDG 05-A-6877 consists of two field samples, J10VC4, and J10VC7, which correspond to the staging pile footprint sample and its duplicate. These samples were analyzed for asbestos. No deficiencies were found in the asbestos analysis. All data in SDG 05-A-6877 is useable for decision-making purposes.

Limited, random or sample matrix-specific influenced batch quality control 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 126-F-2 waste site found the results to be accurate within the standard errors associated with the methods, including sampling and sample handling. The DQA review for the 126-F-2 waste site concludes that the 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 quality assurance and quality control 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 archiving in the HEIS and are summarized in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 126-F-2 waste site has been evaluated and remediated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2005b). The eastern clearwell was recommended for remedial action without confirmatory sampling due to the suspect nature of materials disposed in the clearwell and difficulties in sampling logistics. Approximately 28,986 metric tons (31,952 U.S. tons) of debris and other solid waste was removed from the eastern clearwell structure and disposed at the Environmental Restoration Disposal Facility. Radiological surveys and visual inspection of the clearwell structure revealed no suspect areas on the concrete floor or side slopes and no indication of possible contaminant migration beyond the boundaries of the clearwells. Radiological surveys and verification sampling at the remediation

waste staging area were used to show that soils in this area meet the cleanup objectives for direct exposure, groundwater protection, and river protection. No waste materials were disposed in the western clearwell structure, and the roof of the facility remains intact. In accordance with this evaluation, the results support a reclassification of the 126-F-2 site to interim closed out. Note that demolition of the remaining above grade 126-F-2 structure (western clearwell) is included within the scope of the River Corridor Closure Contract and will be conducted at a later date. Waste generated during roof demolition activities will be properly disposed at the time of demolition. The primary demolition waste associated with the intact roof of the western clearwell is steel-reinforced concrete, roofing tar, and potential asbestos associated with roofing mastic.

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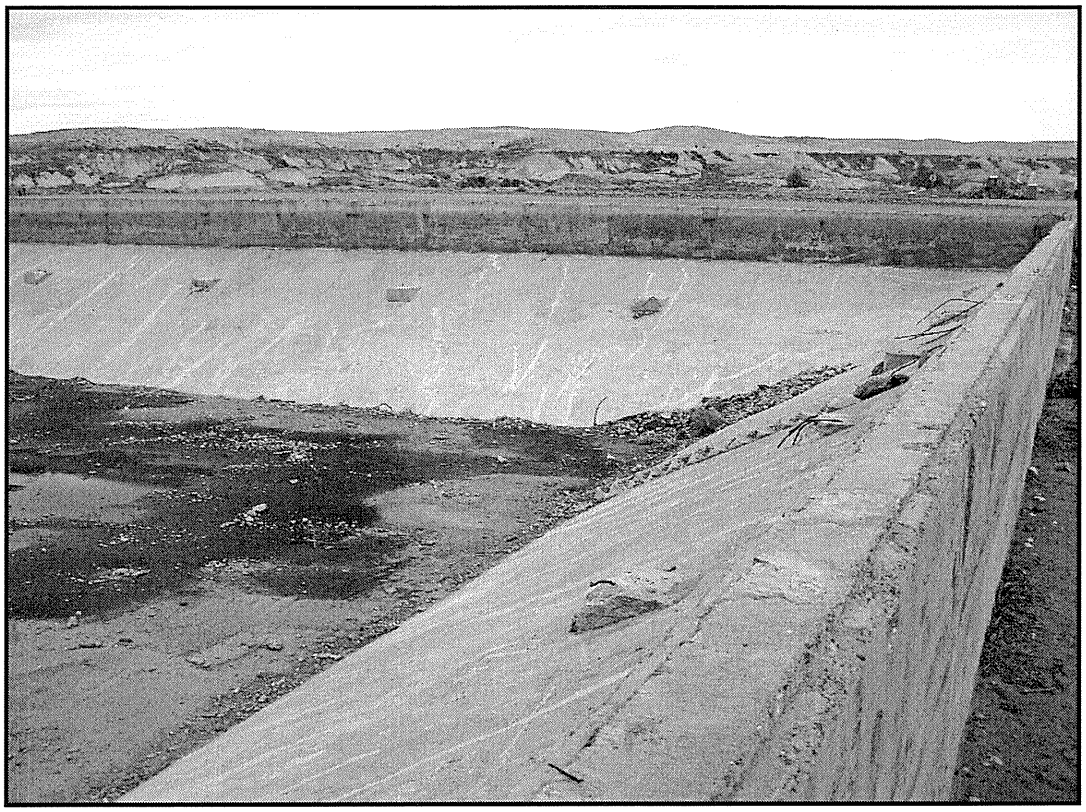
APPENDIX A

MODERN SITE PHOTOGRAPHY

Photograph 1. Southeastern Corner of the Eastern 126-F-2 Clearwell Structure, Post-Remediation (October 2005).



Photograph 2. Northwestern Corner of the Eastern 126-F-2 Clearwell Structure, Post-Remediation (October 2005).

APPENDIX B

WASTE CHARACTERIZATION ANALYTICAL RESULTS

Table B-1. 126-F-2 Waste Characterization Data Results. (4 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241 GEA			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Waste Sample	J03NL6	07/18/05	0.11	U	0.11	2.09		2.0	0.12	U	0.12	0.12	U	0.12	0.31	U	0.31	0.41	U	0.41
Waste Sample	J03NL7	07/18/05	0.093	U	0.093	1.8		1.6	0.098	U	0.098	0.11	U	0.11	0.25	U	0.25	0.29	U	0.29
Waste Sample	J03NL8	07/18/05	0.21	U	0.21	2.3		1.8	0.11	U	0.11	0.092	U	0.092	0.20	U	0.20	0.34	U	0.34
Waste Sample	J03NL9	07/18/05	0.32	U	0.32	1.56	U	1.7	0.15	U	0.15	0.079	U	0.079	0.19	U	0.19	0.26	U	0.26

Sample Location	HEIS Number	Sample Date	Europium-155			Plutonium-238			Plutonium-239/240			Potassium-40			Radium-226			Radium-228		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Waste Sample	J03NL6	07/18/05	0.19	U	0.19	0	U	0.19	0.025	U	0.19	7.12		1.2	0.386		0.16	0.57	U	0.57
Waste Sample	J03NL7	07/18/05	0.15	U	0.15	0.031	U	0.24	0.031	U	0.24	9.14		0.78	0.36		0.12	0.6	U	0.6
Waste Sample	J03NL8	07/18/05	0.19	U	0.19	0.028	U	0.21	0.055	U	0.21	9.23		0.87	0.385		0.15	0.677		0.30
Waste Sample	J03NL9	07/18/05	0.20	U	0.20	0.025	U	0.19	0.025	U	0.19	9.39		0.74	0.414		0.16	0.698		0.33

Sample Location	HEIS Number	Sample Date	Silver-108m			Thorium-228 GEA			Thorium-232 GEA			Tritium			Uranium-233/234			Uranium-235		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Waste Sample	J03NL6	07/18/05	0.077	U	0.077	0.516		0.13	0.57	U	0.57	0.293	U	4.7	0.706		0.18	0.057	U	0.22
Waste Sample	J03NL7	07/18/05	0.062	U	0.062	0.486		0.098	0.60	U	0.60	0.648	U	3.8	0.313		0.16	0	U	0.19
Waste Sample	J03NL8	07/18/05	0.060	U	0.060	0.367		0.086	0.677		0.30	2.36	U	4.3	0.492		0.20	0	U	0.24
Waste Sample	J03NL9	07/18/05	0.057	U	0.057	0.551		0.14	0.698		0.33	0.75	U	4.0	0.674		0.17	0.079	U	0.20

Sample Location	HEIS Number	Sample Date	Uranium-235 GEA			Uranium-238			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Waste Sample	J03NL6	07/18/05	0.32	U	0.32	0.564		0.18	13	U	13
Waste Sample	J03NL7	07/18/05	0.27	U	0.27	0.459		0.16	11	U	11
Waste Sample	J03NL8	07/18/05	0.28	U	0.28	0.621		0.20	11	U	11
Waste Sample	J03NL9	07/18/05	0.31	U	0.31	0.587		0.17	12	U	12

Table C-1. 126-F-2 Asbestos Results.

Sample Location	HEIS Number	Sample Date	Asbestos
Waste Sample	J03NT5	07/19/05	None Detected
Waste Sample	J03P11	07/21/05	None Detected

Acronyms and notes apply to all of the tables in this appendix.
Note: Data qualified with B, C, D, and/or J are considered acceptable values.
B = blank contamination (organic constituents)
C = blank contamination (inorganic constituents)
D = diluted
GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
J = estimate
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
TPH = total petroleum hydrocarbon
U = undetected

Table B-1. 126-F-2 Waste Characterization Data Results. (4 Pages)

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
Waste Sample	J03NL6	7/18/05	6730		2.5	2.8		2.5	11.9		2.8	132		0.12	0.106		0.06	17		1.4	2.2		0.19
Waste Sample	J03NL7	7/18/05	4300		2.5	2.52	U	2.5	4.9		2.8	85.4		0.13	0.063	U	0.06	10.6		1.5	0.58		0.19
Waste Sample	J03NL8	7/18/05	4580		2.5	2.7		2.5	4.1		2.8	498		0.12	0.062	U	0.06	9.3		1.4	0.423		0.19
Waste Sample	J03NL9	7/18/05	4530		2.5	2.6	U	2.6	5.3		2.9	116		0.13	0.06	U	0.06	14.4		1.5	0.62		0.19

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
Waste Sample	J03NL6	7/18/05	36400	C	1.9	11.8		0.44	6.0	C	0.56	20.9		0.50	0.22	U	0.22	17900		18.3	67.6		1.6
Waste Sample	J03NL7	7/18/05	14800	C	1.9	9.1		0.44	5.8	C	0.57	19.4		0.50	0.38		0.22	17200		18.5	21.6		1.6
Waste Sample	J03NL8	7/18/05	16400	C	1.9	8.7		0.44	6.0	C	0.56	16.8		0.50	0.25		0.22	16200		18.2	30.3		1.6
Waste Sample	J03NL9	7/18/05	12200		2.0	11.9		0.45	5.3		0.58	13.8		0.52	0.23	U	0.23	16200		18.9	37.8		1.6

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
Waste Sample	J03NL6	7/18/05	4110	C	4.4	279		0.12	0.12		0.02	0.999	U	1.0	11.5		1.4	1000		56.7	3.06	U	3.1
Waste Sample	J03NL7	7/18/05	3360	C	4.5	267		0.13	0.128		0.01	1.5		1.0	10.8		1.4	948		57.2	3.09	U	3.1
Waste Sample	J03NL8	7/18/05	3380	C	4.4	260		0.12	0.105		0.02	1.3		1.0	9.7		1.4	897		56.5	3.05	U	3.0
Waste Sample	J03NL9	7/18/05	3400		4.6	259		0.13	0.22		0.02	1.0	U	1.0	11.4		1.4	1010		58.5	3.2	U	3.2

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc			TPH		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Waste Sample	J03NL6	7/18/05	644	C	0.95	0.583	U	0.58	328		2.4	43.5		0.37	484		0.31	3080	D	719
Waste Sample	J03NL7	7/18/05	566	C	0.96	0.589	U	0.59	249		2.4	38.6		0.38	90.7		0.32	2510	D	727
Waste Sample	J03NL8	7/18/05	445	C	0.94	0.581	U	0.58	270		2.4	39.7		0.37	316		0.31	3000	D	725
Waste Sample	J03NL9	7/18/05	472		0.98	0.60	U	0.60	284		2.5	37.9		0.39	349		0.32	1100	D	303

Table B-1. 126-F-2 Waste Characterization Data Results. (4 Pages)

Constituents	J03NL6 Waste Sample Sample Date 7/18/05			J03NL7 Waste Sample Sample Date 7/18/05			J03NL8 Waste Sample Sample Date 7/18/05			J03NL9 Waste Sample Sample Date 7/18/05		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polycyclic Aromatic Hydrocarbons												
Acenaphthene	76	U	76	55	U	55	54	U	54	57	U	57
Acenaphthylene	76	U	76	55	U	55	54	U	54	57	U	57
Anthracene	139		8	2558		2558	5		221	75		57
Benzo(a)anthracene	451		8	1458		1458	5		496	340		57
Benzo(a)pyrene	456		8	1494		1494	5		435	320		57
Benzo(b)fluoranthene	354		8	1195		1195	5		427	260		57
Benzo(ghi)perylene	235		8	300		300	5		253	170		57
Benzo(k)fluoranthene	188		8	902		902	5		234	130		57
Chrysene	8	U	8	5166		5166	5		60	5.7	U	57
Dibenz[a,h]anthracene	115		8	176		176	5		104	86		57
Fluoranthene	1035		15	11069		11069	11		1357	460		11.4
Fluorene	8	U	8	748		748	5		132	5.7	U	65.7
Indeno(1,2,3-cd)pyrene	181		8	339		339	5		198	64		57
Naphthalene	76	U	76	862		862	54	U	54	57	U	57
Phenanthrene	619		8	6403		6403	5		904	350		57
Pyrene	1223		15	11299		11299	11		1131	450		11.4
Polychlorinated Biphenyls												
Aroclor-1016	29	U	29	29	U	29	29	U	29	30	U	30
Aroclor-1221	29	U	29	29	U	29	29	U	29	30	U	30
Aroclor-1232	29	U	29	29	U	29	29	U	29	30	U	30
Aroclor-1242	29	U	29	29	U	29	29	U	29	30	U	30
Aroclor-1248	29	U	29	29	U	29	29	U	29	30	U	30
Aroclor-1254	220		29	140		29	85		85	30	U	30
Aroclor-1260	29	U	29	29	U	29	29	U	29	42		30
Semivolatile Organic Analytes												
1,2,4-Trichlorobenzene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
1,2-Dichlorobenzene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
1,3-Dichlorobenzene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
1,4-Dichlorobenzene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2,4,5-Trichlorophenol	9000	UD	9000	9100	UD	9100	9100	UD	9100	9500	UD	9500
2,4,6-Trichlorophenol	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2,4-Dichlorophenol	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2,4-Dimethylphenol	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2,4-Dinitrophenol	9000	UD	9000	9100	UD	9100	9100	UD	9100	9500	UD	9500
2,4-Dinitrotoluene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2,6-Dinitrotoluene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2-Chloronaphthalene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2-Chlorophenol	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2-Methylnaphthalene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2-Methylphenol (cresol, o-)	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
2-Nitroaniline	9000	UD	9000	9100	UD	9100	9100	UD	9100	9500	UD	9500
2-Nitrophenol	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
3+4 Methylphenol (cresol, m+p)	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
3,3'-Dichlorobenzidine	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
3-Nitroaniline	9000	UD	9000	9100	UD	9100	9100	UD	9100	9500	UD	9500
4,6-Dinitro-2-methylphenol	9000	UD	9000	9100	UD	9100	9100	UD	9100	9500	UD	9500
4-Bromophenylphenyl ether	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
4-Chloro-3-methylphenol	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
4-Chloroaniline	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
4-Chlorophenylphenyl ether	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800

Table B-1. 126-F-2 Waste Characterization Data Results. (4 Pages)

Constituents	J03NL6 Waste Sample Sample Date 7/18/05			J03NL7 Waste Sample Sample Date 7/18/05			J03NL8 Waste Sample Sample Date 7/18/05			J03NL9 Waste Sample Sample Date 7/18/05		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Analytes												
4-Nitroaniline	9000	UD	9000	9100	UD	9100	9100	UD	9100	9000	UD	9000
4-Nitrophenol	9000	UD	9000	9100	UD	9100	9100	UD	9100	9500	UD	9500
Acenaphthene	3600	UD	3600	3600	UD	3600	330	JD	3600	3800	UD	3800
Acenaphthylene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Anthracene	3600	UD	3600	250	JD	3600	990	JD	3600	250	JD	3800
Benzo(a)anthracene	610	JD	3600	800	JD	3600	1500	JD	3600	580	JD	3800
Benzo(a)pyrene	640	JD	3600	810	JD	3600	1100	JD	3600	590	JD	3800
Benzo(b)fluoranthene	450	JD	3600	660	JD	3600	910	JD	3600	450	JD	3800
Benzo(ghi)perylene	400	JD	3600	360	JD	3600	430	JD	3600	300	JD	3800
Benzo(k)fluoranthene	590	JD	3600	470	JD	3600	1000	JD	3600	460	JD	3800
Bis(2-chloro-1methylethy1)ether	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Bis(2-Chloroethoxy)methane	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Bis(2-chloroethyl) ether	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Bis(2-ethylhexyl) phthalate	290	JBD	3600	280	JBD	3600	230	JBD	3600	3800	UD	3800
Butylbenzylphthalate	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Carbazole	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Chrysene	890	JD	3600	1200	JD	3600	2100	JD	3600	760	JD	3800
Di-n-butylphthalate	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Di-n-octylphthalate	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Dibenz[a,h]anthracene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Dibenzofuran	3600	UD	3600	3600	UD	3600	180	JD	3600	3800	UD	3800
Diethylphthalate	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Dimethyl phthalate	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Fluoranthene	910	JD	3600	1200	JD	3600	2500	JD	3600	840	JD	3800
Fluorene	3600	UD	3600	3600	UD	3600	360	JD	3600	3800	UD	3800
Hexachlorobenzene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Hexachlorobutadiene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Hexachlorocyclopentadiene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Hexachloroethane	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Indeno(1,2,3-cd)pyrene	230	JD	3600	250	JD	3600	350	JD	3600	220	JD	3800
Isophorone	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
N-Nitroso-di-n-dipropylamine	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
N-Nitrosodiphenylamine	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Naphthalene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Nitrobenzene	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Pentachlorophenol	9000	UD	9000	9100	UD	9100	9100	UD	9100	9500	UD	9500
Phenanthrene	660	JD	3600	940	JD	3600	2400	JD	3600	920	JD	3800
Phenol	3600	UD	3600	3600	UD	3600	3600	UD	3600	3800	UD	3800
Pyrene	960	JD	3600	1800	JD	3600	3200	JD	3600	1200	JD	3800

APPENDIX C

VERIFICATION SAMPLE RESULTS

Table C-1. 126-F-2 Verification Data Results. (4 Pages)

Sample Location	HEIS Number	Sample Date	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Staging area soil	J10VC1	12/14/05	0.33	U	0.33	-1.99	UJ	3.2	0.071		0.046	0.038	U	0.038	0.091	U	0.091	0.11	U	0.11
Duplicate of J10VC1	J10VC2	12/14/05	0.21	U	0.21	-0.607	UJ	3.0	0.039	U	0.039	0.036	U	0.036	0.14	U	0.14	0.13	U	0.13

Sample Location	HEIS Number	Sample Date	Europium-155			Gross alpha			Gross beta			Plutonium-238			Plutonium-239/240			Potassium-40		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Staging area soil	J10VC1	12/14/05	0.12	U	0.12	10.4		3.1	20.0		5.4	0	U	0.19	0.024	U	0.19	13.8		0.36
Duplicate of J10VC1	J10VC2	12/14/05	0.15	U	0.15	8.46		3.3	16.2		6.4	0	U	0.15	0.038	U	0.15	6.31		0.30

Sample Location	HEIS Number	Sample Date	Radium-226			Radium-228			Silver-108m			Thorium-228			Thorium-232			Tritium		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Staging area soil	J10VC1	12/14/05	0.516		0.074	0.709		0.16	0.027	U	0.027	0.651		0.048	0.709		0.16	0.207	UJ	2.5
Duplicate of J10VC1	J10VC2	12/14/05	0.256		0.074	0.420		0.13	0.029	U	0.029	0.613		0.073	0.420		0.13	1.06	UJ	2.4

Sample Location	HEIS Number	Sample Date	Uranium-233/234			Uranium-235			Uranium-235 GEA			Uranium-238			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Staging area soil	J10VC1	12/14/05	0.291		0.22	0	U	0.27	0.16	U	0.16	0.524		0.22	4.7	U	4.7
Duplicate of J10VC1	J10VC2	12/14/05	0.532		0.12	0.077	U	0.12	0.20	U	0.20	0.761		0.097	4.2	U	4.2

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

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

B = blank contamination (organic constituents)

D = diluted

GEA = gamma energy analysis

HEIS = Hanford Environmental Information System

J = estimate

MDA = minimum detectable activity

PQL = practical quantitation limit

Q = qualifier

TPH = total petroleum hydrocarbons

U = undetected

Table C-1. 126-F-2 Verification Data Results. (4 Pages)

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
Staging area soil	J10VC1	12/14/05	6290		1.8	0.48	J	0.40	3.0		0.34	82.4		0.02	0.30		0.01	5.5		0.27	0.07	U	0.07
Duplicate of J10VC1	J10VC2	12/14/05	5860		1.8	0.40	UJ	0.40	2.9		0.34	82.3		0.02	0.28		0.01	5.6		0.27	0.07	U	0.07
Equipment blank	J10VC3	12/14/05	47.2		1.8	0.39	UJ	0.39	0.33	U	0.33	1.3		0.02	0.01	U	0.01	0.26	U	0.26	0.07	U	0.07

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
Staging area soil	J10VC1	12/14/05	6730		1.2	10.9		0.16	6.1		0.12	16.8	J	0.12	0.21	U	0.21	17500		3.2	17.2	J	0.31
Duplicate of J10VC1	J10VC2	12/14/05	6510		1.2	10.4		0.16	6.2		0.12	17.4	J	0.12	0.21	U	0.21	16400		3.2	11.7	J	0.31
Equipment blank	J10VC3	12/14/05	24.2		1.2	0.19		0.16	0.12	U	0.12	0.19	J	0.12				311		3.1	0.40	J	0.30

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
Staging area soil	J10VC1	12/14/05	3930		1.4	274		0.02	0.01	U	0.01	0.38		0.13	10.3		0.13	1210		5.6	0.37		0.36
Duplicate of J10VC1	J10VC2	12/14/05	3790		1.3	267		0.02	0.02	U	0.02	0.39		0.13	10.3		0.13	1120		5.5	0.36	U	0.36
Equipment blank	J10VC3	12/14/05	7.4		1.3	4.3		0.02	0.02	U	0.02	0.13	U	0.13	0.13	U	0.13	19.6		5.4	0.35	U	0.35

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc			TPH		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Staging area soil	J10VC1	12/14/05	286	J	0.82	0.14	U	0.14	158		0.17	41.6		0.09	76.9		0.05	676	J	138
Duplicate of J10VC1	J10VC2	12/14/05	346	J	0.81	0.14	U	0.14	157		0.17	38.7		0.09	63.7		0.05	1650	J	274
Equipment blank	J10VC3	12/14/05	54.8	J	0.80	0.14	U	0.14	6.3		0.17	0.16		0.09	1.5		0.05			

Asbestos Data Results.

Sample Area	HEIS Number	Sample Date	Asbestos Result
Staging area soil	J10VC4	12/14/05	None detected.
Duplicate of J10VC4	J10VC7	12/14/05	None detected.

Table C-1. 126-F-2 Verification Data Results. (4 Pages)

Constituents	J10VC1 Staging area soil 12/14/05			J10VC2 Duplicate of J10VC1 12/14/05			J10VC3 Equipment blank 12/14/05		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Polychlorinated Biphenyls									
Aroclor-1016	14	U	14	14	U	14			
Aroclor-1221	14	U	14	14	U	14			
Aroclor-1232	14	U	14	14	U	14			
Aroclor-1242	14	U	14	14	U	14			
Aroclor-1248	14	U	14	14	U	14			
Aroclor-1254	35		14	74		14			
Aroclor-1260	14	U	14	14	U	14			
Semivolatile Organic Compounds									
1,2,4-Trichlorobenzene	3400	UJD	3400	3400	UJD	3400	330	UJ	330
1,2-Dichlorobenzene	3400	UD	3400	3400	UD	3400	330	U	330
1,3-Dichlorobenzene	3400	UD	3400	3400	UD	3400	330	U	330
1,4-Dichlorobenzene	3400	UD	3400	3400	UD	3400	330	U	330
2,4,5-Trichlorophenol	8600	UD	8600	8600	UD	8600	830	U	830
2,4,6-Trichlorophenol	3400	UD	3400	3400	UD	3400	330	U	330
2,4-Dichlorophenol	3400	UD	3400	3400	UD	3400	330	U	330
2,4-Dimethylphenol	3400	UJD	3400	3400	UJD	3400	330	UJ	330
2,4-Dinitrophenol	8600	UJD	8600	8600	UJD	8600	830	UJ	830
2,4-Dinitrotoluene	3400	UD	3400	3400	UD	3400	330	U	330
2,6-Dinitrotoluene	3400	UD	3400	3400	UD	3400	330	U	330
2-Chloronaphthalene	3400	UD	3400	3400	UD	3400	330	U	330
2-Chlorophenol	3400	UD	3400	3400	UD	3400	330	U	330
2-Methylnaphthalene	3400	UJD	3400	3400	UJD	3400	330	UJ	330
2-Methylphenol (cresol, o-)	3400	UD	3400	3400	UD	3400	330	U	330
2-Nitroaniline	8600	UJD	8600	8600	UJD	8600	830	UJ	830
2-Nitrophenol	3400	UJD	3400	3400	UJD	3400	330	UJ	330
3,3'-Dichlorobenzidine	3400	UJD	3400	3400	UJD	3400	330	UJ	330
3-Nitroaniline	8600	UJD	8600	8600	UJD	8600	830	UJ	830
4,6-Dinitro-2-methylphenol	8600	UJD	8600	8600	UJD	8600	830	UJ	830
4-Bromophenylphenyl ether	3400	UD	3400	3400	UD	3400	330	U	330
4-Chloro-3-methylphenol	3400	UJD	3400	3400	UJD	3400	330	UJ	330
4-Chloroaniline	3400	UD	3400	3400	UD	3400	330	U	330
4-Chlorophenylphenyl ether	3400	UD	3400	3400	UD	3400	330	U	330
4-Methylphenol (cresol, p-)	3400	UD	3400	3400	UD	3400	330	U	330
4-Nitroaniline	8600	UJD	8600	8600	UJD	8600	830	UJ	830
4-Nitrophenol	8600	UD	8600	8600	UD	8600	830	U	830
Acenaphthene	3400	UD	3400	170	JD	3400	330	U	330
Acenaphthylene	3400	UD	3400	3400	UD	3400	330	U	330
Anthracene	260	JD	3400	410	JD	3400	330	U	330
Benzo(a)anthracene	420	JD	3400	760	JD	3400	330	UJ	330
Benzo(a)pyrene	410	JD	3400	700	JD	3400	330	U	330
Benzo(b)fluoranthene	220	JD	3400	560	JD	3400	330	U	330
Benzo(ghi)perylene	250	JD	3400	270	JD	3400	330	U	330
Benzo(k)fluoranthene	320	JD	3400	760	JD	3400	330	U	330
bis(2-Chloro-1-methylethyl)ether	3400	UD	3400	3400	UD	3400	330	U	330
bis(2-Chloroethoxy)methane	3400	UD	3400	3400	UD	3400	330	U	330
bis(2-Chloroethyl) ether	3400	UD	3400	3400	UD	3400	330	U	330
bis(2-Ethylhexyl) phthalate	660	UJD	3400	3400	UJD	3400	660	UJ	660

Table C-1. 126-F-2 Verification Data Results. (4 Pages)

Constituents	J10VC1 Staging area soil 12/14/05			J10VC2 Duplicate of J10VC1 12/14/05			J10VC3 Equipment blank 12/14/05		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
Semivolatile Organic Compounds (continued)									
Butylbenzylphthalate	3400	UJD	3400	3400	UJD	3400	330	UJ	330
Carbazole	3400	UD	3400	3400	UD	3400	330	U	330
Chrysene	560	JD	3400	840	JD	3400	330	UJ	330
Di-n-butylphthalate	3400	UD	3400	3400	UD	3400	49	J	330
Di-n-octylphthalate	3400	UD	3400	3400	UD	3400	330	U	330
Dibenz[a,h]anthracene	3400	UD	3400	200	JD	3400	330	U	330
Dibenzofuran	3400	UD	3400	3400	UD	3400	330	U	330
Diethylphthalate	3400	UD	3400	3400	UD	3400	330	U	330
Dimethyl phthalate	3400	UD	3400	3400	UD	3400	330	U	330
Fluoranthene	1000	JD	3400	1800	JD	3400	330	U	330
Fluorene	3400	UD	3400	210	JD	3400	330	U	330
Hexachlorobenzene	3400	UD	3400	3400	UD	3400	330	U	330
Hexachlorobutadiene	3400	UD	3400	3400	UD	3400	330	U	330
Hexachlorocyclopentadiene	3400	UJD	3400	3400	UJD	3400	330	UJ	330
Hexachloroethane	3400	UD	3400	3400	UD	3400	330	U	330
Indeno(1,2,3-cd)pyrene	240	JD	3400	260	JD	3400	330	U	330
Isophorone	3400	UJD	3400	3400	UJD	3400	330	UJ	330
N-Nitroso-di-n-dipropylamine	3400	UD	3400	3400	UD	3400	330	U	330
N-Nitrosodiphenylamine	3400	UJD	3400	3400	UJD	3400	330	UJ	330
Naphthalene	3400	UD	3400	3400	UD	3400	330	U	330
Nitrobenzene	3400	UJD	3400	3400	UJD	3400	330	UJ	330
Pentachlorophenol	8600	UD	8600	8600	UD	8600	830	U	830
Phenanthrene	910	JD	3400	1600	JD	3400	330	U	330
Phenol	3400	UD	3400	3400	UD	3400	330	U	330
Pyrene	800	JD	3400	1800	JD	3400	330	U	330

APPENDIX D

CALCULATION OF HAZARD QUOTIENTS AND EXCESS CARCINOGENIC RISK VALUES

CALCULATION COVER SHEET

Project Title 100-F Field Remediation Closure Project **Job No.** 14655
Area 100-F
Discipline Environmental *Calc. No. 0100F-CA-V0243
Subject 126-F-2 Waste Staging Area 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 documents 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 Total = 4	J. M. Capron 3/27/06	T. M. Blakley 3/28/06	L. M. Dittmer 3/29/06	S. W. Callison per email	3/30/06

SUMMARY OF REVISION

*Obtain Calc. No. from DIS

DE01437.03 (12/09/2004)

Washington Closure Hanford CALCULATION SHEET

Originator:	J. M. Capron	Date:	03/27/06	Calc. No.:	0100F-CA-V0243	Rev.:	0
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	T. M. Blakley	Date:	3/28/06
Subject:	126-F-2 Waste Staging Area Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and carcinogenic (excess cancer) risk values for the 126-F-2 waste staging area remedial action completion verification. 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 cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 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) EPA, 1994, *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children*, EPA/540/R-93/081, Publication No. 9285.7-15-1, U.S. Environmental Protection Agency, Washington, D.C.

3) WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, 2004.

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

5) WAC 173-350, "Solid Waste Handling Standards," *Washington Administrative Code*, 2005.

6) WCH, 2006, Waste Site Reclassification Form 2006-017, and Attachment *Remaining Sites Verification Package for the 126-F-2 Waste Site, 183-F Clearwells*, 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 cancer risk value for each carcinogenic constituent detected above background and compare to the individual excess cancer risk criterion of $<1 \times 10^{-6}$ (DOE-RL 2005).

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

Washington Closure Hanford CALCULATION SHEET

Originator:	J. M. Capron	Date:	03/27/06	Calc. No.:	0100F-CA-V0243	Rev.:	0
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	T. M. Blakley	Date:	3/28/06
Subject:	126-F-2 Waste Staging Area Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	2 of 3

METHODOLOGY:

Hazard quotient and carcinogenic risk calculations were computed using the maximum detected value for each analyte in the verification data set for the 126-F-2 waste staging area (WCH 2006). Of the contaminants of potential concern for the site, boron and molybdenum require the HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Lead and zinc are included because they were detected at concentrations exceeding the statistical Hanford Site background values. Aroclor-1254 is included because it was detected by laboratory analysis and cannot be attributed to natural occurrence. Polyaromatic hydrocarbons (PAHs) detected in the verification samples are not included because they are the result of asphalt cross-contamination in the sample matrix (WCH 2006). Asphalt that has been used for structural and construction purposes is excluded from consideration as a dangerous waste by WAC 173-303-071(3)(e), is listed as an inert waste in WAC 173-350-990(2)(b), and its constituents are therefore not considered in attainment of soil RAGs (PAH concentrations in the soil matrix are assumed to be negligible). An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron in the staging area is 5.6 mg/kg, divided by the noncarcinogenic RAG value of 16,000 mg/kg (boron is identified as a noncarcinogen in WAC 173-340-740[3]), is 3.5×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculations are completed for the appropriate analytes, the cumulative HQ is obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The sum of the HQ values for the staging area is 1.0×10^{-1}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum value is divided by the carcinogenic RAG value, then multiplied by 1×10^{-6}. For example, the maximum value for aroclor-1254 in the staging area is 0.074 mg/kg; divided by 0.5 mg/kg and multiplied as indicated is 1.5×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-6}$, this criterion is met. Because aroclor-1254 is the sole carcinogenic constituent in this calculation, the cumulative excess carcinogenic risk is also 1.5×10^{-7}, which satisfies the requirement of $<1 \times 10^{-5}$.

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 126-F-2 waste staging area.

Washington Closure Hanford CALCULATION SHEET

Originator:	J. M. Capron JMC	Date:	03/27/06	Calc. No.:	0100F-CA-V0243	Rev.:	0
Project:	100-F Area Field Remediation	Job No:	14655	Checked:	T. M. Blakley JMB	Date:	3/28/06
Subject:	126-F-2 Waste Staging Area Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	3 of 3

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 126-F-2 Waste Staging Area.

Contaminants of Potential Concern	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	5.6	16,000	3.5E-04	--	--
Lead[c]	17.2	353	4.9E-02	--	--
Molybdenum	0.39	400	9.8E-04	--	--
Zinc	76.9	24,000	3.2E-03	--	--
Polychlorinated Biphenyls					
Aroclor-1254	0.074	1.6	4.6E-02	0.5	1.5E-07
Totals					
Cumulative Hazard Quotient:			**1.0E-01**		
Cumulative Excess Cancer Risk:					**1.5E-07**

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, unless otherwise noted.
[c] = Value for the noncarcinogen RAG obtained from EPA (1994).

CONCLUSION:

This calculation demonstrates that the 126-F-2 waste staging area meets the requirements for the hazard quotient and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2005).