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CVP-2006-00010
Rev. 0

Cleanup Verification Package for the 618-2 Burial Ground

Prepared for the U.S. Department of Energy
by Washington Closure Hanford

December 2006

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EXECUTIVE SUMMARY

This cleanup verification package documents completion of remedial action for the 618-2 Solid Waste Burial Ground, also referred to as Solid Waste Burial Ground No. 2; Burial Ground No. 2; 318-2; and Dry Waste Burial Site No. 2. This site is located in the 300-FF-2 Operable Unit in the 600 Area of the Hanford Site in southeastern Washington State. During its period of operation from 1951 to 1954, the 618-2 site was used primarily for the disposal of contaminated equipment, materials, and laboratory waste from 300 Area Facilities.

Site excavation and waste disposal of the 618-2 waste site are complete, and the exposed surfaces have been sampled and analyzed to verify attainment of the remedial action goals. Results of the sampling, laboratory analyses, and data evaluations for the 618-2 site indicate that all remedial action objectives for direct exposure, protection of groundwater, and protection of the Columbia River have been met for industrial land use (see Table ES-1).

The site meets cleanup standards and has been reclassified as "interim closed out" in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) and the Waste Site Reclassification Guideline TPA-MP-14 (RL-TPA-90-0001) (DOE-RL 1998). A copy of the waste site reclassification form is included as Attachment ES-1.

Table ES-1. Summary of Cleanup Verification Results for the 618-2 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?	Ref.
Direct Exposure – Radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years. Attain the CERCLA risk range of 10^{-4} to 10^{-6}.	Maximum dose rate calculated by RESRAD for the site is 1.19 mrem/yr and 0.212 mrem/yr for the combined staging pile and decontamination area. The maximum risk calculated by RESRAD for the site is 1.5×10^{-5} and 9.58×10^{-7} for the combined staging pile and decontamination area. No radionuclides were detected above background in the overburden soil.	Yes	d
Direct Exposure – Nonradionuclides	Attain individual COC RAGs.	All individual COC concentrations are below the RAGs.	Yes	d
Nonradionuclide Risk Requirements	Attain hazard quotient of <1 for noncarcinogens.	All hazard quotients are below 1.	Yes	d
	Attain cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotients for the site, the overburden, and the combined staging pile and decontamination area are all below 1.		
	Attain excess cancer risk of $<1 \times 10^{-5}$ for individual carcinogens.	Excess cancer risks were not calculated because all nonradionuclide carcinogenic COCs (arsenic and cadmium) were detected below statistical background levels.		
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.			
Groundwater/River Protection – Radionuclides	Attain single COC groundwater and river protection RAGs.	With the exception of uranium, RESRAD modeling predicts that contaminants from the site and the combined staging pile and decontamination area do not reach groundwater within 1,000 years. Uranium is predicted to reach groundwater within 1,000 years, but at concentrations below the RAG. Therefore, all groundwater and river protection RAGs have been attained.	Yes	d
	Attain National Primary Drinking Water Standards: 4 mrem/yr (beta/gamma) dose rate to target receptors/organs.[a]	No beta-/gamma-emitting radionuclides are predicted to reach groundwater within 1,000 years; therefore, the Drinking Water Standard RAGs have been attained.		
	Meet drinking water standards for nonuranium alpha emitters: the more stringent of the 15 pCi/L MCL or 1/25th of the derived concentration guide per DOE Order 5400.5.[b]	No nonuranium alpha-emitting radionuclides are predicted to reach groundwater within 1,000 years; therefore, the drinking water standards for alpha emitters have been attained.		
	Meet total uranium standard of 21.2 pCi/L.[c]	The maximum predicted activity for total uranium in 1,000 years (11.2 pCi/L) is below groundwater and river protection RAGs.		
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Soil cleanup levels for groundwater and river protection have been attained.	Yes	d

Table ES-1. Summary of Cleanup Verification Results for the 618-2 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?	Ref.
Supporting Information	1. 618-2 cleanup verification sample location design (Appendix D)			e
	2. Closeout Plan for the 618-2 Burial Ground			f

[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 Hanford Site background, the 30 µg/L MCL (65 *Federal Register* 76708) 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*, 0100X-CA-V0038 (BHI 2001).
[d] *Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint*, 0600X-CA-V0060, Rev. 2, Washington Closure Hanford, Richland, Washington.
[e] *618-2 Shallow, Deep Zone, Overburden/Stockpile Area Sampling Plan*, 0300X-CA-V0077, Rev. 0, Washington Closure Hanford, Richland, Washington.
[f] *Closeout Plan for the 618-2 Burial Ground*, CCN 129577, Washington Closure Hanford, Richland, Washington (WCH 2006a).

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC = contaminant of concern
MCL = maximum contaminant level (drinking water standard)
NA = not applicable
RAG = remedial action goal
UCL = upper confidence limit

Attachment ES-1
Waste Site Reclassification Form

Date Submitted: 12/07/06 **Originator:** L. M. Dittmer **Phone:** 372-9664	**Operable Unit(s):** 300-FF-2 **Waste Site ID:** 618-2 **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number:** 2006-062 **Lead Agency:** EPA

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List of no action or closed-out sites will occur at a future date.

Description of current waste site condition:

Remedial actions at this site have been performed in accordance with remedial action objectives and goals established by the U.S. Environmental Protection Agency and the U.S. Department of Energy, Richland Operations Office, in concurrence with the Washington State Department of Ecology. The selected remedial action involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility in the 200 Area of the Hanford Site, and (3) backfilling the site with clean soil to adjacent grade elevations.

Basis for reclassification:

The 618-2 site has been remediated to meet the remedial action objectives specified in the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2001). Remedial actions were performed so as to allow industrial land use and to protect groundwater and the Columbia River. The waste site has a deep zone; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are required. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 618-2 Burial Ground* (CVP-2006-00010), Washington Closure Hanford, Richland, Washington.

D. C. Smith DOE-RL Project Manager	Signature	12/12/06 Date
NA Ecology Project Manager	Signature	Date
A. L. Boyd EPA Project Manager	Signature	12/28/06 Date

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ACRONYMS AND ABBREVIATIONS

COC	contaminant of concern
CVP	cleanup verification package
DQA	data quality assessment
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESD	Explanation of Significant Differences
GPERS	Global Positioning Environmental Radiological Surveyor
LDR	land disposal restriction
RAG	remedial action goal
RAO	remedial action objective
RDR/RAWP	remedial design report/remedial action work plan
RESRAD	RESidual RADioactivity (dose assessment model)
ROD	record of decision
SAP	sampling and analysis plan
UCL	upper confidence limit
WAC	*Washington Administrative Code*

1.0 INTRODUCTION

This cleanup verification package (CVP) documents that the 618-2 waste site was remediated in accordance with the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site, Benton County, Washington* (ROD) (EPA 2001), as modified by the *Explanation of Significant Differences for the 300-FF-2 Operable Unit Interim Record of Decision* (ESD) (EPA 2004). Remedial action objectives (RAOs) and remedial action goals (RAGs) for this site are documented in the ROD (EPA 2001) and the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (RDR/RAWP) (DOE-RL 2004b). The ROD provides the U.S. Department of Energy, Richland Operations Office, the authority, guidance, and objectives to conduct this remedial action.

The remedy specified in the ROD (EPA 2001) and conducted for the 618-2 waste site included: (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility (ERDF) in the 200 Area of the Hanford Site, and (3) backfilling the site with clean soil to the average adjacent grade elevation. Excavation was driven by RAOs for direct exposure, protection of groundwater, and protection of the Columbia River. For the respective points of compliance, RAGs, summarized in Table 1, were established for the contaminants of concern (COCs) in the RDR/RAWP (DOE-RL 2004b) to support industrial land use. Preliminary waste site contaminants of potential concern were identified in the *300 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2004a). Following excavation of the site, final COCs were identified in the *Closeout Plan for the 618-2 Burial Ground* (WCH 2006a) and are listed in Table 1.

Table 1. Summary of Remedial Action Goals – Industrial Land Use. (3 Pages)

Contaminants of Concern	Industrial Soil Cleanup Level for Direct Contact[a] (mg/kg)	Industrial Soil Cleanup Level for Groundwater Protection[b] (mg/kg)	Industrial Soil Cleanup Level for River Protection[c] (mg/kg)
Nonradionuclides			
Barium	4,900[d]	NA[e]	NA[e]
Cadmium	139[d]	NA[e]	NA[e]
Chromium	>1,000,000[f]	NA[e]	NA[e]
Lead	1,000[g]	NA[e]	NA[e]
Selenium	17,500[h]	NA[e]	NA[e]
Tin	>1,000,000[f]	NA[e]	NA[e]
Uranium (total)	505[i]	385[i]	385[i]

Table 1. Summary of Remedial Action Goals – Industrial Land Use. (3 Pages)

Contaminants of Concern	Industrial Soil Cleanup Level for Direct Exposure[j] (pCi/g)	Industrial Soil Cleanup Level for Groundwater Protection[k] (p/Ci/g)	Industrial Soil Cleanup Level for River Protection[l] (pCi/g)
Radionuclides			
Tritium (H-3)	471	6,932,000	13,864,000
Cobalt-60	5.2	NA[e]	NA[e]
Nickel-63	4,026[m]	83[m]	83[m]
Strontium-90	2,500	NA[e]	NA[e]
Cesium-137	25	NA[e]	NA[e]
Europium-152	12	NA[e]	NA[e]
Europium-154	11	NA[e]	NA[e]
Europium-155	518	NA[e]	NA[e]
Plutonium-238	155	NA[e]	NA[e]
Plutonium-239/240	245	NA[e]	NA[e]
Plutonium-241	12,900[n]	NA[e]	NA[e]
Americium-241	210	NA[e]	NA[e]
Uranium-233/234	169[o]	129[p]	129[p]
Uranium-235	17[o]	13[p]	13[p]
Uranium-238	164[o]	125[p]	125[p]
Uranium (Total)	350[q]	267[r]	267[r]

[a] Direct contact values represent soil concentrations that are protective of human receptors from direct contact with contaminated waste/soil. Listed WAC 173-340-745(4), Method C cleanup standards for industrial soil apply to the top 4.6 m (15 ft) (WAC 173-340-745[6])(1996).

[b] Groundwater protection values represent soil concentrations that will be protective of groundwater. Values are equal to 100 times the groundwater cleanup standard (WAC 173-340-745(4)(a)(ii)(A)) (1996), unless otherwise noted.

[c] River protection values represent soil concentrations that will not cause applicable river cleanup levels to be exceeded as contaminants migrate through the soil column to groundwater, and from groundwater to the river. Listed values are equal to 100 times the applicable river cleanup standard multiplied by a dilution attenuation factor of 2, unless otherwise noted.

[d] Cleanup limit based on the inhalation exposure pathway per WAC 173-340-750(4)(b)(ii)(A) or (B), (1996).

[e] The RESRAD model predicts that the constituent will not reach groundwater within 1,000 years based on a generic site profile (4 m [13.1 ft] contaminated zone and 5.6 m [18.4 ft] uncontaminated zone) per the 300 Area RDR/RAWP, Rev. 1 (DOE/RL-2004b).

[f] Direct contact soil cleanup levels calculated using WAC 173-340-745(4), (1996) can result in values greater than pure material (e.g., >1 million parts per million) (DOE-RL 2004b).

[g] The 1,000 mg/kg lead value reflects the Method A soil cleanup level from WAC 173-340-745 (1996).

[h] Method C industrial cleanup level from the *Cleanup Levels and Risk Calculations (CLARC) Database* (Ecology 2005).

[i] Based on the calculated isotopic distribution of uranium in the 300 Area and cleanup levels of 350 pCi/g and 267 pCi/g for total uranium, the corresponding uranium concentrations are 505 mg/kg and 385 mg/kg, respectively (BHI 2002) for 300-FF-2 Operable Unit sites.

[j] Direct exposure values represent soil activities for individual radionuclides that would meet the remedial action objective for cumulative risk (i.e., 10^{-4} to 10^{-6} risk under an industrial land-use scenario) from exposure to contaminated waste/soil. Values will be lower for multiple radionuclides to achieve the same risk endpoint. Listed values are calculated by RESRAD and apply to the top 4.6 m (15 ft) (DOE-RL 2004b).

[k] Groundwater protection values represent soil concentrations that will be protective of groundwater. Listed values are calculated by RESRAD, based on the applicable groundwater cleanup standard (DOE-RL 2004b).

[l] River protection values represent soil concentrations that will not cause applicable river cleanup standards to be exceeded as contaminants migrate through the soil column to groundwater, and from groundwater to the river. Listed values are calculated by RESRAD, based on the applicable river cleanup standard (DOE-RL 2004b).

[m] Cleanup level values from 100 Area RDR/RAWP (DOE-RL 2005) and (BHI 2004), 100 Area Radionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision, Calculation Number 0100X-CA-V0046, Rev. 0, Bechtel Hanford Inc. Richland, WA.

[n] Cleanup level value determined by RESRAD modeling for plutonium-241 using industrial land-use input parameters, as provided in the 300-FF-2 Focused Feasibility Study (DOE-RL 2000).

[o] Values determined using uranium equilibrium isotopic ratios and the industrial scenario selected soil cleanup level for direct exposure for total uranium (350 pCi/g) as provided in the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (300 Area RDR/RAWP) (DOE-RL 2004b).

[p] Values determined using uranium equilibrium isotopic ratios and the industrial scenario selected soil cleanup level for groundwater/river protection for total uranium (267 pCi/g) as provided in the 300 Area RDR/RAWP (DOE-RL 2004b).

[q] Listed value is equal to a 15 mrem/yr dose, based on the isotopic distribution of uranium-234, uranium-235, and uranium-238 in the 300 Area from calculation brief 0300X-CA-V0042.

[r] Value calculated using RESRAD, based on the generic site model, with a length parallel to groundwater of 100 m (328 ft) and Kd values of 8.9 mL/g for the contaminated zone and 0 mL/g for the saturated zone (with no unsaturated, uncontaminated zone).

MCL = maximum contamination level (drinking water standard)
NA = not applicable
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose assessment model)
WAC = *Washington Administrative Code*

A waste staging pile and decontamination pad area was located in an uncontaminated area near the 618-2 site for combined use during excavation of the 618-2, 618-3 and 618-8 Burial Grounds. Verification sampling of the residual soil beneath the footprint of the 618-2, 618-3, and 618-8 Burial Ground Stockpile Staging Area is evaluated in this CVP using the RAGs for unrestricted land-use listed in Table 2 and includes the additional COCs, arsenic and silver, for the 618-3 and 618-8 waste sites. The combined waste staging pile and decontamination pad area was evaluated for cleanup verification as a single waste staging pile.

Table 2. Summary of Remedial Action Goals – Unrestricted Land Use. (2 Pages)

Contaminants of Concern	Direct Exposure RAGs (mg/kg)[a]	Soil RAG for Groundwater Protection (mg/kg)[b]	Soil RAG for Columbia River Protection (mg/kg)[c]
Nonradionuclides			
Arsenic	20	NA[d]	NA[d]
Barium	1,600	NA[d]	NA[d]
Cadmium	13.9[e]	NA[d]	NA[d]
Chromium	120,000	NA[d]	NA[d]
Lead	353[f]	NA[d]	NA[d]
Tin	48,000	NA[d]	NA[d]
Selenium	400	1[g]	1[g]
Silver	400[g]	8[g]	1[g]
Uranium (total metal)	81[h]	53[h]	53[h]

Table 2. Summary of Remedial Action Goals – Unrestricted Land Use. (2 Pages)

Contaminants of Concern	Direct Exposure RAGs (pCi/g)	Soil RAG for Groundwater Protection (pCi/g)	Soil RAG for Columbia River Protection (pCi/g)
Radionuclides			
Tritium	711	30,530	61,060
Cobalt-60	1.4	NA[d]	NA[d]
Nickel-63	4,026[i]	83[i]	83[i]
Strontium-90	4.50	NA[d]	NA[d]
Cesium-137	6.2	NA[d]	NA[d]
Europium-152	3.3	NA[d]	NA[d]
Europium-154	3.0	NA[d]	NA[d]
Europium-155	125	NA[d]	NA[d]
Uranium-233/234	27.1[j]	17.9[j]	35.8
Uranium-235	2.7[j]	1.8[j]	3.6
Uranium-238	26.2[j]	17.3[j]	34.6
Plutonium-238	38.8	NA[d]	NA[d]
Plutonium-239/240	35.1	NA[d]	NA[d]
Plutonium-241	854[k]	None[k]	None[k]
Americium-241	32.1	NA[d]	NA[d]

[a] Direct contact values represent soil concentrations that are protective of human receptors from direct contact with contaminated waste/soil. Cleanup levels for unrestricted soil apply to the top 4.6 m (15 ft) as listed in WAC 173-340-740(3)(1996).

[b] Groundwater protection values represent soil concentrations that will be protective of groundwater. Values are equal to 100 times the groundwater cleanup standard (WAC 173-340-740) (1996), unless otherwise noted.

[c] River protection values represent soil concentrations that will not cause applicable river cleanup levels to be exceeded as contaminants migrate through the soil column to groundwater, and from groundwater to the river. Listed values are equal to 100 times the applicable river cleanup standard multiplied by a dilution attenuation factor of 2, unless otherwise noted.

[d] The RESRAD model predicts the constituent will not reach groundwater within 1,000 years based on a generic site profile (4.6 m [15 ft] contaminated zone and 6 m [19.6 ft] uncontaminated zone).

[e] Cleanup limit based on the inhalation exposure pathway per WAC 173-340-750(4)(b)(ii)(a) or (b) (1996).

[f] 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 Update Biokinetic Model for Lead in Children* (EPA 1994).

[g] Cleanup level values from 100 Area RDR/RAWP (DOE-RL 2005) and BHI 2004, 100 Area Radionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision, Calculation Number 0100X-CA-V0046, Rev. 0, Bechtel Hanford Inc. Richland, WA.

[h] Based on the calculated isotopic distribution of uranium in the 300 Area and a groundwater protective cleanup level of 37 pCi/g for total uranium, the corresponding uranium concentration is 53 mg/kg. For direct exposure, the activity concentration corresponding to 15 mrem/yr of 56 pCi/g corresponds to a uranium concentration of 81 mg/kg.

[i] Cleanup level values from 100 Area RDR/RAWP (DOE-RL 2005) and BHI 2004, 100 Area Radionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision, Calculation Number 0100X-CA-V0046, Rev. 0, Bechtel Hanford Inc. Richland, WA.

[j] Values determined using uranium equilibrium isotopic ratios and the unrestricted land use scenario selected soil cleanup level for direct exposure for total uranium (56 pCi/g) as provided in the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (300 Area RDR/RAWP) (DOE-RL 2004b).

[k] Cleanup level values determined using RESRAD calculation with input parameters from BHI 2003, *300 Area Unrestricted Land-Use Radioactive Look-up Values RESRAD Calculation*, Calculation Number 0300X-CA-V0042, Rev. 0, Bechtel Hanford Inc., Richland, WA.

RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)
RDR/RAWP = remedial design report/remedial action work plan
NA = not applicable

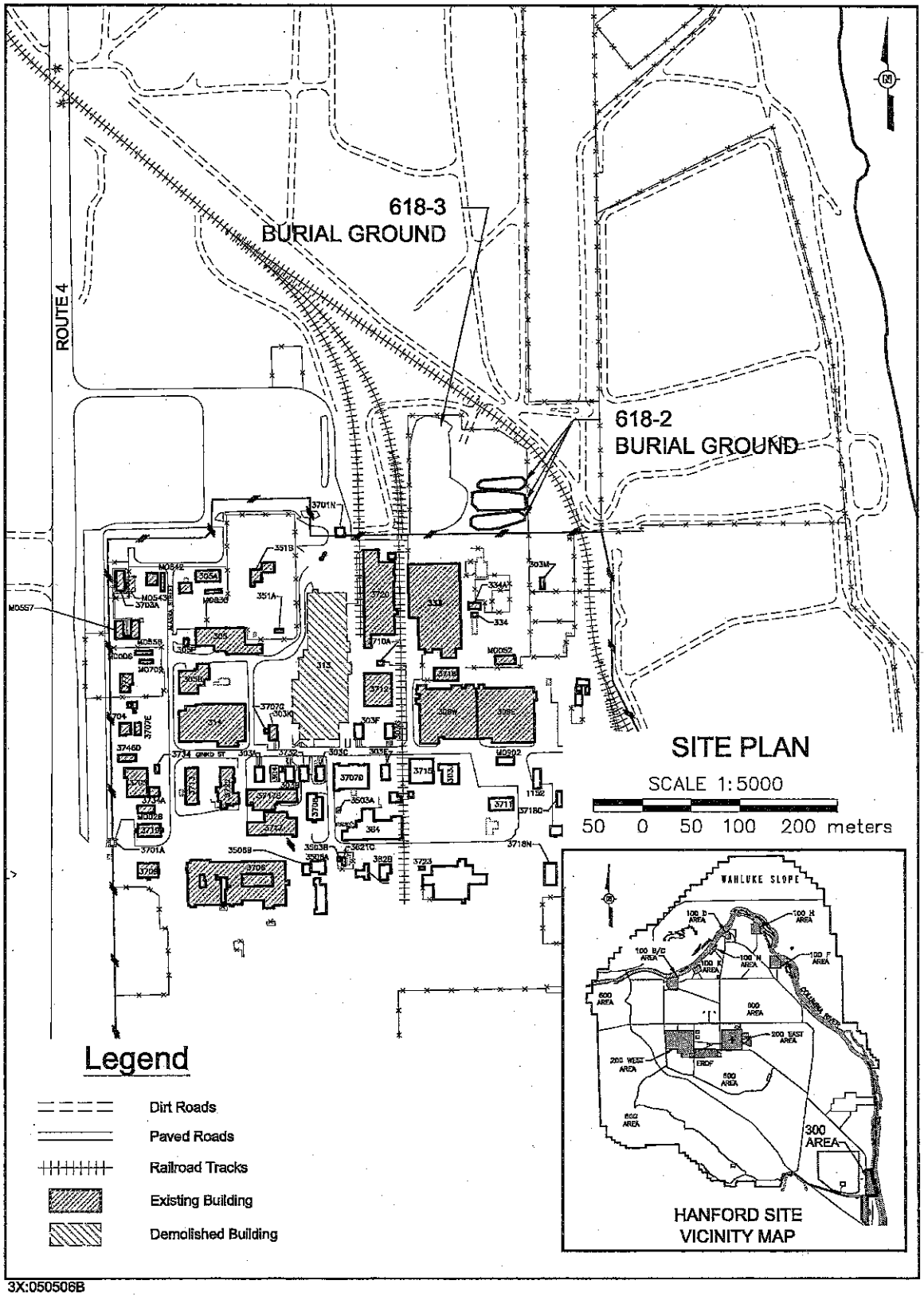
Soil cleanup levels were established in the ROD based on a limited ecological risk assessment. Although not required by the ROD, a comparison against ecological risk screening levels has been made for the site COCs. Screening values were not exceeded for the waste site COCs, with the exception of selenium. Exceeding screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of selenium at this site does not pose a risk to ecological receptors because concentrations of selenium are within the range of natural site background (DOE-RL 1996). Barium, selenium, and uranium concentrations were found in soil at depths greater than 4.6 m (15 ft) and are, therefore, excluded from ecological risk consideration since the depth is below the standard point of compliance per WAC 173-340-7490(4)(b). A baseline risk assessment for the river corridor portion of the Hanford Site began in 2004 and includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used as part of the final ROD for these sites.

2.0 SITE DESCRIPTION AND SUPPORTING INFORMATION

The 618-2 Burial Ground, part of the 300-FF-2 Operable Unit, is located just north of the 300 Area exclusion area fence, and immediately adjacent to the 618-3 Burial Ground in the vicinity of Washington State Plane coordinates E594020, N116360 (Figure 1). The waste site, also known as Solid Waste Burial Ground No. 2; Burial Ground No. 2; 318-2; and Dry Waste Burial Site No. 2, consists of three east-west oriented trenches. A ground penetrating radar investigation, performed in 1995, identified three distinct trenches as follows: a northern trench, approximately 49 m (160 ft) long and 9 m (30 ft) wide; a middle trench approximately 54 m (175 ft) long and 15 m (50 ft) wide; and a southern trench approximately 55 m (180 ft) long and 15 m (50 ft) wide. Each trench was assumed to be approximately 4.6 m (15 ft) deep.

The 618-2 Burial Ground is reported to have been in operation from 1951 to 1954, primarily for the disposal of contaminated equipment, materials, and laboratory waste from the 300 Area Facilities. Radiological contaminants were reported to include uranium, plutonium, and mixed fission products. The uranium waste was reportedly solid metal (uranium oxide) cuttings from reactor fuel fabrication facilities in the 300 Area. The plutonium and fission products came from waste generated in the 300 Area laboratory facilities. Non-radiological contaminants are reported to include lead and tin from various "dip-canning" processes. In 1954, a series of fires in the burial ground reportedly destroyed most of the flammable material contained in the burial ground at the time of the fires. A fire on February 17, 1954, in the northwest corner of burial trench #2, was reported not to have spread to the southeast portion of the trench where high-activity waste was known to be concentrated (GE 1954). In 1989, during interim stabilization, a large number of automotive batteries were discovered on the surface of the waste site. The batteries were left in-place and covered with approximately 0.6 m (2 ft) of clean backfill.

Figure 1. Hanford Site Map and Location of the 618-2 Waste Site.



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3.0 REMEDIAL ACTION FIELD ACTIVITIES

3.1 EXCAVATION AND DISPOSAL

Remedial action activities at the 618-2 waste site initially began in November 2004 and were completed in August 2006 (WCH 2006a, 2006b). Excavation and load-out operations were suspended from December 2004 to December 2005, due to the discovery of higher than anticipated levels of plutonium-contaminated waste. Remediation activities were conducted in accordance with the RDR/RAWP (DOE-RL 2004b). Remediation involved excavation and removal of buried waste and contaminated soil to the extent required to satisfy the RAOs and corresponding RAGs. In-process radiological field screening was conducted during the site remedial actions to guide the excavation and quickly assess the presence and level of contamination. The radiological survey results indicated the presence of isotopes of uranium and plutonium, as well as cesium-137 (WCH 2006a).

The buried waste consisted primarily of a wide variety of laboratory and construction-type debris. Excavation activities found no indication of bulk liquid waste disposal at this waste site. During the initial excavation phase, contaminated soil and debris were excavated from the burial ground and transported to a designated "stockpile" area for sorting and sampling. Sorting and sampling of the excavated soil and debris was performed in a designated staging pile area. This staging pile area supported the 618-2, 618-3, and 618-8 Burial Ground excavations and is included with the closure of the 618-2 waste site. A photo of the staging pile area is provided in Appendix A. Land disposal restriction materials, primarily consisting of lead solids, were identified and separated from the bulk soil and debris during excavation and sorting operations (WCH 2006a). All excavated materials were disposed of at ERDF. Approximately 71,203 metric tons (78,488 U.S. tons) of material from the site was removed and disposed of at ERDF (WCH 2006a). Pre- and post-remediation topographic civil survey results for the 618-2 waste site are depicted in Figures 2 and 3, respectively.

Excavated material consisted of contaminated soil and a wide variety of miscellaneous debris. Some Land Disposal Restriction (LDR) materials, (primarily lead solids) were identified among the debris and were subsequently segregated from the bulk soil and non-LDR debris, then designated for separate load-out as LDR material. Subsequent to sorting, the remaining bulk soil and non-LDR debris material stockpiles were sampled to ensure that the material was in compliance with LDR restrictions. Upon receipt of sample results confirming compliance with LDR restrictions, the "released" stockpile material was loaded into ERDF containers and transported to ERDF for disposal. LDR materials that had been segregated for treatment were subsequently loaded-out and transported to ERDF under a separate waste profile.

Figure 2. Pre-Remediation Topographic Map for the 618-2 Waste Site.

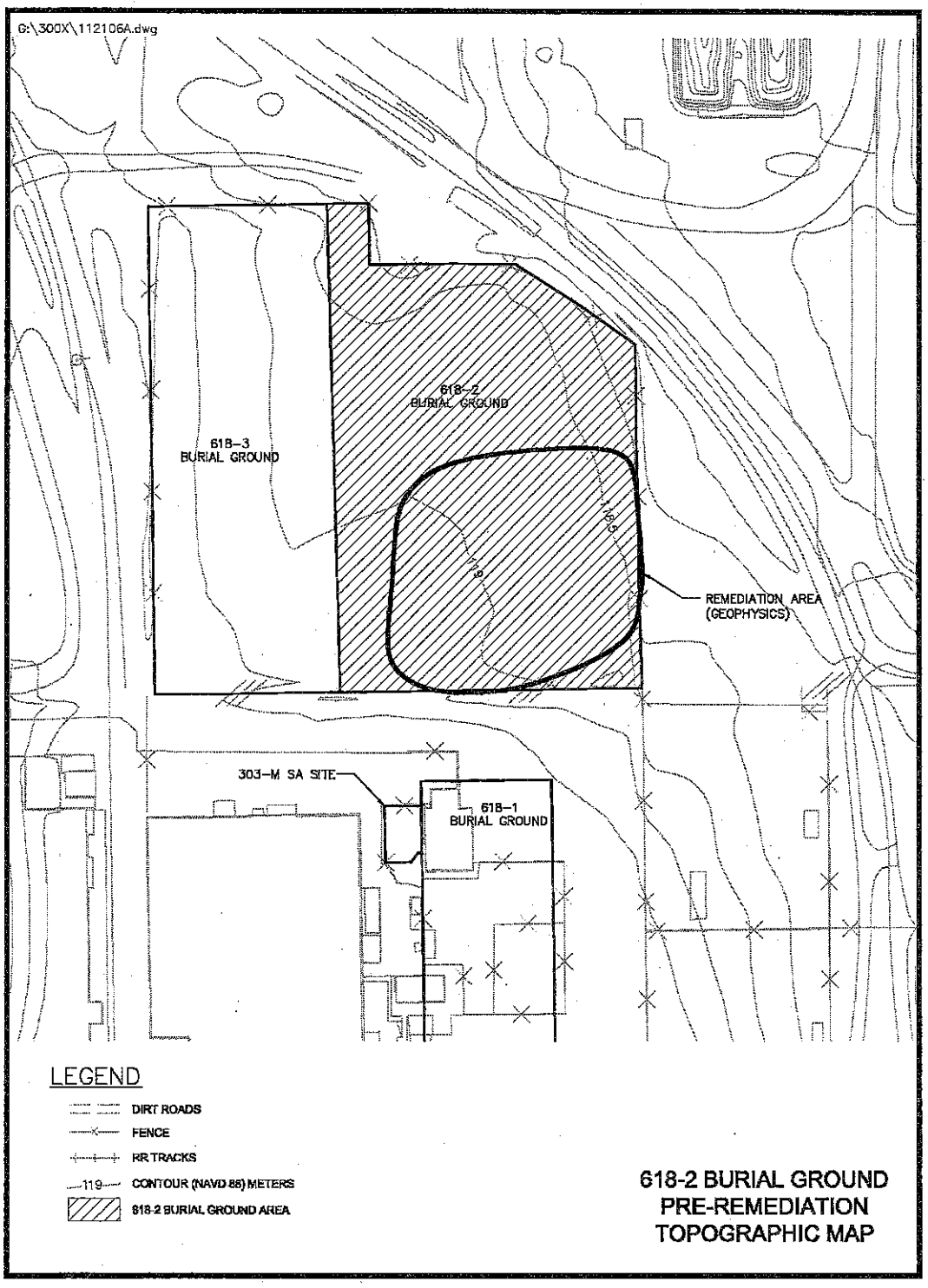
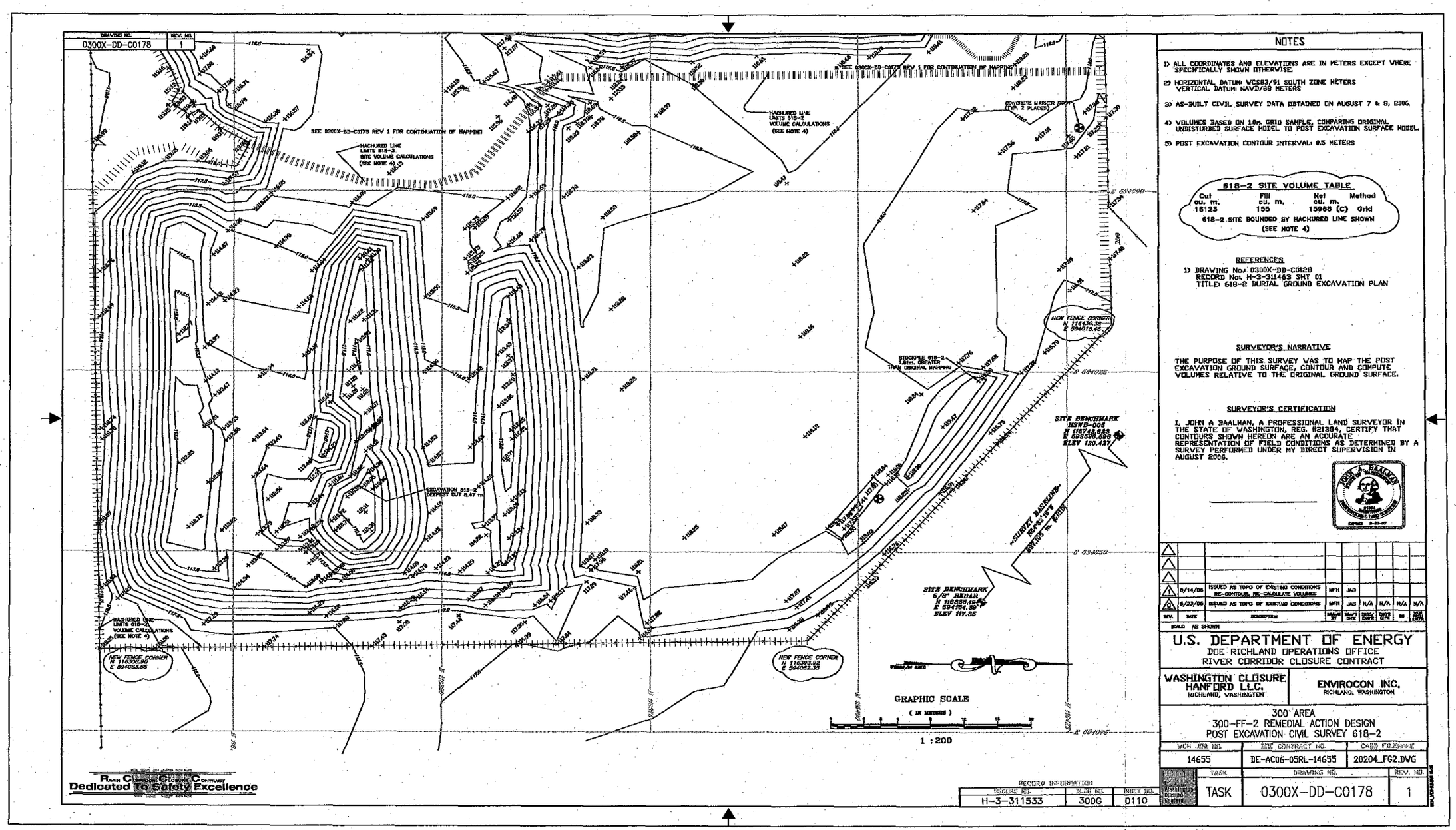


Figure 3. Post-Remediation Topographic Civil Survey Map for the 618-2 Waste Site.



NOTES

1) ALL COORDINATES AND ELEVATIONS ARE IN METERS EXCEPT WHERE SPECIFICALLY SHOWN OTHERWISE.

2) HORIZONTAL DATUM: WCS83/91 SOUTH ZONE METERS
VERTICAL DATUM: NAVD/88 METERS

3) AS-BUILT CIVIL SURVEY DATA OBTAINED ON AUGUST 7 & 8, 2006.

4) VOLUMES BASED ON 1.0m. GRID SAMPLE, COMPARING ORIGINAL UNDISTURBED SURFACE MODEL TO POST EXCAVATION SURFACE MODEL.

5) POST EXCAVATION CONTOUR INTERVAL: 0.5 METERS

618-2 SITE VOLUME TABLE

Cut cu. m.	Fill cu. m.	Net cu. m.	Method
16123	155	15968 (C)	Grid

618-2 SITE BOUNDED BY HACHURED LINE SHOWN (SEE NOTE 4)

REFERENCES

1) DRAWING No.: 0300X-DD-C0128
RECORD No.: H-3-311463 SHT 01
TITLE: 618-2 BURIAL GROUND EXCAVATION PLAN

SURVEYOR'S NARRATIVE

THE PURPOSE OF THIS SURVEY WAS TO MAP THE POST EXCAVATION GROUND SURFACE, CONTOUR AND COMPUTE VOLUMES RELATIVE TO THE ORIGINAL GROUND SURFACE.

SURVEYOR'S CERTIFICATION

I, JOHN A BAALMAN, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF WASHINGTON, REG. #21364, CERTIFY THAT CONTOURS SHOWN HEREON ARE AN ACCURATE REPRESENTATION OF FIELD CONDITIONS AS DETERMINED BY A SURVEY PERFORMED UNDER MY DIRECT SUPERVISION IN AUGUST 2006.

JOHN A. BAALMAN — REGISTERED PROFESSIONAL LAND SURVEYOR — STATE OF WASHINGTON — 21364 — EXPIRES 8-23-07

REV.	DATE	DESCRIPTION	DRAWN BY	DSGN CHK	DSGN ENGR	DWG CHK	SR	NOTIFY CONTR
1	9/14/06	ISSUED AS TOPO OF EXISTING CONDITIONS RE-CONTOUR, RE-CALCULATE VOLUMES	MFH	JAB				
0	8/23/06	ISSUED AS TOPO OF EXISTING CONDITIONS	MFH	JAB	N/A	N/A	N/A	N/A

SCALE: AS SHOWN

U.S. DEPARTMENT OF ENERGY
DOE RICHLAND OPERATIONS OFFICE
RIVER CORRIDOR CLOSURE CONTRACT

WASHINGTON CLOSURE HANFORD LLC. RICHLAND, WASHINGTON | ENVIROCON INC. RICHLAND, WASHINGTON

300 AREA
300-FF-2 REMEDIAL ACTION DESIGN
POST EXCAVATION CIVIL SURVEY 618-2

WCH JOB NO.	DOE CONTRACT NO.	CADD FILENAME
14655	DE-AC06-05RL-14655	20204_FG2.DWG

TASK	DRAWING NO.	REV. NO.
TASK	0300X-DD-C0178	1

RECORD INFORMATION

ISSUED NO.	BLDG NO.	INDEX NO.
H-3-311533	300G	0110

Excavation of contaminated soil and debris was performed until native soil was reached at the floor of each trench. The determination of native soil was based on the absence of debris materials, plus radiological surveys and visual observations of the soil at the base of the excavation.

When operations resumed in December 2005, the first materials designated for load-out were the existing sorted stockpiles located on the east side of the designated stockpile-sorting area. Following a sampling campaign to ensure compliance with LDR restrictions, these sorted stockpiles were loaded into ERDF containers and transported to ERDF for disposal. Concurrent with the load-out of the existing sorted stockpile material, additional stockpiles of previously unsorted and unsampled 618-2 material, located on the west side of the designated stockpile/sorting area, were thoroughly sorted and subsequently sampled. Upon receipt of sample results confirming compliance with LDR restrictions, these stockpiles were also loaded into ERDF containers and transported to ERDF for disposal.

In January 2006, excavation and sorting operations resumed at the 618-2 Burial Ground trenches utilizing a revised material handling strategy that eliminated the requirement for hauling the excavated material to a designated stockpile area. The revised strategy provided a mechanism for direct sorting and stockpiling of the excavated material inside the boundaries of the existing trenches. After sorting, the "in-trench" stockpiles were then sampled to ensure compliance with LDR restrictions. Upon receipt of sample results confirming compliance with LDR restrictions, the "in-trench" stockpiles were loaded into ERDF containers and transported to ERDF for disposal. Load-out of all 618-2 "in-trench" stockpile material was completed in August 2006.

3.2 WASTE SUMMARY

Waste encountered during excavation of the 618-2 Burial Ground trenches was consistent with the types of material anticipated based on reported use of the 618-2 Burial Ground for disposal of contaminated equipment, building materials, and laboratory waste from the 300 Area Facilities. The waste consisted mostly of contaminated soil and debris, with some LDR material. Small quantities of laboratory glassware, drummed oil, metal crucibles and centrifuges were unearthed in discrete areas of the burial ground. A "safe" containing laboratory material was discovered during excavation of the south trench in December 2004. Characterization of the contents of the safe, including sampling and laboratory analysis of the containers found inside the safe, is still in process. LDR material, which included the pile of abandoned automotive batteries, as well as any items containing lead and/or asbestos, were set aside and loaded-out in separate load-out campaigns, under a separate waste shipping profile for LDR materials. No evidence of bulk liquid waste disposal was observed during excavation of this waste site. Photos of waste items are provided in Appendix A.

The total amount of non-LDR waste that was transported to ERDF from the 618-2 Burial Ground waste site was approximately 71,049 metric tons (78,318 U.S. tons) as weighed across the 300 Area truck scale, in 4,181 roll-off containers. The total amount of LDR material (including the pile of abandoned automotive batteries) was approximately 154 metric tons (170 U.S. tons), in 11 roll-off containers.

3.3 FIELD SCREENING

Radiological surveys were performed during the site remedial actions to guide the excavation and after the excavation operations were substantially complete to provide an initial assessment of attainment of radiological cleanup levels. The surveys were performed using Global Positioning Environmental Radiological Surveyor (GPERS) with instrumentation specific to detection of radiation associated with gamma, beta, and alpha emitting radionuclides. A sodium iodide detector was used for gamma radiation and a plastic scintillation detector (SHP-380AB) was used for measurement of beta radiological activity. The plastic scintillation detector was used in addition to the sodium iodide detector because it responds principally to the beta radiation emitted by the uranium-238 progeny and is, therefore, a good indicator of residual uranium contamination. Due to the presence of residual plutonium contamination, a field instrument for the detection of low-energy radiation (FIDLER) was deployed as it responds well to low-energy gamma radiation emitted by plutonium-241 progeny.

3.3.1 In-Process Radiological Surveys

In-process radiological field screening was conducted during the site remedial actions to guide the excavation and quickly assess the presence and level of contamination. Contamination identified by the radiological surveys was further excavated and the site was resurveyed and sampled as necessary to verify the adequacy of removal of contaminated soil.

In June 2006, an area of yellow to orange discolored soil exhibiting high plutonium contamination was located and sampled in the eastern portion of the middle trench at a depth of 8 m (26.2 ft) below grade (111 m [463.2 ft] elevation). This location likely corresponds with the "high activity" waste disposal area of the middle trench that is discussed in the historical memo (GE 1954) concerning the February 17, 1954 fire at the 618-2 Burial Ground. An additional 1 m (3.3 ft) of soil was removed from this area and a soil sample collected at a depth of 9 m (29.5 ft) below grade. The sample results indicated residual plutonium activities decreasing with depth, but not at a rate that would support an evaluation of protection of groundwater using the "50-50" model as discussed in the RDR/RAWP (DOE-RL 2004b). Additionally, a review of historical groundwater levels in the vicinity of the 618-2 site indicated a groundwater low of 104 m (341.2 ft) above sea level (15 m [49.2 ft] below grade) and a groundwater high of 107.5 m (352.7 ft) above sea level (11.5 m [37.7] below grade). Considering this information, and in agreement with the EPA, a test pit was excavated to groundwater in August 2006 to remove the contaminated soil and to collect discrete soil samples for laboratory analysis to support further evaluation of protection of groundwater. A grab

sample of water at the base of the test pit was also collected. An additional 70 BCM (bank cubic meter) of soil was removed at this location and shipped to ERDF.

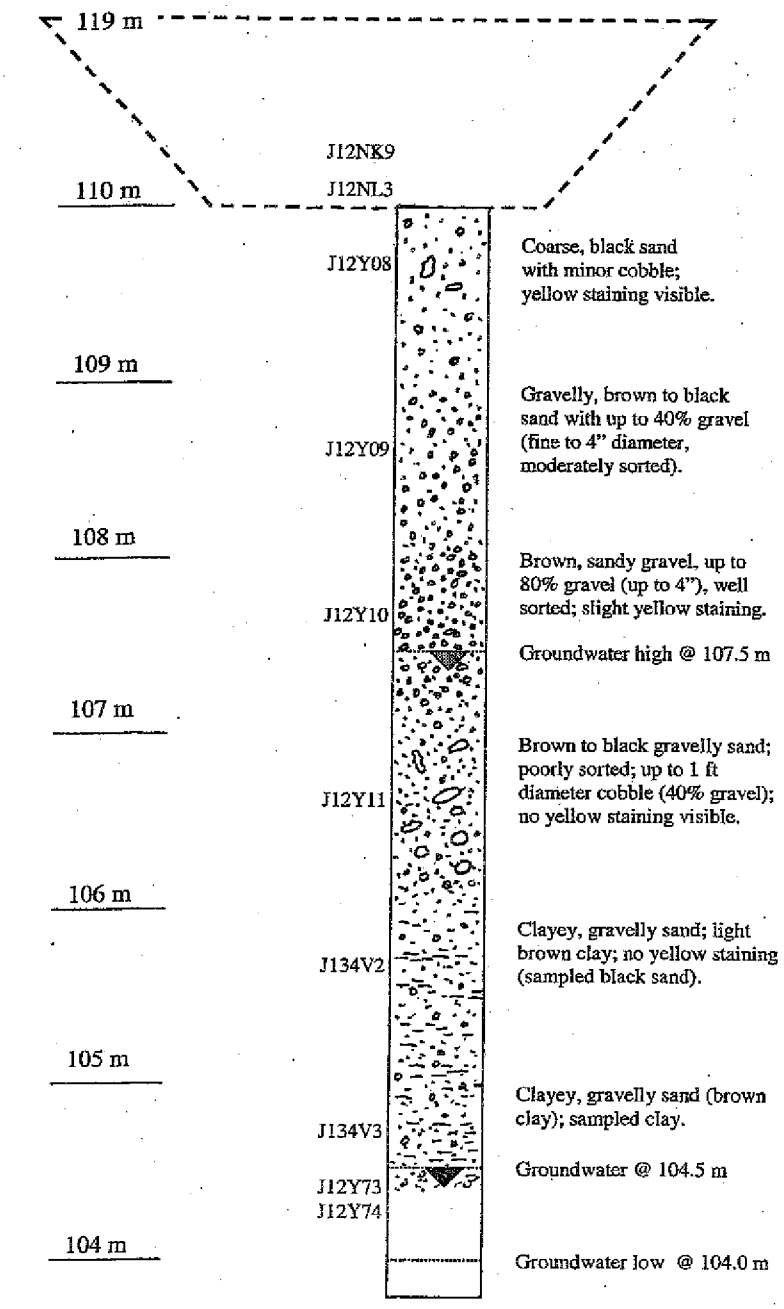
Figure 4 is a schematic of the test pit excavation and associated sample collection intervals. The results of the test pit excavation sampling (Table 3) indicate plutonium contamination was mobilized in the soil column at this location due to the presence of acid in the waste. The contamination decreased with depth to groundwater, but was still present at low activities in the soil column within the range of the historical groundwater table fluctuation (104.5 m [342.8 ft] to 107.5 m [352.7 ft]). A grab sample of water was collected for laboratory analysis and indicated the presence of contamination potentially exceeding drinking water standards. This data, however, is suspect due to the method of collection where stagnant water that had infiltrated into the excavation at the capillary fringe was collected using a backhoe bucket. The Hanford Groundwater Project will perform further evaluation of the groundwater at the 618-2 site. The results of the soil samples collected at this location for plutonium, uranium, and americium-241, including the pH measurements, are summarized in Table 3 with the complete laboratory analysis provided in Appendix B.

Table 3. Test Pit Soil Sample Results (pCi/g).

Sample Number	Sample Date	Sample Elevation (m)	pH	Am-241 (pCi/g)	Pu-238 (pCi/g)	Pu-239/240 (pCi/g)	Pu-241 (pCi/g)	U-233/234 (pCi/g)	U-235 (pCi/g)	U-238 (pCi/g)
J12NK9	6/19/06	111	NA	874	163	13,500	6,760	19	2.71	10.1
J12NL3	7/12/06	110.5	NA	295	38.7	2,350	1,160	15.1	0.468	12.8
J12Y08	8/2/06	110	6.08	332	1.47	57.2	23.5	56	3.45	50.9
J12Y09	8/2/06	109	3.66	306	21.1	1,710	776	13.9	1.16	14.4
J12Y10	8/2/06	108	6.9	111	2.39	150	67.2	16.1	0.996	15.2
J12Y11	8/2/06	107	5.94	63.6	0.827	62.1	32.7	18.2	1.32	18.1
J134V2	8/2/06	106	7.35	0.732	0.49	5.62	13.4	4.46	0.282	3.79
J134V3	8/2/06	105	7.46	2.81	0	0.918	1.15	3.33	0.117	2.71

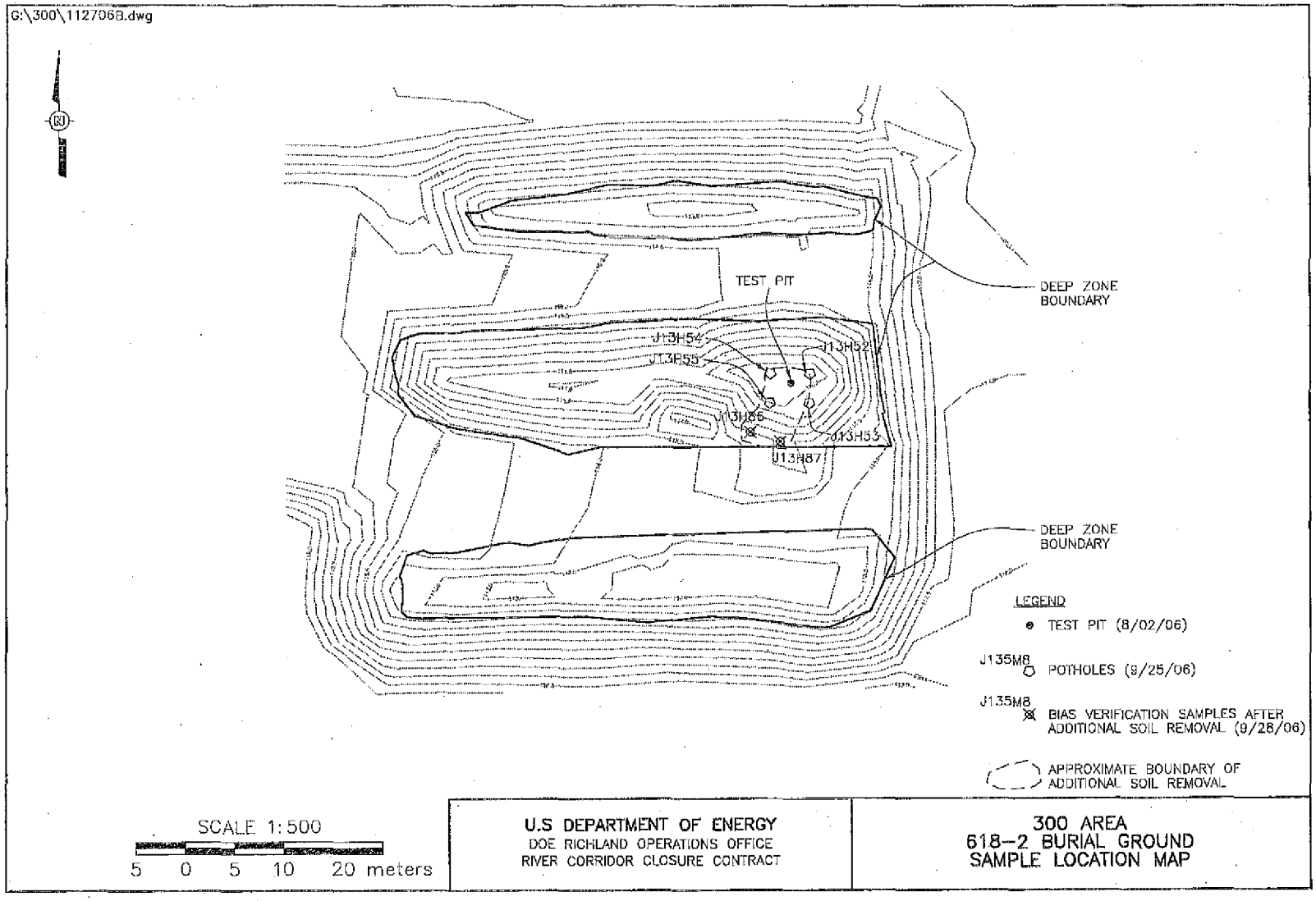
Four additional potholes were dug surrounding the test pit area (see Figure 5), to assess the adequacy of removal of the plutonium contamination. Each pothole was dug 2 m (6.6 ft) (108 m [354.3 ft] elevation) and then a discrete soil sample was collected. The pothole sampling results found residual contamination and soil discoloration in the area southwest of the original test pit excavation. Therefore, additional excavation was required. After this additional soil removal, two bias samples were collected, as discussed in Section 3.4, to verify adequacy of soil remediation. The results of the bias sampling are provided in Appendix B. Figure 5 shows the location of the test pit, the four additional potholes, and the approximate boundary of additional soil removal.

Figure 4. 618-2 Burial Ground Test Pit Sample Locations.



NOT TO SCALE

Figure 5. Location of Test Pit and Potholes.



3.3.2 Final Status Radiological Surveys

Radiological surveys were performed in August and September of 2006, after excavation operations were substantially complete at the 618-2 waste site. These surveys were performed to provide an initial assessment of attainment of radiological cleanup levels (WCH 2006a). The results of the gamma and beta radiological surveys are provided in Figures 6 and 7, respectively. Figures 8 and 9 show the low energy gamma (FIDLER) surveys for the excavation.

Figure 10 provides the low-energy gamma survey results for the staging pile area. Evaluation of the combined survey results for the excavation identified several "hot spot" areas of residual radiological contamination, shown in Figure 11, that were further characterized by collecting "hot spot" samples to support waste designation prior to performing additional soil removal. The location of these samples is shown in Figure 11 and the sample results are provided in Appendix B. An additional 205 BCM of contaminated soil was removed for disposal to ERDF. Bias closeout samples were then collected to verify adequacy of the soil removal as discussed in Section 3.4.

3.4 BIASED SAMPLING, ANALYSIS, AND RESULTS

As provided for in the SAP (DOE-RL 2004a), biased samples were collected to provide confidence for the absence of "hot spots" in residual soil beneath locations that had visual stains, buried liquid wastes, large inventories of hazardous wastes (e.g., lead bricks), or areas where characterization or radiological survey results showed elevated contamination levels. Nine discrete soil verification soil samples (i.e., bias samples) were collected, in addition to the statistical cleanup verification samples, based on agreement with the U.S. Environmental Protection Agency (EPA) and the Department of Energy to assess area-specific residual contamination within the 618-2 Burial Ground excavation. Figure 12 provides the location of the bias soil samples.

Five of the bias samples were determined by post-excavation radiological surveys, which identified suspect "hot spots" that were further excavated (Figure 11). Of these "hot spots," three located in the northern trench were predominantly cesium-137 and were evaluated after additional excavation using radiological field screening instrumentation and one was a piece of debris that was picked up. The bias sample results for the five "hot spots" that exhibited residual plutonium are provided in Appendix B.

Two bias samples were collected at locations where anomalous waste items were found. One bias sample (Bias #1) was collected from the floor of the excavation beneath the location where "the safe" was found. The second bias sample (Bias #2) was collected from the floor of the excavation beneath the former location of several waste oil drums. In addition, two bias soil samples were collected adjacent to the test pit in an area where stained soil had been removed. The results of the bias verification soil samples are provided in Appendix B.

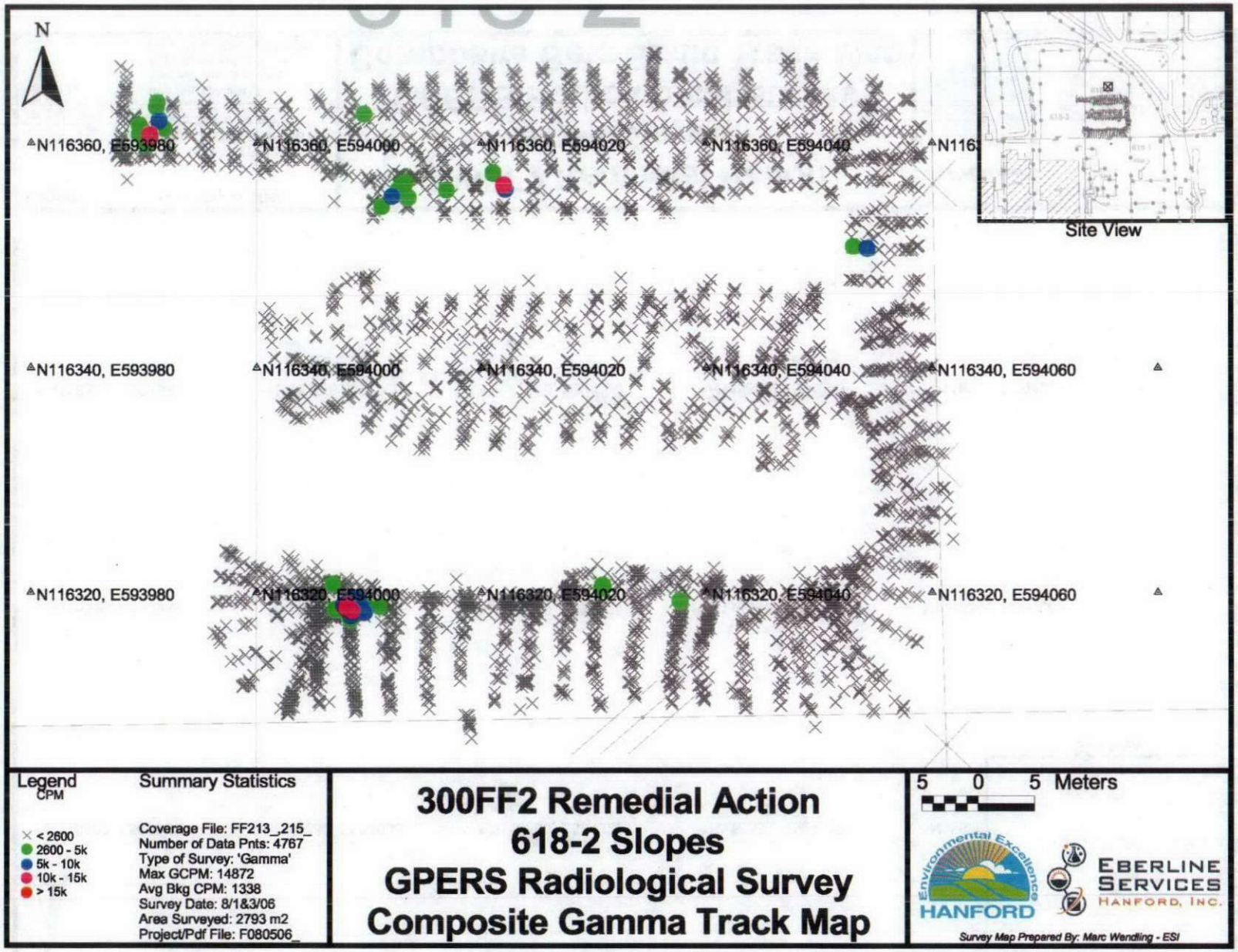


Figure 6. Radiological Mapping (Gamma) Survey Results for the 618-2 Site.

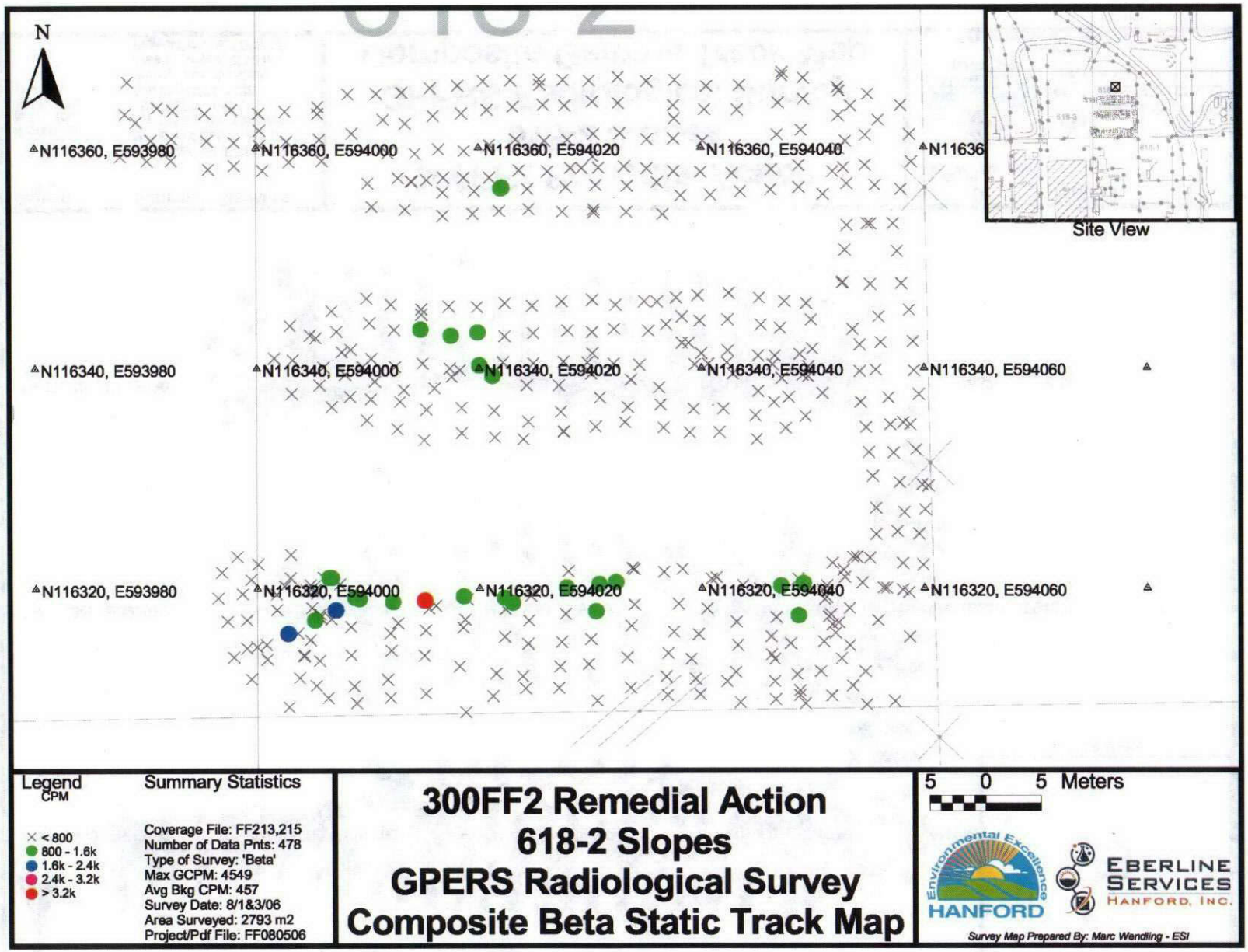


Figure 7. Radiological Mapping (Beta) Survey Results for the 618-2 Site.

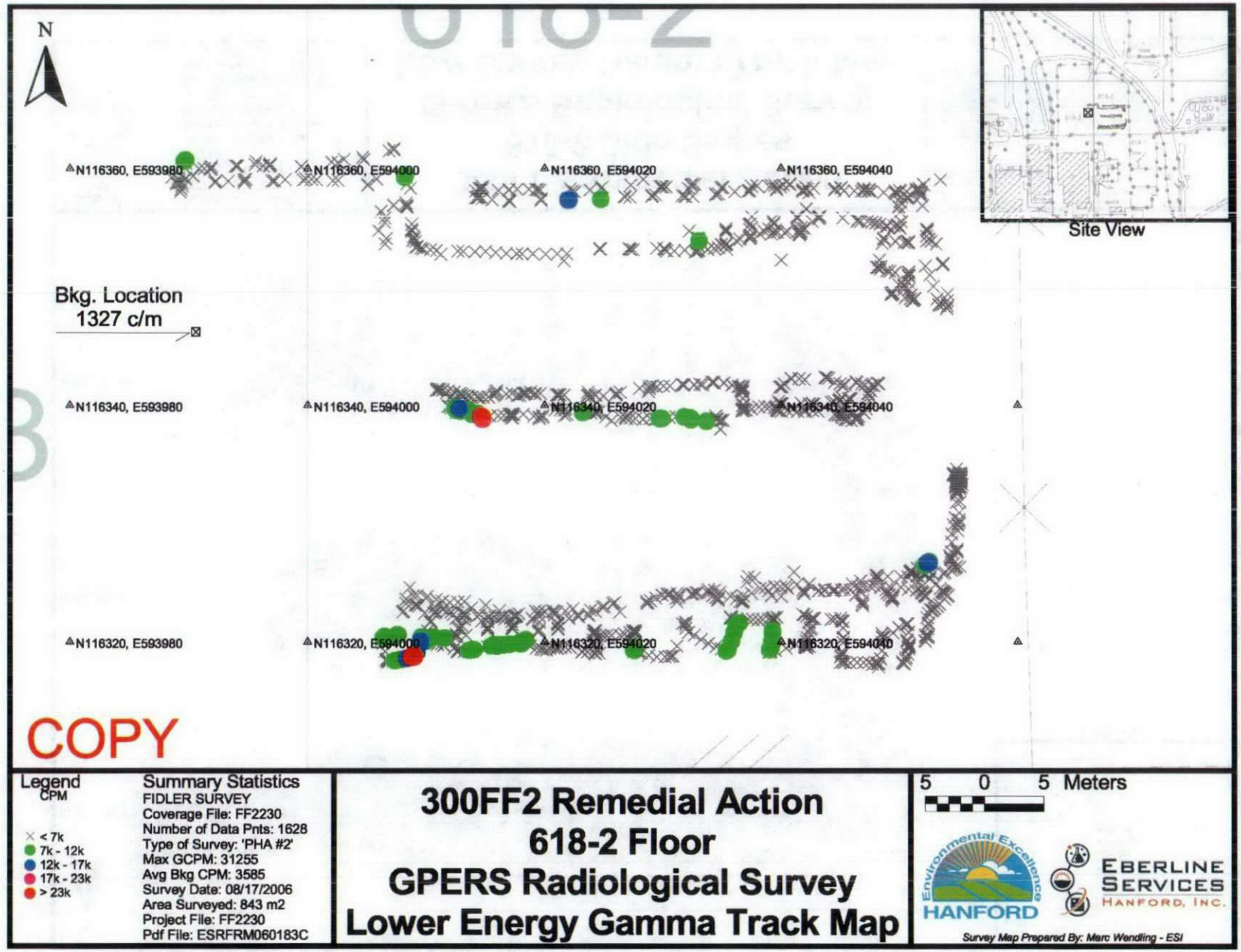


Figure 8. Radiological Mapping (FIDLER) Survey Results for the 618-2 Site.

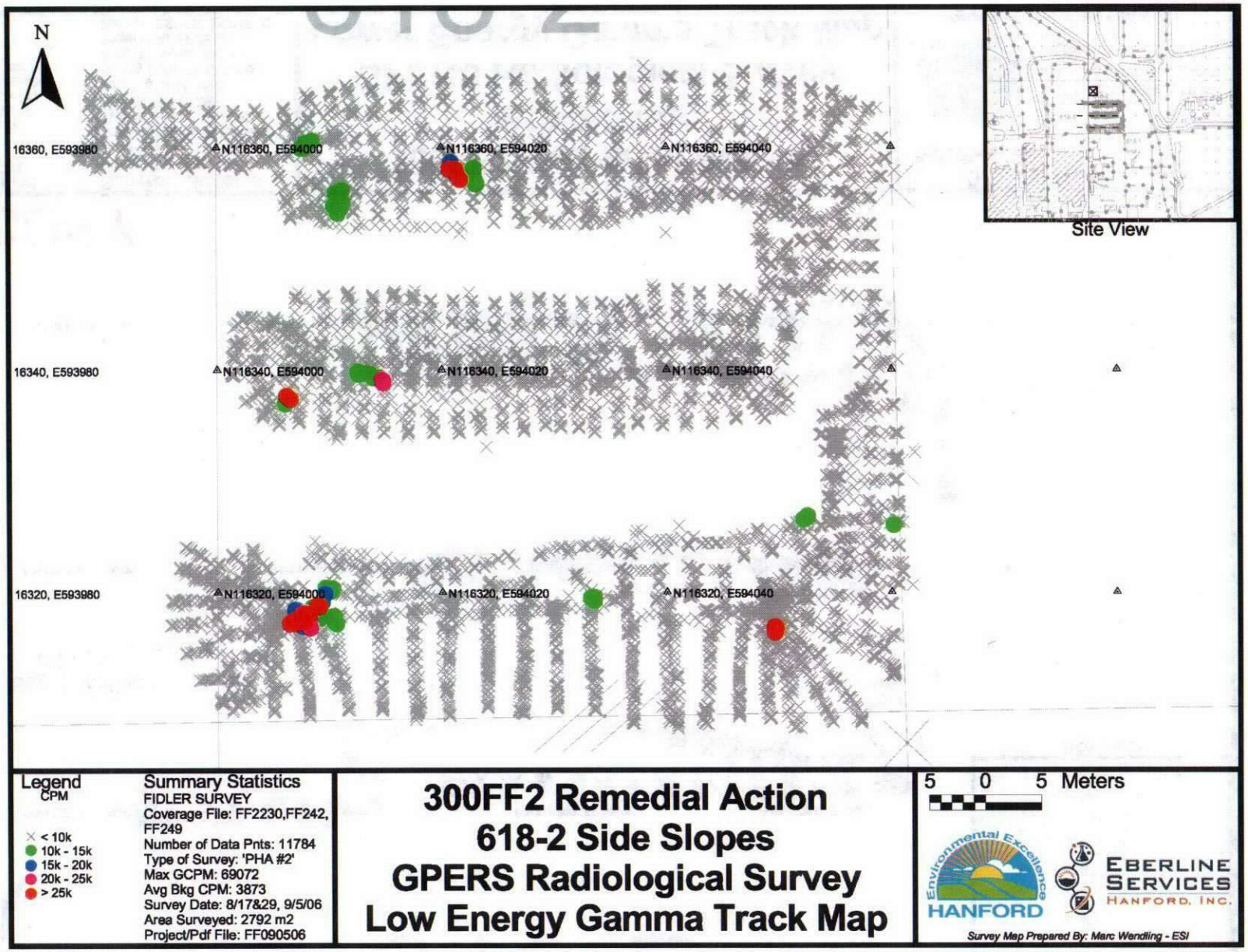
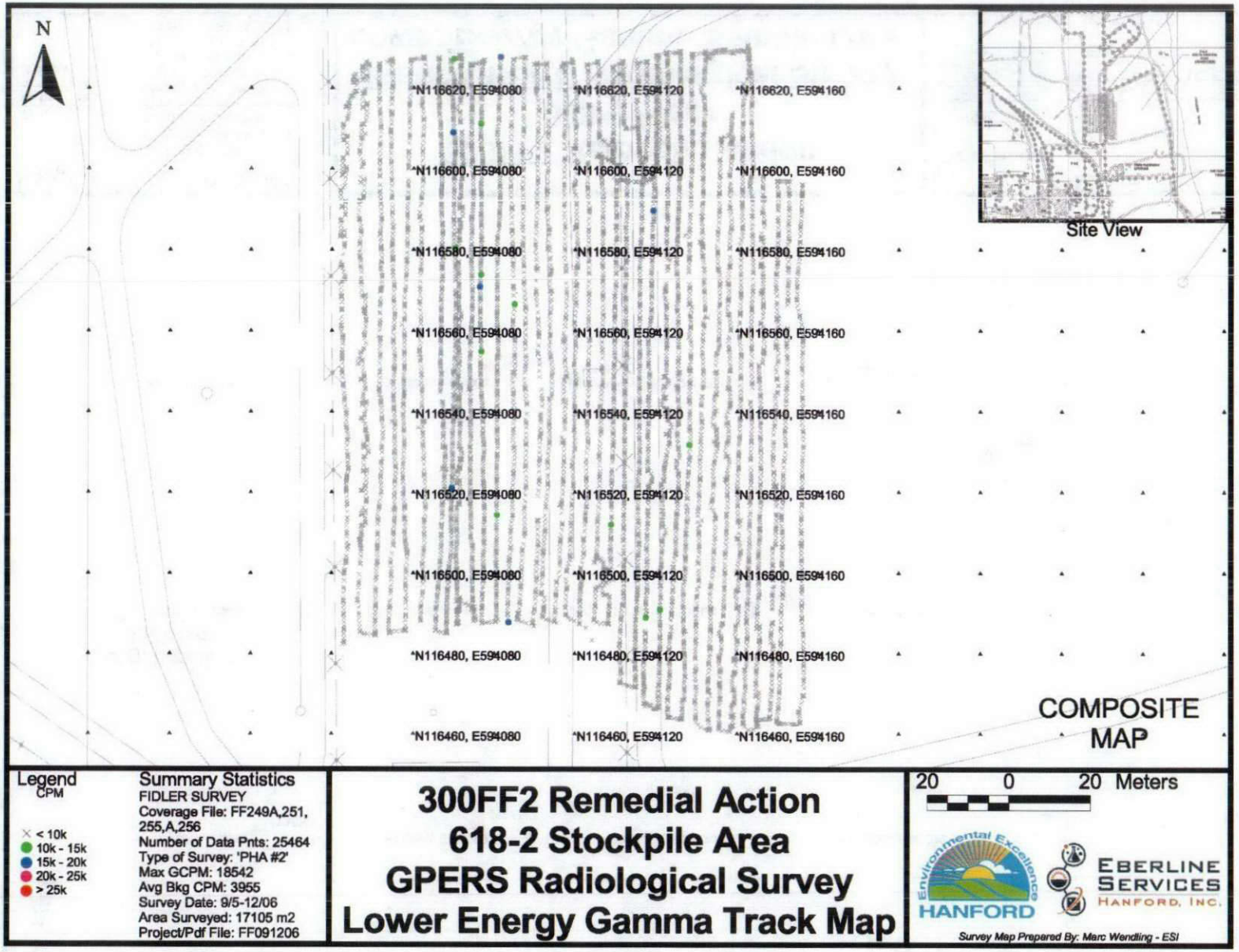


Figure 9. Radiological Mapping (FIDLER) Survey Results for the 618-2 Site.

Figure 10. Radiological Mapping (FIDLER) Survey Results for the Staging Pile Area.



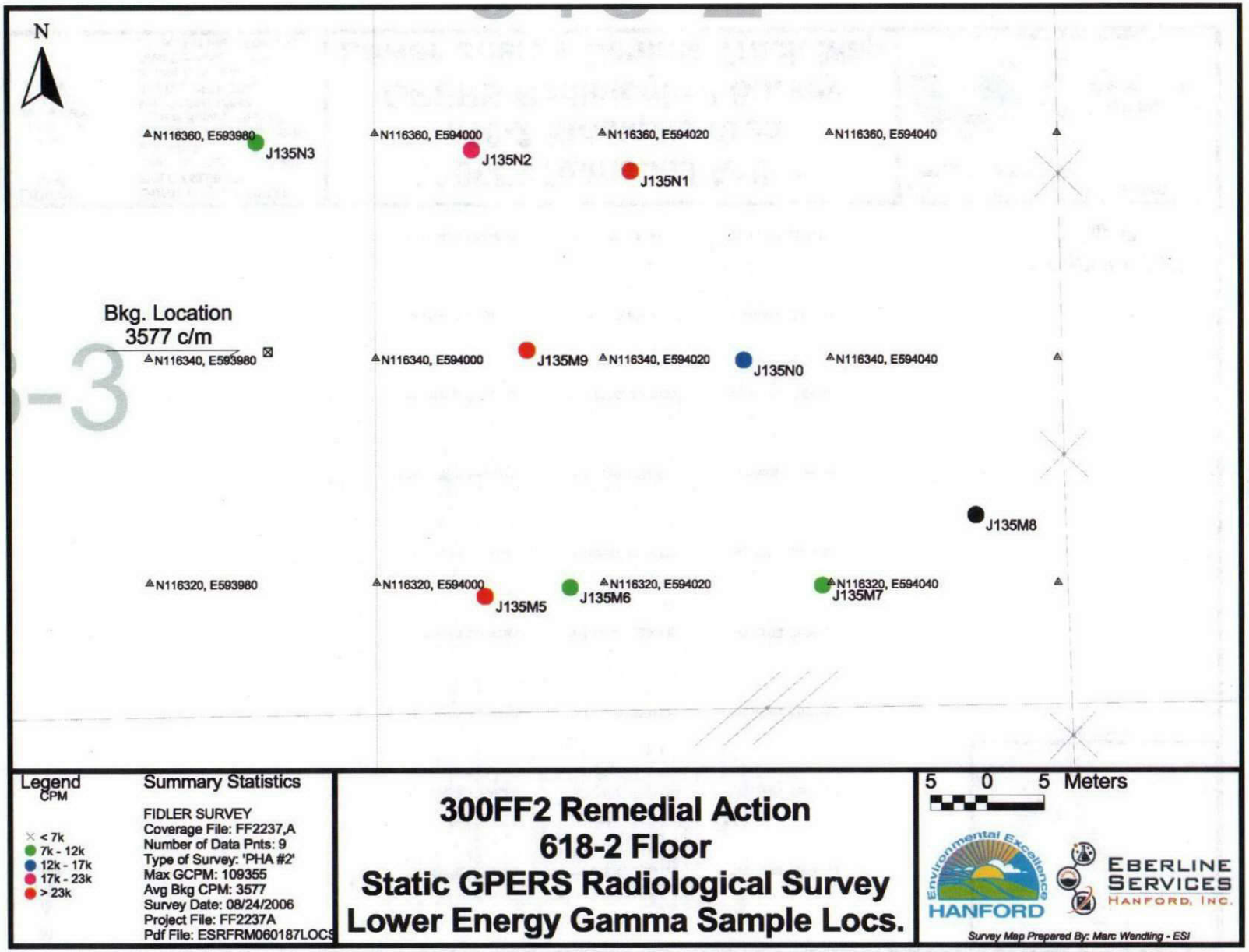
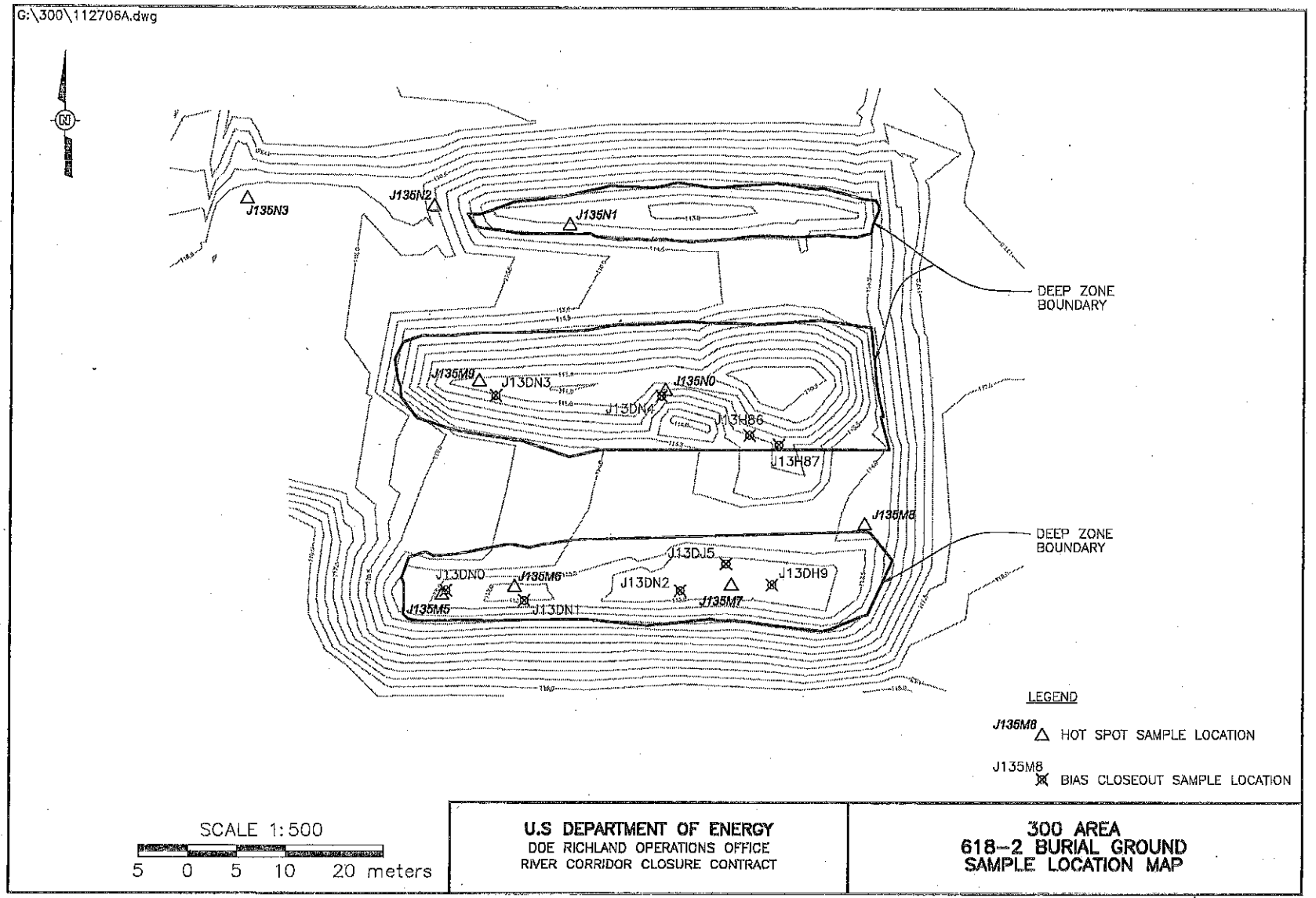


Figure 11. Radiological Survey Locating "Hot Spots."

Figure 12. Map of Bias Sample Locations.



3.5 CLEANUP VERIFICATION SAMPLING AND ANALYSIS

Final cleanup verification samples were collected on September 6 and 7, 2006, to confirm acceptability of residual contaminant concentrations in the soil at the 618-2 waste site (WCH 2006a, 2006b). Each verification sample was a composite formed by combining soil collected at four randomly selected nodes within each sampling area. The sample design methodology and sample location figures are presented in the calculation brief for verification sample design in Appendix D. The final verification samples were submitted to offsite laboratories for analysis using approved EPA analytical methods as required per the SAP (DOE-RL 2004a).

The 618-2 Burial Ground verification sampling events involved four decision units including a shallow zone, deep zone, overburden soil stockpile, and staging pile/decontamination pad footprint. The staging pile/decontamination pad supported the 618-2, 618-3, and 618-8 Burial Ground excavations and, therefore, arsenic and silver were added as COPCs for staging pile/decontamination pad only. The division of the site excavation into shallow zone and deep zone decision units, as shown on the sample design figures in Appendix D, is a function of the applicable RAGs. The direct exposure, groundwater protection, and river protection RAGs are applicable to soils within 4.6 m (15 ft) of the ground surface. This soil zone is referred to as the shallow zone. The groundwater protection and river protection RAGs are applicable to soils greater than 4.6 m (15 ft) below the ground surface. This soil zone is referred to as the deep zone. The 618-2 site consisted of both a shallow and a deep zone decision unit. The site was excavated to a depth of approximately 6 m (19.7 ft), with the shallow zone consisting of the excavation sidewalls to a depth of 4.6 m (15 ft) and the deep zone consisting of the excavation sidewalls below 4.6 m (15 ft) together with the floor of the excavation. All deep zone samples were collected below 4.6 m (15 ft).

The number of decision subunits is determined by the overall footprint area of the decision unit, with the default number of verification samples for each decision unit being four composite samples. The required number of verification samples for each of the decision units associated with the 618-2 Burial Ground waste site are listed in Table 4.

Table 4. Number of Verification Samples for 618-2 Burial Ground.

Decision Unit	Waste Site Footprint (ft^2)	Size Classification (ft^2)	Decision Subunits	Verification Samples
Residual soil (Shallow Zone)	32,570	Small (<100,000)	1	4 composite
Residual soil (Deep Zone)	12,665	Small (<100,000)	1	4 composite
Residual soil (Overburden)	20,270	Small (<100,000)	1	4 composite
Residual soil (Waste staging and decontamination pad footprint)	250,131	Medium (>100,000 to 400,000)	4	16 composite

4.0 CLEANUP VERIFICATION DATA EVALUATION

This section presents the evaluation and modeling of the 618-2 cleanup verification data for comparison with the data quality criteria and RAGs.

4.1 DATA QUALITY ASSESSMENT PROCESS

A data quality assessment (DQA) is performed to compare the verification sampling approach and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 618-2 waste site determined that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. All analytical data were found to be acceptable for decision-making purposes. The evaluation also verified that the sample design was sufficient to support clean site verification. The cleanup verification sample analytical data are stored in the Environmental Restoration database prior to archiving in the Hanford Environmental Information System and are summarized in Appendix B. The detailed DQA is presented in Appendix C.

4.2 CONTAMINANTS OF CONCERN 95% UPPER CONFIDENCE LIMIT

The primary statistical calculation to support cleanup verification is the 95% UCL on the arithmetic mean of the data. The 95% UCL values for each COC are computed for the decision unit. Prior to calculating the 95% UCL, the individual sample results are reviewed and, as appropriate, adjusted per the SAP (DOE-RL 2004a). This process is summarized below.

Radionuclides: The laboratory-reported value is used in the calculation of the 95% UCL. In cases where the laboratory does not report a value for data qualified with a "U" (i.e., less than the detection limit), one-half of the minimum detectable activity is used in the calculation of the 95% UCL.

Nonradionuclides: For data flagged with a "U" (i.e., less than the detection limit), a value equal to one-half the practical quantitation limit is used for in the calculation of the 95% UCL, as required by *Washington Administrative Code* (WAC) 173-340-740[7][g] (1996). If greater than half of the sample results for a given nonradionuclide COC are below detection, the statistical value is set equal to the maximum concentration detected (i.e., versus computing a 95% UCL).

Statistical calculations for 618-2 verification data are presented in the 95% UCL calculation briefs (Appendix D), with results shown in Table 5. Uranium background concentrations are accounted for in the shallow zone, deep zone, overburden soils and combined staging pile and decontamination pad area by subtracting the background

concentration from the statistical value. Anthropogenic and naturally occurring radionuclide background are accounted for in the overburden soil only by subtracting the background concentration from the statistical value.

Table 5. Statistical Cleanup Verification Data Set. (2 Pages)[a]

COCs	Hanford Site Background	Shallow Zone	Deep Zone	Overburden	Staging Pile/ Decon Pad
Radionuclide Concentration (pCi/g)					
Americium-241	NA	0.54	6.52	.023 U	0.15
Cesium-137	1.1[b]	1.5	0.914	0 (<BG)	0.032
Cobalt-60	0.008[b]	0.021 U	0.023 U	0.013 U	0.020 U
Europium-152	NA	0.055 U	0.068 U	0.054 U	0.052 U
Europium-154	0.033[b]	0.070 U	0.080 U	0.037 U	0.070 U
Europium-155	0.054[b]	0.069 U	0.13 U	0.0077 U	0.064 U
Nickel-63	NA	0.498 U	0.261 U	0.648 U	0.85 U
Tritium	NA	0.0938 U	0.788 U	0.862 U	0.98
Plutonium-238	0.004[b]	0.056 U	1.08	0.038 U	0.067 U
Plutonium-239/240	0.025[b]	5.2	72.9	0.065 U	1.8
Plutonium-241	NA	14.5 U	34.3	1.32 U	2.5 U
Strontium-90	0.18[b]	0.037 U	7.4	0 (<BG) U	0.055 U
Uranium-233/234	1.1[b]	0.930	108	0 (<BG)	0.339
Uranium-235	0.11[b]	0.062	2.24	0 (<BG) U	0.0066
Uranium-238	1.1[b]	1.07	111	0 (<BG)	0.294
Nonradionuclide Concentration (mg/kg)					
Arsenic	6.5	1.9	1.4	2.6	3.4
Barium	132	73.6	76.9	70.9	67.5
Cadmium	0.81[c]	0.09 U	0.09 U	0.09 U	1.4 U
Chromium	18.5	6.6	5.7	6.0	6.4
Lead	10.2	4.9	5.5	4.2	4.0
Selenium	0.78[c]	0.76	0.78	1.0	1.4 U
Silver	0.73	NA	NA	NA	2.9 U
Tin	NA[d]	2.3	2.9	2.4	28.8 U

Table 5. Statistical Cleanup Verification Data Set. (2 Pages)[a]

COCs	Hanford Site Background	Shallow Zone	Deep Zone	Overburden	Staging Pile/ Decon Pad
Uranium (total)	3.21	4.17	338	1.06	3.32

[a] Laboratory data, including the minimum detectable activity or practical quantitation limit for the individual cleanup verification samples, are included in Appendix B and the 95% UCL calculation brief in Appendix D.
[b] DOE-RL, 1996, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, DOE/RL-96-12, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
[c] Hanford Site-specific background not available. Value is from Ecology publication 94-115 (Ecology 1994).
[d] No Hanford Site-specific background is available.

BG = background NA = not applicable
COC = contaminant of concern U = undetected

4.3 BIASED SAMPLE RESULTS

Nine biased grab samples were collected. The sample locations are shown in Figure 12. Five were located at suspect hot spots as determined from post-excavation radiological surveys. Bias samples were also collected below the location of the safe and also below the location of the drums. Two bias samples were collected in an area southwest of the test pit to verify the adequacy of removal of the plutonium soil contamination (Figures 5 and 12).

Statistical analysis (e.g., calculation of a 95% UCL value) is inappropriate for evaluation of biased samples; therefore, the sample results for each biased sample are evaluated using the maximum detected activity for each COC and comparing the value directly to the cleanup level. Table 6 provides a comparison of the maximum result of the nine biased samples against the cleanup criteria. Individual sample results are provided in Appendix B.

Table 6. Maximum Results from Biased Sampling. (2 Pages)

Contaminant of Concern	Maximum Result	Industrial Land-Use Soil Cleanup Level		Does the Maximum Result Meet the Cleanup Level?
		Direct Exposure	Groundwater Protection	
Nonradionuclides (mg/kg)				
Arsenic	3.3	58	NA	Yes
Barium	109	4,900	NA	Yes
Cadmium	0.20	139	NA	Yes
Chromium	10.4	>1,000,000	NA	Yes
Lead	6.8	1,000	NA	Yes
Selenium	1.2	17,500	NA	Yes
Silver	0.6	17,500	NA	Yes
Tin	42.5	>1,000,000	NA	Yes

Table 6. Maximum Results from Biased Sampling. (2 Pages)

Contaminant of Concern	Maximum Result	Industrial Land-Use Soil Cleanup Level		Does the Maximum Result Meet the Cleanup Level?
		Direct Exposure	Groundwater Protection	
Total uranium[a]	148	505	385	Yes
Aroclor-1254	0.0069	65.6	0.438	Yes
Radionuclides				
Americium-241	9.19	210	NA	Yes
Cesium-137	1.12	25	NA	Yes
Plutonium-238	1.57	155	NA	Yes
Plutonium-239/240	91.6	245	NA	Yes
Plutonium-241	32.9	12,900	NA	Yes
Strontium-90	7.20	2,500	NA	Yes
Uranium-233/234[b,c]	47.8	169	129	Yes
Uranium-235[b,c]	2.42	17	13	Yes
Uranium-238[b,c]	50.1	164	125	Yes

[a] Reported total uranium value is based on summation of laboratory-reported isotopic uranium concentrations.
[b] The industrial scenario groundwater protection selected soil cleanup level for total uranium (267 pCi/g) was calculated using RESRAD, based on the generic site model, with a length parallel to groundwater of 100 m (328 ft) and distribution coefficient values of 8.9 mL/g for the contaminated unsaturated zone and 0 mL/g for the saturated zone (with no unsaturated, uncontaminated zone) (DOE-RL 2004b).
[c] Values determined using uranium equilibrium isotopic ratios and the industrial scenario selected soil cleanup levels for total uranium as provided in the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (DOE-RL 2004b).
RESRAD = RESidual RADioactivity (dose model) NA = not applicable

4.4 SITE-SPECIFIC CLEANUP VERIFICATION MODEL

The statistical values summarized in Table 5 were evaluated and used to develop a site-specific cleanup verification model. The 618-2 site cleanup verification model comprises two depth intervals: (1) the shallow zone and overburden and (2) the deep zone (4.6 m [15 ft] below surrounding grade). Based on the conservative assumption that residual contaminant levels in the deep zone data set extend uniformly to groundwater (as discussed in the RDR/RAWP [DOE-RL 2004b]), residual soil activities of uranium 233/234, uranium-235, and uranium-238 are predicted to reach groundwater but at concentrations below the RAG for total uranium (30 µg/L = 21.2 pCi/g).

4.5 RESRAD MODELING

The individual radionuclide cleanup verification statistical values (Table 5) were entered into the RESidual RADioactivity dose assessment model (RESRAD) computer code, Version 6.30 (ANL 2005), to estimate the dose rate and to estimate the impact on groundwater and the river from residual COC concentrations. The individual

contributions from the shallow zone and the deep zone, and the combined staging pile and decontamination footprint were separately evaluated for direct exposure pathways and groundwater protection. No RESRAD modeling was performed for the overburden because all radionuclides were either undetected or below background.

The RESRAD modeling methodologies, results, input values, and the site-specific cleanup verification model are included in the RESRAD calculation brief (Appendix D). Specific results from the calculations are discussed in the RAG evaluation section (Section 5.0).

5.0 EVALUATION OF REMEDIAL ACTION GOAL ATTAINMENT

This section demonstrates that remedial actions at the 618-2 waste site have achieved the RAGs developed to support industrial land use at the 300 Area as established in the ESD (EPA 2004) and documented in the RDR/RAWP (DOE-RL 2004b). Since the combined staging pile and decontamination pad area was located in an uncontaminated area, the sample results are compared against the unrestricted land-use soil cleanup levels listed in Table 2. Section 5.4 documents application of the WAC 173-340 three-part test to the shallow zone, deep zone, overburden, and combined staging pile and decontamination pad area. This test is required for nonradionuclide COCs only and is based on the most restrictive RAG for each zone.

5.1 DIRECT EXPOSURE SOIL REMEDIAL ACTION GOALS ATTAINED

5.1.1 Radionuclides

5.1.1.1 Direct Comparison to RAGs. The results of the RESRAD dose rate estimates for the combined shallow and deep zone and for the combined staging pile and decontamination pad area, all-pathways scenarios are presented in Figures 13 and 14, respectively. The dose rates represent the dose contributions from soils at relevant time periods. The dose rate is largest at present (year 2006), 1.19 mrem/yr, for the combined shallow and deep zones. The maximum dose rate for the combined staging pile and decontamination pad area is 0.212 mrem/yr at present (year 2006). The estimated dose rate in the year 2018 is 0.999 mrem/yr for shallow and deep zone and 0.202 mrem/yr for the combined staging pile and decontamination pad area. The 2018 date corresponds to the 30-year site cleanup schedule of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989). All dose rate estimates are less than the 15 mrem/yr RAG. The RESRAD computations are presented in detail in the referenced calculation briefs summarized in Appendix D.

Figure 13. RESRAD Analysis – All-Radionuclides, All-Pathways Dose Rate Estimate – Combined Shallow and Deep Zone.

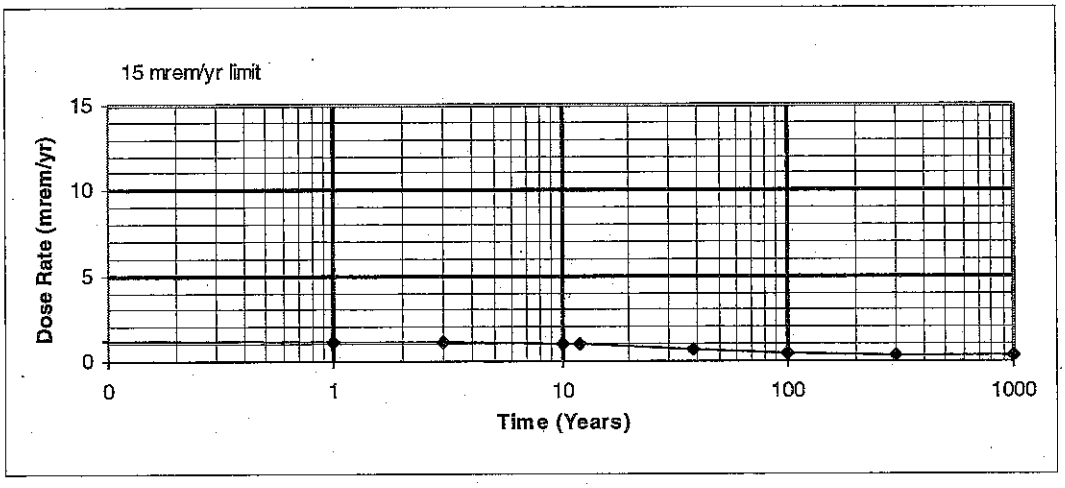
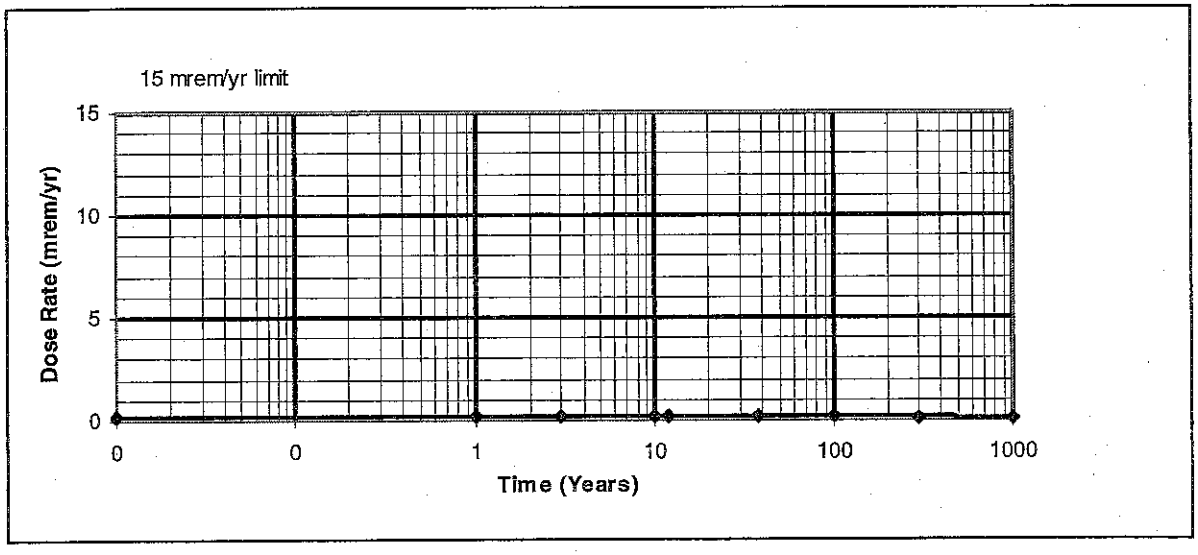


Figure 14. RESRAD Analysis – All-Radionuclides, All-Pathways Dose Rate Estimate – Combined Staging Pile and Decontamination Pad Areas.



5.1.1.2 Radionuclide Risk. The results of the RESRAD analysis for radionuclide excess lifetime cancer risk (ELCR) for the combined shallow and deep zone, and the combined staging pile and decontamination area are shown in Figures 15 and 16, respectively. The maximum ELCR for the combined shallow and deep zone is 1.5×10^{-5} and occurs at year 2006. The maximum ELCR for the combined staging pile and decontamination area is 9.58×10^{-7} and occurs in year 2006. The ELCR predicted for the year 2018 is 1.19×10^{-5} for the combined shallow and deep zone and 8.70×10^{-7} for the combined staging pile and decontamination area. Therefore, both the combined shallow and deep zone ELCR and the combined staging pile and decontamination area attain the CERCLA risk range of 10^{-4} to 10^{-6}.

5.1.2 Nonradionuclides

5.1.2.1 Direct Comparison to RAGs. All nonradionuclide COCs were either not detected, detected below background levels, or below RAGs per the 300 Area RDR/RAWP as shown in Tables 5 and 6. Therefore, all applicable RAGs are met.

5.1.2.2 Noncarcinogenic Hazard Quotient RAG Attained. For noncarcinogenic COCs, WAC 173-340-745(a) and (b) specify the evaluation of the hazard quotient which is given as a daily intake divided by a reference dose. For the shallow zone, tin and uranium were detected above background with calculated individual hazard quotients of 2.3×10^{-6} and 8.3×10^{-3}, respectively, resulting in a cumulative hazard quotient of 8.3×10^{-3}. Selenium, tin, and uranium detected in the overburden resulted in individual respective hazard quotients of 5.7×10^{-6}, 2.3×10^{-6} and 2.1×10^{-3} with a cumulative hazard quotient of 2.2×10^{-3}. For the combined staging pile and decontamination area, only uranium was detected above background resulting in both an individual and cumulative hazard quotient of 4.1×10^{-2}. This evaluation is shown in the 95% UCL calculation brief (Appendix D). All calculated individual and cumulative hazard quotients were less than 1.0, therefore, the noncarcinogenic hazard quotient RAG has been attained for the 618-2 waste site.

Figure 15. RESRAD Analysis – Radionuclide Risk, All Pathways – Combined Shallow and Deep Zone.

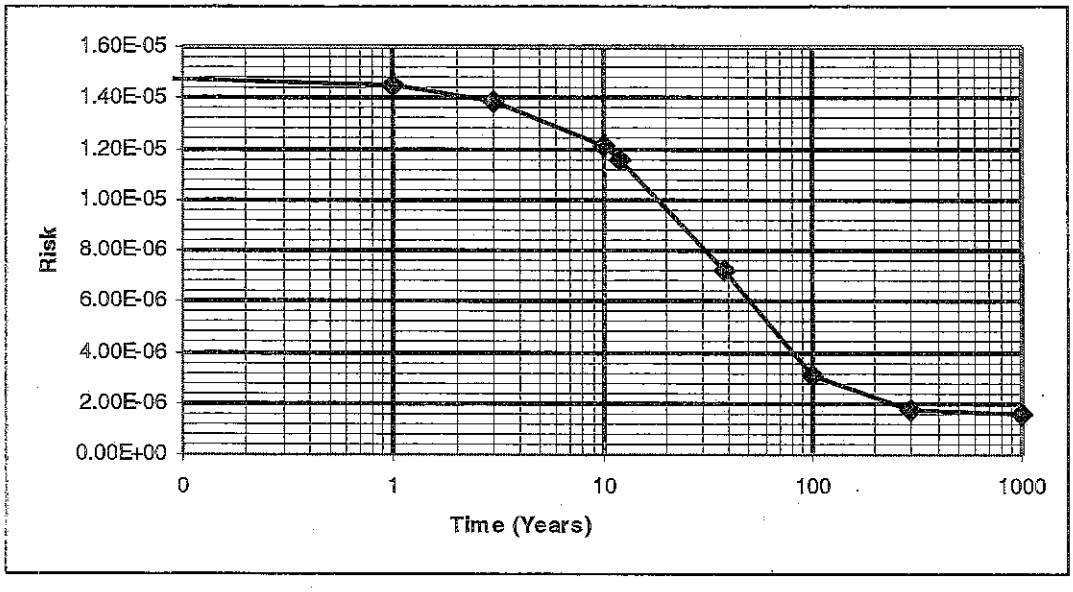
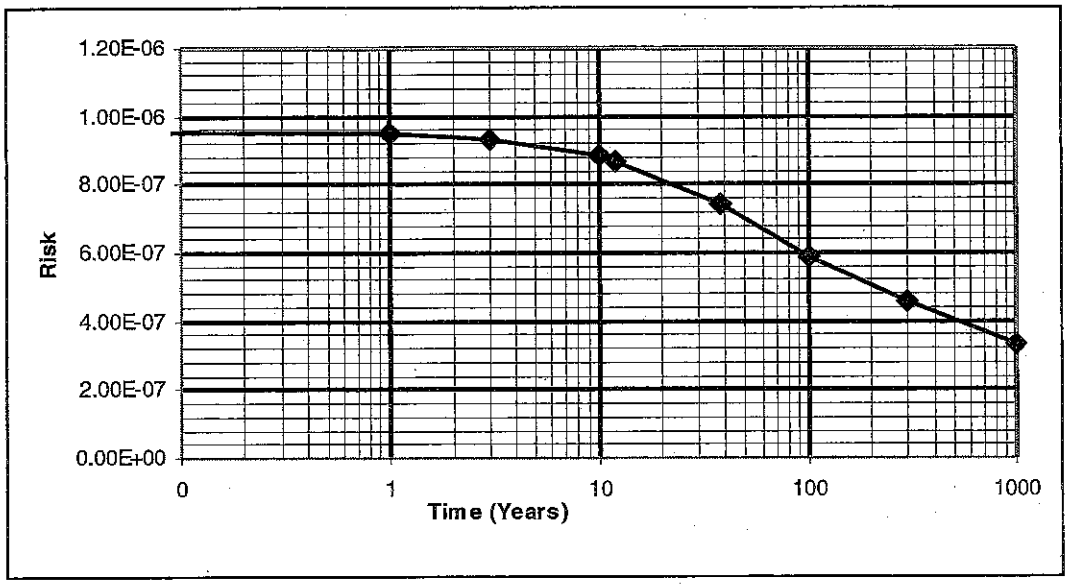


Figure 16. RESRAD Analysis – Radionuclide Risk – Combined Staging Pile and Decontamination Pad Areas.



5.1.2.3 Carcinogenic Risk RAG Attained. For individual nonradionuclide carcinogenic COCs, the WAC 173-340-745(4)(a)(iii) Method C cleanup limits are based on an industrial land-use incremental cancer risk of 1×10^{-5}. The cumulative excess cancer risk for all nonradionuclide carcinogenic COCs must also be less than 1×10^{-5} (WAC 173-340). Excess cancer risk was not calculated because the nonradionuclide carcinogenic COCs (arsenic and cadmium) were either not detected or detected below the statistical background levels.

5.2 GROUNDWATER REMEDIAL ACTION GOALS ATTAINED

5.2.1 Radionuclides

For the radionuclide contaminants of concern, only uranium-233/234, uranium-235 and uranium-238 are predicted to reach groundwater and at concentrations below the RAG established for the protection of groundwater (21.2 pCi/L) (EPA 2004, DOE-RL 2004b).

5.2.2 Nonradionuclides

All nonradionuclide COCs were either not detected, detected below background or below remedial action goals (as shown in Tables 5 and 6) and, therefore, are protective of the groundwater RAGs.

5.3 COLUMBIA RIVER REMEDIAL ACTION GOALS ATTAINED

5.3.1 Radionuclides

The cleanup verification statistical values for isotopic uranium were detected below the total uranium soil cleanup level of 267 pCi/g, which has been determined to be protective of the Columbia River (EPA 2004, DOE-RL 2004b).

5.3.2 Nonradionuclides

All nonradionuclide COCs were either not detected, detected below background levels, or below remedial action goals (as shown in Tables 1 and 2) and, therefore, are protective of the Columbia River. Selenium was not detected in any of the verification samples collected from the combined waste staging pile/decontamination pad area; however, the laboratory practical quantification limit of 1.4 mg/kg, exceeded the RAG of 1.0 mg/kg for protection of the Columbia River. Even if selenium were present at a concentration exceeding 1.4 mg/kg, it has a large K_d (150 mL/g) and therefore RESRAD predicts it will not reach groundwater or the Columbia River within 1,000 years.

5.4 WAC 173-340 THREE-PART TEST FOR NONRADIONUCLIDES

The WAC 173-340-740(7)(e) three-part test is applicable to nonradionuclide COCs and consists of the following criteria: (1) the cleanup verification statistical value must be less than the cleanup level, (2) no single detection can exceed two times the cleanup criteria, and (3) the percentage of samples exceeding the cleanup criteria must be less than 10%. The most restrictive RAG (defined as the lowest of the direct exposure, groundwater protection, and river protection RAGs) is used for the test.

Selenium, tin, and uranium were the only nonradionuclides detected above background in the statistical verification data sets. The three-part test was not performed for selenium for the shallow zone, deep zone, and combined waste staging pile/ decontamination pad area because it was either not detected or was found at a concentration only slightly above the most restrictive RAG of 1.0 mg/kg for protection of the Columbia River and well below the direct exposure industrial land use RAG of 17,500 mg/kg. Additionally, as stated in Section 5.3.2, even if selenium were present at a concentration exceeding 1.4 mg/kg, it has a large K_d (150 mL/g) and RESRAD predicts it will not reach groundwater within 1,000 years. The three-part test was not performed for tin because it was either not detected or was found at concentrations that RESRAD modeling predicts will not reach the groundwater within 1,000 years per the RDR/RAWP (DOE-RL 2004b). Table 7 summarizes the results of the WAC 173-340-740[7][e] three-part test for the 618-2 cleanup verification nonradionuclide data sets for selenium and uranium in comparison to the most restrictive applicable RAG using industrial land use for the shallow zone, deep zone and overburden and unrestricted land use for the combined waste staging pile/decontamination pad area. The table lists the most restrictive RAG (from Table 1 and Table 2 as applicable), the maximum detected value, the total number of samples collected, and the percentage of samples

exceeding the RAG. The final column of the table describes the result of applying the three criteria using the values listed in the preceding columns.

Table 7. Application of the WAC 173-340 Three-Part Test.

Contaminant of Concern	Most Restrictive Applicable RAG[a] (mg/kg)	Statistical Cleanup Verification Value (mg/kg)[b]	Maximum Detected Cleanup Verification Value (mg/kg)[c]	Total Number of Samples[d]	Percentage of Cleanup Verification Data Set Exceeding RAG[e]	Cleanup Criteria Attained?
Shallow Zone						
Uranium	385	4.17	4.53	4	0	Yes
Deep Zone						
Uranium	385	338	501	4	25%	Yes[f]
Overburden						
Selenium	1	1.0	1.0	4	0	Yes
Staging Pile/Decontamination Area						
Uranium	53	3.32	11.2	16	0	Yes

[a] From Table 1, the most restrictive RAG is the soil RAG for protection of the Columbia River.
[b] Criterion is statistical value cannot exceed most restrictive applicable RAG.
[c] Criterion is no single detection can exceed two times the most restrictive applicable RAG.
[d] Total number of samples in the decision unit includes field duplicate samples, which are included in the evaluation as separate samples.
[e] Criterion is percentage of data set exceeding the most restrictive applicable RAG cannot exceed 10%.
[f] RESRAD modeling of the isotopes that comprise total uranium predict that the total concentration of uranium that may reach groundwater will not exceed the total uranium standard of 21.2 pCi/L.
RAG = remedial action goal RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

6.0 STATEMENT OF PROTECTIVENESS

This cleanup verification package demonstrates that remedial action at the 618-2 waste site has achieved the RAOs and corresponding RAGs established for the industrial land-use scenario in the ROD (EPA 2001), the ESD (EPA 2004), and the RDR/RAWP (DOE-RL 2004b). The contaminated materials from the site have been excavated and disposed of at ERDF. The remaining soil at the 618-2 site has been sampled, analyzed, and evaluated. Results indicate that the site supports future land uses that can be represented (or bounded) by the industrial land-use scenario and poses no threat to groundwater or the Columbia River. Institutional controls are required to prevent drilling or excavation into the deep zone. The 618-2 waste site is verified to be remediated in accordance with the ROD (EPA 2001) and the ESD (EPA 2004) and may be backfilled.

This cleanup verification package also demonstrates that the combined waste staging pile and decontamination pad area for the 618-2, 618-3, and 618-8 Burial Grounds do not preclude any future uses, as bounded by the rural-residential scenario, and provided

for in the ESD (EPA 2004) and the RDR/RAWP (DOE-RL 2004b) and allow unrestricted use of shallow zone soils within this area. In consideration of this and because the waste staging pile area has no deep zone, no institutional controls are required at the waste staging pile location.

7.0 REFERENCES

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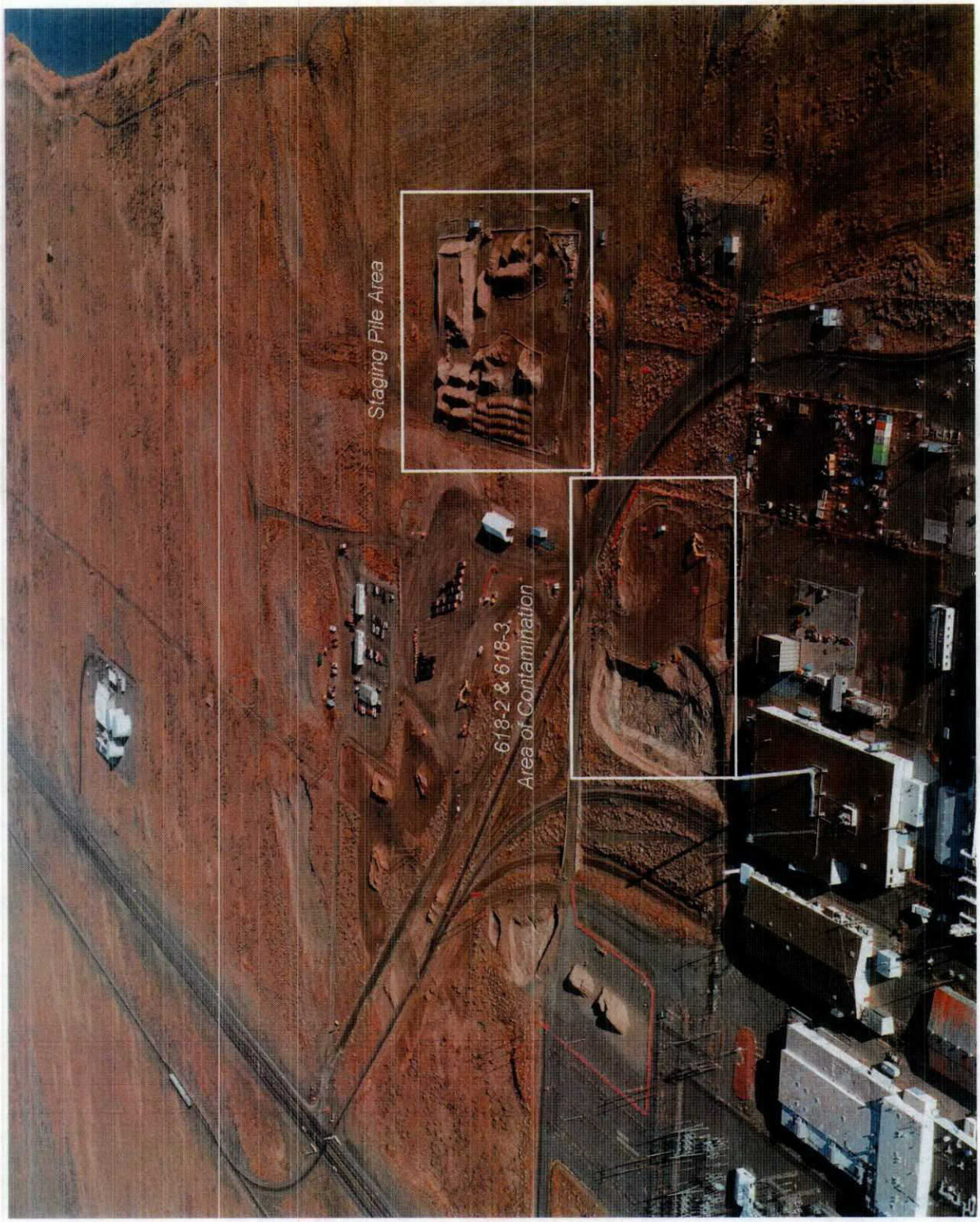
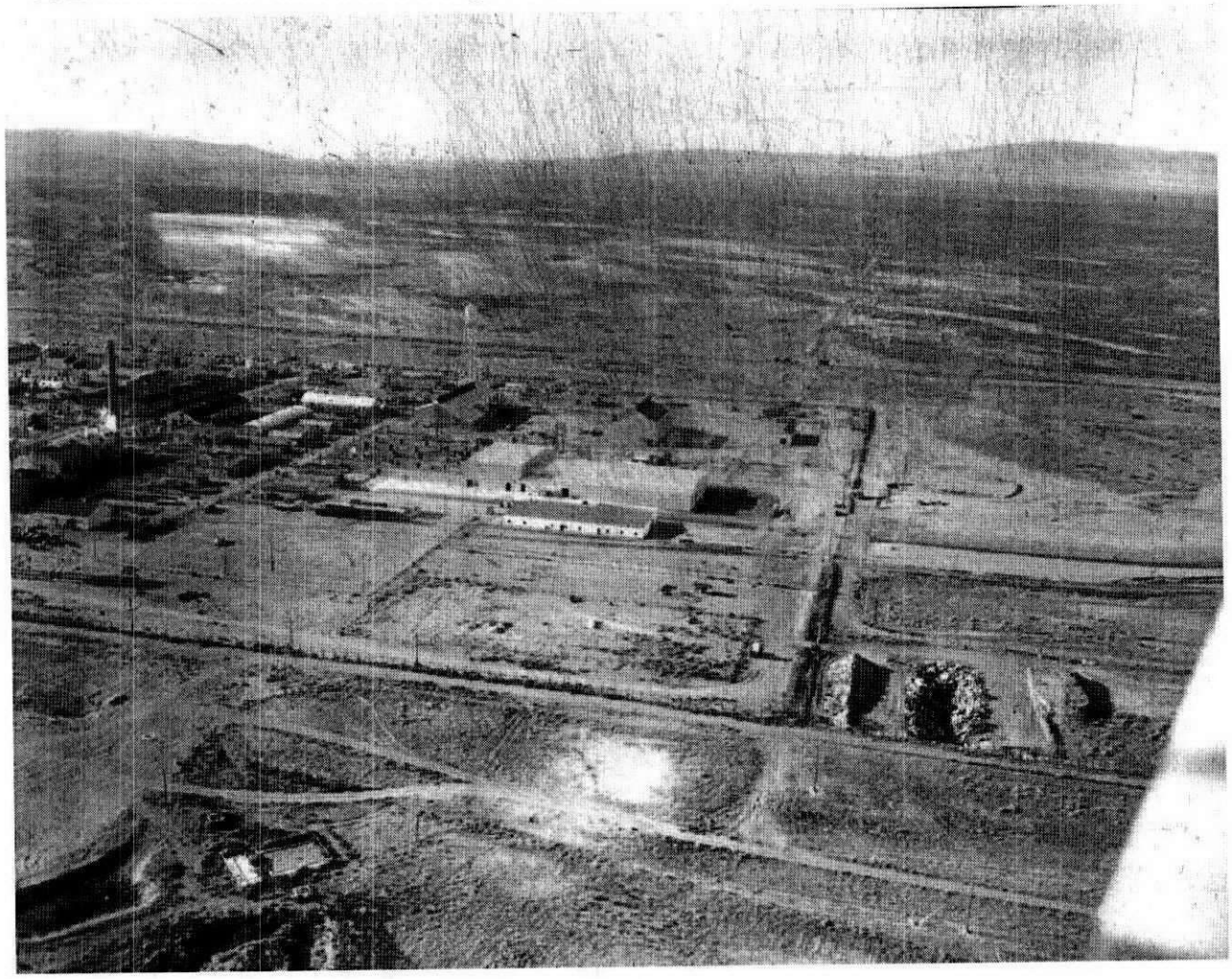
APPENDIX A

PHOTOGRAPHS

A-1. Location of Waste Staging Pile Area used for 618-2, 618-3 and 618-8.



A-2. Historical Photo Showing 618-2 Burial Ground with Open Middle Trench.



A-3. Safe and Inner Containers Removed from 618-2 Burial Ground.

A-4. Laboratory Containers Found in 618-2 Burial Ground.

A-5. Drums Removed from 618-2 Burial Ground and Overpacked.

A-6. "Hot Pig" Container Removed from 618-2 Burial Ground and Staged Until Characterization, Designation and Waste Shipment and Disposal Completed.

A-7. Photo of Test Pit Excavation Performed in Southeast Section of the Middle Trench at 618-2 Burial Ground.

APPENDIX B

SUMMARY OF ANALYTICAL SAMPLING RESULTS

List of Analytical Tables

Table B-1. 618-2 Shallow Zone Cleanup Verification Data. (2 Pages)

Table B-2. 618-2 Deep Zone Cleanup Verification Data. (2 Pages)

Table B-3. 618-2 Overburden Cleanup Verification Data. (2 Pages)

Table B-4. 618-2, 618-3, 618-8 Staging Pile/Decontamination Pad Cleanup Verification Data. (5 Pages)

Table B-5. 618-2 Verification Sample Results (Biased Samples). (3 Pages)

Table B-6. Test Pit Sample Results. (4 Pages)

Table B-7. Pothole Sample Results. (2 Pages)

Table B-8. FIDLER "Hot Spot" Sample Results.

Table B-1. 618-2 Shallow Zone Cleanup Verification Data. (2 Pages)

Sampling Area	Sample Number	Sample Date	Arsenic			Barium			Cadmium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J13DJ6	9/7/06	1.8E+00		1.1E+00	6.73E+01		6E-02	9E-02	U	9E-02	7.1E+00		2.0E-01
A3	J13DJ9	9/7/06	1.8E+00		1.1E+00	7.13E+01		6E-02	9E-02	U	9E-02	6.1E+00		2.0E-01
A4	J13DK0	9/7/06	1.9E+00		1.1E+00	5.85E+01		6E-02	9E-02	U	9E-02	4.2E+00		2.0E-01
A2	J13DJ7	9/7/06	1.3E+00		1.1E+00	7.91E+01		6E-02	9E+00	U	9E+00	4.5E+00		2.0E-01
Duplicate of J13DJ7	J13DJ8	9/7/06	1.7E+00		1.1E+00	6.98E+01		6E-02	9E+00	U	9E+00	4.6E+00		2.0E-01
Split of J13DJ7	J13DK2	9/7/06	1.8E+00		2.8E-01	7.98E+01		5.0E-01	1.4E-01	U	1.4E-01	5.5E+00		3.6E-01
Equipment Blank	J13DK1	9/7/06	1.9E+00		1.1E+00	5.85E+01		6E-02	9E-02	U	9E-02	4.2E+00		2.0E-01

Sampling Area	Sample Number	Sample Date	Lead			Selenium			Tin			Uranium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J13DJ6	9/7/06	5.6E+00		3.5E+00	7.5E-01		7.5E+00	2.0E+00	J	1.0E+00	3.51E+00		7E-03
A3	J13DJ9	9/7/06	3.7E+00		3.5E+00	7.5E-01	U	7.5E+00	2.4E+00	J	1.0E+00	3.35E+00		7E-03
A4	J13DK0	9/7/06	3.3E+00		3.5E+00	7.5E-01	U	7.5E+00	2.1E+00	J	1.0E+00	4.53E+00		7E-03
A2	J13DJ7	9/7/06	3.4E+00		3.4E+00	7.4E-01	U	7.4E-01	2.1E+00	J	1.0E+00	3.72E+00		7E-03
Duplicate of J13DJ7	J13DJ8	9/7/06	3.5E+00		3.4E+00	7.4E-01	U	7.4E-01	2.2E+00	J	1.0E+00	3.35E+00		7E-03
Split of J13DJ7	J13DK2	9/7/06	2.6E+00		1.5E-01	5.5E-01		1.7E-01	2.8E+00	U	2.8E+00	1.25E+01		2.08E-02
Equipment Blank	J13DK1	9/7/06	7.0E-01		1.2E-01	2.5E-01	U	2.5E-01	6.8E-01	J	3.4E-01	5.88E-01		7E-03

J = estimated
MDA = minimum detectable activity
NA = not analyzed
PQL = practical quantification limit
Q = Qualifier
U = undetected

Table B-1. 618-2 Shallow Zone Cleanup Verification Data. (2 pages)

Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154		
		pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
J13DJ6	9/7/06	-1.0E-01	U	7.3E-02	2.24E+00		3.9E-02	2.7E-02	U	2.7E-02	8.4E-02	U	8.4E-02	9.7E-02	U	9.7E-02
J13DJ9	9/7/06	-3.7E-02	U	9.3E-02	4.8E-02	U	4.8E-02	4.8E-02	U	4.8E-02	1.3E-01	U	1.3E-01	1.7E-01	U	1.7E-01
J13DK0	9/7/06	8.1E-01		7.1E-02	2.1E-02	U	2.1E-02	2.3E-02	U	2.3E-02	4.7E-02	U	4.7E-02	7.8E-02	U	7.8E-02
J13DJ7	9/7/06	5.6E-02	U	7.6E-02	3.4E-02		1.7E-02	4.6E-02	U	4.6E-02	3.4E-02	U	3.4E-02	5.3E-02	U	5.3E-02
J13DJ8	9/7/06	9.9E-02	U	1.1E-01	4.0E-02		1.9E-02	1.7E-02	U	1.7E-02	4.3E-02	U	4.3E-02	5.1E-02	U	5.1E-02
J13DK2	9/7/06	3.37E-01		2.52E-02	5.00E-02		1.57E-02	8.05E-03	U	1.84E-02	-8.08E-03	U	3.70E-02	-1.63E-02	U	5.89E-02

Sample Number	Sample Date	Europium-155			Nickel-63			Tritium			Plutonium-238			Plutonium-239/240		
		pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
J13DJ6	9/7/06	6.7E-02	U	6.7E-02	-1.71E+00	U	3.8E+00	-4.29E-01	U	2.4E+00	5.1E-02	U	4.9E-01	3.55E-01	U	3.9E-01
J13DJ9	9/7/06	1.8E-01	U	1.8E-01	8.08E-01	U	3.7E+00	-8.46E-01	U	2.5E+00	0	U	5.3E-01	6.9E-02	U	5.3E-01
J13DK0	9/7/06	4.9E-02	U	4.9E-02	-5.40E-01	U	3.7E+00	-2.26E-01	U	2.5E+00	0	U	4.5E-01	7.67E+00		4.5E-01
J13DJ7	9/7/06	3.8E-02	U	3.8E-02	9.46E-01	U	3.5E+00	1.31E-01	U	2.3E+00	5.9E-02	U	4.5E-01	8.24E-01		4.5E-01
J13DJ8	9/7/06	6.1E-02	U	6.1E-02	-1.01E+00	U	3.9E+00	4.77E-01	U	2.4E+00	6.8E-02	U	2.6E-01	7.18E-01		2.6E-01
J13DK2	9/7/06	3.61E-02	U	4.06E-02	5.95E+00	U	6.18E+00	8.82E-03	U	3.89E-02	1.57E-02	U	2.92E-02	1.73E+00		2.92E-02

Sample Number	Sample Date	Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
		pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
J13DJ6	9/7/06	1.32E+01	U	1.9E+01	6.3E-02	U	2.6E-01	1.66E+00		1.7E-01	1.85E-01	U	2.0E-01	1.90E+00		1.7E-01
J13DJ9	9/7/06	1.40E+01	U	2.2E+01	-6.5E-02	U	2.4E-01	1.59E+00		2.1E-01	6.8E-02	U	2.6E-01	2.20E+00		2.1E-01
J13DK0	9/7/06	4.27E+00	U	2.4E+01	-7.0E-03	U	2.2E-01	2.20E+00		2.1E-01	3.3E-02	U	2.5E-01	2.14E+00		2.1E-01
J13DJ7	9/7/06	1.42E+01	U	2.0E+01	-1.4E-02	U	2.2E-01	1.71E+00		1.7E-01	2.14E-01		2.1E-01	1.77E+00		1.7E-01
J13DJ8	9/7/06	9.65E+00	U	1.8E+01	-2.4E-02	U	2.5E-01	1.83E+00		2.3E-01	1.11E-01	U	2.8E-01	1.89E+00		2.3E-01
J13DK2	9/7/06	6.60E-01	U	9.79E-01	9.71E-03	U	1.26E-01	5.02E+00		3.84E-02	1.15E-01		3.23E-02	4.98E+00		2.61E-02

Table B-2. 618-2 Deep Zone Cleanup Verification Data. (2 pages)

Sampling Area	Sample Number	Sample Date	Arsenic			Barium			Cadmium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J13DJ4	9/7/06	1.4E+00		1.1E+00	5.95E+01		6E-02	9E-02	U	9E-02	4.2E+00		2.1E+00
A3	J13DJ2	9/7/06	1.1E+00	U	1.1E+00	5.85E+01		6E-02	9E-02	U	9E-02	3.7E+00		2.1E+00
A4	J13DJ3	9/7/06	1.5E+00		1.1E+00	8.33E+01		6E-02	9E-02	U	9E-02	6.7E+00		2.0E-01
A2	J13DJ0	9/7/06	1.1E+00	U	1.1E+00	6.35E+01		6E-02	9E-02	U	9E-02	2.5E+00		2.0E-01
Duplicate of J13DJ0	J13DJ1	9/7/06	1.1E+00	U	1.1E+00	7.37E+01		6E-02	9E-02	U	9E-02	4.4E+00		2.0E-01
Split of J13DJ0	J13DK3	9/7/06	1.8E+00		2.8E-01	1.85E+02		5.1E-01	1.4E-01	U	1.4E-01	5.4E+00		3.6E-01

Sampling Area	Sample Number	Sample Date	Lead			Selenium			Tin			Uranium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J13DJ4	9/7/06	6.6E+00		3.5E-01	7.8E-01		7.6E-01	2.8E+00	J	1.0E+00	4.54E+00		7E-03
A3	J13DJ2	9/7/06	2.7E+00		3.5E-01	7.6E-01	U	7.6E-01	2.0E+00	J	1.0E+00	1.37E+01		7.2E-02
A4	J13DJ3	9/7/06	3.8E+00		3.5E+00	7.5E-01	U	7.5E-01	2.7E+00	J	1.0E+00	5.01E+02		7.2E-01
A2	J13DJ0	9/7/06	2.7E+00		3.5E+00	7.6E-01	U	7.6E-01	2.5E+00	J	1.0E+00	3.57E+01		7.2E-02
Duplicate of J13DJ0	J13DJ1	9/7/06	3.2E+00		3.5E-01	7.6E-01	U	7.6E-01	2.9E+00	J	1.0E+00	3.70E+01		7.2E-02
Split of J13DJ0	J13DK3	9/7/06	3.5E+00		1.5E-01	3.9E-01		1.8E-01	8.7E+00		2.9E+00	8.98E+01		2.04E-02

Table B-2. 618-2 Deep Zone Cleanup Verification Data. (2 pages)

Sampling Area	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DJ4	9/7/06	3.08E-01		7.2E-02	7.86E-01		2.3E-02	1.7E-02	U	1.7E-02	4.7E-02	U	4.7E-02	5.2E-02	U	5.2E-02
A3	J13DJ2	9/7/06	2.77E+00		7.9E-02	5.90E-02		4.8E-02	3.7E-02	U	3.7E-02	9.0E-02	U	9.0E-02	1.2E-01	U	1.2E-01
A4	J13DJ3	9/7/06	5.45E+00		8.7E-02	1.04E+00		5.9E-02	4.9E-02	U	4.9E-02	1.6E-01	U	1.6E-01	1.8E-01	U	1.8E-01
A2	J13DJ0	9/7/06	7.94E+00		6.7E-02	2.09E-01		4.6E-02	3.7E-02	U	3.7E-02	9.9E-02	U	9.9E-02	1.2E-01	U	1.2E-01
Duplicate of J13DJ0	J13DJ1	9/7/06	6.82E+00		4.7E-02	3.92E-01		4.6E-02	3.2E-02	U	3.2E-02	9.2E-02	U	9.2E-02	1.1E-01	U	1.1E-01
Split of J13DJ0	J13DK3	9/7/06	1.78E+01		2.00E-02	2.78E-01		1.80E-02	4.98E-03	U	1.88E-02	-1.00E-02	U	4.12E-02	-2.80E-02	U	5.74E-02

Sampling Area	Sample Number	Sample Date	Europium-155			Nickel-63			Tritium			Plutonium-238			Plutonium-239/240		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DJ4	9/7/06	4.0E-02	U	4.0E-02	1.72E-01	U	3.8E+00	7.9E-02	U	2.5E+00	9.8E-02	U	3.7E-01	2.20E+00		3.7E-01
A3	J13DJ2	9/7/06	8.6E-02	U	8.6E-02	-1.48E+00	U	3.5E+00	6.24E-01	U	2.3E+00	1.98E-01	U	5.0E-01	2.68E+01		5.0E-01
A4	J13DJ3	9/7/06	3.5E-01	U	3.5E-01	-4.06E-01	U	3.6E+00	8.59E-01	U	2.3E+00	1.50E+00		4.8E-01	9.06E+01		4.8E-01
A2	J13DJ0	9/7/06	9.6E-02	U	9.6E-02	-4.97E-01	U	3.6E+00	4.54E-01	U	2.5E+00	4.17E-01	U	5.3E-01	5.16E+01		5.3E-01
Duplicate of J13DJ0	J13DJ1	9/7/06	8.9E-02	U	8.9E-02	8.68E-01	U	3.6E+00	5.80E-01	U	2.4E+00	4.15E-01	U	4.5E-01	4.55E+01		4.5E-01
Split of J13DJ0	J13DK3	9/7/06	4.37E-02	U	5.46E-02	4.44E+00	U	6.05E+00	7.13E-02		3.80E-02	1.32E+00		2.19E-02	9.23E+01		2.19E-02

Sampling Area	Sample Number	Sample Date	Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DJ4	9/7/06	7.07E+00		1.8E+01	9.9E-02	U	2.2E-01	3.26E+00		2.2E-01	1.02E-01	U	2.6E-01	2.87E+00		2.2E-01
A3	J13DJ2	9/7/06	2.08E+01		2.0E+01	1.81E+00		2.2E-01	5.53E+00		2.2E-01	1.02E-01	U	2.6E-01	5.22E+00		2.2E-01
A4	J13DJ3	9/7/06	4.20E+01		2.6E+01	1.75E+00		1.9E-01	1.61E+02		4.8E-01	3.35E+00	U	5.8E+00	1.65E+02		4.6E-01
A2	J13DJ0	9/7/06	2.97E+01		2.9E+01	1.16E+01		2.1E-01	1.46E+01		2.9E-01	7.76E-01		2.8E-01	1.48E+01		2.9E-01
Duplicate of J13DJ0	J13DJ1	9/7/06	9.69E+00	U	2.2E+01	9.39E+00		2.0E-01	1.28E+01		3.0E-01	7.61E-01		2.5E-01	1.25E+01		2.6E-01

Table B-3. 618-2 Overburden Cleanup Verification Data. (2 pages)

Sampling Area	Sample Number	Sample Date	Arsenic			Barium			Cadmium			Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J13DF9	9/7/06	2.7E+00		1.2E+00	6.42E+01		6E-02	9E-02	U	9E-02	6.1E+00		2.0E-01
A3	J13DH2	9/7/06	1.8E+00		1.1E+00	7.47E+01		6E-02	9E-02	U	9E-02	5.1E+00		2.0E-01
A4	J13DH3	9/7/06	2.4E+00		1.1E+00	6.29E+01		6E-02	9E-02	U	9E-02	5.2E+00		2.0E-01
A2	J13DH0	9/7/06	1.5E+00		1.1E+00	6.22E+01		6E-02	9E-02	U	9E-02	5.3E+00		2.0E-01
Duplicate of J13DH0	J13DH1	9/7/06	1.2E+00		1.1E+00	6.35E+01		6E-02	9E-02	U	9E-02	6.6E+00		2.0E-01
Split of J13DH0	J13DH4	9/7/06	2.0E+00		2.8E-01	8.41E+01		5.0E-01	1.4E-01	U	1.4E-01	7.0E+00		3.6E-01

Sampling Area	Sample Number	Sample Date	Lead			Selenium			Tin			Uranium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J13DF9	9/7/06	4.1E+00		3.8E-01	8.2E-01	U	8.2E-01	2.7E+00	J	1.1E+00	1.14E+00		7E-03
A3	J13DH2	9/7/06	4.3E+00		3.5E-01	1.0E+00		7.6E-01	1.6E+00	J	1.0E+00	9.15E-01		7E-03
A4	J13DH3	9/7/06	3.4E+00		3.5E-01	7.5E-01	U	7.5E-01	2.0E+00	J	1.0E+00	8.72E-01		7E-03
A2	J13DH0	9/7/06	3.5E+00		3.5E-01	7.6E-01	U	7.6E-01	1.0E+00	U	1.0E+00	9.72E-01		7E-03
Duplicate of J13DH0	J13DH1	9/7/06	4.3E+00		3.5E-01	7.5E-01	U	7.5E-01	2.2E+00	J	1.0E+00	8.91E-01		7E-03
Split of J13DH0	J13DH4	9/7/06	3.2E+00		1.5E-01	5.5E-01		1.7E-01	2.8E+00	U	2.8E+00	2.69E+00		2.10E-02

Table B-3. 618-2 Overburden Cleanup Verification Data. (2 pages)

Sampling Area	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DF9	9/7/06	-6.0E-03	U	6.9E-02	5.8E-02		3.9E-02	3.3E-02	U	3.3E-02	9.0E-02	U	9.0E-02	1.1E-01	U	1.1E-01
A3	J13DH2	9/7/06	3.5E-02	U	6.2E-02	3.6E-02	U	3.9E-02	4.0E-02	U	4.0E-02	1.1E-01	U	1.1E-01	1.4E-01	U	1.4E-01
A4	J13DH3	9/7/06	-1.2E-02	U	8.2E-02	4.0E-02		3.4E-02	2.9E-02	U	2.9E-02	7.4E-02	U	7.4E-02	9.9E-02	U	9.9E-02
A2	J13DH0	9/7/06	2.0E-02	U	6.5E-02	4.2E-02	U	4.2E-02	3.8E-02	U	3.8E-02	9.3E-02	U	9.3E-02	1.2E-01	U	1.2E-01
Duplicate of J13DH0	J13DH1	9/7/06	-5.0E-03	U	7.0E-02	4.8E-02		4.8E-02	4.9E-02	U	4.9E-02	1.2E-01	U	1.2E-01	1.6E-01	U	1.6E-01
Split of J13DH0	J13DH4	9/7/06	2.97E-02		2.03E-02	1.55E-02		1.50E-02	1.98E-03	U	1.65E-02	-1.99E-02	U	3.28E-02	2.36E-02	U	5.37E-02

Sampling Area	Sample Number	Sample Date	Europium-155			Nickel-63			Tritium			Plutonium-238			Plutonium-239/240		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DF9	9/7/06	8.9E-02	U	8.9E-02	-6.92E-01	U	3.8E+00	7.23E-01	U	2.5E+00	-6.2E-02	U	4.7E-01	6.2E-02	U	4.7E-01
A3	J13DH2	9/7/06	1.4E-01	U	1.4E-01	1.02E+00	U	4.1E+00	1.23E-01	U	2.6E+00	0	U	4.9E-01	6.5E-02	U	4.9E-01
A4	J13DH3	9/7/06	6.6E-02	U	6.6E-02	2.43E-01	U	4.3E+00	9.62E-01	U	2.4E+00	0	U	5.2E-01	0	U	5.2E-01
A2	J13DH0	9/7/06	8.4E-02	U	8.4E-02	-7.17E-01	U	3.7E+00	3.49E-01	U	2.6E+00	1.26E-01	U	4.8E-01	0	U	4.8E-01
Duplicate of J13DH0	J13DH1	9/7/06	1.1E-01	U	1.1E-01	-1.15E+00	U	4.0E+00	5.62E-01	U	2.6E+00	0	U	5.0E-01	1.97E-01	U	5.0E-01
Split of J13DH0	J13DH4	9/7/06	1.92E-02	U	4.05E-02	1.82E+00	U	5.96E+00	3.38E-02	U	4.15E-02	0	U	1.79E-02	-1.32E-03	U	3.16E-02

Sampling Area	Sample Number	Sample Date	Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DF9	9/7/06	-7.94E+00	U	2.2E+01	5.1E-02	U	2.6E-01	5.42E-01		1.9E-01	3.0E-02	U	2.3E-01	4.44E-01		1.9E-01
A3	J13DH2	9/7/06	-5.23E+00	U	2.4E+01	7.0E-02	U	2.5E-01	4.38E-01		2.1E-01	3.3E-02	U	2.5E-01	3.56E-01		2.1E-01
A4	J13DH3	9/7/06	-4.35E+00	U	2.5E+01	-2.4E-02	U	2.4E-01	5.86E-01		2.1E-01	3.4E-02	U	2.6E-01	4.75E-01		2.1E-01
A2	J13DH0	9/7/06	4.63E+00	U	2.4E+01	-1.2E-02	U	2.5E-01	6.44E-01		2.1E-01	9.7E-02	U	2.5E-01	5.10E-01		2.1E-01
Duplicate of J13DH0	J13DH1	9/7/06	4.82E+00	U	2.8E+01	-9.7E-02	U	2.5E-01	5.37E-01		2.1E-01	0	U	2.5E-01	5.91E-01		2.1E-01
Split of J13DH0	J13DH4	9/7/06	3.28E-01	U	1.50E+00	8.98E-02	U	1.20E-01	1.02E+00		3.74E-02	2.97E-02		2.43E-02	7.67E-01		2.43E-02

Table B-4. 618-2, 618-3, 618-8 Staging Pile/Decon Pad Cleanup Verification Data. (5 pages)

Sampling number	Sample Number	Sample Date	Arsenic			Barium			Cadmium			Chromium			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
B5	J13D61	9/6/06	2.9E+00	U	2.9E+00	7.19E+01		5.73E+01	1.4E+00	U	1.4E+00	6.1E+00		2.9E+00	3.6E+00		8.6E-01
B6	J13D60	9/6/06	2.8E+00	U	2.8E+00	5.94E+01		5.69E+01	1.4E+00	U	1.4E+00	5.9E+00		2.8E+00	3.4E+00		8.5E-01
B7	J13D63	9/6/06	2.9E+00	U	2.9E+00	6.24E+01		5.72E+01	1.4E+00	U	1.4E+00	5.0E+00		2.9E+00	3.7E+00		8.6E-01
B8	J13D64	9/6/06	2.9E+00	U	2.9E+00	5.91E+01		5.72E+01	1.4E+00	U	1.4E+00	4.5E+00		2.9E+00	2.8E+00		8.6E-01
C9	J13D65	9/6/06	2.8E+00	U	2.8E+00	6.54E+01		5.66E+01	1.4E+00	U	1.4E+00	6.8E+00		2.8E+00	3.5E+00		8.5E-01
C10	J13D66	9/6/06	3.0E+00		2.8E+00	6.03E+01		5.68E+01	1.4E+00	U	1.4E+00	5.8E+00		2.8E+00	3.4E+00		8.5E-01
C1	J13D67	9/6/06	2.8E+00	U	2.8E+00	6.62E+01		5.68E+01	1.4E+00	U	1.4E+00	6.9E+00		2.8E+00	4.0E+00		8.5E-01
C2	J13D68	9/6/06	2.8E+00		2.8E+00	6.86E+01		5.64E+01	1.4E+00	U	1.4E+00	6.0E+00		2.8E+00	4.1E+00		8.5E-01
D3	J13D69	9/6/06	3.4E+00		2.8E+00	8.21E+01		5.66E+01	1.4E+00	U	1.4E+00	7.8E+00		2.8E+00	4.7E+00		8.5E-01
D4	J13D70	9/6/06	2.9E+00	U	2.9E+00	6.09E+01		5.71E+01	1.4E+00	U	1.4E+00	6.1E+00		2.9E+00	3.6E+00		8.6E-01
D5	J13D71	9/6/06	3.1E+00		2.9E+00	6.92E+01		5.74E+01	1.4E+00	U	1.4E+00	5.9E+00		2.9E+00	5.1E+00		8.6E-01
D6	J13D72	9/6/06	2.9E+00	U	2.9E+00	7.37E+01		5.72E+01	1.4E+00	U	1.4E+00	5.4E+00		2.9E+00	4.0E+00		8.6E-01
A1	J13D73	9/6/06	2.8E+00	U	2.8E+00	5.68E+01		5.66E+01	1.4E+00	U	1.4E+00	5.9E+00		2.8E+00	3.3E+00		8.5E-01
A3	J13D75	9/6/06	2.8E+00	U	2.8E+00	5.78E+01		5.66E+01	1.4E+00	U	1.4E+00	6.5E+00		2.8E+00	4.0E+00		8.5E-01
A4	J13D62	9/6/06	3.0E+00		2.9E+00	6.28E+01		5.73E+01	1.4E+00	U	1.4E+00	5.9E+00		2.9E+00	3.6E+00		8.6E-01
A2	J13D74	9/6/06	2.9E+00	U	2.9E+00	5.75E+01	U	5.75E+01	1.4E+00	U	1.4E+00	5.4E+00		2.9E+00	3.0E+00		8.6E-01
Duplicate of J13D74	J13D59	9/6/06	3.0E+00		2.9E+00	5.74E+01	U	5.74E+01	1.4E+00	U	1.4E+00	6.8E+00		2.9E+00	3.5E+00		8.6E-01
Split of J13D74	J13D76	9/6/06	4.6E+00		2.8E-01	7.27E+01		5.1E-01	1.4E-01	U	1.4E-01	9.4E+00		3.6E-01	3.0E+00		1.5E-01

Table B-4. 618-2, 618-3, 618-8 Staging Pile/Decon Pad Cleanup Verification Data. (5 pages)

Sampling Area	Sample Number	Sample Date	Selenium			Silver			Tin			Uranium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
B5	J13D61	9/6/06	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	9.89E-01		1.0E-02
B6	J13D60	9/6/06	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.84E+01	U	2.84E+01	3.21E+00		1.0E-02
B7	J13D63	9/6/06	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	1.32E+00		1.0E-02
B8	J13D64	9/6/06	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	1.42E+00		1.0E-02
C9	J13D65	9/6/06	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.83E+01	U	2.83E+01	2.68E+00		1.0E-02
C10	J13D66	9/6/06	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.84E+01	U	2.84E+01	3.62E+00		1.0E-02
C1	J13D67	9/6/06	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.84E+01	U	2.84E+01	1.40E+00		1.0E-02
C2	J13D68	9/6/06	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.84E+01	U	2.84E+01	1.55E+00		1.0E-02
D3	J13D69	9/6/06	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.83E+01	U	2.83E+01	1.43E+00		1.0E-02
D4	J13D70	9/6/06	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	2.03E+00		1.0E-02
D5	J13D71	9/6/06	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.87E+01	U	2.87E+01	1.12E+01		1.0E-01
D6	J13D72	9/6/06	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	1.26E+00		1.0E-02
A1	J13D73	9/6/06	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.83E+01	U	2.83E+01	1.08E+00		1.0E-02
A3	J13D75	9/6/06	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.83E+01	U	2.83E+01	1.04E+00		1.0E-02
A4	J13D62	9/6/06	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	1.20E+00		1.0E-02
A2	J13D74	9/6/06	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.88E+01	U	2.88E+01	1.27E+00		1.0E-02
Duplicate of J13D74	J13D59	9/6/06	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.87E+01	U	2.87E+01	1.12E+00		1.0E-02
Split of J13D74	J13D76	9/6/06	9.5E-01		1.7E-01	2.0E-01	U	2.0E-01	2.8E+00	U	2.8E+00	1.86E+00		2.04E-02

Table B-4. 618-2, 618-3, 618-8 Staging Pile/Decon Pad Cleanup Verification Data. (5 pages)

Sampling Area	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B5	J13D61	9/6/06	-1.5E-02	U	6.1E-02	4.6E-02	U	4.6E-02	4.0E-02	U	4.0E-02	1.1E-01	U	1.1E-01	1.4E-01	U	1.4E-01
B6	J13D60	9/6/06	4.5E-02	U	6.4E-02	4.4E-02	U	4.4E-02	4.3E-02	U	4.3E-02	1.1E-01	U	1.1E-01	1.4E-01	U	1.4E-01
B7	J13D63	9/6/06	-6.0E-03	U	6.1E-02	3.0E-02	U	3.0E-02	2.6E-02	U	2.6E-02	7.0E-02	U	7.0E-02	8.9E-02	U	8.9E-02
B8	J13D64	9/6/06	3.1E-02	U	4.8E-02	2.7E-02	U	2.7E-02	3.2E-02	U	3.2E-02	6.1E-02	U	6.1E-02	1.0E-01	U	1.0E-01
C9	J13D65	9/6/06	4.0E-03	U	6.2E-02	2.0E-02	U	2.0E-02	2.0E-02	U	2.0E-02	4.5E-02	U	4.5E-02	8.2E-02	U	8.2E-02
C10	J13D66	9/6/06	8.18E-01		3.6E-02	9.5E-02		2.4E-02	2.2E-02	U	2.2E-02	5.6E-02	U	5.6E-02	7.3E-02	U	7.3E-02
C1	J13D67	9/6/06	2.0E-02	U	4.4E-02	4.0E-02	U	4.0E-02	3.2E-02	U	3.2E-02	9.1E-02	U	9.1E-02	1.1E-01	U	1.1E-01
C2	J13D68	9/6/06	1.0E-02	U	6.5E-02	5.5E-02	U	5.5E-02	5.4E-02	U	5.4E-02	1.5E-01	U	1.5E-01	2.1E-01	U	2.1E-01
D3	J13D69	9/6/06	4.1E-02	U	6.6E-02	3.5E-02	U	3.5E-02	3.8E-02	U	3.8E-02	8.2E-02	U	8.2E-02	1.4E-01	U	1.4E-01
D4	J13D70	9/6/06	4.7E-02	U	5.6E-02	2.5E-02	U	2.5E-02	2.4E-02	U	2.4E-02	6.5E-02	U	6.5E-02	8.0E-02	U	8.0E-02
D5	J13D71	9/6/06	6.1E-02	U	6.9E-02	4.9E-02	U	4.9E-02	3.8E-02	U	3.8E-02	1.1E-01	U	1.1E-01	1.3E-01	U	1.3E-01
D6	J13D72	9/6/06	-2.0E-02	U	5.8E-02	4.9E-02	U	4.9E-02	5.1E-02	U	5.1E-02	1.4E-01	U	1.4E-01	1.8E-01	U	1.8E-01
A1	J13D73	9/6/06	8.0E-03	U	4.9E-02	4.2E-02	U	4.2E-02	4.0E-02	U	4.0E-02	1.0E-01	U	1.0E-01	1.3E-01	U	1.3E-01
A3	J13D75	9/6/06	0	U	2.1E-01	2.6E-02	U	2.6E-02	2.5E-02	U	2.5E-02	7.4E-02	U	7.4E-02	8.6E-02	U	8.6E-02
A4	J13D62	9/6/06	1.1E-02	U	6.0E-02	4.5E-02	U	4.5E-02	4.6E-02	U	4.6E-02	1.2E-01	U	1.2E-01	1.7E-01	U	1.7E-01
A2	J13D74	9/6/06	-1.5E-02	U	5.5E-02	3.1E-02	U	3.1E-02	2.7E-02	U	2.7E-02	7.7E-02	U	7.7E-02	8.2E-02	U	8.2E-02
Duplicate of J13D74	J13D59	9/6/06	2.2E-02	U	6.9E-02	4.6E-02	U	4.6E-02	4.2E-02	U	4.2E-02	1.1E-01	U	1.1E-01	1.5E-01	U	1.5E-01
Split of J13D74	J13D76	9/6/06	6.77E-03	U	4.06E-02	-2.16E-03	U	1.45E-02	-7.60E-05	U	1.55E-02	-5.13E-03	U	3.24E-02	1.16E-02	U	5.11E-02

Table B-4. 618-2, 618-3, 618-8 Staging Pile/Decon Pad Cleanup Verification Data. (5 pages)

Sampling Area	Sample Number	Sample Date	Europium-155			Nickel-63			Tritium			Plutonium-238			Plutonium-239/240		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B5	J13D61	9/6/06	1.0E-01	U	1.0E-01	3.56E-01	U	3.6E+00	8.5E-02	UJ	2.4E+00	-1.06E-01	UJ	8.1E-01	0	UJ	8.1E-01
B6	J13D60	9/6/06	1.0E-01	U	1.0E-01	2.78E-01	U	3.7E+00	2.22E-01	UJ	2.5E+00	0	U	4.0E-01	0	U	4.0E-01
B7	J13D63	9/6/06	6.3E-02	U	6.3E-02	1.23E+00	U	3.8E+00	8.61E-01	UJ	2.7E+00	-5.2E-02	U	4.0E-01	5.2E-02	U	4.0E-01
B8	J13D64	9/6/06	8.4E-02	U	8.4E-02	1.02E+00	U	3.7E+00	-1.28E-01	UJ	2.4E+00	5.2E-02	U	4.0E-01	1.56E-01	U	4.0E-01
C9	J13D65	9/6/06	4.8E-02	U	4.8E-02	5.47E-01	U	3.7E+00	0	UJ	2.3E+00	0	U	4.0E-01	6.26E-01		4.0E-01
C10	J13D66	9/6/06	7.8E-02	U	7.8E-02	0	U	3.6E+00	2.33E+00	J	2.3E+00	1.03E-01	U	3.9E-01	1.00E+01		3.9E-01
C1	J13D67	9/6/06	8.1E-02	U	8.1E-02	1.31E-01	U	3.5E+00	1.13E+00	UJ	2.5E+00	4.6E-02	U	4.4E-01	1.86E-01	U	3.5E-01
C2	J13D68	9/6/06	2.1E-01	U	2.1E-01	6.74E-01	U	3.6E+00	6.95E-01	UJ	2.3E+00	2.48E-01	U	4.0E-01	4.1E-02	U	3.2E-01
D3	J13D69	9/6/06	1.2E-01	U	1.2E-01	1.22E+00	U	3.7E+00	1.29E+00	UJ	2.5E+00	-9.7E-02	U	4.7E-01	4.9E-02	U	3.7E-01
D4	J13D70	9/6/06	9.4E-02	U	9.4E-02	6.9E-01	U	3.5E+00	2.51E-01	UJ	2.3E+00	0	U	4.0E-01	5.2E-02	U	4.0E-01
D5	J13D71	9/6/06	1.0E-01	U	1.0E-01	1.49E+00	U	3.5E+00	6.8E-02	UJ	2.5E+00	0	U	4.2E-01	1.05E+00		4.2E-01
D6	J13D72	9/6/06	1.9E-01	U	1.9E-01	7.79E-01	U	3.5E+00	1.14E+00	UJ	2.5E+00	-6.2E-02	U	4.7E-01	1.23E-01	U	4.7E-01
A1	J13D73	9/6/06	9.0E-02	U	9.0E-02	2.99E-01	U	3.4E+00	4.13E-01	UJ	2.3E+00	6.1E-02	U	4.7E-01	0	U	4.7E-01
A3	J13D75	9/6/06	1.1E-01	U	1.1E-01	7.6E-01	U	3.6E+00	7.77E-01	UJ	2.3E+00	1.52E-01	U	5.8E-01	0	U	5.8E-01
A4	J13D62	9/6/06	1.8E-01	U	1.8E-01	9.08E-01	U	4.1E+00	1.12E+00	UJ	2.4E+00	1.32E-01	U	5.0E-01	0	U	5.0E-01
A2	J13D74	9/6/06	6.6E-02	U	6.6E-02	5.03E-01	U	3.7E+00	1.18E+00	UJ	2.4E+00	-6.2E-02	U	4.7E-01	0	U	4.7E-01
Duplicate of J13D74	J13D59	9/6/06	9.9E-02	U	9.9E-02	2.15E-01	U	4.4E+00	1.11E+00	UJ	2.3E+00	0	U	4.8E-01	0	U	4.8E-01
Split of J13D74	J13D76	9/6/06	4.61E-02	U	4.64E-02	4.56E+00	U	6.14E+00	-7.58E-04	U	3.67E-02	0	U	6.46E-02	3.81E-02	U	1.35E-01

Table B-4. 618-2, 618-3, 618-8 Staging Pile/Decon Pad Cleanup Verification Data. (5 pages)

Sampling Area	Sample Number	Sample Date	Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B5	J13D61	9/6/06	2.92E+00	U	2.2E+01	2.8E-02	U	2.7E-01	5.51E-01		1.6E-01	0	U	1.9E-01	4.69E-01		1.6E-01
B6	J13D60	9/6/06	-5.17E+00	U	2.2E+01	-2.9E-02	U	2.4E-01	1.68E+00		1.5E-01	1.96E-01		1.9E-01	1.76E+00		1.5E-01
B7	J13D63	9/6/06	-1.14E+00	U	2.4E+01	4.0E-02	U	2.2E-01	6.80E-01		2.3E-01	7.2E-02	U	2.7E-01	7.69E-01		2.3E-01
B8	J13D64	9/6/06	0	U	2.3E+01	1.10E-01	U	2.3E-01	5.57E-01		1.7E-01	2.7E-02	U	2.1E-01	7.80E-01		1.7E-01
C9	J13D65	9/6/06	-1.90E-01	U	2.4E+01	1.25E-01	U	2.4E-01	1.20E+00		4.3E-02	1.34E-01		2.4E-02	1.19E+00		3.2E-02
C10	J13D66	9/6/06	-1.79E-01	U	2.3E+01	-8.6E-02	U	2.6E-01	1.75E+00		4.2E-02	1.39E-01		2.5E-02	1.83E+00		3.7E-02
C1	J13D67	9/6/06	3.22E+00	U	2.4E+01	1.38E-01	U	3.0E-01	7.50E-01		3.2E-02	5.6E-02		3.9E-02	7.21E-01		3.5E-02
C2	J13D68	9/6/06	-2.04E-01	U	2.6E+01	-4.5E-02	U	2.4E-01	8.36E-01		4.0E-01	8.4E-02		2.8E-02	8.02E-01		3.3E-02
D3	J13D69	9/6/06	2.36E+00	U	2.5E+01	-5.0E-03	U	2.4E-01	7.26E-01		4.0E-01	8.3E-02		2.5E-02	6.13E-01		3.7E-02
D4	J13D70	9/6/06	-1.94E+00	U	2.2E+01	1.46E-01	U	3.0E-01	1.04E+00		5.5E-02	8.6E-02		4.1E-02	9.77E-01		5.5E-02
D5	J13D71	9/6/06	9.22E+00	U	2.1E+01	-1.1E-02	U	2.1E-01	4.07E+00		5.3E-02	2.67E-01		2.9E-02	3.82E+00		5.0E-02
D6	J13D72	9/6/06	2.62E+00	U	2.5E+01	5.7E-02	U	2.7E-01	6.17E-01		3.1E-02	5.1E-02		2.6E-02	6.70E-01		2.7E-02
A1	J13D73	9/6/06	1.81E+00	U	2.3E+01	-6.1E-02	U	3.4E-01	8.38E-01		1.8E-01	8.5E-02	U	2.2E-01	5.82E-01		1.8E-01
A3	J13D75	9/6/06	3.55E+00	U	2.8E+01	2.0E-03	U	2.1E-01	4.69E-01		1.9E-01	9.0E-02	U	2.3E-01	4.69E-01		1.9E-01
A4	J13D62	9/6/06	1.73E+00	U	2.7E+01	4.3E-02	U	2.7E-01	6.43E-01		1.5E-01	2.4E-02	U	1.9E-01	5.62E-01		1.5E-01
A2	J13D74	9/6/06	7.42E+00	U	2.7E+01	-2.3E-02	U	2.1E-01	7.45E-01		1.9E-01	0	U	2.3E-01	8.45E-01		1.9E-01
Duplicate of J13D74	J13D59	9/6/06	-4.44E+00	U	2.4E+01	-1.05E-01	U	2.7E-01	8.59E-01		2.2E-01	3.5E-02	U	2.7E-01	6.30E-01		2.2E-01
Split of J13D74	J13D76	9/6/06	-4.79E-01	U	5.25E+00	1.35E-02	U	1.12E-01	1.72E+00		2.95E-02	7.87E-02		3.65E-02	1.75E+00		3.65E-02

Table B-5. 618-2 Verification Sample Results (Biased Samples). (3 pages)

Description	Sample Number	Sample Date	Arsenic			Barium			Cadmium			Chromium			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Discolored soil	J13H86	09/28/06	1.4		1.1	68		0.06	0.09	U	0.09	3.8		0.21	1.6		0.37
Discolored soil	J13H87	09/28/06	1.7		1.1	64.3		0.06	0.16		0.09	3.2		0.21	2.3		0.36
Hot spot	J13DN0	09/26/06	1.6		1.1	107		0.06	0.09	U	0.09	4.4		4.4	2.4		0.35
Hot spot	J13DN1	09/26/06	1.7		1.1	58.8		0.06	0.20		0.09	4.4		0.20	3.3		0.34
Hot spot	J13DN2	09/26/06	1.8		1.1	109		0.06	0.09	U	0.09	10.4		0.21	6.6		0.35
Hot spot	J13DN3	09/26/06	1.7		1.1	56.1		0.06	0.09	U	0.09	4.0		0.20	1.7		0.35
Hot spot	J13DN4	09/26/06	1.6		1.1	60.2		0.06	0.09	U	0.09	3.9		0.20	1.8		0.35
Beneath safe	J13DJ5	09/07/06	2.5		1.1	101		0.06	0.09	U	0.09	6.9		0.20	4.5		0.35
Beneath oil drums	J13DH9	09/07/06	3.3		1.1	84.5		0.06	0.09	U	0.09	7.9		0.21	6.8		0.35

Description	Sample Number	Sample Date	Selenium			Silver			Tin			Uranium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Discolored soil	J13H86	09/28/06	1.2		0.80	0.34	U	0.34	1.1	U	1.1	16.5		0.10
Discolored soil	J13H87	09/28/06	0.78	U	0.78	0.33	U	0.33	1.0	U	1.0	20.1		0.10
Hot spot	J13DN0	09/26/06	0.76	U	0.76	0.32	U	0.32	1.0	U	1.0	148		0.98
Hot spot	J13DN1	09/26/06	0.74	U	0.74	0.31	U	0.31	1.0	U	1.0	26.0		0.098
Hot spot	J13DN2	09/26/06	0.76	U	0.76	0.32	U	0.32	42.5		1.0	32.8		0.098
Hot spot	J13DN3	09/26/06	0.75	U	0.75	0.32		0.32	1.0	U	1.0	0.878		0.010
Hot spot	J13DN4	09/26/06	0.94		0.76	0.32	U	0.32	1.2		1.0	0.952		0.010
Beneath safe	J13DJ5	09/07/06	0.82		0.76	0.32	U	0.32	1.6	J	1.0	5.80		0.007
Beneath oil drums	J13DH9	09/07/06	0.77	U	0.77	0.6		0.32	1.9	J	1.0	29.1		0.072

Description	Sample Number	Sample Date	Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248			Aroclor-1254		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Beneath oil drums	J13DH9	09/07/06	14	U	14	14	U	14	14	U	14	14	U	14	14	U	14	6.9	J	14

Description	Sample Number	Sample Date	Aroclor-1260			TPH		
			ug/kg	Q	PQL	mg/kg	Q	PQL
Beneath oil drums	J13DH9	09/07/06	14	U	14	145	U	145

Table B-5. 618-2 Verification Sample Results (Biased Samples). (3 pages)

Description	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Discolored soil	J13H86	09/28/06	0.086	U	0.16	0.018	U	0.018	0.053	U	0.053	0.051	U	0.051	0.065	U	0.065
Discolored soil	J13H87	09/28/06	0.842		0.18	0.039	U	0.039	0.046	U	0.046	0.11	U	0.11	0.14	U	0.14
Hot spot	J13DN0	09/26/06	0.044		0.041	0.249		0.056	0.047	U	0.047	0.15	U	0.15	0.16	U	0.16
Hot spot	J13DN1	09/26/06	6.47		0.047	0.158		0.028	0.025	U	0.025	0.066	U	0.066	0.084	U	0.084
Hot spot	J13DN2	09/26/06	9.19		0.046	1.12		0.048	0.033	U	0.033	0.098	U	0.098	0.1	U	0.1
Hot spot	J13DN3	09/26/06	-0.003	U	0.045	0.126		0.027	0.037	U	0.037	0.063	U	0.063	0.077	U	0.077
Hot spot	J13DN4	09/26/06	0	U	0.24	0.235		0.040	0.033	U	0.033	0.095	U	0.095	0.13	U	0.13
Beneath safe	J13DJ5	09/07/06	0.15		0.088	0.061	U	0.061	0.078	U	0.078	0.095	U	0.095	0.22	U	0.22
Beneath oil drums	J13DH9	09/07/06	1.38		0.053	0.069		0.026	0.019	U	0.019	0.050	U	0.050	0.062	U	0.062

Description	Sample Number	Sample Date	Europium-155			Nickel-63			Tritium			Plutonium-238			Plutonium-239/240		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Discolored soil	J13H86	09/28/06	0.076	U	0.076	1.03	U	3.6	0.464	U	2.6	0	U	0.30	0.237	U	0.30
Discolored soil	J13H87	09/28/06	0.14	U	0.14	-0.486	U	3.7	0.548	U	2.7	0.089	U	0.34	1.12		0.34
Hot spot	J13DN0	09/26/06	0.29	U	0.29	1.08	U	3.5	-0.232	U	2.7	0.155	U	0.50	0.207	U	0.40
Hot spot	J13DN1	09/26/06	0.093	U	0.093	-0.302	U	3.3	0.844	U	2.7	0.526		0.42	79.7		0.33
Hot spot	J13DN2	09/26/06	0.092	U	0.092	0.306	U	3.6	0.236	U	2.7	1.57		0.48	91.6		0.48
Hot spot	J13DN3	09/26/06	0.082	U	0.082	0.391	U	3.5	-1.24	U	2.8	-0.058	U	0.44	0	U	0.44
Hot spot	J13DN4	09/26/06	0.082	U	0.082	-0.174	U	3.5	-1.64	U	2.9	-0.081	U	0.62	0	U	0.62
Beneath safe	J13DJ5	09/07/06	0.062	U	0.062	-0.243	U	3.6	0.852	U	2.6	0.088	U	0.42	1.58		0.34
Beneath oil drums	J13DH9	09/07/06	0.047	U	0.047	1.29	U	3.8	1.79	U	2.6	0.142	U	0.54	21.1		0.54

Description	Sample Number	Sample Date	Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Discolored soil	J13H86	09/28/06	3.93	U	20	0.014	U	0.29	6.37		0.22	0.465		0.21	6.28		0.22
Discolored soil	J13H87	09/28/06	10.2	U	23	0.038	U	0.22	7.24		0.20	0.520		0.19	6.71		0.20
Hot spot	J13DN0	09/26/06	1.04	U	18	7.09		0.22	47.8		0.42	2.42		0.23	50.1		0.40
Hot spot	J13DN1	09/26/06	12.3	U	17	0.462		0.23	8.99		0.23	0.473		0.23	10.3		0.23
Hot spot	J13DN2	09/26/06	32.9		17	7.20		0.23	13.4		0.28	0.695		0.23	13.4		0.24
Hot spot	J13DN3	09/26/06	-6.99	U	19	0.006	U	0.32	0.546		0.20	0	U	0.24	0.494		0.20
Hot spot	J13DN4	09/26/06	2.10	U	20	0.062	U	0.32	0.497		0.21	0.033	U	0.26	0.497		0.21
Beneath safe	J13DJ5	09/07/06	6.09	U	18	0.375		0.28	3.05		0.17	0.293		0.20	3.52		0.17
Beneath oil drums	J13DH9	09/07/06	19.6	U	22	1.61		0.21	9.82		0.25	0.438		0.24	10.7		0.20

Table B-5. 618-2 Verification Sample Results (Biased Samples). (3 pages)

Constituents	J13DH9 Beneath oil drums 09/07/06		
	µg/kg	Q	PQL
1,2,4-Trichlorobenzene	340	UJ	340
1,2-Dichlorobenzene	340	U	340
1,3-Dichlorobenzene	340	U	340
1,4-Dichlorobenzene	340	U	340
2,4,5-Trichlorophenol	850	U	850
2,4,6-Trichlorophenol	340	U	340
2,4-Dichlorophenol	340	U	340
2,4-Dimethylphenol	340	UJ	340
2,4-Dinitrophenol	850	U	850
2,4-Dinitrotoluene	340	U	340
2,6-Dinitrotoluene	340	U	340
2-Chloronaphthalene	340	U	340
2-Chlorophenol	340	U	340
2-Methylnaphthalene	340	UJ	340
2-Methylphenol (cresol, o-)	340	UJ	340
2-Nitroaniline	850	U	850
2-Nitrophenol	340	U	340
3+4 Methylphenol (cresol, m+p)	340	UJ	340
3,3'-Dichlorobenzidine	340	U	340
3-Nitroaniline	850	U	850
4,6-Dinitro-2-methylphenol	850	U	850
4-Bromophenylphenyl ether	340	U	340
4-Chloro-3-methylphenol	340	UJ	340
4-Chloroaniline	340	U	340
4-Chlorophenylphenyl ether	340	U	340
4-Nitroaniline	850	U	850
4-Nitrophenol	850	U	850
Acenaphthene	340	U	340
Acenaphthylene	340	U	340
Anthracene	340	U	340
Benzo(a)anthracene	340	U	340
Benzo(a)pyrene	340	U	340

Constituents	J13DH9 Beneath oil drums 09/07/06		
	µg/kg	Q	PQL
Benzo(b)fluoranthene	340	U	340
Benzo(ghi)perylene	340	U	340
Benzo(k)fluoranthene	340	U	340
bis(2-Chloro-1-methylethyl)ether	340	U	340
bis(2-Chloroethoxy)methane	340	U	340
bis(2-Chloroethyl) ether	340	U	340
bis(2-Ethylhexyl) phthalate	27	J	340
Butylbenzylphthalate	340	U	340
Carbazole	340	U	340
Chrysene	340	U	340
Di-n-butylphthalate	18	J	340
Di-n-octylphthalate	340	U	340
Dibenz[a,h]anthracene	340	U	340
Dibenzofuran	340	U	340
Diethylphthalate	340	U	340
Dimethyl phthalate	340	U	340
Fluoranthene	340	U	340
Fluorene	340	U	340
Hexachlorobenzene	340	U	340
Hexachlorobutadiene	340	U	340
Hexachlorocyclopentadiene	340	U	340
Hexachloroethane	340	U	340
Indeno(1,2,3-cd)pyrene	340	U	340
Isophorone	340	UJ	340
N-Nitroso-di-n-dipropylamine	340	U	340
N-Nitrosodiphenylamine	340	U	340
Naphthalene	340	U	340
Nitrobenzene	340	UJ	340
Pentachlorophenol	850	U	850
Phenanthrene	340	U	340
Phenol	340	U	340
Pyrene	340	U	340

Table B-6. Test Pit Sample Results. (4 Pages)

Description	Sample Elevation (m)	Sample Number	Sample Date	Arsenic			Barium			Beryllium			Cadmium			Chromium		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	111	J12NK9	6/19/06	1		0.62	88.4		0.02	0.17		0.02	1.5		0.07	6.7		0.13
Soil	110.5	J12NL3	7/12/06	0.99		0.61	102		0.02	0.03		0.02	1.6		0.07	3.9		0.13
Soil	110	H12Y08	8/2/06	1.5		0.61	72.3		0.02	0.02	U	0.02	2.5		0.07	1.9		0.13
Soil	109	J12Y09	8/2/06	1.3		0.60	47.9		0.02	0.02	U	0.02	0.64		0.07	4.6		0.13
Soil	108	J12Y10	8/2/06	1.6		0.61	47.8		0.02	0.18		0.02	0.89		0.07	3.5		0.13
Soil	107	J12Y11	8/2/06	2.3		0.64	60.2		0.02	0.11		0.02	1.1		0.07	3.7		0.14
Soil	106	J134V2	8/2/06	7.5		0.73	123		0.02	0.42		0.02	0.38		0.08	8.7		0.16
Soil	105	J134V3	8/2/06	2.1		0.74	84.5		0.02	0.91		0.02	0.60		0.08	10.4		0.16
Water Samples				ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
Water (Filtered)	104.5	J12Y73	8/2/06	6.1	U	6.1	229		229	0.20	U	0.20	421		0.70	1.3	U	1.3
Water (nonfiltered)	104.5	J12Y74	8/2/06	738		30.5	38,300		1.0	95.3		1.0	2380		3.5	2180		6.5

Description	Sample Elevation (m)	Sample Number	Sample Date	Lead			Selenium			Silver			Tin			Uranium		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	111	J12NK9	6/19/06	29.6		0.31	0.48	U	0.48	0.07	U	0.07	2.9		1.1	28.1		0.89
Soil	110.5	J12NL3	7/12/06	3.4		0.31	0.47	U	0.47	0.07	U	0.07	1.1	U	1.1	13.0		0.88
Soil	110	H12Y08	8/2/06	2.0		0.31	0.47	U	0.47	0.07	U	0.07	1.1	U	1.1	74.2		0.88
Soil	109	J12Y09	8/2/06	2.6		0.31	0.46	U	0.46	0.07	U	0.07	1.1	U	1.1	12.8		0.87
Soil	108	J12Y10	8/2/06	2.7		0.31	0.47	U	0.47	0.07	U	0.07	1.1	U	1.1	33.9		0.89
Soil	107	J12Y11	8/2/06	2.6		0.33	0.50	U	0.50	0.07	U	0.07	1.1	I	1.1	18.0		0.93
Soil	106	J134V2	8/2/06	4.9		0.37	0.56	U	0.56	0.08	U	0.08	1.3	U	1.3	20.5		1.1
Soil	105	J134V3	8/2/06	12.2		0.38	0.57	U	0.57	0.08	U	0.08	1.3	U	1.3	4.1		1.1
Water Samples				ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
Water (Filtered)	104.5	J12Y73	8/2/06	3.1	U	3.1	5.2		4.7	NA			NA			NA		
Water (nonfiltered)	104.5	J12Y74	8/2/06	1000		15.5	23.5	U	23.5	NA			NA			NA		

Table B-6. Test Pit Sample Results. (4 pages)

Description	Sample Elevation (m)	Sample Number	Sample Date	Bromide			Chloride			Flouride			Nitrite		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	111	J12NK9	6/19/06	NA			NA			NA			NA		
Soil	110.5	J12NL3	7/12/06	NA			NA			NA			NA		
Soil	110	H12Y08	8/2/06	2.5	U	2.5	287		25.3	2.5	U	2.5	2.53	U	2.53
Soil	109	J12Y09	8/2/06	3.7		2.6	622		25.6	2.6	U	2.6	2.56	U	2.56
Soil	108	J12Y10	8/2/06	2.8		2.5	515		24.9	7.0		2.5	2.49	U	2.49
Soil	107	J12Y11	8/2/06	2.7	U	2.7	329		27.4	2.7	U	2.7	2.74	U	2.74
Soil	106	J134V2	8/2/06	10.6		3.1	2620		77.7	3.1	U	3.1	15.5		15.5
Soil	105	J134V3	8/2/06	6.9		3.2	3620		158	3.2	U	3.2	31.5	U	31.5
Water (Filtered)	104.5	J12Y73	8/2/06	NA			NA			NA			NA		
Water (nonfiltered)	104.5	J12Y74	8/2/06	NA			NA			NA			NA		

Description	Sample Elevation (m)	Sample Number	Sample Date	Nitrate			Phosphate			Sulfate			pH		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Soil	111	J12NK9	6/19/06	NA			NA			NA			NA		
Soil	110.5	J12NL3	7/12/06	NA			NA			NA			NA		
Soil	110	H12Y08	8/2/06	2.5	U	2.53	2.5	U	2.5	80.5		2.5	6.1		0.01
Soil	109	J12Y09	8/2/06	297		25.6	2.6	U	2.6	3.4		2.6	3.7		0.01
Soil	108	J12Y10	8/2/06	33.1		2.49	2.5	U	2.5	63.7		2.5	6.9		0.01
Soil	107	J12Y11	8/2/06	66.0		2.74	2.70	U	2.70	31.7		2.7	5.9		0.01
Soil	106	J134V2	8/2/06	345		15.5	3.1	U	3.1	225		15.5	7.4		0.01
Soil	105	J134V3	8/2/06	1930		158	3.2	U	3.2	153		31.5	7.5		0.01
Water (Filtered)	104.5	J12Y73	8/2/06	NA			NA			NA			NA		
Water (nonfiltered)	104.5	J12Y74	8/2/06	NA			NA			NA			NA		

Table B-6. Test Pit Sample Results. (4 pages)

Description	Sample Elevation (m)	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil	111	J12NK9	6/19/06	874		15	0.835		0.030	0.022	U	0.022	0.239		0.069	0.068	U	0.068
Soil	110.5	J12NL3	7/12/06	295		1.0	0.301		0.041	0.037	U	0.037	0.10	U	0.10	0.11	U	0.11
Soil	110	H12Y08	8/2/06	332		0.56	0.097	U	0.097	0.12	U	0.12	0.16	U	0.16	0.41	U	0.41
Soil	109	J12Y09	8/2/06	306		1.9	0.067	U	0.067	0.072	U	0.072	0.18	U	0.18	0.23	U	0.23
Soil	108	J12Y10	8/2/06	111		0.28	0.071	U	0.071	0.069	U	0.069	0.16	U	0.16	0.21	U	0.21
Soil	107	J12Y11	8/2/06	63.6		0.15	0.052	U	0.052	0.054	U	0.054	0.15	U	0.15	0.18	U	0.18
Soil	106	J134V2	8/2/06	0.732		0.13	0.062	U	0.062	0.075	U	0.075	0.18	U	0.18	0.23	U	0.23
Soil	105	J134V3	8/2/06	2.81		0.16	0.13	U	0.13	0.13	U	0.13	0.29	U	0.29	0.39	U	0.39
Water Samples				**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**
Water (Filtered)	104.5	J12Y73	8/2/06	6.70		0.63	70	U	70	83	U	83	170	U	170	210	U	210
Water (nonfiltered)	104.5	J12Y74	8/2/06	104		1.8	130	U	130	78	U	78	160	U	160	190	U	190

Description	Sample Elevation (m)	Sample Number	Sample Date	Europium-155			Nickel-63			Tritium			Plutonium-238			Plutonium-239/240		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil	111	J12NK9	6/19/06	0.17	U	0.17	-3.31	U	21	0.978	U	2.7	163		34	13,500		27
Soil	110.5	J12NL3	7/12/06	0.17	U	0.17	-1.26	U	11	2.85		2.8	38.7		13	2,350		13
Soil	110	H12Y08	8/2/06	0.14	U	0.14	6.52	U	16	1.05	U	2.6	1.47		0.45	57.2		0.36
Soil	109	J12Y09	8/2/06	0.23	U	0.23	9.29	U	50	3.57		2.7	21.1		3.9	1710		2.2
Soil	108	J12Y10	8/2/06	0.20	U	0.20	1.32	U	3.6	2.38	U	2.4	2.39		0.11	150		0.076
Soil	107	J12Y11	8/2/06	0.13	U	0.13	-0.54	U	3.50	2.09	U	2.6	0.827		0.10	62.1		0.071
Soil	106	J134V2	8/2/06	0.27	U	0.27	1.39	U	3.7	5.79		2.4	0.049	U	0.049	5.62		0.075
Soil	105	J134V3	8/2/06	0.33	U	0.33	2.14	U	3.1	12.9		2.5	0	U	0.15	0.918		0.075
Water Samples				**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**
Water (Filtered)	104.5	J12Y73	8/2/06	180	U	180	13	U	16	4890		160	-0.060	U	0.81	2.96		0.46
Water (nonfiltered)	104.5	J12Y74	8/2/06	170	U	170	-1.84	U	15	7830		160	0.188	U	0.52	20		0.36

Table B-6. Test Pit Sample Results. (4 pages)

Description	Sample Elevation (m)	Sample Number	Sample Date	Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil	111	J12NK9	6/19/06	6,760		350	2.94	U	3.5	19.0		8.6	2.71	U	10	10.1		8.6
Soil	110.5	J12NL3	7/12/06	1,160		210	1.02	U	3.2	15.1		1.5	0.468	U	1.8	12.8		1.5
Soil	110	H12Y08	8/2/06	23.5	U	94	0.389	U	2.5	56.0		1.3	3.45		1.3	50.9		1.3
Soil	109	J12Y09	8/2/06	776		320	-2.19	U	8.0	13.9		3.7	1.16	U	4.4	14.4		3.7
Soil	108	J12Y10	8/2/06	67.2		16	0.122	U	0.25	16.1		0.34	0.996		0.28	15.2		0.34
Soil	107	J12Y11	8/2/06	32.7		17	0.266		0.22	18.2		0.35	1.32		0.24	18.1		0.32
Soil	106	J134V2	8/2/06	13.4	U	16	-0.071	U	0.24	4.46		0.22	0.282		0.27	3.79		0.22
Soil	105	J134V3	8/2/06	1.15	U	18	0.048	U	0.19	3.33		0.25	0.117	U	0.30	2.71		0.26
Water Samples				**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**	**pCi/L**	**Q**	**MDA**
Water (Filtered)	104.5	J12Y73	8/2/06	30.5	U	110	263		2.8	436		2.6	26.8		0.92	444		2.5
Water (nonfiltered)	104.5	J12Y74	8/2/06	39.1	U	91	127		2.1	22.5		0.96	1.06	U	1.2	25.1		0.96

Table B-7. Pothole Sample Results. (2 pages)

Description	Sample Elevation (m)	Sample Number	Sample Date	Arsenic			Barium			Beryllium			Cadmium			Chromium		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Northeast corner	108	J13H52	9/25/06	1.1		0.37	59.3		0.02	0.25		0.01	0.06		0.03	2.7		0.07
Southeast corner	108	J13H53	9/25/06	1.3		0.36	55.5		0.02	0.30		0.01	0.05		0.03	3.8		0.07
Northwest corner	108	J13H54	9/25/06	1.5		0.35	52.3		0.02	0.32		0.01	0.07		0.03	3.9		0.07
Southwest corner	108	J13H55	9/25/06	1.5		0.37	69.4		0.02	0.39		0.01	2.7		0.03	5.3		0.07

Description	Sample Elevation (m)	Sample Number	Sample Date	Lead			Selenium			Silver			Tin			Uranium		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Northeast corner	108	J13H52	9/25/06	2.3		0.12	0.26	U	0.26	0.11	U	0.11	0.92		0.35	2.1	U	2.1
Southeast corner	108	J13H53	9/25/06	11.2		0.12	0.26	U	0.26	0.11	U	0.11	0.62		0.34	5.4		2.1
Northwest corner	108	J13H54	9/25/06	2.5		0.11	0.25	U	0.25	0.11	U	0.11	0.72		0.33	2	U	2
Southwest corner	108	J13H55	9/25/06	2.5		0.12	0.26	U	0.26	0.11	U	0.11	0.79		0.35	2.1	U	2.1

Description	Sample Elevation (m)	Sample Number	Sample Date	Bromide			Chloride			Flouride			Nitrite			Nitrate		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Northeast corner	108	J13H52	9/25/06	5.5		2.5	614		25.2	2.5	U	2.5	2.52	U	2.52	5.52		2.52
Southeast corner	108	J13H53	9/25/06	2.7	U	2.7	425		26.7	2.7	U	2.7	2.67	U	2.67	11		2.67
Northwest corner	108	J13H54	9/25/06	2.2	U	2.2	77.8		77.8	2.2	U	2.2	2.19	U	2.19	7.69		2.19
Southwest corner	108	J13H55	9/25/06	16.3		2.6	1430		52.6	2.6	U	2.6	2.63	U	2.63	22.6		2.63

Description	Sample Elevation (m)	Sample Number	Sample Date	Phosphate			Sulfate			pH		
				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Northeast corner	108	J13H52	9/25/06	2.5	U	2.5	50.6		2.5	8		0.01
Southeast corner	108	J13H53	9/25/06	2.7	U	2.7	33.9		2.7	7.9		0.01
Northwest corner	108	J13H54	9/25/06	2.2	U	2.2	9.7		2.2	8.4		0.01
Southwest corner	108	J13H55	9/25/06	2.6	U	2.6	108		52.6	6		0.01

Table B-7. Pothole Sample Results. (2 pages)

Description	Sample Elevation (m)	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Northeast corner	108	J13H52	9/25/06	1.49		0.18	0.091	U	0.091	0.12	U	0.12	0.14	U	0.14	0.39	U	0.39
Southeast corner	108	J13H53	9/25/06	0.116	U	0.18	0.043	U	0.043	0.038	U	0.038	0.10	U	0.10	0.12	U	0.12
Northwest corner	108	J13H54	9/25/06	0.180		0.17	0.024	U	0.024	0.026	U	0.026	0.062	U	0.062	0.084	U	0.084
Southwest corner	108	J13H55	9/25/06	38.0		0.16	0.041	U	0.041	0.037	U	0.037	0.098	U	0.098	0.13	U	0.13

Description	Sample Elevation (m)	Sample Number	Sample Date	Europium-155			Nickel-63			Tritium			Plutonium-238			Plutonium-239/240		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Northeast corner	108	J13H52	9/25/06	0.090	U	0.090	0.712	U	3.4	1.16	U	2.6	0	U	0.44	10.0		0.44
Southeast corner	108	J13H53	9/25/06	0.095	U	0.095	1.14	U	3.3	-0.359	U	2.5	0	U	0.45	1.17		0.45
Northwest corner	108	J13H54	9/25/06	0.087	U	0.087	0.126	U	3.4	-0.486	U	2.7	0.066	U	0.51	0.464	U	0.51
Southwest corner	108	J13H55	9/25/06	0.091	U	0.091	0.910	U	3.3	-0.530	U	2.6	0.102	U	0.97	3.97		0.78

Description	Sample Elevation (m)	Sample Number	Sample Date	Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
				pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Northeast corner	108	J13H52	9/25/06	1.55	U	20	7.72		0.22	2.27		0.16	0.101	U	0.19	2.23		0.16
Southeast corner	108	J13H53	9/25/06	0.682	U	18	3.17		0.24	5.47		0.20	0.360		0.20	6.15		0.16
Northwest corner	108	J13H54	9/25/06	3.55	U	18	0.070		0.23	0.848		0.16	0	U	0.20	0.997		0.16
Southwest corner	108	J13H55	9/25/06	-20.6	U	49	0.195	U	0.22	1.64		0.17	0.055	U	0.21	1.53		0.17

Table B-8. FIDLER "Hot Spot" Sample Results.

Description	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil	J135M5	8/24/06	0	U	1.1	2640		5.4	2.0	U	2.0	15	U	15	6.4	U	6.4	6.4	U	6.4
Soil	J135M6	8/24/06	-0.270	U	2.1	0.79	U	0.79	0.74	U	0.74	1.6	U	1.6	2.0	U	2.0	1.9	U	1.9
Soil	J135M7	8/24/06	18.3		0.58	12.7		1.7	1.9	U	1.9	3.2	U	3.2	5.4	U	5.4	2.7	U	2.7
Debris	J135M8	8/24/06	-2.72	U	10.0	3.0	U	3.0	1.7	U	1.7	6.4	U	6.4	5.2	U	5.2	120	U	120
Soil	J135M9	8/24/06	1,540		11	41.0		0.55	0.51	U	0.51	1.3	U	1.3	1.5	U	1.5	1.4	U	1.4
Soil	J135N0	8/24/06	172		1.6	1.7	U	1.7	2.0	U	2.0	3.5	U	3.5	6.2	U	6.2	2.7	U	2.7
Soil	J135N1	8/24/06	0.343		0.20	33.4		1.2	0.56	U	0.56	2.2	U	2.2	2.5	U	2.5	1.4	U	1.4
Soil	J135N2	8/24/06	0.122	U	0.23	4,530		11	4.2	U	4.2	36	U	36	13	U	13	20	U	20
Soil	J135N3	8/24/06	0.086	U	0.33	38.1		2.1	2.5	U	2.5	4.2	U	4.2	6.5	U	6.5	3.3	U	3.3

Description	Sample Number	Sample Date	Plutonium-238			Plutonium-239/240			Plutonium-241			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Soil	J135M5	8/24/06	9.1	U	9.1	1.28		0.98	-1.50	U	47	146		0.97	7.51		0.4	146		0.89
Soil	J135M6	8/24/06	-0.274	U	2.1	0.822	U	2.1	-11.9	U	100	216		1.6	11.8		0.72	211		1.5
Soil	J135M7	8/24/06	1.66		0.79	150		0.79	38.1	U	46	53.2		0.56	3.58		0.29	52.9		0.53
Debris	J135M8	8/24/06	3.98	U	19	5.96	U	15	108	U	1,000	3,050		20	226		6.7	3,130		19
Soil	J135M9	8/24/06	56.7		18	4,070		14	2,070	U	890	11.6		5.2	2.48	U	6.3	5.46		5.2
Soil	J135N0	8/24/06	2.63		1.5	99.5		1.5	56.5	U	82	7.49		0.31	0.448		0.38	7.77		0.31
Soil	J135N1	8/24/06	0.054	U	0.41	0.862		0.41	7.80	U	24	3.29		0.044	0.182		0.027	3.12		0.042
Soil	J135N2	8/24/06	0	U	0.31	0.080	U	0.31	4.21	U	23	0.685		0.030	0.069		0.025	0.590		0.026
Soil	J135N3	8/24/06	0	U	0.34	0.843		0.27	-1.84	U	24	0.956		0.033	0.051		0.028	1.08		0.023

APPENDIX C

DATA QUALITY ASSESSMENT

C1.0 DATA QUALITY ASSESSMENT FOR THE 618-2 SOLID WASTE BURIAL GROUND

C1.1 OVERVIEW

The data quality assessment (DQA) completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process. The DQA includes a review of the field logbook information (WCH 2006b) to verify sample location, date, and time. It also involves a scientific and statistical evaluation of the data to determine if they are of the right type, quality, and quantity to support their intended use for closeout decisions (EPA 2000).

This DQA was performed in accordance with data quality objectives found in the *300 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2004a). The DQA is based on the guidelines presented in *Guidance for Data Quality Assessment* (EPA 2000). Statistical tests used in this DQA were performed as specified in the SAP and the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (RDR/RAWP) (DOE-RL 2004b).

Prior to performing statistical tests, the field logbook (WCH 2006b), the *Closeout Plan for the 618-2 Burial Ground* (WCH 2006a), and the sample analytical data were evaluated. A portion of the cleanup verification sample analytical data are validated for compliance requirements (DOE-RL 2004a). An evaluation is performed to determine if the laboratory carried out all steps required by the SAP and the laboratory contract governing the conduct of analysis and reporting of the data. Third-party data validation, in accordance with validation procedures specified in *Data Validation Procedure for Chemical Analysis* (BHI 2000a) and in *Data Validation Procedure for Radiochemical Analysis* (BHI 2000b), is performed as part of data evaluation. After validation and data evaluation, the appropriate statistical analyses are performed on the analytical data (Appendix D) to determine statistical values, as appropriate, for each contaminant. The cleanup verification sample analytical data are stored in the Environmental Restoration (ENRE) project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System (HEIS) database and are also summarized in Appendix B.

C1.2 LABORATORY QUALITY MEASURES

All verification samples are subject to laboratory-specific quality assurance (QA) requirements, including instrument procurement, maintenance, calibration, and operation. Additional laboratory quality control (QC) checks are performed, as appropriate, for the analytical method at a rate of 1 per sample delivery group (SDG), or 1 per 20 samples, whichever is more frequent. Laboratory internal QC checks include the following:

- Laboratory Contamination. Each analytical batch contains a laboratory (method) blank (material of similar composition as the samples with known/minimal concentrations of the analytes of interest) carried through the complete analytical process. The method blank is used to evaluate samples for false-positive results due to contamination at the laboratory.

- Analytical Accuracy. For most analyses, a known quantity of representative analytes of interest are added to a separate aliquot of a sample from the analytical batch, known as the matrix spike/matrix spike duplicate (MS/MSD). The recovery percentages of the added MS are used to evaluate analytical accuracy. For analyses not amenable to MS techniques (e.g., gamma energy analysis) or where analytical recovery is corrected via internal standards (e.g., alpha spectral analyses), accuracy is evaluated from recovery of the QC reference sample (i.e., laboratory control spike [LCS] or blank spike sample).

- Analytical Precision. Separate aliquots removed from the same sample container are analyzed for each analytical batch, and referred to as the laboratory duplicate or replicate. The replicate sample results (evaluated by relative percent differences [RPDs]) are used to assess the analytical precision achieved at the laboratory. However, natural heterogeneities often found in soil matrix samples also play a significant part in the RPD result.

- QC Reference Samples. A QC reference sample is prepared from an independent standard at a concentration other than that used for calibration, but within the calibration range. Reference samples provide an independent check on analytical technique and methodology.

Laboratories are also subject to periodic and random assessments of the laboratory performance, systems, and overall program. These assessments are performed by the Washington Closure Hanford QA group to ensure that the laboratories are performing within laboratory contract requirements.

C1.3 DATA VALIDATION

After sampling was completed, all of the fixed laboratory data from SDG K0545 were submitted for third-party validation to Level C. Level C validation procedures are specified in *Data Validation Procedure for Radiochemical Analysis* (BHI 2000b) and *Data Validation Procedure for Chemical Analysis* (BHI 2000a).

Level C validation procedures were used to review and qualify the data for the following parameters:

- Sample holding times
- Method blanks
- MS/MSD recovery
- Surrogate recovery

- Sample replicates (duplicates)
- Laboratory control sample results
- Data package completeness
- Achievement of required detection limits (RDLs) or contract required quantitation limits.

Data qualified as rejected (i.e., "R" flagged) indicate that the associated analytical result is tainted by a major deficiency in the quality of the data. Rejected data are unsuitable for decision-making purposes. Data qualified as estimated (i.e., "J" flagged) indicate that the data is estimated, but may be used for decision- making purposes. Data qualified as undetected (i.e., "U" flagged) indicate the analyte was analyzed for but not detected. For nonradionuclides, nondetected results are reported at the practical quantitation limit (PQL). For radionuclides, nondetected results are reported at the actual value obtained from analysis (positive or negative but less than the minimum detected activity [MDA]), except for limited analyses where no value can be calculated and the analytes are reported nondetected at the MDA. All other validated results are considered accurate within the standard errors associated with the methods.

The adequacy of laboratory QA/QC was evaluated for precision, accuracy, completeness, and RDLs pursuant to the SAP (DOE-RL 2004a). The organization performing the data validation reported that, of the data given formal validation, the laboratory met the standards for performance for precision (±30%), accuracy (±30%), and completeness (>90%).

SDG K0545

This data package contains 17 samples (J13D59 through J13D75) analyzed by alpha spectroscopy, tritium analysis, nickel-63 analysis, plutonium-241 analysis, total uranium analysis, total strontium analysis, gamma spectroscopy, and by inductively coupled plasma (ICP) metals analysis. The 17 samples were collected from the 618-2 overburden and the staging pile/decontamination pad footprint. Sample J13D74 (A2) is the main sample and sample J13D59 is the corresponding field duplicate. SDG K0545 was evaluated through a formal third-party validation process. A summary of the validation follows:

Radionuclides. No major deficiencies were found in the SDG K0545 radiological data. Minor deficiencies are as follows:

The radiochemical yield in sample J13D61 was outside the QC limits at 19%. Third-party validation qualified all of the plutonium-238 and plutonium-239/240 results in sample J13D61 as estimated with "J" flags. Estimated data are useable for decision-making purposes.

Due to a lack of MS analysis, third-party validation qualified all tritium results in SDG K0545 as estimates with "J" flags. Matrix spikes for some radionuclides are not typically performed by the laboratory. Other accuracy measures, such as blind audit samples, are used to assess laboratory accuracy for these radionuclides. Estimated data are useable for decision- making purposes.

Due to an RPD outside the QC limits (thorium-228, 34%), third-party validation qualified all of the thorium-228 results in SDG K0545 as estimated with "J " flags. Estimated data are useable for decision- making purposes.

Nonradionuclides. No major or minor deficiencies were found in the SDG K0545 nonradiological data.

Limited, random, or sample matrix-specific influenced batch QC issues such as those identified in the radionuclide data for SDG K0545 are potential issues for any analysis. The number and types seen in SDG K0545 are within expectations for the matrix types and analyses performed. All of the data in SDG K0545 are useable for decision-making purposes.

C1.4 LABORATORY DATA EVALUATION

The following paragraphs include a data evaluation of the remaining verification sample SDGs (K0547, K0580, K0586, J00098, J00099) for the 618-2 waste site. Comments on the comparability of the samples to the project splits are presented in section C1.5.

SDG K0547

This data set comprises 18 field samples (J13DF9, J13DH0 through J13DH3, J13DH9, J13DJ0 through J13DJ9, J13DK0, and J13DK1). These samples are a mixture of shallow zone, deep zone, overburden, overburden footprint, and biased samples. Appendix D provides specific sample locations and analyte lists for samples from the 618-2 waste site. Samples J13DJ7 (shallow zone, A2), J13DJ0 (deep zone, A2) and sample J13DH0 (overburden, A2) are "main" samples in conjunction with corresponding duplicate samples J13DJ8, J13DJ1, and J13DH1, respectively. Sample J13DK1 is the equipment blank (field blank) for the 618-2 waste site. Samples J13DJ5 and J13DH9 are bias samples.

Radionuclides. No major deficiencies were found in the SDG K0547 radiological data. Minor deficiencies are as follows:

- Detected quantities of uranium-233/234 (161 pCi/g) and uranium-238 (165 pCi/g) in sample J13DJ3 caused spectral interference in the analysis of uranium-235. Due to this interference, the MDA for uranium-235 in sample J13DJ3 was elevated to 5.8 pCi/g. This result is typical of radiological counting methods. The uranium-233/234

and uranium-238 results are large enough that a minimal increase in the uranium-235 MDA is not a significant problem for this waste site. The data are useable for decision-making purposes.

- The MDAs for plutonium-241 was also elevated in the SDG K0547 sample data. In this case, the elevated MDAs are due to slightly shortened counting times. The resulting MDAs are all well below the RAG values. The data are useable for decision-making purposes.

Nonradionuclides. No major deficiencies were found in the SDG K0547 nonradiological data. Minor deficiencies are as follows:

- In the semivolatile organic analysis, of sample J13DH9, low recoveries were observed in the MSs and some LCSs for 8 analytes. The analytes are 2-methylphenol, 4-methylphenol, nitrobenzene, isophorone, 2,4-dimethylphenol, 1,2,4-trichlorobenzene, 4-chloro-3-methylphenol, and 2-methylnaphthalene. The MS/MSD and/or LCS recoveries in question were all in the range of 39% to 59%. The project has qualified results for these analytes, in sample J13DH9, as estimated and assigned "J" flags to the data.

- In the ICP metals analysis, the analyte tin was detected in the method blank (MB) and in all of the samples. The MB concentration is greater than the PQL and greater than 1/20th of all of the sample concentrations. The project has qualified all of the results for tin in SDG K0547 as estimated with "J" flags. Estimated data are useable for decision- making purposes.

- In the ICP metals analysis, the RPD results for tin and arsenic were above the acceptance criteria at 57.1% and 51.2%, respectively. Because the duplicate is prepared from actual field sample matrix (soil), the heterogeneities within the matrix contribute to the RPD result. This deficiency does not indicate a problem with the analytical laboratory methodology. The data are useable for decision-making purposes.

SDG K0580

This data set comprises five field samples (J13DN0 through J13DN4). These are biased samples collected within the 618-2 excavation.

Radionuclides. No major deficiencies were found in the SDG K0580 radiological data. Minor deficiencies are as follows:

- The MDAs for plutonium-241 are elevated in the SDG K0580 data. In this case, the elevated MDAs are due to slightly shortened counting times. The resulting MDAs are all well below the RAG values. The data are useable for decision-making purposes.

Nonradionuclides. No major or minor deficiencies were found in the SDG K0080 radiological data.

SDG K0086

This data set comprises two field samples (J13H86 and J13H87). These samples are biased within the 618-2 excavation.

Radionuclides. No major deficiencies were found in the SDG K0586 radiological data. Minor deficiencies are as follows:

- The MDAs for plutonium-241 are elevated in the SDG K0586 data. In this case, the elevated MDAs are due to slightly shortened counting times. The resulting MDAs are all well below the RAG values. The data are useable for decision-making purposes.

Nonradionuclides. No major or minor deficiencies were found in the SDG K0086 radiological data.

SDG J00098

This data set comprises one field sample (J13D76). Sample J13D76 is a project split of sample J13D74.

Radionuclides. No major deficiencies were found in the SDG J00098 radiological data. Minor deficiencies are as follows:

- Insufficient sample matrix was sent to the laboratory to provide for a duplicate sample. The sample (J13D76) was analyzed on two separate detectors to provide a duplicate analysis. This is acceptable. The data are useable for decision-making purposes.

Nonradionuclides. No major deficiencies were found in the SDG J00098 radiological data. Minor deficiencies are as follows:

- The MS/MSD results for cadmium are 59% and 58%, respectively. The field sample results for cadmium should be considered estimated. Estimated data are useable for decision-making purposes.

SDG J00099

This data set comprises three field samples (J13DH4, J13DK2, and J13DK3). Samples J13DH4, J13DK2, and J13DK3 are field splits of samples J13DH0, J13DJ7, and J13DJ0, respectively.

Radionuclides. No major deficiencies were found in the SDG J00099 radiological data. Minor deficiencies are as follows:

- The LCS result for americium-241 was above the acceptance criteria at 131%. This implies a slight high bias in the data. High-biased data are acceptable for decision-making purposes.

- The LCS result for radium-226 was below the acceptance criteria at 69%. This implies a low bias in the data. The radium-226 results in SDG J00099 are considered estimated. Estimated data are useable for decision-making purposes.

Nonradionuclides. No major deficiencies were found in the SDG J00098 radiological data. Minor deficiencies are as follows:

- The MS/MSD results for cadmium are 59% and 58%, respectively. The sample results for cadmium should be considered estimated. Estimated data are useable for decision- making purposes.

- The MS result for silver was below the acceptance criteria at 65%. The MSD, LCS, and RPD results for silver are all within the acceptance criteria range. The silver results may be considered estimated but useable for decision-making purposes.

C1.4.1 MAJOR DEFICIENCIES

Any data anomaly that causes final data to be qualified as rejected ("R" flagged) is considered a major deficiency. No major deficiencies were found the 618-2 verification data set.

C1.4.2 MINOR DEFICIENCIES

Sample Holding Times. All of the method-specific holding times were met for all samples in the 618-2 verification data set.

Method Blanks. The method blank is used to evaluate false-positive results in samples due to contamination during handling at the laboratory.

Radionuclides. All of the radionuclide method blank results were within the acceptance criteria.

Nonradionuclides. A minor method blank deficiency was identified in SDG K0547 (see above).

MS/MSDs Recoveries. Recoveries of spiked analytes in the MS/MSD pair(s) are used to evaluate method efficiency and the effect of the sample matrix on the environmental sample results.

Radionuclides. A minor method blank (MB) deficiency was identified in SDG K0547 (see above).

Nonradionuclides. Minor deficiencies in the MS/MSD recoveries are identified in SDGs K0547, J00098, and J00099. Some data are qualified as estimated. Estimated data are useable for decision-making purposes.

RDL Comparison. Reported analytical detection levels for nondetected analytes were compared to the RDLs specified in the SAP (DOE-RL 2004a). When detected results were obtained, evaluation of detection limits was not performed.

Radionuclides. All of the reported contaminant of concern (COC) MDAs are sufficiently low for decision-making purposes. All values meet the site cleanup criteria as demonstrated in the calculation briefs (Appendix D) and discussed in this cleanup verification package.

Nonradionuclides. All of the reported MDLs are sufficiently low for decision-making purposes. All values meet the site cleanup criteria as discussed in this cleanup verification package.

Precision and Accuracy Evaluation. RPD evaluation of the main sample(s) versus the laboratory duplicate(s) are routinely performed by the laboratory, and any deficiencies in the calculations are reported by SDG in section C1.4.0.

C1.5 FIELD QUALITY ASSURANCE/QUALITY CONTROL

Field QA/QC measures were used to assess potential sources of error and cross contamination of soil samples that could bias results. Field QA/QC samples listed in the field logbook (WCH 2006b) are summarized in Table C-1. The main and QA/QC sample results are presented in Appendix B.

Table C-1. Summary of Field Quality Control Samples.

Sample location (designation)	Main Sample	Duplicate Sample	Split Sample
Staging pile/decon pad (A2)	J13D74	J13D59	J13D76
Overburden (A2)	J13DH0	J13DH1	J13DH4
Shallow zone (A2)	J13DJ7	J13DJ8	J13DK2
Deep zone (A2)	J13DJ0	J13DJ1	J13DK3

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the duplicate samples for each COC. Only analytes with values above five times the detection limits for both the main and duplicate samples are calculated and compared. The 95% upper confidence limit (UCL) calculation brief in Appendix D provides details on duplicate pair evaluation and RPD calculation. The data are suitable for the intended purpose of cleanup verification.

Split samples are collected to provide a relative measure of the degree of variability in the sampling, sample handling, and analytical techniques used by commercial laboratories. The field main and split samples are evaluated by computing the RPD of the split samples for each COC to determine the usability of the verification data. The U.S. EPA Contract Laboratory Program duplicate sample comparison methodology, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994), is used as an initial test of the data from the splits. Only analytes that had values above five times the contractual RDL for both the main and split sample were compared. The 95% UCL calculation briefs in Appendix D provide details on split pair RPD calculation. The acceptance criteria RPD for project-split samples is ≤ 30% (less than or equal to 30%).

Radionuclides.

- The RPDs calculated for the deep zone project split sample (J13DK3) analytes americium-241, plutonium-239/240, uranium-233/234, uranium-238, and uranium (metal) are above the acceptance criteria (30%) at 77%, 57%, 67%, 66%, and 86%, respectively. Elevated RPDs, such as these, in the analysis of environmental soil samples, are largely attributed to heterogeneities in the soil matrix and only in small part attributed to precision and accuracy issues at the laboratory. The data are useable for decision-making purposes.

Nonradionuclides.

- The RPD calculated for the staging pile/decontamination pad project split sample (J13D76) analyte chromium is above the acceptance criteria (30%) at 54%.

- The RPD calculated for the deep zone project split sample (J13DK3) analyte uranium (metal) is above the acceptance criteria (30%) at 86%.

Elevated RPDs, such as these, in the analysis of environmental soil samples, are largely attributed to heterogeneities in the soil matrix and only in small part attributed to precision and accuracy issues at the laboratory. The data are useable for decision-making purposes.

RPDs for the remaining nonradionuclide analytes were either within the acceptance criteria or were not calculated because an evaluation of the data shows the analytes

were not detected in both the main and duplicate (or main and split) sample at more than 5 times the target detection limit. RPDs of analytes detected at low concentrations (less than five times the detection limit) are not considered indicative of the analytical system performance. The data are useable for decision-making purposes.

A visual inspection of all of the data is also performed by the data reviewer. No major deficiencies were noted. No additional minor deficiencies were noted. The data are useable for decision-making purposes.

C1.6 SUITABILITY OF DATA

The DQA for the 618-2 waste site determined that the data are of the right type, quality, and quantity to support site cleanup verification decisions within specified error tolerances. The DQA verified that the sample design was sufficient for the purpose of clean site verification.

C2.0 REFERENCES

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

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

DOE-RL, 2004a, *300 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-2001-48, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2004b, *Remedial Design Report/Remedial Action Work Plan for the 300 Area*, DOE/RL-2001-47, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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.

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

WCH, 2006a, *Closeout Plan for the 618-2 Burial Ground,* CCN 129577, Washington Closure Hanford, Richland, Washington.

WCH, 2006b, *Remedial Sampling*, Logbook EFL-1395-12, Washington Closure Hanford, Richland, Washington.

APPENDIX D

CALCULATION BRIEF EXCERPTS

DISCLAIMER FOR CALCULATIONS

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

CALCULATION BRIEFS

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

WCH, 2006, *Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden and 618-2, 618-3, and 618-8 Staging Pile and Decon Pad Footprint*, Calculation No. 0600X-CA-V0060, Rev. 2, Washington Closure Hanford, Richland, Washington.

WCH, 2006, *618-2 Shallow, Deep Zone, Overburden/Stockpile Area Sampling Plan*, 0300X-CA-V0077, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2006, *618-2 Burial Ground Cleanup Verification RESRAD Calculation Brief*, Calculation No. 0300X-CA-V0080, Rev. 0, Washington Closure Hanford, Richland, Washington.

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

CALCULATION COVER SHEET

Project Title	300 Area Field Remediation	**Job No.**	14655
Area	600		
Discipline	Environmental	***Calc. No.**	0600X-CA-V0060
Subject	Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint		
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 [X] **Preliminary** [ ] **Superseded** [ ] **Voided** [ ]

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 21 Total = 22	*K. A. Anselm* *11/1/06*	*J. M. Capron* *11/1/06*	*R. B. Kerkow* *11/1/06*	*M. J. Haass* *F. M. Corpuz*	*11/1/06* *11/1/06*
1	Cover = 1 Sheets = 21 Total = 22	*K. A. Anselm* *11/16/06*	W.S. Thompson *11/20/06* J. M. Capron *11/21/06*	*R. B. Kerkow* *11/21/06*	*M. J. Haass* *F. M. Corpuz*	*11/21/06* *11/21/06*
2 KAA 12/7/06	Cover = 1 Sheets = 21 Total = 22	KA Anselm 12/7/06 K. A. Anselm	W.S. Thompson 12/7/06 W.S. Thompson	R.B. Kerkow 12/7/06 R. B. Kerkow	M. J. Haass M J Haass F. M. Corpuz	12/7/06 12/7/06

SUMMARY OF REVISIONS

1	Revised to include results of third-party data validation (which added "J" flags) and to reflect final data received with adjustments for metals in the shallow zone, deep zone, and overburden data. Cover sheet, sheets 3, 6, 9, 12, 18, 19, and 20 replaced in entirety. Sheet 2, line 47: J = estimate was inserted. Sheet 13, lines 4 to 20: "J" was added to the Tritium "Q" column. Sheet 14, line 4: "J" was added to the Plutonium-238 and Plutonium-239/240 "Q" columns for sample J13D61. Sheet 21, lines 4 and 5: "J" was added to the Tritium "Q" column.
2	Revised to correct values from Unrestricted Land-Use to Industrial Land-Use as follows: Cover sheet replaced in entirety. Sheet 2, line 55: RESRAD acronym added. Sheet 3, line 38: overburden index sum recalculated. Sheet 9, lines 36, 37, 38: Tin 3-Part Test explanation revised. Sheet 12, lines 31, 37, 38, and 42: Selenium values corrected for the RAG, noncarcinogenic value, hazard quotient, and index sum.

WCH-DE-018 (9/01/2006) *Obtain Calc. No. from R&DC and Form from Intranet

Washington Closure Hanford **CALCULATION SHEET**

Originator K. A. Anselm	**Date** 11/01/06	**Calc. No.** 0600X-CA-V0060	**Rev. No.** 0
Project 300 Area Field Remediation	**Job No.** 14655	**Checked** J. M. Capron	**Date** 11/01/06
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint			**Sheet No.** 1 of 21

Summary

Purpose:
This document contains calculations based on analytical results from data collected from the 618-2 shallow zone, deep zone, and overburden piles, as well as a staging pile and decon pad footprint used for staging excavation material from the 618-2, 618-3, and 618-8 Burial Grounds. Other calculations to support cleanup of 618-3 and 618-8 Burial Grounds are included in cleanup verification packages (CVPs) for those sites. The calculations in this document include (1) calculation of the 95% upper confidence limit (UCL) to evaluate compliance with cleanup standards, (2) calculation of the carcinogenic risk for applicable nonradionuclide analytes, (3) performance of the *Washington Administrative Code* (WAC) 173-340 (Model Toxics Control Act [MTCA]) 3-part test, as required, and (4) calculation of the relative percent difference (RPD) for each contaminant of concern (COC)/contaminant of potential concern (COPC).

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Sheets 1 to 3 - Summary
Sheets 4 to 6 - 618-2 Shallow Zone Verification
Sheets 7 to 9 - 618-2 Deep Zone Verification
Sheets 10 to 12 - 618-2 Overburden Verification
Sheets 13 to 16 - 618-2, 618-3, and 618-8 Staging Pile/Decon Pad Footprint Verification
Sheet 17 - MTCAStat Results
Sheets 18 to 21 - Split-Duplicate Analyses

Given/References:
1) Sample Results.
2) Background values and remedial action goals (RAGs) are from DOE-RL (2001 and 2004b), and Ecology (1994).
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, 2004a, *300 Area Remedial Action Sampling and Analysis Plan*, (SAP) DOE/RL 2001-48, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) DOE-RL, 2004b, *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (RDR/RAWP), DOE/RL-2001-47, Rev. 1, 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, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication No. 94-115, Washington State Department of Ecology, Olympia, Washington.
9) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013, U.S. Environmental Protection Agency, Washington, D.C.
10) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code*.

Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2004b). Use data from the attached worksheets to calculate the 95% UCL, hazard quotients, excess carcinogenic risk, perform the WAC 173-340 3-part test for nonradionuclides, and calculate the RPD for each COC/COPC in the primary-duplicate and primary-split sample pairs.

Calculation Description:
The subject calculations were performed on data from soil verification samples from the 618-2 waste site, and the 618-2, 618-3, and 618-8 staging pile/decon pad footprint. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by utilizing 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 2004b) is documented by this calculation. Split and duplicate RPD results are used in evaluation of data quality and are presented in the CVP for this site.

Methodology:
For nonradioactive analytes with <50% of the data below detection limits and all 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 value for the data set is used instead of the 95% UCL. All nonradionuclide data reported as being below detection limits are set to ½ the detection limit value for calculation of the statistics (Ecology 1993). 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 primary-duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.

Washington Closure Hanford **CALCULATION SHEET**

Originator K. A. Anselm KAA Date 12/07/06 Calc. No. 0600X-CA-V0060 Rev. No. 2
Project 300 Area Field Remediation Job No. 14655 Checked W.S. Thompson Date 12/07/06
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint Sheet No. 2 of 21

Summary (continued)

Methodology (continued):

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 MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2004b) and MTCAStat coding and due to a limitation in the MTCAStat coding (no direct capability to address variable quantitation limits within a data set), substitutions for censored data are performed before software input and the resulting input set treated as uncensored.

The hazard quotient (for shallow zone nonradionuclide COCs/COPCs) is determined by dividing the statistical value (derived in this calculation) by the WAC 173-340 noncarcinogenic cleanup limit. The excess nonradionuclide carcinogenic risk is determined by dividing the statistical value by the WAC 173-340 carcinogenic cleanup limit and then multiplying by 10^{-6}.

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

The RPD is calculated when both the primary value and either the duplicate or split values are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit predetermined for each analytical method as listed in Table 2-1 of the SAP (DOE-RL 2004a). 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. Additional discussion as necessary is provided in the data quality assessment section of the CVP.

If regulator split comparison is required, an additional parameter is evaluated. A control limit of +/- 2 times the TDL shall be used if either the main or regulator split value is less than 5 times the TDL and above detection. In the case where only one result is greater than 5 times the TDL and the other is below, the +/- 2 times the TDL criteria applies. Therefore, the following calculation is performed as part of the evaluation for these two cases involving regulator split data: difference = main - regulator split. If the difference is greater than +/- 2 times the TDL, then further investigation regarding the usability of the data is performed and presented in the applicable CVP data quality assessment section. No regulatory split samples were collected for this site.

Abbreviations/Acronyms:

BG = background
COC = contaminant of concern
COPC = contaminant of potential concern
CVP = cleanup verification package
GW = groundwater
J = estimate
MDA = minimum detectable activity
MTCA = *Model Toxics Control Act*
NA = not applicable
PQL = practical quantitation limit
Q = qualifier
QA/QC = quality assurance/quality control
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose model)
RDR/RAWP = remedial design report/remedial action work plan
RPD = relative percent difference
SAP = sampling and analysis plan
TDL = target detection limit
U = less than MDA/PQL
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Washington Closure Hanford **CALCULATION SHEET**

Originator K. A. Anselm KAA **Date** 12/07/06 **Calc. No.** 0600X-CA-V0060 **Rev. No.** 2
Project 300 Area Field Remediation **Job No.** 14655 **Checked** W.S. Thompson WS Thompson **Date** 12/07/06
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint **Sheet No.** 3 of 21

Summary (continued)

Results:

The results presented in the summary tables that follow are for use in the 618-2 CVP.

Results Summary

Analyte	Shallow Zone		Deep Zone		Overburden		Staging Pile/Decon Pad		Units
	Result	Q	Result	Q	Result	Q	Result	Q	
Americium-241	5.4E-01		6.52E+00		2.3E-02	U	1.5E-01		pCi/g
Cesium-137	1.5E+00		9.14E-01		0 (< BG)		3.2E-02		pCi/g
Cobalt-60	2.1E-02	U	2.3E-02	U	1.3E-02	U	2.0E-02	U	pCi/g
Europium-152	5.5E-02	U	6.8E-02	U	5.4E-02	U	5.2E-02	U	pCi/g
Europium-154	7.0E-02	U	8.0E-02	U	3.7E-02	U	7.0E-02	U	pCi/g
Europium-155	6.9E-02	U	1.3E-01	U	7.7E-03	U	6.4E-02	U	pCi/g
Nickel-63	4.98E-01	U	2.61E-01	U	6.48E-01	U	8.5E-01	U	pCi/g
Tritium	9.38E-02	U	7.88E-01	U	8.62E-01	U	9.8E-01		pCi/g
Plutonium-238	5.6E-02	U	1.08E+00		3.8E-02	U	6.7E-02	U	pCi/g
Plutonium-239/240	5.2E+00		7.29E+01		6.5E-02	U	1.8E+00		pCi/g
Plutonium-241	1.45E+01	U	3.43E+01		1.32E+00	U	2.5E+00	U	pCi/g
Strontium-90	3.7E-02	U	7.4E+00		0 (< BG)	U	5.5E-02	U	pCi/g
Uranium-233/234	9.30E-01		1.08E+02		0 (< BG)		3.39E-01		pCi/g
Uranium-235	6.2E-02		2.24E+00		0 (< BG)	U	6.6E-03		pCi/g
Uranium-238	1.07E+00		1.11E+02		0 (< BG)		2.94E-01		pCi/g
Arsenic	1.9E+00		1.4E+00		2.6E+00		3.4E+00		mg/kg
Barium	7.36E+01		7.69E+01		7.09E+01		6.75E+01		mg/kg
Cadmium	9E-02	U	9E-02	U	9E-02	U	1.4E+00	U	mg/kg
Chromium	6.6E+00		5.7E+00		6.0E+00		6.4E+00		mg/kg
Lead	4.9E+00		5.5E+00		4.2E+00		4.0E+00		mg/kg
Selenium	7.6E-01		7.8E-01		1.0E+00		1.4E+00	U	mg/kg
Silver	NA	NA	NA	NA	NA	NA	2.9E+00	U	mg/kg
Tin	2.3E+00		2.9E+00		2.4E+00		2.88E+01	U	mg/kg
Uranium	4.17E+00		3.38E+02		1.06E+00		3.32E+00		mg/kg
WAC 173-340 Evaluation:									
3-Part Test:									
95% UCL > Cleanup Limit?		NO	NO		NO		NO		
> 10% above Cleanup Limit?		NO	YES[a]		NO		NO		
Any sample > 2x Cleanup Limit?		NO	NO		NO		NO		
Risk Estimate:									
Nonrad noncarcinogenic index sum:		8.3E-03	NA		2.2E-03		4.1E-02		
Nonrad carcinogenic risk:		NA	NA		NA		NA		

[a]Because of the "yes" answer to the WAC 173-340 3-part test, additional site-specific evaluation will be performed and included in the CVP.

Relative Percent Difference Results and QA/QC Analysis*

Analyte	Deep Zone		Overburden		Staging Pile/Decon Pad	
	Duplicate Analysis**	Split Analysis**	Duplicate Analysis**	Split Analysis**	Duplicate Analysis**	Split Analysis**
Americium-241	15%	77%				
Plutonium-239/240	13%	57%				
Strontium-90	21%	23%				
Uranium-233/234	13%	67%				
Uranium-238	17%	66%				
Uranium	4%	86%				
Chromium			22%	28%	23%	54%

*RPD listed where result produced, based on criteria. If RPD not required, no value is listed.

**The significance of the reported RPD values, including values greater than 30%, is addressed in the CVP data quality assessment section.

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Project 300 Area Field Remediation
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Date 11/01/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 0
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618-2 Shallow Zone Sample Data

Sampling Area	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Nickel-63			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	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DJ6	9/7/06	-1.0E-01	U	7.3E-02	2.24E+00		3.9E-02	2.7E-02	U	2.7E-02	8.4E-02	U	8.4E-02	9.7E-02	U	9.7E-02	6.7E-02	U	6.7E-02	-1.71E+00	U	3.8E+00	-4.29E-01	U	2.4E+00
A3	J13DJ9	9/7/06	-3.7E-02	U	9.3E-02	4.8E-02	U	4.8E-02	4.8E-02	U	4.8E-02	1.3E-01	U	1.3E-01	1.7E-01	U	1.7E-01	1.8E-01	U	1.8E-01	8.08E-01	U	3.7E+00	-8.46E-01	U	2.5E+00
A4	J13DK0	9/7/06	8.1E-01		7.1E-02	2.1E-02	U	2.1E-02	2.3E-02	U	2.3E-02	4.7E-02	U	4.7E-02	7.8E-02	U	7.8E-02	4.9E-02	U	4.9E-02	-5.40E-01	U	3.7E+00	-2.26E-01	U	2.5E+00
A2	J13DJ7	9/7/06	5.6E-02	U	7.6E-02	3.4E-02		1.7E-02	4.6E-02	U	4.6E-02	3.4E-02	U	3.4E-02	5.3E-02	U	5.3E-02	3.8E-02	U	3.8E-02	9.46E-01	U	3.5E+00	1.31E-01	U	2.3E+00
Duplicate of J13DJ7	J13DJ8	9/7/06	9.9E-02	U	1.1E-01	4.0E-02		1.9E-02	1.7E-02	U	1.7E-02	4.3E-02	U	4.3E-02	5.1E-02	U	5.1E-02	6.1E-02	U	6.1E-02	-1.01E+00	U	3.9E+00	4.77E-01	U	2.4E+00

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Americium-241 pCi/g	Cesium-137 pCi/g	Cobalt-60 pCi/g	Europium-152 pCi/g	Europium-154 pCi/g	Europium-155 pCi/g	Nickel-63 pCi/g	Tritium pCi/g
A1	J13DJ6	9/7/06	-1.0E-01	2.24E+00	1.4E-02	4.2E-02	4.9E-02	3.4E-02	-1.71E+00	-4.29E-01
A3	J13DJ9	9/7/06	-3.7E-02	2.4E-02	2.4E-02	6.5E-02	8.5E-02	9.0E-02	8.08E-01	-8.46E-01
A4	J13DK0	9/7/06	8.1E-01	1.1E-02	1.2E-02	2.4E-02	3.9E-02	2.5E-02	-5.40E-01	-2.26E-01
A2	J13DJ7/J13DJ8	9/7/06	7.8E-02	3.7E-02	1.6E-02	1.9E-02	2.6E-02	2.5E-02	-3.20E-02	3.04E-01

Statistical Computations

	Americium-241	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Nickel-63	Tritium
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
N	4	4	4	4	4	4	4	4
% < Detection limit	75%	50%	100%	100%	100%	100%	100%	100%
mean	1.9E-01	5.8E-01	1.6E-02	3.7E-02	5.0E-02	4.3E-02	-3.69E-01	-2.99E-01
st. dev.	4.2E-01	1.1E+00	5.5E-03	2.1E-02	2.5E-02	3.1E-02	1.05E+00	4.78E-01
Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
95% UCL on mean	5.4E-01	1.5E+00	2.1E-02	5.5E-02	7.0E-02	6.9E-02	4.98E-01	9.38E-02
max value	8.1E-01	2.2E+00	4.8E-02 U	1.3E-01 U	1.7E-01 U	1.8E-01 U	9.46E-01 U	4.77E-01 U
Statistical value	5.4E-01	1.5E+00	2.1E-02 U	5.5E-02 U	7.0E-02 U	6.9E-02 U	4.98E-01 U	9.38E-02 U
Background	NA	NA	NA	NA	NA	NA	NA	NA
Statistical value above background	5.4E-01	1.5E+00	2.1E-02 U	5.5E-02 U	7.0E-02 U	6.9E-02 U	4.98E-01 U	9.38E-02 U

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Date 11/01/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 0
Date 11/01/06
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618-2 Shallow Zone Sample Data

Sampling Area	Sample Number	Sample Date	Plutonium-238			Plutonium-239/240			Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DJ6	9/7/06	5.1E-02	U	4.9E-01	3.55E-01	U	3.9E-01	1.32E+01	U	1.9E+01	6.3E-02	U	2.6E-01	1.66E+00		1.7E-01	1.85E-01	U	2.0E-01	1.90E+00		1.7E-01
A3	J13DJ9	9/7/06	0	U	5.3E-01	6.9E-02	U	5.3E-01	1.40E+01	U	2.2E+01	-6.5E-02	U	2.4E-01	1.59E+00		2.1E-01	6.8E-02	U	2.6E-01	2.20E+00		2.1E-01
A4	J13DK0	9/7/06	0	U	4.5E-01	7.67E+00		4.5E-01	4.27E+00	U	2.4E+01	-7.0E-03	U	2.2E-01	2.20E+00		2.1E-01	3.3E-02	U	2.5E-01	2.14E+00		2.1E-01
A2	J13DJ7	9/7/06	5.9E-02	U	4.5E-01	8.24E-01		4.5E-01	1.42E+01	U	2.0E+01	-1.4E-02	U	2.2E-01	1.71E+00		1.7E-01	2.14E-01		2.1E-01	1.77E+00		1.7E-01
Duplicate of J13DJ7	J13DJ8	9/7/06	6.8E-02	U	2.6E-01	7.18E-01		2.6E-01	9.65E+00	U	1.8E+01	-2.4E-02	U	2.5E-01	1.83E+00		2.3E-01	1.11E-01	U	2.8E-01	1.89E+00		2.3E-01

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Plutonium-238 pCi/g	Plutonium-239/240 pCi/g	Plutonium-241 pCi/g	Strontium-90 pCi/g	Uranium-233/234 pCi/g	Uranium-235 pCi/g	Uranium-238 pCi/g
A1	J13DJ6	9/7/06	5.1E-02	3.55E-01	1.32E+01	6.3E-02	1.66E+00	1.85E-01	1.90E+00
A3	J13DJ9	9/7/06	0	6.9E-02	1.40E+01	-6.5E-02	1.59E+00	6.8E-02	2.20E+00
A4	J13DK0	9/7/06	0	7.67E+00	4.27E+00	-7.0E-03	2.20E+00	3.3E-02	2.14E+00
A2	J13DJ7/J13DJ8	9/7/06	6.4E-02	7.71E-01	1.19E+01	-1.9E-02	1.77E+00	1.68E-01	1.83E+00

Statistical Computations

	Plutonium-238		Plutonium-239/240		Plutonium-241		Strontium-90		Uranium-233/234		Uranium-235		Uranium-238	
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.	
N	4		4		4		4		4		4		4	
% < Detection limit	100%		50%		100%		100%		0%		75%		0%	
mean	2.9E-02		2.2E+00		1.08E+01		-7.0E-03		1.81E+00		1.1E-01		2.02E+00	
st. dev.	3.3E-02		3.6E+00		4.47E+00		5.3E-02		2.74E-01		7.3E-02		1.8E-01	
Z-statistic	1.645		1.645		1.645		1.645		1.645		1.645		1.645	
95% UCL on mean	5.6E-02		5.2E+00		1.45E+01		3.7E-02		2.03E+00		1.7E-01		2.17E+00	
max value	6.8E-02	U	7.7E+00		1.42E+01	U	6.3E-02	U	2.20E+00		2.1E-01		2.20E+00	
Statistical value	5.6E-02	U	5.2E+00		1.45E+01	U	3.7E-02	U	2.03E+00		1.7E-01		2.17E+00	
Background	NA		NA		NA		NA		1.1		0.11		1.1	
Statistical value above background	5.6E-02	U	5.2E+00		1.45E+01	U	3.7E-02	U	9.30E-01		6.2E-02		1.07E+00	

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Project 300 Area Field Remediation
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Date 11/20/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked W.S. Thompson WST

Rev. No. 1
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618-2 Shallow Zone Sample Data

Sampling Area	Sample Number	Sample Date	Arsenic			Barium			Cadmium			Chromium			Lead			Selenium			Tin			Uranium		
			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
A1	J13DJ6	9/7/06	1.8E+00		1.1E+00	6.73E+01		6E-02	9E-02	U	9E-02	7.1E+00		2.0E-01	5.6E+00		3.5E-01	7.6E-01		7.5E-01	2.0E+00		1.0E+00	3.51E+00		7E-03
A3	J13DJ9	9/7/06	1.8E+00		1.1E+00	7.13E+01		6E-02	9E-02	U	9E-02	6.1E+00		2.0E-01	3.7E+00		3.5E-01	7.5E-01	U	7.5E-01	2.4E+00		1.0E+00	3.35E+00		7E-03
A4	J13DK0	9/7/06	1.9E+00		1.1E+00	5.85E+01		6E-02	9E-02	U	9E-02	4.2E+00		2.0E-01	3.3E+00		3.5E-01	7.5E-01	U	7.5E-01	2.1E+00		1.0E+00	4.53E+00		7E-03
A2	J13DJ7	9/7/06	1.3E+00		1.1E+00	7.91E+01		6E-02	9E-02	U	9E-02	4.5E+00		2.0E-01	3.4E+00		3.4E-01	7.4E-01	U	7.4E-01	2.1E+00		1.0E+00	3.72E+00		7E-03
Duplicate of J13DJ7	J13DJ8	9/7/06	1.7E+00		1.1E+00	6.98E+01		6E-02	9E-02	U	9E-02	4.6E+00		2.0E-01	3.5E+00		3.4E-01	7.4E-01	U	7.4E-01	2.2E+00		1.0E+00	3.35E+00		7E-03

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Selenium mg/kg	Tin mg/kg	Uranium mg/kg
A1	J13DJ6	9/7/06	1.8E+00	6.73E+01	5E-02	7.1E+00	5.6E+00	7.6E-01	2.0E+00	3.51E+00
A3	J13DJ9	9/7/06	1.8E+00	7.13E+01	5E-02	6.1E+00	3.7E+00	3.8E-01	2.4E+00	3.35E+00
A4	J13DK0	9/7/06	1.9E+00	5.85E+01	5E-02	4.2E+00	3.3E+00	3.8E-01	2.1E+00	4.53E+00
A2	J13DJ7/J13DJ8	9/7/06	1.5E+00	7.45E+01	5E-02	4.6E+00	3.5E+00	3.7E-01	2.2E+00	3.54E+00

Statistical Computations

	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Tin	Uranium
95% UCL based on	Small data set. Use nonparametric z-statistic.	Small data set. Use nonparametric z-statistic.	>50% of data are below detection. Default to max value.	Small data set. Use nonparametric z-statistic.	Small data set. Use nonparametric z-statistic.	>50% of data are below detection. Default to max value.	Small data set. Use nonparametric z-statistic.	Small data set. Use nonparametric z-statistic.
N	4	4	4	4	4	4	4	4
% < Detection limit	0%	0%	100%	0%	0%	75%	0%	0%
mean	1.8E+00	6.79E+01	5E-02	5.5E+00	4.0E+00	4.7E-01	2.2E+00	3.73E+00
st. dev.	1.7E-01	6.91E+00	0E+00	1.4E+00	1.1E+00	1.9E-01	1.7E-01	5.39E-01
Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
95% UCL on mean	1.9E+00	7.36E+01	5E-02	6.6E+00	4.9E+00	6.3E-01	2.3E+00	4.17E+00
max value	1.9E+00	7.91E+01	9E-02 U	7.1E+00	5.6E+00	7.6E-01	2.4E+00	4.53E+00
Statistical value	1.9E+00	7.36E+01	9E-02 U	6.6E+00	4.9E+00	7.6E-01	2.3E+00	4.17E+00
Most Stringent Cleanup Limit for nonradionuclide and RAG type	20 Direct Exposure	4,900 Direct Exposure	139 Direct Exposure	1,000,000 Direct Exposure	1,000 Direct Exposure	400 Direct Exposure	1,000,000 Direct Exposure	505 Direct Exposure
WAC 173-340 3-PART Test								
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NA	NO	NO
> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NA	NO	NO
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NA	NO	NO
EXCESS RISK EVALUATION:								
WAC 173-340 Noncarcinogenic Cleanup:	NA	NA	NA	NA	NA	NA	1,000,000	505
Hazard quotient for each nonradionuclide:	NA	NA	NA	NA	NA	NA	2.3E-06	8.3E-03
WAC 173-340 Carcinogenic Cleanup:	NA	NA	NA	NA	NA	NA	NA	NA
Risk for each carcinogenic nonradionuclide:	NA	NA	NA	NA	NA	NA	NA	NA
WAC 173-340 3-Part-Test Compliance? YES	Because all arsenic values are below background (6.5 mg/kg), the 3-part test and excess risk calculations are not required.	Because all barium values are below background (132 mg/kg), the 3-part test and excess risk calculations are not required.	Because all cadmium values are below background (0.81 mg/kg), the 3-part test and excess risk calculations are not required.	Because all chromium values are below background (18.5 mg/kg), the 3-part test and excess risk calculations are not required.	Because all lead values are below background (10.2 mg/kg), the 3-part test and excess risk calculations are not required.	Because all selenium values are below background (0.78 mg/kg), the 3-part test and excess risk calculations are not required.		
Nonrad noncarcinogenic index sum: 8.3E-03								
Nonrad carcinogenic risk: NA								

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Date 11/01/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 0
Date 11/01/06
Sheet No. 7 of 21

618-2 Deep Zone Sample Data

Sampling Area	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Nickel-63			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	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DJ4	9/7/06	3.08E-01		7.2E-02	7.86E-01		2.3E-02	1.7E-02	U	1.7E-02	4.7E-02	U	4.7E-02	5.2E-02	U	5.2E-02	4.0E-02	U	4.0E-02	1.72E-01	U	3.8E+00	7.9E-02	U	2.5E+00
A3	J13DJ2	9/7/06	2.77E+00		7.9E-02	5.90E-02		4.8E-02	3.7E-02	U	3.7E-02	9.0E-02	U	9.0E-02	1.2E-01	U	1.2E-01	8.6E-02	U	8.6E-02	-1.48E+00	U	3.5E+00	6.24E-01	U	2.3E+00
A4	J13DJ3	9/7/06	5.45E+00		8.7E-02	1.04E+00		5.9E-02	4.9E-02	U	4.9E-02	1.6E-01	U	1.6E-01	1.8E-01	U	1.8E-01	3.5E-01	U	3.5E-01	-4.06E-01	U	3.6E+00	8.59E-01	U	2.3E+00
A2	J13DJ0	9/7/06	7.94E+00		6.7E-02	2.09E-01		4.6E-02	3.7E-02	U	3.7E-02	9.9E-02	U	9.9E-02	1.2E-01	U	1.2E-01	9.6E-02	U	9.6E-02	-4.97E-01	U	3.6E+00	4.54E-01	U	2.5E+00
Duplicate of J13DJ0	J13DJ1	9/7/06	6.82E+00		4.7E-02	3.92E-01		4.6E-02	3.2E-02	U	3.2E-02	9.2E-02	U	9.2E-02	1.1E-01	U	1.1E-01	8.9E-02	U	8.9E-02	8.68E-01	U	3.6E+00	5.80E-01	U	2.4E+00

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Americium-241 pCi/g	Cesium-137 pCi/g	Cobalt-60 pCi/g	Europium-152 pCi/g	Europium-154 pCi/g	Europium-155 pCi/g	Nickel-63 pCi/g	Tritium pCi/g
A1	J13DJ4	9/7/06	3.08E-01	7.86E-01	8.5E-03	2.4E-02	2.6E-02	2.0E-02	1.72E-01	7.90E-02
A3	J13DJ2	9/7/06	2.77E+00	5.90E-02	1.9E-02	4.5E-02	6.0E-02	4.3E-02	-1.48E+00	6.24E-01
A4	J13DJ3	9/7/06	5.45E+00	1.04E+00	2.5E-02	8.0E-02	9.0E-02	1.8E-01	-4.06E-01	8.59E-01
A2	J13DJ0/J13DJ1	9/7/06	7.38E+00	3.01E-01	1.7E-02	4.8E-02	5.8E-02	4.6E-02	1.86E-01	5.17E-01

Statistical Computations

	Americium-241	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Nickel-63	Tritium
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
N	4	4	4	4	4	4	4	4
% < Detection limit	0%	0%	100%	100%	100%	100%	100%	100%
mean	3.98E+00	5.46E-01	1.7E-02	4.9E-02	5.8E-02	7.1E-02	-3.82E-01	5.20E-01
st. dev.	3.09E+00	4.47E-01	6.6E-03	2.3E-02	2.6E-02	7.0E-02	7.82E-01	3.27E-01
Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
95% UCL on mean	6.52E+00	9.14E-01	2.3E-02	6.8E-02	8.0E-02	1.3E-01	2.61E-01	7.88E-01
max value	7.94E+00	1.04E+00	4.9E-02 U	1.6E-01 U	1.8E-01 U	3.5E-01 U	8.68E-01 U	8.59E-01 U
Statistical value	6.52E+00	9.14E-01	2.3E-02 U	6.8E-02 U	8.0E-02 U	1.3E-01 U	2.61E-01 U	7.88E-01 U
Background	NA	NA	NA	NA	NA	NA	NA	NA
Statistical value above background	6.52E+00	9.14E-01	2.3E-02 U	6.8E-02 U	8.0E-02 U	1.3E-01 U	2.61E-01 U	7.88E-01 U

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA
Project 300 Area Field Remediation
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Date 11/01/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 0
Date 11/01/06
Sheet No. 8 of 21

1 **618-2 Deep Zone Sample Data**

2	Sampling	Sample	Sample	Plutonium-238			Plutonium-239/240			Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	A1	J13DJ4	9/7/06	9.8E-02	U	3.7E-01	2.20E+00		3.7E-01	7.07E+00		1.8E+01	9.9E-02	U	2.2E-01	3.26E+00		2.2E-01	1.02E-01	U	2.6E-01	2.87E+00		2.2E-01
5	A3	J13DJ2	9/7/06	1.98E-01	U	5.0E-01	2.68E+01		5.0E-01	2.08E+01		2.0E+01	1.81E+00		2.2E-01	5.53E+00		2.2E-01	1.02E-01	U	2.6E-01	5.22E+00		2.2E-01
6	A4	J13DJ3	9/7/06	1.50E+00		4.8E-01	9.06E+01		4.8E-01	4.20E+01		2.6E+01	1.75E+00		1.9E-01	1.61E+02		4.8E-01	3.35E+00	U	5.8E+00	1.65E+02		4.6E-01
7	A2	J13DJ0	9/7/06	4.17E-01	U	5.3E-01	5.16E+01		5.3E-01	2.97E+01		2.9E+01	1.16E+01		2.1E-01	1.46E+01		2.9E-01	7.76E-01		2.8E-01	1.48E+01		2.9E-01
8	Duplicate of J13DJ0	J13DJ1	9/7/06	4.15E-01	U	4.5E-01	4.55E+01		4.5E-01	9.69E+00	U	2.2E+01	9.39E+00		2.0E-01	1.28E+01		3.0E-01	7.61E-01		2.5E-01	1.25E+01		2.6E-01

9
10
11 **Statistical Computation Input Data**

12	Sampling	Sample	Sample	Plutonium-238	Plutonium-239/240	Plutonium-241	Strontium-90	Uranium-233/234	Uranium-235	Uranium-238
13	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
14	A1	J13DJ4	9/7/06	9.8E-02	2.20E+00	7.07E+00	9.9E-02	3.26E+00	1.02E-01	2.87E+00
15	A3	J13DJ2	9/7/06	1.98E-01	2.68E+01	2.08E+01	1.81E+00	5.53E+00	1.02E-01	5.22E+00
16	A4	J13DJ3	9/7/06	1.50E+00	9.06E+01	4.20E+01	1.75E+00	1.61E+02	3.35E+00	1.65E+02
17	A2	J13DJ0/J13DJ1	9/7/06	4.16E-01	4.86E+01	1.97E+01	1.05E+01	1.37E+01	7.69E-01	1.37E+01

18
19
20 **Statistical Computations**

21		Plutonium-238	Plutonium-239/240	Plutonium-241	Strontium-90	Uranium-233/234	Uranium-235	Uranium-238
22	95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
23	N	4	4	4	4	4	4	4
24	% < Detection limit	75%	0%	0%	25%	0%	75%	0%
25	mean	5.53E-01	4.20E+01	2.24E+01	3.5E+00	4.59E+01	1.08E+00	4.67E+01
26	st. dev.	6.45E-01	3.75E+01	1.45E+01	4.7E+00	7.69E+01	1.55E+00	7.90E+01
27	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645
28	95% UCL on mean	1.08E+00	7.29E+01	3.43E+01	7.4E+00	1.09E+02	2.35E+00	1.12E+02
29	max value	1.50E+00	9.06E+01	4.20E+01	1.2E+01	1.61E+02	3.35E+00	1.65E+02
30	Statistical value	1.08E+00	7.29E+01	3.43E+01	7.4E+00	1.09E+02	2.35E+00	1.12E+02
31	Background	NA	NA	NA	NA	1.1	0.11	1.1
32	Statistical value above background	1.08E+00	7.29E+01	3.43E+01	7.4E+00	1.08E+02	2.24E+00	1.11E+02

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CALCULATION SHEET

Originator K. A. Anselm KAA **Date** 12/07/06 **Calc. No.** 0600X-CA-V0060 **Rev. No.** 2
Project 300 Area Field Remediation **Job No.** 14655 **Checked** W.S. Thompson WST **Date** 12/07/06
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint **Sheet No.** 9 of 21

618-2 Deep Zone Sample Data

Sampling Area	Sample Number	Sample Date	Arsenic			Barium			Cadmium			Chromium			Lead			Selenium			Tin			Uranium		
			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
A1	J13DJ4	9/7/06	1.4E+00		1.1E+00	5.95E+01		6E-02	9E-02	U	9E-02	4.2E+00		2.1E+00	6.6E+00		3.5E-01	7.8E-01		7.6E-01	2.8E+00		1.0E+00	4.54E+00		7E-03
A3	J13DJ2	9/7/06	1.1E+00	U	1.1E+00	5.85E+01		6E-02	9E-02	U	9E-02	3.7E+00		2.1E+00	2.7E+00		3.5E-01	7.6E-01	U	7.6E-01	2.0E+00		1.0E+00	1.37E+01		7.2E-02
A4	J13DJ3	9/7/06	1.5E+00		1.1E+00	8.33E+01		6E-02	9E-02	U	9E-02	6.7E+00		2.0E-01	3.8E+00		3.5E-01	7.5E-01	U	7.5E-01	2.7E+00		1.0E+00	5.01E+02		7.2E-01
A2	J13DJ0	9/7/06	1.1E+00	U	1.1E+00	6.35E+01		6E-02	9E-02	U	9E-02	2.5E+00		2.0E-01	2.7E+00		3.5E-01	7.6E-01	U	7.6E-01	2.5E+00		1.0E+00	3.57E+01		7.2E-02
Duplicate of J13DJ0	J13DJ1	9/7/06	1.1E+00	U	1.1E+00	7.37E+01		6E-02	9E-02	U	9E-02	4.4E+00		2.1E+00	3.2E+00		3.5E-01	7.6E-01	U	7.6E-01	2.9E+00		1.0E+00	3.70E+01		7.2E-02

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Selenium mg/kg	Tin mg/kg	Uranium mg/kg
A1	J13DJ4	9/7/06	1.4E+00	5.95E+01	5E-02	4.2E+00	6.6E+00	7.8E-01	2.8E+00	4.54E+00
A3	J13DJ2	9/7/06	5.5E-01	5.85E+01	5E-02	3.7E+00	2.7E+00	3.8E-01	2.0E+00	1.37E+01
A4	J13DJ3	9/7/06	1.5E+00	8.33E+01	5E-02	6.7E+00	3.8E+00	3.8E-01	2.7E+00	5.01E+02
A2	J13DJ0/J13DJ1	9/7/06	5.5E-01	6.86E+01	5E-02	3.5E+00	3.0E+00	3.8E-01	2.7E+00	3.64E+01

Statistical Computations

	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Tin	Uranium
95% UCL based on	Small data set. Use nonparametric z-statistic.	Small data set. Use nonparametric z-statistic.	>50% of data are below detection. Default to max value.	Small data set. Use nonparametric z-statistic.	Small data set. Use nonparametric z-statistic.	>50% of data are below detection. Default to max value.	Small data set. Use nonparametric z-statistic.	Small data set. Use nonparametric z-statistic.
N	4	4	4	4	4	4	4	4
% < Detection limit	50%	0%	100%	0%	0%	75%	0%	0%
mean	1.0E+00	6.75E+01	5E-02	4.5E+00	4.0E+00	4.8E-01	2.6E+00	1.39E+02
st. dev.	5.2E-01	1.15E+01	0E+00	1.5E+00	1.8E+00	2.0E-01	3.7E-01	2.42E+02
Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
95% UCL on mean	1.4E+00	7.69E+01	5E-02	5.7E+00	5.5E+00	6.4E-01	2.9E+00	3.38E+02
max value	1.5E+00	8.33E+01	9E-02 U	6.7E+00	6.6E+00	7.8E-01	2.9E+00	5.01E+02
Statistical value	1.4E+00	7.69E+01	9E-02 U	5.7E+00	5.5E+00	7.8E-01	2.9E+00	3.38E+02
Most Stringent Cleanup Limit for nonradionuclide and RAG type	NA[a] GW/River Protection	NA[a] GW/River Protection	NA[a] GW/River Protection	NA[a] GW/River Protection	NA[a] GW/River Protection	NA[a] GW/River Protection	NA[a] GW/River Protection	385 GW/River Protection
WAC 173-340 3-PART Test								
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NO
> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	YES
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NO
WAC 173-340 3-Part-Test Compliance? NO	Because all arsenic values are below background (6.5 mg/kg), the 3-part test calculations are not required.	Because all barium values are below background (132 mg/kg), the 3-part test calculations are not required.	Because all cadmium values are below background (0.81 mg/kg), the 3-part test calculations are not required.	Because all chromium values are below background (18.5 mg/kg), the 3-part test calculations are are not required.	Because all lead values are below background (10.2 mg/kg), the 3-part test calculations are not required.	Because all selenium values are at or below background (0.78 mg/kg), the 3-part test calculations are not required.	RESRAD predicts tin will not reach GW within 1,000 years, per DOE-RL 2004b.	Further assessment will be performed because uranium fails the 3-part test.

[a]As provided in the RDR/RAWP (DOE-RL 2004b).

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CALCULATION SHEET

Originator K. A. Anselm *KAA* **Date** 11/01/06 **Calc. No.** 0600X-CA-V0060 **Rev. No.** 0
Project 300 Area Field Remediation **Job No.** 14655 **Checked** J. M. Capron *JMC* **Date** 11/01/06
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint **Sheet No.** 10 of 21

618-2 Overburden Sample Data

Sampling Area	Sample Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Nickel-63			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	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DF9	9/7/06	-6.0E-03	U	6.9E-02	5.8E-02		3.9E-02	3.3E-02	U	3.3E-02	9.0E-02	U	9.0E-02	1.1E-01	U	1.1E-01	8.9E-02	U	8.9E-02	-6.92E-01	U	3.8E+00	7.23E-01	U	2.5E+00
A3	J13DH2	9/7/06	3.5E-02	U	6.2E-02	3.6E-02	U	3.9E-02	4.0E-02	U	4.0E-02	1.1E-01	U	1.1E-01	1.4E-01	U	1.4E-01	1.4E-01	U	1.4E-01	1.02E+00	U	4.1E+00	1.23E-01	U	2.6E+00
A4	J13DH3	9/7/06	-1.2E-02	U	8.2E-02	4.0E-02		3.4E-02	2.9E-02	U	2.9E-02	7.4E-02	U	7.4E-02	9.9E-02	U	9.9E-02	6.6E-02	U	6.6E-02	2.43E-01	U	4.3E+00	9.62E-01	U	2.4E+00
A2	J13DH0	9/7/06	2.0E-02	U	6.5E-02	4.2E-02	U	4.2E-02	3.8E-02	U	3.8E-02	9.3E-02	U	9.3E-02	1.2E-01	U	1.2E-01	8.4E-02	U	8.4E-02	-7.17E-01	U	3.7E+00	3.49E-01	U	2.6E+00
Duplicate of J13DH0	J13DH1	9/7/06	-5.0E-03	U	7.0E-02	4.8E-02		4.8E-02	4.9E-02	U	4.9E-02	1.2E-01	U	1.2E-01	1.6E-01	U	1.6E-01	1.1E-01	U	1.1E-01	-1.15E+00	U	4.0E+00	5.62E-01	U	2.6E+00

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Americium-241 pCi/g	Cesium-137 pCi/g	Cobalt-60 pCi/g	Europium-152 pCi/g	Europium-154 pCi/g	Europium-155 pCi/g	Nickel-63 pCi/g	Tritium pCi/g
A1	J13DF9	9/7/06	-6.0E-03	5.8E-02	1.7E-02	4.5E-02	5.5E-02	4.5E-02	-6.92E-01	7.23E-01
A3	J13DH2	9/7/06	3.5E-02	3.6E-02	2.0E-02	5.5E-02	7.0E-02	7.0E-02	1.02E+00	1.23E-01
A4	J13DH3	9/7/06	-1.2E-02	4.0E-02	1.5E-02	3.7E-02	5.0E-02	3.3E-02	2.43E-01	9.62E-01
A2	J13DH0/J13DH1	9/7/06	7.5E-03	3.5E-02	2.2E-02	5.3E-02	7.0E-02	4.9E-02	-9.34E-01	4.56E-01

Statistical Computations

	Americium-241		Cesium-137		Cobalt-60		Europium-152		Europium-154		Europium-155		Nickel-63		Tritium	
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.	
N	4		4		4		4		4		4		4		4	
% < Detection limit	100%		25%		100%		100%		100%		100%		100%		100%	
mean	6.1E-03		4.2E-02		1.8E-02		4.8E-02		6.1E-02		4.9E-02		-9.06E-02		5.66E-01	
st. dev.	2.1E-02		1.1E-02		3.3E-03		8.3E-03		1.0E-02		1.5E-02		8.98E-01		3.61E-01	
Z-statistic	1.645		1.645		1.645		1.645		1.645		1.645		1.645		1.645	
95% UCL on mean	2.3E-02		5.1E-02		2.1E-02		5.4E-02		7.0E-02		6.2E-02		6.48E-01		8.62E-01	
max value	3.5E-02	U	5.8E-02		4.9E-02	U	1.2E-01	U	1.6E-01	U	1.4E-01	U	1.02E+00	U	9.62E-01	U
Statistical value	2.3E-02	U	5.1E-02		2.1E-02	U	5.4E-02	U	7.0E-02	U	6.2E-02	U	6.48E-01	U	8.62E-01	U
Background	NA		1.1		0.008		NA		0.033		0.054		NA		NA	
Statistical value above background	2.3E-02	U	0 (< BG)		1.3E-02	U	5.4E-02	U	3.7E-02	U	7.7E-03	U	6.48E-01	U	8.62E-01	U

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CALCULATION SHEET

Originator K. A. Anselm KAA
Project 300 Area Field Remediation
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Date 11/01/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 0
Date 11/01/06
Sheet No. 11 of 21

618-2 Overburden Sample Data

Sampling Area	Sample Number	Sample Date	Plutonium-238			Plutonium-239/240			Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J13DF9	9/7/06	-6.2E-02	U	4.7E-01	6.2E-02	U	4.7E-01	-7.94E+00	U	2.2E+01	5.1E-02	U	2.6E-01	5.42E-01		1.9E-01	3.0E-02	U	2.3E-01	4.44E-01		1.9E-01
A3	J13DH2	9/7/06	0	U	4.9E-01	6.5E-02	U	4.9E-01	-5.23E+00	U	2.4E+01	7.0E-02	U	2.5E-01	4.38E-01		2.1E-01	3.3E-02	U	2.5E-01	3.56E-01		2.1E-01
A4	J13DH3	9/7/06	0	U	5.2E-01	0	U	5.2E-01	-4.35E+00	U	2.5E+01	-2.4E-02	U	2.4E-01	5.86E-01		2.1E-01	3.4E-02	U	2.6E-01	4.75E-01		2.1E-01
A2	J13DH0	9/7/06	1.26E-01	U	4.8E-01	0	U	4.8E-01	4.63E+00	U	2.4E+01	-1.2E-02	U	2.5E-01	6.44E-01		2.1E-01	9.7E-02	U	2.5E-01	5.10E-01		2.1E-01
Duplicate of J13DH0	J13DH1	9/7/06	0	U	5.0E-01	1.97E-01	U	5.0E-01	4.82E+00	U	2.8E+01	-9.7E-02	U	2.5E-01	5.37E-01		2.1E-01	0	U	2.5E-01	5.91E-01		2.1E-01

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Plutonium-238 pCi/g	Plutonium-239/240 pCi/g	Plutonium-241 pCi/g	Strontium-90 pCi/g	Uranium-233/234 pCi/g	Uranium-235 pCi/g	Uranium-238 pCi/g
A1	J13DF9	9/7/06	-6.2E-02	6.2E-02	-7.94E+00	5.1E-02	5.42E-01	3.0E-02	4.44E-01
A3	J13DH2	9/7/06	0	6.5E-02	-5.23E+00	7.0E-02	4.38E-01	3.3E-02	3.56E-01
A4	J13DH3	9/7/06	0	0	-4.35E+00	-2.4E-02	5.86E-01	3.4E-02	4.75E-01
A2	J13DH0/J13DH1	9/7/06	6.30E-02	9.85E-02	4.73E+00	-5.5E-02	5.91E-01	4.9E-02	5.51E-01

Statistical Computations

	Plutonium-238		Plutonium-239/240		Plutonium-241		Strontium-90		Uranium-233/234		Uranium-235		Uranium-238	
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.	
N	4		4		4		4		4		4		4	
% < Detection limit	100%		100%		100%		100%		0%		100%		0%	
mean	2.5E-04		5.6E-02		-3.20E+00		1.1E-02		5.39E-01		3.6E-02		4.56E-01	
st. dev.	5.1E-02		4.1E-02		5.50E+00		5.9E-02		7.09E-02		8.3E-03		8.05E-02	
Z-statistic	1.645		1.645		1.645		1.645		1.645		1.645		1.645	
95% UCL on mean	4.2E-02		9.0E-02		1.32E+00		6.0E-02		5.97E-01		4.3E-02		5.23E-01	
max value	1.26E-01	U	1.97E-01	U	4.82E+00	U	7.0E-02	U	6.44E-01		9.7E-02	U	5.91E-01	
Statistical value	4.2E-02	U	9.0E-02	U	1.32E+00	U	6.0E-02	U	5.97E-01		4.3E-02	U	5.23E-01	
Background	0.004		0.025		NA		0.18		1.1		0.11		1.1	
Statistical value above background	3.8E-02	U	6.5E-02	U	1.32E+00	U	0 (< BG)	U	0 (< BG)		0 (< BG)	U	0 (< BG)	

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA
Project 300 Area Field Remediation
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Date 12/07/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked W.S. Thompson

Rev. No. 2
Date 12/07/06
Sheet No. 12 of 21

618-2 Overburden Sample Data

Sampling Area	Sample Number	Sample Date	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Selenium mg/kg	Q	PQL	Tin mg/kg	Q	PQL	Uranium mg/kg	Q	PQL
A1	J13DF9	9/7/06	2.7E+00		1.2E+00	6.42E+01		6E-02	9E-02	U	9E-02	6.1E+00		2.2E-01	4.1E+00		3.8E-01	8.2E-01	U	8.2E-01	2.7E+00		1.1E+00	1.14E+00		7E-03
A3	J13DH2	9/7/06	1.8E+00		1.1E+00	7.47E+01		6E-02	9E-02	U	9E-02	5.1E+00		2.0E-01	4.3E+00		3.5E-01	1.0E+00		7.6E-01	1.6E+00		1.0E+00	9.15E-01		7E-03
A4	J13DH3	9/7/06	2.4E+00		1.1E+00	6.29E+01		6E-02	9E-02	U	9E-02	5.2E+00		2.0E-01	3.4E+00		3.5E-01	7.5E-01	U	7.5E-01	2.0E+00		1.0E+00	8.72E-01		7E-03
A2	J13DH0	9/7/06	1.5E+00		1.1E+00	6.22E+01		6E-02	9E-02	U	9E-02	5.3E+00		2.0E-01	3.5E+00		3.5E-01	7.6E-01	U	7.6E-01	1.0E+00	U	1.0E+00	9.72E-01		7E-03
Duplicate of J13DH0	J13DH1	9/7/06	1.2E+00		1.1E+00	6.35E+01		6E-02	9E-02	U	9E-02	6.6E+00		2.0E-01	4.3E+00		3.5E-01	7.5E-01	U	7.5E-01	2.2E+00		1.0E+00	8.91E-01		7E-03

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Selenium mg/kg	Tin mg/kg	Uranium mg/kg
A1	J13DF9	9/7/06	2.7E+00	6.42E+01	5E-02	6.1E+00	4.1E+00	4.1E-01	2.7E+00	1.14E+00
A3	J13DH2	9/7/06	1.8E+00	7.47E+01	5E-02	5.1E+00	4.3E+00	1.0E+00	1.6E+00	9.15E-01
A4	J13DH3	9/7/06	2.4E+00	6.29E+01	5E-02	5.2E+00	3.4E+00	3.8E-01	2.0E+00	8.72E-01
A2	J13DH0/J13DH1	9/7/06	1.4E+00	6.29E+01	5E-02	6.0E+00	3.9E+00	3.8E-01	1.4E+00	9.32E-01

Statistical Computations

	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Tin	Uranium
95% UCL based on	Small data set. Use nonparametric z-statistic.	Small data set. Use nonparametric z-statistic.	>50% of data are below detection. Default to max value.	Small data set. Use nonparametric z-statistic.	Small data set. Use nonparametric z-statistic.	>50% of data are below detection. Default to max value.	Small data set. Use nonparametric z-statistic.	Small data set. Use nonparametric z-statistic.
N	4	4	4	4	4	4	4	4
% < Detection limit	0%	0%	100%	0%	0%	75%	0%	0%
mean	2.1E+00	6.62E+01	5E-02	5.6E+00	3.9E+00	5.4E-01	1.9E+00	9.65E-01
st. dev.	6.0E-01	5.73E+00	0E+00	5.1E-01	3.9E-01	3.1E-01	5.9E-01	1.20E-01
Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
95% UCL on mean	2.6E+00	7.09E+01	5E-02	6.0E+00	4.2E+00	7.9E-01	2.4E+00	1.06E+00
max value	2.7E+00	7.47E+01	9E-02 U	6.6E+00	4.3E+00	1.0E+00	2.7E+00	1.14E+00
Statistical value	2.6E+00	7.09E+01	9E-02 U	6.0E+00	4.2E+00	1.0E+00	2.4E+00	1.06E+00
Most Stringent Cleanup Limit for nonradionuclide and RAG type	20 Direct Exposure	4,900 Direct Exposure	139 Direct Exposure	1,000,000 Direct Exposure	1,000 Direct Exposure	17,500 Direct Exposure	1,000,000 Direct Exposure	505 Direct Exposure
WAC 173-340 3-PART Test								
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NO	NO	NO
> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NO	NO	NO
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NO	NO	NO
EXCESS RISK EVALUATION:								
WAC 173-340 Noncarcinogenic Cleanup:	NA	NA	NA	NA	NA	17,500	1,000,000	505
Hazard quotient for each nonradionuclide:	NA	NA	NA	NA	NA	5.7E-05	2.4E-06	2.1E-03
WAC 173-340 Carcinogenic Cleanup:	NA	NA	NA	NA	NA	NA	NA	NA
Risk for each carcinogenic nonradionuclide:	NA	NA	NA	NA	NA	NA	NA	NA
WAC 173-340 3-Part-Test Compliance? YES	Because all arsenic values are below background (6.5 mg/kg), the 3-part test and excess risk calculations are not required.	Because all barium values are below background (132 mg/kg), the 3-part test and excess risk calculations are not required.	Because all cadmium values are below background (0.81 mg/kg), the 3-part test and excess risk calculations are not required.	Because all chromium values are below background (18.5 mg/kg), the 3-part test and excess risk calculations are not required.	Because all lead values are below background (10.2 mg/kg), the 3-part test and excess risk calculations are not required.			
Nonrad noncarcinogenic index sum: 2.2E-03								
Nonrad carcinogenic risk: NA								

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA
Project 300 Area Field Remediation
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Date 11/16/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 1
Date 11/16/06
Sheet No. 13 of 21

1 **618-2, 618-3, and 618-8 Staging Pile/Decon Pad Footprint Sample Data**

2	Sampling	Sample	Sample	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Nickel-63			Tritium		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	B5	J13D61	9/6/06	-1.5E-02	U	6.1E-02	4.6E-02	U	4.6E-02	4.0E-02	U	4.0E-02	1.1E-01	U	1.1E-01	1.4E-01	U	1.4E-01	1.0E-01	U	1.0E-01	3.56E-01	U	3.6E+00	8.5E-02	UJ	2.4E+00
5	B6	J13D60	9/6/06	4.5E-02	U	6.4E-02	4.4E-02	U	4.4E-02	4.3E-02	U	4.3E-02	1.1E-01	U	1.1E-01	1.4E-01	U	1.4E-01	1.0E-01	U	1.0E-01	2.78E-01	U	3.7E+00	2.22E-01	UJ	2.5E+00
6	B7	J13D63	9/6/06	-6.0E-03	U	6.1E-02	3.0E-02	U	3.0E-02	2.6E-02	U	2.6E-02	7.0E-02	U	7.0E-02	8.9E-02	U	8.9E-02	6.3E-02	U	6.3E-02	1.23E+00	U	3.8E+00	8.61E-01	UJ	2.7E+00
7	B8	J13D64	9/6/06	3.1E-02	U	4.8E-02	2.7E-02	U	2.7E-02	3.2E-02	U	3.2E-02	6.1E-02	U	6.1E-02	1.0E-01	U	1.0E-01	8.4E-02	U	8.4E-02	1.02E+00	U	3.7E+00	-1.28E-01	UJ	2.4E+00
8	C9	J13D65	9/6/06	4.0E-03	U	6.2E-02	2.0E-02	U	2.0E-02	2.0E-02	U	2.0E-02	4.5E-02	U	4.5E-02	8.2E-02	U	8.2E-02	4.8E-02	U	4.8E-02	5.47E-01	U	3.7E+00	0	UJ	2.3E+00
9	C10	J13D66	9/6/06	8.18E-01		3.6E-02	9.5E-02		2.4E-02	2.2E-02	U	2.2E-02	5.6E-02	U	5.6E-02	7.3E-02	U	7.3E-02	7.8E-02	U	7.8E-02	0	U	3.6E+00	2.33E+00	J	2.3E+00
10	C1	J13D67	9/6/06	2.0E-02	U	4.4E-02	4.0E-02	U	4.0E-02	3.2E-02	U	3.2E-02	9.1E-02	U	9.1E-02	1.1E-01	U	1.1E-01	8.1E-02	U	8.1E-02	1.31E-01	U	3.5E+00	1.13E+00	UJ	2.5E+00
11	C2	J13D68	9/6/06	1.0E-02	U	6.5E-02	5.5E-02	U	5.5E-02	5.4E-02	U	5.4E-02	1.5E-01	U	1.5E-01	2.1E-01	U	2.1E-01	2.1E-01	U	2.1E-01	6.74E-01	U	3.6E+00	6.95E-01	UJ	2.3E+00
12	D3	J13D69	9/6/06	4.1E-02	U	6.6E-02	3.5E-02	U	3.5E-02	3.8E-02	U	3.8E-02	8.2E-02	U	8.2E-02	1.4E-01	U	1.4E-01	1.2E-01	U	1.2E-01	1.22E+00	U	3.7E+00	1.29E+00	UJ	2.5E+00
13	D4	J13D70	9/6/06	4.7E-02	U	5.6E-02	2.5E-02	U	2.5E-02	2.4E-02	U	2.4E-02	6.5E-02	U	6.5E-02	8.0E-02	U	8.0E-02	9.4E-02	U	9.4E-02	6.9E-01	U	3.5E+00	2.51E-01	UJ	2.3E+00
14	D5	J13D71	9/6/06	6.1E-02	U	6.9E-02	4.9E-02	U	4.9E-02	3.8E-02	U	3.8E-02	1.1E-01	U	1.1E-01	1.3E-01	U	1.3E-01	1.0E-01	U	1.0E-01	1.49E+00	U	3.5E+00	6.8E-02	UJ	2.5E+00
15	D6	J13D72	9/6/06	-2.0E-02	U	5.8E-02	4.9E-02	U	4.9E-02	5.1E-02	U	5.1E-02	1.4E-01	U	1.4E-01	1.8E-01	U	1.8E-01	1.9E-01	U	1.9E-01	7.79E-01	U	3.5E+00	1.14E+00	UJ	2.5E+00
16	A1	J13D73	9/6/06	8.0E-03	U	4.9E-02	4.2E-02	U	4.2E-02	4.0E-02	U	4.0E-02	1.0E-01	U	1.0E-01	1.3E-01	U	1.3E-01	9.0E-02	U	9.0E-02	2.99E-01	U	3.4E+00	4.13E-01	UJ	2.3E+00
17	A3	J13D75	9/6/06	0	U	2.1E-01	2.6E-02	U	2.6E-02	2.5E-02	U	2.5E-02	7.4E-02	U	7.4E-02	8.6E-02	U	8.6E-02	1.1E-01	U	1.1E-01	7.6E-01	U	3.6E+00	7.77E-01	UJ	2.3E+00
18	A4	J13D62	9/6/06	1.1E-02	U	6.0E-02	4.5E-02	U	4.5E-02	4.6E-02	U	4.6E-02	1.2E-01	U	1.2E-01	1.7E-01	U	1.7E-01	1.8E-01	U	1.8E-01	9.08E-01	U	4.1E+00	1.12E+00	UJ	2.4E+00
19	A2	J13D74	9/6/06	-1.5E-02	U	5.5E-02	3.1E-02	U	3.1E-02	2.7E-02	U	2.7E-02	7.7E-02	U	7.7E-02	8.2E-02	U	8.2E-02	6.6E-02	U	6.6E-02	5.03E-01	U	3.7E+00	1.18E+00	UJ	2.4E+00
20	Duplicate of J13D74	J13D59	9/6/06	2.2E-02	U	6.9E-02	4.6E-02	U	4.6E-02	4.2E-02	U	4.2E-02	1.1E-01	U	1.1E-01	1.5E-01	U	1.5E-01	9.9E-02	U	9.9E-02	2.15E-01	U	4.4E+00	1.11E+00	UJ	2.3E+00

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22 **Statistical Computation Input Data**

23	Sampling	Sample	Sample	Americium-241	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Nickel-63	Tritium
24	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
25	B5	J13D61	9/6/06	-1.5E-02	2.3E-02	2.0E-02	5.5E-02	7.0E-02	5.0E-02	3.56E-01	8.5E-02
26	B6	J13D60	9/6/06	4.5E-02	2.2E-02	2.2E-02	5.5E-02	7.0E-02	5.0E-02	2.78E-01	2.22E-01
27	B7	J13D63	9/6/06	-6.0E-03	1.5E-02	1.3E-02	3.5E-02	4.5E-02	3.2E-02	1.23E+00	8.61E-01
28	B8	J13D64	9/6/06	3.1E-02	1.4E-02	1.6E-02	3.1E-02	5.0E-02	4.2E-02	1.02E+00	-1.28E-01
29	C9	J13D65	9/6/06	4.0E-03	1.0E-02	1.0E-02	2.3E-02	4.1E-02	2.4E-02	5.47E-01	0
30	C10	J13D66	9/6/06	8.18E-01	9.5E-02	1.1E-02	2.8E-02	3.7E-02	3.9E-02	0	2.33E+00
31	C1	J13D67	9/6/06	2.0E-02	2.0E-02	1.6E-02	4.6E-02	5.5E-02	4.1E-02	1.31E-01	1.13E+00
32	C2	J13D68	9/6/06	1.0E-02	2.8E-02	2.7E-02	7.5E-02	1.1E-01	1.1E-01	6.74E-01	6.95E-01
33	D3	J13D69	9/6/06	4.1E-02	1.8E-02	1.9E-02	4.1E-02	7.0E-02	6.0E-02	1.22E+00	1.29E+00
34	D4	J13D70	9/6/06	4.7E-02	1.3E-02	1.2E-02	3.3E-02	4.0E-02	4.7E-02	6.9E-01	2.51E-01
35	D5	J13D71	9/6/06	6.1E-02	2.5E-02	1.9E-02	5.5E-02	6.5E-02	5.0E-02	1.49E+00	6.8E-02
36	D6	J13D72	9/6/06	-2.0E-02	2.5E-02	2.6E-02	7.0E-02	9.0E-02	9.5E-02	7.79E-01	1.14E+00
37	A1	J13D73	9/6/06	8.0E-03	2.1E-02	2.0E-02	5.0E-02	6.5E-02	4.5E-02	2.99E-01	4.13E-01
38	A3	J13D75	9/6/06	0	1.3E-02	1.3E-02	3.7E-02	4.3E-02	5.5E-02	7.6E-01	7.77E-01
39	A4	J13D62	9/6/06	1.1E-02	2.3E-02	2.3E-02	6.0E-02	8.5E-02	9.0E-02	9.08E-01	1.12E+00
40	A2	J13D74/J13D59	9/6/06	3.5E-03	1.9E-02	1.7E-02	4.7E-02	5.8E-02	4.1E-02	3.59E-01	1.15E+00

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42 **Statistical Computations**

43		Americium-241	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Nickel-63	Tritium
44	95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
45	N	16	16	16	16	16	16	16	16
46	% < Detection limit	94%	94%	100%	100%	100%	100%	100%	94%
47	mean	6.6E-02	2.4E-02	1.8E-02	4.6E-02	6.2E-02	5.4E-02	6.7E-01	7.1E-01
48	st. dev.	2.0E-01	2.0E-02	5.1E-03	1.5E-02	2.0E-02	2.3E-02	4.3E-01	6.5E-01
49	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
50	95% UCL on mean	1.5E-01	3.2E-02	2.0E-02	5.2E-02	7.0E-02	6.4E-02	8.5E-01	9.8E-01
51	max value	8.18E-01	9.5E-02	5.4E-02 U	1.5E-01 U	2.1E-01 U	2.1E-01 U	1.49E+00 U	2.33E+00
52	Statistical value	1.5E-01	3.2E-02	2.0E-02 U	5.2E-02 U	7.0E-02 U	6.4E-02 U	8.5E-01 U	9.8E-01
53	Background	NA	NA	NA	NA	NA	NA	NA	NA
54	Statistical value above background	1.5E-01	3.2E-02	2.0E-02 U	5.2E-02 U	7.0E-02 U	6.4E-02 U	8.5E-01 U	9.8E-01

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA
Project 300 Area Field Remediation
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Date 11/16/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 1
Date 11/16/06
Sheet No. 14 of 21

618-2, 618-3, and 618-8 Staging Pile/Decon Pad Footprint Sample Data

Sampling Area	Sample Number	Sample Date	Plutonium-238			Plutonium-239/240			Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B5	J13D61	9/6/06	-1.06E-01	UJ	8.1E-01	0	UJ	8.1E-01	2.92E+00	U	2.2E+01	2.8E-02	U	2.7E-01	5.51E-01		1.6E-01	0	U	1.9E-01	4.69E-01		1.6E-01
B6	J13D60	9/6/06	0	U	4.0E-01	0	U	4.0E-01	-5.17E+00	U	2.2E+01	-2.9E-02	U	2.4E-01	1.68E+00		1.5E-01	1.96E-01		1.9E-01	1.76E+00		1.5E-01
B7	J13D63	9/6/06	-5.2E-02	U	4.0E-01	5.2E-02	U	4.0E-01	-1.14E+00	U	2.4E+01	4.0E-02	U	2.2E-01	6.80E-01		2.3E-01	7.2E-02	U	2.7E-01	7.69E-01		2.3E-01
B8	J13D64	9/6/06	5.2E-02	U	4.0E-01	1.56E-01	U	4.0E-01	0	U	2.3E+01	1.10E-01	U	2.3E-01	5.57E-01		1.7E-01	2.7E-02	U	2.1E-01	7.80E-01		1.7E-01
C9	J13D65	9/6/06	0	U	4.0E-01	6.26E-01		4.0E-01	-1.90E-01	U	2.4E+01	1.25E-01	U	2.4E-01	1.20E+00		4.3E-02	1.34E-01		2.4E-02	1.19E+00		3.2E-02
C10	J13D66	9/6/06	1.03E-01	U	3.9E-01	1.00E+01		3.9E-01	-1.79E-01	U	2.3E+01	-8.6E-02	U	2.6E-01	1.75E+00		4.2E-02	1.39E-01		2.5E-02	1.83E+00		3.7E-02
C1	J13D67	9/6/06	4.6E-02	U	4.4E-01	1.86E-01	U	3.5E-01	3.22E+00	U	2.4E+01	1.38E-01	U	3.0E-01	7.50E-01		3.2E-02	5.6E-02		3.9E-02	7.21E-01		3.5E-02
C2	J13D68	9/6/06	2.48E-01	U	4.0E-01	4.1E-02	U	3.2E-01	-2.04E-01	U	2.6E+01	-4.5E-02	U	2.4E-01	8.36E-01		4.0E-01	8.4E-02		2.8E-02	8.02E-01		3.3E-02
D3	J13D69	9/6/06	-9.7E-02	U	4.7E-01	4.9E-02	U	3.7E-01	2.36E+00	U	2.5E+01	-5.0E-03	U	2.4E-01	7.26E-01		4.0E-01	8.3E-02		2.5E-02	6.13E-01		3.7E-02
D4	J13D70	9/6/06	0	U	4.0E-01	5.2E-02	U	4.0E-01	-1.94E+00	U	2.2E+01	1.46E-01	U	3.0E-01	1.04E+00		5.5E-02	8.6E-02		4.1E-02	9.77E-01		5.5E-02
D5	J13D71	9/6/06	0	U	4.2E-01	1.05E+00		4.2E-01	9.22E+00	U	2.1E+01	-1.1E-02	U	2.1E-01	4.07E+00		5.3E-02	2.67E-01		2.9E-02	3.82E+00		5.0E-02
D6	J13D72	9/6/06	-6.2E-02	U	4.7E-01	1.23E-01	U	4.7E-01	2.62E+00	U	2.5E+01	5.7E-02	U	2.7E-01	6.17E-01		3.1E-02	5.1E-02		2.6E-02	6.70E-01		2.7E-02
A1	J13D73	9/6/06	6.1E-02	U	4.7E-01	0	U	4.7E-01	1.81E+00	U	2.3E+01	-6.1E-02	U	3.4E-01	8.38E-01		1.8E-01	8.5E-02	U	2.2E-01	5.82E-01		1.8E-01
A3	J13D75	9/6/06	1.52E-01	U	5.8E-01	0	U	5.8E-01	3.55E+00	U	2.8E+01	2.0E-03	U	2.1E-01	4.69E-01		1.9E-01	9.0E-02	U	2.3E-01	4.69E-01		1.9E-01
A4	J13D62	9/6/06	1.32E-01	U	5.0E-01	0	U	5.0E-01	1.73E+00	U	2.7E+01	4.3E-02	U	2.7E-01	6.43E-01		1.5E-01	2.4E-02	U	1.9E-01	5.62E-01		1.5E-01
A2	J13D74	9/6/06	-6.2E-02	U	4.7E-01	0	U	4.7E-01	7.42E+00	U	2.7E+01	-2.3E-02	U	2.1E-01	7.45E-01		1.9E-01	0	U	2.3E-01	8.45E-01		1.9E-01
Duplicate of J13D74	J13D59	9/6/06	0	U	4.8E-01	0	U	4.8E-01	-4.44E+00	U	2.4E+01	-1.05E-01	U	2.7E-01	8.59E-01		2.2E-01	3.5E-02	U	2.7E-01	6.30E-01		2.2E-01

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Plutonium-238 pCi/g	Plutonium-239/240 pCi/g	Plutonium-241 pCi/g	Strontium-90 pCi/g	Uranium-233/234 pCi/g	Uranium-235 pCi/g	Uranium-238 pCi/g
B5	J13D61	9/6/06	-1.06E-01	0	2.92E+00	2.8E-02	5.51E-01	0	4.69E-01
B6	J13D60	9/6/06	0	0	-5.17E+00	-2.9E-02	1.68E+00	1.96E-01	1.76E+00
B7	J13D63	9/6/06	-5.2E-02	5.2E-02	-1.14E+00	4.0E-02	6.80E-01	7.2E-02	7.69E-01
B8	J13D64	9/6/06	5.2E-02	1.56E-01	0	1.10E-01	5.57E-01	2.7E-02	7.80E-01
C9	J13D65	9/6/06	0	6.26E-01	-1.90E-01	1.25E-01	1.20E+00	1.34E-01	1.19E+00
C10	J13D66	9/6/06	1.03E-01	1.00E+01	-1.79E-01	-8.6E-02	1.75E+00	1.39E-01	1.83E+00
C1	J13D67	9/6/06	4.6E-02	1.86E-01	3.22E+00	1.38E-01	7.50E-01	5.6E-02	7.21E-01
C2	J13D68	9/6/06	2.48E-01	4.1E-02	-2.04E-01	-4.5E-02	8.36E-01	8.4E-02	8.02E-01
D3	J13D69	9/6/06	-9.7E-02	4.9E-02	2.36E+00	-5.0E-03	7.26E-01	8.3E-02	6.13E-01
D4	J13D70	9/6/06	0	5.2E-02	-1.94E+00	1.46E-01	1.04E+00	8.6E-02	9.77E-01
D5	J13D71	9/6/06	0	1.05E+00	9.22E+00	-1.1E-02	4.07E+00	2.67E-01	3.82E+00
D6	J13D72	9/6/06	-6.2E-02	1.23E-01	2.62E+00	5.7E-02	6.17E-01	5.1E-02	6.70E-01
A1	J13D73	9/6/06	6.1E-02	0	1.81E+00	-6.1E-02	8.38E-01	8.5E-02	5.82E-01
A3	J13D75	9/6/06	1.52E-01	0	3.55E+00	2.0E-03	4.69E-01	9.0E-02	4.69E-01
A4	J13D62	9/6/06	1.32E-01	0	1.73E+00	4.3E-02	6.43E-01	2.4E-02	5.62E-01
A2	J13D74/J13D59	9/6/06	-3.1E-02	0	1.49E+00	-6.4E-02	8.02E-01	1.8E-02	7.38E-01

Statistical Computations

	Plutonium-238		Plutonium-239/240		Plutonium-241		Strontium-90		Uranium-233/234		Uranium-235		Uranium-238	
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.	
N	16		16		16		16		16		16		16	
% < Detection limit	100%		81%		100%		100%		0%		44%		0%	
mean	2.8E-02		7.7E-01		1.3E+00		2.4E-02		1.08E+00		8.8E-02		1.05E+00	
st. dev.	9.6E-02		2.5E+00		3.1E+00		7.5E-02		8.83E-01		6.9E-02		8.44E-01	
Z-statistic	1.645		1.645		1.645		1.645		1.645		1.645		1.645	
95% UCL on mean	6.7E-02		1.8E+00		2.5E+00		5.5E-02		1.44E+00		1.2E-01		1.39E+00	
max value	2.5E-01	U	1.0E+01		9.2E+00	U	1.5E-01	U	4.07E+00		2.7E-01		3.82E+00	
Statistical value	6.7E-02	U	1.8E+00		2.5E+00	U	5.5E-02	U	1.44E+00		1.2E-01		1.39E+00	
Background	NA		NA		NA		NA		1.1		0.11		1.1	
Statistical value above background	6.7E-02	U	1.8E+00		2.5E+00	U	5.5E-02	U	3.39E-01		6.6E-03		2.94E-01	

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA **Date** 11/01/06
Project 300 Area Field Remediation **Job No.** 14655
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 0
Date 11/01/06
Sheet No. 15 of 21

618-2, 618-3, and 618-8 Staging Pile/Decon Pad Footprint Sample Data

Sampling Area	Sample Number	Sample Date	Arsenic			Barium			Cadmium			Chromium			Lead			Selenium			Silver			Tin			Uranium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
B5	J13D61	9/6/06	2.9E+00	U	2.9E+00	7.19E+01		5.73E+01	1.4E+00	U	1.4E+00	6.1E+00		2.9E+00	3.6E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	9.89E-01		1.0E-02
B6	J13D60	9/6/06	2.8E+00	U	2.8E+00	5.94E+01		5.69E+01	1.4E+00	U	1.4E+00	5.9E+00		2.8E+00	3.4E+00		8.5E-01	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.84E+01	U	2.84E+01	3.21E+00		1.0E-02
B7	J13D63	9/6/06	2.9E+00	U	2.9E+00	6.24E+01		5.72E+01	1.4E+00	U	1.4E+00	5.0E+00		2.9E+00	3.7E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	1.32E+00		1.0E-02
B8	J13D64	9/6/06	2.9E+00	U	2.9E+00	5.91E+01		5.72E+01	1.4E+00	U	1.4E+00	4.5E+00		2.9E+00	2.8E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	1.42E+00		1.0E-02
C9	J13D65	9/6/06	2.8E+00	U	2.8E+00	6.54E+01		5.66E+01	1.4E+00	U	1.4E+00	6.8E+00		2.8E+00	3.5E+00		8.5E-01	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.83E+01	U	2.83E+01	2.68E+00		1.0E-02
C10	J13D66	9/6/06	3.0E+00		2.8E+00	6.03E+01		5.68E+01	1.4E+00	U	1.4E+00	5.8E+00		2.8E+00	3.4E+00		8.5E-01	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.84E+01	U	2.84E+01	3.62E+00		1.0E-02
C1	J13D67	9/6/06	2.8E+00	U	2.8E+00	6.62E+01		5.68E+01	1.4E+00	U	1.4E+00	6.9E+00		2.8E+00	4.0E+00		8.5E-01	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.84E+01	U	2.84E+01	1.40E+00		1.0E-02
C2	J13D68	9/6/06	2.8E+00		2.8E+00	6.86E+01		5.64E+01	1.4E+00	U	1.4E+00	6.0E+00		2.8E+00	4.1E+00		8.5E-01	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.84E+01	U	2.84E+01	1.55E+00		1.0E-02
D3	J13D69	9/6/06	3.4E+00		2.8E+00	8.21E+01		5.66E+01	1.4E+00	U	1.4E+00	7.8E+00		2.8E+00	4.7E+00		8.5E-01	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.83E+01	U	2.83E+01	1.43E+00		1.0E-02
D4	J13D70	9/6/06	2.9E+00	U	2.9E+00	6.09E+01		5.71E+01	1.4E+00	U	1.4E+00	6.1E+00		2.9E+00	3.6E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	2.03E+00		1.0E-02
D5	J13D71	9/6/06	3.1E+00		2.9E+00	6.92E+01		5.74E+01	1.4E+00	U	1.4E+00	5.9E+00		2.9E+00	5.1E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.87E+01	U	2.87E+01	1.12E+01		1.0E-01
D6	J13D72	9/6/06	2.9E+00	U	2.9E+00	7.37E+01		5.72E+01	1.4E+00	U	1.4E+00	5.4E+00		2.9E+00	4.0E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	1.26E+00		1.0E-02
A1	J13D73	9/6/06	2.8E+00	U	2.8E+00	5.68E+01		5.66E+01	1.4E+00	U	1.4E+00	5.9E+00		2.8E+00	3.3E+00		8.5E-01	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.83E+01	U	2.83E+01	1.08E+00		1.0E-02
A3	J13D75	9/6/06	2.8E+00	U	2.8E+00	5.78E+01		5.66E+01	1.4E+00	U	1.4E+00	6.5E+00		2.8E+00	4.0E+00		8.5E-01	1.4E+00	U	1.4E+00	2.8E+00	U	2.8E+00	2.83E+01	U	2.83E+01	1.04E+00		1.0E-02
A4	J13D62	9/6/06	3.0E+00		2.9E+00	6.28E+01		5.73E+01	1.4E+00	U	1.4E+00	5.9E+00		2.9E+00	3.6E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.86E+01	U	2.86E+01	1.20E+00		1.0E-02
A2	J13D74	9/6/06	2.9E+00	U	2.9E+00	5.75E+01	U	5.75E+01	1.4E+00	U	1.4E+00	5.4E+00		2.9E+00	3.0E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.88E+01	U	2.88E+01	1.27E+00		1.0E-02
Duplicate of J13D74	J13D59	9/6/06	3.0E+00		2.9E+00	5.74E+01	U	5.74E+01	1.4E+00	U	1.4E+00	6.8E+00		2.9E+00	3.5E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.87E+01	U	2.87E+01	1.12E+00		1.0E-02

Statistical Computation Input Data

Sampling Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Selenium mg/kg	Silver mg/kg	Tin mg/kg	Uranium mg/kg
B5	J13D61	9/6/06	1.5E+00	7.19E+01	7.0E-01	6.1E+00	3.6E+00	7.0E-01	1.5E+00	1.43E+01	9.89E-01
B6	J13D60	9/6/06	1.4E+00	5.94E+01	7.0E-01	5.9E+00	3.4E+00	7.0E-01	1.4E+00	1.42E+01	3.21E+00
B7	J13D63	9/6/06	1.5E+00	6.24E+01	7.0E-01	5.0E+00	3.7E+00	7.0E-01	1.5E+00	1.43E+01	1.32E+00
B8	J13D64	9/6/06	1.5E+00	5.91E+01	7.0E-01	4.5E+00	2.8E+00	7.0E-01	1.5E+00	1.43E+01	1.42E+00
C9	J13D65	9/6/06	1.4E+00	6.54E+01	7.0E-01	6.8E+00	3.5E+00	7.0E-01	1.4E+00	1.42E+01	2.68E+00
C10	J13D66	9/6/06	3.0E+00	6.03E+01	7.0E-01	5.8E+00	3.4E+00	7.0E-01	1.4E+00	1.42E+01	3.62E+00
C1	J13D67	9/6/06	1.4E+00	6.62E+01	7.0E-01	6.9E+00	4.0E+00	7.0E-01	1.4E+00	1.42E+01	1.40E+00
C2	J13D68	9/6/06	2.8E+00	6.86E+01	7.0E-01	6.0E+00	4.1E+00	7.0E-01	1.4E+00	1.42E+01	1.55E+00
D3	J13D69	9/6/06	3.4E+00	8.21E+01	7.0E-01	7.8E+00	4.7E+00	7.0E-01	1.4E+00	1.42E+01	1.43E+00
D4	J13D70	9/6/06	1.5E+00	6.09E+01	7.0E-01	6.1E+00	3.6E+00	7.0E-01	1.5E+00	1.43E+01	2.03E+00
D5	J13D71	9/6/06	3.1E+00	6.92E+01	7.0E-01	5.9E+00	5.1E+00	7.0E-01	1.5E+00	1.44E+01	1.12E+01
D6	J13D72	9/6/06	1.5E+00	7.37E+01	7.0E-01	5.4E+00	4.0E+00	7.0E-01	1.5E+00	1.43E+01	1.26E+00
A1	J13D73	9/6/06	1.4E+00	5.68E+01	7.0E-01	5.9E+00	3.3E+00	7.0E-01	1.4E+00	1.42E+01	1.08E+00
A3	J13D75	9/6/06	1.4E+00	5.78E+01	7.0E-01	6.5E+00	4.0E+00	7.0E-01	1.4E+00	1.42E+01	1.04E+00
A4	J13D62	9/6/06	3.0E+00	6.28E+01	7.0E-01	5.9E+00	3.6E+00	7.0E-01	1.5E+00	1.43E+01	1.20E+00
A2	J13D74/J13D59	9/6/06	2.2E+00	2.87E+01	7.0E-01	6.1E+00	3.3E+00	7.0E-01	1.5E+00	1.44E+01	1.20E+00

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA **Date** 11/01/06
Project 300 Area Field Remediation **Job No.** 14655
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 0
Date 11/01/06
Sheet No. 16 of 21

1 **618-2, 618-3, and 618-8 Staging Pile/Decon Pad Footprint Statistical Computations**

		Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Tin	Uranium
3	95% UCL based on	>50% of data are below detection. Default to max value.	Large data set (n≥10), lognormal and normal distribution rejected, use z-statistic.	>50% of data are below detection. Default to max value.	Large data set (n≥10), use MTCAStat lognormal distribution.	Large data set (n≥10), use MTCAStat lognormal distribution.	>50% of data are below detection. Default to max value.	>50% of data are below detection. Default to max value.	>50% of data are below detection. Default to max value.	Large data set (n≥10), lognormal and normal distribution rejected, use z-statistic.
4	N	16	16	16	16	16	16	16	16	16
5	% < Detection limit	63%	6%	100%	0%	0%	100%	100%	100%	0%
6	mean	2.0E+00	6.28E+01	7.0E-01	6.0E+00	3.8E+00	7.0E-01	1.4E+00	1.42E+01	2.29E+00
7	st. dev.	7.8E-01	1.13E+01	1.1E-16	7.6E-01	5.6E-01	1.1E-16	2.6E-02	7.76E-02	2.51E+00
8	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
9	95% UCL on mean	NA	6.75E+01	NA	6.4E+00	4.0E+00	NA	NA	NA	3.32E+00
10	max value	3.4E+00	8.21E+01	1.4E+00 U	7.8E+00	5.1E+00	1.4E+00 U	2.9E+00 U	2.88E+01 U	1.12E+01
11	Statistical value	3.4E+00	6.75E+01	1.4E+00 U	6.4E+00	4.0E+00	1.4E+00 U	2.9E+00 U	2.88E+01 U	3.32E+00
12	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	20 Direct Exposure	1,600 Direct Exposure	13.9 Direct Exposure	120,000 Direct Exposure	353 Direct Exposure	400 Direct Exposure	400 Direct Exposure	48,000 Direct Exposure	81 Direct Exposure
13	**WAC 173-340 3-PART Test**									
14	95% UCL > Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA	NO
15	> 10% above Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA	NO
16	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NA	NA	NA	NA	NO
17	**EXCESS RISK EVALUATION:**									
18	**WAC 173-340 Noncarcinogenic Cleanup:**	NA	NA	NA	NA	NA	NA	NA	NA	81
19	Hazard quotient for each nonradionuclide:	NA	NA	NA	NA	NA	NA	NA	NA	4.1E-02
20	**WAC 173-340 Carcinogenic Cleanup:**	NA	NA	NA	NA	NA	NA	NA	NA	NA
21	Risk for each carcinogenic nonradionuclide:	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	**WAC 173-340 3-Part-Test Compliance?** YES	Because all arsenic values are below background (6.5 mg/kg), the 3-part test and excess risk calculations are not required.	Because all barium values are below background (132 mg/kg), the 3-part test and excess risk calculations are not required.	Because cadmium was not detected in any sample, the 3-part test and excess risk calculations are not required.	Because all chromium values are below background (18.5 mg/kg), the 3-part test and excess risk calculations are not required.	Because all lead values are below background (10.2 mg/kg), the 3-part test and excess risk calculations are not required.	Because selenium was not detected in any sample, the 3-part test and excess risk calculations are not required.	Because silver was not detected in any sample, the 3-part test and excess risk calculations are not required.	Because tin was not detected in any sample, the 3-part test and excess risk calculations are not required.	The data set meets the 3-part test in comparison to the most stringent RAG.
23	**Nonrad noncarcinogenic index sum:** 4.1E-02									
24	**Nonrad carcinogenic risk:** NA									

Ecology Software (MTCAStat) Results for 618-2, 618-3, and 618-8 Staging Pile/Decon Pad Footprint

Barium 95% UCL Calculation

DATA	ID
7.19E+01	J13D61
5.94E+01	J13D60
6.24E+01	J13D63
5.91E+01	J13D64
6.54E+01	J13D65
6.03E+01	J13D66
6.62E+01	J13D67
6.86E+01	J13D68
6.21E+01	J13D69
6.09E+01	J13D70
6.92E+01	J13D71
7.37E+01	J13D72
5.68E+01	J13D73
5.78E+01	J13D75
6.28E+01	J13D62
2.87E+01	J13D74/ J13D59

Number of samples		Uncensored values	
Uncensored	16	Mean	62.8
Censored		Lognormal mean	63.2
Detection limit or PQL		Std. devn.	11.3
Method detection limit		Median	62.6
TOTAL	16	Min.	28.7
		Max.	82.1

Lognormal distribution? r-squared is: 0.671

Normal distribution? r-squared is: 0.810

Recommendations:
Reject BOTH lognormal and normal distributions.
See Statistics Guidance.

Chromium 95% UCL Calculation

DATA	ID
6.1E+00	J13D61
5.9E+00	J13D60
5.0E+00	J13D63
4.5E+00	J13D64
6.8E+00	J13D65
5.8E+00	J13D66
6.9E+00	J13D67
6.0E+00	J13D68
7.8E+00	J13D69
6.1E+00	J13D70
5.9E+00	J13D71
5.4E+00	J13D72
5.9E+00	J13D73
6.5E+00	J13D75
5.9E+00	J13D62
6.1E+00	J13D74/ J13D59

Number of samples		Uncensored values	
Uncensored	16	Mean	6.0
Censored		Lognormal mean	6.0
Detection limit or PQL		Std. devn.	0.76
Method detection limit		Median	6.0
TOTAL	16	Min.	4.5
		Max.	7.8

Lognormal distribution? r-squared is: 0.92

Normal distribution? r-squared is: 0.92

Recommendations:
Use lognormal distribution.

UCL (Land's method) is: 6.4

Lead 95% UCL Calculation

DATA	ID
3.8E+00	J13D61
3.4E+00	J13D60
3.7E+00	J13D63
2.8E+00	J13D64
3.5E+00	J13D65
3.4E+00	J13D66
4.0E+00	J13D67
4.1E+00	J13D68
4.7E+00	J13D69
3.6E+00	J13D70
5.1E+00	J13D71
4.0E+00	J13D72
3.3E+00	J13D73
4.0E+00	J13D75
3.6E+00	J13D62
3.3E+00	J13D74/ J13D59

Number of samples		Uncensored values	
Uncensored	16	Mean	3.8
Censored		Lognormal mean	3.8
Detection limit or PQL		Std. devn.	0.56
Method detection limit		Median	3.6
TOTAL	16	Min.	2.8
		Max.	5.1

Lognormal distribution? r-squared is: 0.9

Normal distribution? r-squared is: 0.9

Recommendations:
Use lognormal distribution.

UCL (Land's method) is: 4.0

Uranium 95% UCL Calculation

DATA	ID
9.89E-01	J13D61
3.21E+00	J13D60
1.32E+00	J13D63
1.42E+00	J13D64
2.68E+00	J13D65
3.62E+00	J13D66
1.40E+00	J13D67
1.55E+00	J13D68
1.43E+00	J13D69
2.03E+00	J13D70
1.12E+01	J13D71
1.26E+00	J13D72
1.08E+00	J13D73
1.04E+00	J13D75
1.20E+00	J13D62
1.20E+00	J13D74/ J13D59

Number of samples		Uncensored values	
Uncensored	16	Mean	2.29
Censored		Lognormal mean	2.15
Detection limit or PQL		Std. devn.	2.51
Method detection limit		Median	1.41
TOTAL	16	Min.	0.989
		Max.	11.2

Lognormal distribution? r-squared is: 0.773

Normal distribution? r-squared is: 0.492

Recommendations:
Reject BOTH lognormal and normal distributions.
See Statistics Guidance.

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA
Date 11/20/06
Project 300 Area Field Remediation
Job No. 14655
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Calc. No. 0600X-CA-V0060
Checked W.S. Thompson WSJ

Rev. No. 1
Date 11/20/06
Sheet No. 18 of 21

Split-Duplicate Analysis

618-2 Shallow Zone Sample Results:

Sampling Area	Sample Number	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Nickel-63			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	pCi/g	Q	MDA	pCi/g	Q	MDA
A2	J13DJ7	5.6E-02	U	7.6E-02	3.4E-02		1.7E-02	4.6E-02	U	4.6E-02	3.4E-02	U	3.4E-02	5.3E-02	U	5.3E-02	3.8E-02	U	3.8E-02	9.46E-01	U	3.5E+00	1.31E-01	U	2.3E+00
Duplicate of J13DJ7	J13DJ8	9.9E-02	U	1.1E-01	4.0E-02		1.9E-02	1.7E-02	U	1.7E-02	4.3E-02	U	4.3E-02	5.1E-02	U	5.1E-02	6.1E-02	U	6.1E-02	-1.01E+00	U	3.9E+00	4.77E-01	U	2.4E+00
Split of J13DJ7	J13DK2	3.37E-01		2.52E-02	5.00E-02		1.57E-02	8.05E-03	U	1.84E-02	-8.08E-03	U	3.70E-02	-1.63E-02	U	5.89E-02	3.61E-02	U	4.06E-02	5.95E+00	U	6.18E+00	8.82E-03	U	3.89E-02

Sample Analysis:

TDL		1	0.1	0.05	0.1	0.1	0.1	30	400
Duplicate Analysis	Both > PQL or MDA?	No-Stop (acceptable)	**Yes (continue)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	Both > 5xTDL?		No-Stop (acceptable)						
	RPD								
Split Analysis	Both > PQL?	No-Stop (acceptable)	**Yes (continue)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	Both > 5xTDL?		No-Stop (acceptable)						
	RPD								

618-2 Shallow Zone Sample Results (cont.):

Sampling Area	Sample Number	Plutonium-238			Plutonium-239/240			Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
		pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A2	J13DJ7	5.9E-02	U	4.5E-01	8.24E-01		4.5E-01	1.42E+01	U	2.0E+01	-1.4E-02	U	2.2E-01	1.71E+00		1.7E-01	2.14E-01		2.1E-01	1.77E+00		1.7E-01
Duplicate of J13DJ7	J13DJ8	6.8E-02	U	2.6E-01	7.18E-01		2.6E-01	9.65E+00	U	1.8E+01	-2.4E-02	U	2.5E-01	1.83E+00		2.3E-01	1.11E-01	U	2.8E-01	1.89E+00		2.3E-01
Split of J13DJ7	J13DK2	1.57E-02	U	2.92E-02	1.73E+00		2.92E-02	6.60E-01	U	9.79E-01	9.71E-03	U	1.26E-01	5.02E+00		3.84E-02	1.15E-01		3.23E-02	4.98E+00		2.61E-02

Sample Analysis:

TDL		1	1	15	1	1	1	1
Duplicate Analysis	Both > PQL or MDA?	No-Stop (acceptable)	**Yes (continue)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**
	Both > 5xTDL?		No-Stop (acceptable)			No-Stop (acceptable)		No-Stop (acceptable)
	RPD							
Split Analysis	Both > PQL?	No-Stop (acceptable)	**Yes (continue)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both > 5xTDL?		No-Stop (acceptable)			No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD							

618-2 Shallow Zone Sample Results (cont.):

Sampling Area	Sample Number	Arsenic			Barium			Cadmium			Chromium			Lead			Selenium			Tin			Uranium		
		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
A2	J13DJ7	1.3E+00		1.1E+00	7.91E+01		6E-02	9E-02	U	9E-02	4.5E+00		2.0E-01	3.4E+00		3.4E-01	7.4E-01	U	7.4E-01	2.1E+00		1.0E+00	3.72E+00		7E-03
Duplicate of J13DJ7	J13DJ8	1.7E+00		1.1E+00	6.98E+01		6E-02	9E-02	U	9E-02	4.6E+00		2.0E-01	3.5E+00		3.4E-01	7.4E-01	U	7.4E-01	2.2E+00		1.0E+00	3.35E+00		7E-03
Split of J13DJ7	J13DK2	1.8E+00		2.8E-01	7.98E+01		5.0E-01	1.4E-01	U	1.4E-01	5.5E+00		3.6E-01	2.6E+00		1.5E-01	5.5E-01		1.7E-01	2.8E+00	U	2.8E+00	1.25E+01		2.08E-02

Sample Analysis:

TDL		10	20	0.5	1	10	10	10	1
Duplicate Analysis	Both > PQL or MDA?	**Yes (continue)**	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**
	Both > 5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)		No-Stop (acceptable)	No-Stop (acceptable)		No-Stop (acceptable)	No-Stop (acceptable)
	RPD								
Split Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (continue)**
	Both > 5xTDL?	No-Stop (acceptable)	No-Stop (acceptable)		No-Stop (acceptable)	No-Stop (acceptable)			No-Stop (acceptable)
	RPD								

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA
Project 300 Area Field Remediation
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Date 11/20/06
Job No. 14655

Calc. No. 0600X-CA-V0060
Checked W.S. Thompson WSTh

Rev. No. 1
Date 11/20/06
Sheet No. 19 of 21

Split-Duplicate Analysis

618-2 Deep Zone Sample Results:

Sampling Area	Sample Number	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Nickel-63			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	pCi/g	Q	MDA	pCi/g	Q	MDA
A2	J13DJ0	7.94E+00		6.7E-02	2.09E-01		4.6E-02	3.7E-02	U	3.7E-02	9.9E-02	U	9.9E-02	1.2E-01	U	1.2E-01	9.6E-02	U	9.6E-02	-4.97E-01	U	3.6E+00	4.54E-01	U	2.5E+00
Duplicate of J13DJ0	J13DJ1	6.82E+00		4.7E-02	3.92E-01		4.6E-02	3.2E-02	U	3.2E-02	9.2E-02	U	9.2E-02	1.1E-01	U	1.1E-01	8.9E-02	U	8.9E-02	8.68E-01	U	3.6E+00	5.80E-01	U	2.4E+00
Split of J13DJ0	J13DK3	1.78E+01		2.00E-02	2.78E-01		1.80E-02	4.98E-03	U	1.88E-02	-1.00E-02	U	4.12E-02	-2.80E-02	U	5.74E-02	4.37E-02	U	5.46E-02	4.44E+00	U	6.05E+00	7.13E-02		3.80E-02

Sample Analysis:

TDL		1			0.1			0.05			0.1			0.1			0.1			30			400		
Duplicate Analysis	Both > PQL or MDA?	Yes (continue)			Yes (continue)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?	Yes (calc RPD)			No-Stop (acceptable)																				
	RPD	15%																							
Split Analysis	Both > PQL?	Yes (continue)			Yes (continue)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?	Yes (calc RPD)			No-Stop (acceptable)																				
	RPD	77%																							

618-2 Deep Zone Sample Results (cont.):

Sampling Area	Sample Number	Plutonium-238			Plutonium-239/240			Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
		pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A2	J13DJ0	4.17E-01	U	5.3E-01	5.16E+01		5.3E-01	2.97E+01		2.9E+01	1.16E+01		2.1E-01	1.46E+01		2.9E-01	7.76E-01		2.8E-01	1.48E+01		2.9E-01
Duplicate of J13DJ0	J13DJ1	4.15E-01	U	4.5E-01	4.55E+01		4.5E-01	9.69E+00	U	2.2E+01	9.39E+00		2.0E-01	1.28E+01		3.0E-01	7.61E-01		2.5E-01	1.25E+01		2.6E-01
Split of J13DJ0	J13DK3	1.32E+00		2.19E-02	9.23E+01		2.19E-02	2.65E+01		8.06E-01	1.46E+01		1.21E-01	2.94E+01		3.44E-02	1.00E+00		2.89E-02	2.95E+01		3.09E-02

Sample Analysis:

TDL		1	1	15	1	1	1	1
Duplicate Analysis	Both > PQL or MDA?	No-Stop (acceptable)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both > 5xTDL?		Yes (calc RPD)		Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		13%		21%	13%		17%
Split Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both > 5xTDL?		Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		57%		23%	67%		66%

618-2 Deep Zone Sample Results (cont.):

Sampling Area	Sample Number	Arsenic			Barium			Cadmium			Chromium			Lead			Selenium			Tin			Uranium		
		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
A2	J13DJ0	1.1E+00	U	1.1E+00	6.35E+01		6E-02	9E-02	U	9E-02	2.5E+00		2.0E-01	2.7E+00		3.5E-01	7.6E-01	U	7.6E-01	2.5E+00		1.0E+00	3.57E+01		7.2E-02
Duplicate of J13DJ0	J13DJ1	1.1E+00	U	1.1E+00	7.37E+01		6E-02	9E-02	U	9E-02	4.4E+00		2.1E+00	3.2E+00		3.5E-01	7.6E-01	U	7.6E-01	2.9E+00		1.0E+00	3.70E+01		7.2E-02
Split of J13DJ0	J13DK3	1.8E+00		2.8E-01	1.85E+02		5.1E-01	1.4E-01	U	1.4E-01	5.4E+00		3.6E-01	3.5E+00		1.5E-01	3.9E-01		1.8E-01	8.7E+00		2.9E+00	8.98E+01		2.04E-02

Sample Analysis:

TDL		10	20	0.5	1	10	10	10	1
Duplicate Analysis	Both > PQL or MDA?	No-Stop (acceptable)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both > 5xTDL?		No-Stop (acceptable)		No-Stop (acceptable)	No-Stop (acceptable)		No-Stop (acceptable)	Yes (calc RPD)
	RPD								4%
Split Analysis	Both > PQL?	No-Stop (acceptable)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)	No-Stop (acceptable)	Yes (continue)	Yes (continue)
	Both > 5xTDL?		No-Stop (acceptable)		No-Stop (acceptable)	No-Stop (acceptable)		No-Stop (acceptable)	Yes (calc RPD)
	RPD								86%

Note: The significance of the RPD values, including values greater than 30%, is addressed in the data quality assessment section of the CVP.

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA **Date** 11/20/06
Project 300 Area Field Remediation **Job No.** 14655
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Calc. No. 0600X-CA-V0060
Checked W.S. Thompson WSJ

Rev. No. 1
Date 11/28/06
Sheet No. 20 of 21

Split-Duplicate Analysis

618-2 Overburden Sample Results:

Sampling Area	Sample Number	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Nickel-63			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	pCi/g	Q	MDA	pCi/g	Q	MDA
A2	J13DH0	2.0E-02	U	6.5E-02	4.2E-02	U	4.2E-02	3.8E-02	U	3.8E-02	9.3E-02	U	9.3E-02	1.2E-01	U	1.2E-01	8.4E-02	U	8.4E-02	-7.17E-01	U	3.7E+00	3.49E-01	U	2.6E+00
Duplicate of J13DH0	J13DH1	-5.0E-03	U	7.0E-02	4.8E-02		4.8E-02	4.9E-02	U	4.9E-02	1.2E-01	U	1.2E-01	1.6E-01	U	1.6E-01	1.1E-01	U	1.1E-01	-1.15E+00	U	4.0E+00	5.62E-01	U	2.6E+00
Split of J13DH0	J13DH4	2.97E-02		2.03E-02	1.55E-02		1.50E-02	1.98E-03	U	1.65E-02	-1.99E-02	U	3.28E-02	2.36E-02	U	5.37E-02	1.92E-02	U	4.05E-02	1.82E+00	U	5.96E+00	3.38E-02	U	4.15E-02

Sample Analysis:

TDL		1			0.1			0.05			0.1			0.1			0.1			30			400		
Duplicate Analysis	Both > PQL or MDA?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																								
	RPD																								
Split Analysis	Both > PQL?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																								
	RPD																								

618-2 Overburden Sample Results (cont.):

Sampling Area	Sample Number	Plutonium-238			Plutonium-239/240			Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
		pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A2	J13DH0	1.26E-01	U	4.8E-01	0	U	4.8E-01	4.63E+00	U	2.4E+01	-1.2E-02	U	2.5E-01	6.44E-01		2.1E-01	9.7E-02	U	2.5E-01	5.10E-01		2.1E-01
Duplicate of J13DH0	J13DH1	0	U	5.0E-01	1.97E-01	U	5.0E-01	4.82E+00	U	2.8E+01	-9.7E-02	U	2.5E-01	5.37E-01		2.1E-01	0	U	2.5E-01	5.91E-01		2.1E-01
Split of J13DH0	J13DH4	0	U	1.79E-02	-1.32E-03	U	3.16E-02	3.28E-01	U	1.50E+00	8.98E-02	U	1.20E-01	1.02E+00		3.74E-02	2.97E-02		2.43E-02	7.67E-01		2.43E-02

Sample Analysis:

TDL		1			1			15			1			1			1			1					
Duplicate Analysis	Both > PQL or MDA?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**					
	Both > 5xTDL?													No-Stop (acceptable)						No-Stop (acceptable)					
	RPD																								
Split Analysis	Both > PQL?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**					
	Both > 5xTDL?													No-Stop (acceptable)						No-Stop (acceptable)					
	RPD																								

618-2 Overburden Sample Results (cont.):

Sampling Area	Sample Number	Arsenic			Barium			Cadmium			Chromium			Lead			Selenium			Tin			Uranium		
		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
A2	J13DH0	1.5E+00		1.1E+00	6.22E+01		6E-02	9E-02	U	9E-02	5.3E+00		2.0E-01	3.5E+00		3.5E-01	7.6E-01	U	7.6E-01	1.0E+00	U	1.0E+00	9.72E-01		7E-03
Duplicate of J13DH0	J13DH1	1.2E+00		1.1E+00	6.35E+01		6E-02	9E-02	U	9E-02	6.6E+00		2.0E-01	4.3E+00		3.5E-01	7.5E-01	U	7.5E-01	2.2E+00		1.0E+00	8.91E-01		7E-03
Split of J13DH0	J13DH4	2.0E+00		2.8E-01	8.41E+01		5.0E-01	1.4E-01	U	1.4E-01	7.0E+00		3.6E-01	3.2E+00		1.5E-01	5.5E-01		1.7E-01	2.8E+00	U	2.8E+00	2.69E+00		2.10E-02

Sample Analysis:

TDL		10			20			0.5			1			10			10			10			1		
Duplicate Analysis	Both > PQL or MDA?	**Yes (continue)**			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**		
	Both > 5xTDL?	No-Stop (acceptable)			No-Stop (acceptable)						**Yes (calc RPD)**			No-Stop (acceptable)									No-Stop (acceptable)		
	RPD										22%														
Split Analysis	Both > PQL?	**Yes (continue)**			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**		
	Both > 5xTDL?	No-Stop (acceptable)			No-Stop (acceptable)						**Yes (calc RPD)**			No-Stop (acceptable)									No-Stop (acceptable)		
	RPD										28%														

Note: The significance of the RPD values, including values greater than 30%, is addressed in the data quality assessment section of the CVP.

Washington Closure Hanford

CALCULATION SHEET

Originator K. A. Anselm KAA
Date 11/16/06
Project 300 Area Field Remediation
Job No. 14655
Subject Cleanup Verification 95% UCL Calculations for 618-2 Shallow Zone/Deep Zone/Overburden, and 618-2, 618-3, 618-8 Staging Pile and Decon Pad Footprint

Calc. No. 0600X-CA-V0060
Checked J. M. Capron JMC

Rev. No. 1
Date 11/16/06
Sheet No. 21 of 21

Split-Duplicate Analysis

618-2, 618-3, and 618-8 Staging Pile/Decon Pad Sample Results:

Sampling Area	Sample Number	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Nickel-63			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	pCi/g	Q	MDA	pCi/g	Q	MDA
A2	J13D74	-1.5E-02	U	5.5E-02	3.1E-02	U	3.1E-02	2.7E-02	U	2.7E-02	7.7E-02	U	7.7E-02	8.2E-02	U	8.2E-02	6.6E-02	U	6.6E-02	5.03E-01	U	3.7E+00	1.18E+00	UJ	2.4E+00
Duplicate of J13D74	J13D59	2.2E-02	U	6.9E-02	4.6E-02	U	4.6E-02	4.2E-02	U	4.2E-02	1.1E-01	U	1.1E-01	1.5E-01	U	1.5E-01	9.9E-02	U	9.9E-02	2.15E-01	U	4.4E+00	1.11E+00	UJ	2.3E+00
Split of J13D74	J13D76	6.77E-03	U	4.06E-02	-2.16E-03	U	1.45E-02	-7.60E-05	U	1.55E-02	-5.13E-03	U	3.24E-02	1.16E-02	U	5.11E-02	4.61E-02	U	4.64E-02	4.56E+00	U	6.14E+00	-7.58E-04	U	3.67E-02

Sample Analysis:

TDL		1			0.1			0.05			0.1			0.1			0.1			30			400		
Duplicate Analysis	Both > PQL or MDA?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																								
	RPD																								
Split Analysis	Both > PQL?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																								
	RPD																								

618-2, 618-3, and 618-8 Staging Pile/Decon Pad Sample Results (cont.):

Sampling Area	Sample Number	Plutonium-238			Plutonium-239/240			Plutonium-241			Strontium-90			Uranium-233/234			Uranium-235			Uranium-238		
		pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A2	J13D74	-6.2E-02	U	4.7E-01	0	U	4.7E-01	7.42E+00	U	2.7E+01	-2.3E-02	U	2.1E-01	7.45E-01		1.9E-01	0	U	2.3E-01	8.45E-01		1.9E-01
Duplicate of J13D74	J13D59	0	U	4.8E-01	0	U	4.8E-01	-4.44E+00	U	2.4E+01	-1.05E-01	U	2.7E-01	8.59E-01		2.2E-01	3.5E-02	U	2.7E-01	6.30E-01		2.2E-01
Split of J13D74	J13D76	0	U	6.46E-02	3.81E-02	U	1.35E-01	-4.79E-01	U	5.25E+00	1.35E-02	U	1.12E-01	1.72E+00		2.95E-02	7.87E-02		3.65E-02	1.75E+00		3.65E-02

Sample Analysis:

TDL		1			1			15			1			1			1			1			1		
Duplicate Analysis	Both > PQL or MDA?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**					
	Both > 5xTDL?													No-Stop (acceptable)						No-Stop (acceptable)					
	RPD																								
Split Analysis	Both > PQL?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**					
	Both > 5xTDL?													No-Stop (acceptable)						No-Stop (acceptable)					
	RPD																								

618-2, 618-3, and 618-8 Staging Pile/Decon Pad Sample Results (cont.):

Sampling Area	Sample Number	Arsenic			Barium			Cadmium			Chromium			Lead			Selenium			Silver			Tin			Uranium		
		mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A2	J13D74	2.9E+00	U	2.9E+00	5.75E+01	U	5.75E+01	1.4E+00	U	1.4E+00	5.4E+00		2.9E+00	3.0E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.88E+01	U	2.88E+01	1.27E+00		1.0E-02
Duplicate of J13D74	J13D59	3.0E+00		2.9E+00	5.74E+01	U	5.74E+01	1.4E+00	U	1.4E+00	6.8E+00		2.9E+00	3.5E+00		8.6E-01	1.4E+00	U	1.4E+00	2.9E+00	U	2.9E+00	2.87E+01	U	2.87E+01	1.12E+00		1.0E-02
Split of J13D74	J13D76	4.6E+00		2.8E-01	7.27E+01		5.1E-01	1.4E-01	U	1.4E-01	9.4E+00		3.6E-01	3.0E+00		1.5E-01	9.5E-01		1.7E-01	2.0E-01	U	2.0E-01	2.8E+00	U	2.8E+00	1.86E+00		2.04E-02

Sample Analysis:

TDL		10			20			0.5			1			10			10			0.2			10			1		
Duplicate Analysis	Both > PQL or MDA?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**		
	Both > 5xTDL?										**Yes (calc RPD)**			No-Stop (acceptable)												No-Stop (acceptable)		
	RPD										23%																	
Split Analysis	Both > PQL?	No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**		
	Both > 5xTDL?										**Yes (calc RPD)**			No-Stop (acceptable)												No-Stop (acceptable)		
	RPD										*54%*																	

Note: The significance of the RPD values, including values greater than 30%, is addressed in the data quality assessment section of the CVP.

CALCULATION COVER SHEET

Project Title:	618-2 Burial Ground Sample Design	**Job No.**	14655
Area	300 Area		
Discipline	Environmental Engineering	***Calc. No.**	0300X-CA-V0077
Subject	618-2 Shallow, Deep Zone, Overburden/Stockpile Area Sampling Plan		
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 conjuction with other relevent documents in the administrative record.

Committed Calculation ☒ **Preliminary** ☐ **Superseded** ☐ **Voided** ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sht Calc = 2 Shts Attach1 = 1 Sht Attach2 = 1 Sht Attach3 = 4 Shts Total = 9 Shts	G. Cruz 10/31/06	C.A. Bentz 10/31/06	R.B. Kerkow 11/1/06	M.J. Haass F.M. Corpuz	11/6/06 11/6/06

SUMMARY OF REVISIONS

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

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

Washington Closure Hanford **CALCULATION SHEET**

Originator G. Cruz **Date** 10/31/2006 **Calc. No.** 0300X-CA-V0077 **Rev. No.** 0
Project 618-2 Burial Ground Sample Design **Job No.** 14655 **Checked** DB **Date** 10/31/06
Subject 618-2 Shallow, Deep Zone, Overburden/Stockpile Area Sampling Plan **Sheet No.** 1of2

1	**Problem:**	Calculate and display required sampling nodes in concurrence with 300 Area
2		SAP DOE/RL-2001-48 Rev. 1 for verification and closure.
3		
4		{Per Table 3-3 of DOE/RL-2001-48, the deep zone decision unit size is less than 100,000 ft2 and is therefore
5		divided into 4 decision subunits of approximate equal area for the placement of the sampling grid and the
6		selection of the four discrete random samples. The four discrete samples are then composited into a single
7		verification soil sample. This process would unacceptably result in a composite soil sample consisting of
8		individual discrete samples from more than a single trench. Because each of the three 618-2 trenches received
9		unique wastes, it was decided with acceptance from the EPA, that the subunits should not composite soil
10		samples across more than a single trench. In so doing, the grid spacing for sampling is different for each of the
11		trenches to accommodate maintaining a subunit within the boundaries of the appropriate trench.}
12		
13	**Given:**	-SAP (DOE/RL-2001-48 Rev. 1) requirements
14		-Shallow Sampling Area (Surface area of each zone determined from CAD program,
15		Attachment 3, Sht 1of4, CAD file 3X:081706A, 618-2 Burial Ground Shallow Zone Sampling Plan)
16		
17		-Deep Zone Sampling Area (Surface area of each zone determined from CAD program,
18		Attachment 3, Sht 2of4, CAD file 3X:081706B, 618-2 Burial Ground Deep Zone Sampling Plan)
19		
20		-Overburden Sampling Area (Surface area of each zone determined from CAD program,
21		Attachment 3, Sht 3of4, CAD file 3X:081706C, 618-2 Burial Ground Overburden Sampling Plan)
22		
23		-Stockpile Sampling Area (Surface area of each zone determined from CAD program,
24		Attachment 3, Sht 4of4, CAD file 3X:081706D, 618-2 Burial Ground Stockpile Area Sampling Plan)
25		
26	**SAP Requirements:**	
27		-Develop a 16 node sampling grid for the sampling area
28	Shallow Zone	-Use table 3-2 of the SAP to determine which four of the sixteen nodes will be sampled
29		to collect clean up verification samples
30		
31		-Develop a 16 node sampling grid for the sampling area
32	Overburden:	-Use table 3-2 of the SAP to determine which four of the sixteen nodes will be sampled
33		to collect clean up verification samples
34		
35		-Develop a 16 node sampling grid for the sampling area
36	Deep Zone:	-Use table 3-2 of the SAP to determine which four of the sixteen nodes will be sampled
37		to collect clean up verification samples
38		
39	**Determination of Shallow Zone Sampling Grid:**	
40		
41	Shallow Zone Sampling Grid Area determined from Table 3-2, SAP	
42	Attachment 2, Number of Decision Subunits Based on Area (Converted to Sq Meters)	
43		
44	Total Area:	3025.77 m^2
45	Area of Decision Subunits (total area 1 subunit)	3025.77 m^2
46		
47	Decision Subunit divided into 4 Sampling Areas:	varies m^2
48		
49	Sampling Areas divided into a 16 node grid (node numbers 1-16):	varies m^2
50		
51	Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)	
52		See Attachment 3, Sht 1of4, 618-2 Burial Ground Shallow Zone Sampling Plan,
53		for Sample Location Table
54		
55		

Washington Closure Hanford **CALCULATION SHEET**

Originator G. Cruz Date 10/31/2006 Calc. No. 0300X-CA-V0077 Rev. No. 0
Project 618-2 Burial Ground Sample Design Job No. 14655 Checked CSB Date 10/31/06
Subject 618-2 Shallow, Deep Zone, Overburden/Stockpile Area Sampling Plan Sheet No. 2of2

1			
2	**Determination of Deep Zone Sampling Grid:**		
3			
4	Deep Zone Sampling Grid Area determined from Table 3-2, SAP		
5	Attachment 2, Number of Decision Subunits Based on Area (Converted to Sq Meters)		
6			
7	Total Area:	1176.66	m^2
8	Area of Decision Subunits (total area 1 subunit)	1176.66	m^2
9			
10	Decision Subunits divided into 4 Sampling Areas:	varies	m^2
11			
12	Sampling Areas divided into a 16 node grid (node numbers 1-16):	varies	m^2
13			
14	Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)		
15	See Attachment 3, Sht 2of4, 618-2 Burial Ground Deep Zone Sampling Plan,		
16	for Sample Location Table		
17			
18	**Determination of Overburden Sampling Grid:**		
19			
20	Overburden Sampling Grid Area determined from Table 3-2, SAP		
21	Attachment 2, Number of Decision Subunits Based on Area (Converted to Sq Meters)		
22			
23	Total Area:	1883.27	m^2
24	Area of Decision Subunits (total area 1 subunit)	1883.27	m^2
25			
26	Decision Subunits divided into 4 Sampling Areas:	470.81	m^2
27			
28	Sampling Areas divided into a 16 node grid (node numbers 1-16):	29.42	m^2
29			
30	Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)		
31	See Attachment 3, Sht 3of4, 618-2 Burial Ground Overburden Sampling Plan,		
32	for Sample Location Table		
33			
34	**Determination of Stockpile Area Sampling Grid:**		
35			
36	Stockpile Area Sampling Grid Area determined from Table 3-2, SAP		
37	Attachment 2, Number of Decision Subunits Based on Area (Converted to Sq Meters)		
38			
39	Total Area:	20709.59	m^2
40	Area of Decision Subunits (total area 4 subunits)	5177.40	m^2
41			
42	Decision Subunits divided into 4 Sampling Areas:	1294.35	m^2
43			
44	Sampling Areas divided into a 16 node grid (node numbers 1-16):	80.89	m^2
45			
46	Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)		
47	See Attachment 3, Sht 4of4, 618-2 Burial Ground Stockpile Area Sampling Plan,		
48	for Sample Location Table		

Washington Closure Hanford

Originator	G. Cruz	Date	10/31/2006	Calc. No.	0300X-CA-V0077	Rev. No.	0
Project	618-2 Burial Ground Sample Design			Job No.	14655	Checked	OSB Date 10/31/06
Subject	618-2 Shallow, Deep Zone, Overburden/Stockpile Area Sampling Plan					Sheet No	1of1

ATTACHMENT 1

Sample Grid Point Lookup Table.

Default Plan	Sampling Area 1	Sampling Area 2	Sampling Area 3	Sampling Area 4	Sampling Area 5	Sampling Area 6	Sampling Area 7	Sampling Area 8	Sampling Area 9	Sampling Area 10
Verification	3	6	1	4	5	1	3	3	4	16
Verification	4	7	11	3	15	15	5	13	10	10
Verification	16	3	2	7	7	10	11	4	3	14
Verification	10	15	4	12	1	13	4	8	16	4
Not Sampling	2	14	5	9	13	12	8	2	14	8
Not Sampling	13	10	9	13	2	16	1	12	5	3
Not Sampling	6	1	10	8	14	4	16	5	8	6
Not Sampling	1	9	13	1	10	5	12	1	1	15
Not Sampling	9	12	7	5	6	2	6	7	15	9
Not Sampling	15	16	15	14	16	6	2	15	11	1
Not Sampling	8	13	8	10	12	11	13	14	2	12
Not Sampling	5	2	3	11	4	3	9	10	7	11
Not Sampling	7	11	14	15	11	14	14	6	13	2
Not Sampling	11	4	6	2	9	7	7	11	9	7
Not Sampling	12	8	16	16	3	8	15	9	6	13
Not Sampling	14	5	12	6	8	9	10	16	12	5

** **Note:** Grid nodes for each sampling area in each waste site should be numbered consistently, e.g., begin numbering the nodes in the northwesternmost node. Then number consecutively left to right.

Washington Closure Hanford

Originator G. Cruz Date 10/31/2006 Calc. No. 0300X-CA-V0077 Rev. No. 0
Project 618-2 Burial Ground Sample Design Job No. 14655 Checked GB Date 10/31/06
Subject 618-2 Shallow, Deep Zone, Overburden/Stockpile Area Sampling Plan Sheet No. 1of1

ATTACHMENT 2

Number of Decision Subunits Based on Area.

Site Verification Sampling Frequencies Based on Area.

Decision Unit[a]	Waste Site Size[b]	Decision Subunits	Blocks[c]	Discrete Samples	Composite Samples
Shallow zone – 0 to 15 ft	Small: $\leq 100{,}000$ ft^2	1	4	16	4
	Medium: $>100{,}000$ ft^2 $\leq 400{,}000$ ft^2	4	16	64	16
	Large: $>400{,}000$ ft^2	8	32	128	32
Deep Zone - >15 ft	Small: $\leq 100{,}000$ ft^2	1	4	16	4
	Medium: $>100{,}000$ ft^2 $< 400{,}000$ ft^2	4	16	64	16
	Large: $>400{,}000$ ft^2	8	32	128	32
Overburen/layback stockpiles	Small: $\leq 100{,}000$ ft^2	1	4	16	4
	Medium: $>100{,}000$ ft^2 $\leq 400{,}000$ ft^2	4	16	64	16
	Large: $>400{,}000$ ft^2	8	32	128	32
Staging pile areas (residual soil)	Small: $\leq 100{,}000$ ft^2	1	4	16	4
	Medium: $>100{,}000$ ft^2 $\leq 400{,}000$ ft^2	4	16	64	16
	Large: $>400{,}000$ ft^2	8	32	128	32

[a] The shallow zone, deep zone, overburden stockpile, and staging pile areas each represent single decision units. The total number of decision units will vary because individual waste sites may not have a deep zone, overburden stockpile, and/or staging pile areas.
[b] Area of exposed surface after excavation or area of stockpile base (as applicable)
[c] Decision subunits are divided into four blocks to ensure that random sampling locations are not bunched together in one area

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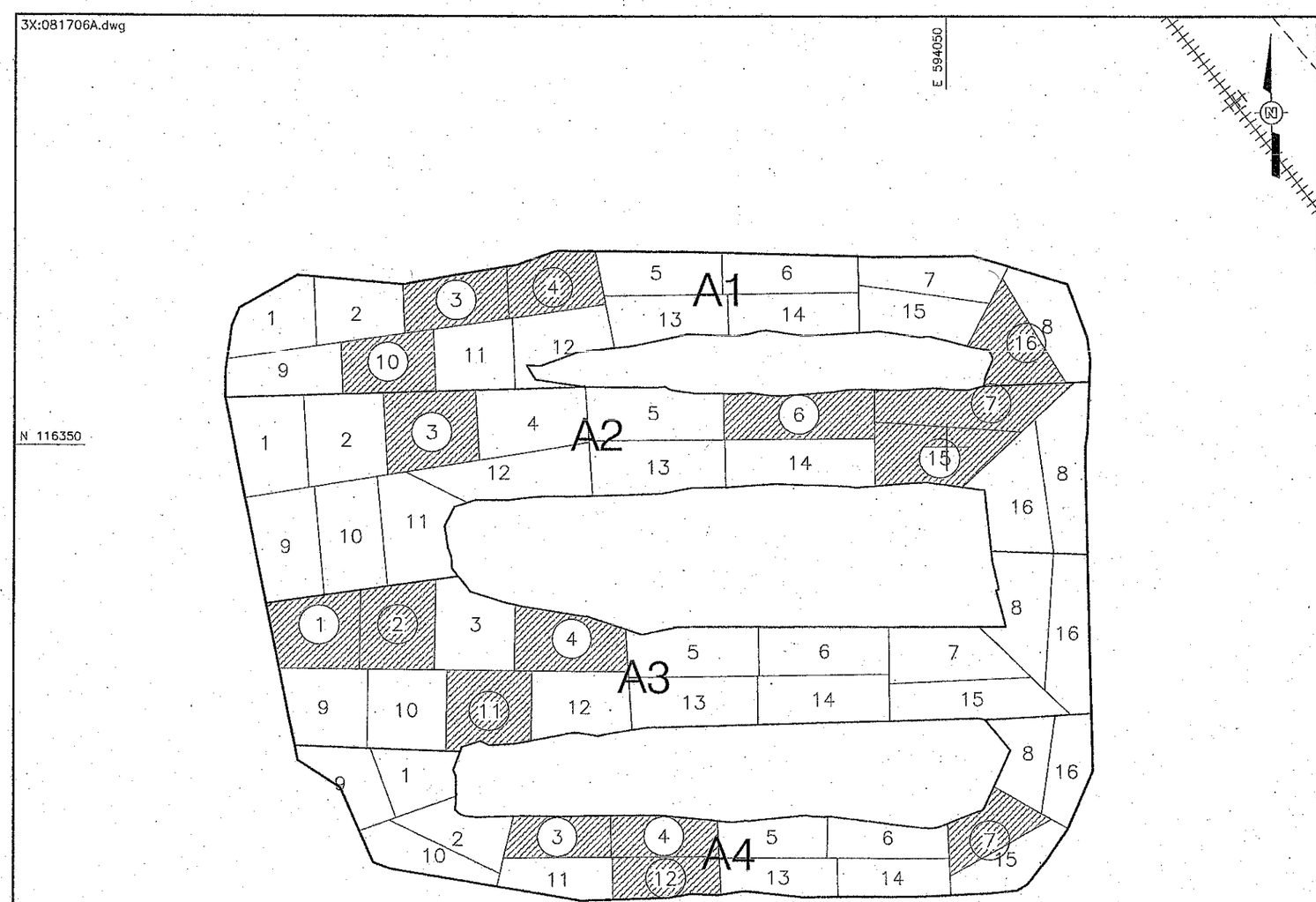

NOTES

1. SHALLOW ZONE NODE AREAS VARY FOR EACH SAMPLING AREA.
2. SAMPLES ARE TAKEN FROM THE APPROXIMATE CENTER OF EACH NODE.
3. THE SHALLOW ZONE CONSISTS OF SAMPLING AREAS A1, A2, A3 AND A4 WITHIN DECISION SUBUNIT 1.

LEGEND

(8) VERIFICATION SAMPLING NODE

SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	S-A1-3	116363.44	594005.68
		S-A1-4	116364.63	594014.42
		S-A1-10	116357.75	593999.57
		S-A1-16	116359.58	594057.23
	A2	S-A2-3	116351.30	594003.51
		S-A2-6	116352.88	594036.61
		S-A2-7	116354.02	594053.99
		S-A2-15	116348.97	594049.36
	A3	S-A3-1	116333.59	593993.39
		S-A3-2	116333.65	594000.48
		S-A3-4	116332.37	594016.14
		S-A3-11	116325.70	594008.66
	A4	S-A4-3	116314.07	594014.78
		S-A4-4	116314.18	594024.44
		S-A4-7	116313.84	594053.74
		S-A4-12	116310.30	594024.62

Attachment 3 — Sheet No. 1 of 4
Originator C. CRUZ — Date 10/31/06
Ch'k'd By CAS — Date 10/31/06
Calc. No. 03608-CA-V0077 — Rev. No. 0

ATTACHMENT 3

SCALE 1:400
4 0 4 8 16 meters

U.S DEPARTMENT OF ENERGY
DOE RICHLAND OPERATIONS OFFICE
RIVIER CORRIDOR CLOSURE CONTRACT

300 AREA
618-2 BURIAL GROUND
SHALLOW ZONE SAMPLING PLAN

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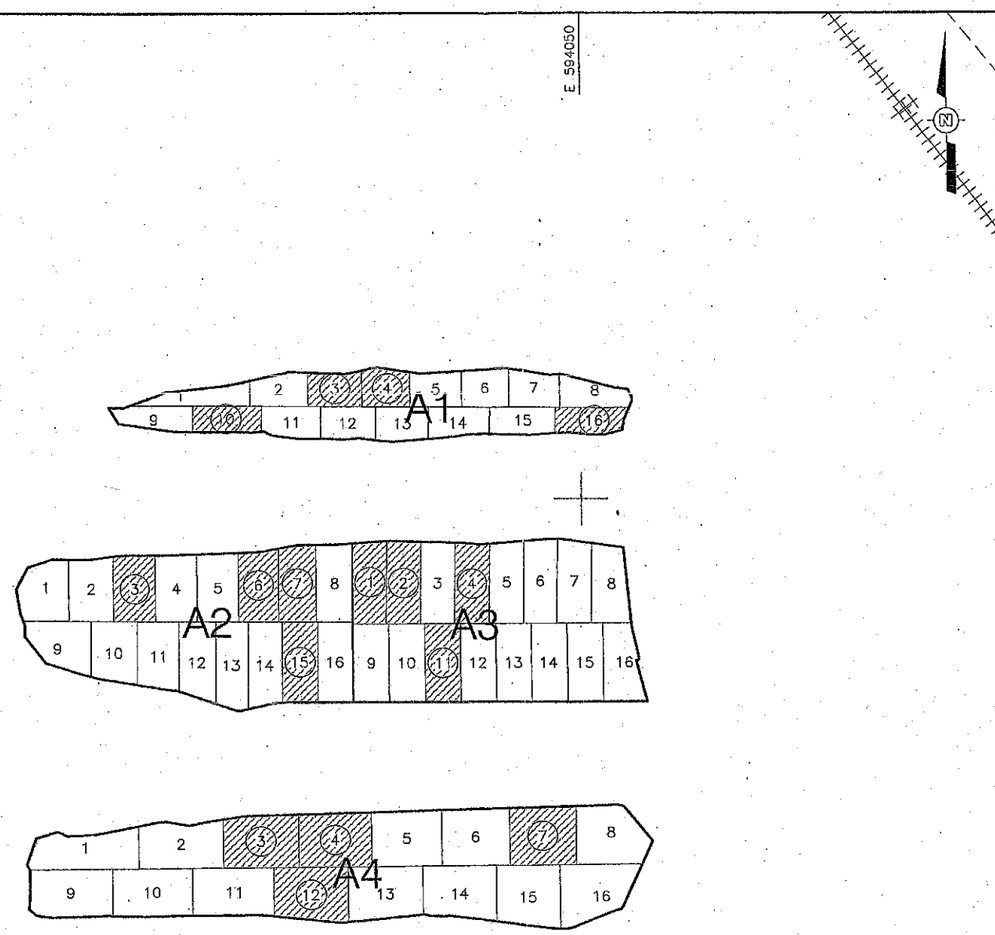

SCALE 1:400

4 0 4 8 16 meters

NOTES

1. DEEP ZONE NODE AREAS VARY FOR EACH SAMPLING AREA.
2. SAMPLES ARE TAKEN FROM THE APPROXIMATE CENTER OF EACH NODE.
3. THE DEEP ZONE CONSISTS OF SAMPLING AREAS A1, A2, A3 AND A4 WITHIN DECISION SUBUNIT 1.

LEGEND

VERIFICATION SAMPLING NODE

SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	D-A1-3	116358.98	594030.22
		D-A1-4	116359.00	594034.41
		D-A1-10	116356.54	594021.57
		D-A1-16	116356.39	594051.05
	A2	D-A2-3	116342.69	594014.15
		D-A2-6	116342.98	594024.12
		D-A2-7	116343.12	594027.20
		D-A2-15	116336.73	594027.40
	A3	D-A3-1	116343.23	594032.97
		D-A3-2	116343.16	594035.65
		D-A3-4	116343.09	594041.18
		D-A3-11	116338.66	594038.81
	A4	D-A4-3	116322.13	594024.25
		D-A4-4	116322.25	594030.14
		D-A4-7	116322.57	594046.82
		D-A4-12	116317.75	594028.22

Attachment 3 Sheet No. 2 of 4
Originator G. CRUZ Date 10/31/06
Ch'd By CAB Date 10/31/06
Calc. No. 03000X-CA-V0017 Rev. No. 0

ATTACHMENT 3

U.S DEPARTMENT OF ENERGY
DOE RICHLAND OPERATIONS OFFICE
RIVIER CORRIDOR CLOSURE CONTRACT

300 AREA
618-2 BURIAL GROUND
DEEP ZONE SAMPLING PLAN

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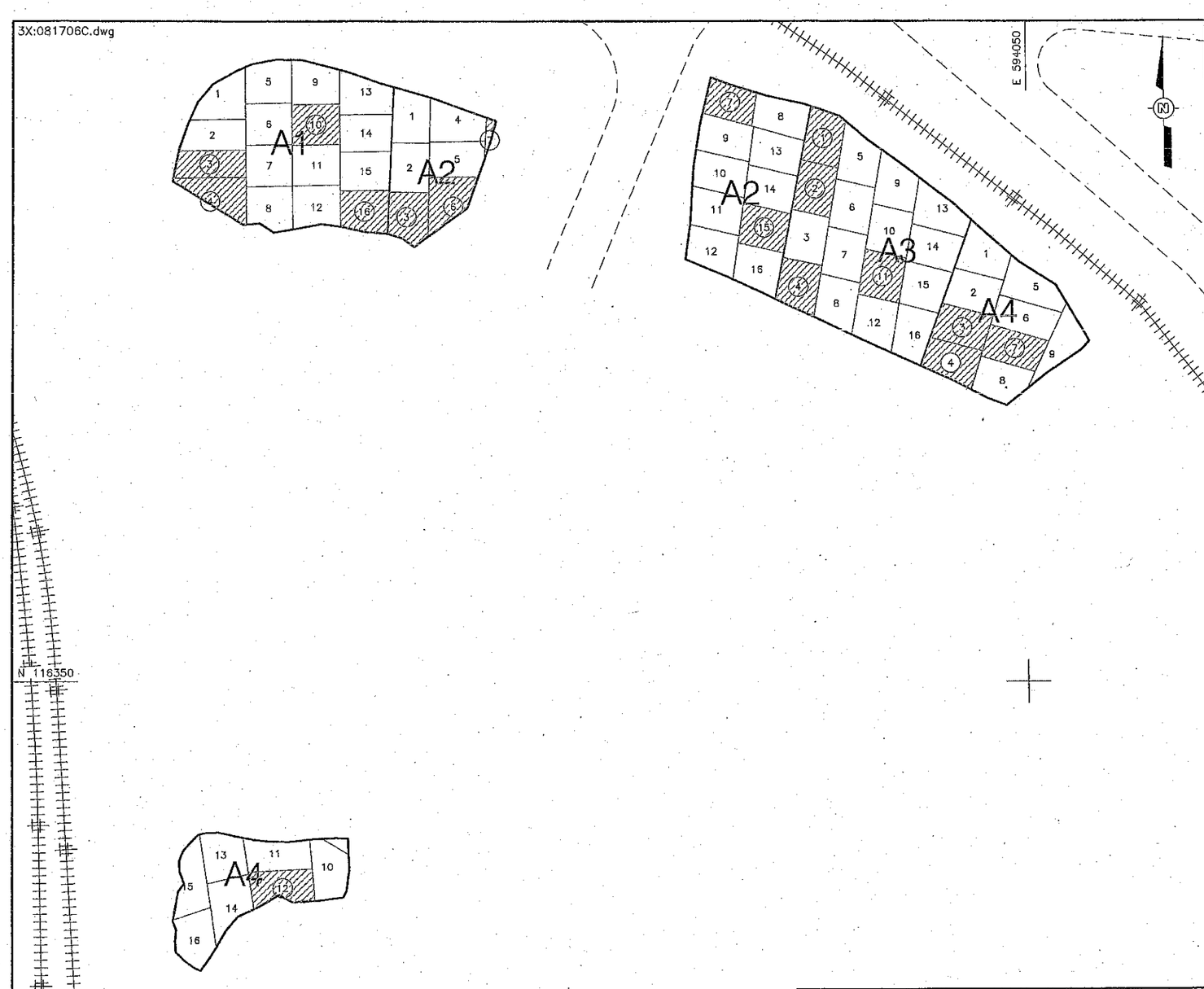

SCALE 1:500

5 0 5 10 20 meters

NOTES

1. OVERBURDEN NODE AREAS ARE APPROXIMATELY 29.42 SQUARE METERS.
2. SAMPLES ARE TAKEN FROM THE APPROXIMATE CENTER OF EACH NODE.
3. THE OVERBURDEN CONSISTS OF SAMPLING AREAS A1, A2, A3 AND A4 WITHIN DECISION SUBUNIT 1.

LEGEND

VERIFICATION SAMPLING NODE

SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	0-A1-3	116414.52	593949.33
		0-A1-4	116409.92	593949.41
		0-A1-10	116419.44	593962.46
		0-A1-16	116408.67	593968.37
	A2	0-A2-3	116407.99	593973.55
		0-A2-6	116409.29	593978.37
		0-A2-7A	116417.51	593983.95
		0-A2-7B	116422.22	594013.47
		0-A2-15	116406.70	594017.57
	A3	0-A3-1	116417.71	594024.91
		0-A3-2	116411.48	594023.94
		0-A3-4	116399.34	594021.82
		0-A3-11	116400.64	594032.20
	A4	0-A4-3	116394.24	594042.05
		0-A4-4	116389.83	594040.62
		0-A4-7	116391.65	594048.47
		0-A4-12	116324.13	593958.31

Attachment 3 Sheet No. 3 of 4
Originator G-CRUZ Date 10/31/06
Chk'd By AG Date 10/31/06
Calc. No. 0300X-CA-V0077 Rev. No. 10

ATTACHMENT 3

U.S DEPARTMENT OF ENERGY
DOE RICHLAND OPERATIONS OFFICE
RIVIER CORRIDOR CLOSURE CONTRACT

300 AREA
618-2 BURIAL GROUND
OVERBURDEN SAMPLING PLAN

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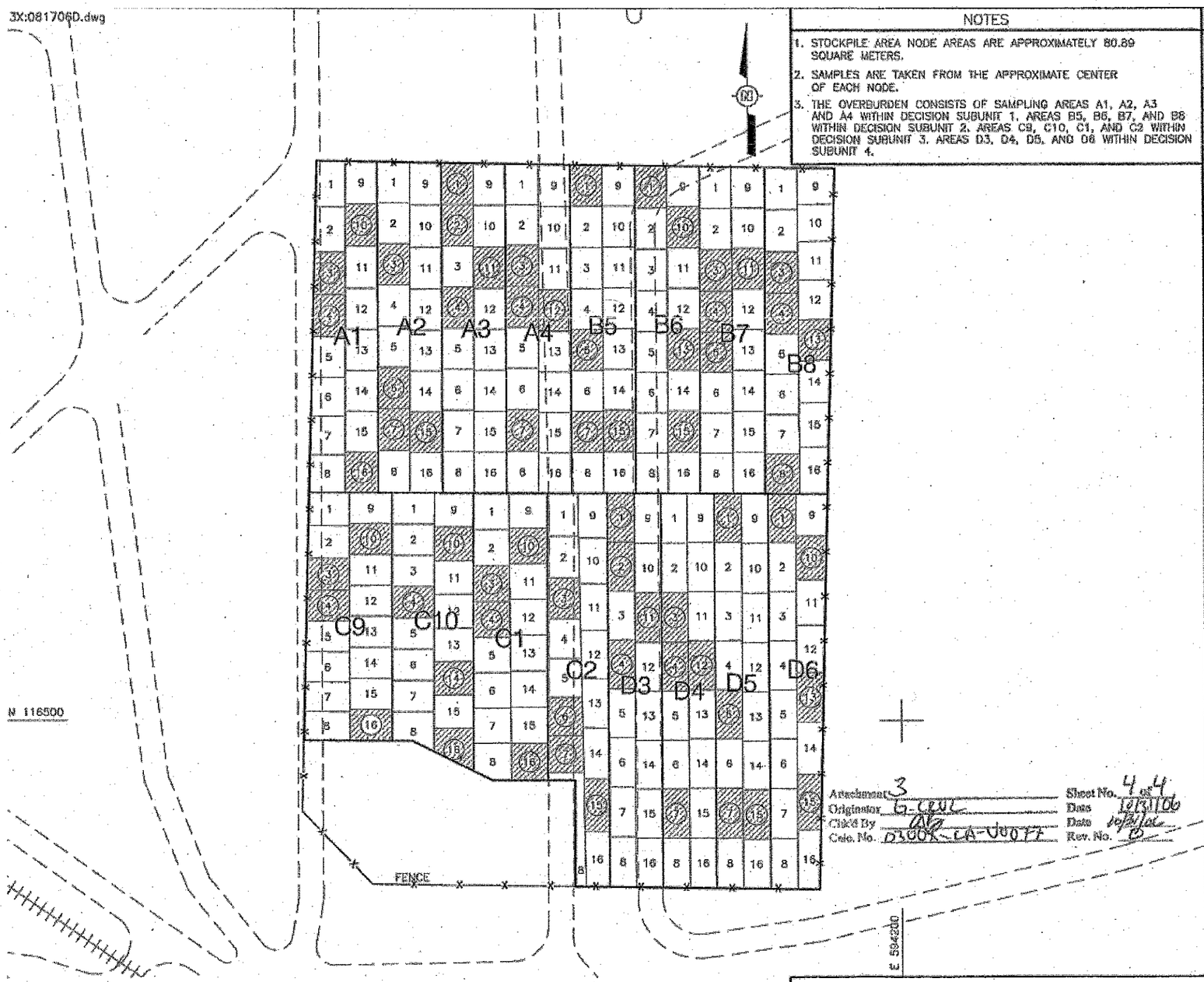


NOTES

1. STOCKPILE AREA NODE AREAS ARE APPROXIMATELY 80.89 SQUARE METERS.
2. SAMPLES ARE TAKEN FROM THE APPROXIMATE CENTER OF EACH NODE.
3. THE OVERBURDEN CONSISTS OF SAMPLING AREAS A1, A2, A3 AND A4 WITHIN DECISION SUBUNIT 1, AREAS B5, B6, B7, AND B8 WITHIN DECISION SUBUNIT 2, AREAS C9, C10, C1, AND C2 WITHIN DECISION SUBUNIT 3, AREAS D3, D4, D5, AND D6 WITHIN DECISION SUBUNIT 4.

LEGEND

VERIFICATION SAMPLING NODE

SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	O-A1-3	116611.87	594069.01
		O-A1-4	116601.12	594059.90
		O-A1-10	116623.65	594067.73
		O-A1-16	116582.05	594067.87
	A2	O-A2-3	116613.97	594075.61
		O-A2-6	116583.13	594075.68
		O-A2-7	116572.72	594075.70
		O-A2-15	116572.07	594083.60
	A3	O-A3-1	116633.97	594091.30
		O-A3-2	116623.73	594091.34
		O-A3-4	116603.28	594091.42
		O-A3-11	116613.19	594099.29
	A4	O-A4-3	116613.63	594107.21
		O-A4-4	116603.45	594107.23
		O-A4-7	116572.56	594107.39
		O-A4-12	116602.55	594115.17
2	B5	O-B5-1	116633.50	594122.97
		O-B5-6	116592.06	594123.11
		O-B5-7	116572.21	594123.18
		O-B5-15	116572.38	594131.09
	B6	O-B6-1	116633.23	594138.89
		O-B6-10	116623.17	594146.86
		O-B6-13	116592.78	594146.91
		O-B6-15	116572.26	594146.94
	B7	O-B7-3	116612.43	594154.85
		O-B7-4	116602.22	594154.88
		O-B7-8	116592.05	594154.88
		O-B7-11	116612.88	594162.79
	B8	O-B8-3	116611.97	594170.76
		O-B8-4	116601.75	594170.79
		O-B8-8	116591.67	594170.92
		O-B8-13	116595.19	594178.82
3	C9	O-C9-3	116536.53	594069.75
		O-C9-4	116526.71	594069.72
		O-C9-10	116545.48	594070.04
		O-C9-16	116498.93	594070.11
	C10	O-C10-4	116526.58	594080.44
		O-C10-10	116544.25	594080.44
		O-C10-14	116510.83	594080.39
		O-C10-16	116492.72	594080.40
	C1	O-C1-3	116534.23	594099.72
		O-C1-4	116525.26	594099.75
		O-C1-10	116543.88	594108.73
		O-C1-16	116489.50	594108.80
	C2	O-C2-3	116530.54	594117.33
		O-C2-6	116501.00	594117.62
		O-C2-7	116491.60	594117.71
		O-C2-15	116478.77	594125.20
4	D3	O-D3-1	116550.79	594131.36
		O-D3-2	116539.69	594131.44
		O-D3-4	116514.13	594131.63
		O-D3-11	116525.89	594138.08
	D4	O-D4-3	116525.84	594144.60
		O-D4-4	116513.51	594144.66
		O-D4-7	116476.67	594144.84
		O-D4-12	116513.89	594151.21
	D5	O-D5-1	116550.69	594157.83
		O-D5-5	116501.57	594157.82
		O-D5-7	116476.81	594157.91
		O-D5-15	116476.40	594164.47
	D6	O-D6-1	116550.64	594170.74
		O-D6-10	116540.74	594177.64
		O-D6-13	116505.84	594177.50
		O-D6-16	116479.64	594177.28

ATTACHMENT 3

Attachment 3
Originator G-CLUL
Chk'd By AB
Calc. No. D3004-CA-00077
Sheet No. 4 of 4
Date 12/31/06
Date 10/31/06
Rev. No. 0

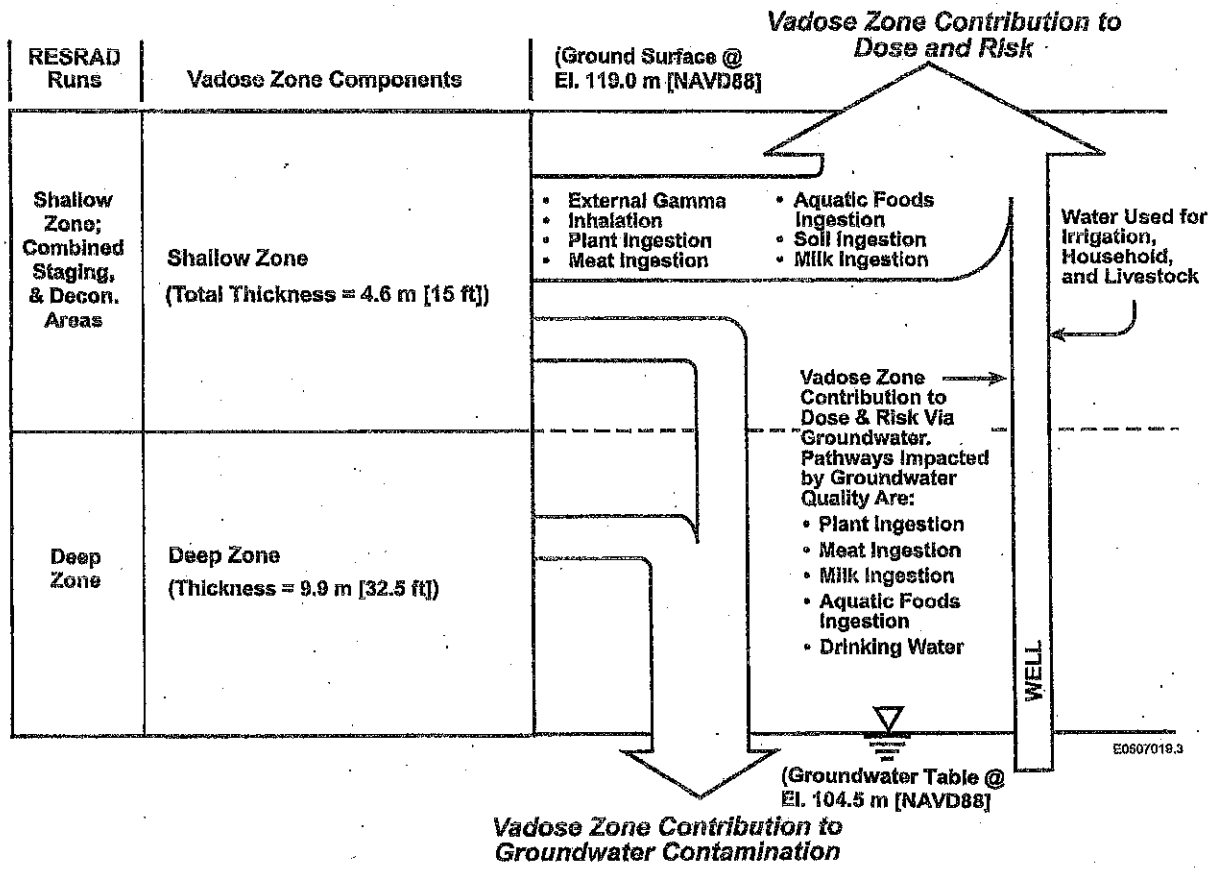
SCALE 1:1000
10 0 10 20 40 meters

U.S DEPARTMENT OF ENERGY
DOE RICHLAND OPERATIONS OFFICE
RIVER CORRIDOR CLOSURE CONTRACT

300 AREA
618-2 BURIAL GROUND
STOCKPILE AREA SAMPLING PLAN

ATTACHMENT 1

618-2 Burial Ground Cleanup Verification Model



Attachment 1 Sheet No. 1 of 1
Originators: S. W. Clark Date 11/1/06
Chk'd By M. W. Perrott Date 11/1/06
Calc. No. 0300X-CA-V0080 Rev. No. 0

1RESRAD, Version 6.30 T« Limit = 0.5 year 11/01/2006 07:36 Page 1
Summary : 618-2 Shallow Zone Industrial Scenario RESRAD Evaluation
File : 618-2 Shallow Zone.RAD

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Summary : 618-2 Shallow Zone Industrial Scenario RESRAD Evaluation
File : 618-2 Shallow Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(3)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(4)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(5)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(6)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(7)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(8)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(9)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(10)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(11)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(12)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(13)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(14)
B-1	U-233	1.350E-01	1.350E-01	DCF2(15)
B-1	U-234	1.320E-01	1.320E-01	DCF2(16)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(17)
B-1	U-236	1.250E-01	1.250E-01	DCF2(18)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(19)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(3)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(4)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(5)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(6)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(7)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(8)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(9)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(10)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(11)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(12)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(13)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(14)
D-1	U-233	2.890E-04	2.890E-04	DCF3(15)
D-1	U-234	2.830E-04	2.830E-04	DCF3(16)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(17)
D-1	U-236	2.690E-04	2.690E-04	DCF3(18)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(19)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)

1RESRAD, Version 6.30 T« Limit = 0.5 year 11/01/2006 07:36 Page 3
Summary : 618-2 Shallow Zone Industrial Scenario RESRAD Evaluation
File : 618-2 Shallow Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(3,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(3,3)
D-34				
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(4,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(5,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(5,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(6,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(6,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(6,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(7,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(8,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(9,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(9,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(9,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(10,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(10,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(10,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(11,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(11,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(11,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(12,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(12,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(13,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(13,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(14,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(14,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(14,3)
D-34				

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Summary : 618-2 Shallow Zone Industrial Scenario RESRAD Evaluation
File : 618-2 Shallow Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(15,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(15,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(15,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(16,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(16,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(16,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(17,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(17,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(18,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(18,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(18,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(19,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(19,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(19,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(3,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(4,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(4,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(5,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(5,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(6,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(6,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(7,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(7,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(8,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(8,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(9,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(9,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(10,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(10,2)

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Summary : 618-2 Shallow Zone Industrial Scenario RESRAD Evaluation
File : 618-2 Shallow Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(11,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(11,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(12,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(12,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(13,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(13,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(14,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(14,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(15,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(15,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(16,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(16,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(17,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(17,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(18,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(18,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(19,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(19,2)

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Summary : 618-2 Shallow Zone Industrial Scenario RESRAD Evaluation
File : 618-2 Shallow Zone.RAD

Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.202E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	4.600E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.200E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	3.800E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	5.400E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.500E+00	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Pu-239	4.200E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Pu-240	1.000E+00	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-234	9.300E-01	0.000E+00	---	S1(16)
R012	Initial principal radionuclide (pCi/g): U-235	6.200E-02	0.000E+00	---	S1(17)
R012	Initial principal radionuclide (pCi/g): U-238	1.070E+00	0.000E+00	---	S1(19)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(16)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(17)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(19)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.200E-03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	1.500E+01	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.400E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.100E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.524E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	Romberg failures occurred	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ

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Summary : 618-2 Shallow Zone Industrial Scenario RESRAD Evaluation
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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.447E-06	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.971E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.447E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.447E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

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Summary : 618-2 Shallow Zone Industrial Scenario RESRAD Evaluation
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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.641E-04	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.641E-04	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(19,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.641E-04	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.385E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.787E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.971E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.488E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.124E-05	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.124E-05	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.447E-06	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.447E-06	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.447E-06	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.447E-06	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.641E-04	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)

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R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.641E-04	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.650E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	5.500E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F

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STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	64	---	---	NPTS
TITL	Maximum number of integration points for dose	5	---	---	LYMAX
TITL	Maximum number of integration points for risk	9	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

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      Contaminated Zone Dimensions                Initial Soil Concentrations, pCi/g
      ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ                ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
         Area:   4202.00 square meters                  Am-241     5.400E-01
   Thickness:       4.60 meters                         Cs-137     1.500E+00
 Cover Depth:       0.00 meters                         Pu-239     4.200E+00
                                                        Pu-240     1.000E+00
                                                        U-234      9.300E-01
                                                        U-235      6.200E-02
                                                        U-238      1.070E+00
0
                                        Total Dose TDOSE(t), mrem/yr
                                   Basic Radiation Dose Limit = 1.500E+01 mrem/yr
                        Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
                        ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
    t (years):  0.000E+00  1.000E+00  3.000E+00  1.000E+01  1.200E+01  3.800E+01  1.000E+02  3.000E+02  1.000E+03
     TDOSE(t):  1.192E+00  1.174E+00  1.139E+00  1.028E+00  9.993E-01  7.264E-01  4.716E-01  3.811E-01  3.523E-01
         M(t):  7.947E-02  7.825E-02  7.591E-02  6.852E-02  6.662E-02  4.843E-02  3.144E-02  2.541E-02  2.349E-02
0Maximum TDOSE(t):  1.192E+00 mrem/yr   at t = 0.000E+00 years
```

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Dose Conversion Factor (and Related) Parameter Summary
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(3)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(4)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(5)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(6)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(7)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(8)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(9)
B-1	Pu-241+D	8.250E-03	8.250E-03	DCF2(10)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(12)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(13)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(14)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(15)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(16)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(17)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(18)
B-1	U-233	1.350E-01	1.350E-01	DCF2(19)
B-1	U-234	1.320E-01	1.320E-01	DCF2(20)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(21)
B-1	U-236	1.250E-01	1.250E-01	DCF2(22)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(23)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(3)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(4)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(5)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(6)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(7)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(8)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(9)
D-1	Pu-241+D	6.850E-05	6.850E-05	DCF3(10)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(12)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(13)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(14)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(15)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(16)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(17)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(18)
D-1	U-233	2.890E-04	2.890E-04	DCF3(19)
D-1	U-234	2.830E-04	2.830E-04	DCF3(20)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(21)
D-1	U-236	2.690E-04	2.690E-04	DCF3(22)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(23)

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Dose Conversion Factor (and Related) Parameter Summary (continued)
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0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(3,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(3,3)
D-34				
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(4,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(5,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(5,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(6,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(6,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(6,3)
D-34				
D-34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(7,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(8,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(9,3)
D-34				
D-34	Pu-241+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(10,1)
D-34	Pu-241+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(10,2)
D-34	Pu-241+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(10,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(12,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(13,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(13,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(13,3)
D-34				

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Dose Conversion Factor (and Related) Parameter Summary (continued)
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0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(14,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(14,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(14,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(15,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(16,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(17,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(17,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(17,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(18,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(18,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(18,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(19,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(19,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(19,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(20,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(20,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(20,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(21,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(21,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(21,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(22,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(22,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(22,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(23,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(23,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(23,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(3,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				

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Dose Conversion Factor (and Related) Parameter Summary (continued)
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Menu	Parameter	Current Value	Default	Parameter Name
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(4,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(4,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(5,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(5,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(6,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(6,2)
D-5				
D-5	Pu-238 , fish	3.000E+01	3.000E+01	BIOFAC(7,1)
D-5	Pu-238 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(7,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(8,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(8,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(9,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(9,2)
D-5				
D-5	Pu-241+D , fish	3.000E+01	3.000E+01	BIOFAC(10,1)
D-5	Pu-241+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(10,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(12,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(12,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(13,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(13,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(14,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(14,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(15,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(15,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(17,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(17,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(18,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(18,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(19,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(19,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(20,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(20,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(21,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(21,2)

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Dose Conversion Factor (and Related) Parameter Summary (continued)
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Menu	Parameter	Current Value	Default	Parameter Name
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(22,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(22,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(23,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(23,2)

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Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.202E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	9.900E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.200E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	3.800E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	6.520E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Cs-137	9.140E-01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Pu-238	1.080E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Pu-239	5.880E+01	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Pu-240	1.410E+01	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): Pu-241	3.430E+01	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): Sr-90	7.400E+00	0.000E+00	---	S1(14)
R012	Initial principal radionuclide (pCi/g): U-234	1.080E+02	0.000E+00	---	S1(20)
R012	Initial principal radionuclide (pCi/g): U-235	2.240E+00	0.000E+00	---	S1(21)
R012	Initial principal radionuclide (pCi/g): U-238	1.110E+02	0.000E+00	---	S1(23)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): Pu-241	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(14)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(20)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(21)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(23)
R013	Cover depth (m)	4.600E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.600E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.200E-03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	1.500E+01	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.400E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.100E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.524E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	Romberg failures occurred	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.460E-06	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(3)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.380E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(7)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.460E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(8)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.460E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(9)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.460E-06	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Pu-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(10)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.460E-06	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCC(14)
R016	Saturated zone (cm**3/g)	not used	3.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.750E-05	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(20)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.623E-05	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(21)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.623E-05	ALEACH(21)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(21)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(23)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(23)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.623E-05	ALEACH(23)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(23)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.431E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(4)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.689E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(5)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.380E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(6)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.914E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(12)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.870E-06	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(13)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.870E-06	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(15)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.460E-06	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(16)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.460E-06	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(17)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.460E-06	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(18)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.460E-06	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(19)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.623E-05	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)

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R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(22)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.623E-05	ALEACH(22)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(22)
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.650E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	5.500E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI

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R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F

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STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	64	---	---	NPTS
TITL	Maximum number of integration points for dose	5	---	---	LYMAX
TITL	Maximum number of integration points for risk	9	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

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Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	4202.00 square meters	Am-241	6.520E+00
Thickness:	9.90 meters	Cs-137	9.140E-01
Cover Depth:	4.60 meters	Pu-238	1.080E+00
		Pu-239	5.880E+01
		Pu-240	1.410E+01
		Pu-241	3.430E+01
		Sr-90	7.400E+00
		U-234	1.080E+02
		U-235	2.240E+00
		U-238	1.110E+02

0

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	1.200E+01	3.800E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.938E-27	5.693E-22
M(t):	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.959E-28	3.796E-23

0Maximum TDOSE(t): 5.693E-22 mrem/yr at t = 1.000E+03 years

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Dose Conversion Factor (and Related) Parameter Summary
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0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(3)
B-1	H-3	6.400E-08	6.400E-08	DCF2(4)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(5)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(6)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(7)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(8)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(9)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(10)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(11)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(12)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(13)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(14)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(15)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(16)
B-1	U-233	1.350E-01	1.350E-01	DCF2(17)
B-1	U-234	1.320E-01	1.320E-01	DCF2(18)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(19)
B-1	U-236	1.250E-01	1.250E-01	DCF2(20)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(21)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(3)
D-1	H-3	6.400E-08	6.400E-08	DCF3(4)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(5)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(6)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(7)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(8)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(9)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(10)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(11)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(12)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(13)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(14)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(15)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(16)
D-1	U-233	2.890E-04	2.890E-04	DCF3(17)
D-1	U-234	2.830E-04	2.830E-04	DCF3(18)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(19)
D-1	U-236	2.690E-04	2.690E-04	DCF3(20)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(21)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)

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Dose Conversion Factor (and Related) Parameter Summary (continued)
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0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(3,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(3,3)
D-34				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(4,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(4,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(4,3)
D-34				
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(5,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(6,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(6,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(7,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(7,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(7,3)
D-34				
D-34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(8,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(9,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(10,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(10,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(10,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(11,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(11,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(11,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(12,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(13,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(13,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
D-34				

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Dose Conversion Factor (and Related) Parameter Summary (continued)
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0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(14,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(14,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(14,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(15,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(16,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(17,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(17,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(18,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(18,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(18,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(19,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(19,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(19,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(20,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(20,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(20,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(21,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(21,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(21,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(3,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(4,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(4,2)
D-5				
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(5,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(5,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(6,2)

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Dose Conversion Factor (and Related) Parameter Summary (continued)
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0 Menu	Parameter	Current Value	Default	Parameter Name
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(7,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(7,2)
D-5				
D-5	Pu-238 , fish	3.000E+01	3.000E+01	BIOFAC(8,1)
D-5	Pu-238 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(8,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(9,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(9,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(10,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(10,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(11,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(11,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(12,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(12,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(13,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(13,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(14,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(14,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(15,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(15,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(17,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(17,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(18,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(18,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(19,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(19,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(20,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(20,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(21,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(21,2)

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Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	2.071E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	4.600E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.200E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	3.800E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	1.500E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Cs-137	3.200E-02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): H-3	9.800E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Pu-238	1.080E+00	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Pu-239	1.400E+00	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): Pu-240	4.000E-01	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-234	3.390E-01	0.000E+00	---	S1(18)
R012	Initial principal radionuclide (pCi/g): U-235	6.600E-03	0.000E+00	---	S1(19)
R012	Initial principal radionuclide (pCi/g): U-238	2.940E-01	0.000E+00	---	S1(21)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(18)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(19)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(21)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.200E-03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	1.500E+01	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.400E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	8.000E+00	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.100E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.524E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	7.600E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	Romberg failures occurred	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.387E-05	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.149E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.752E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.387E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.387E-05	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.387E-05	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.187E-03	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(19,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.187E-03	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(21)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(21,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.187E-03	ALEACH(21)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(21)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.342E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.186E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.149E-04	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.076E-04	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.537E-04	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.537E-04	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.797E-07	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.387E-05	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.387E-05	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.797E-07	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	8.900E+00	5.000E+01	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.187E-03	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(20)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(20,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.149E-04	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.650E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	5.500E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)

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R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Number of graphical time points	64	---	---	NPTS
TITL	Maximum number of integration points for dose	5	---	---	LYMAX
TITL	Maximum number of integration points for risk	9	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

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Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	20710.00 square meters	Am-241	1.500E-01
Thickness:	4.60 meters	Cs-137	3.200E-02
Cover Depth:	0.00 meters	H-3	9.800E-01
		Pu-238	1.080E+00
		Pu-239	1.400E+00
		Pu-240	4.000E-01
		U-234	3.390E-01
		U-235	6.600E-03
		U-238	2.940E-01

0

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	1.200E+01	3.800E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.121E-01	2.111E-01	2.092E-01	2.033E-01	2.017E-01	1.844E-01	1.591E-01	1.289E-01	1.076E-01
M(t):	1.414E-02	1.407E-02	1.395E-02	1.355E-02	1.345E-02	1.229E-02	1.061E-02	8.591E-03	7.172E-03

0Maximum TDOSE(t): 2.121E-01 mrem/yr at t = 0.000E+00 years

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